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Reviews

FROM THE EDITOR

This may feel a little heftier than past issues. It is. And it's wonderful. We are receiving record numbers of submissions, and every time it gets harder to be selective: well-researched, articulate, intelligent and incisive ideas about human activities in space abound. This irrefutably demonstrates a growing interest in space—and a growing comprehension that space needs lawyers.

This volume starts with the dawn of space mining and travels into a future where we have to accept humans will commit crimes in space. We offer a review of Russian space law and introduce a perspective on quantum cryptography. We showcase four students each tackling pressing issues: authorization and supervision, human rights, the space environment and global collaboration in space activities. We offer two book reviews as well as an examination of an old film. *2001: A Space Odyssey* was inspired by, and inspired, art and science. What did it say about our society then, how have we changed, what lessons should we take from it now?

Our student editors, especially Senior Editors Charles Ellzey, Hunter Williams and Sean Taylor were indispensable in preparing this issue. Our Executive Editors, CJ Robison and Jeremy Grunert deserve an extra round of credit for cheerfully reviewing, re-reviewing, and let's be honest, re-re-reviewing, the daunting number of words in this tome. All that said, the entire team joins me in expressing the deepest appreciation and gratitude to the authors who trusted, responded promptly and worked patiently with us through a very odd first-half of 2020. In this time of COVID, we have been physically secluded and separated from each other. Ironically, the experience provides insight into what makes a human community work. It is the essence of the human spirit—persistence, innovation, inspiration, adaptability and understanding—that will assure our survival both here on Earth and in space.

Michelle L.D. Hanlon
Editor-in-Chief
From Quarantine in New Haven, Connecticut
July, 2020

A RE-EXAMINATION OF FUNDAMENTAL PRINCIPLES OF INTERNATIONAL SPACE LAW AT THE DAWN OF SPACE MINING

Fengna Xu,[*] *Jinyuan Su*[**] *& Miqdad Mehdi*[***+]

ABSTRACT

When the Outer Space Treaty and Moon Agreement were concluded, there existed no urgency to regulate space resources extraction activities. Four decades thereafter, technological development makes the exploitation and use of space resources not only possible, but likely a reality in the near future. At present, both governments and ambitious private actors are engaged in the development of technologies for space mining activities. The United States and Luxembourg have enacted domestic legislation to protect property rights over the resources to be extracted. Consequently, given that the context in which the Outer Space Treaty operates has become starkly different from the one in which it was conceived, there is an urgent need for a new international regime to regulate these activities. Indeed, the international community is trying to create an appropriate legal framework, in fora such as the Legal Subcommittee of United Nations Committee on the Peaceful Uses of Outer Space and the Hague Space Resources Governance Working Group. But before instigating such a regime, it is important to examine the contents of the Outer Space Treaty, the *Magna Carta* of international outer space law, especially the four fundamental principles most relevant to space mining, including the freedom of exploration and use, non-appropriation, common benefit and interests and environmental protection. This Article analyzes these fundamental

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[+] This paper is a fully revised and updated version of a paper with the same title which was presented at the 2019 China Space Conference, Changsha, China, April 2019.

principles of international space law, bearing in mind today's new circumstances where the mining of space resources is becoming feasible, so as to shed some light on their application in the context of space mining. It is submitted that the international community should cooperate to establish a legal framework on space resources activities.

I. INTRODUCTION

At the dawn of the space age, many expected that outer space would be used only for peaceful purposes and in the interest of all humankind. After several years of deadlock in the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS), the urgent need for a space treaty arose partly due to the great strides humanity was making towards landing on the Moon in the mid-1960s.[1] Recognizing the need to establish a regime in outer space before national interests developed and froze positions on the matter, the Union of Soviet Socialist Republics (Soviet Union) and the United States (US) tended to agree on proposals about the initial principles of space legislation.[2] Eventually, the Outer Space Treaty (OST)[3] was concluded with both nations making important concessions. The OST was largely based on the 1963 Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space (1963 Declaration),[4] but also introduced some new provisions. Significantly, the OST only precludes States from appropriating territorial portions of outer space. It never mentions

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[1] Comm. On the Peaceful Uses of Outer Space, Rep. of the Legal Subcomm. on Its Fifth Session, 44th mtg., U.N. Doc. A/AC.105/PV.44, at 20 (Oct. 25, 1966); Comm. on the Peaceful Uses of Outer Space, Rep. of the Legal Subcomm. On Its Fifth Session, 72nd mtg., U.N. Doc A/AC.105/C.2/SR.72, at 3 (Oct. 19, 1966) (The US delegation noted that "[i]t was important to establish a universally accepted regime of law before the first landing was mode on the moon.").

[2] U.N. Doc. A/AC.105/PV.44, *supra* note 1, at 20. *See also* Rep. of the First Comm. on Its Sixteenth Session, 1214th mtg., U.N. Doc. A/C.1/SR.1214, at 268 (Dec. 11, 1961). The delegate from the Soviet Union noted that "the debate on the question of the peaceful uses of outer space had shown that all States were anxious to see the establishment of international co-operation, on a basis of equality, in that new and important field of human activity [space]."

[3] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205 [hereinafter Outer Space Treaty].

[4] G.A. Res. 1962 (XVIII) (Dec. 13, 1963).

the exploitation and use of space resources, although the COPUOS was required to study questions related to the utilization of outer space and celestial bodies.[5] Consequently, the OST left many non-space powers unsatisfied as negotiations mostly emphasized demilitarization and peaceful uses.[6]

As newly independent developing States pushed for the establishment of a "New International Economic Order" during the late 1960s and early 1970s, they also sought to assure their access to the benefits derived from space exploration and exploitation.[7] Consequently, questions related to the utilization of the resources of the Moon continued to be discussed for several years.[8] But little progress was made by the Legal Subcommittee (LSC) of COPUOS as, among other things, some States held it was premature to enact international legal principles on the matter,[9] and consensus could not be reached on whether a new treaty should govern just the Moon or other celestial bodies as well.[10] Astonishingly, the Moon Agreement (MA)[11] was completed after secret discussion within fifteen days.[12] But the MA has only been ratified by eighteen

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[5] This idea was first proposed by France. Rep. of the First Comm. on Its Twenty-First Session, 1492nd mtg., U.N. Doc. A/C.1/SR.1492, at 430 (Dec. 17, 1966) ("[W]hile the principles established by the [Outer Space Treaty] would no doubt be easy to apply in the case of the exploration of space, their application would be more difficulty when State activities involved exploitation.").

[6] BIN CHENG, STUDIES IN INTERNATIONAL SPACE LAW 358 (1997).

[7] Nirav S., *Comprehensive Essay on New International Economic Order (NIEO)*, PRESERVE ARTICLES, http://www.preservearticles.com/essay/comprehensive-essay-on-new-international-economic-order-nieo/20115 (last visited May 2, 2020).

[8] *See* Comm. on the Peaceful Uses of Outer Space, Rep. of the Legal Subcomm. on Its Eighth Session, Annex I, U.N. Doc. A/AC.105/58, at 4-7 (1969).

[9] *See e.g.,* Comm. On the Peaceful Uses of Outer Space, Rep. of the Legal Subcomm. on Its Eleventh Session, 187th mtg., A/AC.105/C.2/SR.187, at 3 (May 2, 1972). The Japanese delegation "still had some doubts, however, as to the usefulness of trying to prepare a new treaty in addition to the 1967 Treaty."

[10] *See e.g.,* Comm. On the Peaceful Uses of Outer Space, Rep. of the Legal Subcomm. on Its Eleventh Session, 188th mtg., U.N. Doc A/AC.105/C.2/SR.188, at 21 (May 3, 1972). The Austrian delegation noted that "there were differences of opinion as to whether [the treaty] should apply only to the moon, or to other celestial bodies as well."

[11] Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, Dec. 18, 1979, 1363 U.N.T.S. 3 (1979) [hereinafter Moon Agreement].

[12] BIN CHENG, *supra* note 6, at 361-362. After several futile attempts to address resource utilization on the Moon, an informal
working group was established in June 1979 to focus on the matter. After four secret meetings between June 26 and July 3, 1979, whose proceedings are not published, a draft treaty relating to the Moon was adopted by consensus without a vote.

countries.[13] After that, the international community failed to make any progress in developing binding space law at the international level. For a time this caused no great concern, as it would be nearly three decades before a State attempted space resources activities.

Over the five decades since the adoption of the OST and four decades since the negotiation of the MA, the global political and commercial environment has changed dramatically. Today's world is no longer dominated by two superpowers and tends to be multipolar. Technological innovation has increased the possibility of the exploitation and use of space resources and greatly reduced the cost of getting into space. At present, the extraction and use of space resources is not technically feasible, but is expected to happen in the near future. It is no longer national prestige, but scientific and economic opportunities that drive missions to space. Many believe that space mining could support commercial application, stimulate technological innovation, produce economic return and give important contribution to create and redistribute wealth in the world. Consequently, not only governments but also ambitious private actors are engaged in the development of technologies for space mining activities. For example, several private business entities have publicly indicated that they are making plans to extract resources from the Moon and other celestial bodies, including, for example, Caterpillar, Inc.,[14] Moon Express, Inc.,[15] (Moon Express) and Blue Origin, Inc.[16] To support American commercial efforts in space, the US adopted the Commercial Space Launch Competitiveness Act (CSLCA), which seeks to facilitate the commercial exploration for and commercial recovery of space resources by US citizens.[17]

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[13] State parties are Armenia, Australia, Austria, Belgium, Chile, Kazakhstan, Kuwait, Lebanon, Mexico, Morocco, the Netherlands, Pakistan, Peru, Philippines, Romania, Saudi Arabia, Turkey, Uruguay and Venezuela. *See* Comm. on the Peaceful Uses of Outer Space, *Status of International Agreements Relating to Activities in Outer Space as at 1 Jan. 2019*, U.N. Doc. A/AC.105/C.2/2019/CRP.3 (2019).

[14] Jennifer Leman, *Construction Company Caterpillar Wants to Mine the Moon,* POPULAR MECHANICS. (Oct. 30, 2019), https://www.popularmechanics.com/space/moon-mars/a29587959/caterpillar-space-mining/.

[15] Mike Wall, *50 Years After Apollo 11, A New Moon Rush Is Coming,* SPACE.COM (July 22, 2019), https://www.space.com/moon-exploration-plans-nasa-india-china-and-more.html.

[16] Jayshree Pandya, *The Race to Mine Space,* FORBES (May 13, 2019), https://www.forbes.com/sites/cognitiveworld/2019/05/13/the-race-to-mine-space/#49e7ef3c1a70.

[17] *See* 51 U.S.C. §§ 51301-03 (2018).

Luxembourg followed suit two years later and enacted its own national space law granting property rights to private space resource extractors.[18] As the US and other States seek to expand extraterrestrial private property rights, it is apparent that the exploitation and use of space resources requires clearer international governance.[19]

However, as mentioned above, there was no urgency to regulate space resources activities when the OST and MA were concluded. In particular, there was insufficient scientific information available regarding space resources and the possibility of their economic use. Consequently, the two treaties do not regulate the exploitation and use of space resources. Nevertheless, the OST, as the cornerstone of international space law, established important principles directly related to space mining, including the freedom of exploration and use, non-appropriation, common benefit and interests and environmental protection.[20] These principles could provide guidance for space mining, but their precise applications to this activity are not at all clear. The MA further developed these principles, but, as we have seen, it was not accepted by the major spacefaring countries. For the beneficial use of space resources, a specific legal regime for the exploitation of resources should be elaborated. In the development of such a regime, the four principles enumerated above need to be clarified, as they should provide the foundation for the management of resource extraction and utilization.

In fact, the international community is trying to create an appropriate legal framework. The LSC of COPUOS meets every year to discuss legal questions related to the exploration and use of outer

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[18] Loi 674 du 20 juillet 2017 sur l'exploration et l'utilisation des ressources de l'espace [Law 674 of July 20, 2017 on the Exploration and Use of Space Resources], JOURNAL OFFICIEL DU GRAND-DUCHE DE LUX., July 28, 2017, http://legilux.public.lu/eli/etat/leg/loi/2017/07/20/a674/jo. *See also* Philip de Man, *Luxembourg's Law on Space Resources Rests on a Contentious Relationship With International Framework,* THE SPACE REV. (Oct. 23, 2017), http://www.thespacereview.com/article/3355/1. The UAE has also released some details of its new space law which suggest that they are also considering ways to administer resource extraction and utilization legislation. Melissa Maday, *UAE Space Law Details Announced to Facilitate Space Sector Development*, SPACEWATCH.GLOBAL (Feb. 25, 2020), https://spacewatch.global/2020/02/uae-space-law-details-announced-to-facilitate-space-sector-development/.

[19] Eytan Tepper, *Structuring the Discourse on the Exploitation of Space Resources: Between Economic and Legal Commons*, 49 SPACE POL'Y 101290, 2 (2019).

[20] Outer Space Treaty, *supra* note 3, arts. I, II and IX.

space. In 2016, it agreed on a new item for discussion, entitled "General exchange of views on potential legal models for activities in exploration, exploitation and utilization of space resources," which became an agenda item in the sessions of 2017-2019.[21] The representatives of member States debated on the issue, including the application of these principles. In the 2019 session, Belgium and Greece submitted a working paper proposing the establishment of a working group for the development of an international regime on the utilization and exploitation of space resources.[22] Although it was not successful due to the opposition of some delegations, the proposal was not completely ruled out.

Efforts are also being undertaken outside the COPUOS. The Hague Space Resources Governance Working Group (HSRGWG), for instance, gathered interested members from government, industry, universities, civil society and research centers in 2014 to discuss and propose solutions to the governance of space resources.[23] On September 13, 2017, it released Draft Building Blocks for the Development of An International Framework on Space Resource Activities, which were developed to create an enabling environment for space resources activities.[24] After minor revisions, it adopted a final version of the Building Blocks (Hague Building Blocks) on November 12, 2019.[25] The HSRGWG members included "stakeholders of space resource activities and represent[ed] consortium partners, industry, States, international organisations [sic], academia and

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[21] Comm. On the Peaceful Uses of Outer Space, Rep. of the Legal Subcomm. on Its Fifty-Fifth Session, U.N. Doc. A/AC.105/1113, at 250 (2016).

[22] Comm. On the Peaceful Uses of Outer Space, Rep. of the Legal Subcomm. Rep. on Its Fifty-Eight Session, U.N. Doc. A/AC.105/C.2/2019/CRP.22 (Apr. 8, 2019) (working paper by Belgium and Greece); Comm. On the Peaceful Uses of Outer Space, Rep. of the Legal Subcomm. on Its Fifty-Eight Session, U.N. Doc. A/AC.105/C.2/L.311 (Mar. 11, 2019) (working paper by Belgium and Greece).

[23] Comm. On the Peaceful Uses of Outer Space, Rep. of the Legal Subcomm. on Its55th Session, U.N. Doc. A/AC.105/C.2/2016/CRP.17 (Apr. 5, 2016).

[24] DRAFT BUILDING BLOCKS FOR THE DEVELOPMENT OF AN INTERNATIONAL FRAMEWORK ON SPACE RESOURCE ACTIVITIES (2017), https://www.universiteitleiden.nl/binaries/content/assets/rechtsgeleerdheid/instituut-voor-publiekrecht/lucht—en-ruimterecht/space-resources/draft-building-blocks.pdf.

[25] BUILDING BLOCKS FOR THE DEVELOPMENT OF AN INTERNATIONAL FRAMEWORK ON SPACE RESOURCE ACTIVITIES (2019), https://www.universiteitleiden.nl/binaries/content/assets/rechtsgeleerdheid/instituut-voor-publiekrecht/lucht—en-ruimterecht/space-resources/hisrgwg_building-blocks-for-space-resource-activities.pdf [hereinafter BUILDING BLOCKS].

NGOs."[26] The Hague Building Blocks represent their consensus perspective on the fundamental principles set forth in the OST, namely, the freedom of exploration and use, non-appropriation, common benefit and interests and environmental protection

This Article analyzes these fundamental principles of international space law under today's new circumstances where the exploitation and use of space resources is becoming a reality, so as to shed some light on their application in the context of space mining. Parts II-V address the principles of freedom of exploration and use, non-appropriation, common benefit and interests and environmental protection respectively. Each part begins with the interpretation of the principle in the OST and the MA and proceeds to elaborate on and evaluate the relevant debates in the LSC and the Hague Building Blocks of HSRGWG. Part VI concludes and calls for international cooperation to establish a legal framework to manage space resources activities.

II. FREEDOM OF EXPLORATION AND USE

Space mining is considered to be promising. It has provoked interest by States as well as private actors in recent years. For example, the US National Aeronautics and Space Administration (NASA) launched the OSIRIS-REx spacecraft in 2016 to explore the asteroid Bennu before collecting a sample to return to Earth, with the intent to improve our understanding of the resources in near-Earth space.[27] Similarly, the United Arab Emirates "has launched a multipronged effort" to establish a space mining industry, including an investment of more than $5 billion and continuous launch of satellites.[28] Luxembourg is also taking part in the race to mine space resources by setting up a $227 million fund to entice space mining companies to open offices in the country and make it the

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[26] *The Hague International Space Resources Working Group,* UNIV. OF LEIDEN, https://www.universiteitleiden.nl/en/law/institute-of-public-law/institute-of-air-space-law/the-hague-space-resources-governance-working-group (last visited Apr. 17, 2020).

[27] *NASA Mission Reveals Asteroid Has Big Surprises*, NASA, https://www.nasa.gov/press-release/nasa-mission-reveals-asteroid-has-big-surprises (last visited Apr. 17, 2020).

[28] Thomas Heath, *Space-mining May Be Only A Decade Away. Really*, THE WASH. POST, June 2, 2017, https://www.washingtonpost.com/business/space-mining-may-be-only-a-decade-away-really/2017/04/28/df33b31a-29ee-11e7-a616-d7c8a68c1a66_story.html?utm_term=.e00b010f3a37.

hub of space mining innovation.[29] Additionally, Moon Express, the first company to receive US government approval to fly a mission beyond Earth orbit and to the Moon, is planning to set up the first lunar research outpost and prospect for water and useful minerals.[30] Moon Express also signed a Memorandum of Understanding (MOU) with the Canadian Space Agency (CSA) to explore the possibilities of using its orbiter and lander for missions to the Moon.[31] Clearly, the exploitation and use of space resources is going to take place. However, whether the activity is sanctioned by the OST is ambiguous at best.

A. Freedom of Outer Space

Under Article I of the OST, outer space shall "be free for exploration and use by all States."[32] Such freedom shall be non-discriminatory, equal and in conformity with international law.[33] Moreover, all areas of celestial bodies shall be freely accessible and "there shall be freedom of scientific investigation."[34] These aspects constitute the freedom of exploration and use principle in the OST. Like the freedom of high seas, such freedom in outer space stems from its status of *terra communis*. Unlike *terra nullius*, which refers to a territory not belonging to any particular country, [35] *terra communis* or *res communis* denotes a common thing or area that cannot be owned or appropriated, such as light, air and the sea.[36] Accordingly, outer space is open to all States, but cannot be appropriated by any of them. The MA developed more specific rules than the OST. Pursuant to the MA, States may collect and remove from the Moon samples of its mineral and other substances for scientific investigation and use these resources in quantities appropriate to support

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[29] Lily Hay Newman, *Luxembourg Bets Big on Space Mining for Some Reason*, SLATE (June 7, 2016), https://slate.com/technology/2016/06/luxembourg-invests-in-space-mining-research.html.

[30] *Three Maiden Expeditions*, MOON EXPRESS, http://moonexpress.com/ (last visited May 2, 2020).

[31] *Supporting Canada's Lunar Initiatives*, MOON EXPRESS, http://moonexpress.ca/ (last visited Apr. 21, 2020).

[32] Outer Space Treaty, *supra* note 3, art. I.

[33] *Id.*

[34] *Id.*

[35] *Terra Nullius,* BLACK'S LAW DICTIONARY (9th ed. 2009).

[36] *Res Communes,* BLACK'S LAW DICTIONARY (9th ed. 2009).

their missions.[37] These provisions not only reaffirm the freedom of exploration and use principle, but also expressly refer to the use of space resources for the first time. Unfortunately, the MA was rejected by major spacefaring countries because it recognized the Moon and its natural resources as "the common heritage of [hu]mankind" (CHM).[38] The concept of CHM means that outer space belongs to all humanity and should be protected and managed for its benefit.[39]

The freedom of exploration and use principle, which grants all States the right of access, exploration and scientific investigation, is similar to John Rawls' equality of opportunity or liberty principle.[40] Rawls uses a thought experiment widely known as the "veil of ignorance" where public policy is based on the hypothetical condition that people do not know the social positions or the particular comprehensive doctrines of the persons they represent.[41] As a result, a fair agreement must eliminate the bargaining advantages resulting from cumulative social and historical tendencies.[42] And people similarly motivated and endowed should have the same prospects of success.[43] Basically, the OST grants each State an equal right to the most extensive scheme of equal basic liberties compatible with a similar scheme of liberties for others. Accordingly, outer space is open for access and all States have an equal chance to access space for exploration and use, regardless of their degree of economic or scientific development. But it's worth noting that the OST restricts total freedom to scientific investigation. It does not refer to commercial exploitation and use of space resources. Indeed, some argue that the freedom to engage in scientific exploration of outer space does not justify large-scale exploitation of extraterrestrial resources for commercial purpose.[44] That is why the national laws of

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[37] Moon Agreement, *supra* note 11, art 6.

[38] *See* Dennison A. Butler, *Who Owns the Moon, Mars, and Other Celestial Bodies: Lunar Jurisprudence in Corpus Juris Spatialis*, 82 J. OF AIR L. & COM. 505, 508-09 (2017).

[39] *Common Heritage of Mankind*, BLACK'S LAW DICTIONARY (9th ed. 2009).

[40] JOHN RAWLS, JUSTICE AS FAIRNESS: A RESTATEMENT ¶ 13.1 (2001).

[41] *Id.* ¶ 6.2.

[42] *Id.*

[43] *Id.*

[44] Jinyuan Su, *Legality of Unilateral Exploitation of Space Resources under International Law,* 66 INT'L COMP. LAW Q. 991, 1006 (2017).

the US and Luxembourg caused widespread controversy in the international community.

Scientific research and commercial mineral exploitation have different purposes: the former aims for scientific knowledge while the latter is focused on profit. Moreover, there exists a marked difference in quantity of resource collection. The six Apollo missions brought back 382 kilograms (842 pounds) of lunar material for research and teaching projects,[45] some of which NASA exchanged with the Soviet Union for some of the approximately 300 grams of lunar material brought back by three Soviet Luna missions.[46] Although these sample collections were never protested by other countries, it does not mean that commercial space mining was also accepted by the international community, as the numbers of samples collected from the Moon are significantly smaller than the normal scale of mineral exploitation. As the *Whaling in the Antarctic* case demonstrates, large-scale extraction of resources is likely beyond the reasonable need of scientific research.[47] However, the OST does not give a clear answer as to whether the exploitation and use of space resources for commercial purpose is in conformity with this principle. According to Article 31 of the Vienna Convention on the Law of Treaties (VCLT),[48] we must review the object and purpose of a Treaty during the course of interpretation. From its preamble, we could observe that the purpose of the OST is to promote rather than restrict the free exploration and use of outer space, especially given that the common interest of all humankind is implicated.[49] Accordingly, as long as space mining for commercial purpose could promote the free exploration and use of outer space, it may be lawful under the freedom of exploration and use principle.

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[45] *Lunar Rocks and Soils from Apollo Missions*, NASA, https://curator.jsc.nasa.gov/lunar/ (last visited Apr. 18, 2020).

[46] Berin Szoka and James Dunstan, *Space Law: Is Asteroid Mining Legal?* WIRED (May 1, 2012), https://www.wired.com/2012/05/opinion-asteroid-mining/.

[47] Whaling in Antarctica (Austl. v. Japan), Judgment, 2014 I.C.J. Rep. 226, ¶ 94 (Mar. 31) ("In particular, a State party may not, in order to fund the research for which a special permit has been granted, use lethal sampling on a greater scale than is otherwise reasonable in relation to achieving the programme's stated objectives."); Su, *supra* note 44, at 1005-06.

[48] Vienna Convention on the Law of Treaties art. 31(1), May 23, 1969, 1155 U.N.T.S. 331 [hereinafter Vienna Convention].

[49] Outer Space Treaty, *supra* note 3, Preamble.

B. Commercial Incentives

To answer whether the exploitation and use of space resources for commercial purpose conforms to this principle, the terms "exploration," "use" and "exploitation" should first be clearly defined. In the context of outer space, "exploration" refers to all activities that have as their primary goal the gaining of knowledge, without immediate practical application;[50] "use" denotes those activities that could be transformed into actionable interests, be they of economic, military, civil or other nature.[51] In comparison, "exploitation" means the act of taking advantage of something,[52] regardless of its purpose. Surely, in practice, the three notions are difficult to distinguish from each other, as the finality of activities is not always clear from the start.[53] Moreover, taking into account statements made by French delegate, it is clear the drafters of the OST did not preclude the concept of the exploitation of space resources from the broad definition of the concept of "use."[54] The delegation referred to practical uses of space like meteorological research and telecommunications, but reserved discussion of utilization of minerals on the Moon as it was "hard" at that time to conceive.[55] Additionally, the evolution of these terms in the *travaux préparatoires* of the OST, including the United Nations General Assembly Resolution 1348,[56]

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[50] PHILIP DE MAN, EXCLUSIVE USE IN AN INCLUSIVE ENVIRONMENT, THE MEANING OF THE NON-APPROPRIATION PRINCIPLE FOR SPACE RESOURCE EXPLOITATION 79 (2016).

[51] *Id.* at 79, 80.

[52] *Exploitation*, BLACK'S LAW DICTIONARY (9th ed. 2009).

[53] *See* DE MAN, *supra* note 50, at 78-82.

[54] According to the French delegation:

> It was quite clear that the treaty was to apply both to celestial bodies and to outer space, but what type of activity was it to regulate? The text referred to exploration and "use." Did the latter term imply use for exploration purposes, such as the launching of satellites or did it mean us in the sense of exploitation, which would involve far more complex issues?

Comm. On the Peaceful Uses of Outer Space, Rep. of the Legal Subcomm. on Its Fifth Session, 63rd mtg., U.N. Doc A/AC.105/C.2/SR.63, at 8 (July 20, 1966). *See also* Comm. On the Peaceful Uses of Outer Space, Rep. of the Legal Subcomm. on Its Fifth Session, 69th mtg., U.N. Doc A/AC.105/C.2/SR.69, at 5-6 (July 27, 1966) (Indicating that the French delegation had no "theoretical preference as to whether the treaty should be limited to scientific exploration or should also deal with use.").

[55] U.N. Doc A/AC.105/C.2/SR.63, *supra* note 54, at 8.

[56] The Resolution, entitled "Question of the Peaceful Use of Outer Space," addresses the desire "to promote energetically the fullest exploration and exploitation of outer space for the benefit of [hu]mankind." G.A. Res. 1348 (XIII), at Preamble (Dec. 13, 1958).

United Nations General Assembly Resolution 1721[57] and the 1963 Declaration,[58] confirmed to some extent the synonymity between the concept of use and exploitation. Hence, the exploitation of space resources is encompassed by the freedom of exploration and use principle.

Commercial incentives are essential to develop space mining ventures because of the high cost and risk involved. In 2009, NASA reported that the total cost of the Apollo program "arrived at a figure of [US]$170 billion in 2005 dollars (or around [US]$200 billion in today's money)."[59] This figure does not calculate the associated risk of no return on investments, death, pollution and other investment-limiting factors. Out of financial pressure, governments are increasingly turning to private companies to spearhead space resource utilization efforts and providing confidence for investors by way of regulations and laws in order to generate revenues and open new markets. According to Hayek's theory of free-market,[60] commercial incentives could promote investment in the exploration of space resources and enable the development of the most efficient use of such resource. With the prospect of obtaining some sort of property rights, the private sector would likely make every effort to invest and develop technology for profit. Free markets would increase the means of production by placing it directly in the hands of laborers, which makes it possible for private sectors to acquire space resources legitimately. Such a spontaneous order—which is not designed by anyone but evolves slowly as the result of human actions, would do a remarkable job of coordinating people's actions in outer space. For instance, Moon Express, by using robotic explorers, claims it will collapse the cost of lunar access and deliver

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[57] The Resolution, entitled "International Co-operation in the Peaceful Uses of Outer Space," indicates a belief that "the exploration and use of outer space should be only for the betterment of [hu]mankind." G.A. Res 1721 (XVI), at Preamble (Dec. 20, 1961).

[58] The 1963 Declaration opens with the statement that delegates are "inspired by the great prospects opening up before [hu]mankind as a result of man's entry into outer space." G.A. Res. 1962 (XVIII), at Preamble (Dec. 13, 1963).

[59] Sebastian Anthony, *The Apollo 11 Moon Landing, 45 Years On: Looking Back at Mankind's Giant Leap*, EXTREMETECH (July 21, 2014), https://www.extremetech.com/extreme/186600-apollo-11-moon-landing-45-years-looking-back-at-mankinds-giant-leap.

[60] For a succinct explanation of F.A. Hayek's theory as considered in the context of space, see Lawrence A. Cooper, *Space Exploration Through A New Application of Space Property Rights*, 19 SPACE POL'Y 115-16 (2003).

breakthrough opportunities for scientific and commercial exploration.[61] As a result, space mining for commercial purpose would promote rather than limit the exploration and use of outer space and be to the benefit and in the interests of all countries. Thus, in this regard, space mining driven by commercial incentives is in line with the purpose of the OST.

However, the hand of the market is blind to issues of distributional justice.[62] *Pareto optimum* and perfect markets have never existed and may not be theoretically possible.[63] Without government interference, the *laissez-faire* market does indeed generate extreme distributions of wealth. Extrapolating this concept to space resources, due to huge economic and technological disadvantages, developing countries may be left far behind by spacefaring countries. Free markets may do nothing to help developing countries escape from their current predicaments; they may even make their situation worse. For example, the introduction of space resources to the global market may hurt the gross domestic product of countries that have industries mining these resources terrestrially. Gradually, these developing countries may never be able to participate in space mining and enjoy its attendant benefits. Consequently, the freedom of exploration and use principle should be restricted by the terms of the OST and general international law, including the treaty's

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[61] *Scalable Robotic Spacecraft,* MOON EXPRESS, http://moonexpress.com/ (last visited Apr. 18, 2020).

[62] *Free Market Pros and Cons - Should We Privilege Allocative Efficiency and Accept the Resulting Inequality?* NETIVIST, https://netivist.org/debate/free-market-pros-and-cons (last visited Apr. 23, 2020). A free market may nevertheless sometimes result in unsatisfactory outcomes too. It is considered by many economists as one of the major causes of income inequality and economic disparity. For instance, monopolistic and cartelistic behavior of companies can disrupt allocative and productive efficiency, as well as generate a welfare loss.

[63] Supriya Guru, *Economic Efficiency and Pareto Optimality: Marginal Condition and Critical Evaluation*, YOUR ARTICLE LIBRARY, http://www.yourarticlelibrary.com/economics/economic-efficiency-and-pareto-optimality-marginal-condition-and-critical-evaluation/37570 (last visited Apr. 23, 2020). *Pareto optimum* (often called economic efficiency) is a position from which it is impossible to make anyone better off without making someone worse off by any reallocation of resources or distribution of outputs. However, the conditions under which a perfect competitive market system achieves *Pareto-optimality* are quite restrictive, including: (1) the second order conditions are satisfied; (2) the externalities in production and consumption are absent; (3) prevailing distribution of income is optimal from the social point of view; and (4) available resources are fully employed. It may also be noted that in present-day free enterprise capitalist economies perfect competition is an exception rather than the rule.

common benefit and interests principle and its environmental protection principle.

In the debates within the LSC, States expressed views on potential legal models for space resources activities. These statements may be qualified as State practice "that contributes to the formation, or expression, of rules of customary international law,"[64] as it is now generally accepted that verbal conduct (whether written or oral) of a State may count as practice.[65] For example, delegates often referred to "exploration," "exploitation," "use" and "extraction" interchangeably when talking about space mining. And they did not make a distinction between scientific and commercial exploration, but it could be inferred that they primarily focused on the latter, as the term "commercial" or "private entities" was repeatedly used. For space resources activities, most delegates expressed that the extraction of space resources is included in the scope of Art. I of the OST,[66] although the opposite view exists.[67] Besides, some argued that resources extraction needs to adhere to this principle, ensuring that free access to all areas of the celestial body would be maintained.[68] Meanwhile, some held that the freedom of exploration and use principle should be restricted by other principles in the OST and international law[69] and in a manner that respects the freedoms of others.[70] Hence, it can be observed that the mainstream view of the international community is that the exploitation and use of space resources for commercial purpose conforms to this principle, subject to some limitations.

The Hague Building Blocks also support the freedom of exploration and use principle and envisages some mechanisms to

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[64] Int'l Law Comm'n, Rep. on the Work of its Sixty-Eighth Session, U.N. Doc. A/71/10, at 76 (2016).

[65] *Id.* at 77.

[66] *See* Comm. on the Peaceful Uses of Outer Space, Legal Subcomm., Questions and Observations by Belgium on the Establishment of National Legal Frameworks for the Exploitation of Space Resources, U.N. Doc. A/AC.105/C.2/2018/CRP.8, at 2 (2018); Comm. on the Peaceful Uses of Outer Space, Draft Rep. of the Legal Subcomm. on Information on the Activities of International Non-Governmental Organizations, U.N. Doc. A/AC.105/C.2/L.304/Add.3, ¶ 27 (2018) [hereinafter 2018 Information Report]; Comm. on the Peaceful Uses of Outer Space, Rep. of the Legal Subcomm on Its Fifty-Sixth Session, U.N. Doc. A/AC.105/1122, ¶¶ 232, 246 (2017) [hereinafter Fifty-Sixth Legal Subcomm.].

[67] Fifty-Sixth Legal Subcomm., *supra* note 66, ¶ 247.

[68] 2018 Information Report, *supra* note 66, at ¶ 31.

[69] *Id.* ¶ 41.

[70] Fifty-Sixth Legal Subcomm., *supra* note 66, ¶ 243.

promote commercial incentives. Principle goals include: promoting and securing "the orderly and safe utilization of space resources," promoting "the sustainable, rational, efficient and economic use of space resources," providing "legal certainty and predictability for operators" and taking "into particular account the contributions of pioneer operators."[71] These principles perhaps reflect the fact that the members of the HSRGWG are primarily from spacefaring and emerging space powers and include representatives of commercial entities like ispace Inc. and Asteroid Mining Corporation.[72]

C. The Rule of Capture

Another important problem in the freedom of exploitation and use of space resources is that some actors may simply use first possession as a justification for ownership of space resources. Indeed, space resources, as *res communis,* can be appropriated to some extent on the basis of the freedom of exploration and use principle. But the rule of capture,[73] which illustrates the role of first possession, still needs to be carefully studied. In fact, this rule drove early and rapid development of the oil industry of the US in the 19th century, although a frenetic race among surface owners followed and led to an extraordinary waste of oil and gas. Today, the rule of capture is still in force, with some functional substitutes incorporated to effectively control its side effects.[74] Given that so far there is no

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[71] BUILDING BLOCKS, *supra* note 25, ¶ 4.

[72] There are 22 confirmed members, including members from the following countries: Brazil, Australia, Indonesia, South Africa, the Netherlands, Italy, the United Kingdom, the United States, Switzerland, India, France, Mexico, China, Luxembourg. *See Members*, UNIV. OF LEIDEN, https://www.universiteitleiden.nl/binaries/content/assets/rechtsgeleerdheid/instituut-voor-publiekrecht/lucht—en-ruimterecht/space-resources/members-website-1-3.pdf (last visited Apr. 18, 2020).

[73] The rule of capture means that the owner of a tract of land acquires title to the oil and gas which he produces from wells drilled thereon, though it may be proved that part of such oil or gas migrated from adjoining lands. For a fuller explanation see Bruce M. Kramer & Owen L. Anderson, *The Rule of Capture - An Oil and Gas Perspective*, 35 ENVTL. L. 900 (2005).

[74] *See* Terence Daintith, *The Rule of Capture: the Least Worst Property Rule for Oil and Gas*, *in* AILEEN MCHARG, PROPERTY AND THE LAW IN ENERGY AND NATURAL RESOURCES 140-158 (2010). Functional substitutes include: binding work or work expenditure programs at the exploration stage as well as creating obligations to relinquish substantial amounts of acreage at fixed intervals and on entering the production phase, continue exploration obligations even on production acreage. *See generally* TERENCE

agreement regarding property rights in space resources, they are essentially in a "state of nature." Allocation by the capture rule is simple and requires very little government involvement to deter another person or entity (called a "junior") from displacing the rightful first comer (called a "senior").[75] And it would maximize overall efficiency of the exploitation and use of space resources by developing more rapid and more diverse space exploration vehicles.[76]

However, considering the defects of the capture rule,[77] we should not vest an absolute monopoly in the senior and deprive a whole neighborhood or community of its rights. The international community should equitably distribute rights therein so as to prevent waste and abstract claims, learning from the experience of water rights and mineral rights in the expansion of the western US.[78] The senior who has mined substances and removed them from a celestial body would be awarded priority rights, but not a monopoly on that land's limited resources. The junior, who begins appropriating resources from the same land, could also receive rights and prevent the senior from enlarging his share to the junior's detriment. Alternatively, a dual system may be another good choice. For instance, the International Telecommunication Union (ITU) employs the rule of "first-come, first-served," supplemented by a nominal allocation of an orbital slot to each ITU member.[79] Similarly, due to the vastness of outer space and the uncertainty of resources,

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DAINTITH, DISCRETION IN THE ADMINISTRATION OF OFFSHORE OIL AND GAS: A COMPARATIVE STUDY (2006).

[75] Robert P Merges & Glenn Harlan Reynolds, *Space Resources, Common Property, and the Collective Action Problem,* 6 N.Y.U. ENVTL. L. J. 119 (1997). Aside from a method of recording claims and some threat or sanction to deter stronger second-comers from displacing rightful first possessors, very little in the way of governmental authority is needed.

[76] *Id.* at 120. The rule of capture will encourage a race ever deeper into space. Such inefficient races to claim and develop space resources will come with a significant spillover benefit: the development of more rapid and more diverse space exploration vehicles.

[77] "The two major problems associated with a rule of capture ownership regime [are] overdrilling and the dissipation of the reservoir's natural energy." Kramer & Anderson, *supra* note 73, at 902 (internal citations omitted).

[78] Ross Meyers, *The Doctrine of Appropriation and Asteroid Mining: Incentivizing the Private Exploration and Development of Outer Space*, 17 OR. REV. INT'L L.190, 198-200 (2015).

[79] *See* Mark Griffin, Space Servs. Dep't, Intl Telecomm. Union, Orbit/Spectrum Allocation Procedures 10-13 (Sept. 28-30, 2010), https://www.itu.int/en/ITU-R/space/workshopBangkok2010/03a-Orbit_Spectrum%20Allocation%20Procedures_MG.pdf.

it may be more necessary and advisable to establish reserve zones on the Moon and Mars than asteroids passing by the Earth for those countries with limited capabilities for space mining.

In the debates within the LSC, some delegates expressed that resource extraction on the Moon and other celestial bodies based on "first come, first served" basis was not compatible with the principles of equality of access to space.[80] Conversely, the Hague Building Blocks enable the attribution of priority rights for a maximum period of time.[81] Based on the analyses above, giving States equal liberty to explore and use outer space does not negate the "first come, first served" rule, as such freedom is implemented in terms of their abilities in practice. Recognizing priority rights of spacefaring countries to search and/or recover space resources may stimulate them to invest and develop mining industry. Nevertheless, overprotecting the "senior" by awarding priority rights could run the risk of disorder, waste, inequality and even monopoly. At present, space resources are accessible to only a very limited number of States and to a handful of enterprises within those States. Consequently, considering the interests of developing countries, priority rights should not be absolute but subject to some arrangements. For example, such rights would necessarily be limited in terms of the size of the area and the duration to be exploited or by reserve zones. After all, others' freedom should be respected too. Otherwise, the free exploration and use of outer space might be hindered.

In sum, the exploitation of space resources for commercial purpose is subsumed by the freedom of exploration and use principle and is therefore lawful under the OST. Commercial incentive and the capture rule could give stimulus for mining in outer space, while their defects must be tackled.

III. NON-APPROPRIATION

Anticipating a race for space resources, some States took the lead by enacting legislation to grant and recognize property rights over mined resources. For example, the 2015 CSLCA states that US citizens engaged in commercial recovery of an asteroid resource or

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[80] Comm. on the Peaceful Uses of Outer Space, Rep. of the Legal Subcomm on Its Fifty-Fifth Session, U.N. Doc. A/AC.105/1113, ¶ 83 (2016) [hereinafter Fifty-Fifth Legal Subcomm.].

[81] BUILDING BLOCKS, *supra* note 25, ¶ 7.

a space resource are entitled to "possess, own, transport, use, and sell the asteroid resource or space resource obtained in accordance with applicable law, including the international obligations of the United States."[82] Similarly, Luxembourg developed a legal framework in 2017, which not only guarantees miner's rights to the resources they extract, but also provides for the authorization and the issuance of licenses by States.[83] However, due to the lack of an international regime, concerns have been raised about whether these domestic laws conflict with international law, especially the non-appropriation principle.

Article II of the OST embodies the non-appropriation principle, which proscribes the national appropriation of outer space "by claim of sovereignty, by means of use or occupation, or by other means."[84] From Article VI of the OST, it can be inferred that "national appropriation" covers both appropriation by States and by private entities.[85] Although this principle precludes the possibility of the appropriation of outer space and celestial bodies, whether it extends to natural resources therein is uncertain. The OST never makes a distinction between space and celestial bodies on the one hand and resources extracted from them on the other. Put differently, it is unclear whether the term "outer space" includes both outer space broadly considered and its natural resources. In contrast, the MA clearly states that the Moon and its resources are the CHM and prohibits national appropriation of the resources of the Moon. There is no proprietary right over natural resources in place, which is without prejudice to the establishment of an international regime referred to in Article 11(5) of the Agreement.[86] Due to this provision, the MA has garnered limited support and will not prevent the majority of spacefaring countries from carrying out space mining.[87]

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[82] 51 U.S.C. § 51303 (2018).

[83] Jeff Foust, *Luxembourg Adopts Space Resources Law*, SPACENEWS (July 17, 2017), https://spacenews.com/luxembourg-adopts-space-resources-law/.

[84] Outer Space Treaty, *supra* note 3, art II.

[85] *Id.* at art VI. Among other things, Article VI indicates that States "shall bear international responsibility for national activities in outer space . . . whether such activities are carried on by governmental agencies *or by non-governmental entities* . . . ." *Id.* (emphasis added).

[86] Moon Agreement, *supra* note 11, art 11.

[87] *See* Butler, *supra* note 38, at 508-09.

Given these tensions, the legal status of resources on celestial bodies has raised much controversy over the years. While some hold the prohibition in Article II applies both to outer space and its natural resources,[88] others argue that the non-appropriation principle refers only to celestial bodies but not to the resources.[89] The latter view is supported by the US and Luxembourg, whose national law stipulates that private entities only have rights to resources and not to the body from which they are extracted. Under this interpretation, space resource extraction does not violate non-appropriation principle. Similarly, for the HSRGWG, the concept of exploitation in this manner conforms to its purpose, namely to "enable, support and co-ordinate the use of space resources [in a manner] acceptable for spacefaring nations and other interested States."[90]

In comparison, delegates in the LSC differ on this question. Some argued that the unilateral national legislation to protect private property rights in resources extracted from the Moon or any other celestial body may amount to either a claim of sovereignty or a national appropriation of those bodies.[91] Conversely, some held that such legislation did not constitute a violation of the OST without an authorization granted to an entity for space mining as its application would necessarily be reviewed in accordance with the international treaty obligations of that State.[92] Besides, some delegates expressed that the principle of non-appropriation only applies to resources that are "in place,"[93] while others expressed that whether the resources are to be used in situ or transported to Earth would not make any difference to the determination of the lawfulness of that space resource activity.[94] What's more, national laws

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[88] Carl Q. Christol, *The Common Heritage of Mankind Provision in the 1979 Agreement Governing the Activities of States on the Moon and Other Celestial Bodies*, 14 INT'L L. 429, 440 (1980).

[89] *Id.* at 441.

[90] *The Hague International Space Resources Governance Working Group*, UNIV. OF LEIDEN, https://www.universiteitleiden.nl/en/law/institute-of-public-law/institute-of-air-space-law/the-hague-space-resources-governance-working-group (last visited Apr. 18, 2020).

[91] Fifty-Fifth Legal Subcomm., *supra* note 80, ¶ 74; Fifty-Sixth Legal Subcomm., *supra* note 66, ¶¶ 241, 247.

[92] Fifty-Fifth Legal Subcomm., *supra* note 80, ¶ 75; 2018 Information Report, *supra* note 66, ¶¶ 31, 47.

[93] Fifty-Sixth Legal Subcomm., *supra* note 66, ¶ 248.

[94] 2018 Information Report, *supra* note 66, ¶ 49.

on space resource exploitation and utilization were questioned,[95] and the view was expressed by multiple delegates that an international framework is required to provide legal certainty on commercial activities in outer space.[96] Thus, the essential question is still whether exploitation of space resources amounts to appropriation prohibited by the OST.

A. Distinction Between Exploitation and Appropriation

The OST was concluded during the Cold War and should be read as anti-imperial.[97] By excluding sovereignty in outer space under Article II, the OST encourages States to choose a peaceful and cooperative strategy rather than engage in intense and heavy extraterritorial land grab. As legal theorist Carl Schmitt demonstrated, the history of international law could be traced through land appropriation.[98] Indeed, the term "appropriation" is primarily concerned with the expansion of State territory. But the legal status of natural resources is not necessarily the same as the surface of land. There are three different types of property rights over natural resources of the subsoil in Earth: i) the regime of *accessio*; ii) the national property model; and iii) the model of absolute property of the State.[99] Consequently, the land in outer space not under national or private dominion doesn't mean that exploitation of natural

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[95] *Id.* ¶ 37.

[96] *Id.* ¶¶ 34, 40 and 48. *See also* Fifty-Sixth Legal Subcomm., *supra* note 66, ¶¶ 228, 234 and 250.

[97] P. J. Blount and Christian J. Robison, *One Small Step: The Impact of the U. S. Commercial Space Launch Competitiveness Act of 2015 on the Exploitation of Resources in Outer Space,* 18 N.C. J. L. & TECH. 160, 164 (2016).

[98] *Id.* at 169.

[99] Jose Juan Gonzalez, *The Scope and Limitations of the Principle of National Property of Hydrocarbons in Mexico*, *in* AILEEN MCHARG ET.AL., PROPERTY AND THE LAW IN ENERGY AND NATURAL RESOURCES, 210-12 (2010). Under the regime of *accessio*, the natural resources of the subsoil belong to the land owner. The national property model distinguishes between property in land and property of other natural resources whose nature is different from the soil, such as hydrocarbons. It means property of resources in the subsoil is vested in the State. In contrast, the model of absolute property of the State recognizes the absolute property of the State over natural resources. These different types of property rights over natural resources of the subsoil demonstrate that the legal status of natural resources is not necessarily the same as the surface of land. In this respect, although outer space is not subject to national appropriation, it does not necessarily mean natural resources therein cannot be subject to appropriation.

resources in the subsoil is unlawful under the non-appropriation principle.

When the OST was adopted, the issue of exploitation and use of natural resources did not emerge, thus it was not addressed *expressis verbis*. But explicit prohibition does not amount to lawfulness. As Brooks posited, the question about the rights of States in using the resources of celestial bodies may still be open.[100] The recent advancements of science and technology and the increasing interest in space resources makes it urgent to develop a clear international legal regime to handle these activities. In the search for such a regime, existing international mechanisms such as those regulating international fisheries or seabed mining might be instructive.[101]

Outer space is identified as a global commons, like the high seas, the atmosphere and Antarctica.[102] Many examples confirm that the exploitation and use of resources to some extent can occur in global commons. The protection of property rights over resources that private actors may recover from an area beyond national jurisdiction or of global interest, as shown by international regulations governing mining from the deep seabed, does not necessarily amount to a sovereignty claim over the territorial area.[103] Mineral resources in the deep seabed, which is recognized as CHM, could become the property of miners based on their labor or effort rather than sovereignty.[104] And the operators are obliged to respect international law and get licensed by the International Seabed Authority.[105]

Nevertheless, concerns have been raised that apart from sovereignty, under the OST, "use or occupation" or "other means" may

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[100] *See* Christol, *supra* note 88, at 442.

[101] Fifty-Fifth Legal Subcomm., *supra* note 80, ¶ 81.

[102] U.N. SYSTEM TASK TEAM ON THE POST-2015 UN DEVELOPMENT AGENDA 5 (2013), https://www.un.org/en/development/desa/policy/untaskteam_undf/thinkpieces/24_thinkpiece_global_governance.pdf.

[103] *See generally* Tepper, *supra* note 19, at 6-7.

[104] United Nations Convention on the Law of the Sea art. 137(2), Dec. 10, 1982, 1833 U.N.T.S. 397 [hereinafter UNCLOS] ("All rights in the resources of the Area are vested in [hu]mankind as a whole, on whose behalf the Authority shall act. These resources are not subject to alienation. *The minerals recovered from the Area, however, may only be alienated in accordance with this Part and the rules, regulations and procedures of the Authority*.") (emphasis added).

[105] *Id.* at arts. 138, 151(2).

also be equivalent to appropriation. In this respect, whether exploitation and use of space resources amounts to appropriation would largely depend on the manner in which it is to be implemented. The OST demonstrates the possibility of occupation or inhabitation in Article XII by recognizing that "all stations, installations, equipment and space vehicles on the Moon and other celestial bodies,"[106] are something different from appropriation. It is also true when it comes to geostationary slots and frequencies in the outer space. These resources in this inclusive area are administrated and allocated by the ITU and can be exclusively used and not interfered with by other users. States using frequency bands for radio services temporarily are given rights based on the ITU Constitution rather than their ownership over these resources. One of the conditions is that States have the obligation to ensure equitable access to those orbits and frequencies.[107] In this way, a balance could be struck between maintaining the open access, non-appropriable and collectively beneficial nature of space while also ensuring that private property rights can attach to space resources.

What's more, the exploitation of space resources is not equated with appropriation to some extent. The reasons are multiple. First of all, as referred to above, the exploitation of space resources is permitted by the freedom of exploration and use principle encapsulated in Article I of the OST. Considering the consistency with Article II, a reasonable explanation may be that acts of exploitation of space resources are lawful and not included in the scope of non-appropriation principle. Second, the MA also differentiates the concept of exploitation from appropriation. On the one hand, it refers to exploitation of the natural resources of the Moon and other celestial bodies in the preamble and the need for an international regime in Article 11 (5); on the other hand, in Article 11 (2) and (3),[108] it repeats the non-appropriation principle, much like Article II of the OST. The structure in the MA demonstrates that the exploitation of the natural resources of the Moon does not constitute a means of appropriation. Third, some have argued that exploitation of space resources always accompanying actual use determines the

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[106] Outer Space Treaty, *supra* note 3, art. XII.

[107] Constitution of the International Telecommunication Union [ITU] art. 44(3), https://www.itu.int/council/pd/constitution.html [hereinafter ITU Constitution].

[108] Moon Agreement, *supra* note 11, art. 11.

lawfulness of the exclusion of others from use of these resources. In contrast, the justification of appropriation of an area is derived from authority rather than effort. In this respect, claims over space resources are different from claims over areas.[109] Nevertheless, it cannot be argued that traditional property rights over space resources are lawful under the OST.

It is noted that rules relevant in other global commons cannot be automatically applied to outer space, as they are distinct in many ways. For example, the approach that each ITU member is entitled to an orbital position should not be introduced into the legal regime regulating space mining.[110] In addition to the great difficulty of physically allocating space resources fairly, regulation tends to cause inefficiency and potential waste. Although the MA has provided a valuable framework to govern the exploitation of space resources, due to its poor ratification, an international regime for such exploitation should be formulated independent of the MA. Otherwise, the legal uncertainty will shrink the investment pool and impede the process of exploration and use of outer space by humankind. In this context, the national legislation of the US and Luxembourg as well as the Hague Building Blocks are of great importance and can greatly enhance discussions in the international community. The following section will focus on these subsequent practices, which introduce a new version of the concept of appropriation in international space law as a starting point for a workable regime of resources exploitation.

B. Subsequent Practice

As the context of space mining evolves, some provisions of the OST are more likely to be re-interpreted or even informally modified to fulfil its object and purpose, or maintain its foundation in the

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[109] DE MAN, *supra* note 50, at 207-08, 410-11.

[110] For a review of major principles regarding the ITU regulation of orbit usage, see ITU Radio Regulatory Framework for Space Services, online at: https://www.itu.int/en/ITU-R/space/snl/Documents/ITU-Space_reg.pdf. Space mineral resources are different from geosynchronous orbit in many ways. For instance, as space is quite large and many asteroids are movable, there are great difficulties in physical allocation of mineral resources therein. More importantly, space mineral resources are exhaustible while orbital positions are not. For this reason, space mining may seek its own distinct legislation.

agreement of the parties.[111] For example, the US and Luxembourg, by transforming their interpretation of Article II, the non-appropriation principle, into national law, may lead the future development of international space law in their desired direction. According to Article 31(3)(b) of VCLT,[112] these domestic laws can be subsequent practice in the application of Article II, which is helpful to establish agreement among the parties regarding its interpretation. Besides, given that space resource activities depend on the level of technological and economic power of the State, they can be conducted by only a limited number of States Parties of the OST. It is these States that are most active in pursuing a particular interpretation through domestic legislation. For this reason, these State practices can be considered to be representative and should be given more weight as an interpretative tool of the OST. However, we should be careful in examining whether the limited State conduct is accepted by those parties not engaged in this particular practice, albeit tacitly.[113] In this respect, the practice of US and Luxembourg is one of several possible interpretations, but the consensus of the international community on this issue has not been reached.[114]

Actually, the Hague Building Blocks also uphold the non-appropriation principle by indicating that the rights to space resources and products derived therefrom should be lawfully acquired and mutually recognized between States.[115] Moreover, it permits the establishment of safety zones.[116] The mutual recognition of resources rights is similar to a "reciprocating States regime," a practice among States on international seabed mining. Before the United Nations Convention of the Law of the Sea (UNCLOS)[117] entered into force, some western States wanted to protect their domestic companies which had invested much in preparation for seabed mining. The reciprocating states regime requires that each State adopt similar national legislation on deep seabed mining and

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[111] Int'l Law Comm'n Rep. on the Work of the Sixtieth Session, Annex A, U.N. Doc. A/63/10, ¶ 14 (2008).

[112] Vienna Convention, *supra* note 48, art. 31(3)(b).

[113] Philip De Man, *State Practice, Domestic Legislation and the Interpretation of Fundamental Principles of International Space Law,* 42 SPACE POL'Y 98 (2017).

[114] *Id.* at 92, 97.

[115] BUILDING BLOCKS, *supra* note 25, ¶ 8.

[116] *Id.* ¶ 11.

[117] UNCLOS, *supra* note 104.

commit to coordinate and not interfere with each other's activities.[118] But this regime only served as a transition and was later replaced by the 1994 Implementation Agreement of Part XI of the UNCLOS.[119] Hence, given the status quo of technological and industrial development at the dawn of space mining, the practice of mutual recognition of space resources rights could also play a similar role before an international framework is reached. In fact, Luxembourg is concluding cooperative agreements with like-minded States such as Poland, the United Arab Emirates, Portugal and Japan, comparable to those concluded under a reciprocating states regime.[120]

On the other hand, the practice of mutual recognition of space resources rights may also be established by the agreement of all States, although the fundamental principles of the OST—the freedom of exploration and use, common benefit and interests—warrant a particularly rigorous assessment of the conditions for subsequent practice as an interpretative tool. Nevertheless, such practice may primarily reflect or protect the interests of technologically advanced countries, as the majority of developing countries do not have meaningful space capabilities. Consequently, it is important to exchange views continually on new and upcoming issues on space mining like in the LSC to take the developing countries' concerns into account.[121] Additionally, with the numerous challenges and questions posed by the utilization of space resources, the determination of the legality of such activities cannot be resolved through unilateral action but requires an inclusive multilateral process.[122] An international framework that clearly defines and provides guidance on commercial activities in outer space is indispensable in avoiding gaps and ensuring the consistency of national legislation.

Regarding the issue of safety zones, although the access to these zones is restricted only to a limited period of time, it

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[118] FABIO TRONCHETTI, THE EXPLOITATION OF NATURAL RESOURCES OF THE MOON AND OTHER CELESTIAL BODIES A PROPOSAL FOR A LEGAL REGIME 111-12 (2009).

[119] Agreement relating to the implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982, July 28, 1994, 1836 U.N.T.S. 3.

[120] Luxembourg Ministry of the Economy, *Luxembourg and the Republic of Poland Agree to Cooperate on Space Activities* (Oct. 12, 2018), https://space-agency.public.lu/en/news-media/news/2018/Lux_Poland.html.

[121] De Man, *supra* note 113, at 101-02.

[122] Fifty-Sixth Legal Subcomm., *supra* note 66, ¶ 237.

nevertheless does not amount to appropriation because of the lack of claims to that area. For example, under the ITU system, during a limited and predetermined period of time, the operator is allowed to use a certain orbital slot located in a non-appropriable area exclusively, without ownership rights granted over it.[123] Similarly, the safety zone is also permitted in the exclusive economic zones created by UNCLOS to ensure the safety both of navigation and of offshore oil and gas facilities.[124] Additionally, during the Cold War, both the US and the Soviet Union established keep out zones and safety zones in outer space. Such jurisdiction would not involve a claim of ownership rights but in the interest of national security to repel other human-made objects coming close to their space system.[125] Hence, a safety zone is necessary to assure safety and avoid any harmful interference with others' space resources activities. In particular, considering that space resources are scarce with limited quantity, accessibility and affordability, an inevitable economic rivalry is likely to occur in the exploitation and use of these resources. Consequently, a safety zone should be established to protect a mining activity or a habitat on an asteroid or other celestial body from intrusion by a competitor. Otherwise, it wouldn't be guaranteed for the business certainty and investor confidence as well as continued safety of operations.[126] However, when a safety zone is established and how an appropriate limited period of time is authorized need to be clearly addressed. Without proper regulation, there is a high risk that the safety zone is equivalent to *de facto* appropriation. Imagine a safe area for space mining established in a manner that excludes others from entering a particular location for a significant period of time. How would this be different from appropriating the celestial body?

To summarize, the exploitation of space resources is not unlawful under the non-appropriation principle. It is simply a matter left for the future development of international law. In the search for such a regime, it would be useful to look at existing legal

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[123] ITU Constitution, *supra* note 107, art. 44(5).

[124] UNCLOS, *supra* note 104, art. 60.

[125] Colleen Driscoll Sullivan, Defining and Strengthening the Common Nature of the Outer Space, 64-65 (Apr. 19, 1993) (unpublished Ph.D. thesis, Temple University (on file with author).

[126] *See* Cody Knipfler, *Revisiting 'Non-Interference' Zones in Outer Space*, THE SPACE REV. (Jan. 29, 2018), https://www.thespacereview.com/article/3418/1.

framework regulating the exploration and use of resources in other global commons and relevant contents in the national legislation of the US and Luxembourg and the Hague Building Blocks.

IV. COMMON BENEFIT AND INTERESTS

Article I of the OST provides that the exploration and use of outer space shall be: carried out for the benefits and in the interests of all countries, regardless of their degree of economic or scientific development; and the province of all humankind.[127] It reflects the common benefit and interests principle, which means that the interests of spacefaring countries and non-spacefaring countries, developed countries and developing countries should be taken into account. Under this provision, the obligation of countries to share benefits is legally binding. As the word "shall"' indicates, it cannot be relegated to the preamble of the OST and has the full strength of a duly formulated international contractual norm.[128] However, States hold opposing positions on what constitutes "the interests of all countries" and how to share benefits which might rely largely on their good faith. The MA further adds the interests of future generations and requires that benefits equitably derived from space resources be shared on the basis of CHM.[129] But the CHM of the Moon and its natural resources was one of the biggest barriers for the MA to be ratified by most major developed States.[130]

A. Maximum Benefits

Basically, the exploitation and use of space resources would bring a wide-range of benefit and interests to all countries. For instance, it is argued that these activities are incentives: to develop new technologies for furthering deep space missions; promoting terrestrial development activities;[131] expanding the use of outer space; and impelling future generations to reach beyond the relatively close resources of our solar system for "their share."[132] So it is of great significance to encourage activities of space mining to

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[127] Outer Space Treaty, *supra* note 3, art. I.
[128] Su, *supra* note 44, at 1003.
[129] Moon Agreement, *supra* note 11, arts. 4, 11.
[130] Butler, *supra* note 38, at 508-09 (2017).
[131] Fifty-Sixth Legal Subcomm., *supra* note 66, ¶ 238.
[132] Cooper, *supra* note 60, at 114.

maximize welfare for humankind. Spacefaring countries who have invested much on such activities are certainly entitled to profit from the work of their own labor. Developing countries, despite their limited capabilities for space exploration, could also benefit from such activities.

However, the common benefit and interests of all countries are not equivalent to the common benefit and interests of every country. As Bentham proposed, the highest principle of morality requires "the greatest happiness for the greatest number," namely a focus on the sum whole of happiness.[133] It's conceivable that, with different levels of economic or scientific development among States, the benefits and interests they gain from space mining will also vary. Inequalities are inevitable, as it is often difficult to satisfy each and every State. But some inequalities could be tolerable if they are to the greatest benefit of the least advantaged. Based on Rawls' difference principle, such inequalities should be arranged so that they are both (a) reasonably expected by every State's advantage and (b) attached to positions and offices open to all.[134] The difference principle provides a "social minimum," including basic liberties such as freedom of thought, choice, wealth, self-respect and so on. In many ways, it is about fair procedure to kick in unequal distribution of talents instead of outcomes distributed at exactly the same levels to all States. In Article I of the OST, every State is endowed with a minimum set of "primary goods" like freedom of access, exploration and scientific investigation. Accordingly, they have self-respect to pursue their good as an equally worthy member of societies. Such arrangement expresses the commitment of spacefaring countries to share their fate and could help maximize resources of developing countries to explore and use the outer space. In this respect, inequalities in practice should be allowed, as they

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[133] BENJAMIN K. SOVACOOL & MICHAEL H. DWORKIN, GLOBAL ENERGY JUSTICE, PROBLEMS, PRINCIPLES, AND PRACTICES 93 (2014).

[134] *Id.* at 157-159. The difference principle justifies social and economic inequalities only if they are to the greatest benefit of the least advantaged. It ensures that society is endowed with a minimum set of "primary goods" or "goods every rational man is presumed to want," including basic liberties such as freedom of thought, freedom of movement and freedom of choice, powers and prerogatives of offices and positions of responsibility, income and wealth, and self-respect and confidence. It provides a "social minimum" and kicks in to correct for unequal distribution of talent by rewarding only attributes that benefit society as a whole.

would benefit the least advantaged and help avoid an even greater inequality.

Nevertheless, under current space law, developing countries hardly benefit from space mining. Rawls' difference principle cannot avoid a greater inequality. Actually, the gap among spacefaring and developing countries is widening instead. As a pragmatic compromise, Rawls only designs a procedure to divide slices of cake, but pays less attention to the size of each slice of cake, as for Rawls, the goal is to design a procedure that encourages fairness and impartiality. But basic liberties are far from enough to reach socioeconomic equality. For this reason, this principle is widely criticized.

Sen and Nussbaum developed Rawls' theory and referred to notions of "functioning" and "capabilities" which refer to the substantial freedoms people ought to have to enjoy the various things they may value doing.[135] It is implied that every State ought to have access to a "social minimum" energy or technology so that its citizens can enjoy a modern, healthy lifestyle. In furthering distribution, developing countries need to be assured that they will not be excluded from the vast potential that space resources offer. In short, Sen and Nussbauum argue that outcomes matter. As Nussbaum puts it, "the capabilities approach is fully universal: the capabilities in question are held to be important for each and every citizen, in each and every nation, and each person is to be treated as an end." In this way, they would benefit from the exploitation and use of space resources.[136] Thus, an international legal framework governing space mining to maximize welfare is essential, not necessarily in the narrow utilitarian way argued by Bentham, but also in the ability to enable peoples to realize functions and capabilities.

This view is also supported by some delegates in the LSC and HSRGWG. In the LSC, views were expressed that the benefits of the exploration and use of outer space will be enjoyed by all humanity, and all countries will stand to benefit from the progress made in space resource utilization.[137] Similarly, the Hague Building Blocks reiterate the common benefit and interests principles.[138]

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[135] *Id.* at 159-61.

[136] *Id.* at 160.

[137] Fifty-Fifth Legal Subcomm., *supra* note 80, ¶ 79; Fifty-Sixth Legal Subcomm., supra note 66, ¶¶ 230, 232, 238 and 242; 2018 Information Report, *supra* note 66, ¶¶ 31, 42 and 45.

[138] BUILDING BLOCKS, *supra* note 25, ¶¶ 1, 4 and 9.

They refer to several relevant principles, such as considering the needs of developing countries and the contributions of pioneer operators.[139]

B. International Cooperation

Similar to other global commons, outer space faces a collective action problem. Because of the competing views and interests among different countries, substantial disagreement exists with regard to benefit sharing. This issue has become more tangible and pressing especially given that space mining will become a reality soon. Specifically, spacefaring countries are seemingly reluctant to sacrifice their "hard earned" benefits to those who do not have the capacity to invest or gain them on their own, while developing countries are pressing for equitable distribution of benefits. To make these benefits truly accrue to all countries and avoid the tragedy of the anti-commons, the concept of a "community of shared future for humankind" (CSFM) provides a potential solution. It was first proposed by China,[140] and has been written into several resolutions adopted by the UN.[141] Unlike CHM, CSFM requires States to cooperate to jointly tackle current security and developmental challenges and properly handle State-to-State relations. On the one hand, CSFM highlights the idea of common interest and harmonious coexistence for universal prosperity in the outer space. By international cooperation, States would conduct space resources activities with due regard to the corresponding interests of other States and the international community. Developing countries could be enabled to bridge the still widening gap of technology and knowledge, which is beneficiary for their future development and

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[139] *Id.* ¶ 4.

[140] The term of CSFM first appeared in a White Paper of the State Council of China in September 2011, entitled "China's Peaceful Development," where it was translated as "the Community of common density." President Jinping Xi then put forward and expounded on the vision of CSFM on a number of international occasions. *See* Fengna Xu & Jinyuan Su, *Shaping 'A Community of Shared Future for Mankind': New Elements of General Assembly Resolution 72/250 on Further Practical Measures for the PAROS*, 44-45 SPACE POL'Y 57, 59 (2018).

[141] The concept of CSFM has been written into several resolutions adopted by the UN, including: G.A. Res. 74/6, at 2 (Oct. 31, 2018); G.A. Res. 37/23 (Mar. 19, 2018); G.A. Res 72/250 (Dec. 24, 2017); S.C. Res. 2344 (Mar. 17, 2017).

considerably contributes to worldwide stability and peace.[142] On the other hand, as a community of shared interests, CSFM advocates win-win cooperation instead of confrontation and exclusiveness. Given that the space mining industry, with high cost and risk, has posed developmental challenges to humankind, all States need to jointly tackle it. International cooperation provides a feasible way to strike a balance among different players. For developing countries, their interests would be guaranteed by directly participating in the exploitation and use of space resources, as they would be recognized as partners in formulating decisions and not merely recipients of benefits.[143]

It is clear that international cooperation, as an important principle in both general international law as well as the *lex specialis* of space law, does not incur mandatory monetary benefit-sharing. In the discussion within COPUOS and the LSC on a relevant item, developing countries were willing to allay the concerns of developed countries and struck a compromise to resolve the issue.[144] And in the 1996 Declaration on International Cooperation, States are allowed to determine freely "all aspects of their participation in international cooperation on an equitable and mutually acceptable basis."[145] The fate of Part XI of the UNCLOS also demonstrates this. After hard negotiations among developed and developing countries, the 1994 Implementation Agreement[146] was adopted. It accepted a

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[142] STEPHAN HOBE, COLOGNE COMMENTARY ON SPACE LAW, VOL. I: OUTER SPACE TREATY ¶ 72 (2009).

[143] Xu & Su, *supra* note 140, at 59, 60.

[144] *See* Marietta Benkii & Kai-Uwe Schrogl, *History and Impact of the 1996 UN Declaration on 'Space Benefits'*, 13 SPACE POL'Y 139-42 (1997).

[145] G.A. Res. 51/122, ¶ 2 (Dec. 13, 1996).

[146] Agreement Relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea, Nov. 16, 1994, 1386 U.N.T.S. 3. In the 1980s, some marine powers like the US, the UK, Germany and France refused to join UNCLOS due to their skepticism of Part XI. There are many requirements of equalitarianism in Part XI, such as compulsory economic assistance or compensation to developing States whose economies are seriously affected by deep seabed mining activities (UNCLOS, Article 151, 6 (10)), unconditional transfer of technology (UNCLOS, Annex III, Article 5(3), (6)), high annual fee from the date of entry into force of the contract (UNCLOS, Annex III, Article 13(3)). But after hard negotiations between them and developing countries, the 1994 Implementation Agreement of Part XI of the UNCLOS was adopted with notable changes to reflect commercial interests. For instance, economic assistance fund should not exceed payments received from contractors and voluntary contributions (1994 Implementation Agreement of Part XI of the UNCLOS, Annex, Section 7); the transfer of technology should be based on fair and reasonable commercial terms and conditions on

free-market approach to some extent. For this reason, for spacefaring countries, with a considerable amount of money and effort going into space mining, compulsory monetary benefit-sharing would generate disincentives for them to invest in space mining. And requirements that benefit or technology be shared with others regardless of their level of involvement in the endeavor would also place substantial burdens on private space development, especially in its early stage.[147] Hence, international cooperation must be considered to be subject to some extent to commercial incentives, which are vital for investment in the exploitation and use of space resources as mentioned above. As argued by Olson, in a large group, rational and self-interested individuals will not voluntarily act in their common or group interest, unless there is coercion or some separate incentive.[148] Besides, developing countries should also make what contribution they can to an activity of common interest to all.[149] A lesson drawn from the failure of the MA is that concepts like CHM focusing on rights and benefits while neglecting obligations and burdens are unacceptable for spacefaring countries. Developing countries should indicate a readiness to cooperate through positive action rather than as free-riders, as voluntary cooperation implies win-win cooperation.

As a result, the international community needs to carefully balance the interests of developed and developing countries which are reconcilable and not mutually exclusive. Fortunately, there are various options we could use to expand access to energy and technology, such as joint ventures like pro-poor public private partnerships (5Ps).[150] According to this new pro-poor partnership model, developing countries are recognized not only as consumers receiving benefits but also as partners in business ventures. In this way, each party could benefit a lot from this model. Besides, assistance

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the open market, or through joint-venture arrangements (Section 5); and the annual fee is reduced and paid from the date of commencement of commercial production (Section 8). As a result, the UNCLOS was joined and ratified by most countries in the world.

[147] Thomas R. Irwin, *Space Rocks: A Proposal to Govern the Development of Outer Space and Its Resources,* 76 OHIO ST. L. J. 217, 232 (2015).

[148] MANCUR OLSON, LOGIC OF COLLECTIVE ACTION, PUBLIC GOODS AND THE THEORY OF GROUPS 2 (2002).

[149] Comm. On the Peaceful Uses of Outer Space, Rep. of the Legal Subcomm. on Its Fifth Session, U.N. Doc. A/AC.105/C.2/SR.71, at 23 (1966).

[150] Akanksha Chaurey et al., *New Partnerships and Business Models for Facilitating Energy Access,* 47 ENERGY POL'Y 48, 50 (2012).

programs could help avoid inequality and protect the interests of developing countries. In fact, it is quite practical to compensate those countries who are adversely affected to achieve the "ultimate good" for society. According to the principle of rational benevolence refined by Henry Sidgwick, the good of any State is of no more importance, from the point of view of the Universe, than the good of any other.[151]

What's more, procedural justice also matters because it tends to promote better outcomes in terms of the traditional welfare economics approach.[152] Unlike distributive justice, procedural justice is oriented towards process rather than outcome. It is recognized as an important determinant of perceived fairness[153] by providing meaningful involvement and access to the decision-making process. Specifically, procedural justice deals with recognition (who is recognized), participation (who gets to participate) and power (how power is distributed in decision-making forums).[154] Outer space, as a global commons, should be collectively managed by all States or all humankind. The exploitation and use of space resources is no exception. To establish relevant regimes of benefits sharing, the UN should play a key role due to its legitimacy and inclusivity. At the same time, stakeholders, including private sectors, governments of spacefaring and developing countries and experts, should be encouraged to participate in it. As in the LSC, the majority of delegations have actively participated in the discussion on potential legal models for activities in exploration, exploitation and use of space resources. Nevertheless, decisions should not be made on a "one State, one vote" basis, as demonstrated by the failure of Part XI of the UNCLOS. Those countries contributing much to the exploitation and use of space resources should be given an impact proportionate to their interest and the involvement. But it is still rewarding for developing countries to be included in the decision-making forums to raise possible concerns. Additionally, other measures may also be useful, such as better information disclosure and

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[151] SOVACOOL & DWORKIN, *supra* note 133, at 94.

[152] *See* Paul Dolan et al., *It Ain't What You Do, It's the Way that You Do It: Characteristics of Procedural Justice and Their Importance in Social Decision-Making,* 64 J. ECON. BEHAVIOR & ORG. 159 (2007).

[153] *See* Robert J. Bies et al., *Procedural Fairness and Profit Seeking: The Perceived Legitimacy of Market Exploitation*, 6 J. BEHAVIORAL DECISION-MAKING 253 (1993).

[154] SOVACOOL & DWORKIN, *supra* note 133, at 137, 138.

auditing to promote transparency of decisions, effective remedies mechanism and so on.

In the debates within the LSC, many delegations held that solid cooperation is beneficial to maximize space resources for the common prosperity, security and the long-term sustainability of outer space activities.[155] And international space cooperation should be based on the concepts of equality, mutual benefit and inclusive development.[156] In particular, developing countries must be involved for their rights and benefits to be considered.[157] Hence, it is important to strengthen technical assistance and sharing.[158] Regarding procedural justice, delegates stressed the important role of the UN in strengthening and developing cooperation and collaboration among countries,[159] since taking a multilateral approach to space resources within COPUOS and its LSC is the only way to ensure that the concerns of all States.[160] Obviously, these views are basically consistent with our above analyses. In contrast, the Hague Building Blocks address some measures and requirements of benefits sharing, including: promoting the participation in space activities by all countries, in particular developing countries; no compulsory monetary benefit-sharing; and encouraging operators to provide for benefit-sharing.[161] But these provisions only cover distributive justice; not procedural justice. Given its membership, there is no broad participation in the HSRGWG, which makes it impossible to fully reflect the demands of the international community. As Belgium argued, without any actual mandate received from States and of a formal mechanism ensuring their representation, the HSRGWG does not provide a "forum for negotiations on an international framework."[162] Besides, the neutrality of the Working Group

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[155] Rep. of the Comm. on the Peaceful Uses of Outer Space on Its Sixtieth Session, U.N. Doc. A/72/20, ¶ 58 (2017) [hereinafter the COPUOS 2017 Report].

[156] Fifty-Fifth Legal Subcomm., *supra* note 80, ¶ 244; Fifty-Sixth Legal Subcomm., *supra* note 66, ¶ 264.

[157] COPUOS 2017 Report, *supra* note 155, ¶ 229.

[158] *Id.* ¶ 311. *See also* Fifty-Fifth Legal Subcomm., *supra* note 80, ¶ 65.

[159] COPUOS 2017 Report, *supra* note 155, ¶ 58.

[160] Fifty-Sixth Legal Subcomm., *supra* note 66, ¶ 225; 2018 Information Report, *supra* note 69, ¶ 28.

[161] BUILDING BLOCKS, *supra* note 25, ¶ 13.

[162] Comm. on the Peaceful Uses of Outer Space, Rep. of the Legal Subcomm., Questions and Observations by Belgium on the Establishment of National Legal Frameworks for the Exploitation of Space Resources, U.N. Doc. A/AC.105/C.2/2018/CRP.8, ¶ 3 (2018).

can be questioned, as it is primarily financed by the Dutch Ministries of Foreign and Economic Affairs, the Secure World Foundation, Deep Space Industries, ispace, the University of Luxembourg, Nishimura & Asahi and the Ten to the Ninth Plus Foundation[163]

Thus, the exploitation and use of space resources for commercial purpose conforms to common benefit and interests principle. International cooperation is conducive to balancing the interests of developed and developing countries and contributes to a CSFM of outer space. In addition to distributive justice, procedural justice could also promote equitable benefits sharing.

V. ENVIRONMENTAL PROTECTION

When the OST was concluded, it emphasized the peaceful use of outer space; environmental protection was not a priority or concern. But this issue is becoming particularly important at the dawn of space mining. Article IX of the OST has laid the basis for environmental protection in outer space. It requires that States pursue studies and conduct exploration of outer space so as to avoid their harmful contamination and also adverse changes in the environment of the Earth.[164] In addition, according to Article VI, States are obliged to consider environmental aspects for the authorization and supervision of national activities in outer space[165] and adopt appropriate measures when necessary. This is the environmental protection principle. However, the provisions contained in this principle are rather vague and broad. The MA also addresses this principle in Article 7, using the terms "preventing the disruption of the existing balance of its environment," and "avoiding harmfully affecting the environment of the Earth through the introduction of extraterrestrial matter or otherwise."[166] It also creates an obligation of notification of States to the maximum extent feasible, concerning the measures adopted by them and all placements of radioactive materials. What's more, it refers to areas as international scientific preserves which should be reported and protected by special

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[163] Comm. on the Peaceful Uses of Outer Space, Rep. of the Legal Subcomm., The Hague Space Resources Governance Working Group, Information Provided by the Netherlands, U.N. Doc. A/AC.105/C.2/2018/CRP.18, at 4 (2018).

[164] Outer Space Treaty, *supra* note 3, art. IX.

[165] *Id.* at art. VI.

[166] Moon Agreement, *supra* note 11, art. 7.

arrangements.[167] But major spacefaring nations who have not ratified the MA may argue that they do not have to comply with these obligations. As a result, current space law cannot protect the environment of outer space and the Earth adequately.

Space resources activities are *per se* ultra-hazardous activities, which may be harmful to both the outer space and the Earth environment. Forward contamination arising from Earth affects the environment of outer space. This type of contamination may include: all forms of debris found in outer space of nonhazardous nature; hazardous waste which is chemically or physically dangerous; radioactive waste which is the residue of nuclear-powered space objects;[168] and biological material from Earth to a planetary body with space probes or human space missions. On the other hand, backward contamination arising in space adversely affects the surface or atmosphere of Earth. In particular, returning spacecraft may also spread pollution or bring back waste, such as radioactive debris and extraterrestrial material. For this reason, we should carry out these activities with a high standard of care and due diligence, in spite of uncertainties about specific contamination at present.

According to Article III of the OST, general international environmental law is applicable to protect the environment of outer space as well as the Earth. For example, the 1972 Stockholm Declaration and the 1992 Rio Declaration affirm that, "States have . . . the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction."[169] In addition to *post hoc* action, Principle 15 of the Rio Declaration also requires States to take "the precautionary approach . . . according to their capabilities. Where there are threats of serious or irreversible damage. . . [and] the lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent

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[167] *Id.*

[168] Major Bernard K. Schafer, *Solid, Hazardous, and Radioactive Wastes in Outer Space: Present Controls and Suggested and Changes,* 19 CAL. W. INT'L L. J. 2, 3 (1988).

[169] U.N. Conf. on Environment and Development, *Rio Declaration on Environment and Development*, Principle 2, U.N. Doc. A/CONF.151/26 (Vol. 1) (Aug. 12, 1992) [hereinafter Rio Declaration]; U.N. Conference on Environment and Development, *Declaration of the United Nations Conference on the Human Environment,* Principle 21, U.N. Doc. A/CONF.48/14/Rev.1 (June 16, 1972).

environmental degradation.[170] Actually, the duty of prevention and due diligence has been recognized by the International Court of Justice (ICJ) in the *Gabcikovo-Nagymaros Project*[171] case.

Regarding forward contamination, the fragility of the space environment itself, and our general lack of understanding of that environment are behind the reasoning of the precautionary principle. After all, it is always easier to avoid contamination than deal with it after it emerges. As for backward contamination, we should also take prudent precautions to protect the Earth environment. For instance, the Committee on Space Research (COSPAR) promulgated a Planetary Protection Policy as an international standard on procedures to avoid organic constituent and biological contamination in space exploration.[172] There are five categories for target body/mission type combinations. Category V pertains to all Earth-return missions. For the subcategory defined as "Restricted Earth Return," destructive impact upon return is absolutely prohibited. Post-mission, there is a need for strict containment and timely analyses of any unsterilized sample collected and returned to Earth. If any sign of the existence of a non-terrestrial replicating organism is found, the returned sample must be treated by an effective sterilization procedure.[173] Similarly, NASA had a Lunar Quarantine Program during the Apollo program for the astronauts when they came back from their lunar missions to maintain its planetary protection policy.[174] Both the European Space Agency (ESA) as well as

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[170] Rio Declaration, *supra* note 169, at Principle 15. Similarly, several international environmental law conventions, such as the Vienna Convention for the Protection of the Ozone Layer of 1985 and the Convention on the Protection and Use of Transboundary Watercourses and International Lakes of 1992 repeat this principle. *See* EIRIK BJORGE & CAMERON MILES, LANDMARK CASES IN PUBLIC INTERNATIONAL LAW 438 (2017).

[171] Case Concerning the Gabčikovo-Nagymaros Project (Hung. v. Slovk.), Judgment, 1997 I.C.J. Rep. 7, ¶ 97 (Sept. 25). In the Gabčikovo -Nagymaros proceedings, Hungary connected prevention to precaution in its arguments by urging that "[t]he previously existing obligation not to cause substantive damage to the territory of another State had . . . evolved into an *erga omnes* obligation of prevention of damage pursuant to the 'precautionary principle.'" *Id.*

[172] COSPAR PLANETARY PROTECTION POLICY (2005), http://w.astro.berkeley.edu/~kalas/ethics/documents/environment/COSPAR%20Planetary%20Protection%20Policy.pdf.

[173] *Id.* at 2.

[174] *Interplanetary Contamination and Extraterrestrial Life*, SPACE SAFETY MAG., http://www.spacesafetymagazine.com/space-exploration/extraterrestrial-life/ (last visited Apr. 19, 2020).

the Japanese Aerospace Exploration Agency (JAXA) are also cooperating with NASA to implement and develop planetary protection policy.[175]

Recently, there has been a growing tendency not only towards tackling the problem of environmental preservation and protection in outer space, but also towards trying to avoid their harmful contamination to the maximum possible extent.[176] Space sustainability has become an important concern at modern times, and is a priority agenda in the Scientific and Technical Subcommittee (STSC) of COPUOS. In 2010, the STSC established the Working Group on the Long-Term Sustainability of Outer Space Activities (LTS) to propose measures that could enhance sustainability and produce voluntary guidelines to reduce risks to long-term sustainability.[177] After continuous discussion, STSC has made tangible progress and reached consensus on the text of twenty-one guidelines. Although these guidelines are safety-oriented, they could help protect the environment of outer space to some extent by: supervising national space activities; sharing information on space objects and orbital events; and managing space debris in the long term.[178] Additionally, these guidelines are also meaningful because they raise a broad awareness among COPUOS members of the need to address space sustainability concerns by international cooperation. Similarly, in the debates within LSC, some delegates also expressed that there is a need to care for the outer space environment in the same way as the Earth for the benefit of future generations.[179] And some delegates held that studying the conditions under which both public and private operators could conduct resource utilization activities

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[175] *Office of Planetary Protection*, NASA, https://planetaryprotection.nasa.gov/intpolicy/ (last visited Apr. 19, 2020).

[176] HOBE, *supra* note 142, ¶ 36.

[177] *Long-term Sustainability of Outer Space Activities*, U.N. OFF. FOR OUTER SPACE AFF., http://www.unoosa.org/oosa/en/ourwork/topics/long-term-sustainability-of-outer-space-activities.html (last visited May 17, 2019).

[178] Rep. of the Comm. On the Peaceful Uses of Outer Space, U.N. Doc. A/73/20, at 207, 208 (2018); Comm. on the Peaceful Uses of Outer Space, Rep. of the Sci. and Technical Subcomm. on Its Fifty-Fifth Session, U.N. Doc. A/AC.105/1167 (2018); Comm. on the Peaceful Uses of Outer Space, Rep. of the Legal Subcomm. on Its Fifty-Ninth Session, U.N. Doc. A/71/20 (2016).;

[179] COPUOS 2017 Report, *supra* note 155, ¶ 34; Fifty-Fifth Legal Subcomm., *supra* note 80, ¶ 33; Fifty-Sixth Legal Subcomm., *supra* note 66, ¶¶ 51, 232.

and reaching a multilateral consensus to prevent multiple new potential risks to both the terrestrial and space environments,[180] would ultimately contribute to the preservation of a safe, secure and sustainable space environment.[181]

The Hague Building Blocks also mark a significant step forward in addressing the very complex topic of space sustainability. In paragraph 4, the Building Blocks refer to "contributing to sustainable development" and "promoting the use of sustainable technology."[182] In paragraph 10, they address a variety of harmful impacts resulting from space resources activities, including but not limited to harmful contamination of outer space and adverse changes in the environment of the Earth. Specifically, the paragraph also adds "[r]isks to the safety of persons, the environment or property," "[d]amage to persons, the environment or property," "[h]armful interference with other on-going space activities," "[c]hanges to designated and internationally endorsed outer space natural or cultural heritage sites," as well as "[a]dverse changes to designated and internationally endorsed sites of scientific interest."[183] Hence, HSRGWG keeps pace with COPUOS to enhance the long-term sustainability of outer space activities by improving the safety of space operations and the protection of the space environment. For example, avoiding harmful interference could mitigate risks posed by congestion and ensure the freedom of all States to explore and use outer space. Regarding the space environment, it is also progressive by protecting the areas in the last two categories due to their important value.[184] Additionally, the provisions in paragraphs 11 and 12 address corresponding measures in the whole process of space mining to avoid harmful impacts. In paragraph 11, the Hague Building Blocks require that space mining activities be reviewed prior to a decision to proceed with a space resource activity, develop technical standards and assess conformity to avoid harmful impacts.[185] These precautionary measures are rewarding for space mining activities to be carried out in a safer manner. For

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[180] 2018 Information Report, *supra* note 66 at ¶ 30.

[181] COPUOS 2017 Report, *supra* note 155, ¶ 45.

[182] BUILDING BLOCKS, *supra* note 25, ¶ 4.

[183] *Id.* ¶ 10.

[184] Mark Williamson, *A Pragmatic Approach to the "Harmful Contamination" Concept in Art. IX of the Outer Space Treaty*, 53 PROC. INT'L INST. SPACE L. 666, 668 (2010).

[185] BUILDING BLOCKS, *supra* note 25, ¶ 11.

example, standardization could facilitate routine interactions and decrease operational risk by increasing predictability, which is an effective method to promote coordination among many operators.[186] In contrast, section 12 provides *post hoc* solutions. It requires States to monitor these activities, conduct response measures and adaptive management if a harmful impact occurs.[187]

However, these regulations are not enough to avoid harmful contamination of the environment of outer space and the Earth. The stress on "safety," "technical standards" and the scope of harmful impacts demonstrate that the Hague Building Blocks are more concerned with protecting activities rather than protecting the environment. This conclusion is consistent with our previous analysis that the HSRGWG is in favor of the industrial development. But HSRGWG should not be blamed for this. After all, considering the increasing use of outer space, all States are concerned about the ability to continue operating in a safe environment.[188] That is why the international community at present are focusing mainly on the safety and security of space activities for long-term sustainability. In contrast, the more forward-looking topics of protection and preservation of the space environment are not fully discussed, as space mining has not yet become a reality.

Last but not least, in regulating the negative effects of space mining on the environment, a balance needs to be made between protection and preservation on the one hand and exploration and development on the other. Compared with passive preservation or non-activity, active preservation is more in line with the purpose of the OST. As a result, the growth of this nascent industry should not be impeded by over-regulation.[189] Further, the sustainability of space activities might be enhanced through the formulation of best practices, standards and rules applicable to space operators, which are not burdensome or unnecessary.

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[186] Blount & Robison, *supra* note 97, at 160.

[187] BUILDING BLOCKS, *supra* note 25, ¶ 12.

[188] Comm. on the Peaceful Uses of Outer Space, Rep. of the Sci. & Technical Comm., Long-term Sustainability of Outer Space Activities, Preliminary Reflections, U.N. Doc. A/AC.105/C.1/2010/CRP.3, at 5 (2010).

[189] S.M. Mousavi Sameh, *Suborbital Flights: Environmental Concerns and Regulatory Initiatives*, 81 J. AIR L. & COM. 65, 90 (2016).

VI. CONCLUSION

As the resource supplies of the Earth continue to dwindle, outer space is the only place where we can find fresh supplies of energy and raw materials. And technological development makes the exploitation and use of space resources possible and likely to become a reality in the near future. Besides, more and more emerging space actors as well as private entities are developing capabilities to involve them to a much greater extent than hitherto in space resources activities. But, as mentioned above, the OST was concluded during the Cold War, it cannot effectively protect and promote these activities. Given that the context in which the OST operates has become different from the one in which it was conceived, there is an urgent need for a new international regime to regulate these activities. But before expounding such a regime, we need to examine the contents of the OST, the *Magna Carta* of international outer space law, especially the four fundamental principles most relevant to space mining. Elaborating them could help us find out the legality of exploitation and use of space resources, as these principles reflect the object and purpose of the OST, though generous and ambiguous. Additionally, considering the debates within the LSC from 2017 to 2019 and the Hague Building Blocks, it is significant to analyze and review these principles so as to correctly understand and apply them.

It is concluded that the exploitation and use of space resources conforms to the principles of freedom of exploration and use, common benefit and interests and is hence permitted. However, without further regulation, it is likely to lead to a *laissez-faire* approach to space mining in an open access commons. A number of issues can be anticipated, such as over-consumption, disorder, intra-generational inequality and even monopoly. Besides, as the legality of space resources activities is unclear under the non-appropriation principle, some spacefaring countries are interpreting their international obligations to serve their own interests best. For example, the US and Luxembourg adopted their national laws to protect investors' rights and enhance their confidence. Such a unilateral approach has challenged the spirit and wording of the OST to some

extent.[190] What's more, although environmental protection is a technical issue to a large extent, a relevant regime is also needed. States are obliged to consider environmental protection and preservation when they carry out space resources activities with a view towards long-term sustainability. As a result, a legal framework is called for to include three essential points: universal benefit rather than monopoly; guarantees of legal certainty; and rationality and sustainability.[191]

To search for such a regime, international cooperation and dialogue pave the way to balance interests among different countries. For example, through active participation by the majority of delegations in the LSC during 2017-2019, a growing awareness of the need for internationally agreed rules and multilateral approach has been raised. And, despite its failure, a working group was proposed by Belgium and Greece in the LSC 2019 session to address the development of an international regime for space mining activities. More than that, the twenty-one agreed guidelines in the STSC also opened new avenues for negotiation of some difficult issues.[192] Thus, we are moving in the direction of multilateralism rather than unilateralism regarding the regulation of exploration and use of outer space, and space mining is no exception.

However, given that COPUOS operates in a manner that requires for a program of work to be adopted by consensus, it is difficult to negotiate such an international regime among States in a short period of time. For this reason, establishing a working group in COPUOS with a clear mandate might be a viable option to achieve concrete results. Besides, relevant customary practice is of a comparatively short duration and historical experience does not necessarily transfer into the unique environment of outer space. Consequently, the working group could consider developing soft international space law to clarify, interpret and develop these principles above. On one hand, it could refer to subsequent practice like national legislation of the US and Luxembourg as well as the Hague

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[190] Fabio Tronchetti, Multilateralism vs Unilateralism, the Road Ahead in the Exploration and Utilization of Outer Space Resources, Presentation at China Space Conference (Apr. 2019).

[191] Fifty-Sixth Legal Subcomm., *supra* note 66, at ¶272.

[192] Peter Martinez, *Development of An International Compendium of Guidelines for the Long-Term Sustainability of Outer Space Activities*, 43 SPACE POL'Y 13, 17 (2018).

Building Blocks to enable, support and coordinate the exploitation and use of space resources. On the other hand, taking into account the needs and interests of developing countries, this group could encourage them to participate in a continued high-level exchange of views on space mining to raise possible concerns. Only in this way, is the space age deemed to be an opportunity of development for all countries, rather than for a limited group of States. Accordingly, the vision of a CSFM of outer space is likely to be fulfilled.

STAR LAWS: CRIMINAL JURISDICTION IN OUTER SPACE

Danielle Ireland-Piper[*] *& Steven Freeland*[**]

ABSTRACT

In August 2019, reports emerged of NASA investigating an allegation that an astronaut committed a crime in space. This gives rise to the question: what criminal law is to guide individuals in outer space? The answer has broad consequences because human activity in space is increasing, including with respect to developments in exploration, commercialization, weaponization and tourism, which means there will be new types of extraterrestrial interactions. Space is also relevant for many aspects of human life. Remote sensing technologies can be applied to global health initiatives, agricultural development, environment monitoring, disaster management, education, transportation, communication and humanitarian aid projects. This Article considers the jurisdiction of criminal law in space and challenges readers to consider the effects of nationality, delineation, space tourism and private operators. To

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do so, we identify three categories of potential crimes to which different jurisdictional rules may apply: crimes committed on the International Space Station, crimes committed on commercial space vessels and crimes committed in space other than on a space vessel or the International Space Station. Ultimately, we conclude that existing principles of extraterritorial criminal jurisdiction are not ideal for the unique challenges of space and that development of a specialized jurisdictional regime is necessary.

I. INTRODUCTION

In August 2019, reports emerged NASA was investigating an allegation that an astronaut committed a crime aboard the International Space Station (ISS). Allegedly, the astronaut accessed her estranged spouse's bank account.[1] This leads us to ask: what body of criminal law applies in outer space? In this particular instance, the answer is relatively straightforward because both the alleged perpetrator and alleged victim are United States (US) nationals. Additionally, the alleged conduct took place on the ISS, which is governed by an agreement with specific provisions for criminal jurisdiction. Therefore, US law applies. However, if the victim and perpetrator were of different nationalities, or were dual nationals, or had the conduct taken place elsewhere in space (other than the ISS), the answer might be more complicated. Human activity in space is increasing, and so the question of criminal jurisdiction must be answered.

Between fifty and seventy States are engaged in space activities. The United Nations Committee on the Peaceful Uses of Outer Space has grown from twenty-four member States in 1959 to ninety-five member States in 2020. The Organization for Economic Cooperation and Development (OECD) reports that "the space sector is currently experiencing an innovation-driven paradigm shift."[2] The OECD further states, "as technology has evolved and states

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[1] Brandon Specktor, *The World's First Space Crime May Have Occurred on the International Space Station Last Year,* LIVESCIENCE (Aug. 27, 2019)(". . . NASA astronaut Anne McClain was accused by her estranged spouse, Summer Worden, of signing into Worden's personal bank account from a NASA-affiliated computer aboard the ISS. This alleged space invasion of privacy is being investigated by NASA's Office of the Inspector General.").

[2] ORG. FOR ECON. COOPERATION AND DEV., SPACE AND INNOVATION (9th ed. 2016).

have increasingly recognized the potential of outer space, the range of activities planned for outer space has proliferated."[3]

This increased use of space may strain existing legal frameworks, particularly as these frameworks relate to the principles of jurisdiction. Space is relevant to many aspects of human life. For instance, remote sensing technologies can be usefully applied to global health initiatives,[4] agricultural development,[5] environmental monitoring,[6] disaster management,[7] education,[8] transportation,[9] communication[10] and humanitarian aid projects.[11] Other research developments in space can also have applications on Earth. "Scratch resistant lenses, temper foam, [and] freeze drying technology" are examples of space technologies adapted for use on Earth.[12] There is also some speculation that outer space "will almost certainly include outer space colonies established, operated, and

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[3] Steven Freeland, *Up, Up and … Back: The Emergence of Space Tourism and Its Impact on the International Law of Outer Space*, 6 CHI. J. INT'L L. 1, 5 (2005).

[4] *Benefits of Space: Global Health*, U.N. OFF. OUTER SPACE AFF., https://www.unoosa.org/oosa/en/benefits-of-space/global-health.html (last visited Mar. 5, 2020).

[5] *Benefits of Space: Agriculture*, U.N. OFF. OUTER SPACE AFF., http://www.unoosa.org/oosa/en/benefits-of-space/agriculture.html (last visited Mar. 5, 2020).

[6] *Benefits of Space: Environment*, U.N. OFF. OUTER SPACE AFF., http://www.unoosa.org/oosa/en/benefits-of-space/enviroment.html (last visited Mar. 5, 2020).

[7] *Benefits of Space: Disaster Management*, U.N. OFF. OUTER SPACE AFF., http://www.unoosa.org/oosa/en/benefits-of-space/disasters.html (last visited Mar. 5, 2020).

[8] *Benefits of Space: Education*, U.N. OFF. OUTER SPACE AFF., http://www.unoosa.org/oosa/en/benefits-of-space/education.html (last visited Mar. 5, 2020).

[9] *Benefits of Space: Transportation*, U.N. OFF. OUTER SPACE AFF., http://www.unoosa.org/oosa/en/benefits-of-space/transportation.html (last visited Mar. 5, 2020).

[10] *Benefits of Space: Communication*, U.N. OFF. OUTER SPACE AFF., http://www.unoosa.org/oosa/en/benefits-of-space/communication.html (last visited Mar. 5, 2020).

[11] *Benefits of Space: Humanitarian Assistance*, U.N. OFF. OUTER SPACE AFF., http://www.unoosa.org/oosa/en/benefits-of-space/humanitarian-assistance.html (last visited Mar. 5, 2020).

[12] *Benefits of Space: Research and Development*, U.N. OFF. OUTER SPACE AFF., http://www.unoosa.org/oosa/en/benefits-of-space/research.html (last visited Mar. 5, 2020).

populated" by humans.[13] Human activity in outer space may also bring with it the darker side of human nature, such as its potential for criminal conduct. For example, "space is already a military arena,"[14] despite "efforts to make outer space a demilitarized zone, military use of space has been substantial since the beginning of space exploration."[15] The confluence of space militarization, space tourism,[16] space exploration, private commercial interests[17] and space mining[18] may create new types of legal interactions and relations "that the treaty regimes have not anticipated."[19] Further, space is hard. It is a difficult and challenging environment; it is so unlike Earth that traditional notions of jurisdiction may not be ideal in the longer term.

Much like the High Seas, the legal starting point is that space is generally regarded as *res communis*—it belongs to everyone. It is not any one State's territory. On Earth it is widely recognized that States can assert jurisdiction outside of their territory on a number of bases: the nationality principle, the universality principle, the protective principle and, more controversially, the effects doctrine.[20] This is accepted at customary international law[21] and as a

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[13] Taylor Hardenstein, *In Space, No One Can Hear You Contest Jurisdiction: Establishing Criminal Jurisdiction on the Outer Space Colonies of Tomorrow*, 81 J. AIR L. & COM. 251, 282 (2016).

[14] Edward Finch, *Law and Security in Outer Space: Implications for Private Enterprise*, 11 J. SPACE. L. 107, 110 (1983). *See also* Michel Bourbonnière & Ricky J. Lee, *Jus ad bellum and ius in bello Considerations on the Targeting of Satellites: The Targeting of Post-Modern Military Space Assets*, 44 ISRAELI BOOK OF HUMAN RIGHTS 167 (2014); Michel Bourbonnière & Ricky J. Lee, *Legality of the Deployment of Conventional Weapons in Earth Orbit: Balancing Space Law and the Law of Armed Conflict*, 18 EUR. J. INT. LAW 873 (2008); Jayan Panthamakkada Acuthan, *China's Outer Space Programme: Diplomacy of Competition or Co-operation?* 63 CHINA PERSP. 1, 6 (2006); Glenn Harlan Reynolds, *International Space Law in Transformation: Some Observations* 6 CHI. J. INT'L L. 69, 71 (2005).;

[15] Reynolds, *supra* note 14, at 71; *see also* Finch, *supra* note 14, at 110.

[16] *See, e.g.,* P.J. Blount, *Jurisdiction in Outer Space: Challenges of Private Individuals in Space*, 33 J. SPACE. L. 300, 302 (2007).

[17] *See e.g.,* Finch, *supra* note 14, at 107; Freeland, *supra* note 3, at 3.

[18] *See* Elizabeth Pearson, *Space Mining: The New Goldrush*, BBC SCI. FOCUS MAG. (Dec.11, 2018), https://www.sciencefocus.com/space/space-mining-the-new-goldrush/; Clive Cookson, *Space Mining Takes Giant Leap from Sci-fi to Reality*, FIN. TIMES (Oct. 19, 2017), https://www.ft.com/content/78e8cc84-7076-11e7-93ff-99f383b09ff9.

[19] Blount, *supra* note 16, at 300.

[20] *See e.g.,* Danielle Ireland-Piper, *Prosecutions of Extraterritorial Criminal Conduct and the Abuse of Rights Doctrine*, 9 UTRECHT L. R. 68, 68 (2013).

[21] *Id*.

matter of domestic constitutional law in several States.[22] However, this may not be the case for space. Legal jurisdiction on Earth is inherently linked with notions of State sovereignty, but this principle, too, is not entirely applicable in outer space, and may pose challenges for the law of jurisdiction. It is also a key tenet of space law that "space . . . is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means" that could apply on Earth.[23] Therefore, it may be that not all "the classical rules of international law on sovereignty, territory and delimitation" can apply in space.[24]

For these reasons, this Article considers two questions: (1) what criminal law applies in space and (2) what is the law of extraterritoriality in space? We first briefly explain the principles of extraterritorial jurisdiction in international law and introduce the current foundational framework of space law. We then consider the law of criminal jurisdiction in space and challenges posed, including challenges around nationality, delineation, space tourism and private operators. In so doing, it appears there are three categories of potential crimes to which different jurisdictional rules may apply: (1) crimes committed on the ISS; (2) crimes committed on commercial space vessels; and (3) crimes committed in space in places other than on a space vessel or the ISS. As a preliminary matter, we use the terms "space" and "outer space" interchangeably, not as a matter of any scientific accuracy, but simply by way of description.

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[22] *See e.g.,* Republic of Italy v Union of India, (2013) 4 SCC 721, 745 (India); GVK Indus. Ltd. v The Income Tax Officer, (2011) 3 SCR 366, 367 (India); *XYZ v The Commonwealth* (2006) 227 CLR 532, 535-36 (Austl.); EEOC v Arabian American Oil Co., 499 U.S. 244, 248 (1991).

[23] Treaty on Principles Governing the Activities in the Exploration and Use of Outer Space, Including the Moon and other Celestial Bodies art. II, Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S 205 [hereinafter Outer Space Treaty].

[24] Ricky J. Lee, *Article II of the Outer Space Treaty: Prohibition of State Sovereignty, Private Property Rights, or Both*, 11 AUSTL. J. INT'L L. 128, 128 (2004).

II. BACKGROUND

A. Introducing the Laws of Outer Space

There are currently five key treaties governing space, known colloquially as: the Outer Space Treaty;[25] the Rescue Agreement;[26] the Liability Convention;[27] the Registration Convention;[28] and the Moon Agreement.[29] As of January 2019, the Outer Space Treaty had 109 ratifications and twenty-three signatures, the Rescue Agreement had ninety-eight ratifications and twenty-three signatures (plus two declarations accepting rights and obligations), the Liability Convention had ninety-six ratifications and nineteen signatures (plus three declarations accepting rights and obligations), the Registration Convention had sixty-nine ratifications and three signatures (plus three declarations accepting rights and obligations) and the Moon Agreement had eighteen ratifications and four signatures.[30] We now briefly summarize these five key treaties.

In essence, the Outer Space Treaty is an exhortation to good behavior: the exploration and use of outer space is to be free, in the interests of all countries[31] and not subject to any claims of sovereignty.[32] The Moon and other celestial bodies are to be used only for "peaceful purposes."[33] States are prohibited from placing weapons of mass destruction in orbit or in outer space and the militarization of celestial bodies is forbidden.[34] States are responsible for national

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[25] Outer Space Treaty, *supra* note 23.

[26] Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, Apr. 22, 1968, 672 U.N.T.S. 119 [hereinafter Rescue Agreement].

[27] Convention on International Liability for Damage Caused by Space Objects arts. II-III, Mar. 29, 1972, 24 U.S.T. 2389, 961 U.N.T.S. 187 [hereinafter Liability Convention].

[28] Convention on Registration of Objects Launched into Outer Space art. I, Jan. 14, 1975, 28 U.S.T. 695, 1023 U.N.T.S. 15 [hereinafter the Registration Convention].

[29] Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, Dec. 18, 1979, 1363 U.N.T.S. 3 [hereinafter Moon Agreement].

[30] Comm. on the Peaceful Uses of Outer Space, Status of International Agreements Relating to Activities in Outer Space as at 1 January 2019, U.N. Doc. A/AC.105/C.2/2019/CRP.3 (2019).

[31] Outer Space Treaty, *supra* note 23, art. I.

[32] *Id.* at art. II.

[33] *Id.* at art. IV.

[34] *Id.*

space activities and are liable for damage caused by their space objects.[35]

The Rescue Agreement requires States to take all possible steps to rescue and assist astronauts in distress,[36] promptly return them to their launching State[37] and provide assistance to launching States in recovering space objects that return to Earth outside their territory.[38]

Under the Liability Convention, which also provides for procedures for the settlement of claims for damages, a launching State is liable to pay compensation for damage caused by its space objects[39] and liable for damage due to its faults in space.[40]

The Registration Convention requires States, and some international intergovernmental organizations, to establish national registries and provide information on their space objects to the Secretary-General of the United Nations.[41] According to the United Nations Office for Outer Space Affairs, eighty-nine percent of "all satellites, probes, landers, crewed spacecraft and space station flight elements launched into Earth orbit or beyond" have been registered.[42] However, the launch of large constellations of smaller satellites and the trend towards miniaturization may make future registrations challenging.[43] Registration also occurs voluntarily in accordance with General Assembly Resolution 1721B[44] and is still actively being used by States not party to the Registration Convention.

In large part, the Moon Agreement simply reaffirms and elaborates on many of the provisions of the Outer Space Treaty relating to the Moon and other celestial bodies. For instance, it claims that

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[35] *Id.* at art. VII.

[36] Rescue Agreement, *supra* note 26, art. 2.

[37] *Id.* at art. 4.

[38] *Id.* at art. 5.

[39] Liability Convention, *supra* note 27, art. II.

[40] *Id.* at art. III.

[41] *Id.* at art. II.

[42] *United Nations Register of Objects Launched into Outer Space*, U.N. OFF. OUTER SPACE AFF., http://www.unoosa.org/oosa/en/spaceobjectregister/index.html (last visited Mar. 13, 2019).

[43] *See* Steven Freeland, *Newspace, Small Satellites, and Law: Finding a Balance Between Innovation, a Changing Space Paradigm, and Regulatory Control*, *in* NEWSPACE COMMERCIALIZATION AND THE LAW 107-123 (M.T. Ahmad & J. Su eds., 2017).

[44] G.A. Res. 1721 (XVI) B, International Cooperation in the Peaceful Uses of Outer Space (Dec. 20, 1968).

the Moon and celestial bodies can only be used "exclusively for peaceful purposes"[45] and that the Moon and its natural resources are the common heritage of humankind.[46] It also calls on parties to establish an international regime to govern the exploitation of resources when such exploitation is about to become feasible.[47]

The International Space Station Intergovernmental Agreement (IGA) is also important in the context of criminal law jurisdiction.[48] The IGA is an international agreement signed on January 29, 1998 by governments involved in the ISS project. Although not a general treaty, the IGA is a rare "positive source of criminal law"[49] in outer space, and so will be considered in further detail below.

In addition to the five space treaties, there are also five key declarations and principles relating to space: the Declaration of Legal Principles;[50] the Broadcasting Principles;[51] the Remote Sensing Principles;[52] the Nuclear Power Source Principles;[53] and the Benefits Declaration.[54] We will not go into these in detail, but we will mention them for completeness.

B. Introducing Extraterritorial Jurisdiction

Jurisdiction is a claim of authority and a "technical means of establishing public authority."[55] It follows that considering jurisdictional practice is a means of gaining insight into the nature of public authority. The Australian Oxford Dictionary, for example, defines "jurisdiction" as the administration of justice, a legal or other authority and the extent of such authority.[56] Jurisdiction, in a strict

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[45] Moon Agreement, *supra* note 29, art. 3.

[46] *Id.* at art. 11(1).

[47] *Id.* at art. 11(5)-(6).

[48] Agreement Among the Government of Canada, Governments of Member States of the European Space Agency, the Government of Japan, the Government of the Russian Federation, and the Government of the United States of America Concerning Cooperation on the Civil International Space Station, Jan. 29, 1998, 1998 U.S.T. LEXIS 303, T.I.A.S. No. 12927 [hereinafter IGA].

[49] Blount, *supra* note 16, at 312.

[50] G.A. Res. 1962 (XVIII), at 15 (Dec. 13, 1963).

[51] G.A. Res. 37/92, at 98-99 (Dec. 10, 1982).

[52] G.A. Res. 41/65, at 1-4 (Dec. 3, 1986).

[53] G.A. Res. 47/68, at 1-6 (Dec. 14, 1992).

[54] G.A. Res. 51/112, at 1-3 (Dec. 13, 1996).

[55] Shaunnagh Dorsett & Shaun McVeigh, *Jurisprudences of Jurisdiction: Matters of Public Authority*, 23 GRIFFITH L. R. 569, 585 (2014).

[56] AUSTRALIAN CONCISE OXFORD DICTIONARY 768 (5th ed. 2009).

legal sense, can be prescriptive, enforcing or adjudicative. Prescriptive jurisdiction might refer to a statute prescribing legal authority over a particular conduct by labeling it as an offense. Enforcement jurisdiction might refer to the legal authority to arrest, detain or punish. Adjudicative jurisdiction describes the legal authority of courts to adjudicate on a given matter. This means all arms of government—the legislature, the executive and the judiciary—are involved in the development and practice of jurisdictional norms.

Historically, geographical conceptions of territory were the defining pillar of international law, including international law on legal jurisdiction. In the 1600s, the Treaty of Westphalia conceptualized a State's power as ending at its territorial borders.[57] In this way, regardless of economic or military disparities, "each State possessed exclusive jurisdiction within its own territory."[58] Assertions of extraterritorial jurisdiction tended to occur as an exception, rather than the norm. However, by the mid-1900s the "heyday" of territorial jurisdiction had begun its demise.[59] As economies became increasingly interconnected, there was increased interest in regulating cross-border activities, such as transnational crime and the activities of multinational corporations.[60] In some cases, the interest in extraterritoriality became associated with attempts to enforce human rights.[61] In other cases, assertions of extraterritorial jurisdiction more closely resembled unilateral projection of foreign policy objectives.[62]

In 1927, the Permanent Court of International Justice (PCIJ) delivered judgment in the *Lotus* case.[63] This decision was a legal turning point, although it remains the subject of academic criticism. The PCIJ considered whether Turkey, in instituting criminal proceedings against a French national over a collision on the high seas between a Turkish ship and a French ship, which resulted in the death of Turkish nationals, acted in conflict with international

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[57] Leo Gross, *The Peace of Westphalia, 1648-1948*, 42 AM. J. INT'L L. 20, 28–29 (1948).

[58] Austen Parrish, *The Effects Test: Extraterritoriality's Fifth Business*, 61 VAND. L. REV. 1455, 1464 (2008).

[59] *Id.* at 1467.

[60] *Id.* at 1469.

[61] *Id.* at 1470.

[62] *Id.*

[63] The S.S. Lotus Case (Fr. v. Turk.), Judgment, 1927 P.C.I.J. (ser. A) No. 10 (Sept. 7).

law.[64] The French government submitted that the Turkish courts, in order to have jurisdiction, must be able to identify a specific title to jurisdiction given to Turkey in international law.[65] Conversely, the Turkish government took the view that it inherently had jurisdiction, provided such jurisdiction did not come into conflict with a principle of international law.[66] The PCIJ, while observing that "jurisdiction is certainly territorial,"[67] found that:

> It does not, however, follow that international law prohibits a State from exercising jurisdiction in its own territory, in respect of any case which relates to acts which have taken place abroad, and in which it cannot rely on some permissive rule of international law. Such a view would only be tenable if international law contained a general prohibition . . . .[68]

The Court concluded,

> Far from laying down a general prohibition to the effect that States may not extend the application of their laws and the jurisdiction of their courts to persons, property and acts outside their territory, it leaves them in this respect *a wide measure of discretion which is only limited to certain cases by prohibitive rules*; as regards other cases, every State remains free to adopt the principles which it regards as best and most suitable.[69]

In this way, the PCIJ established a presumption in favor of a State's extraterritorial jurisdiction, in the absence of a prohibitive rule. Some commentators attribute the development of the "effects test" to the decision in the *Lotus* case having undermined "territoriality as a limiting constraint on legislative jurisdiction."[70] Cedric Ryngaert has said that the judgment is "nowadays often considered as obsolete"[71] and F.A. Mann argues the decision "cannot claim to

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[64] *Id*. at 5.
[65] *Id*. at 18.
[66] *Id*.
[67] *Id*.
[68] *Id*. at 19.
[69] *S.S. Lotus*, 1927 P.C.I.J. at 19 (emphasis added).
[70] David Gerber, *Beyond Balancing: International Law Restraints on the Reach of National Laws*, 10 YALE J. INT'L L. 185, 196-97 (1984).
[71] CEDRIC RYNGAERT, JURISDICTION IN INTERNATIONAL LAW 34 (2d ed. 2015).

be good law."[72] Customary international law based on actual State practice would point towards extraterritorial jurisdiction being prohibited unless specifically permitted, rather than the permissive approach in *Lotus*.[73] Ian Brownlie described the sufficiency of a base of jurisdiction as being "relative to the rights of other States and not as a question of basic competence."[74] Similarly, James Crawford has said that the "sufficiency of grounds for jurisdiction is normally considered relative to the rights of other States."[75]

In any event, following the decision in *Lotus*, domestic courts began to grapple with the consequences of assertions of extraterritorial jurisdiction by their State. By the end of the twentieth and beginning of the twenty-first centuries, a number of treaties called on States to assert extraterritorial jurisdiction.[76] For example, the 1989 Convention on the Rights of the Child (CRC) and the Optional Protocol on the Sale of Children, Child Prostitution and Child Pornography together require parties to criminalize child prostitution whether or not the acts occur domestically or extraterritorially.[77] The major international treaties on anti-corruption all either require or permit a degree of extraterritorial jurisdiction.[78] Similarly, international treaties relating to terrorism and torture also permit some assertions of extraterritorial jurisdiction. For example, the International Convention for the Suppression of Terrorist Bombings calls upon parties to assert jurisdiction on the basis of both passive

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[72] Frederick Alexander Mann, *The Doctrine of Jurisdiction in International Law*, *in* KARL M. MEESSEN, EXTRATERRITORIAL JURISDICTION IN THEORY AND PRACTICE 64, 66 (1996).

[73] CEDRIC RYNGAERT, JURISDICTION IN INTERNATIONAL LAW 26 (2008).

[74] IAN BROWNLIE, PRINCIPLES OF PUBLIC INTERNATIONAL LAW 299 (7th ed. 2008).

[75] JAMES CRAWFORD, BROWNLIE'S PRINCIPLES OF PUBLIC INTERNATIONAL LAW 457 (8th ed. 2012).

[76] DANIELLE IRELAND-PIPER, ACCOUNTABILITY IN EXTRATERRITORIALITY: A COMPARATIVE AND INTERNATIONAL LAW PERSPECTIVE 8–14 (2017).

[77] *See* Optional Protocol to the Convention on the Rights of the Child on the Sale of Children, Child Prostitution and Child Pornography arts. 1, 5, May 5, 2000, 2171 U.N.T.S. 227.

[78] *See, e.g.,* United Nations Convention Against Corruption, Dec. 9, 2003, S. TREATY DOC. NO. 109-06, 43 I.L.M. 37; Additional Protocol to the Criminal Law Convention on Corruption, May 15, 2003, Eur. T.S. No. 191; OECD Convention on Combating the Bribery of Foreign Public Officials in International Business Transactions, Dec. 17, 1997, S. TREATY DOC. NO. 105-43; Inter-American Convention Against Corruption, Mar. 29, 1996, S. TREATY DOC. NO. 105-39, 35 I.L.M. 724.

and active nationality[79] and the International Convention for the Suppression of the Financing of Terrorism calls upon parties to assert active nationality jurisdiction.[80] The Convention against Torture and Other Cruel, Inhuman or Degrading Treatment or Punishment also permits States to exercise active nationality jurisdiction and passive nationality, where a State deems it to be "appropriate."[81]

Many States now have domestic legislation with extraterritorial reach. By way of example, States as diverse as Australia,[82] India,[83] Singapore,[84] Indonesia,[85] Zimbabwe,[86] Iraq,[87] Russia,[88] France,[89] the United Kingdom,[90] Mexico,[91] Canada,[92] the US,[93] Japan,[94] Israel,[95] Thailand,[96] China[97] and Vietnam[98] have at least some legislative provisions with extraterritorial effect. Geographical conceptions of territory are "becoming a less salient feature of the international legal landscape."[99] States are acting on treaty

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[79] International Convention for the Suppression of Terrorist Bombings art. 6, Dec. 15, 1997, 2149 U.N.T.S. 256.

[80] International Convention for the Suppression of the Financing of Terrorism art. 7(1), Dec. 9, 1999, 2178 U.N.T.S. 197.

[81] Convention Against Torture and Other Cruel, Inhuman or Degrading Treatment or Punishment art. 5, Dec. 10, 1984, 1465 U.N.T.S. 85.

[82] *See, e.g., Criminal Code Act 1995* (Cth) s 15 (Austl.).

[83] *See, e.g.,* Indian Penal Code, No. 45 of 180, PEN. CODE (1860) (India).

[84] *See, e.g.,* Penal Code (2008 rev. ed.) s 3 (Sing.).

[85] *See, e.g.,* Penal Code of Indonesia (1982) art. 4 (Indon.). Note that significant changes to Penal Code of Indonesia are expected in late 2019.

[86] *See, e.g.,* Criminal Law (Codification and Reform) Act (2004) s 5 (Zim.).

[87] *See, e.g.,* Criminal Code 1969 ss 2-4 (Iraq).

[88] *See, e.g.,* UGOLOVNYI KODEKS ROSSIISKOI FEDERATSII [Criminal Code] art. 12 (Russ.).

[89] *See, e.g.,* CODE PENAL [C. PEN.] [PENAL CODE] art. 113(6)-(12) (Fr.).

[90] *See, e.g.,* Bribery Act 2010, c. 23, s. 12 (Eng.).

[91] *See, e.g.,* Código Penal Federal [CPF], art. 4, Diario Oficial de la Federación [DOF] 14-08-1931 (Mex.).

[92] *See, e.g.,* Canada Criminal Code, R.S.C. 1985, c C-46, s 7(4.1) (Can.).

[93] *See, e.g.,* 18 U.S.C. § 3261 (2018).

[94] *See, e.g.,* KEIHŌ [PEN. C.] 1907 art. 3-5 (Japan).

[95] *See, e.g.,* Penal Law, 5737-1977, §§ 13-17 (1977-78) (Isr.).

[96] *See, e.g.,* Criminal Code (1956) ss 7-8 (Thai.).

[97] *See, e.g.,* [Criminal Law of the People's Republic of China] (promulgated by Order No. 5 of the Chairman of the Standing Comm. Nat'l People's Cong., July 6, 1979, effective Jan. 1, 1980), art. 7 & 8, 1980 STANDING COMM. NAT'L PEOPLE'S CONG. GAZ. (China).

[98] *See, e.g.,* Penal Code art 6 (Viet.).

[99] Michael Byers, *Abuse of Rights: An Old Principle, A New Age*, 47 MCGILL L.J. 389, 424 (2002).

obligations, reacting to world events or seeking to achieve political objectives.[100]

As noted at the outset, customary law recognizes a number of bases on which a nation State can assert extraterritorial jurisdiction. Under customary international law, States are entitled to exercise jurisdiction on three main bases: territoriality, nationality and universality.[101]

In short, the territoriality principle may be invoked where conduct either takes place within a State's borders, known as subjective territoriality, or the effects of the conduct are felt within the State's borders, known as objective territoriality.[102] An example of objective territorial jurisdiction can be seen in a hypothetical murder on the border between two States, State *A* and State *B*. A gun is fired across the border from State *A* into State *B*, where it causes injury and death. Although, the trigger was pulled in State *A*, the injury from the bullet occurred in State *B*. In that scenario, State *B* may exercise objective territorial jurisdiction.[103] In theory, this scenario could take place between space colonies or space vessels.

The nationality principle can provide a State with grounds for jurisdiction where a victim (passive nationality) or a perpetrator (active nationality) is a national of that State. An example of passive nationality jurisdiction would be a State *A* legislating to make it an offence to recklessly or intentionally harm, commit manslaughter or seriously injure a State *A* citizen or resident anywhere in the world.[104] A common example of an assertion of active nationality jurisdiction can be seen in child sex offence legislation around the world, as mentioned at the outset. State *A* may legislate to criminalize sexual activities between its nationals and children, regardless of the jurisdiction in which the offence takes place.[105]

The universality principle is reserved for conduct recognized as criminal under international law, such as piracy, genocide and crimes against humanity. Unlike other grounds of extraterritorial jurisdiction, which demand some connection with the regulating

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[100] *See* Danielle Ireland-Piper, *Extraterritorial Criminal Jurisdiction: Does the Long Arm of the Law Undermine the Rule of Law?* 13 MELB. J. INT'L L. 122 (2012).

[101] *Id.* at 130.

[102] *Id.*

[103] IRELAND-PIPER, *supra* note 76, at 23.

[104] *Id.* at 25.

[105] *Id.*

State (such as the nationality of the perpetrator or the victim), this principle provides every State with a basis to prosecute certain international crimes. An example can be seen in the French prosecution between 2013 and 2014, of Pascal Simbikangwa, a Rwandan national, for the crimes of complicity in genocide and complicity in crimes against humanity.[106] The offences, for which a French court found Mr. Simbikangwa guilty, took place in Rwanda in 1994.[107] Rather than refer cases to the International Criminal Tribunal of Rwanda, France prosecuted the crimes under French legislation with extraterritorial reach.[108]

The scope of universal jurisdiction is conceived of in two different ways: conditional and absolute. A conditional conception of universal jurisdiction requires the presence of the accused in the prosecuting State.[109] An absolute conception, in contrast, may not require the presence of the accused.[110] This is sometimes described as universal jurisdiction in absentia and is controversial and not considered to be widely accepted.[111] The potential risks in space that could potentially involve universal jurisdiction could be military activities involving grave breaches of international humanitarian law and armed conflict, or acts of space piracy, if, in the future, private operators gain access to space travel.

International law also recognizes a "protective principle," wherein a State can assert jurisdiction over foreign conduct that threatens its national security. The protective principle has been used to prosecute extraterritorial offences relating to counterfeiting

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[106] Tracy French et al., *Criminal Courts and Tribunals*, 20 HUMAN RIGHTS BRIef 69, 71 (2013).

[107] *See, e.g.,* Kim Willshar, *Rwanda Former Spy Chief Pascal Simbikangwa Jailed Over Genocide*, THE GUARDIAN (Mar. 15, 2014), http://www.theguardian.com/world/2014/mar/14/rwanda-former-spy-chief-pascal-simbikangwa-jailed-genocide; *Rwanda Ex-spy chief Pascal Simbikangwa Jailed in France*, BBC NEWS, Mar. 14, 2014), http://www.bbc.com/news/world-africa-26587816; French et al., *supra* note 106, at 71.

[108] *See* IRELAND-PIPER, *supra* note 76, at 31-32.

[109] Helena Gluzman, *On Universal Jurisdiction – Birth, Life and a Near-Death Experience*, BOCCONI SCH. OF L. STUDENT-EDITED PAPERS (Paper No. 2009-08/EN)), 2009, at 4. See also the discussion of "subsidiary universality" in Neil Boister, *Transnational Criminal Law*? 14 Eur. J. of Int'l. L. 953, 964 (2003).

[110] *See* Gluzman, *supra* note 109, at 4.

[111] For a more comprehensive discussion of universal jurisdiction in absentia, see Mohamed M. El Zeidy, *Universal Jurisdiction in Absentia: Is It a Legal Valid Option for Repressing Heinous Crimes?* 37 INT'L. LAW. 835 (2003).

currency, desecration of flags, economic crimes, forgery of official documents such as passports and visas and political offences (such as treason).[112] Foreseeably, this ground of jurisdiction could occur if false passports or permissions were used by persons travelling in (or to) outer space. There is also some support for an "effects principle," which gives jurisdiction over extraterritorial conduct, the effects of which are felt by a State. Examples of claims of effects jurisdiction can be seen in anti-trust and competition laws, including by the US,[113] Argentina, Mexico, China and in the European Community.[114] Effects doctrine jurisdiction is complicated and fraught with the risk of over-reach, and the same would likely be true of space given the interconnectedness of space activities and the known—and as yet unknown—consequences or "effects" of space activities for activities on Earth.

Extraterritorial criminal jurisdiction can be a useful tool in regulating offences occurring outside national borders, so as to avoid impunity and to realize global values.[115] However, there are also a number of concerns about unilateral exercises of extraterritorial jurisdiction, including the view that it can be undemocratic, undermine meaningful multilateralism and might lead to piecemeal approaches to shared problems and the fragmentation of international law.[116] Some of the challenges in regulating assertions of extraterritorial jurisdiction also stem from the fact there is no clear hierarchy of jurisdiction at international law and this can lead to tensions between States.[117] Further, the regulation of extraterritoriality has not kept pace with its increased exercise. Very little

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[112] *See* IRELAND-PIPER, *supra* note 76, at 33.

[113] *See, e.g.,* American Banana Co v. United Fruit Co., 213 U.S. 347 (1909); United States v. Aluminium Company of America, 148 F.2d 416 (1944). *See also* Deborah Senz & Hilary Charlesworth, *Building Blocks: Australia's Response to Foreign Extraterritorial Legislation*, 2 MELB. J. INT'L L. 69, 70 (2001).

[114] ERIK NEREP, EXTRATERRITORIAL CONTROL OF COMPETITION UNDER INTERNATIONAL LAW 281-282 (1983).

[115] CEDRIC RYNGAERT, UNILATERAL JURISDICTION AND GLOBAL VALUES 53-54 (2015).

[116] *See, e.g.,* Austen Parrish, *Reclaiming International Law from Extraterritoriality*, 93 MINN. L. REV. 815 (2009); Austen Parrish, *The Effects Test: Extraterritoriality's Fifth Business*, 61 VAND. L. REV. 1455 (2008).

[117] *See, e.g.,* Devirup Mitra, *India, Italy Spar Over Marines Issue Again as Ad-hoc Tribunal Reviews Enrica Lexie Case*, THE WIRE (Mar. 30, 2016), http://thewire.in/2016/03/30/india-italy-spar-over-marines-issue-again-as-ad-hoc-tribunal-reviews-enrica-lexie-case-26752/ (describing the tension in relations between India and Italy as a result of competing assertions of jurisdiction in the Italian Marines Case).

analysis has been undertaken on the adequacy of the ways in which jurisdiction is regulated in relation to the interests of individual persons before domestic courts, rather than the interests of States in relation to each other. In many ways, the system is "dominated by sovereignty . . . law enforcement and the objectification of individuals as criminals."[118] As Ireland-Piper has observed in the context of extraterritorial jurisdiction over criminal conduct on Earth, reliance on extraterritorial jurisdiction may have the following consequences:

- An accused person may be subject to multiple prosecutions for the same conduct, with no foreseeable end point because the principle of double-jeopardy only applies within a State and not as between States;[119]
- Persons may be unable to know or ascertain each and every law in each and every State that may have grounds for jurisdiction over their conduct, creating legal uncertainty; and
- Given that a country other than the jurisdiction in which an offence occurred may assert jurisdiction and seek to prosecute, plea bargains and a government's promises of amnesties may be undermined.[120]

Technology, including the internet and other communications technologies, also pose particular challenges for traditional conceptions of the "rules" of extraterritoriality. Dan Svantesson has considered this issue in this specific context of internet jurisdiction. In his view, the complexity of jurisdictional competence could be resolved by reference to a rule that jurisdiction may only be exercised in three circumstances: (1) there is a substantial connection between the matter and the State seeking to exercise jurisdiction; (2) the State seeking to exercise jurisdiction has a legitimate interest in the matter; and (3) the exercise of jurisdiction is reasonable given the proportionality between the State's legitimate interests and

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[118] Neil Boister, *Transnational Criminal Law?* 14 EUR. J. INT'L L. 953, 959 (2003).

[119] *See* Human Rights Comm., *A.P. v. Italy, Com. No. 204/1986*, U.N. Doc. CCPR/C/OP/2 (Nov. 2, 1987).

[120] IRELAND-PIPER, *supra* note 76, at 8, 185.

other competing interests.[121] In some ways, the internet has parallels with outer space because both pose challenges to traditional notions of geographically-bound legal systems. However, the question as to how to resolve competing claims in scenarios where international tensions run high—such as space—remains unresolved so far.

In essence, it is possible that the problems with extraterritorial criminal jurisdiction on Earth may follow assertions of extraterritoriality into space. This points to the need to develop "fresh eyes" on the question of extraterritoriality and a specialist regime for jurisdiction in space. Notwithstanding that, the existing law on jurisdiction in the specific context of space is now considered.

III. JURISDICTION IN OUTER SPACE

A. The Outer Space Treaty

As a starting point, and as noted above, Article I of the Outer Space Treaty provides that the "exploration and use of outer space, including the moon and other celestial bodies . . . shall be the province of all [hu]mankind."[122] Under Article II, space is not "subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means."[123]

P.J. Blount has argued that, taken together, Article VI and Article VIII of the Outer Space Treaty imply that States have the authority to assert jurisdiction over individuals in space.[124] Specifically, Article VI indicates the activities of non-government entities require authorization and supervision by a State.[125] Article VIII provides that: "[o]wnership of objects launched into outer space . . . is not affected by their presence in outer space . . . or by their return to the Earth" and that a "State Party to the Treaty on whose registry an object launched into outer space is carried shall retain jurisdiction and control over such object, and *over any personnel*

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[121] Dan Jerker B. Svantesson, *A New Legal Framework for the Age of Cloud Computing*, THE CONVERSATION (Feb. 3, 2015), http://theconversation.com/a-new-legal-framework-for-the-age-of-cloud-computing-37055.

[122] Outer Space Treaty, *supra* note 23, art. I.

[123] *Id.* at art. II.

[124] Blount, *supra* note 16, at 312.

[125] Outer Space Treaty, *supra* note 23, art. VI.

thereof."[126] Within the meaning of the provision, "thereof" seems to mandate that a State maintain jurisdiction over any personnel on board the spacecraft, regardless of that person's nationality. This apportionment of control parallels the basic conventions of "flag-ship" jurisdiction.

As a practical matter, Article VIII's jurisdictional provision draws a distinction between criminal acts carried out onboard a spacecraft and criminal acts carried out outside any spacecraft or space object.[127] In the latter case, this drafting decision may leave regulatory gaps amongst the treaties.

Article III of the Outer Space Treaty provides that international law applies to any exploration or use of outer space.[128] Given that international law recognizes extraterritorial jurisdiction, it follows that the Outer Space Treaty's jurisdictional mandate exceeds the nationality principle in order to encompass transactions arising in space. However, because "personnel" is undefined, it remains unclear whether the regulation applies to citizens travelling, for example, as space tourists rather than on official State business. As a result, this ambiguity will likely require further elucidation in the future.

B. The IGA

The IGA sets forth express provisions governing jurisdiction over criminal matters in outer space.[129] The provisions only apply onboard the ISS and bind only the "Partner States." Article 22(1), titled "Criminal Jurisdiction" provides for nationality-based jurisdiction and directs that "Canada, the European Partner States, Japan, Russia, and the US may exercise criminal jurisdiction over personnel in or on any flight element who are their respective nationals."[130] This is an example of active-nationality jurisdiction.

Article 22(2) sets forth a narrow basis for passive nationality jurisdiction and requires that the "Partner State" of which the perpetrator is a national either "concurs" in such exercise; or, in the alternative, fails to provide assurances that it will prosecute the

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[126] *Id.* at art. VIII (emphasis added).
[127] *Id.*
[128] *Id.* at art. III.
[129] IGA, *supra* note 48.
[130] *Id.* at art. 22(1).

perpetrator itself.[131] The latter, passive nationality jurisdiction based on an absence of domestic prosecution parallels "unwilling or unable" jurisdiction. Article 22(2)'s formulation of passive nationality jurisdiction hinges on the specific type of conduct under question. Namely, the provision differentiates between misconduct in orbit that "affects the life or safety of a national of another Partner State or . . . occurs in or on or causes damage to the flight element of another Partner State. . . ."[132] In order for the second strain of misconduct to fall within the regulatory ambit of Article 22, Partner States must consult with each other regarding "respective prosecutorial interests" before the wronged entity may attempt to exercise criminal jurisdiction over the alleged offender.[133] Following the prosecutorial conference, the wronged Partner State may acquire criminal jurisdiction over the perpetrator either by express conferral from the perpetrator's native Partner State or as a matter of law if the perpetrator's native Partner State fails to provide assurances that it will launch a domestic prosecution.[134]

In the context of mutual assistance, Article 22(3) of the IGA provides that its terms may be replaced with an applicable extradition treaty if the domestic law of the relevant State requires such an agreement.[135] Article 22(3) also contemplates the application of domestic law where "extradition shall be subject to the procedural provisions and the other conditions of the law of the requested Partner State."[136] Further, each "Partner State" must, subject to its national laws and regulations, aid other Partner States in mitigating any harm cause by the alleged misconduct.[137] One scholar has argued that Article 22 should be the "foundation on which humanity will base all future outer space jurisdiction."[138] For example, should colonization of Mars become a reality, Article 22 may provide a model framework for adjudicating criminal conduct occurring on foreign planets.[139]

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[131] *Id*. at art. 22(2).
[132] *Id*.
[133] *Id*.
[134] *Id*.
[135] IGA, *supra* note 48, art. 22(3).
[136] *Id*. at art. 22(3).
[137] *Id*. at art. 22(2).
[138] Hardenstein, *supra* note 13, at 282.
[139] *Id*.

However, Article 22 is not without its critics; the embedded passive nationality principle is controversial, as many of the contemporary problems with Earthly extraterritorial jurisdiction[140] (such as competing claims to jurisdiction, overlooking of the procedural rights of an accused in favor of the jurisdictional rights of States, and that the principle of double-jeopardy only applies within a State and not as between them)[141] also arise in exercises of extraterritorial jurisdiction into space. While most assertions of extraterritorial jurisdiction derive from the premise that terrestrial law maintains interstellar applicability, they often fail to consider the vast temporal, spatial and financial realities of interstellar regulation.

C. The International Criminal Court

While there are no technical restrictions on the jurisdiction of the International Criminal Court (ICC) extending into outer space, various practical factors, such as time and distance, may impede enforcement.[142] Hypothetically speaking, the ICC's jurisdiction on foreign planets would mirror its Earthly expanse with respect to crimes of genocide; crimes against humanity; war crimes; and the crime of aggression.[143] It would also only apply if: the "State on the territory of which the conduct in question occurred or, if the crime was committed on board a vessel or aircraft, the State of registration of that vessel or aircraft" was a State Party; or where, "the State of which the person accused of the crime is a national is a

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[140] To explore examples of contemporary issues surrounding extraterritorial jurisdiction on Earth include competing claims to jurisdiction, neglect of the accused's procedural rights in favor of the State's jurisdictional rights and the limited applicability of double-jeopardy, see Human Rights Committee, *supra* note 119. For a more detailed discussion of the problems associated with assertions of extraterritorial jurisdiction, see Danielle Ireland-Piper, *The Enrica Lexie and St. Antony: A Voyage into Jurisdictional Conflict* 14 QUT L. REV. (2014); Danielle Ireland-Piper, *Abuse of Process in Cross Border Cases: Moti v The Queen*, 12 QUT L. & JUST. J. (2012); Ireland-Piper, *supra* note 100; Ireland-Piper, *supra* note 18.

[141] *See* Human Rights Comm., *A.P. v. Italy, Com. No. 204/1986*, U.N. Doc. CCPR/C/OP/2 (Nov. 2, 1987).

[142] *See* Steven Freeland, *International Criminal Justice in the Asia-Pacific Region: The Role of the International Criminal Court Regime*, 11 J. INT'L CRIM. JUST. 1029 (2013).

[143] *See* Rome Statute of the International Criminal Court Preamble, July 17, 1998, 2187 U.N.T.S. 90 [hereinafter Rome Statute].

State Party."[144] The jurisdictional reach would also encompass Article 1 of the Rome Statute, which provides that its jurisdiction "shall be complementary to national criminal jurisdictions."[145] If one of the four serious international crimes occurs in outer space and the jurisdictional requirements are met, the ICC exercises presumptive jurisdiction over the resultant proceedings.[146]

Despite its expansive authority, the ICC frequently falls under marked criticism. The debates associated with the ICC are well documented[147] and would likely extend to outer space governance in a similar manner.

D. Domestic Courts

Generally speaking, most domestic constitutional courts adopt permissive approaches to State assertions of extraterritorial jurisdiction. While interstellar expansions of individual States' criminal codes likely pass domestic constitutional muster, such a regime may create excessive complexity and inconsistency for individuals domiciled in outer space. There are systemic issues stemming from a lack of clear jurisdictional hierarchy in international law for domestic and regional courts to reference and clumsy metrics of jurisdiction, such as comity and the act of State doctrine.[148]

Contemporary courts lack the necessary legal tools to effectively adjudicate extraterritorial claims, which compels the development of a specialized regime for jurisdictional regulation in space. Such a system could involve specialist tribunals, rather than general courts. Nonetheless, at present, domestic courts endure as the only real practical forum for adjudicating instances of extraterritorial criminal conduct. Nonetheless, such an approach is still capable of developing international law because "the rule of law at the

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[144] *Id.* at art. 12.

[145] *Id.* at art. 1.

[146] *Id.* at art. 5. In the alternative, an individual nation State could exercise universal jurisdiction. *See generally* VALERIE EPPS & LORIE GRAHAM, EXAMPLES & EXPLANATIONS: INTERNATIONAL LAW 140 (2d ed. 2015) ("Universal jurisdiction is an international legal principle that reasons that certain activities are so reprehensible that the usual rules of jurisdiction are waived, and any state apprehending the alleged perpetrator is deemed competent to exercise its jurisdiction.").

[147] *See, e.g.,* Darryl Robinson, *Inescapable Dyads: Why the International Criminal Court Cannot Win*, 28 LEIDEN J. INT'L L. 323 (2015).

[148] *See* Danielle Ireland-Piper, *Outdated and Unhelpful: The Problem with the Comity Principle and Act of State Doctrine*, 24 AUSTL. INT'L L.J. 15 (2018).

international and domestic levels is not a normative ideal or a requirement of separate legal orders, but is intimately connected and mutually reinforcing."[149] It may be that "national institutions can protect the rule of law against weaknesses of international law itself . . . [and] national courts can provide the missing link by assessing international acts against fundamental rights, whether as international norms or in the form of domestic constitutional rights."[150]

IV. CHALLENGES

A. Nationality

As discussed above, the current jurisdictional framework of most space treaties hinges on nationality jurisdiction. While the practice may seem to be sound on its face, the same challenges to nationality jurisdiction on Earth also arise in space.[151] International law generally embodies a neutral approach towards grants of nationality, provided that the granting State does not breach certain international obligations.[152] For dual citizens, there is also potential amenability to multiple, potentially conflicting, legislative regimes.[153]

The passive nationality principle grows increasingly problematic. As a ground of criminal jurisdiction, it has been described as the "most contested in contemporary International Law."[154] While a person generally maintains awareness of their own nationality,

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[149] ANDRE NOLLKAEMPER, NATIONAL COURTS AND THE INTERNATIONAL RULE OF LAW 301 (2011).

[150] *Id*. at 305.

[151] Common challenges to nationality jurisdiction are the changing nature of citizenship and nationality and the lack of consistent approach to the grant and revocation of citizenship by nation-states. *See* Ariel Zemach, *Fairness and Moral Judgments in International Criminal Law: The Settlement Provision in the Rome Statute*, 41 COLUM. J. TRANSNAT'L L. 895, 901 (2003).

[152] *See, e.g.,* Convention Relating to the Status of Stateless Persons art. 2, Sept. 28, 1954, 360 U.N.T.S. 117.

[153] Kim Rubenstein, *Citizenship in an Age of Globalisation: The Cosmopolitan Citizen?* 25 LAW IN CONTEXT 88, 90-91 (2007) ("Domestic laws about who is and who is not a citizen vary significantly, and laws relating to citizenship in each of the different States are also different. As a result, many people hold more than one nationality by fulfilling the formal requirements for citizenship in more than one domestic legal framework.").

[154] ALEJANDRO CHEHTMAN, THE PHILOSOPHICAL FOUNDATIONS OF EXTRATERRITORIAL PUNISHMENT 67 (2010).

they may not be aware of the nationality of the persons with whom they interact.[155] In essence, while the nationality principle bears some applicability to the regulation of criminal law in outer space, it is encumbered by many of the same constraints hindering effectiveness here on Earth. As a result, there may be a necessity for specialized rules of nationality and for individuals entering space.

B. Delineation

The concept of outer space generally encompasses "the space upwards from the airspace . . . surrounding the Earth."[156] However, the precise point at which airspace becomes outer space remains hotly debated.[157] The Outer Space Treaty lacks a definition of outer space's lower limits. In many ways, identification of an exact border between the two is more of a political and legal question than a scientific one.[158] The lack of scientific precision derives from the fact that the atmosphere does not change dramatically at any certain or consistent height that would render it possible to discern the line separating it from outer space.[159] Though it might seem a question of semantics, the definition of a clear boundary is important for a variety of reasons. For example, this dividing line would dictate which high-flying humans get to be designated as astronauts.[160] The measurement also implicates matters of national security: "flying a satellite 55 miles above . . . [a State] is just fine if space begins at 50 miles up, but [defining] the edge at 60 miles, . . . [might cause it to be considered] an act of military aggression."[161] In short, it is essential to discern the spatial confines governing which laws apply where.[162]

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[155] IRELAND-PIPER, *supra* note 76, at 24-29.

[156] LOTTA VIIKARI, THE ENVIRONMENTAL ELEMENT IN SPACE LAW 1 (2008). *See also* Anél Ferreira-Snyman & Bin Cheng, *The Legal Status of Outer Space And Relevant Issues: Delimitation Of Outer Space And Definition Of Peaceful Use*, 11 J. SPACE L. 89 (1981).

[157] *See* Bhavya Lal & Emily Nightingale, *Where is Space? And Why Does That Matter?* 2014 SPACE TRAFFIC MGMT. CONF. 4-10 (2014).

[158] *See, e.g.,* Snyman & Cheng, *supra* note 156; VIIKARI, *supra* note 156, at 1.

[159] VIIKARI, *supra* note 156, at 1.

[160] Nadia Drake, *Where, Exactly, is the Edge of Space? It Depends on Who You Ask*, NAT'L GEOGRAPHIC (Dec. 20, 2018), https://www.nationalgeographic.com/science/2018/12/where-is-the-edge-of-space-and-what-is-the-karman-line/.

[161] *Id.*

[162] *See* Freeland, *supra* note 3, at 8.

There are at least two possible approaches to determining when airspace becomes outer space. One approach is to simply agree on a particular height or distance at which outer space commences.[163] Suggested distances include eighty kilometers above mean sea level due to the composition of the atmosphere at the point[164] or, for example, 100 kilometers as set out in Australian legislation, which links its definition of space objects in relation to that measure, although is not intended as a delineation measure.[165]

Other sources suggest universal adoption of the "Kármán line," a boundary named after Hungarian physicist Theodore von Kármán, who advocated the adoption of a boundary around eighty kilometers above sea level.[166] As of 2018, though, the "Kármán line" is set at roughly 100 kilometers above sea level.[167] Another approach is to delineate outer space from airspace by reference to the nature of activities possible in each. However, Lotta Viikari identifies a problem with the latter approach through the example of the US Space Shuttle.[168] The Space Shuttle launches like a rocket, but can also use aerodynamic lift (as an airplane would) when returning to Earth.[169] Therefore, in theory, the Space Shuttle could be governed by both space law and air law and questions of State sovereignty, and jurisdiction, in airspace might become a complicating factor. The illusive nature of atmospheric zoning is complicated by the fact that "Earth's atmosphere doesn't simply vanish; rather, it gradually becomes thinner and thinner over about 600 miles."[170] In fact, "the International Space Station—which orbits at an average height of 240 miles—would not be in space if we defined 'space' as the absence of an atmosphere."[171]

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[163] Vernon Nase, *Delimitation and the Suborbital Passenger: Time to End Prevarication*, 77 J. AIR L. & COM. 747, 767 (2012) (noting that a definitive zone determination requires that "states enact or amend domestic legislation on space to implement their international obligations under Article VI of the Outer Space Treaty and to declare the agreed limitation point between airspace and outer space.").

[164] VIIKARI, *supra* note 156, at 2.

[165] *Space (Launches and Returns) Act 2018* (Cth) s 8 (Austl.).

[166] Drake, *supra* note 160.

[167] *Id*.

[168] VIIKARI, *supra* note 156, at 1.

[169] *Id*.

[170] Drake, *supra* note 160.

[171] *Id*.

In any event, a lack of universal definition persists. The Legal Subcommittee of the Committee on the Peaceful Uses of Outer Space observed in 2002 that it had heard diverse views on the definition and delimitation of outer space since 1967 and still struggled to resolve substantive legal issues related to the definition and delimitation of outer space years later.[172]

Responses, in 2012, by France and Australia to the question of whether "their Government considered it necessary to define outer space and/or to delimit airspace and outer space,"[173] are emblematic of the debate. The Australian government stated that it:

> recognizes that it is advantageous to domestic entities conducting space activities to have certainty as to the legal framework which applies to their activities. In this respect, the delimitation of activities that must comply with the requirements of the Space Activities Act and activities that need not comply is necessary for the efficient regulation of domestic Australian space activities. In achieving this goal, the existence of an accepted point of delimitation is more important than the physical location of that point. [174]

In contrast,

> France does not consider it appropriate, as the situation with regard to space activities currently stands, to define and delimit outer space. It maintains a functionalist approach to space activities: any object whose purpose is to reach outer space, whether or not that purpose is achieved, is a space object. Thus, the international liability regime established by treaties under the aegis of the United Nations may be applied even when a launched object fails to reach outer space but nevertheless causes damage.[175]

The point is that there is currently no agreement as to the precise delineation between outer space and airspace. This is an obstacle in clarifying the nature of jurisdiction because of competing legal

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[172] Comm. On the Peaceful Uses of Outer Space, Rep. of the Legal Subcomm. on Its Fifty-First Sess., U.N. Doc. A/AC.105/769 (Jan. 18, 2002).

[173] Comm. on the Peaceful Uses of Outer Space, Rep. of the Legal Subcomm. on Its Fifty-Second Sess., U.N. Doc. A/AC.105/889/Add.10 (Feb. 21, 2012).

[174] *Id.*

[175] *Id.*

regimes—earth-bound versus space-bound—and the different national interests at play in both.

C. Space Tourism

In 2001, American national Dennis Tito become the first "space tourist."[176] At the time of this writing, seven private citizens have paid to go to space, with the most recent in 2009.[177] On December 13, 2018, Virgin Galactic conducted their first trip to "near-space" with Virgin's spaceplane VSS Unity, reaching an altitude of 82.7 kilometers (51.4 miles).[178] On its website, Virgin Galactic describes its mission to be, among other things, "Democratizing Space," suggesting it will, "for the first time, offer everyone the opportunity to become private astronauts and experience the wonder of space for themselves. Our spaceships will also offer the research community a unique platform for space-based science."[179] Additionally, Virgin's mission indicates there will be "a regular schedule of spaceflights for private individuals and researchers from our operational hub at New Mexico's Spaceport America, the world's first purpose built commercial spaceport."[180]

The notion of "democratizing" access to space is attractive, although in reality, the sheer wealth required to engage in such an activity will preclude all but a few. Nonetheless, it is "almost inevitable that commercial space tourism will emerge as a realistic and foreseeable use of outer space within the near future."[181] Steven Freeland has noted that:

> [a] poll conducted in May 2002 indicated that 19 percent of affluent American adults would be willing to pay one hundred thousand dollars for a fifteen minute suborbital flight, while 7 percent would be prepared to pay twenty million dollars for a two-week flight to an orbital space station, with that figure

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[176] Jonathan O'Callaghan, *2019 Is the Year that Space Tourism Finally Becomes a Reality. No, Really*, WIRED (Jan. 24, 2019), https://www.wired.co.uk/article/spacex-blue-origin-space-tourism.

[177] *Id.*

[178] *Id.*

[179] *Mission*, VIRGIN GALACTIC, https://www.virgingalactic.com/mission/ (last visited May 21, 2020).

[180] *Id.*

[181] Freeland, *supra* note 3, at 3.

> rising to 16 percent if the price were reduced to a "mere" five million dollars.[182]

In Blount's view,

> Tourists could be an especially volatile development, since they are not military-esque state actors that have been sent to space as the "envoys of mankind", nor would they even feel constrained by the rules and regulations of a private company with operations in space as an employee of that company might. Their interactions would most closely resemble interactions of the average citizen on earth where crime and other conflicts regularly occur.[183]

In a jurisdictional sense, Blount is right. In this regard, his proposal for a "space visa which will serve as a way to create an internationally uniform jurisdictional regime"[184] has merit. Blount suggests that the State issuing a space visa to an individual would do so on the condition that the individual subjugated his/her self to the jurisdiction of that State.[185] This proposal may be useful for individual, *ad hoc* crimes. What, however, if transnational organized crimes, such as migrant smuggling, weapons trafficking, or environmental crimes, made their way into space? That may involve organizations comprised of multiple individuals travelling under various space visas. And what of visa fraud? In the event of a fraudulent space visa, whom would have jurisdiction? It could also create a tiered hierarchy of criminal liability, particularly between nationals of countries with space capacity and those without. Space visas would likely be a useful administrative tool, but could not be the complete and final word on jurisdiction.

D. Private operators

It is not clear whether the prohibition on appropriation of outer space found in the Outer Space Treaty only applies to States or whether it would also bind private, non-State operators. For example, as Ricky Lee has pointed out, Article II of the Outer Space

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[182] *Id*. at 2 (quoting Eddie Fitzmaurice, *Beam Me Up, Richard,* THE SUN-HERALD (Sydney), Oct. 24, 2004, at 52).

[183] Blount, *supra* note 16, at 303.

[184] *Id*. at 301.

[185] *Id*.

Treaty doesn't expressly apply to private entities—indeed, the Chinese version expressly provides that "States" cannot appropriate, with the possible implication that only States (and not corporations) are bound.[186] However, there is reference to non-governmental entities in Article II(3) of the Moon Agreement and Article VI of the Outer Space Treaty. As a matter of interpretation, does the specific mention of non-governmental entities in the Moon Agreement imply that they are exempt from the Outer Space Treaty? As a matter of common sense, it would seem inconsistent with the "common heritage of humankind" intentions behind the legal frameworks on outer space. However, private operators may act independently of the State and could be made up of multiple persons with multiple nationalities. Thus, they are not as easily regulated by the nationality principle of jurisdiction. Corporate entities can also have nationality, but the rules for ascertaining that nationality are complex, often leading to harmful types of forum shopping or competing claims to jurisdiction.

Potentially, the objective territoriality principle, the protective principle and the effects doctrine could provide criminal jurisdiction. However, the relevant criminal conduct of a non-governmental entity would have to exhibit the requisite effects on a particular State, as required by each ground. The universality principle of extraterritorial jurisdiction may also be helpful, but only in limited circumstances. Universality is only applicable to certain universally recognized crimes, such as piracy. Given the comparison made between the High Seas and outer space, in the sense that both are considered common heritage of humankind and not the sovereign territory of a particular State, the application of the universality principle is not entirely unreasonable for some crimes analogous to piracy. Such crimes may include hijacking of a space vessel or theft from such a vessel, but universality would not be applicable for other criminal activity. These shortcomings do raise concerns as to the hierarchy of jurisdictional claims in outer space.

The issue of private operators also raises questions as to attribution for the purposes of determining "State Responsibility." The question as to whether private parties, such as subcontractors, can be considered functionaries of the State is taken up in Article 5

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[186] Lee, *supra* note 24, at 131.

of the International Law Commission's Articles on the Responsibility of States for Internationally Wrongful Acts (ARSIWA).[187] It provides:

> The conduct of a person or entity which is not an organ of the State under article 4 but which is empowered by the law of that state to exercise elements of the governmental authority shall be considered an act of the State under international law, provided the person or entity is acting in that capacity in the particular instance.[188]

While these principles only apply to conduct which is "internationally wrongful,"[189] the principles nonetheless provide domestic courts with a useful architecture by which to explore questions of attribution for extraterritorial action of non-governmental entities.

E. Human Rights and Space

Human activity in space also raises questions as to the role of human rights law in space and the consequences of space activities on the realization of human rights. For the purpose of international human rights law, the Universal Declaration of Human Rights (UDHR),[190] recognizes two types of human rights: (1) civil and political rights; and (2) economic, social and cultural rights.[191] In order to codify these into legal obligations, two separate international covenants were adopted "which, taken together, constitute the bedrock of the international normative regime for human rights."[192] These two conventions are the International Covenant on Civil and Political Rights (ICCPR)[193] and the International Covenant on Economic, Social and Cultural Rights (ICESCR).[194] Many other multilateral and regional treaties have also been negotiated setting out

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[187] Int'l L. Comm'n, Rep. on the Work of Its Fifty-Third Session, U.N. Doc. A/56/10, at art. 5 (2001).

[188] *Id*. at art. 5.

[189] *Id*. at art. 1.

[190] G.A. Res. 217 (III) A, Universal Declaration of Human Rights (Dec. 10, 1948).

[191] PHILLIP ALSTON & RYAN GOODMAN, INTERNATIONAL HUMAN RIGHTS 278 (2013).

[192] *Id*. at 277.

[193] International Covenant on Civil and Political Rights, Dec. 16, 1966, 999 U.N.T.S. 171.

[194] International Covenant on Economic, Social and Cultural Rights, Dec. 16, 1966, 993 U.N.T.S. 3.

human rights obligations. In short, international human rights law recognizes the individual person as a subject of international rights. For breaches of the ICCPR, individuals can bring legal proceedings before the Human Rights Committee.[195] An individual complaints mechanism is provided for in an optional protocol to the ICESCR that came into force in 2013.[196]

The usefulness of international human rights law in the regulation of extraterritorial jurisdiction lies in the recognition of the rights of individuals, contrary to the relative rights and interests of States in relationship to one another which normally preoccupies extraterritoriality analyses. Further, "human rights law applies to extraterritorial State actions, thereby potentially offering a normative framework by which conformity to human rights standards can be judged."[197] In an advisory opinion titled *Legal Consequences of the Construction of a Wall in the Occupied Palestinian Territory (Wall Opinion)*,[198] the International Court of Justice held that States parties to the ICCPR should be bound to comply with its provisions, even when exercising jurisdiction outside national territory.[199] Further, Article 14 of the ICCPR provides for a number of "fair trial" rights[200] and Article 9 of the ICCPR is relevant to an

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[195] *Human Rights Committee*, OFF. OF THE HIGH COMM'R OF HUMAN RIGHTS, https://www.ohchr.org/EN/HRBodies/CCPR/Pages/CCPRIntro.aspx (last visited Mar. 3, 2020).

[196] *Committee on Economic, Social and Cultural Rights*, OFF. OF THE HIGH COMM'R OF HUMAN RIGHTS, https://www.ohchr.org/EN/HRBodies/CESCR/Pages/CESCRIntro.aspx (last visited Mar. 3, 2020).

[197] Ralph Wilde, *Legal "Black Hole"? Extraterritorial State Action and International Treaty Law on Civil and Political Rights*, 26 MICH. J. OF INT'L. L. 739, 740 (2005).

[198] Legal Consequences of the Construction of a Wall in the Occupied Palestinian Territory, Advisory Opinion, 2004 I.C.J. Rep. 136 (July 9).

[199] *Id* ¶ 109. Note, however, that in that case, Israel was found to be bound by its obligations under the ICCPR on the basis that it was exercising a type of territorial jurisdiction over Occupied Palestine*; see also*. In *Bankovic v. Belgium*, an application by six citizens of the Federal Republic of Yugoslavia complained that the bombing of a radio and television building by NATO during the Kosovo crisis in April 1999 in which a number of people were killed violated the right to life in Article 2 and the freedom of expression in Article 10, of the European Convention on Human Rights. The Court declared the application inadmissible on the basis that there was no jurisdictional link between the victims of the act and the respondent States. Bankovic v. Belgium, 2001-XII Eur. Ct. H.R. 890.

[200] International Covenant on Civil and Political Rights art. 14, Dec. 16, 1966, 999 U.N.T.S. 171.

exercise of extraterritoriality because it prohibits arbitrary arrest or detention.[201]

An example of such rights can be seen in the decision of the Human Rights Committee in *Domukovsky v. Georgia*, where the Committee suggests that an impermissible exercise of extraterritorial jurisdiction can lead to a finding of an Article 9 violation.[202] That case was brought by a number of complainants, of which Mr. Domukovsky was one. Mr. Domukovsky, a Russian national, was one of nineteen persons brought to trial before the Supreme Court of Georgia on charges of participating in terrorist acts.[203] Domukovsky argued that the government of Azerbaijan, where he had sought refuge, refused Georgia's request to extradite him and that in April 1993, he was kidnapped from Azerbaijan and illegally arrested.[204] For this reason, Domukovsky argued, among other things, that his arrest was a violation of Article 9 of the ICCPR.[205] In response, Georgia submitted that Domukovsky was arrested following an agreement with the Azerbaijan authorities on cooperation in criminal matters.[206] The Human Rights Committee, however, found the arrest was unlawful in violation of Article 9, paragraph 1, of the Covenant.[207]

Further, as noted at the outset, the use of space does have consequences on many activities, including the delivery of humanitarian aid and access to information. Therefore, the use of space also has indirect consequences for the realization of human rights. In any event, however, a comprehensive analysis of the relationship between space law and international human rights law is beyond the scope of this Article. The main point to be made at this juncture is that if the legal authority of the State can—as it currently does—stretch extraterritorially into space, it follows that human rights obligations do too. The United Nations Human Rights Committee,

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[201] International Covenant on Civil and Political Rights art. 9, Dec. 16, 1966, 999 U.N.T.S. 171. Article 9 requires that "[n]o one shall be deprived of his liberty except on such grounds and in accordance with such procedure as are established by law."

[202] Human Rights Comm., Views of Its Sixty-Second Session, ¶ 18.2, U.N. Docs. CCPR/C/62/D/623/1995, CCPR/C/62/D/624/1995, CCPR/C/62/D/626/1995, CCPR/C/62/D/627/1995 (May 29, 1998).

[203] *Id.* ¶ 2.1.

[204] *Id.* ¶ 2.2.

[205] *Id.* ¶ 11.1.

[206] *Id.* ¶ 10.3.

[207] *Id.* ¶ 18.2.

which hears complaints of violations of the International Covenant on Civil and Political Rights, might have jurisdiction to hear complaints relating to assertions of extraterritorial jurisdiction in space.

V. CONCLUSION

From the above, we can surmise that there is currently a distinction between criminal acts carried out onboard a spacecraft and criminal acts committed outside a spacecraft. For the purposes of treaty law, it is a regulatory gap filled by the principles of jurisdiction which are currently understood to be customary international law. In the case of criminal acts onboard spacecraft, however, Article VIII of the Outer Space Treaty would operate to extend the jurisdiction of the State of registry. There may also be a distinction between conduct taking place in relation to outer space and activities in outer space. Such distinction relates to the delineation debate and would likely be resolved by international agreement on the point of demarcation of airspace and outer space, or by the adoption of a purpose test. A purpose test would, in determining if a vessel's purpose is related to outer space, minimize the effect of a finding that the relevant space craft was still in airspace.

The potential increase in space tourism is also instructive for it reveals a need for a code of conduct or principles of jurisdiction to apply to civilian space tourists. Such rules are also needed in relation to the issue of private and commercial operators in outer space.

Ultimately, however, our above consideration of the rules of extraterritorial criminal jurisdiction in outer space has raised as many questions as answers. Arguably, existing principles of international law "are merely proxy principles for underlying core principles"[208] and outdated notions at the periphery of the core principles should not constrain contemporary legal thinking.[209] This is particularly true in the context of new frontiers, such as outer space. In short, the complexity of existing rules of extraterritorial jurisdiction and the limitations of those rules in space point to the need for new principles of jurisdiction for settlement of extraterrestrial disputes and criminal conduct. We look forward to the debate.

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[208] Svantesson, *supra* note 121.
[209] *Id.*

FALLING BACK TO EARTH: THE RETURN OF STATE PREDOMINANCE IN RUSSIAN NATIONAL SPACE LEGISLATION IN THE ROSCOSMOS ERA

Christian A. Packard[*]

ABSTRACT

The Russian Federation is, as the Soviet Union historically was, an international leader in space activity. Having specialization in space activity that few countries can match, Russia's views on its rights and obligations under international space law carry significant weight. Expressions of such views can contribute to description of subsequent State practice in accordance with a treaty, or as the

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opinio juris or State practice that leads to international custom. Perhaps the clearest expression of the views of the Russian state are its laws, promulgated by various state institutions. This Article presents a survey of the state of Russian domestic space legislation at the start of 2020 and draws conclusions from that survey regarding trends in Russian space law. The author reaches conclusions on several issues, including: how Russia views commercial space activity conducted within Russian jurisdiction; how Russia views its obligations under the four primary space treaties; and how Russia intends to regulate its domestic space industry in the foreseeable future.

I. INTRODUCTION

For the past century, the law in what is now Russia has persisted in a state of transition. Soviet law "was claimed to be in constant transition" from the imperial past to a socialist and ultimately communist future.[1] Russian[2] law since the end of the Union of Soviet Socialist Republics (Soviet Union or USSR) has again embraced transition, but away from the Soviet legacy and toward something new.[3] Indeed, "[t]he Russian jurist of whatever generation and specialty in the law finds either his [or her] previous training in Marxism-Leninism to be irrelevant and unacceptable or his [or her] present training, eclectic and uncertain."[4] Russia's laws and regulations governing human activity related to outer space are a good example and studying them may shed some light on the future direction of Russian law as a whole.

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[1] WILLIAM E. BUTLER, RUSSIAN LAW AND LEGAL INSTITUTIONS 2 (2d ed. 2018).

[2] It should be noted that two words in the Russian language are translated as meaning "Russian." These are "*российский*" and its declensions and "*русский*" and its declensions. The former relates to the Russian State, in the sense of the Russian Federation, Russian citizenship or Russian political history. The latter references the Russian language and ethnicity (as distinct from Belorussian, Ukrainian, etc.), whose self-identified members live throughout the former Soviet Union Republics and all across the world, and who comprise a majority of the population of the Russian Federation. All of the legal authorities discussed in this Article use the first word and all translations should be read as carrying the sense of that word. For example, a clause noting the rights or obligations of "Russian persons" would, in this Article, mean anyone with Russian citizenship, regardless of whether they self-identify as "*русский*," as distinct from Chechen, Kalmyk, Ukrainian, or so on.

[3] *Id*.

[4] *Id*. at 69.

Secondary sources surveying or discussing Russian space law are scarce in any language, including English. Moreover, the English-language resources that do exist are typically outdated. The same is true for English-language scholarship. Anyone investigating Russian space law will find themselves awash in a sea of primary sources, some dating back to the earliest days of the Russian Federation, some established by familiar government entities like a President or a legislature and some promulgated by a special type of State agent, the "State corporation." If the researcher is limited to the English language, the problem is further muddled by inadequate access to current and quality translations. For example, many of the Russian resources on the website of the United Nations Office for Outer Space Affairs (UNOOSA) are fifteen or twenty years old and do not reflect a multitude of later amendments.[5]

This Article provides a contemporary snapshot of Russian space law, as it exists at the start of 2020. This Article should not be regarded as a literature survey or a comparative analysis, though secondary sources and comparisons will be invoked as needed to explain a given source. Instead, this Article is meant to be a review of the sources of Russian national legislation touching on outer space, highlighting Russian's implementation of its space treaty obligations as well as trends and unique features in those sources.

Within this Article, "space law" is defined as "every legal or regulatory regime having a significant impact, even if implicitly or indirectly, on at least one type of space activity or major space application."[6] For the purposes of this Article, "legislation" refers to statutes adopted by the legislature (State Duma and Federation Council), proclamations or other documents issued by the Government, decrees from the President and decrees, proclamations, or regulations issued by the Russian State Corporation for Space Activity, stylized as "Roscosmos." Because of limitations on resources, this Article will focus on expressly space-related authorities and direct the reader to further resources, not primarily focused on space

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[5] *National Space Law Collection*, U.N. OFF. OUTER SPACE AFF., http://www.unoosa.org/oosa/en/ourwork/spacelaw/nationalspacelaw/index.html (last visited July 5, 2020).

[6] Frans von der Dunk, *Preface*, *in* HANDBOOK OF SPACE LAW xxiv, xxvi (Frans von der Dunk & Fabio Tronchetti eds., 2015).

law, when applicable. All Russian-language sources in this Article will be cited under their translated English names, but citations will direct the reader to publicly-accessible Russian-language versions, derived from government websites when possible.[7]

This Article will first review the historical background of space activity in Russia and the Soviet Union, without which Russian space law may not make much sense. Second, this Article will address the Russian legal system, so the reader may understand the nature of a given primary source. The Article will then explore Russian national space legislation at length. The major space treaties will guide the organization of this section, which will assess various sources as implementations of Russia's treaty obligations. Finally, the Article will close with an analysis of larger trends in Russian space law, specifically the law's surge toward State dominance of the space sector, its continued exhaustive codification and its elaboration and expansion of obligations originating in treaties.

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[7] All Russian-language sources quoted in this Article were cited by the author. Where a Russian-language source is cited, but not directly quoted, the author read the source in the original language. A few quick notes about translation and citations are thus in order.

The author holds a Bachelor's degree in Russian from the University of Florida and a Master's degree in Russian, East European and Central Asian Studies from Harvard. Therefore, he translated the relevant authorities himself. However, he is not a native speaker of Russian, is not a certified translator and is not licensed to practice law in any Russian-speaking jurisdiction. As a result, the reader should not rely on his translations for any purpose and should assign fault for any translation errors to the author alone.

Russian-language sources will generally be cited under their Russian and English names. However, the Russian-language names will not be transliterated (that is, phonetically rewritten into the English alphabet), as that process normally does not make finding the original-language sources easier and typically creates needless extra work. Also, if a citation requires reference to something peculiar in the Russian version of a document, the title will only be given in Russian. Russian-language secondary sources, typically journal articles, frequently come with an author-recommended translation for the title of the publication. The author defers to the author-recommended translations when such are supplied, unless they are clearly erroneous. When a Russian scholar supplies their own English transliteration of their own Russian name in a scholarly work, the author defers to the supplied transliteration. Finally, the almost-universal convention in Russian academic citations is to name a writer using only their first two initials and their surname. As an example, Vladimir Vladimirovich Putin would, in academic writings, be cited as "V. V. Putin" (or *В. В. Путин*). The author has attempted to find the full names of cited authors where possible, to conform to Western convention, but this was not always possible.

II. BACKGROUND

A. The Origins of the Soviet Space Program and International Space Law

The story of Russia's space program commences around 1945. The predecessor of the Russian Federation was the Soviet Union which, like the United States (US), was one of the victors of World War II. However, unlike the US, the Soviet experience in the war involved the enslavement, deportation and murder of millions of its civilians by Nazi Germany.[8] By the end of the war, the US and the USSR were technically allies, but the Soviet Union had conquered Eastern Europe and was in no mood to relinquish control.[9]

Against this backdrop began two phenomena of importance to the space lawyer. On the one hand, the end of World War II almost immediately led to the Cold War: a global-scale series of confrontations and conflicts between the USSR and its allies and the US and its allies. The Cold War had many causes, ranging from sharp ideological differences, to inflexible strategic concerns, to abstract fears about history repeating itself.[10] By 1948, the USSR and the US had become adversaries.[11] This hostility set the stage for the Soviet space program. The development of ballistic missiles and nuclear weapons spurred the US and the USSR both to compete for prestige and practical accomplishment in space activities.[12]

On the other hand, the erstwhile allies, together with dozens of other nations, opened a new chapter in the history of international law by founding the United Nations (UN). In October 1945, the US, the Soviet Union and other countries ratified the Charter of the United Nations.[13] Under the auspices of the UN, a group of experts began seriously considering human activity in outer space

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[8] *See generally* PETER KENEZ, A HISTORY OF THE SOVIET UNION FROM THE BEGINNING TO THE END 144-48 (1999).

[9] *See id.* at 159.

[10] *See id.* at 160-66.

[11] *See id.*

[12] Peter Jankowitsch, *The Background and History of Space Law*, *in* HANDBOOK OF SPACE LAW 1, 2-3 (Frans von der Dunk & Fabio Tronchetti eds., 2017).

[13] *Milestones 1941-1950*, UNITED NATIONS, http://www.un.org/en/sections/history/milestones-1941-1950/index.html (last visited January 11, 2020).

as the ad hoc Committee on the Peaceful Uses of Outer Space (COPUOS).[14]

This paradoxical mix of physical hostility and legal cooperation led to two series of events proceeding in parallel: the astonishing accomplishments of the Soviet space program and the pragmatic creation of a legal regime for international relations in space. In 1957, the USSR put the first satellite, simply named Sputnik-1 (literally "Satellite-1") into Earth orbit.[15] For much of the 1950s, some believed that the USSR had surpassed the US in a critical area of spaceflight technology—rocket design.[16] Indeed, by 1956, the Soviet leadership publicly claimed that Soviet supremacy in this area made world wars avoidable and that "peaceful coexistence" between the capitalist and communist systems had become achievable.[17]

In 1959, the USSR space probe Luna 2 became the first human-made object to impact another celestial body when it crashed into the lunar surface, and a second probe, Luna-3, took a photograph of the theretofore unseen far side of the Moon.[18] That same year, COPUOS became a permanent committee by a resolution of the UN General Assembly. The Soviet Union initially boycotted COPUOS due to concerns about it "not being sufficiently representative."[19] However, the Soviet Union relented after reaching a compromise with Western states that restructured COPUOS.[20] Specifically, the two factions agreed that the new, permanent COPUOS would take its decisions by consensus and report to the General Assembly.[21]

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[14] *History*, U.N. OFF. OUTER SPACE AFF., http://www.unoosa.org/oosa/en/aboutus/history/index.html (last visited January 11, 2020).

[15] *A Timeline of the Exploration and Peaceful Use of Outer Space*, U.N. OFF. OUTER SPACE AFF., http://www.unoosa.org/oosa/en/timeline/index.html (last visited January 11, 2020).

[16] Alexei Kojevnikov, *The Cultural Spaces of the Soviet Cosmos*, *in* INTO THE COSMOS: SPACE EXPLORATION AND SOVIET CULTURE 15, 23 (James T. Andrews & Asif A. Siddiqi eds., 2011).

[17] *Id*. at 23.

[18] *Id*.

[19] Jankowitsch, *supra* note 12, at 11.

[20] *Id*.

[21] *Id*. at 11-12.

In 1961, the Soviet Union put Yuri Alekseyevich Gagarin into a complete orbit of the Earth, making him the first person in space.[22] In 1963, Soviet cosmonaut Valentina Vladimirovna Tereshkova became the first woman in space, orbiting the Earth for three days.[23] In 1965, Alexei Leonov performed the first spacewalk.[24] And in 1966, the Soviet Union landed a probe, Luna-9, on the surface of the Moon and impacted another probe, Venera-3, on Venus.[25]

In 1967, the "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies," commonly known as the "Outer Space Treaty," entered into force. The Soviet Union was among the original ratifying States.[26] In 1969, two Soviet Soyuz (Union) spacecraft docked and exchanged crew members, making what some call the "world's first space station."[27] In May 1969, the Soviet Union was one of three States to submit the "Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space," commonly called the "Rescue Agreement."[28] Then on July 21, 1969, the Soviet Union suffered its most serious defeat in the so-called "space race," as US astronaut Neil Armstrong became the first human to set foot on the Moon.[29] In the US, this event is often perceived as "winning" the space race. However, given the absence of long-term human activity on the Moon and the strategic and economic super-importance of communication satellites in the following decades, some frame it as a "consolation

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[22] *Pioneers of the Cosmos,* ROSCOSMOS, https://www.roscosmos.ru/22487/ (last visited July 5, 2020).

[23] U.N. OFF. OUTER SPACE AFF., *supra* note 15.

[24] *Id*. *See also* ROSCOSMOS, *supra* note 22.

[25] U.N. OFF. OUTER SPACE AFF., *supra* note 15. *See also* James T. Andrews & Asif A. Siddiqi, *Introduction: Space Exploration in the Soviet Context*, *in* INTO THE COSMOS: SPACE EXPLORATION AND SOVIET CULTURE 1, 5 (James T. Andrews & Asif A. Siddiqi eds., 2011); Kojevnikov, *supra* note 16, at 23-24.

[26] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer space, Including the Moon and Other Celestial Bodies, Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205 [hereinafter Outer Space Treaty].

[27] U.N. OFF. OUTER SPACE AFF., *supra* note 15.

[28] Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, Apr. 22, 1968, 19 U.S.T. 7570, 672 U.N.T.S. 119 [hereinafter Rescue Agreement]. As an aside, the Russian version of this treaty uses the word "Cosmonaut" (космонавт). As will be discussed later in this Article, modern Russian law ascribes a unique definition to "cosmonaut" which may not have been contemplated by the English word "astronaut."

[29] ROSCOSMOS, *supra* note 22.

prize," compared to the success of Sputnik.[30] The Soviet and Russian view has generally been to see Gagarin's first crewed orbit of the Earth as the highest achievement of the space race.[31]

Nevertheless, the Soviet space program continued. 1971 saw a Soviet robotic rover, Lunakhod-1, freely move across the surface of the Moon, a Soviet probe, Venera-7, gently land on Venus and a Soviet space station, Salyut-1, endure for several months in orbit.[32]

In 1973, the Soviet Union ratified the "Convention on the International Liability for Damage Caused by Space Objects," also known as the "Liability Convention."[33] In 1975, under the "Apollo Soyuz Test Project," an American and Soviet spacecraft docked together.[34] In 1978, the Soviet Union ratified the thus-far final widely-adopted space treaty,[35] the "Convention on Registration of Objects Launched into Outer Space," also known as the "Registration Convention."[36] In 1986, the Soviet Union achieved its last major space milestone before its collapse: the launch of the main module of the first "permanent" space station, Mir.[37]

Of course, the Soviet space program had more value to the Soviet people and regime than merely its military-strategic significance. For example, more people assembled in Red Square to welcome home Yuri Gagarin than had attended certain parades

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[30] Kojevnikov *supra* note 16, at 24.

[31] *Id*. at 23-24.

[32] U.N. OFF. OUTER SPACE AFF., *supra* note 15.

[33] Convention on the International Liability for Damage Caused by Space Objects, Mar. 29, 1972, 24 U.S.T. 2389, 961 U.N.T.S. 187 [hereinafter Liability Convention].

[34] U.N. OFF. OUTER SPACE AFF., *supra* note 15.

[35] Another agreement, the Agreement governing the Activities of States on the Moon and Other Celestial Bodies, or "Moon Agreement," was made available for signature in 1979, but it was not widely adopted. Russia has neither signed nor ratified the Moon Agreement. *See* Frans von der Dunk, *International Space Law*, *in* HANDBOOK OF SPACE LAW 29, 99-103 (Frans von der Dunk & Fabio Tronchetti eds., 2015). However, Kazakhstan, from which Russia currently launches all of its crewed spacecraft, through Baikonur, has ratified the Moon Agreement. *See Agreement Governing the Activities of States on the Moon and Other Celestial Bodies: Status*, U.N. TREATY COLLECTION, https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXIV-2&chapter=24&clang=_en (last visited January 11, 2020).

[36] Convention on Registration of Objects Launched into Outer Space, Jan. 14, 1975, 28 U.S.T. 695, 1023 U.N.T.S. 15 [hereinafter Registration Convention].

[37] *MIR FAQs - Fact and History*, EUR. SPACE AGENCY, http://www.esa.int/esaCP/ESA28WTM5JC_Life_2.html (last visited Jan. 11, 2020).

celebrating the Soviet Union's victory over Nazi Germany.[38] However, the public's enthusiasm and the Soviet authorities' desire to inspire the public's continued belief in communism, and devotion to the State itself, was in constant conflict with the State's desire to maintain secrecy.[39] This secrecy was motivated by strategic concerns, the military's desire to protect itself within the cutthroat Soviet internal political scene and the Soviet State's general desire to only provide the domestic public with information about the space program's prestige, rather than its risks and failures. This led to a difficult reality for the State: it had to promulgate general, ambiguous statements that would serve its ends, at home and abroad, while simultaneously depriving the public and foreign adversaries of any specifics that could jeopardize those ends. When the secrecy largely collapsed in the 1980s, it became difficult to distinguish truth from fiction.[40] In general, the interests of the State dominated space policy in the Soviet era.

B. The Collapse

Like the Russian Federation, the Soviet Union was also a federated State made of smaller entities, which had varying levels of jurisdiction and ranks of sovereignty. At its the time of its demise, the Soviet Union included fifteen top-level "Union Republics," the largest of which was the Russian Soviet Federative Socialist Republic (RSFSR). In 1991, the Soviet Union dissolved, for reasons far too diverse and complicated to detail here. What matters for our purposes is that the RSFSR left the Soviet Union (some say it "seceded from itself") in 1991, declaring independence.[41] The consequences of this event also far exceed the limits of this paper. Of importance to the space lawyer, however, is the Alma-Ata Protocol, a treaty between eleven new States which had ceased being Union Republics within the Soviet Union. This treaty, signed in 1991, authorized the country now known as Russia to take over the role of the Soviet

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[38] Andrews & Siddiqi, *supra* note 25, at 5. The author suspects there could be other causes, like the decimation of the Soviet population in the war, but that exceeds the scope of this Article.

[39] Asif A. Siddiqi, *Cosmic Contradictions*, *in* INTO THE COSMOS: SPACE EXPLORATION AND SOVIET CULTURE 47, 48-49 (James T. Andrews & Asif A. Siddiqi eds., 2011).

[40] *See id.* at 55-58, 63-72.

[41] *See generally* Kenez, *supra* note 8, at 144-48.

Union in the UN and all other international organizations.[42] Among other acts taken in the wake of that treaty, Russia's President submitted a note to the US in 1992 accepting the US offer of full diplomatic relations in exchange for committing to fulfill the USSR's treaty obligations.[43] Therefore, while the Soviet Union ceased to exist, and its physical spaceflight infrastructure was scattered between many new States, the Soviet Union's role in international space law was immediately transferred to the nascent Russian Federation.

Thus, Russia's choice to continue involving itself in outer space affairs seems entirely natural. Russia inherited the Soviet legacy of pioneering space exploration, industry and law. One could also note the Russian Federation's continuation of the Soviet legacy of military and strategic ambitions. Either way, it is enough to say that Russia is simply continuing the activities of its predecessor, the Soviet Union.

III. RUSSIAN SPACE LEGISLATION

A. Preliminary Notes

i. Russian Law and Translation

This Article assumes that its readers will primarily be English-speaking lawyers trained in the US or in other nations with similar legal systems. Therefore, this Article must present some notes concerning the Russian legal system's distinguishing features and the translation of legal materials from the Russian language into English. These topics are not easily separated.

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[42] *The End of the Soviet Union; Text of Accords by Former Soviet Republics Setting up a Commonwealth*, N.Y. TIMES (Dec. 23, 1991), https://www.nytimes.com/1991/12/23/world/end-soviet-union-text-accords-former-soviet-republics-setting-up-commonwealth.html.

[43] *See* Paul R. Williams, *The Treaty Obligations of the Successor States of the Former Soviet Union, Yugoslavia, and Czechoslovakia: Do They Continue in Force?* 23 DENV. J. INT'L L. & POL'Y 1, 24 (1997); Lucinda Love, *International Agreement Obligations after the Soviet Union's Break-up: Current United States Practice and Its Consistency with International Law*, 26 VAND. J. TRANSNAT'L L. 373, 403 (1993) (noting Yeltsin's expression, in a letter to UN Secretary General, that Russia would take over various Soviet rights and obligations).

Almost thirty years have elapsed since the dissolution of the Soviet Union. The "law," broadly defined, of the Russian Federation has spent that time in transition away from its Soviet heritage to a more market-focused system.[44] The modern Russian legal system is often deemed a "civil" system, like France, by outsiders. However, this is not necessarily true. There are many ways to classify the Russian system.[45] That discussion is outside the scope of this Article, but outside observers should not assume that anything they know about another legal system (and not merely the substantive law or procedural rules) applies in Russia. Further, unless one is a native speaker of Russian, Russia's legal system cannot be approached without some extent of legal translation.

William Butler has observed that there are "perhaps as many approaches to legal translation as there are translators . . . ."[46] If a translation is not strictly accurate, however, it becomes an "attempt to recharacterize or redress the terminology of one legal system in the guise of another . . . ."[47] That is, the translation can look "*remarkably* like English or United States law . . . ."[48] Such a translation would be useless, dangerous or both. Broadly speaking, translation can be "literary," "contextual" or "literal."[49] This Article attempts to follow the literal approach as much as possible, "to convey the sense, cadence and rhythm of the original text as much as possible, preserving as it occurs the ambiguity or unwieldiness of the original without improving upon it."[50] Of course, context cannot be ignored entirely. For example, the "international legal vocabulary of Marxism-Leninism" is still not entirely gone and may never be.[51] Also, persistent are "the Soviet traditions of directness and bluntness usually at the expense of elegance and sometimes subtlety."[52] So, the author has attempted to keep these traditions in mind as the context surrounding Russian space law. Further, though the author's knowledge of aerospace science and technology is far from

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[44] BUTLER, *supra* note 1, at 2.
[45] *See id*. at 4-14.
[46] *Id*. at 29.
[47] *Id*.
[48] *Id*. at 30.
[49] *Id*. at 29-30.
[50] Butler, *supra* note 1, at 31.
[51] *Id*. at 20.
[52] *Id*. at 31.

perfect, the author has attempted to equate technical terms as much as possible, particularly when a literal translation of a technical space-related term would be absurd.

An initial difficulty in Russian legal translation is the word "law." Russian preserves the ancient Latin distinction between *jus* (now *право* or *pravo*),[53] or "all law within a legal system," and *lex* (now *закон* or *zakon*), which "normally encompasses positive forms of law: legislation, normative legal acts, and the like."[54] In describing the Russian legal system, it can be important to emphasize whether one speaks of *jus* or *lex*. Indeed, several of the authorities discussed below use both words. Further, *jus* is not just the aggregate of promulgated textual laws in a system. It can carry a connotation of positive law, though no Russian legal authority has yet spelled out how this differs from the Russian constitution.[55]

Another distinction that frequently trips up English speakers from the US is the reality that the State and the Government are not the same thing. The Russian word for the one is often mistranslated as the other. This can have disastrous consequences. For example, "the Russian Government is not a juridical person and may only enter into transactions as a specifically authorized representative of the Russian State . . . [which] does have legal personality and capacity."[56] Also, there is no such thing in Russia as "governmental immunity," only "State immunity" and the expression best translated as "State interference" is not the same thing as "governmental regulation," but is instead "something far worse . . . ."[57]

The Russian language lacks a word that is used in the same ubiquitous present tense fashion as the word "is" or "are." Comparable words do exist (*есть* and conjugations of *являться*), but they often carry additional meanings and are rarely used. Instead, the verb "to be" is usually just omitted or represented by a hyphen. Further, the distinctions between "is," "must," "should" and "shall" have no simple analogues in Russian. In English, these words can make or break a given lawsuit or contract. In Russian, similar

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[53] Historically, that word shared some overlapping meaning with *правда*, the modern word for truth. That latter word historically could also mean "justice." *See id*. at 72.

[54] *Id*. at 32.

[55] *Id*. at 122.

[56] BUTLER, *supra* note 1, at 33.

[57] *Id*. *See also id*. at 35 (discussing a court case in which a Russian media entity convinced a court that it had State immunity based on a mistranslation).

words exist, but they have overlapping nonexclusive meanings, which can vary with context. Of particular note, Butler advises that the void left by the absent conjugation of "to be" can, at times, appropriately be translated as the future imperative English word "shall."[58]

The Russian language also lacks articles: "the" or "a" or "an." Which word should be supplied to make a translation legible "can sometimes be determined from the subject-matter and context," but sometimes the ambiguity is deliberate.[59] The English-speaking lawyer probably cringes once again. As a result "[t]ranslator discretion inevitably arises" on this issue, though "[m]any translators will perforce minimize the use of articles where this is possible."[60] To illustrate these difficulties together, a Russian law could contain a sentence which may be literally read in its entirety: "Organization liable." This could become "the organization is liable," or "an organization shall be liable" or some rearrangement of those two sentences.

Butler urges that the translator disclose as much about his or her experience, qualifications and translation sources as possible. With this in mind: the author holds a Bachelor's degree in Russian from the University of Florida and a Master's degree in Russian, East European, and Central Asian Studies from Harvard University. He has lived in Russian speaking cities and worked (but never practiced law) in multilingual environments. However, he is not a native speaker of Russian, is not a certified translator and is not licensed to practice law in any Russian-speaking jurisdiction. The dictionaries relied upon included the OXFORD RUSSIAN DICTIONARY[61] and the RUSSIAN-ENGLISH LEGAL DICTIONARY.[62] The author confesses that when those sources failed, he simultaneously consulted Google Translate and the likely-crowdsourced website Multitran.ru, as well as general internet searches for ambiguous terms. Resort to the internet happened most often for terms related to aerospace technology or insurance. The author translated everything cited in this Article himself and any errors are his alone.

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[58] *Id*. at 35-36.
[59] *Id*. at 36.
[60] *Id*.
[61] MARCUS WHEELER ET AL., OXFORD RUSSIAN DICTIONARY (4th ed. 2007).
[62] WILLIAM E. BUTLER, RUSSIAN-ENGLISH LEGAL DICTIONARY (1995).

In sum, concerning translation, the author urges caution for the practitioner. To be blunt: do not rely on the translations in this Article—hire a professional translator and be deeply skeptical of translations from anyone you did not personally hire, including translations obtained from government or organizational websites. "'Official' rubbish is rubbish nonetheless" and the "equal authenticity" of multiple versions of a law is a perilous legal fiction.[63] In Russia, as elsewhere, an interpreter can face criminal prosecution for incorrect translation.[64] Ultimately, the author disagrees with the conclusion that law is ever truly "untranslatable,"[65] but there is some truth in the assertion that "you can't translate legal language –except that you must."[66]

Sources of law in Russia are many, with overlapping and inconsistent naming conventions. A Soviet law, and the names thereof, may still apply in the Russian Federation unless it has: been expressly repealed or suspended; is contrary to the Constitution or Russian legislation after 12 June 1990; or "it has become obsolete."[67] For example, parts of the RSFSR Civil Code lingered until January 2008.

There is a hierarchy of sources under Russian law.[68] Under the Russian Constitution, the Constitution is supreme over all other sources of law.[69] The Russian Constitution was adopted in 1993. However, there are many approaches to its interpretation and no consensus on its goals.[70] "Legislation" is paramount in the Federation, below the Constitution, but the relationships between "subordinate acts containing legal rules . . . are confused and confusing."[71] The system involves "the inconsistent and extensive use of more than 40 denominations for enactments."[72] For example, the Federal Assembly (a bicameral legislature, with a lower house, the State Duma and an upper house, the Federation Council), enacts law, or

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[63] BUTLER, *supra* note 1, at 39.
[64] *Id*. at 44.
[65] *See id.* at 41 n.16 (quoting D. BELLOS, IS THAT A FISH IN YOUR EAR? 217 (2011)).
[66] *Id*.
[67] *Id*. at 126.
[68] *Id*. at 122.
[69] BUTLER, *supra* note 1, at 127.
[70] *Id*. at 116-20.
[71] *Id*. at 128.
[72] *Id*. at 128.

lex (*закон)*, the President may issue an edict (*указ)* and the Government may issue a decree (*постановление*).[73]

There exist some other confusing realities. The two houses of the Federal Assembly, the Duma and the Federation Council, sometimes promulgate their own decrees (*постановление*) within their own areas of competence. The Federal Assembly also "confirms, by way of federal laws, other normative acts," under many other names: "statute [положение], code [кодекс], and fundamental principles [основы]," as well as "appeal [обращение], declaration [декларация], statement [заявление], resolution [резолюция], or message [послание], for transmission to other governments . . ."[74] The Federal Assembly churns out hundreds of laws and thousands of decrees each year.[75] What counts as a "normative" or "non-normative" act is a murky question with no clear answer.[76] However, several of the laws cited in this Article contemplate future normative acts to fill gaps and clear up ambiguities.[77]

The President, of which the Russian Federation has had only three in almost thirty years, may issue an edict (*указ*), but also a regulation (*распоряжение*). These "must not be contrary to either the Constitution or to federal laws. Both are a form of subordinate legislation," but it is not clear which should be used for a given purpose; in practice, edicts tend to be "most important," while regulations are "non-normative" and concern "individual administrative matters."[78] However, within the President's "competence," the President's acts "enjoy the same stature" as legislative acts within the legislature's competence."[79] This is in part because the Constitution does not require that edicts be issued based on, or in order to

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[73] *Id*. at 127.

[74] *Id*. at 128 (brackets in original).

[75] BUTLER, *supra* note 1, at 129.

[76] *Id*. at 122.

[77] Also, though Russian space law appears to be exclusively Federal, Russia's subordinate entities can promulgate their own laws, which may inadvertently impact space-related industry. For example, Russia contains twenty-one (or twenty-two if you count the newest, Crimea) Republics, which do not cover most of the population or territory of Russia and which are not at all analogous to American or German States, yet which still have their own Constitutions. "Law" (*закон*) can also come from the legislative branches of those republics and other constituent entities (provinces, regions, etc.) within the Federation, including the Federal Cities of Moscow and St. Petersburg.

[78] BUTLER, *supra* note 1, at 129.

[79] *Id*.

execute, laws.[80] This becomes relevant for space law because, as noted below, the legislature has given the President "leadership,"[81] and a list of enumerated powers in outer space affairs, arguably placing outer space affairs within the Russian President's competence.

The Government has responsibility for "[e]xecutive power . . . 'on the basis of and in execution of'" the Constitution, federal laws and normative Presidential edicts.[82] In fulfilling this responsibility, the Government issues documents under titles the reader has already seen: decree (*постановление*) and regulation (*распоряжение*). "As a rule, decrees are normative, and regulations" address routine administrative matters.[83] If either category does not "conform to the Constitution, federal laws, or edicts," the President has the constitutional power to repeal them.[84] The Government can also produce documents "not having a legal character," including appeals, statements and other acts.[85] The Government's decrees and regulations "are binding throughout the Federation without further action" by the Federal Assembly, President or subjects of the Federation—thousands are produced each year, but their importance decreases as the President and Federal Assembly increase their output.[86]

As in other States, Russia's administrative agencies and ministries further complicate the legal landscape. Ministers may issue an order (*приказ*) or "confirm" an instruction (*инструкция*).[87] Entities can also produce "joint instructions."[88] The difference between an instruction (*инструкция*) and an institutional directive (*указание*) is unclear, but the latter are rarely jointly issued.[89] Orders may be normative or non-normative, but instructions are always normative "because they elaborate a particular law, edict, or administrative decree."[90] State agencies also produce what Butler

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[80] *Id.*
[81] *See infra* note 121.
[82] BUTLER, *supra* note 1, at 130.
[83] *Id.*
[84] *Id.*
[85] *Id.*
[86] *Id.* at 131.
[87] *Id.*
[88] BUTLER, *supra* note 1, at 131.
[89] *Id.*
[90] *Id.*

calls an "administrative reglament" (*административный регламент*).[91] Sometimes agencies produce other documents like a letter (*письмо*).[92] Others produce rules (*правила*) or the apparently untranslatable "*nastavlenie* [*наставление*]."[93] "Each of these latter two categories may extend to institutions and personnel or their own particular system or may be binding generally. In the latter case they are normative."[94]

Finally, and of critical importance to space law, treaties (as well as generally-recognized principles and norms of international law) are "an integral part of the legal system of the Russian Federation."[95] This is a radical departure from Russian Imperial and Soviet law. "The expression 'international treaties' is defined broadly and 'treaty norms' prevail over those of international law," generally speaking.[96] Nothing in Russian space law yet appears to unambiguously contradict anything in the major outer space treaties.[97] If that was the case, then the treaty would prevail.[98]

At the least, the reader can be reasonably confident that Russia, in a way comparable to the Romano-Germanic tradition, rejects the lawmaking power of the courts, though certain courts have in

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[91] *Id*.

[92] *Id*.

[93] *Id*.

[94] BUTLER, *supra* note 1, at 131.The reader may wish to note that the term "administrative" can also relate to "administrative commissions" that deal with "administrative offenses," which is "a category unknown to the Anglo-American world . . ." The term "administrative violations" can refer to a subset of antisocial behaviors that do not fit within Russian criminal law. This has no bearing yet on Russian space law, but the reader should be aware of the distinction to avoid future confusion. *See id*. at 293-97.

[95] *Id*. at 150.

[96] *Id*. at 150-52.

[97] Finally, other sources of law do exist, but mercifully they are not clearly referenced by any of the documents discussed in this Article. *See id*. at 146-64.

[98] Anna Alekseevna Malyuchenko & Ekaterina L'vovna Farafontova, *Правовое регулирование деятельности предприятий ракетно-космической промышленности* [Legal regulation of the activity of space-rocket manufacturing enterprises], *in* АКТУАЛЬНЫЕ ВОПРОСЫ ПРАВА, ЭКОНОМИКА И УПРАВЛЕНИЯ - СБОРНИК СТАТЬЕЙ XIII МЕЖДУНАРОДНОЙ НАУЧНО-ПРАКТИЧЕСКОЙ КОНФЕРЕНЦИИ [Current issues of law, economics and administration - collection of materials from the 13th International scientific-practical conference] 155, 155 (German Yur'evich Gulyaev ed., 2018) (quoting KONSTITUTSIIA ROSSIISKOI FEDERATSII [CONSTITUTION] art. 15(4) (Russ.), http://constitution.kremlin.ru/).

recent decades published decisions that function almost like precedent.[99]

ii. Russian Statutory Interpretation

Because this Article primarily focuses on the evaluation of statutes, a brief note about Russian statutory interpretation is warranted. In short, it would be a mistake to assume that any other nation's interpretive tradition is used in Russia. In the view of E.N. Tonkov: "[i]n the Russian paradigm of interpretation of law, it is difficult to draw out generally-significant rules, presumptions, and linguistic maxims, as, for example, in the English doctrine of interpretation."[100] "In Russian scholarship, there does not exist unity in understanding the way of interpretation of law [lex] and in the quantity of practiced methods."[101] A.F. Cherdantsev agrees, writing that there is "no unity regarding a list of methods of interpretation or even their names."[102]

Concerning specific methods of interpretation, "in the English doctrine of interpretation, logical analysis is viewed as a universal general-scientific method, and not as an independent approach."[103] Instead of being limited to logical analysis, Russian interpretation (usually *толкование*, sometimes *интерпитация*) begins with the "grammatical" or "philological" approach, which limits itself to the rules of language.[104] Cherdantsev notes this is also called the "linguistic" approach, preferring that name to the other two.[105]

Whatever the name, this first approach is usually regarded as sufficient, and other approaches may be invoked to confirm or to clarify. There is no required order or priority of other approaches, however, and Tonkov explains that the lawyer is permitted to proceed "in a spiral" through however many are needed.[106]

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[99] Valeriya Nikolayevna Stepanova, *Судебная Практика в российском правотворчестве, in* ТОЛКОВАНИЕ ЗАКОНА И ПРАВА 101, 101-05 (Evgenii Nikandrovich Tonkov ed., 2015).

[100] Evgenii Nikandrovich Tonkov, *Толкование Закона и Права (вместо предисловия), in* ТОЛКОВАНИЕ ЗАКОНА И ПРАВА 9, 24 (Evgenii Nikandrovich Tonkov ed., 2015).

[101] *Id*. at 25.

[102] A.F. CHERDANTSEV, ТОЛКОВАНИЕ ПРАВА И ДОГОВОРА 120 (2003).

[103] Tonkov, *supra* note 100, at 25.

[104] *Id*. at 26-27.

[105] CHERDANTSEV, *supra* note 102, at 120.

[106] Tonkov, *supra* note 100, at 33.

Cherdantsev describes the various approaches as connected, not layered, and states that the formalization "of the process of interpretation is not just impossible but also useless."[107] Different scholars produce different numbers of approaches.[108] A full discussion of each approach exceeds the resources of the author and an application of each approach to the sources space law sources evaluated in this Article would bloat it beyond all reason. Still, the reader may wish to note that their options include, among others: the "systemic" approach, most like that used almost exclusively in the American tradition;[109] the teleological, or goal-oriented, approach;[110] the psycho-emotional approach (likely not recommended in American courts);[111] and the "corruption approach,"[112] which still considers paramount the drafter's intent, but acknowledges the cynical-yet-not-unrealistic possibility that legislators permit laws to be written by lobbyists or on the advice of "the old comrades."[113]

Cherdantsev notes that the "logical" approach is not universally regarded as independent because "all approaches are founded on the laws of logic."[114] However, many formal-logic operations have limits and are not applicable under every approach.[115] "But obviously . . . a leading role belongs to the rules of formal logic."[116]

The reader might note that this discussion has so far avoided the phrase, familiar to American lawyers, statutory construction. Cherdantsev addresses this in a discussion of what he calls the "special-juridical" approach to interpretation.[117] He notes that "juridical construction" is a "method of organization of the content of rules [or norms] of law [jus], and not something external to the contents . . . . Only having interpreted the rule of law, using knowledge about its contents, can we speak definitely about its construction." He further notes that "legal science," sometimes translated as

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[107] CHERDANTSEV, *supra* note 102, at 133.

[108] *See id*. at 120-130. *See also* Tonkov, *supra* note 100, at 26-40.

[109] *See* Tonkov, *supra* note 100, at 26-27.

[110] *See id*. at 28.

[111] *See id*. at 39.

[112] *Id*. at 39.

[113] *Id*. at 39-40. The author suspects that "the old comrades" are comparable to the American concept of "the (good) old boys' club."

[114] CHERDANTSEV, *supra* note 102, at 126.

[115] *Id*.

[116] *Id*. at 128.

[117] *Id*. at 125.

jurisprudence, "'serves interpretation by all of its contents, and its entire arsenal of knowledge, categories, and constructions."[118] So there may be a place in the interpretation of Russian statutes for the familiar rules of statutory construction, if the linguistic approach fails the interpreter.

The author has more or less adhered to the linguistic approach to translate the various authorities referenced in this Article into English. Thereafter, the author resorts to the logical analysis approach in which he was educated. However, application of other approaches to Russian space law sources, especially the corruption approach, would make for fascinating reading if future writers choose to explore those methods.

B. Creation of New Authorities

The Soviet Union was not entirely devoid of space law. Various organs of State and the Communist Party promulgated special resolutions and decisions regulating space activity. However, there was apparently no single, comprehensive source of law addressing space.[119]

The newly-formed Russian Federation adopted its first truly post-Soviet Constitution through a nationwide referendum in December 1993.[120] But before even adopting its basic, organic law, the legislature of the Russian Federation had already adopted its Law on Outer Space Activity (Law on Space Activity), in August 1993.[121]

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[118] *Id*.

[119] Irmgard Marboe, *National Space Law*, in HANDBOOK OF SPACE LAW xxiv, xxvi (Frans von der Dunk & Fabio Tronchetti eds., 2015).

[120] KONSTITUTSIIA ROSSIISKOI FEDERATSII [CONSTITUTION] (Russ.), http://constitution.kremlin.ru/.

[121] Закон Российской Федерации о Космической Деятельности [Law of the Russian Federation on Space Activity], Aug. 20, 1993, No. 5663-1 (as amended by Federal Law No. 54-ФЗ, Apr. 15, 2019), http://pravo.gov.ru/proxy/ips/?docbody=&link_id=8&nd=102025742 [hereinafter Law on Space Activity]. Citations to the "Law on Space Activity" reference that law as amended April 15, 2019. Citations to earlier versions of the law will include the amendment date of the relevant earlier version. Also, because the author does not have access to certain paper publications like the Sobranie Zakonodatel'stva Rossiiskoi Federatsii [Russian Federation Collection of Legislation] or the Grazhdanskii Kodeks Rossiiskoi Federatsii [Civil Code], citations in this Article to statutes and regulations will cite to STATE SYS. OF LEGAL INFO., http://pravo.gov.ru. Laws published on this website "are considered to be official." THE BLUEBOOK: A UNIFORM SYSTEM OF CITATION 450 (Columbia Law Review Ass'n et al. eds., 20th ed. 2015). All such citations include the original date of publication of the statute,

Since then, the Russian government has adopted the Statute on Licensing of Space Activity, later superseded by a Decree on Licensing of Space Activity (Licensing Decree).[122] Further, since mid-2015, substantial regulatory authority has been placed with the State corporation, Roscosmos, which will be discussed in greater detail in Part III of this Article.[123] Several other sources of law touch on space activity and will be referenced as needed.

i. Scope of Application

In 1995, the Law on Space Activity addressed "space activity" and dealt with "an, in principle, extraordinary wide range of activities."[124] The scope of Russia's space legislation has, if anything, only grown after amendments to that definition in 1996 and 2015. As the Law on Space Activity has read since its first adoption in 1993, space activity is defined as "any activity connected with direct carrying out of work on research or exploitation of cosmic space, including the Moon and other heavenly bodies."[125] The definition

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as well as the relevant date of amendment, because without that information, the database on that website is not navigable.

[122] Постановление лицензировании космической деятельности [Decree on Licensing of Space Activities], June 30, 2006 (as amended Feb. 22, 2012), http://pravo.gov.ru/proxy/ips/?docbody=&prevDoc=102699094&backlink=1&&nd=102154278 [hereinafter Licensing Decree]. This decree was superseded by a new variation late in the editing cycle of this Article. It does contain numerous substantive changes. Between the disruptions caused by the Covid-19 pandemic and the fact that this Article's goal is to summarize Russian space legislation as it existed at the start of 2020, the substance of the new version has not been added to this Article.

[123] Федеранльный Закон о Государственной корпорации по космической деятельности "Роскосмос" [Law of the Russian Federation on the State Corporation for Space Activity "Roscosmos"], July 13, 2015, No. 215-ФЗ, arts. 4(1), 8(1) (as amended Dec. 2, 2019), http://pravo.gov.ru/proxy/ips/?docbody=&nd=102376005&rdk=8 [hereinafter Law on Roscosmos]. *See also* Avaneesh Pandey, *Russia's Federal Space Agency Dissolved, Responsibilities to Be Transferred to State Corporation*, INT'L BUS. TIMES (Dec. 28, 2015), http://www.ibtimes.com/russias-federal-space-agency-dissolved-responsibilities-be-transferred-state-2240831. All citations to the Law on Roscosmos will reference the law as amended December 2, 2019, unless otherwise specified. Late in the editing cycle of this Article, the law was amended again. It appears that none of the April 2020 changes impact the discussion in this Article.

[124] Frans G. von der Dunk, *Two New National Space Laws: Russia and South Africa*, 47 UNIV. OF NEB. C. OF L. SPACE, CYBER & TELECOMM. L. PROGRAM FAC. PUBS. 251, 251 (1995), https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1046&context=spacelaw.

[125] Law on Space Activity, *supra* note 121, art. 2(1). The phrase which the author renders as "cosmic space" would, if translated literally, read "outer space space," which

further includes a long list of other specified activities, including, e.g., "other types of activities carried out in aid of space technology."[126] The statute continues:

> Space activity includes the creation . . . and use (exploitation) of space machinery, space materials, space technology, and the rendering of other services connected with space activities, and also the use of results of space activity and the international cooperation of the Russian Federation in the realm of research and use of cosmic space.[127]

Given the sweeping breadth of these provisions, it is likely that virtually anything remotely connected with the space industry will be subjected to Russia's space legislation.

ii. Applying Institutions

Authority over space activity is divided between several institutions. These entities are strictly federal: "[s]pace activity is found in the jurisdiction of the Russian Federation."[128] Therefore, it appears that none of Russia's several subordinate constituent entities (Republics, Regions, Provinces and so on) have jurisdiction over space activities. The federal institutions specified in the Law on Space Activity include the President, the Government and Roscosmos.[129] The President is responsible for "general leadership" and is given a few enumerated powers including designating some important projects as having "Presidential Status" and deciding the "most important" questions.[130] The Government is given several enumerated powers ranging from coordination of State agencies, to ruling on financing proposals for the Federal space program.[131]

Roscosmos, in turn, is the "authorized organ on space activity" and is granted several enumerated powers including, among others, handling licensing for space activity and guaranteeing (jointly with

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is clearly redundant and awkward in English. Therefore, the author elected to render the phrase "cosmic space" to preserve the meaning of the original, and approximate the Russian adjective "космический," which can be transliterated as "kosmicheskii."

[126] *Id*.

[127] *Id*. at art. 2(2).

[128] *Id*. at art. 5(1).

[129] *Id*. at art. 5(2).

[130] *Id*.

[131] Law on Space Activity, *supra* note 121, art. 5(3)

other State services) the security or safety of space activity.[132] Roscosmos has its own governing law. As that law explains, Roscosmos is a Russian legal entity, organized as a State corporation.[133] The Russian State created Roscosmos in 2015 out of the merger of the Federal Space Agency and the United Space-Rocket Corporation.[134] All of the Federal Space Agency's contract obligations transferred to Roscosmos.[135]

a. What is a State Corporation?

It has been observed that the role of the "State sector" in the Russian economy has increased in the wake of sanctions and ongoing economic instability.[136] The "basic subject" of the State sector is the State corporation.[137] They are typically large-scale and some are "practically monopolistic" within their sector of the economy.[138] Usually, the State corporations "being economic agents of the state sector," are permitted "to control the development of strategically important sectors of the economy . . . ."[139]

In 1996, a federal law "On noncommercial organizations" recognized the State corporation as "a noncommercial organization, lacking membership[140] and administered by the Russian Federation on the basis of a property contribution and founded for the realization of social, administrative, or other socially beneficial

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[132] *Id*. at art. 6.

[133] Law on Roscosmos, *supra* note 123, art. 3(1).

[134] *Id*. at art. 36(3). The Federal Space Agency was completely abolished. *Executive Order abolishing Federal Space Agency*, PRESIDENT OF RUSS. (Dec. 28, 2015), http://en.kremlin.ru/catalog/keywords/123/events/51025.

[135] N.V. Eroshevich, *Государственная корпорация "РОСКОСМОС" как один из основных регуляторов государственноых закупок* [State Corporation "Roscosmos" as a major regulator of the System of State Procurement], *in* АКТУАЛЬНЫЕ ВОПРОСЫ АВИАЦИИ И КОСМОНАВТИКИ [Current issues of aviation and astronautics] 603-605 (2018).

[136] Al'vina Aramovna Asatryan & Ol'ga Gennad'yevna Andryushchenko, *Становление и Развитие Государственных Корпораций в России* [Formation and Development of State Corporations in Russia], *in* ПРОБЛЕМЫ РАЗВИТИЯ СОВРЕМЕННОГО ОБЩЕСТВА [Issues of development of modern society] 53, 53 (Jan. 2019).

[137] *Id*.

[138] *Id*.

[139] *Id*. at 56.

[140] *Id*. at 53.

functions."[141] The State corporation "must be established by Federal law, which specifies the goals of its foundation and its functions of activity."[142]

A State corporation is distinct from a "State company" or a "State enterprise" and has several distinctive features under Russian law.[143] As described by Asatryan and Andryushchenko, the State corporation is founded on the basis of federal law.[144] The formation of its property proceeds at the expense of a property contribution by the Russian Federation.[145] Property given to the State corporation by the Russian Federation is the property of the State corporation.[146] The State corporation will not answer for the obligations of the Russian Federation and vice-versa if the law on the State corporation's establishment does not provide otherwise.[147] The State Corporation shall[148] use its property exclusively for the goals for which it was founded. The State corporation may conduct entrepreneurial activity only so far as such activity furthers the goals for which it was founded and is in accordance with those goals.[149] The State corporation must annually publish an accounting of its property.[150] Because the State corporation is formed completely by funds from the State, the State alone can direct its activities.[151]

The first State corporation in Russia was established in 1999 and concerned restructuring of credit.[152] Between 2004 and 2007 another seven independent State corporations were founded, each

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[141] *Id*. (citing Федеральный Закон О некоммерческих организациях [Federal Law on Noncommercial Organizations], Jan. 12 1996, No. 7-ФЗ art. 7.1. (as amended Dec. 2, 2019), http://pravo.gov.ru/proxy/ips/?docbody=&nd=102039064. The word "membership" in this quote is meant in the sense of membership in an LLC or other business entity. It appears that this law was amended again in March 2020, but the official government website indicates the new version is "not ready." *See id*.

[142] Asatryan & Andryushchenko, *supra* note 136, at 53.

[143] *Id*. at 54.

[144] *Id*.

[145] *Id*.

[146] *Id*.

[147] *Id*.

[148] *See* BUTLER, *supra* note 1, at 33.

[149] Asatryan & Andryushchenko, *supra* note 136, at 54.

[150] *Id*.

[151] *Id*. at 55.

[152] *Id*. at 54.

"with the goal of solving concrete problems."[153] These have names as diverse as the "Deposit Insurance Agency" (Agency on Insurance of Deposits), Rosnanotech, Vnesheconombank (commonly called *Банк Развитии*), Rosatom and Rostec.[154] Each State corporation relates to a sector of the economy which the State intends to develop and over which the State grants influence. Often, that sector can be inferred from the name of a given State corporation.[155] For example, Roscosmos administers the space industry.[156] Because that industry demands "a large quantity of financial and intellectual resources," as well as industrial capacity, Roscosmos is "factually, monopolistic."[157] Roscosmos "guarantees the realization of state policy and renders services in the sphere of space activity, and also carries out work within the [International Space Station (ISS)] . . . framework."[158]

b. Roscosmos

The Law of the Russian Federation on the State Corporation for Space Activity "Roscosmos" (Law on Roscosmos) defines "space activity" slightly differently from, but still with extreme breadth as to be comparable to, the definition in the Law on Space Activity. "Space activity" is still "any activity connected with direct carrying out of work on research or exploitation of cosmic space (including the Moon and other heavenly bodies)."[159] Such activity, however, also includes several enumerated activities ranging from the creation of "space equipment, [or technology], materials or technologies," to the rendering of services connected to space activity and the use of results of such activity.[160]

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[153] *Id*.

[154] *Id*. at 55, Diagram 2. Vnesheconombank is subjected to capital market restrictions following the tumultuous events of 2014 through the present. *Russia Sanctions List*, THE RISK ADVISORY GROUP, https://www.riskadvisory.com/sanctions/russia-sanctions-list/ (last visited July 5, 2020).

[155] Asatryan & Andryushchenko, *supra* note 136, at 55.

[156] *Id*.

[157] *Id*.

[158] *Id*.

[159] Law on Roscosmos, *supra* note 123, art. 2(1).

[160] *Id*. The word here translated as "equipment" is техника. The author believes this Russian word to be ambiguous. This word can mean "equipment," but it is often translated as "technology," for which the Russian language has an additional word, технология, which in turn is phonetically closer to the English word "technology." Also,

Roscosmos has several responsibilities, the first of which is the implementation of State policy via the creation of regulations for space activity.[161] The law empowers Roscosmos to do so.[162] Those regulations are subject to confirmation by the Government.[163] Roscosmos also has some limited power to conclude international agreements of an "inter-ministerial character."[164] Finally, some clauses of both laws give powers to the Ministry of Defense, usually jointly with Roscosmos.[165] A related law signed at the same time, "On Amendments to Article 241 of the Russian Federation Budget Code," delineated Roscosmos' financial powers.[166] Among other things, Roscosmos has its own insurance broker.[167] Though it does not have a "membership"[168] Roscosmos does, at least as of 2019, have a role for a "shareholder" in its administration.[169] Roscosmos also enjoys certain privileges. It is not subject to the same information sharing regimes as other State entities, and it is exempt from anti-monopoly scrutiny.[170]

техника and технология are sometimes used in the same sentence in the authorities discussed in this Article, as above, indicating different intended meanings. The word техника is also sometimes translated as "techniques," which the author believes is a poor fit in this context. The author has further seen and heard native speakers of Russian, and translation authorities, translate this word into English as "technics." "Technics" is not strictly wrong, but that word will not be understood by most native speakers of English. The author has elected to translate the word техника as "equipment" in this Article because that makes the most sense in the contexts discussed in this Article, and because multiple authorities discussed in this article use that word as well as the separate word технология, which can only mean technology. Still, the reader should be aware that there is significant overlap between the notions of "equipment," "technology," and "techniques" in the Russian language, all compressed within the word техника, and any given translation may not preserve this overlap.

[161] *Id.* at art. 4(1)(1).

[162] *Id.* at art. 8(1).

[163] *Id.* at art. 33.

[164] *Id.* at art. 13(2).

[165] Law on Roscosmos, *supra* note 123, art. 7; Law on Space Activity, *supra* note 121, arts. 6, 7, 11, 22.

[166] *Vladimir Putin Signed Federal Law on State Corporation for Space*, PRESIDENT OF RUSS. (July 13, 2015), http://en.kremlin.ru/catalog/keywords/123/events/49919.

[167] *Industry Briefing for Insurers and Customers*, ROSCOSMOS (July 12, 2019), https://www.roscosmos.ru/26559/.

[168] Asatryan & Andryushchenko, *supra* note 136, at 53.

[169] Law on Roscosmos, *supra* note 123, arts. 28(2) & 28(2^1).

[170] Eroshevich, *supra* note 135, at 604. A full discussion of the Law on Roscosmos could fill an article in its own right, but Eroshevich provides an excellent overview of the institution itself.

It should be noted that not everyone agrees that the 2015 advent of Roscosmos is a positive development. One observer, Sh. R. Zaripov, has noted that the rise of Roscosmos correlates with a decline in Russian space launches.[171] In 2011, Russia launched 32 rockets carrying space objects. In 2012, the number was 24.[172] In 2013 and 2014, 32 each—which, in 2014, made Russia the world leader.[173] In 2015, the number of launches shrank to 26, though Russia was still the global forerunner. In 2016, the number fell to 19, and in 2017 it dropped again to 16.[174] In 2018, this number increased to 19 successful launches.[175] Zaripov believed in 2019 that the situation could be remedied by amendments to the Law on Roscosmos to fix excessive delegation and a lack of accountability.[176]

A.A. Malyuchenko and Ya. S. Voronovskaya take a different view. These scholars note that funding for space rocket manufacturing rose dramatically from 2008 to 2016, but sharply declined in 2017.[177] Malyuchenko and Voronovskaya opine that the decline in the number of Roscosmos' rocket launches in 2017 is "in large part" due to "external causes." Those scholars cite the decline in the quality of the Proton launch vehicle, the rise in accidents, the "sanctions war" between Russia and the United States (which "raises the risk of forbidding the import of electronics") and the worsening of Russo-Ukrainian relations, which caused a "freeze in cooperation" on certain projects.[178] They also note the rise of "more energetic competitors."[179]

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[171] Shamil' Rishatovich Zaripov, *Делегирование функций государственного управления государственным корпорациям, на примере госкорпорации РОСКОСМОС* [The Delegation of Governance Functions to Public Corporations, on the Example of State Corporation *ROSCOSMOS*], *in* УСТОЙЧИВОЕ РАЗВИТИЕ НАУКИ И ОБРАЗОВАНИЯ [Sustainable Development of Science and Education] 19, 22 (2019).

[172] *Id*.

[173] *Id*.

[174] *Id*.

[175] Запуски [Launch], ROSCOSMOS, *2018 in Spaceflight*, https://www.roscosmos.ru/launch/2018/ (last visited July 6, 2020).

[176] Zaripov, *supra* note 171, at 22.

[177] A.A. Malyuchenko & Ya. S. Voronovskaya, *Проблемы ракетно-космической промышленности в России* [Problems of the space industry in Russia], *in* АКТУАЛЬНЫЕ ВОПРОСЫ АВИАЦИИ И КОСМОНАВТИКИ (Current issues of aviation and astronautics) 710, 710-11 (2018).

[178] Zaripov, *supra* note 171, at 711.

[179] *Id*. at 712.

Eroshevich alludes to a third view that Roscosmos inherited the task of rescuing Russia's space industry from crisis."[180] He notes that Roscosmos turned a significant profit in 2016 and 2017 selling launch services to NASA and Arianspace.[181] This proceeded in concert with a decline of State financial support for Roscosmos.[182] Other experts also concur that Roscosmos was created in reaction to the rise of competition from private industries abroad.[183]

In any event, because Russia considers the space industry sufficiently critical to place a State corporation over it,[184] the State is probably not satisfied with the downturn in Russian space services. Therefore, the author considers it likely that Roscosmos does not exist in a form that will persist indefinitely. Instead, the Russian State will likely continue to reshape this State corporation at least until space launch services return to pre-Roscosmos levels.[185]

B. Obligations Under the Outer Space Treaty

i. Authority and Supervision

One of the main tenets of the Outer Space Treaty is found in Article VI, which essentially calls on States to promulgate national regulation of space activities. The Article imposes international responsibility on States Parties for activities in outer space by States themselves and "by non-governmental entities." Further, Article VI requires "authorization and continuing supervision" by a State over non-governmental entities in outer space.[186]

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[180] Eroshevich, *supra* note 135 at 604, 605.

[181] *Id*.

[182] *Id*.

[183] M.N. Shul'gin, *Финансирование инновационной деятельности предприятий ракетно-космической промышленности на основе государственно-частного партнёрства* [The financing of innovative activity of space-rocket manufacturing enterprises on the basis of a public-private partnership], *in* АКТУАЛЬНЫЕ ВОПРОСЫ АВИАЦИИ И КОСМОНАВТИКИ [Current issues of aviation and astronautics] 26, 26-28 (2018).

[184] Asatryan & Andryushchenko, *supra* note 136, at 56.

[185] The current Administrator of Roscosmos, Dmitry Olegovich Rogozin, was subjected to international sanctions following the tumultuous events of 2014. RISK ADVISORY GROUP, *supra* note 154.

[186] Outer Space Treaty, *supra* note 26, art. VI.

As noted above, the President has "general leadership" of space activity.[187] Roscosmos is the "authorized organ" and also has leadership over space activity, including the responsibility to "organize[] and coordinate[] work on commercial space projects and cooperate[] in their realization."[188] Further, the definitions of "space activity" in Russian law are quite broad, as discussed above. Therefore, A.G. Mel'nikov concludes that all space activity, commercial or otherwise, happens "under state leadership and control."[189] Mel'nikov believes this raises questions as to how far "commercial interests of private legal and physical persons are devalued" and "their interest in such activity is lowered."[190] Mel'nikov suggests instead that "world practice" shows the necessity of such strict control to be doubtful concerning commercial activity generally and commercial space activity in particular. Instead, legislation closer to the wording of the Outer Space Treaty would be preferable.[191]

Roscosmos meets the Russian obligation to authorize and supervise by implementing a licensing regime. [192] The Law on Space Activity contemplates that the Government will establish a regime for licensing.[193] The Government did so by adopting the Licensing Decree. The Decree required licenses for Russian individual entrepreneurs or legal entities of any form, as well as foreign citizens and organizations "effectuated under the jurisdiction of the Russian Federation," as well as other categories.[194] Individual entrepreneurs had not been contemplated in the 1993 or 1996 versions of the Law on Space Activity.[195]

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[187] Law on Roscosmos, *supra* note 123, art. 5(2).

[188] *Id*. at art. 6.

[189] Alexander Georgievich Mel'nikov, *Коллизии и пробелы современного космического законодательства (теоретико-правовые и практические вопросы современного космического права)* (Conflict and Gaps in Modern Space Legislation (Practical Issues of Modern Space Law)), *in* NO. 4 ВЕСТНИК МОСКОВСКОГО ГОСУДАРСТВЕННОГО ОБЛАСТНОГО УНИВЕРСИТЕТАЮ СЕРИЯ: ЮРИСПРУДЕНЦИЯ (Bulletin of Moscow Region State University. Series: Jurisprudence) 37, 43 (2018).

[190] *Id*. at 44.

[191] *Id*.

[192] Law on Roscosmos, *supra* note 123, art. 14(2); Law on Space Activity, *supra* note 121, art. 6.

[193] Law on Space Activity, *supra* note 121, art. 9.

[194] Licensing Decree, *supra* note 122, art. 3.

[195] *See* Law on Space Activity, *supra* note 121.

Curiously, the Licensing Decree claimed to establish a regime of licensing for space activities "conducted by legal entities."[196] The Government made this change in 2006.[197] It is difficult to imagine that Russia simply excuses individuals from obtaining space activity licenses. Instead, a reasonable inference here may be that the Licensing Decree simply does not expressly allow for licensing of individuals. This is reflected on the Russian Federation's "Official Internet-Portal for State Services," which has a page discussing the "Licensing of Space Activity."[198] On this page, it is noted that certain services like "[a]cquisition of information from the registry of licenses," are expressly allowed (by application) for "individual entrepreneurs and legal entities."[199] Seeking "acquisition of a license for space activity," however, is allowed "only for legal entities."[200] Therefore, it appears that the Russian State interprets its own law to forbid natural persons from engaging in space activity.

Like other Russian space laws, the Licensing Decree encompasses a wide variety of activities appended in a schedule of "performed tasks and rendered services in the realization of space activity . . . ."[201] The schedule lists many activities, such as "creation and modernization" of various devices, vessels or stations, launches and launch-facilities, rocket building and repair, operation of devices in flight, preparation of cosmonauts, Earth remote sensing and transporting space technology.[202] Though the Licensing Decree still names the "Federal Space Agency" as the licensing

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[196] Licensing Decree, *supra* note 122, art. 1.

[197] *Compare* Licensing Decree, *supra* note 122, art. 1 *with* Постановление лицензировании космической деятельности [Decree on Licensing of Space Activities], June 14 2002, art. 1 (as amended Feb. 1, 2005), http://pravo.gov.ru/proxy/ips/?docbody=&nd=102076603 (permitting licensing of activities by "individual entrepreneurs").

[198] *Лицензирование космической деятельности* [Licensing of space activity, Госуслугиру [Gosuslugiru], https://www.gosuslugi.ru/13113 (last visited Jan. 11, 2020). "GOSUSLUGIRU" is an acronym combining syllables and words that together mean "State Services - Russia."

[199] *Получение сведений из реестра лицензий* [Acquisition of information from the registry of licenses], ГОСУСЛУГИРУ [GOSUSLUGIRU], https://www.gosuslugi.ru/13113/5/info (last visited Jan. 11, 2020).

[200] *Получение лицензии на космическую деятельность* (Acquisition of a license for space activity), ГОСУСЛУГИРУ [GOSUSLUGIRU], https://www.gosuslugi.ru/13113/4/info (last visited Jan. 11, 2020).

[201] Licensing Decree, *supra* note 122, art. 1.

[202] *Id*. at Schedule.

authority,[203] that entity no longer exists. Roscosmos is the licensing agency. The Licensing Decree also outlines the six categories of conditions that license applicants must meet, most of which involve the presence of equipment or specialists. One noteworthy condition is the requirement to conform with the Russian Federation's Law on State Secrets.[204] Additionally, a licensee must submit a long list of documents and declarations; some are required by the Federal Law on Licensing of Certain Activities[205] and some are identified in the Licensing Decree itself. One of these documents must contain the applicant's statement of compliance with the Law on State Secrets.[206] Roscosmos' website provides more details on which documents are necessary for the acquisition of a license.[207]

A 2019 amendment to the Law on Space Activity now requires that licensing be conducted in accordance with the Federal statute "On the licensing of particular types of activity."[208] It is unclear whether those requirements replace the Government's previous promulgations or add to them. Nevertheless, the Licensing Decree appeared to remain in effect at the time this Article was written.

Unlike the licensing regimes of other States,[209] neither the Licensing Decree itself nor the Roscosmos website clearly requires insurance as a precondition specifically for licensing.[210] However, Russia's space legislation does not overlook space insurance entirely and does impose some requirements.

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[203] *Id*. at art. 2.

[204] *Id*. at art. 3.

[205] Федеральный Закон о Лицензировании отдельных видов деятельности [Federal Law on Licensing of Particular Types of Activities], May 4, 1991, No. 99-ФЗ (as amended by Federal Law No. 21-ФЗ, Feb. 18, 2020), http://pravo.gov.ru/proxy/ips/?docbody=&nd=102147413.

[206] Licensing Decree, *supra* note 122, art. 5.

[207] *Перечень документов и сведений, предоставляемых для получения лицензии* [Schedule of documents and information, given for the acquisition of a license], ROSCOSMOS, https://www.roscosmos.ru/22368/ (last visited Jan. 11, 2020).

[208] Law on Space Activity, *supra* note 121, art. 9 (citing Закон Российской Федерации о лицензировании отдельных видов деятельности [Law of the Russian Federation on the licensing of particular types of activity], May 2001, No. 99-ФЗ (as amended by Federal Law No. 298-ФЗ, Aug. 2019), http://pravo.gov.ru/proxy/ips/?docbody=&nd=102147413.

[209] *See, e.g.,* Commercial Space Launch Act, 51 U.S.C. § 50914(1)(a) (2018); Space Industry Act 2018, c. 5 § 38 (U.K.).

[210] This seems like a serious oversight on the part of Roscosmos, though it could be justified because other authorities, discussed later in this Article, separately require insurance.

As of early 2020, a license holder is subject to an extensive list of conditions or requirements. For example, as before, the license holder must continue to conform to the Law on State Secrets. Further, the license holder is expressly required to "observe the international obligations of the Russian Federation" concerning defense and nonproliferation of rocket and dual-use technologies.[211] Failure to comply with certain enumerated conditions constitutes a "serious violation[];" however, punishment for those violations is not spelled out in the Licensing Decree.[212]

One obligation of Roscosmos under its establishing law is to implement licensing of space activities and a register of licenses.[213] Perhaps in obedience to that obligation, Roscosmos maintains on its website an "excerpt" of its register of currently-issued licenses. According to this list, roughly 1,080 licenses are outstanding. The oldest license currently active, assuming Roscosmos' list is accurate, involves activity which began in August 2006. The most recent license involved activity beginning on December 25, 2019.[214] This exhaustive list makes it evident that license-holders are numerous.

Russia's Law on Space Activity imposes a further requirement of "certification and declaration." That is: "[s]pace equipment, including space objects and objects of space infrastructure made for scientific or social-economic purposes, is subject to inspection in conformity with the demands of established Russian Federation legislation (obligatory certification or declaration of compliance)."[215] "Space object," it should be noted, is never defined in the Law on Space Activity. However, given the rather broad definition of "space activity," it may be safe to assume that a "space object" will be any object involved in space activity. For example, the certification process may also apply to equipment "accepted for the creation or use of space equipment."[216] The law indicates that the process is conducted within the framework of the legislation on

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[211] Licensing Decree, *supra* note 122, art. 4(к).

[212] *Id*. at art. 9.

[213] Law on Roscosmos, *supra* note 123, art. 7(11).

[214] *Выписка из реестра лицензий* [Excerpt from register of licenses], ROSCOSMOS, https://www.roscosmos.ru/22405/ (last visited Jan. 11, 2020). It appears that this file does receive updates, as it has been updated more than once since the author began this project.

[215] Law on Space Activity, *supra* note 121, art. 10, s.1.

[216] *Id*.

"Technical Regulations," most likely the "Law on Technical Regulations," which is a separate, sprawling document.[217] Of further note, the powers of Roscosmos under the latter statute appear to be limited to making technical regulations "only of a recommendational character."[218] Further, the aforementioned law expressly does not apply to requirements for the guarantee of security or safety of space activity.[219] In any event, there is an important distinction between licensing and certification. Space activities must be licensed. Space "equipment" must be certified.[220] The law does not indicate that fulfilling one requirement fulfils the other. Therefore, merely seeking a license for space activity may not be enough to win government approval for that activity. The equipment involved in that activity must also be certified.

A third requirement appears in the Law on Space Activity. Article 15, section one, provides that "[t]he use (exploitation) of space equipment (under the condition of state registration of rights to it) is conducted by its owner or by a person, to whom its owner or a person authorized by its owner, is provided the right to use (exploitation) of space technology in the established legal regime."[221] This section is complex, but the purpose is clear: an individual using space equipment must be the equipment's owner or a person legally authorized by the owner and the use must be "under the condition of state registration of rights" to the equipment. The section imposes further requirements on components of space equipment "which are being" State property in that they "may be found in the economic jurisdiction or operational administration of one or more enterprises, if this does not violate the technological regime of functioning of such equipment."[222] However, components of space technology may be removed from such jurisdiction or administration as

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[217] Федеральный Закон о Техническом Регулировании [Federal Law on Technical Regulation], Dec. 2002, No. 184-ФЗ (as amended Nov. 2018), http://pravo.gov.ru/proxy/ips/?docbody=&nd=102079587.

[218] *Id*. at art. 4, s.3.

[219] *Id*. at art. 1, s.4.

[220] H.R. Isfandiyarov, *Лицензирование космической деятельности и сертификация космической техники* [Licensing of space activity and certification of space equipment], *in* АКТУАЛЬНЫЕ ВОПРОСЫ АВИАЦИИ И КОСМОНАВТИКИ (Current issues of aviation and astronautics) 606-07 (2018).

[221] Law on Space Activity, *supra* note 121, art. 15(1) (parentheses in original).

[222] *Id*.

provided in the Civil Code.[223] Finally, space equipment taken "out of exploitation may be transferred in a regime established by an authority or organization, the basic activity of which is directed to the use of the results of space activity for education, science or culture."[224] Returning to section one, the question remains: what does it mean to say that the use of space equipment is "under the condition of registration of rights to it?"

Historically, this was "registration of rights" in the same sense as could be applied to immovable property—without registration, the rights were not "publicly reliable."[225] However, until recently, there was no registration system for space objects like there was for real estate. Then, in 2014, the Russian Civil Code was amended to "no longer relate space objects to immovable property and, consequentially, to not demand state registration of rights to it."[226] Now, property rights to space objects "are regulated by the general approach to regulation of rights to movable property," with the special features of space law, an example of the latter being the object's inclusion in the national and UN registries of space objects.[227] To exercise property rights to a space object, including to launch it, the conditions of State registration to those rights must be observed.[228] Mel'nikov relates that under the Civil Code, a property right "arises for those who prepare a given object . . . or for the purchaser of such object under the conditions of a contract."[229] Unfortunately, Russian space law remains ambiguous on how to register those rights, despite the Law on Space Activity requiring registration in Article 1, subsections 15 and 17.[230] One observer, Alexander G. Mel'nikov, the "Head of the Service of Foreign Trade Contracts and Agreements of [the] Public Joint Stock Company Rocket Space Corporation 'Energia,'" blames the lack of clear definitions in national and international law.[231] Because there is no clear system of State registration for property rights to space objects specifically, Mel'nikov

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[223] *Id*.
[224] *Id*. at art. 15(2).
[225] Mel'nikov, *supra* note 189, at 38.
[226] *Id*.
[227] *Id*.
[228] *Id*.
[229] *Id*.
[230] *Id*. at 39-40.
[231] Mel'nikov, *supra* note 189, at 40.

warns that this "does not allow the realization of rights to the use of a space object, even for the owners of the given property."[232] The transition from treating registration as a question of immovable property to a question of movable property ameliorated a serious problem of transferability.[233] However, use of a given space object may be legally impossible in the absence of a registration system.[234] This, most likely, is not the result that the legislature intended. However, the deep ambiguity created by the requirement to register property rights in space objects does, as Mel'nikov properly observes, demand legislative action in the near future.[235]

ii. Non-appropriation

Article II of the Outer Space Treaty forbids "national appropriation," by any means, of outer space or any bodies therein.[236] The Law on Space Activity incorporates this non-appropriation principle by stating "[r]ights of jurisdiction and control over a space object, and also property rights to such object, do not affect the legal status of zones or parcels of cosmic space, or the surface or interior of heavenly bodies, occupied by [those objects]."[237] The law does not expressly forbid changes in legal status of space areas by other means (perhaps by private mining of asteroids), but at the very least the law precludes any State claim of discovery or any private or State territorial claim by "first in time first in right." This is in contrast to US law which expressly authorizes possession or ownership of asteroid or space resources "in accordance with applicable law."[238] Of course, this innovation in the US has attracted the ire of some Russian observers.[239] Indeed, private attempts to appropriate outer space have largely been derided or ignored in Russia.[240]

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[232] *Id*.
[233] *Id*. at 38-39.
[234] *Id*. at 40.
[235] *Id*. at 40.
[236] Outer Space Treaty, *supra* note 26, art. II.
[237] Law on Space Activity, *supra* note 121, art. 17(5).
[238] 51 U.S.C. § 51303 (2018).
[239] Mel'nikov, *supra* note 189, at 45.
[240] A.S. Stepanenko & Michal Pietkiewicz, *Попытки национального присвоения космического пространства и небесных тел* [Attempts at national acquisition of cosmic space and heavenly bodies], *in* МЕЖДУНАРОДНЫФ НАУЧНЫЙ ЖУРНАЛ "ИННОВАЦИОННАЯ НАУКА" [International Scientific Journal "Innovational Science"]

iii. Harmful Contamination and Adverse Changes

Article IX of the Outer Space Treaty requires States Parties to "conduct exploration" of outer space and celestial bodies "so as to avoid their harmful contamination and also adverse changes in the environment."[241] Russia's Law on Space Activity addresses this issue in the context of "Security [or safety] of Space Activity."[242] Security is the responsibility of Roscosmos and defense institutions, which are given "general leadership" on that topic.[243] In particular, "space activity should [or must] be conducted taking into account the security of the level of anthropogenic impact on the surrounding environment and near-Earth space."[244] Roscosmos and the Ministry of Defense are obligated, on the demand of "interested organizations and citizens" to provide information about "danger, which arises from the realization of space activity." Both also have a responsibility to "immediately" warn citizens, organizations and other State agencies about the rise of "threats" to the security of the population and surrounding environment.[245]

The Outer Space Treaty, among other authorities, imposes an obligation on States to "facilitate and encourage international cooperation" in the free scientific investigation of outer space.[246] Russia's Law on Space Activity takes that requirement seriously and references it in at least five different articles.[247] For example, the Russian Federation takes "international responsibility" for "space activity"[248] and dictates that "Space activity, which has been forbidden by the international agreements of the Russian Federation, will not be allowed."[249] Russian entities or citizens participating in international "projects in the realm of space activity" will conclude agreements with foreign organizations, and such agreements will

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(2016) (summarizing private attempts to claim property rights in space between 1756 and 2015).

[241] Outer Space Treaty, *supra* note 26, Article IX.

[242] *See* Law on Space Activity, *supra* note 121, Ch. 5 "Security of Space Activity." The word used in this part of the law is "безопасность." This word can mean security or safety.

[243] Law on Space Activity, *supra* note 121, art. 22(1), (2).

[244] *Id*. at art. 22(1).

[245] *Id*. at art. 22(2).

[246] Outer Space Treaty, *supra* note 26, art. I.

[247] *See* Law on Space Activity, *supra* note 121, arts. 3(5), 4(1), 5, 7, 18(4), 27, 28.

[248] *Id*. at art. 4(5).

[249] *Id*. at art. 4(7).

be subject to Russian law, unless the agreement contemplates otherwise.[250] Further, if there is a "conflict of laws" between Russian and foreign law, then Russian law controls, unless a treaty contemplates otherwise.[251] Additionally, foreign organizations and citizens conducting space activity "under the jurisdiction of the Russian Federation" will use the legal regime established for Russian entities, to the extent of which that regime is applied "by the corresponding state" to Russian citizens and entities.[252] In sum, Russia acknowledges that international cooperation will happen in space activities, but expects Russian law to apply, unless there has been some clear, binding statement to the contrary.

At this point, it is worth mentioning an example of Russian international space cooperation. Four years before the International Space Station Intergovernmental Agreement (to which Russia is also a party),[253] Russia signed and ratified the "Agreement Between the Russian Federation and the Republic of Kazakhstan on the Basic Principles and Conditions of the Use of the Cosmodrome 'Baikonur.'"[254] Baikonur is a major spaceport located in Kazakhstan, built when Russia and Kazakhstan were both Union Republics within the USSR.[255] Under that treaty, Russia retains the right to use Baikonur for both civil and defense-related space activities and to do so jointly with foreign States in the Commonwealth of Independent States, as well as for commercial space projects.[256]

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[250] *Id.* at art. 28(1).

[251] *Id.* at art. 28(2).

[252] *Id.* at art. 27(1).

[253] *International Space Station Legal Framework*, EUR. SPACE AGENCY, http://www.esa.int/Our_Activities/Human_Spaceflight/International_Space_Station/International_Space_Station_legal_framework (last visited Jan. 11, 2020).

[254] *Соглашение между Российской Федерацией и Республкой Казахстан об Основных Принципах и Условиях Использования Космодрома "Байконур"* [Agreement Between the Russian Federation and the Republic of Kazakhstan on the Basic Principles and Conditions of the Use of the Cosmodrome "Baikonur"], MIN. OF FOREIGN AFF. OF THE RUSS. FEDERATION, http://www.mid.ru/foreign_policy/international_contracts/2_contract/-/storage-viewer/bilateral/page-329/48288 [hereinafter Baikonur Agreement]. This agreement can be found in English as an appendage in Maria Bjornerud, *Baikonur Continues: The New Lease Agreement Between Russia and Kazakhstan*, 30 J. SPACE L. 13, 26 (2004).

[255] Baikonur is also part of Russia's strategic defense apparatus. *See* JOHN BLOOM, ECCENTRIC ORBITS: THE IRIDIUM STORY 166-67 (2016) (describing eyewitness accounts of a room at Baikonur as a "carbon copy of the NORAD Combined Operations Center").

[256] Baikonur Agreement, *supra* note 254, art. 1.

Kazakhstan leases this facility to Russia.[257] The treaty goes on to delineate the rights and responsibilities of the two sides in detail. For better or for worse, however, the Baikonur treaty does not address the responsibility or liability of either party under international law. The Baikonur treaty was amended in 2016-17, though only with respect to taxes on goods and services.[258]

iv. Responsibility and Liability

This brings the discussion back to Article VI of the Outer Space Treaty. That Article requires authorization and supervision of space activities implemented even by nongovernment entities and imposes international responsibility for "national space activity" on State Parties, including both activities conducted by "governmental agencies or by non-governmental entities."[259] As noted above, the Russian Federation takes "international responsibility" for "space activity"[260] and disallows space activity "which has been forbidden" by treaty.[261] It therefore appears that Russia has voluntarily taken onto itself an enormous amount of risk, given its own expansive definition of space activity. It would be difficult for Russia to interpret the relevant treaties narrowly and to disclaim responsibility for any conduct by its citizens or legal entities involved in space activity, because it has expressly defined "space activity" so broadly in its own law. However, Russia has also forewarned that it will, in turn, hold responsible anyone who causes it to incur responsibility. Specifically, "State organizations and their officials, other organizations and their officials, and also citizens, guilty of violating this law or [other laws] which regulate space activity, have responsibility in accordance with the legislation of the Russian Federation."[262] The meaning of the latter phrase has not been officially clarified or explored in secondary sources.

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[257] *Id*. at art. 2.

[258] Федеральный Закон о ратификации Протокола о внесении изменений в Соглашение между Российской Федерацией и Республикой Казахстан о статусе города Байконур [Law ratifying Protocol to amend Russia-Kazakhstan Agreement on the Status of the City of Baikonur], May 2017, No. 81-ФЗ, http://en.kremlin.ru/catalog/keywords/123/events/54419.

[259] Outer Space Treaty, *supra* note 26, art. VI.

[260] Law on Space Activity, *supra* note 121, art. 4(5).

[261] *Id*. at art. 4(7).

[262] *Id*. at art. 29.

It is noteworthy that the Russian version of the Outer Space Treaty, as in other languages, speaks of "responsibility" where the English version uses that term, but speaks of "responsibility for damage" or "for harm" where the English version would use "liability."[263] In the next section, addressing Russia's domestic-law adaptation of its obligations under the Liability Convention, this Article will interpret "responsibility for damage" or the related phrase "responsibility for harm"[264] to mean liability.

C. Obligations Under the Space Liability Convention

Article VII of the Outer Space Treaty imposes "international liability for damage" on each "State Party . . . that launches or procures the launching of an object into outer space . . . ."[265] The Liability Convention goes into greater detail. The Convention expands on the definition of "launching State"[266] and "space object."[267] It imposes "absolute" liability for damage caused by a State's space object "on the surface of the Earth or to aircraft in flight"[268] and fault-based liability for "damage being caused elsewhere than on the surface of the Earth . . . ."[269] Russia has, at times, taken these obligations seriously. For example, it has been reported that in 2006 Russia paid Kazakhstan more than one million dollars for damage caused by a failed launch from Baikonur.[270]

Russia has also taken the extra step of importing several of these notions into its own law. Though "space object" is not defined in the Law on Space Activity, if a space object causes harm within

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[263] *Compare* Outer Space Treaty, *supra* note 26, arts. VI, VII *with* Договор о принципах деятельности государств по исследованию и использованию космического пространства, включая Луну и другие небесные тела, [Treaty on principles governing the activities of states in the exploration and use of outer space, including the moon and other celestial bodies], Статьи VI, VII, , http://www.un.org/ru/documents/decl_conv/conventions/outer_space_governing.shtml (using "ответственность" and "ответственность за ущерб" respectively).

[264] That is, *ответственность за вред*, as found in the Law on Space Activity, *supra* note 121, art. 30(1).

[265] Outer Space Treaty, *supra* note 26, art. VII.

[266] Liability Convention, *supra* note 33, art. I(c).

[267] *Id*. at art. I(d).

[268] *Id*. at art. II.

[269] *Id*. at art. III.

[270] Y.V. Vashchenko, *К вопросу о юридической ответственности в космическом праве* [The question of legal liability in space law], *in* АКТУАЛЬНЫЕ ВОПРОСЫ АВИАЦИИ И КОСМОНАВТИКИ (Current issues of aviation and astronautics) 582, 584 (2018).

or outside of the Russian Federation, excluding space, then liability arises "independently of guilt for the causation of such harm."[271] This clearly includes harm inflicted on aircraft in flight or ships at sea. In contrast:

> If in any place, apart from the surface of the Earth, a space object of the Russian Federation involved in space activity causes harm to another space object of the Russian Federation or property on board such object, then compensation to the full extent will be placed upon the organization or individual which owns the space object, which has *caused* harm, under the regime and conditions contemplated by the Civil Code of the Russian Federation.[272]

Clearly, the party which causes injury in space owes compensation to the injured party "to the full extent" under the Russian Civil Code. The Law on Space Activity mirrors the Liability Convention's distinction between absolute liability on Earth and fault-based liability in Space. The reviewed Russian laws do not give precise definition for the line between airspace, where there is sovereign jurisdiction and outer space.[273] Further, these laws do not define "apart from the surface of the Earth." Given the ever-growing number of space objects, these definitions should be clarified sooner rather than later.

The Article of the Law on Space Activity governing liability has one further provision. Specifically:

> Harm, which was caused to a person or property of a citizen, but also harm, which was caused to property of a legal entity, by a space object of the Russian Federation in the course of space activity on the territory of the Russian Federation, or outside its borders, is subject to compensation by the organization or citizen, which has insured its own responsibility for the

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[271] Law on Space Activity, *supra* note 121, art. 30(1).

[272] *Id*. at art. 30(2) (emphasis added). In the Russian-language original, the sentence structure is different, giving a reading that would be confusing in English. Therefore, the translator has deviated from the literal approach.

[273] This is in line with the widely-acknowledged reality that under international law "[t]here is no provision on the precise boundary between outer space and airspace . . . ." IAN BROWNLIE, PRINCIPLES OF PUBLIC INTERNATIONAL LAW 256 (7th ed. 2008).

> causation of harm, in the volume and under the regime contemplated by, the Civil Code of the Russian Federation.[274]

This provision is unclear. Three possible, and possibly overlapping, interpretations exist. Either this provision seeks: to assure that the injured party will always have recourse against someone through an existing insurance policy (perhaps like "no-fault" insurance in the US); to prevent insurers from disclaiming liability for otherwise-covered space activity; or to set a limit on the liability of an injuring party, to the "volume" allowed by the insurance policy at issue.[275]

An earlier version of this paragraph applied joint and several liability.[276] However, Article 30 was amended in 1996, removing that statement and inserting the new paragraph. An article from 2007 claims that a fourth paragraph existed within Article 30 of the Law on Space Activity, which placed a limit "on the amount recoverable to the insured sum or insurance indemnity provided in contracts of insurance of space technology and risks involved in space activity."[277] This is consistent with the version that can be found on the Website of the UNOOSA.[278] That version of the above-quoted paragraph, however, was superseded by the 1996 amendments to the Law on Space Activity.[279]

Also, one trait of the State corporation, here specifically Roscosmos, as discussed above, leaps out against the backdrop of the Outer Space Treaties, as it concerns obligations related to

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[274] Law on Space Activity, *supra* note 121, art. 30(3).

[275] Also, the provision could operate to prevent liability to uninsured entities. However, that seems to be an unlikely result, especially given that insurance is required of entities engaging in space activity.

[276] Francis G. Montgomery, *Russian Outer Space Law and U.S.-Russian Cooperative Efforts in Space*, 2 PARKER SCH. J. E. EUR. L. 212, 217 (1994).

[277] Zeldine Niamh O'Brien, *Theories of Liability for Space Activities*, IRISH STUDENT L. REV. 15, 58 (2007).

[278] *Selected Examples of National Laws Governing Space Activities: Russian Federation*, U.N. OFF. OUTER SPACE AFF., http://www.unoosa.org/oosa/en/ourwork/spacelaw/nationalspacelaw/russian_federation/decree_5663-1_E.html (last visited July 5, 2020).

[279] The Russian version of the law hosted on the Russian government's website indicates that Article 30 has not been amended since 1996. Indeed, the new version of paragraph three was adopted in that same year. Федеральный Закон о внесении изменений и дополнений в Закон Российской Федерации "О Космической Деятельности" [Federal Law on the adoption of changes and additions to the Law of the Russian Federation on Space Activity], Nov. 1996, No. 147-ФЗ, http://pravo.gov.ru/proxy/ips/?docbody=&nd=102044427.

responsibility and liability. Specifically, as Asatryan and Andryushchenko note, State corporations do not "answer for the obligations of the Russian Federation, and vice-versa, if the law on the State corporation's establishment does not provide otherwise."[280] This is, at first, an extraordinary deviation from the responsibility and liability rules discussed above. Three subsections of the Law on Roscosmos may be relevant to clearing up this potential discontinuity.

Article Six, section nine, of the Law on Roscosmos requires that Roscosmos "continues to fulfill to the full extent the functions of the authorized organ of the Russian Federation (competent organ of the Government of the Russian Federation), which is responsible for the realization of international (intergovernmental) agreements in the area of space activity."[281] Further, Article 37, subsection four, transfers to Roscosmos several responsibilities that the State might otherwise have had, including responsibility for causation of harm to life or health.[282] Therefore, it appears that the Law on Roscosmos does "provide otherwise" to a complete rejection of the Russian State's potential to "answer for" Roscosmos' activities and vice-versa. Moreover, as noted above, Mel'nikov feels that because that the Russian President and Roscosmos are both assigned "leadership" of space activity in Russia,[283] it may be difficult to say that any space activity subject to Russian law, including Roscosmos, is not attributable to the State. Therefore, this is an exception to the usual ability of the Russian Federation to say that it does not answer for the obligations of State corporations.

Finally, regardless of what Russian law says about Roscosmos' liability or responsibility for domestic legal purposes, it would strain credulity to suggest that the activities of Roscosmos, the State-controlled monopolistic Russian actor and regulator for space activity, would not be "national activities" within the meaning of the relevant treaties.[284] That is, the activities of such an entity, of

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[280] Asatryan & Andryushchenko, *supra* note 136, at 54.

[281] Law on Roscosmos, *supra* note 123, art. 6(9).

[282] *Id.* at art. 37(4).

[283] Mel'nikov, *supra* note 189, at 43 (discussing Law on Space Activity, *supra* note 121).

[284] *See also* Vienna Convention on the Law of Treaties arts. 27, 46, May 23, 1969, 1155 U.N.T.S. 331 (explaining that "[a] party may not invoke the provisions of its

necessity, must be accompanied by the international responsibility or liability of the Russian Federation. Therefore, while the Russian State may not have to answer for Roscosmos' activities under its own law and to its own citizens, it will have to answer under international law and to foreign States.

In any event, the Law on Space Activity has a little more to say about compensation in its Articles addressing accidents and "incidents." Incidents, including "crashes" and "disasters," are subject to investigation, as defined in other unidentified laws.[285] The State has obligations to coordinate search and rescue operations.[286] "Work on mitigation of consequences of events resulting from the conduct of space activity includes: restoration and reconstruction of industrial or other objects, lost as a result of the event; necessary environmental protection measures; and compensation of harm to the subjects of the Russian Federation, organizations and citizens."[287] The definition of that category becomes important because:

> Search and rescue operations, and also work on mitigation of consequences of events resulting from space activity on the territory of a foreign state will be conducted in coordination with the competent organs of that state at the expense of funds of the organizations and individuals who are realizing such activity, and the funds of the Federal budget.[288]

It should be noted that the word "activity" used in the penultimate clause is only repeated as part of "space activity." Therefore, it appears that whoever participates in a given space activity is liable for search and rescue operations. This appears to pass along the obligation of Article 5, Section 5, of the Rescue Agreement, which requires that expenses incurred in "recover and return" of a space object or its component parts shall be borne by the launching

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internal law as justification for its failure to perform a treaty . . ." except concerning competence to conclude treaties) [hereinafter Vienna Convention].

[285] Law on Space Activity, *supra* note 121, art. 23(1).

[286] *Id*. at art. 24(1). The word in this quote translated as "mitigation" could be literally translated as "liquidation" (*ликвидация*). However, it most likely means mitigation, in context.

[287] Law on Space Activity, *supra* note 121, art. 24(2).

[288] *Id*. at art. 24(3).

authority.[289] That is, if a search and rescue operation is understood to include "recover and return" operations, then the "launching authority" which is held liable under international law might be understood in Russian law to be whoever "realized" (or implemented, performed, or effectuated) the space activity. Reference is also made to the federal budget, but it is the more likely that the Russian State would, as would any State, prefer to recoup any losses from those realizing the space activity.

D. Obligations Under the Rescue Agreement

No portion of the Russian Law on Space Activity clearly or directly implements the Rescue Agreement, or the provisions of Article V of the Outer Space Treaty,[290] beyond the search and rescue reimbursement provisions already mentioned. However, a few provisions may be relevant to understanding how the Russian Federation views its obligations under that Agreement.

Under a heading titled, for better or for worse, "Peculiarities[291] of Administration of Space Objects," the Law on Space Activity requires that, generally, "[m]aneuvering of space objects in Russian Federation air space is carried out accounting for the demands of" Russian air law.[292] This is not immediately relevant to space law, except that the next paragraph continues:

> A space object of a foreign state may conduct a one-time harmless flight through Russian Federation air space with the goal of launching the object into orbit around the Earth or farther into cosmic space, and also with the goal of returning it to Earth under the condition of timely notification of the

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[289] *See* Rescue Agreement, *supra* note 28, art. 5.

[290] That Article requires States Parties to regard astronauts (or, in the Russian version, cosmonauts) "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." Outer Space Treaty, *supra* note 26, art. V. Article V further requires that "[i]n 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." *Id*.

[291] A better translation might be "Features." The word is "*особенности*."

[292] Law on Space Activity, *supra* note 121, art. 19(3).

> corresponding service of the Russian Federation concerning the time, place, trajectory and other conditions of such flight.[293]

Therefore, Russian law does at least provide for a right of innocent passage through Russian air space for space objects. This appears to be unusual—at least one highly qualified publicist has stated that customary international law "does not permit a right of innocent passage [through airspace], even through airspace over the territorial sea."[294] In contrast, innocent passage is actually generally allowed to nautical vessels under customary international law.[295]

As a result, Russia has preemptively removed a possible complication for the safe launch or return of space objects, likely including crewed objects, by making it legal for other States, with proper notice, to launch through Russian airspace. For example, an endangered crewed spacecraft, in a scenario like that of Apollo 13, likely would not need to worry about causing a diplomatic incident if it had to cross Russian airspace; rather, it would just need to give "timely notification" to the Russian Federation.

It is also noteworthy that the Law on Space Activity does not define "space" or "outer space" or the phrase that this Article renders as "cosmic space." However, this provision about right of passage only applies to "air space." Therefore, because the two terms are used distinctly, they would clearly have a legal difference under the "logical" approach to statutory interpretation.[296] So Russian law clearly contemplates that there is a boundary between the two zones somewhere. Unfortunately, that boundary is not explained in Russian law.

Returning to Russia's space law, specifically the Law on Space Activity does have several further provisions related to cosmonauts,[297] primarily in Article 20. Russian citizens who meet certain requirements are selected for cosmonaut training on a competitive

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[293] *Id*. at art. 19(4).

[294] BROWNLIE, supra note 273, at 116, 186.

[295] *Id*.

[296] *See, e.g.,* Abbot v. Abbot, 560 U.S. 1, 33 (2010) ("In interpreting statutory text, we ordinarily presume that the use of different words is purposeful and evinces an intention to convey a different meaning." (citing Russello v. United States, 464 U.S. 16, 23 (1983)).

[297] The word translated as "cosmonaut" (*космонавт*) is commonly deemed synonymous with astronaut, taikonaut and other terms. The Russian versions of the relevant treaties use the world "cosmonaut" where the English versions say "astronaut."

basis, which competition is conducted in accordance with the Civil Code.[298] Several topics related to cosmonauts, including their rights, obligations and pay are governed by the "laws and other normative legal acts of the Russian Federation."[299] Expanding on this, the 1993 "Law on Questions of Material and Pension Provision for Cosmonauts" fixes the salaries and pensions of cosmonauts, cosmonaut candidates, "cosmonaut-instructors" and related personnel.[300] Article 20, section six, of the Law on Space Activity foresees that "[t]he legal situation (status) of cosmonauts is defined by the Government of the Russian Federation."[301] This is a positive development, given that cosmonaut, astronaut and related terms may not be identical and are not defined in international law.[302] In turn, the 2017 Decree on the Confirmation of the Law on Cosmonauts of the Russian Federation (hereinafter "Decree on Cosmonauts") provides more detail, even indicating that "a citizen of the Russian Federation" who participates in a wide variety of enumerated activities "is a cosmonaut."[303] This law does not mention nationals of other States, suggesting that the Russian Federation does not consider foreign nationals to be "cosmonauts" for the purposes of domestic law. Most of the Decree on Cosmonauts concerns their duties,[304] none of which clearly relate to the Rescue Agreement. For example, cosmonauts under Russian law have rights to medical aid, housing, access to technical documentation and other information, as well as responsibilities to inform specialists about worsening health and to participate in "'propaganda of achievements' of Russia in piloted

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[298] Law on Space Activity, *supra* note 121, art. 20(1).

[299] *Id*. at art. 20(2).

[300] Постановление - Вопросы Материального и Пенсионного Обеспечения Космонавтов [Decree on Questions of Material and Pension Provision for Cosmonauts], May 17, 1993 (as amended Mar. 7, 2016), http://pravo.gov.ru/proxy/ips/?docbody=&link_id=0&nd=102023545 [https://perma.cc/SC3B-HM6H].

[301] Law on Space Activity, *supra* note 121, art. 20(6) (parenthetical in original).

[302] *See* V.S. Kichenina, *Правовой статус космонавтов и иных участников космических полетов* (The legal status of cosmonauts and other participants in space flights), *in* ВОПРОСЫ РОССИЙСКОГО И МЕЖДУНАРОДНОГО ПРАВА (Matters of Russian and international Law), 161, 167 (2017); Mel'nikov, *supra* note 189, at 41.

[303] Постановление об Утверждении Положения о Космонавтах Российской Федерации [Decree on the Confirmation of the Law on Cosmonauts of the Russian Federation] [hereinafter Decree on Cosmonauts], May 10, 2017, No. 551, art. 1, http://pravo.gov.ru/proxy/ips/?docbody=&link_id=2&nd=102432366 [hereinafter Decree on Cosmonauts].

[304] *See id*. at art. 6.

spaceflight."[305] This may be sensible for some purposes, like fixing pay or allocating the benefits discussed above, but it does create a potential problem for international rescue obligations.[306] The law does not expressly exclude foreign nationals from the definition of cosmonaut, but it is unlikely that Russia would extend such supportive privileges and State-centered obligations to people who do not hold Russian citizenship.

Mel'nikov agrees that foreign citizens, even if they go through the same training process or participate in spaceflight on a Russian space object, may not be considered cosmonauts.[307] He also notes that in practice, however, foreigners flying on Soyuz spacecraft have been called cosmonauts for many years.[308] Therefore, he concludes that the current legal formulation is only for a "cosmonaut of the Russian Federation" and not for all possible cosmonauts.[309]

On flights to the ISS, "for foreign cosmonauts the term 'participants in space flight' is used."[310] In other circumstances, the State has approved "member of the ISS crew" to describe both the "expeditionary crew" and "crew of a visit to the ISS."[311] Mel'nikov observes that these definitions are limited to the ISS and likely do not apply elsewhere.[312]

To make matters more confusing, as recently as 2019, Roscosmos used the term "participant in space flight" in a Russian-language Twitter announcement, to describe the first spacefarer from the United Arab Emirates. The same announcement deemed the Russian commander of the relevant Soyuz mission a "cosmonaut,"

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[305] Kichenina, *supra* note 302, at 168. For a detailed summary of the rights and obligations of a cosmonaut under Russian law see D.E. Nerovnya, *Исследование юридических гарантий космонавтов в РФ* (Research on legal guarantees for cosmonauts in the Russian Federation), *in* АКТУАЛЬНЫЕ ВОПРОСЫ АВИАЦИИ И КОСМОНАВТИКИ (Current issues of aviation and astronautics) 608-10 (2018).

[306] The domestic statute would also not be a legal excuse for avoiding those international obligations. *See* Vienna Convention, *supra* note 284, at arts. 27, 46.

[307] Mel'nikov, *supra* note 189, at 41. *See also* Nerovnya, *supra* note 305, at 608 (interpreting the Decree on Cosmonauts to mean that cosmonauts are "citizens of the Russian Federation").

[308] Mel'nikov, *supra* note 189, at 41.

[309] *Id*.

[310] *Id*. at 42.

[311] *Id*.(discussing Russia's code of conduct for ISS crew members).

[312] *Id*.

and an American on the mission an "astronaut."[313] Roscosmos' website, possibly in contradiction, includes the UAE spacefarer in a list of "ISS Cosmonauts", while also calling him an "Astronaut of the UAE."[314] That being said, Roscosmos' website includes every spacefarer it has ever sent to the ISS on its website under the same label, though they hailed from a myriad of different States.[315]

Returning to the Law on Space Activity, "[t]he commander of the crew of a piloted space object of the Russian Federation is designated «Cosmonaut-Citizen» of the Russian Federation."[316] Mel'nikov suggests that someone who is not a Russian citizen cannot receive this designation, so the commander of a crewed Russian space object must always be a Russian citizen.[317] Kichenina also includes "citizen of the Russian Federation" in her list of requirements for cosmonaut status, derived from the Decree on Cosmonauts.[318] This is unlike modern Russian air law, which allows for the possibility of the commander of an aircraft being a foreign citizen, perhaps because of a shortage of Russian pilots.[319] Mel'nikov thinks a future similar change to Russian space law may be needed to lower the potential cost of commercial space services.[320]

In any event, the commander is "endowed with the fullness of power necessary for the realization of space flight, leadership of the crew, and *other individuals participating* in the flight."[321] Further, the commander "has responsibility for fulfilling the program of the flight, security or safety of the crew, and *other individuals*

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[313] Roscosmos (@roscosmos), TWITTER (Sept. 24, 2019), https://mobile.twitter.com/roscosmos/status/1176474203798802434. The English version of that tweet, available at the same link, evaded these titles entirely, noting the "Commander" and two "flight engineers."

[314] *Космонавты МКС - Хазза Аль Мансури*, Roscosmos, https://www.roscosmos.ru/26745/ (last visited Jan. 11, 2020).

[315] *Космонавты МКС*, ROSCOSMOS, https://www.roscosmos.ru/35/ (last visited Jan. 11, 2020).

[316] Law on Space Activity, *supra* note 121, art. 20(3).

[317] Mel'nikov, *supra* note 189, at 42.

[318] Kichenina, *supra* note 302, at 168.

[319] Mel'nikov, *supra* note 189, at 42.

[320] *Id*. at 42-43.

[321] *Id*. (emphasis added). This power appears comparable to that once held by the commanders of the U.S. Space Shuttle. *See* Michael Chatzipanagiotis & Rafael Moro-Aguilar, *Criminal Jurisdiction in International Space Law: Future Challenges in View of the ISS IGA*, 57 PROC. INT'L INST. OF SPACE L. 323, 328 (2014) (discussing 14 C.F.R. 1214.7 (2019)).

participating in the flight . . . ."[322] Therefore, Russian law has begun to contemplate a distinction between the crew of a spacecraft and other spaceflight participants. It should be noted that the Rescue Agreement in English uses the phrase "personnel of a spacecraft" in describing the obligations of States-Parties.[323] The Russian-language word used in that part of that treaty is the same word used in the Law on Space Activity where the translator has written "crew."[324] Therefore, the Russian Law on Space Activity arguably distinguishes between "personnel," toward whom Russia has treaty obligations and "other individuals participating" in spaceflight. It remains to be seen whether Russia actually believes the Rescue Agreement does not require special obligations, beyond any found in other areas of law, toward "other individuals" besides the "crew," but the current wording of the Law on Space Activity suggests that possibility.

"The Russian Federation retains jurisdiction and control over any crew of a piloted space object registered with the Russian Federation" at any time "up until the conclusion of the flight program, unless otherwise is contemplated by an international treaty of the Russian Federation."[325] "Citizens of foreign states" preparing for space flight in Russia or "participating in the flight of a piloted space object" of the Russian Federation "are obligated to observe" Russian law, unless otherwise contemplated by treaty.[326] This, once again, seems to exclude foreign citizens from cosmonaut status. One contrasting example is in the Law on Roscosmos, which explicitly gives Roscosmos the power to make rules regarding, among many other things, the composition of the "crew (including foreign citizens as members of the crew or participants in space flight) of piloted space objects . . . ."[327] One observer pointed out that there is no current definition of "piloted space object" in Russian space law,

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[322] Chatzipanagiotis & Moro-Aguilar, *supra* note 321, at 328 (emphasis added).

[323] *See* Rescue Agreement, *supra* note 28.

[324] *See Соглашение о спасении космонавтов, возвращении космонатов и возвращении объектов, запущенных в космическое пространвнство*, U.N. OFF. OUTER SPACE AFF., http://www.unoosa.org/pdf/gares/ARES_22_2345R.pdf (last visited July 5, 2020). The Russian word for "personnel" in that treaty is "*экипаж*," which should be transliterated as "ekipazh."

[325] Law on Space Activity, *supra* note 121, art. 20(4).

[326] *Id*. at art. 20(5).

[327] Law on Roscosmos, *supra* note 123, art. 9(2).

leading to potential ambiguity.[328] Another has noted that the ill-defined category of "suborbital flights" is not addressed in the Decree on Cosmonauts, leading to more possible ambiguity.[329]

Still, the Law on Space Activity leaves foreigners generally in the category of "other individuals participating" in the flight. In that case, one must ask whether Russia, confronted with a scenario where (for example) an American space object carrying American astronauts and a Canadian national, would regard the Canadian as an "astronaut" for the purposes of the Rescue Agreement. The answer is probably "yes," if for no other reason than simple international comity. If we change the hypothetical to involve a non-US national from a State with which Russia has markedly worse relations and no reason to extend comity, for example an Estonian or Georgian national, then hopefully the answer should still be "yes" and some Russian scholars would agree.[330]

E. Obligations Under the Registration Convention

Articles V and VIII of the Outer Space Treaty impose certain obligations on States "on whose registry" particular space objects or vehicles can be found.[331] The Registration Convention fleshes out this notion, expressly requiring a "launching State" (as defined in that treaty) to register space objects and to inform the Secretary-General of the UN of the establishment of that registry.[332] Russia's Law on Space Activity provides further detail for domestic purposes.

Initially, "[s]pace objects of the Russian Federation are subject to registration and shall[333] have markings attesting that they belong" to the Russian Federation.[334] The law is silent about whether

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[328] *See* Aleksandr Aleksandrovich Bessarabenko, *Особенности правового регулирования купли-продажи космического корабля* (Features of legal regulation of the purchase and sale of a spaceship), *in* NO. 4(67) ВЕСТНИК МЕЖДУНАРОДНОГО ЮРИЕДИЧЕСКОГО ИНСТИТУТА (Bulletin of the International Juridical Institute) 55-58 (2018).

[329] Kichenina, *supra* note 302, at 168.

[330] *Id*. 167 (internal citation omitted).

[331] Outer Space Treaty, *supra* note 26, arts. V, VIII.

[332] Registration Convention, *supra* note 36, arts. I & II.

[333] Currently, the Russian version of the statute uses a word that can be understood as "should," "must" or "shall." Out of an abundance of caution, this Article interprets the word to mean "shall."

[334] Law on Space Activity, *supra* note 121, art. 17(1).

there will be a national registry, what entity should manage it or any further detail. However, Roscosmos appears to have taken the initiative and has begun filling in some gaps. Roscosmos has published three documents under the heading of "draft" documents: Draft Law on Regime of Registration of Space Objects, Launched by the Russian Federation into Cosmic Space and of the Jurisdiction of the Registry of Space Objects of the Russian Federation (Draft Law); a Draft Decree on Confirmation of the Law on Registration Regime; and a draft "Clarifying Memorandum" concerning the draft decree.[335] While it is not clear that these have been adopted or otherwise given authoritative force, these documents are illuminating for an otherwise ambiguous law. Further, all three documents, and in particular the Draft Law, are dense documents that deserve individual consideration in separate papers. However, this Article will address a few notable provisions.

The Draft Law provides for the creation of a Russian Federation Registry of Space Objects. This registry will include objects launched into space by the Russian Federation and which are under Russian Federation jurisdiction and control for purposes of the Registry; and for the presentation of information to the Secretary-General of the UN.[336] Registration is required irrespective of an object's mass, dimensions or functional composition.[337] The Draft Law affirms that it fulfills Russia's requirements under the Outer Space Treaty and the Registration Convention.[338]

The Draft Law also states that the Registry will be a "continuation of the State Registry of space objects launched by the USSR," and that Russia continues to retain "in full measure," jurisdiction and control over space objects "launched previously by the USSR."[339] Incidentally, the USSR notified the Secretary-General of the UN about the creation of its registry in 1978, authorizing what

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[335] *Проекты нормативных документов* [*Drafts of normative documents*], Roscosmos, https://www.roscosmos.ru/110/1/ (last visited Jan. 11, 2020).

[336] ROSCOSMOS, DRAFT LAW ON REGIME OF REGISTRATION OF SPACE OBJECTS, LAUNCHED BY THE RUSSIAN FEDERATION INTO COSMIC SPACE, AND OF THE JURISDICTION OF THE REGISTRY OF SPACE OBJECTS OF THE RUSSIAN FEDERATION, art. 1, https://www.roscosmos.ru/media/files/docs/2017/polozenie.o.registrazii.ka.docx (last visited Jan. 11, 2020)

[337] *Id*. at art. 3.

[338] *Id*. at art. 4.

[339] *Id*. at art. 6.

was then the USSR Academy of Sciences to communicate with the Secretary-General.[340] Even without the Draft Law's formal adoption, it appears that UNOOSA has regarded Russia's registrations as following the Soviet Union's registry, including hundreds of registrations since the end of the USSR.[341]

Under the Draft Law, Roscosmos' directive is to provide the UN Secretary-General with relevant information about each space object in the Russian registry.[342] Roscosmos reviews the applications of Russian and foreign interested legal or physical persons before the launch of a space object, "in relation of which" the Russian Federation will "appear in the capacity of" the launching State. [343] In those applications for a "foreign space object," it "shall be indicated" which State "on whose register the given space object is planned to be registered."[344] To rephrase, it appears that the Draft Law would require Roscosmos to determine and approve the State of registration of a given space object, when more than one State is legally possible, before the launch of that object occurs. Though not expressed on the face of the Draft Law, as a practical concern, it seems quite likely that if Roscosmos disagrees with the applicant's proposed State of registry for an object, then Roscosmos would object to the launch of that object, if the launch falls under Russia's jurisdiction.

The Draft Law's Appendix includes several tables that appear to be alternative formulations, or examples, of entries in the Registry. All information required by Article 4 of the Registration Convention is illustrated in the tables.[345]

The Law on Space Activity goes on to describe the impact of registration. The Russian Federation "retains jurisdiction and control" over registered objects, while "on Earth, in any phase of flight

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[340] Information Furnished by the Permanent Mission of the Union of Soviet Socialist Republics to the United Nations in note verbale dated 13 January 1978 addressed to the Secretary-General, U.N. Doc. ST/SG/SER.E/INF.4, http://www.unoosa.org/pdf/reports/regdocs/SER_INF_004E.pdf.

[341] *Notifications from States & Organizations: Russian Federation / Union of Soviet Socialist Republics*, U.N. OFF. OUTER SPACE AFF., http://www.unoosa.org/oosa/en/spaceobjectregister/submissions/rf.html (last visited July 5, 2020).

[342] Roscosmos, *supra* note 335, arts. 10-12.

[343] *Id*. at art. 14.

[344] *Id*.

[345] *Compare id*. at arts. 9-19 *with* Registration Convention, *supra* note 36, art. IV.

in space or their stay in space, on heavenly bodies, and also after return to Earth in the limits of jurisdiction of any state."[346] However, property rights in those objects remain "untouched" unless an international treaty provides otherwise.[347] If an object is built by a Russian organization or Russian citizen jointly with a foreign State, then registration, jurisdiction, control and property rights are all decided by the treaty.[348] In sum, registration is mandatory as a fulfillment of Russia's international legal obligations and it ensures that Russia's authority travels with registration and perhaps preserves private property rights. Russia (and the USSR before it) has communicated to UNOOSA Affairs the registration of more than 3,500 space objects.[349] In contrast, Russia has, according to UNOOSA, failed to register with the UN only thirty-three objects known to the UN.[350]

Article XI of the Outer Space Treaty, however, further requires States' parties to inform the Secretary-General of outer space activities, "to the greatest extent feasible and practicable..."[351] According to the UNOOSA website, it appears that States rarely comply with this requirement. For example, the United Kingdom has filed twelve notifications under Article XI.[352] The Netherlands has filed

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[346] Law on Space Activity, *supra* note 121, art. 17(2).

[347] *Id*. at art. 17(3).

[348] *Id*. at art. 17(4).

[349] *Online Index of Objects Launched into Outer Space*, U.N. OFF. OUTER SPACE AFF., http://www.unoosa.org/oosa/osoindex/search-ng.jspx (applying filters "UN Registered: Yes" and "State / Organization: Russian Federation (including USSR))." (last visited Jan. 11, 2020).

[350] *Online Index of Objects Launched into Outer Space*, U.N. OFF. OUTER SPACE AFF., http://www.unoosa.org/oosa/osoindex/search-ng.jspx (applying filters "UN Registered: No" and "State / Organization: Russian Federation (including USSR))" (last visited Jan. 11, 2020). The author suspects that the Russian Federation probably has many other undeclared space objects in orbit.

[351] Outer Space Treaty, *supra* note 26, art. XI.

[352] *Notifications from States & Organizations: United Kingdom of Great Britain and Northern Ireland*, U.N. OFF. OUTER SPACE AFF., http://www.unoosa.org/oosa/en/spaceobjectregister/submissions/uk.html (last visited July 5, 2020).

sixteen.[353] The US has filed one, the hyperlink to which leads in turn to a "Page request not found."[354] Russia has filed none.[355]

IV. NOTEWORTHY MISCELLANEOUS PROVISIONS

Having explored the domestic legal applications of Russia's treaty obligations, we now turn to a few idiosyncratic provisions of the Law on Space Activity. Specifically, the provisions governing: financing of space activity; space infrastructure; space insurance; foreigners; Earth remote sensing; and, most interesting, Russia's limited assertion of proscriptive jurisdiction in space.

A. Financing and Infrastructure

It has been said that Russia had planned to "renationalize" its space industry[356] and this process culminated with the merger of the former Federal Space Agency into the Roscosmos State corporation. Nowhere in the Law on Space Activity is this move to nationalization more apparent than in the provisions of the addressing financing and space infrastructure.

Article 12 of the Law on Space Activity states that the "volume of financing of space activity is defined in the Federal budget for the corresponding year."[357] Further, the financing of space activity "is realized in the manner foreseen for a state defense order, via assignment of allocations from the federal budget to state customers and distributed between the executors of work in accordance with

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[353] *Notifications from States & Organizations: The Netherlands*, U.N. OFF. OUTER SPACE AFF., http://www.unoosa.org/oosa/en/spaceobjectregister/submissions/netherlands.html (last visited July 5, 2020).

[354] *Notifications from States & Organizations: United States of America*, U.N. OFF. OUTER SPACE AFF., http://www.unoosa.org/oosa/en/spaceobjectregister/submissions/usa.html (last visited July 5, 2020).

[355] *Notifications from States & Organizations: Russian Federation/Union of Soviet Socialist Republics*, U.N. OFF. OUTER SPACE AFF., http://www.unoosa.org/oosa/en/spaceobjectregister/submissions/rf.html (last visited July 5, 2020).

[356] *The Future of Russian Space Strategy*, STRATFOR WORLDVIEW (Sept. 16, 2013), https://worldview.stratfor.com/article/future-russian-space-strategy (noting 2013 "renationalization plan"). For an overview of the perilous state of Russia's space industry, see Paulina Glass, *Russia Is Slowly Declining As A Space Superpower*, DEFENSE ONE (Aug. 5, 2018), https://www.defenseone.com/threats/2018/08/russia-slowly-declining-space-superpower/150279/.

[357] Law on Space Activity, *supra* note 121, at art. 12(1).

state contracts."[358] A "state customer organizes the use of extra-budgetary funds of organizations, which are directed to the fulfillment of work (services), in addition to the expense obligations of the Russian Federation on the orders of" Roscosmos and the Ministry of Defense.[359] The "head executor" of "work has the right to direct extra-budgetary funds to the financing of work, which was foreseen by State contracts for the fulfillment of work (services) on the Federal Space Program, other Federal programs" in space activity, "in addition to expense obligations of the Russian Federation in the manner and under the conditions which are defined by the Government of the Russian Federation."[360] This may be simply a general description of how government contracts work. However, it may instead be an exclusive and short list of ways in which space activity may be financed. Under the logical approach to statutory interpretation, specifically the notion that the expression of one thing is the exclusion of another,[361] strictly-private funding of private space activity appears excluded. That is, the statute contemplates Federal Budget allocations as for a "state defense order" and "extra-budgetary" funds directed to State projects, but not *private* funding of *private* projects.

It could be argued that this is an absurd result. However, as the Law on Space Activity does not expressly forbid private funding of otherwise licensed private space activity, nor is it even contemplated as other types of funding are, this leaves private financing in an uncomfortable legal limbo. Further, the reality of the situation proves that commercial space activity is still possible. Russian rockets do launch satellites which are owned by private entities and financed by entities other than the Russian State.

Article 12 continues, noting that organizations and citizens participating in "the realization of space projects" can be given

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[358] Law on Space Activity, *supra* note 121, at art. 12(1). Also, the Russian word here translated as "work" is "работ," which is the genitive plural of a word commonly translated as "work," or "job." The author suspects that there may be a sense of "tasks" or "projects" in this clause. Nevertheless, out of an abundance of caution, the word "work" will be used here, though its plural "works" might also be appropriate, if possibly archaic.

[359] *Id*. at art. 12(2).

[360] *Id*.

[361] As an example of this canon, and the logical approach in general, applied in a western court system, see Jennings v. Rodriguez, 138 S. Ct. 830, 844 (2018) (noting canon that "[t]he expression of one thing implies the exclusion of others" (quoting ANTONIN SCALIA & BRYAN GARNER, READING LAW, 107 (2012))).

"state guarantees and privileges" as provided by law.[362] Further, foreign investment in space activity "connected with the fulfillment of the Federal Space Program" may be guaranteed by funds from the Federal Budget, or property, and foreign investment in space activity "of organizations and citizens of the Russian Federation" may be guaranteed[363] by the funds or property (intellectual or otherwise) of those organizations or citizens.[364] These provisions, however, still do not expressly address private space financing of private space projects.

Turning to "space infrastructure," that term is extensively defined in the Law on Space Activity. Space infrastructure includes a diverse array of things from cosmodromes to "points of reception, preservation, and processing of information," to cosmonaut training and equipping facilities and "other ground structures and equipment, used for the realization of space activities," including "mobile" objects.[365] All space infrastructure objects "are such to the extent that they are used for the guaranteeing or realization of space activities."[366] Once again, these definitions are very broad.

"Objects of space infrastructure, *which are being Federal property*, are found under the economic jurisdiction or operational administration of state organizations, which are carrying out their exploitation."[367] The italicized phrase is ambiguous.[368] The author is unwilling to risk changing the drafter's intended meaning by making it more readable. It may mean simply that space infrastructure is federal property. However, it is more likely that it means only those objects which are federal property are under the jurisdiction of State organizations. This latter interpretation, though, feels tautological or redundant, rendering most of the sentence statutory surplusage. Under American canons of interpretation, as an example of the "logical approach," reading language as surplusage should be avoided, though that rule is not absolute. Recourse may be made

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[362] Law on Space Activity, *supra* note 121, at art. 12(3).

[363] The word used here is literally "*гарантироваться*" (garantirovat'sya). It is typically translated as "to be guaranteed," but it probably means "to be secured" in this context.

[364] Law on Space Activity, *supra* note 121, art. 12(4).

[365] *Id*. at art. 18(1).

[366] *Id*.

[367] *Id*. at art. 18(2) (emphasis added).

[368] The word is a declension of "*являющийся*."

to that canon when it favors one of multiple competing interpretations.[369] Interestingly, the Law on Space Activity uses the same phrasing in the next paragraph, contemplating that the transfer of space infrastructure objects, "which are being Federal property," will be done in the manner established by Federal law.[370] Nevertheless, it leaves open the possibility that space infrastructure is meant to be solely State property. If that is so, then the establishment of private commercial spaceports may, for now, be impossible in Russia.

Despite the fact that the law is murky when it comes to private space activity, some argue that a private space sector exists in Russia.[371] For example, Shul'gin suggests that "[i]t is worth noting that participation of private companies in the Russian market for space-rocket manufacturing is in the initial stages."[372] Shul'gin identifies the "Space Cluster" at the Skolkovo Innovation Center and a handful of other companies as examples.[373] He concedes, however, that Russia's "civilian space programs" are hindered by "high demands for licensing," the prolonged period before any return on investments, a lack of State support (until recently) and State unwillingness to share technology.[374]

The Law on Roscosmos does direct that agency to "develop and realize" investment projects into space infrastructure and certain other targets.[375] State-run universities, though obviously not private institutions, are nonetheless able to build small satellites on their own initiative and operate them in space under licenses issued by Roscosmos.[376] Also, in list of licenses maintained on the

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[369] *See, e.g.*, Marx v. Gen. Revenue Corp., 568 U.S. 371, 385 (2013) (discussing rule against surplusage).

[370] Law on Space Activity, *supra* note 121, art. 18(2).

[371] Matthew Bodner, *60 Years After Sputnik, Russia is Lost in Space*, SPACENEWS (Oct. 4, 2017), https://spacenews.com/60-years-after-sputnik-russia-is-lost-in-space/ (quoting an analyst at the Skolkovo Space Cluster, saying that "as a corporation Roscosmos can now claim a private sector exists.").

[372] Shul'gin, *supra* note 183, at 27.

[373] *Id*. at 27-28.

[374] *Id*. at 27.

[375] Law on Roscosmos, *supra* note 123, art.14(7).

[376] N.N. Filippova, *Лицензирование космической деятельности ВУЗА на примере СИБГУ им. М.Ф. Решентева [Licensing of the space activity of a higher education institution on the example of the Reshentev Siberian State University]*, *in* АКТУАЛЬНЫЕ ВОПРОСЫ АВИАЦИИ И КОСМОНАВТИКИ (Current issues of aviation and astronautics) 632, 633 (2018).

Roscosmos website, hundreds of licenses for space activity are held by commercial entities that can be privately owned, as opposed to strictly State-owned entities like a State Corporation.[377]

Some amount of private space enterprise persists in Russia.[378] However, it would be difficult to say that it thrives, or has State support, on the face of the law. Russian space law does not favor private entities and instead gives the State a commanding role in the space sector.

B. Insurance

Viktoriya Sergeyevna Kichenina, a law professor at the Russian Customs Academy, has properly noted that the "[i]nsurance of space objects is one of the most important elements in the realization of space activity."[379] This is because of the potential for significant losses and damages.[380] Therefore, a review of modern Russian space insurance law is necessary for a complete picture of space law in Russia.

Insurance for space activities appeared in Russia in the mid-1990s.[381] Kichenina notes that the first Russian policy for the "insurance of space risks," which covered the risk of loss of a satellite in the "pre-launch preparation and launch phases" was concluded in 1990, while the first Russian insurance policy for third-party liability for space activity was issued in 1996. Today, such policies are limited to military and civil space projects in "obligatory and voluntary forms."[382]

In addition to the curious provision about the interaction between liability and insurance noted above,[383] the Law on Space

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[377] *Выписка из реестра лицензий [Excerpt from register of licenses]*, ROSCOSMOS (Dec. 12, 2019), https://www.roscosmos.ru/22405/. It would be a painstaking endeavor to investigate which are privately-owned and which are State owned. That endeavor is beyond the scope of this Article.

[378] See Shul'gin, *supra* note 183, at 28. At least two of the companies identified by Shul'gin, Dauria Aerospace and Sputnix, claim to be purely private entities and both produce satellites. S7 Space offers launch services through the SeaLaunch platform.

[379] V.S. Kichenina, *Правовое регулирование страхования космических рисков* [The legal status of insurance of space risks], *in* АЛЛЕЯ НАУКИ [Avenue of Science] 799, 799-805 (2019)

[380] *Id*.

[381] *Id*.

[382] *Id*. at 799-800.

[383] *See* Law on Space Activity, *supra* note 121, art. 30(3).

Activity delineates when insurance is required and when it is optional. Regarding the former:

> Organizations and individuals who use (exploit) space technology, or on the order of [whom or which] is conducted the creation or use (exploitation) of space technology, will effect obligatory insurance of life and health of cosmonauts, space infrastructure workers, and also inflicted on life, health or property of other individuals, under the regime and with conditions which are established by law.[384]

Further, "[o]rganizations and citizens, who conduct space activities, are allowed to effect voluntary insurance of space equipment (risk of loss, shortfall, or damage to space equipment)."[385] In sum, people must be insured, as must the property of individuals, while "space equipment" (aside from "space technology") may be insured. The authorities identified and reviewed in this Article do not set a floor or a ceiling for insurance amounts or policy limits.[386]

In practice, one should recall the broad definitions of "space activity" adopted in Russian law.[387] Thus, the policy drafters insuring "space activity" may find themselves insuring far more risk than they intend. Equally, this may lead to a problematic situation for purchasers of insurance, who must obtain insurance in more situations than they may wish to, or more than they might have to in other States. Kichenina notes that Russian law contains no model or standard for conditions of space insurance. However, insurers do provide:

> comprehensive coverage for a whole space project and its participants generally, but also for its realization in any phase of

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[384] *Id*. at art. 25(1).

[385] *Id*. at art. 25(2).

[386] It appears that there has been some attempt at promoting the business of insuring space activity, in the form of a website aptly titled (in Russian) "Space Insurance." However, that website does not appear to have been substantially updated since 2013. SPACE INS., http://www.space-ins.ru/ (last visited Jan. 11, 2020). A 2002 article on that site lists a wide variety of legislative authorities that may have some relevance to relevance to space activity. D.A. Medvedchikov, *Legal Regulation of Insurance of Space Activity in the Russian Federation*, *Ins. Bus., No. 11, 2002, at 23-32*, SPACE INS., http://www.space-ins.ru/index.php/o/117-pub6.html (last visited Jan. 11, 2020). An exploration of those laws is, for better or for worse, outside the limits of this Article.

[387] *See* Kichenina, *supra* note 379, at 800 (reciting a long list of things included in formulations of "space activity.")

> development, construction, assembly, tests, transport, pre-launch preparation, and launch of a rocket of space significance, introduction into flight operation, work of the space device, and its onboard systems in orbit.[388]

Kichenina also notes that statistical data "demonstrates intense quantitative and qualitative" growth in the space insurance market, both abroad and in Russia.[389] As of her writing in 2019, Kichenina notes that for Russian projects, there is an insurance market with a capacity allowing for 150-200 million USD for a single launch.[390] Between 1990 and 2010, Russian insurance companies provided coverage for more than two-hundred Russian-Federal and international space projects.[391] In the past fifteen years, Russian insurers have paid out more than 150 million USD. Notable payouts included: 50.5 million USD for the full constructive loss of a satellite in 2000; a 37.4 million Ruble payout for the loss of a rocket engine in 2002; and a payout exceeding 20 million rubles for causation of harm to third persons in the failed launch of a Proton-M rocket in 2007.[392] Unfortunately, several other Russian space objects have suffered failures over the years. For example, the ill-fated Phobos-Grunt project (a mission intended to return a sample from the Martian moon, Phobos) cost around five billion rubles, and the space device itself was valued at 1.2 billion rubles. The craft was insured for 1.2 billion rubles.[393]

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[388] *Id*. at 800.

[389] *Id*. at 801. Kichenina relies heavily on a website which has significantly changed since she cited to it. However, its prior version is available through the Internet Archive. *See Российская Ассоциация Авиационных и Космических Страховщиков* [Russian Association of Air and Space Insurers], WAYBACK MACHINE, https://web.archive.org/web/20180524115621/http://raaks.ru:80/page.php?id=55 (last visited Jan. 11, 2020).

[390] Kichenina, *supra* note 379, at 801.

[391] *Id*. at 802.

[392] *Id*. In 2002, 37.4 million rubles amounted to roughly 1.2 million dollars. *The World Factbook: Exchange Rates,* CENTRAL INTELLIGENCE AGENCY, https://www.cia.gov/library/publications/download/download-2002/index.html (last visited July 6, 2020)(open "geos" folder). In 2007, 20 million rubles amounted to roughly 800,000 dollars. *Historical Chart of U.S. Dollar to Russian Ruble: Year 2007*, POUNDSTERLINGLIVE, https://www.poundsterlinglive.com/bank-of-england-spot/historical-spot-exchange-rates/usd/USD-to-RUB-2007 (last visited July 5, 2020).

[393] Kichenina, *supra* note 379, at 802. In Late 2011, around the time of the launch of Phobos-Grunt, five billion rubles amounted to roughly one hundred and sixty-seven million dollars and 1.2 billion rubles amounted to roughly forty million dollars. *Historical*

The government has promulgated rules concerning subsidies from the Federal Budget to entities which maintain or carry[394] insurance for property in launches of test-flights of space objects.[395] These rules are expansive, yet appear only to recommend insurance rates charged by the insurer, rather than amounts the insured should secure.[396] The same is true in the government's follow-ups to those rules.[397] As such, the law appears to provide more specialized attention to those who provide insurance for space activities, rather than those who must be insured.

In 2014, one company, *Мегарусс-Д* (Megaruss-D), in conjunction with Roscosmos, proposed a draft law "On the obligation of insurance for the realization of space activity.".[398] It does not appear, though, that this proposed law has been finished or adopted. The portion of the Roscosmos website devoted to draft documents does

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Chart of U.S. Dollar to Russian Ruble: Year 2011, POUNDSTERLINGLIVE, https://www.poundsterlinglive.com/bank-of-england-spot/historical-spot-exchange-rates/usd/USD-to-RUB-2011 (last visited July 5, 2020).

[394] The word used in the law is "*осуществляющ[ие] страхование*. Strictly speaking, this means those who "implement," "effectuate" or "realize" insurance. In other contexts, the phrase means the variations used in the main body of this Article, given above. Further, the law in several places uses the common word for an insurer, "страховщик" as a subject of the law. As a result, the phrases probably reference insurers, but a professional insurance translator should be consulted before advising a client.

[395] "On the confirmation of Rules of providing, in the years 2012-2019, subsidies from the Federal budget for the support of organizations which are realizing property insurance of risk for launches and test flights of space devices." Resolution No. 804, Aug. 8, 2012 (*amended* by Resolution No. 899, Jul. 29, 2017) (Russ.), http://pravo.gov.ru/proxy/ips/?docbody=&link_id=0&nd=102158729.

[396] *See id.*

[397] Постановление об утверждении Правил предоставления в 2012 - 2019 годах субсидий из федерального бюджета на поддержку организаций, осуществляющих имущественное страхование рисков при запусках и летных испытаниях космических аппаратов [Decree on the provision of subsidies from the Federal Budget for the support of organizations which are realizing property insurance of risk for launches and test flights of space devices in 2015], Sept. 2, 2015, http://pravo.gov.ru/proxy/ips/?docbody=&link_id=2&nd=102377979.; Постановление о предоставлении субсидий из федерального бюджета на поддержку организаций, осуществляющих имущественное страхование рисков при запусках и летных испытаниях космических аппаратов в 2014 году [Decree on the provision of subsidies from the Federal Budget for the support of organizations which are realizing property insurance of risk for launches and test flights of space devices in 2014], Jul. 2, 2014, http://pravo.gov.ru/proxy/ips/?docbody=&link_id=1&nd=102354994.

[398] *Космос,* MEGARUSS-D, http://www.megarussd.com/content/kosmos (last visited Jan. 11, 2020).

not list any documents expressly addressing insurance.[399] And, indeed, Kichenina, writing in 2019, notes that the same draft law is still in development.[400]

The developers of the draft law "propose to envisage the possibility of long-term compensation of expenditures on property insurance from the federal budget."[401] Likewise, "foreign physical and legal persons, which are working on their own space programs under the jurisdiction of the Russian Federation," should have property insurance spread to them.[402] Kichenina also notes that, currently, the conversation is about insurance "only of space objects," but ecological problems resulting from space activity should also be addressed.[403]

"Unfortunately, [the] mechanism for compensation of costs of insurers for insurance payouts is still not regulated," causing a lack of motivation of insurers "in the given sphere."[404] Perhaps, as a result, the "market for insurance of space objects in Russia is sufficiently narrowed" and has few companies specializing in that sector.[405]

Kichenina observes that "experience shows" existing norms are "inadequate for the creation of a reliable mechanism of insurance of space objects."[406] A particular problem is a difficulty in defining the causes of an insured event associated with space activity.[407] As a result, insurers may refuse payment and, if they do pay, this makes subrogation difficult.[408] Further difficulties include: limited data on insured events; the complicated and specific nature of space activity; high-technology production; the uniqueness of every object, again frustrating collection of statistical data; the need for multiple insurance companies to properly insure policies through pooling of resources; and the fact that insured events are almost always characterized as "mistaken project-design-office

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399 ROSCOSMOS, *supra* note 335.
400 Kichenina, *supra* note 379, at 802.
401 *Id*. at 804.
402 *Id*.
403 *Id*.
404 *Id*. at 803.
405 *Id*.
406 Kichenina, *supra* note 379, at 802.
407 *Id*. at 803.
408 *Id*.

decisions" or "inadequate control [or inspection] on the side of the insured" and, thus, rejected.[409] Kichenina concludes that in Russia, at present, insurance does not fully cover the economic interests of enterprises or the State.[410] Therefore, the domestic markets must obtain "access to the international level."[411]

C. Other Provisions About Foreigners

In addition to the provisions already mentioned, the Law on Space Activity contains a few special provisions for non-Russians involved in space activity. First, foreign organizations or citizens conducting space activity under the jurisdiction of the Russian Federation are subject to the same legal regime as Russian nationals and citizens.[412] Therefore, Roscosmos must be the entity which licenses foreigners involved in space activity in Russia.

Some rights, however, are protected, as well. The Russian Federation guarantees the "legal security of technologies and commercial secrets" of those foreign individuals or entities.[413] "Other security of technologies and commercial secrets" of foreign entities or individuals in space activity under Russian jurisdiction "is guaranteed on a reciprocal basis."[414]

"Foreign organizations and citizens, conducting space activity under the jurisdiction of the Russian Federation will effect insurance of space equipment, and also of risks, connected with space activity, under the regime established by the Civil Code . . . and the current law."[415] It thus appears that foreigners have the same insurance obligations, vague though they may be, as Russian nationals.

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[409] *Id*. at 804.
[410] *Id*. at 805.
[411] *Id*.
[412] Law on Space Activity, *supra* note 121, art. 27(1).
[413] *Id*. at art. 27(2).
[414] *Id*.
[415] *Id*. at art. 27(3).

D. Earth Remote Sensing

The 2018 amendments to the Law on Space Activity create an "Earth Remote Sensing Database."[416] The goal of this new institution is to promote the effective use of data acquired, at State expense, from space devices, whether those devices are State or privately funded.[417] The Database includes "initial" (or raw) data, acquired directly from remote sensing satellites and communicated or sent to Earth by "whatever" means. The data covered also includes materials acquired from the "working out" (or processing) of raw data.[418] The Law enumerates a long list of possible sources, including data collected by the State, bought by the State or given to the State, including copies thereof, essentially encompassing all relevant data acquired by the State.[419] It also expressly includes metadata and certain environmental or pollution-related data.[420] The Law on Space Activity also provides that "[spatial data are not related to Earth-remote-sensing-from-space."[421] The word used here for "spatial,"[422] however, is not the word for "space," in the sense of the cosmos; instead, this word carries a sense of geographical data. The Earth Remote Sensing Database is a "state informational resource."[423] If the executive organs of the State acquire data from "nonstate space devices," then such information should also go into the Database.[424]

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[416] The literal translation is: "the "Federal [Fund/Foundation] of Data of Distance Observation of the Earth from Space." Russia's government websites use the better interpretation (if not a strictly accurate translation) presented above. *Law to Establish Database for Storing Remote Sensing Data*, KREMLIN (Mar. 7, 2018), http://en.kremlin.ru/catalog/keywords/123/events/57000.

[417] Law on Space Activity, *supra* note 121, art. 31(1).

[418] *Id*. at art. 31(2).

[419] *Id*. at art. 31(3).

[420] *Id*. *See also id.* at art. 33 (describing special responsibilities regarding the organization of metadata).

[421] *Id*. at art. 31(2).

[422] The original Russian phrase is "пространственные данные."

[423] Law on Space Activity, *supra* note 121, art. 31(4).

[424] *Id*. at Art. 31(5). It also appears in that Article that State institutions must do so at their own expense, except (though the wording is confusing) in the instances of defense and security institutions.

The governing authority of the Earth Remote Sensing Database is Roscosmos.[425] Among many other responsibilities, Roscosmos must make the Database accessible online.[426]

It appears that the intended customers of the ERS Database are State entities, down to the municipal level and organizations under contract with State entities. The government will make rules for transferring data to those entities.[427] The Law on Space Activity imposes time limits for the fulfillment of orders and other requirements.[428]

E. Prescriptive Jurisdiction

As noted above, Russia has, as required by the various treaties, asserted jurisdiction and control over its space objects and their crews and passengers.[429] This requirement of jurisdiction is not surprising, as liability and responsibility is a concern in every human activity, including in space and provision must be made to prevent harm to persons and property.[430] Further, it has been proposed that the current system of registration and active nationality bases for jurisdiction are "too rigid" for long-term human presence in space.[431]

Perhaps, as a result, Russia has also taken the unique further step of asserting prescriptive jurisdiction over regions *outside* of Russia's space objects. Specifically: "[i]n the immediate vicinity of a space object of the Russian Federation within the bounds of a zone minimally necessary for the guarantee of security [or safety] of space activity, rules may be established, which are obligatory for Russian and foreign organizations and citizens."[432]

It does not appear that such rules have yet been promulgated. Under current international law, it would be permissible for Russia

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[425] Law on Space Activity, *supra* note 121, art. 31(6). *See also id*. at art. 6.

[426] *Id*. at art. 31(7). Roscosmos appears to have done so through the website *Геопортал Роскосмоса* [Geoportal of Roscosmos], ROSCOSMOS, https://gptl.ru (last visited Jan. 11, 2020).

[427] Law on Space Activity, *supra* note 121, at art. 32.

[428] *Id*.

[429] *Id*. at arts. 17(2), 20(4).

[430] *See* Michael Chatzipanagiotis, *Criminal Issues in International Space Law*, 18 EUR. J. L. REFORM 105, 105 (2016).

[431] Wanlu "Laura" Zhang, *Extraterritorial Jurisdiction on Celestial Bodies*, 47 SPACE POL'Y 148, 152 (2019).

[432] Law on Space Activity, *supra* note 121, art. 17(5).

to forbid, by law, striking (as in assault or battery on, or trespass to) a space object or a cosmonaut. However, would it be permissible for Russia to legally proscribe an otherwise innocent near approach by another State's space object or spacefarer, "astronaut" or otherwise? NASA has recommended establishing rules concerning the historical relics left on the Moon by the Apollo missions, though NASA's recommendations are not yet law.[433] Could Russia instead forbid, and attempt to arrest for, perceived negligence or politically offensive gestures by a national of another State, passing near a Russian space object? The quoted provision does not specify the nature of the rules to be promulgated, just the region to which they would be applicable. So, whether intended or not, Russia has opened the possibility of criminalizing, or otherwise asserting prescriptive jurisdiction over, such acts.

V. TRENDS IN THE LAW AND CONCLUSION

Russian national space legislation is robust and finely-detailed in many respects. Nevertheless, as befits an area of law which must deal with transformational technological advancements, it continues to evolve. As we consider its development, we can identify a number of trends.

The first and most obvious trend is the recentralization and renationalization (perhaps a better term might be "re-state-ification") of the Russian space industry. Russia's legislators have accomplished in law what the State desired to do in practice—to bring the space industry back under State control. This trend is clearly demonstrated by, among other things, the creation of a "monopolistic" state corporation, Roscosmos;[434] the implied exclusion of private ownership of space infrastructure;[435] and the implied exclusion of private funding of space activity.[436] Indeed, the Administrator of Roscosmos, Dmitry Olegovich Rogozin, told a meeting of insurers and customers, "we are working on the unification" of the space-

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[433] *NASA's Recommendations to Space-Faring Entities: How to Protect and Preserve the Historic and Scientific Value of U.S. Government Lunar Artifacts*, NASA (Jul. 20, 2011), https://www.nasa.gov/pdf/617743main_NASA-USG_LUNAR_HISTORIC_SITES_RevA-508.pdf.

[434] Asatryan & Andryushchenko, *supra* note 136, at 53, 55.

[435] *See* Law on Space Activity, *supra* note 121, art. 18(2).

[436] *Id*. at art. 12.

rocket industry.[437] Of course, the space-rocket industry is just one branch of the larger space sector. Administrator Rogozin's stated goal may refer only to the launch industry, but the State's actions reach far beyond that goal.

This recentralization comes with ancillary and perhaps unintended consequences. First, is the complete exclusion of private individuals from obtaining space activity licenses.[438] Second, is the narrowing of space actors to entities of Russian national identity.[439] Finally, though the landing by any entity, public or private, of a human-made space object on any celestial body will not create private property rights in that celestial body under Russian law,[440] such arrival will bring along the State's power to proscribe undesirable conduct.[441] Thus, should the Russian Federation land a cosmonaut on the Moon by 2030,[442] State proscriptive jurisdiction will go where no private property rights have gone before.

The worst likely consequence of the current Russian law is that private space activity and space industry is considered a dubious venture. There appears to be some agreement among observers that private space activity is possible[443] and experience indicates this is true.[444] However, there is just as much agreement that such

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[437] *Отраслевой брифинг для страховщиков и заказчиков* [Industry Briefing for Insurers and Customers], ROSCOSMOS, July 12, 2019, https://www.roscosmos.ru/26559/.

[438] *See Получение лицензии на космическую деятельность* [Acquisition of a license for space activity], ГОСУСЛУГИРУ [GOSUSLUGIRU], https://www.gosuslugi.ru/13113/4/info (last visited Jan. 11, 2020) (only permitting licenses for legal entities).

[439] *See* Mel'nikov, *supra* note 189, at 41. *See also* Nerovnya, *supra* note 305, at 608 (interpreting the Decree on Cosmonauts to mean that cosmonauts are "citizens of the Russian Federation").

[440] *See* Law on Space Activity, *supra* note 121, art. 17(5).

[441] *Id*.

[442] N.S. Plekhanov & O.V. Letunova, *Освоение Космоса: Цели, задачи и перспективы* [Space Development: Goals, objectives and prospects), *in* АКТУАЛЬНЫЕ ВОПРОСЫ АВИАЦИИ И КОСМОНАВТИКИ (Current issues of aviation and astronautics) 719, 719 (2018) (citing Ivan Cherebko, *Россия начнет колонизацию Луны в 2030 году (Russia will begin colonization of the Moon in 2030)*, IZVESTIA (May 8, 2014), https://iz.ru/news/570482). *See also Основные положения Федеральной космической программы 2016-2025 (Basic positions of the Federal space program 2016-2025)*, ROSCOSMOS, https://www.roscosmos.ru/22347/ (last visited Dec. 1, 2019).

[443] *See* Mel'nikov, *supra* note 189, at 42-43; Shul'gin, *supra* note 183, at 27-28.

[444] *See* Shul'gin, *supra* note 183, at 28.

private activity will labor under heavy burdens and only in a close relationship with the State.[445]

The second identifiable and consequential trend is the clear break from the Soviet era. The Soviet Union did not bother to codify or promulgate law governing space activity. While there are ambiguities and gaps in the current Russian space law, there is far more clarity than there would have been in the Soviet era. Moreover, the relevant body of law is identifiable, accessible and exhaustive.

A positive continuity with the Soviet past, however, is the consistency with international law. The Russian space law implements a host of treaty obligations, assigning liability in the same way as the space treaties,[446] requiring the State to coordinate the rescue of cosmonauts[447] (subject to the definitional ambiguity concerning that word's relationship to citizenship) and asserting close State supervision and control over Russia's national activities in space.[448] Also, Russia has extended a right of innocent passage to distressed returning spacefarers, subject to minimal conditions.[449]

These trends will likely continue. Due to the high-profile and historic nature of the Russian space program, the Russian State will not be eager to relinquish control any time soon, absent some incentive to do otherwise. Further, as more nations engage in space activity and Russia continues its quest to catch up with its competitors, Russia's legislators will likely continue to insist on compliance with international law.

At this point, we must discuss the future of Russia's space legislation. This is difficult to predict. One anecdote may shed light on why that is the case. After the 2008 general elections, former President Vladimir Vladimirovich Putin won the office of Prime Minister and Dmitry Anatolyevich Medvedev, until then, First Deputy Prime Minister, won the office of President. [450] When both entered the President's office for the required formal meetings between

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[445] *See* Mel'nikov, *supra* note 189, at 44; Shul'gin, *supra* note 183, at 27. *See also* Filippova, *supra* note 376, at 633 (discussing experiences of State-run universities).

[446] *See* Law on Space Activity, *supra* note 121, art. 30.

[447] *See id*. at art. 24.

[448] *See* Mel'nikov, *supra* note 189, at 43.

[449] *See* Law on Space Activity, *supra* note 121, art. 19(4).

[450] Guy Falconbridge, *Russia's Putin Keeps his Kremlin Chair*, REUTERS (May 13, 2008), https://www.reuters.com/article/us-russia-kremlin-chair/russias-putin-keeps-his-kremlin-chair-idUSL1344062720080513.

Prime Minister and President, Putin motioned Medvedev toward the President's chair. Putin said, "[n]ow, this is your place." Medvedev responded, "[w]ell, what's the difference?"[451]

At the start of 2020, Putin was again President, and Medvedev was again Prime Minister. This change of executive offices illustrates the point that President Putin likely has total control over the system of government and any law can probably change based on his sole direction. Butler observes that, whatever the reality may be for routine or daily administration of justice, the longstanding perception of Russian law, both inside and outside Russia, is that the rule of law is doubted in high-profile or politically important situations.[452] The space sector, both for its historical importance and its reflection of national prestige, easily fits both of these criteria. This will easily continue to be the case as Russia pursues its goal of putting a cosmonaut on the Moon by 2030.[453] Therefore, changes in Russian space legislation will not likely occur in response to market forces, industry lobbying or the needs of the people. Instead, it appears to the author that Russian space legislation will change in response to State's perception of its own needs, or more specifically, the President's perception of the needs of the State. Trying to guess that perception from the outside is more akin to reading tea leaves than a sound legal science.

The author does not expect that private space enterprise in Russia will end entirely. It would be self-defeating for the State to forbid private entities from contributing their wealth toward Russia's State-centered ventures in space. A private entity considering investing in a Russian space-sector company, however, must proceed with caution. That is, the company will likely feel compelled to prioritize the needs of the State over its own and this may harm the investment. Further, if the legal trend of recentralization and renationalization continues, the investment may be lost entirely, or at least changed into an unfavorable form.[454] As the above anecdote

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[451] *Id*.

[452] BUTLER, *supra* note 1, at 24-26.

[453] *See supra* note 439.

[454] Indeed, comparable things have happened in the Russian oil industry, a sector no less high-profile or politically important than the space industry. *See* Nils Pratley, *Taking a Stake in Rosneft is a Big Gamble for BP,* THE GUARDIAN (Oct. 22, 2012), https://www.theguardian.com/business/nils-pratley-on-finance/2012/oct/22/stake-rosneft-gamble-bp.

illustrates, such a change conceivably could happen at the whim of the administration, with little recourse.

Partnering with a Russian space company on a given project is likely a better option. Nothing that the author has seen in Russian space law forbids such partnerships. Of course, every country has export-control regimes, international trade rules and foreign policy concerns that sometimes lead to sanctions. That is, space technology is sensitive, both for its potential military use and its reflection of national prestige and Russia is certainly no stranger to international drama. So, any entity seeking to partner with a Russian space company must weigh the risks of failing to comply with their home country's legal regimes, as well as any other concerns they may have about doing business with entities serving the interests of the Russian State.

The author sees no reason for this situation to change any time soon. Russia's legislators have reorganized the space industry such that the State is the predominant entity. It is not as if this is a new experiment. Rather, this is a return to something like the familiar Soviet model. The experiment, in the wider historical context, was the departure from the State-centered model in the early 1990s. Clearly, Russia's legislators have decided that that experiment should not continue and its ideals have fallen back to Earth. The author expects that it would take something extraordinary to transition Russia's space law regime toward a new experiment with liberalization, something like a generational change in leadership.

QUANTUM BITS OF LIGHT: THE FUTURE OF QUANTUM KEY DISTRIBUTION UNDER EXPORT ADMINISTRATION REGULATIONS AND THE FIRST AMENDMENT

Marshall McKellar[*]

ABSTRACT

Modern advances in encryption technology, such as the quantum key distribution method—using entangled photons to transmit secret keys[1]—have begun a worldwide race to achieve truly unbreakable cryptography. In a world held captive by constantly emerging stories of cyber-attacks, national security breaches and government mass surveillance, issues involving privacy and communication technology are now at the forefront of cultural dialogue. Within the past several years, secure communication icons like Edward Snowden, Julian Assange and Anonymous have become household names, greatly influencing international politics and mainstream media. The key ingredient to many of these world-changing events is reliable encryption methods that allow information activists to securely and anonymously communicate anything from personal emails to top secret government files. Although issues related to encryption source code have been adjudicated in the federal court system with some positive results, the future of

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[1] *See* Eleni Diamanti et al., *Practical Challenges in Quantum Key Distribution,* 2 NPJ: QUANTUM INFO. 1, 1 (2016).

cryptography—specifically advances associated with quantum cryptography (quantum key distribution)—remains unsecured under both federal First Amendment[2] jurisprudence and the United States (US) Export Administration Regulations (EAR). This Article will seek to illuminate the legal landscape surrounding encryption and suggest both judicial and regulatory clarifications to help ensure the future accessibility and use of quantum encryption technology. This Article will first provide a brief overview of how modern commercial encryption works, describing how it has advanced in recent years from fairly straightforward computer software to ultra-sophisticated methods of transmitting secret keys using the physics of quantum entanglement.[3] Next, it will summarize key court decisions related to encryption and the First Amendment; namely, *Junger v. Daley* and *Bernstein v. Department of Justice*. This Article will then analyze the current regulatory framework for the export of quantum cryptography technologies under Category 5, Part 2 of the EAR's Commerce Control List. Finally, this Article will assess—in light of current EAR regulations and *Junger v. Daley*—whether the future development and potential widespread public use of quantum cryptographic technology in the US is at risk under the current judicial landscape/export regulatory regime and what changes are necessary to protect it.

I. INTRODUCTION

Over two thousand years ago, Julius Caesar maintained military secrecy by using a process already ancient in its application. Trusting no one (including his messengers), Caesar replaced every A in his messages with a D, every B with an E and so on for every letter in the alphabet, ensuring that only someone who knew the "shift by 3 key" could decipher his messages.[4] This process of using a secret "key" to correctly assemble a jumbled, unintelligible mess

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[2] U.S. CONST. amend. I ("Congress shall make no law respecting an establishment of religion, or prohibiting the free exercise thereof; or abridging the freedom of speech, or of the press; or the right of the people peaceably to assemble, and to petition the Government for a redress of grievances.").

[3] *See* NETWORK ASSOCS. INC., AN INTRODUCTION TO CRYPTOGRAPHY 11 (1998), http://www.ncsa.illinois.edu/People/ncsairst/pgp/IntroToCrypto.pdf; Sheng-Kai Liao, et al., *Satellite-to-Ground Quantum Key Distribution*, 549 NATURE 43 (2017).

[4] NETWORK ASSOCS. INC., *supra* note 3, at 11.

of letters is called encryption.[5] Two millennia later, the military strategists of Nazi Germany implemented a similar (yet dramatically more sophisticated) encryption method using their famed Enigma machines.[6] Only after years of endless labor by many of the world's most talented cryptographers—along with significant advances in computing technology—was the Enigma code cracked, allowing Allied forces to gain an upper hand in the Atlantic theater.

Modern advances in encryption technology such as the quantum key distribution method—using entangled photons to transmit secret keys[7]—have begun a worldwide race to achieve truly unbreakable cryptography. In a world held captive by constantly emerging stories of cyber-attacks, national security breaches and government mass surveillance, issues involving privacy and communication technology are now at the forefront of cultural dialogue. Within the past several years, secure communication icons like Edward Snowden, Julian Assange and Anonymous have become household names, greatly influencing international politics and the mainstream media. The key ingredient to many of these world-changing events is reliable encryption methods, allowing information activists to securely and anonymously communicate anything from personal emails to top secret government files.

Due to its powerful social and military uses, encryption technology was closely regulated in the US under the International Traffic in Arms Regulations (ITAR) for many years. However, this began to change in November of 1996 when President Clinton transferred commercial encryption technology from the ITAR to the Export Administration Regulations (EAR) regime.[8] Although this act had the appearance of reducing some regulatory hurdles for the export of encryption, the US government maintained a consistently firm grip on nearly every facet of encryption technology under the

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[5] *Id.* at 1.

[6] Junger v. Daley, 8 F. Supp. 2d 708, 712 (N.D. Ohio 1998), *rev'd*, 209 F.3d 481, 482-83 (6th Cir. 2000).

[7] Diamanti, et al., *supra* note 1, at 1.

[8] President Clinton shifted licensing authority for nonmilitary encryption technologies from the State Department (ITAR) to the Department of Commerce via Exec. Order No. 13,026, 61 Fed. Reg. 58,767 (1996). The Department of Commerce then created regulations under the EAR to manage and license the export of encryption technology. These new regulations were to be administered by the Bureau of Export Administration (BXA) per 61 Fed. Reg. 68,572 (1996) (codified at 15 C.F.R. §§ 730-74 (2020)).

EAR. Both before and after the Clinton shift, cryptographers brought suits against the government to enjoin the enforcement of any regulation whatsoever on 1990's era cryptography, claiming free speech protection as enshrined in the First Amendment of the US Constitution. Two notable plaintiffs eventually won influential holdings from both the Sixth[9] and Ninth[10] federal circuit courts of appeals.

Although issues related to encryption source code have been adjudicated in the federal court system with some positive results, the future of cryptography—specifically advances associated with quantum cryptography (quantum key distribution)—remains unsecured under both federal First Amendment jurisprudence and the EAR. This Article will seek to illuminate the legal landscape surrounding encryption and suggest both judicial and regulatory clarifications to help ensure the future accessibility and use of quantum encryption technology. This Article will first provide a brief overview of how modern commercial encryption works, describing how it has advanced in recent years from fairly straightforward computer software to ultra-sophisticated methods of transmitting secret keys using the physics of quantum entanglement.[11] Next, it will summarize key court decisions related to encryption and the First Amendment; namely, *Junger v. Daley* and *Bernstein v. Department of Justice*. This Article will then analyze the current regulatory framework for the export of quantum cryptography technologies under Category 5, Part 2 of the EAR's Commerce Control List. Finally, this Article will assess—in light of current EAR regulations and *Junger*/*Daley*—whether the future development and potential widespread public use of quantum cryptographic technology in the US is at risk under the current judicial landscape/export regulatory regime and what changes are necessary to protect it.

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[9] *See Junger*, 8 F. Supp. 2d at 708.

[10] *See* Bernstein v. U.S. Dep't of Justice, 176 F.3d 1132, 1133 (9th Cir. 1999), *reh'g granted*, *opinion withdrawn*, 192 F.3d 1308 (9th Cir. 1999).

[11] *See generally* NETWORK ASSOCS. INC., *supra* note 3. *See also* Liao et al., *supra* note 3.

II. ENCRYPTION: A BRIEF OVERVIEW

A. Conventional and Public Key Cryptography

The primary purpose of cryptography is to ensure secrecy and confidentiality. In an alternate universe built entirely on trust, the science of cryptography would exist only as a mathematical game; however, in this reality, cryptography is the means by which two people may exchange information in such a way as to protect it from the prying eyes of untrusted third parties. Encryption serves as a powerful shield against totalitarian regimes, snooping government agencies and even our favorite social media providers.

As previously mentioned, encryption has origins as a weapon of war, only recently becoming accessible to the American public during the Clinton Era.[12] However, even before the Clinton administration moved encryption technologies from the ITAR to the EAR, an anti-nuclear activist named Phil Zimmerman developed an encryption program called Pretty Good Privacy (PGP) and—in 1991—uploaded it to a primordial version of the internet.[13] PGP spread like wildfire across the globe, finding its way into democratic and totalitarian countries alike.[14] Zimmerman's program became the archetype for how modern cryptography is used and understood by the masses.[15] Using the relative simplicity of PGP as a helpful example, this section will provide a brief overview of how modern encryption works. It will then briefly assess one of the world's most anticipated encryption technologies—quantum key distribution (QKD)—and its potential world-shaping applications.

To better understand how encryption works, let's use our friends, Harry and Ginny, as an example. Harry writes Ginny an email in standard English professing his love for her; this standard email message is called *plaintext* or *cleartext*.[16] However, Harry has a nagging suspicion that Ginny's professor, Severus, secretly has access to Ginny's school email account from his office at the school of magic. In order to ensure that only Ginny can read his epic love letter, Harry looks for free encryption software on the internet.

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[12] *See Bernstein*, 176 F.3d at 1136.
[13] *See* ANDY GREENBERG, THIS MACHINE KILLS SECRETS 70-93 (2012).
[14] *Id.* at 74-75.
[15] *See id.* at 70-93.
[16] NETWORK ASSOCS. INC., *supra* note 3, at 11.

Good encryption software would allow Harry to encrypt his plaintext letter, turning it into a heap of "unreadable gibberish" called ciphertext.[17] Harry quickly finds several "conventional" encryption programs that use something called a *key*—essentially a gigantic numerical value that plugs into a cryptographic algorithm—to mathematically scramble (encrypt) and unscramble (decrypt) his plaintext letter.[18] However, this conventional encryption method has potential security risks. Because conventional cryptography uses a single key to both encrypt and decrypt a plaintext, Harry would need to communicate the secret key to Ginny so she could use it to decrypt and read Harry's email. This would be a non-issue if Ginny still lived in the dormitory down the hall from Harry's, but alas, she is on summer vacation in the Galapagos islands studying Hungarian Horntails. Ginny's only method of communication is through her email account.

Fearing that Severus would intercept an email containing his secret key, Harry abandons conventional encryption in favor of a more secure alternative called *public key cryptography* (PKC). Unlike conventional encryption, PKC uses at least two keys for encryption: a public (non-secret) key for encrypting plaintext, and a corresponding secret key for decrypting it.[19] Instead of sending a shared secret key across potentially unsecure networks, Harry and Ginny can each create a public key and share them freely online, whilst keeping their private keys safely hidden on a local hard-drive.[20] Harry would then encrypt his love letter using Ginny's easily accessible public key.[21] Because the numerical value of Ginny's secret key is derived directly from her public key, it ensures that Ginny alone can open an email encrypted by her public key. Although it is theoretically possible to extract Ginny's secret key from her public key, such a feat would require computing resources beyond that of her snooping professor.[22] One of the most prolific, user friendly versions of public key cryptography is none other than a free version of Phil Zimmerman's PGP software called OpenPGP. OpenPGP is

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[17] *Id.*
[18] *Id.* at 12.
[19] *Id.* at 14.
[20] *Id.*
[21] *Id.*
[22] NETWORK ASSOCS. INC., *supra* note 3, at 15.

public key encryption with an additional (third) key to help protect a user's secret key from potential attackers.[23]

Because most encryption "hacking" techniques (a.k.a. cryptanalysis) use data patterns found within a plaintext to unscramble its cyphertext, OpenPGP first compresses the plaintext, reducing patterns in the plaintext data to greatly enhance its encryption strength.[24] Next, OpenPGP encrypts the compressed plaintext with a randomly generated, one-time *session key*.[25] The program then encrypts that one-time session key using the intended recipient's public key.[26] Finally, this two-fold encryption package is sent to the recipient, who can then use his/her secret key to unlock the public key encrypted one-time session key.[27] This in turn can decrypt a ciphertext into readable plaintext.[28] Consequently, even if Severus intercepts Harry's email, he will receive nothing more than an infinitely complex jumble of meaningless characters. Thus, with no plaintext data patterns to crack and Ginny's secret key hidden safely in the Galapagos islands, Harry and Ginny's love story remains as it should: private.

Although Harry and Ginny's use of public key encryption may thwart Severus at first, their communications remain at risk. For example, Severus could download OpenPGP and create a private/public key pair that looks nearly identical to Ginny's, potentially fooling Harry into encrypting his communications to Severus' public key. To help battle potential identity fraud, OpenPGP implements an identity authentication system using *digital signatures* [29] and *hash functions*.[30] On its face, digital signatures are fairly simple: "[i]nstead of encrypting information using someone else's public key, you encrypt it with your private key. If the information can be decrypted with your public key, then it must have originated with you;" thereby assuring authenticity of origin.[31] Hash functions take a "variable length input—in this case, a message of any length, even

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[23] *Id*. at 16.
[24] *Id*.
[25] *Id*.
[26] *Id*.
[27] *Id*. at 17.
[28] NETWORK ASSOCS. INC., *supra* note 3, at 17.
[29] *Id*. at 18.
[30] *Id*. at 19.
[31] *Id*.

thousands or millions of bits—and produces a fixed length output."[32] The final result is an encrypted digital signature that cannot be altered or detached from the document in any way without causing the digital signature verification process to fail.[33]

B. Quantum Key Distribution

Unfortunately, even if Harry and Ginny implement OpenPGP's three-key system and digital signature verification process, Severus could potentially—given enough time—invest all of his assets to build a supercomputer capable of extracting Ginny's secret key from her public key. This is the inherent problem for practically all encryption systems that rely on "the perceived computational intractability of certain mathematical functions."[34] Despite the mathematic complexity of public key algorithms, "such schemes do not provide information-theoretic security because they are vulnerable to future advances in hardware and algorithms."[35] One of the most radical threats to public key encryption methods is the development of powerful quantum computers.[36] Ironically, this purported bane of effective cryptography is also its potential savior. Whereas quantum computers will likely render obsolete the algorithmic firewalls of public key encryption, quantum encryption may soon redefine the science of cryptography by providing practically fail-proof secret key distribution.[37]

Quantum cryptography promises "unconditional security—the Holy Grail of communication security—based on the laws of physics only."[38] The principle behind QKD's effectiveness is the *quantum non-cloning principle*, which "forbids eavesdroppers from creating copies of a transmitted quantum cryptographic key."[39] To illustrate

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[32] *Id*.
[33] *Id*. at 20.
[34] Liao et al., *supra* note 3, at 43.
[35] Diamanti et al., *supra* note 1, at 1.
[36] *Id*.
[37] *See id.*
[38] *Id*.
[39] *The No-cloning Theorem*, QUANTIKI (October 26, 2015), https://www.quantiki.org/wiki/no-cloning-theorem ("Fundamentally, the no-cloning theorem protects the uncertainty principle in quantum mechanics. If one could clone an *unknown* state, then one could make as many copies of it as one wished, and measure each dynamical variable with arbitrary precision, thereby bypassing the uncertainty principle. This is prevented by the non-cloning theorem.").

how QKD works, let's return to our hopeless lovers, Harry and Ginny. Much to their dismay, Severus sells all of his magical belongings to purchase a brand-new quantum supercomputer for the sole purpose of decrypting Harry and Ginny's secret keys from their public keys. In response, the ever-resourceful couple hires their brilliant friend, Dobby, to build a sophisticated QKD system they can use to thwart Severus' newfound computing power. Current QKD systems are designed to transmit information by sending entangled pairs of single photons through either optical fibers (lines of fiber-optic cables), free space (satellite-to-ground transmission), or a combination of the two methods.[40] This allows distant users to securely produce a secret key made up of "a common, random string of secret bits," capable of encrypting and decrypting confidential messages.[41] Because mere observation alone disturbs particles at the quantum level, "any eavesdropper on the quantum channel attempting to gain information about the key will inevitably introduce disturbances into the system, and so can be detected by the communicating users."[42] The benefits of such a system guarantee users not only the potential un-crackability of secret keys (for now), but also unquestionable certainty as to whether a secret key experienced any attempted observation or tampering. This technology would allow for an unprecedented level of confidence in secure-communication.

i. The Optical Fiber Method

The most straightforward method of practicing QKD is by sending photons through fiber optic cables. However, the effectiveness of this system decreases exponentially as distance increases. "Unlike classical telecommunications, the quantum signal in QKD cannot be noiselessly amplified, owing to the quantum non-cloning theorem, limiting the maximum distance for secure QKD to a few hundred kilometres."[43] In fact, a recent study by Chinese scientists calculated that sending even a single bit key over a 1,200 km fiber

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[40] Liao et al., *supra* note 3, at 43.

[41] *Id*.

[42] *Id*. *See also* Duncan Graham-Rowe, *Quantum Cryptography for the Masses*, MIT TECH. REV. (Aug. 28, 2009), https://www.technologyreview.com/s/415073/quantum-cryptography-for-the-masses/.

[43] Liao et al., *supra* note 3, at 43.

would take approximately six million years.[44] Despite this significant hurdle, companies around the world are developing technology to solve the problem of distance for key transmission across fiber. [45]

ii. The Satellite-to-Ground Method

A more encouraging solution for efficient global QKD is through the use of quantum satellites in space.[46] Due to the relative thinness of the Earth's atmosphere in low-earth-orbit, "satellite-to-ground connections has significantly reduced losses. This is mainly because . . . most of the propagation path of photons is in empty space with negligible absorption and turbulence."[47] China is currently experimenting with satellite-based QKD using its Quantum Experiments at Space Scale (QUESS) spacecraft, the very first quantum satellite launched into orbit.[48] The QUESS spacecraft has successfully performed QKD during daily routines of 273 second periods, and at distances of up to 1200 kilometers.[49] During the course of these 273 second periods, ground stations collected as many as 1,671,072 bits of sifted keys.[50] To put this performance level in perspective, "at 1200 km, the channel efficiency of the satellite-based QKD over the 273-s coverage time is 20 orders of magnitudes higher than that achieved using the optical fiber."[51] In short, the future of cryptography is space-based.

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[44] *Id*. at 46.

[45] *See Battelle to Test Quantum Key Distribution on Ohio Fiber-optic network*, LIGHTWAVE (Sept. 8, 2014). http://www.lightwaveonline.com/articles/2014/09/battelle-to-test-quantum-key-distribution-on-ohio-fiber-optic-network.html; Graham-Rowe, *supra* note 42.

[46] Liao et al., *supra* note 3, at 43.

[47] *Id*.

[48] Mike Wall, *China Launches Pioneering 'Hack-Proof' Quantum-Communications Satellite*, SPACE.COM (Aug. 16, 2016), https://www.space.com/33760-china-launches-quantum-communications-satellite.html; Gabriel Popkin, *China's Quantum Satellite Achieves 'Spooky Action' at Record Distance*, SCIENCE (June 15, 2017), http://www.sciencemag.org/news/2017/06/china-s-quantum-satellite-achxieves-spooky-action-record-distance.

[49] Liao et al., *supra* note 3, at 46.

[50] *Id*.

[51] *Id*.

iii. Future applications

If the future of effective private communication is dependent on immeasurably expensive trans-continental fiber-optic cables and billion-dollar quantum satellites, the general public is at a severe disadvantage compared to the deep pockets of mega-corporations and world governments. Thankfully, there has been a "tremendous scientific and engineering effort" towards creating a global quantum internet, complete with accessible QKD encryption.[52] By syncing a series of quantum satellites in a constellation around the Earth, quantum keys can be distributed from New York to Sydney with relative speed and efficiency.[53] Short fiber-optic cables could then be used to create metropolitan quantum networks, "sufficient and convenient to connect numerous users in a city over distance scales of approximately 100 km."[54] Such networks would make quantum cryptography available on a global scale;

The long-term vision is for each user to use a simple and cheap transmitter and outsource all the complicated devices for network control and measurement to an untrusted network operator… The important advantage is that the network operator can be completely untrusted without compromising security.[55]

Although the demise of public key encryption is likely a ship fast approaching on the horizon, QKD must overcome a litany of challenges before it is ready to replace its conventional predecessor. Developers must launch many QKD-capable satellites at higher orbits, increase com-link efficiency, employ more advanced telescopes for tracking and enhance wave-front correction capabilities before quantum satellite constellations become sufficiently reliable.[56] However, before this wondrous technology becomes widely accessible in the US, it would behoove secure communication advocates to assess whether the current judicial and regulatory infrastructure is prepared to facilitate these advances in technology and privacy. If QKD is the future of secure communication, should it not be protected as zealously as communication itself?

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[52] Diamanti et al., *supra* note 1, at 1.
[53] *Id*. at 9.
[54] Liao et al., *supra* note 3, at 47.
[55] Diamanti et al., *supra* note 1, at 8.
[56] Liao et al., *supra* note 3, at 47.

III. ENCRYPTION AND THE COURTS

Encryption as a scientific and communicative discipline has experienced relatively little adjudication in the US. The lion's share of judicial material is derived from two district court cases: *Junger v. Daley*[57] and *Bernstein v. U.S. Department of Justice*.[58] Despite both cases dealing almost exclusively with mere source-code for encryption software, the holdings from both the Sixth and Ninth Circuits provide helpful insight as to how the judicial system will likely approach the use of encryption-related technologies going into the future. This section will analyze the holdings from both cases, with an eye towards how the Courts' decisions could potentially impact the future use and development of encryption technologies like QKD.

A. Bernstein v. U.S. Department of Justice

Spanning three district court decisions before reaching the Ninth Circuit, *Bernstein* is by far the more expansive of the two encryption cases. Daniel J. Bernstein was a professor in the Department of Mathematics, Statistics and Computer Science at the University of Illinois at Chicago.[59] As a doctoral student at the University of California, Berkeley, he had developed a "zero-delay private-key stream encryptor" called "Snuffle." Bernstein wished to publish a description of his encryption method via both a paper (containing analysis and mathematical equations) and multiple computer programs written in the "C" programming language. The content of this programming constituted the source code for Bernstein's encryption program.[60] However, at that time encryption software was listed under the ITAR's munitions control list. Consequently, the US State Department labeled Snuffle as a munition under the ITAR and demanded that Bernstein acquire a license to "export" (publish, sell, or share online) any aspect of the program.[61] Thus began a legal battle lasting the better part of four years.

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[57] Junger v. Daley, 8 F. Supp. 2d 708 (N.D. Ohio 1998), *rev'd*, 209 F.3d 482 (6th Cir. 2000).

[58] Bernstein v. U.S. Dep't of Justice, 176 F.3d 1132 (9th Cir. 1999), *reh'g granted*, *opinion withdrawn*, 192 F.3d 1308 (9th Cir. 1999).

[59] *Id*. at 1135.

[60] *Id*. at 1135-36.

[61] *Id*. at 1136.

In response to the State Department's decision, Bernstein filed an action challenging the constitutionality of the ITAR's regulations on encryption technology, winning an initial holding from the district court that encryption source code was a form of expression protected by the First Amendment.[62] Subsequently, the district court granted Bernstein summary judgment on his First Amendment claims, holding the ITAR's encryption regulations as an invalid prior restraint on speech.[63] In the wake of Bernstein's victory over the oppressive ITAR regime, the Clinton administration coincidentally shifted export control of commercial encryption from the Department of State (ITAR) to the Department of Commerce (EAR).[64] The Department of Commerce then created EAR regulations to govern the export of encryption technology.[65]

In an epic show of audacity, Bernstein then amended his complaint to add the Department of Commerce as a defendant, making the same constitutional claims against the EAR's export regulations.[66] Once again, the district court granted summary judgment in Bernstein's favor, finding the EAR regulations facially invalid as a prior restraint on the freedom of expression.[67] The Department of Commerce then appealed the district court's decision, leading to a holding from the Ninth Circuit Court of Appeals.

Although the EAR's regulation was theoretically less restrictive than previous ITAR regulations, the circuit court observed that any encryption falling within the coverage of the EAR required a prepublication license prior to an "export."[68] An export included publishing encryption software using any global medium, including the internet, if such publication would allow access by a foreign national.[69] The regulations held that printed materials containing encryption source code did not require a license; however the same source code would require a license if included on "machine-readable media," like CD-ROMs.[70] Furthermore, even printed source

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[62] Bernstein v. U.S. Dep't of State, 922 F. Supp. 1426 (N.D. Cal. 1996).
[63] Bernstein v. U.S. Dep't of State, 945 F. Supp. 1279 (N.D. Cal. 1996).
[64] *Bernstein*, 176 F.3d at 1136.
[65] *Id*.
[66] Bernstein v. U.S. Dep't of State, 974 F. Supp. 1288, 1292 (N.D. Cal. 1997).
[67] *Id*.
[68] *Bernstein*, 176 F.3d at 1138.
[69] *Id*.
[70] *Id*.

code required a license if the printed material could be easily scanned and uploaded onto a computer.[71] This overt ambiguity continued into the actual licensing process. For any export of encryption technology, the EAR took a "case-by-case" analysis to determine whether the export was "consistent with U.S. national security and foreign policy interests."[72] A license application was then sent to the President no later than 90 days after its submission; however, the regulations stated no limit as to how long the President could pocket the application.[73] If the President eventually returned a negative verdict, an applicant had the right to administrative appeal only "within a reasonable time."[74] Furthermore, any final administrative decision was not subject to judicial review.[75]

In defense of the EAR's licensing system, the government argued that encryption source code is different from other forms of expression because one can use it to directly operate a computer.[76] Essentially, its functional aspects outweigh its expressive aspects.[77] However, the court held that, "this cannot be so . . . The First Amendment is concerned with expression, and we reject the notion that the admixture of functionality necessarily puts expression beyond the protections of the Constitution."[78] As to whether encryption source code constitutes expression, the court held that:

> cryptographers use source code to express their scientific ideas in much the same way that mathematicians use equations or economists use graphs. . . . [M]athematicians and economists have adopted these modes of expression in order to facilitate the precise and rigorous expression of complex scientific ideas. . . . [C]ryptographers utilize source code in the same fashion.[79]

Because encryption source code constitutes constitutionally protected expression, the court held that any licensing regime

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[71] *Id.*
[72] *Id.*
[73] *Id.*
[74] *Bernstein*, 176 F.3d at 1138.
[75] *Id.*
[76] *Id.* at 1141-42.
[77] *Id.* at 1142.
[78] *Id.*
[79] *Id.* at 1141.

placing restrictions upon the dissemination of encryption source code is subject to facial challenge as a prior restraint:[80]

> A licensing regime is always subject to facial challenge as a prior restraint where it [1] "gives a government official or agency substantial power to discriminate based on the content or viewpoint of speech by suppressing disfavored speech or disliked speakers," and [2] has "a close enough nexus to expression, or to conduct commonly associated with expression, to pose a real and substantial threat of . . . censorship risks."[81]

Because prior restraints on speech and publication are "the most serious and least tolerable infringement on First Amendment Rights,"[82] the court applied a three-factor test to determine whether the EAR regulations constituted a valid prior restraint on encryption source code. For a licensing scheme to impose a valid prior restraint on expression, the court held it must satisfy the following three factors: "(1) any restraint must be for a specified brief period of time; (2) there must be expeditious judicial review; and (3) the censor must bear the burden of going to court to suppress the speech in question and must bear the burden of proof."[83] After applying these three factors to the EAR's regulations on encryption, the court found that there was no time limit governing when the President had to return a verdict on applications, and there was no firm time limit governing the internal appeals process.[84] Therefore, the court found that "the challenged regulations allow the government to restrain speech indefinitely" and "[a]s a result, Bernstein and other scientists have been effectively chilled from engaging in valuable scientific expression."[85] The court's holding was a major victory not only for Bernstein and his Snuffle program, but also computer programmers, encryption users and political activists around the world.

However, the court didn't stop there. In addition to liberating encryption source code from a First Amendment standpoint, Judge

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[80] *Bernstein*, 176 F.3d at 1132.

[81] *Id*. at 1139 (quoting Lakewood v. Plain Dealer Publ'g Co., 486 U.S. 750, 759, (1988)).

[82] *Id*. at 1138 (quoting Nebraska Press Ass'n v. Stuart, 427 U.S. 539, 559 (1976)).

[83] *Id*. at 1144.

[84] *Id*.

[85] *Id*. at 1145.

Fletcher also took several more steps down the path to protecting the free use of encryption for years to come. She first recognized that the science of cryptography "has blossomed in the civilian sphere, driven on the one hand by dramatic theoretical innovations within the field, and on the other by the needs of modern communication and information technologies."[86] In response to these communication and information needs, she stated, "It is the cryptographer's primary task to find secure methods to encrypt messages, making them unintelligible to all except the intended recipients."[87] Here, Judge Fletcher distinguished the critical difference between general encryption and encryption that actually works. The fact that a particular source code satisfies one's definition of "encryption technology" does not necessitate said technology's ability to protect private information. In regards to the importance of privacy, Judge Fletcher states:

> [T]he government's efforts to regulate and control the spread of knowledge relating to encryption may implicate more than the First Amendment rights of cryptographers. In this increasingly electronic age, we are all required in our everyday lives to rely on modern technology to communicate with one another. This reliance on electronic communication, however, has brought with it a dramatic diminution in our ability to communicate privately.[88]

As Judge Fletcher was writing this opinion in 1999, cell phones were a fairly new and bulky commodity, email had only recently begun to overtake snail mail and the monstrous social media industry was not even a twinkle in Mark Zuckerberg's eye. This is a stark contrast to today's world, where smart phones and social media apps shape everything from how we grocery shop to who we elect as President. Nearly two decades ago, Judge Fletcher could already see the importance of encryption far beyond mere source code printed in university textbooks. In the court's holding, she writes that the free use of encryption likely involves not only the freedom of expression guaranteed under the First Amendment, but also the right of privacy secured by the Fourth Amendment:

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[86] *Bernstein*, 176 F.3d at 1137.
[87] *Id*.
[88] *Id*. at 1145.

> The availability and use of *secure* encryption may offer an opportunity to reclaim some portion of the privacy we have lost. Government efforts to control encryption thus may well implicate not only the First Amendment rights of cryptographers intent on pushing the boundaries of their science, but also the constitutional rights of each of us as potential recipients of encryption's bounty. Viewed from this perspective, the government's efforts to retard progress in cryptography may implicate the Fourth Amendment, as well as the right to speak anonymously.[89]

Although the circuit court subsequently held that the case be reheard by the court *en banc* and withdrew its opinion,[90] Judge Fletcher's forward thinking set a strong precedent for future adjudication of regulatory issues involving encryption technology.

B. Junger v. Daley

Peter Junger was a professor at the Case Western University School of Law and maintained sites on the internet that included information about his "Computers and the Law" course.[91] Junger wished to post source code on his website demonstrating how computers work; however, at the time, such a posting was defined as an export under EAR regulations.[92] Junger submitted three applications to the Commerce Department requesting determinations of commodity classifications for encryption software programs and other items. Although the Commerce Department found that printed source code in the first chapter of Junger's *Computers and the Law* textbook was allowable, his other submissions of various software programs were not allowable without a license.[93] Consequently, Junger filed "an action to make a facial challenge to the Regulations on First Amendment grounds, seeking declaratory and injunctive relief that would permit him to engage in the unrestricted distribution of encryption software through his web site."[94]

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[89] *Id*. at 1146 (emphasis added).
[90] Bernstein v. U.S. Dep't of Justice, 192 F.3d 1308, 1309 (9th Cir. 1999).
[91] Junger v. Daley, 209 F.3d 481, 483 (6th Cir. 2000).
[92] *Id*.
[93] *Id*. at 484.
[94] *Id*.

Following in the footsteps of *Bernstein*, the Sixth Circuit held that "[t]he issue of whether or not the First Amendment protects encryption source code is a difficult one because source code has both an expressive feature and a functional feature."[95] However, "[t]he fact that a medium of expression has a functional capacity should not preclude constitutional protection."[96] Quoting the Supreme Court in *Roth v. United States*, the court in *Junger* states, "'all ideas having even the slightest redeeming social importance,' including those concerning 'the advancement of truth, science, morality, and arts' have the full protection of the First Amendment."[97] However, subsequent to the oral arguments presented for this case, the Department of Commerce amended the EAR to relax license requirements for encryption technology. This forced the Sixth Circuit to reverse and remand the case for further consideration, pending whether Junger's constitutional standing survived the EAR's amended regulations.[98] Regardless of this hiccup in the adjudication process, the Sixth Circuit's opinion helped further solidify encryption source code's status as a form of protected speech under the First Amendment and reinforced that expression and utility can walk hand-in-hand.

For those encryption advocates hoping to find a sense of security in federal circuit court jurisprudence, *Junger* and *Bernstein* provide a mixed bag of results. On one hand, freely available encryption source appears safely within the protection of the First Amendment, expression and utility can co-exist and the government is barred from chilling scientific discussion. On the other hand, these cases were adjudicated nearly twenty years ago, involved antiquated encryption technology and neither of the courts' holdings are truly final. Additionally, Judge Fletcher's analysis of encryption's potential Fourth Amendment implications is in dire need of elaboration. Taking into account both the positive and negative results of these cases, one is left standing on a proverbial iceberg: safely afloat for now, but for how long?

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[95] *Id*.
[96] *Id*.
[97] *Junger*, 209 F.3d at 484 (quoting Roth v. United States, 354 U.S. 476, 484 (1957)).
[98] *Id*. at 485.

IV. THE EXPORT ADMINISTRATION REGULATION

Recall now that thanks to Dobby, Harry and Ginny have QKD capabilities and are able to communicate without the fear of unwanted observation by Severus, at least for now. Because of this technological success, Dobby is quite proud of his handy invention and wishes to share the technology with the world—both by freely publishing the source code and object code for his QKD device on the internet, and also by selling hardware components capable of using his code to transmit secret quantum-entangled keys. Having studied the circuit courts' opinions in *Bernstein* and *Junger*, Dobby now seeks to discover whether he will encounter any regulatory roadblocks when distributing his products. In general, the EAR is a dense, convoluted corn maze; a maze riddled with notes, notes to notes and complicated exceptions. Nonetheless, to help Dobby with his investigation, the next section of this paper will briefly summarize EAR regulations currently in place for encryption technology and analyze what protections and restrictions are in place for both conventional cryptography and future technology, such as quantum key distribution.

Generally, the EAR regulates items listed under its Commerce Control List (CCL) in adherence to the US obligations under the Wassenaar Arrangement.[99] Category 5, Part 2 of the CCL lists all regulated items associated with cryptography in sections 5A002, 5A992, 5A004, 5B002, 5D002, 5D992 and 5E002.[100] These sections of the list include "cryptography for data confidentiality having 'in excess of 56 bits of symmetric cryptographic strength key length'" items "designed/modified to enable, by means of 'cryptographic activation,' an item to achieve/exceed [56 bits]," and items "designed/modified to use or perform 'quantum cryptography (Quantum Key Distribution—QKD).'"[101] These three item descriptions alone encompass a vast percentage of encryption technology, including encryption source code, software like PGP and QKD capable

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[99] *See* The Wassenaar Arrangement on Export Controls for Conventional Arms and Dual-Use Goods and Technologies (1996); 15 C.F.R. § 743.1 (2020).

[100] *See* 15 C.F.R. § 774, Supp. 1, Cat. 5. *See also* BUREAU OF INDUS. & SEC., QUICK REFERENCE GUIDE CATEGORY 5 PART 2 – INFORMATION SECURITY: ECCN 5X (July 2017), https://www.bis.doc.gov/index.php/documents/new-encryption/1652-cat-5-part-2-quick-reference-guide/file [hereinafter APPENDIX A].

[101] APPENDIX A, *supra* note 100.

hardware. Because any item on the list requires a license to export, it appears there is a radical disconnect between the circuit court's decisions in *Junger* and *Bernstein* and current EAR regulations. However, CCL's broad regulatory umbrella comes with a number of notable exceptions; the most important of which offer apparent regulatory breaks for (1) published items,[102] (2) mass market items[103] and (3) items falling under license exception ENC.[104]

A. Published Items

15 C.F.R. § 734.7(a) states that, "unclassified 'technology' or 'software' is 'published,' and is thus not 'technology' or 'software' subject to the EAR, when it has been made available to the public without restrictions upon its further dissemination" in a number of ways, including: in libraries, at conferences, on the internet, in written manuscripts, in computer readable datasets, at open gatherings and for researchers of fundamental research.[105] However, 15 C.F.R. § 734.7(b) appears to directly contradict itself, stating that this exception does not apply to encryption object code software (primarily functional code),[106] unless it's corresponding source code (primarily expressive code)[107] meets the prepublication criteria set out in section 742.15(b).[108] This section once again states that encryption source code made publicly available is not subject to the EAR; however, "[y]ou must notify the [Bureau of Industry and Security] (BIS and the ENC Encryption Request Coordinator via email of the Internet location (e.g., URL or Internet address) of the publicly available encryption source code . . . ."[109] What we are left with is that both the directly functional object code and the expressive source

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[102] 15 C.F.R. § 734.7(a).

[103] 15 C.F.R. § 774, Supp. 1, Cat. 5, Part 2, Note 3.

[104] *See* 15 C.F.R. § 740.17 (2017). *See also License Exception ENC*, BUREAU OF INDUS. & SEC., https://www.bis.doc.gov/index.php/component/content/article/223-new-encryption/1234-740-17b2?Itemid=1050 (last visited Mar. 3, 2020).

[105] 15 C.F.R. § 734.7.

[106] Bernstein v. U.S. Dep't of Justice, 176 F.3d 1132, 1142 (9th Cir. 1999), *reh'g granted*, *opinion withdrawn*, 192 F.3d 1308 (9th Cir. 1999) (derived from source code, object code directly controls the functioning of a computer).

[107] *Id*. ("[T]he distinguishing feature of source code is that it is meant to be read and understood by humans, and that it cannot be used to control directly the functioning of a computer.").

[108] 15 C.F.R. § 734.7(b).

[109] *Id*. § 742.15(b).

code are essentially free from the EAR's grasp, on the condition that exporters of encryption software notify both the BIS and the NSA of where the software is made available on the internet. Perhaps this is a small price to pay for "freedom?"

B. Mass Market Items

Another way to avoid needing an EAR license for encryption technology is to sell it. Note 3 to category 5, part 2 of the CCL states that encryption software falling under 5A002 and 5D001(a)-(b)[110] is not controlled by the EAR if made "generally available to the public by being sold, without restriction."[111] This exception applies to a majority of encryption technology, expressly *excluding* items associated with QKD. However, in order for an item to be exempt under the mass market exception, 15 C.F.R. § 740.17(b) demands that the exporter submit either a yearly self-classification form, which is essentially a statement identifying the technology, or a one-time classification request that is similar to the self-classification form, only with a 30 day holding period.[112] After successfully completing whichever of these two classifications is required for a particular product, the majority of commercial encryption items are ready to be sold around the world.

C. License Exception ENC

Despite the arguably broad umbrella of the Published Item and Mass Market exceptions, several encryption technologies remain un-exempted; most notably, items associated with quantum encryption. Thankfully, License Exception ENC takes the reigns, providing that quantum cryptography may be exported without a license after the exporter submits (1) a classification request to BIS,[113] and (2) a semi-annual sales report[114] detailing the product's

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[110] *See* APPENDIX A, *supra* note 100.

[111] 15 C.F.R. § 774, Supp. 1, Cat. 5.

[112] *Id.* § 740.17(b).

[113] *See* BUREAU OF INDUS. & SEC., *supra* note 104. *See also Classification Request Guidelines*, BUREAU OF INDUS. & SEC., https://www.bis.doc.gov/index.php/licensing/commerce-control-list-classification/classification-request-guidelines (last visited Mar. 3, 2020).

[114] *See How to File a Semi-Annual Sales Report*, BUREAU OF INDUS. & SEC., https://www.bis.doc.gov/index.php/policy-guidance/encryption/4-reports-and-reviews/b-semi-annual-sales-report (last visited Mar. 3, 2020).

dissemination.[115] Upon submission of its classification request, a product becomes immediately eligible for export to a host of countries.[116] After 30 days, the product becomes eligible for export to nearly every country on Earth, save those labeled terrorist nations.[117]

V. QUANTUM KEY DISTRIBUTION AND THE FUTURE

Twenty-five years ago, cellular phones resembled cinder blocks, home computers were the size of a mini-fridge and the internet was a finite landscape one could traverse over a weekend. As our needs developed, so did these technologies. Today, basic smartphones and laptops cruise the now infinite internet at warp-speed, utilizing computing power beyond that of the previous generation's wildest dreams. Encryption technology has also developed and adapted to the changing times. Whereas PKC once stood as the bastion of secure communication, QKD has now risen to take its place, necessitated by privacy concerns and catalyzed by revolutionary scientific research. Although cryptographers once spoke primarily through various computer code languages, they now speak the language of particle physics, sending and receiving entangled photons rather than traditional computer code. To some, new languages seem foreign or even scary; nonetheless, just because something appears different does not mean it should be treated with hostility. It is the author's position that quantum encryption is the natural evolution of traditional encryption—a product of both the consumer's need for effective information security and the progression of scientific expression and exploration. This new "smartphone" of cryptography deserves equal or better protection than that afforded to traditional "cinder-block" forms of cryptography.

A. Key Points from Junger and Bernstein

Whether by sheer coincidence or strategic planning, the federal government managed to defer a final judgment in both *Junger* and *Bernstein* by actively shifting and amending language in the EAR. Although the absence of true final holdings is not ideal for

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[115] *Id.*
[116] *See* 15 C.F.R. § 740, Supp. 3.
[117] *Id.* § 740.17(b)(2).

encryption advocates, the court in both cases provided a modest well-spring of language protecting the free use and distribution of encryption source code. If applied analogously to QKD, this same language becomes an arsenal for protecting encryption technology going into the future.

For example, the court in *Bernstein* expressly rejected the notion that "the admixture of functionality necessarily puts expression beyond the protections of the Constitution."[118] In the same way that the court analogized cryptographers' use of source code to mathematicians' use of equations, modern cryptographers' use of QKD-capable software/hardware should be analogized to the use of traditional source code: a method by which scientists facilitate the "precise and rigorous expression of complex scientific ideas."[119] Similarly, the court in *Junger* held, "the fact that a medium of expression has a functional capacity should not preclude constitutional protection."[120] It is the author's stance that, because QKD has far more than a slight "redeeming social importance" and surely concerns "the advancement of truth, science, morality, and arts," it should have the full protection of the First Amendment.[121] Although QKD may sound futuristic and foreboding due to the oversaturation of sci-fi television with words like "quantum," it is a beacon of hope for entrepreneurs, major businesses and social or political advocates around the world relying on access to secure communication methods.

On the topic of security, Judge Fletcher emphasized that the cryptographer's primary task is to develop *secure* encryption methods, "making them unintelligible to all except the intended recipients . . . ."[122] Twenty-five years ago, programs like OpenPGP embodied this pursuit; however, modern technological developments demand that practitioners of free speech and scientific expression adopt secure communication on the quantum level. Judge Fletcher expressly stated that "never has our ability to shield our affairs from prying eyes been at such a low ebb" and that "the availability and use of secure encryption may offer an opportunity to reclaim

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[118] Bernstein v. U.S. Dep't of Justice, 176 F.3d 1132, 1142 (9th Cir. 1999), *reh'g granted*, *opinion withdrawn*, 192 F.3d 1308 (9th Cir. 1999).

[119] *Id.* at 1141.

[120] Junger v. Daley, 209 F.3d 481, 484 (6th Cir. 2000).

[121] *Id.* (quoting Roth v. United States, 354 U.S. 476, 484 (1957)).

[122] *Bernstein*, 176 F.3d at 1137.

some portion of the privacy we have lost," and posited that the free use of encryption implicates not only the freedom of expression guaranteed by the First Amendment, but also the right to privacy guaranteed by the Fourth Amendment.[123] Because of the fundamental nature of these rights, the court in *Bernstein* held that any licensing scheme imposing a restraint on the freedom of scientific expression must satisfy three factors: "(1) any restraint must be for a specified brief period of time; (2) there must be expeditious judicial review; and (3) the censor must bear the burden of going to court to suppress the speech in question and must bear the burden of proof."[124] This three-part test provided a sufficient legal standard to protect Bernstein's right to freely export encryption source code. If applied to modern day QKD, the same legal standard could serve as a moat surrounding the genesis of a QKD-capable society.

B. Key Points from the EAR

As previously shown, QKD technology is regulated relatively lightly under current EAR language. Exporting QKD under license exception ENC requires the submission of (1) a classification request to BIS and (2) a semi-annual sales report detailing the product's dissemination.[125] No, these requirements are not as severe as those faced by Bernstein and Junger in the mid-1990s; however, the prepublication requirements for QKD are more numerous and onerous than for conventional encryption. Because QKD technology is the natural evolution of conventional encryption methods, it is the author's position that QKD should share the same regulatory shelters as conventional encryption listed under section 5A002(a) of the CCL. Designating QKD under section 5A002(c) of the CCL sets it apart from encryption as a whole, exposing it to potential regulatory actions by lawmakers who neither understand nor have an interest in the future of QKD. Therefore, the EAR should be amended to include QKD under 5A002(a), moving it under the umbrella of both the published item[126] and mass market item[127] exceptions to

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[123] *Id.* at 1146.

[124] *Id.* at 1144.

[125] *See* 15 C.F.R. § 740.17(b) (2020). *See also* BUREAU OF INDUS. & SEC., *supra* note 113.

[126] *See* 15 C.F.R. § 734.7(a).

[127] *See* 15 C.F.R. § 774, Supp. 1, Cat. 5, Part 2, Note 3.

the EAR. By designating QKD under 5A002(a) of the CCL, it would receive the same protections as traditional encryption methods and ensure the free development, use and dissemination of this important technology.

VI. CONCLUSION

When the Department of State transferred encryption technology over to the Department of Commerce, Bernstein could have saved himself years of intense strain and effort by simply dropping his case and waiting to see how the new regime would respond to his requests. However, he immediately took pre-emptive action to protect his freedom of expression. As a society on the verge of a quantum revolution, we must also take pre-emptive steps to protect this evolution of scientific expression. Conducting routine, preventive maintenance on a vehicle is ordinarily less expensive than replacing it outright. In the same way, taking action to surround quantum encryption with judicial and regulatory protections today could save years of difficult litigation in the future. One who does not exercise his/her rights loses them, and it is the author's belief that QKD should be free to develop, use and export—in the name of scientific advancement, freedom of expression and secure communication.

UBERS OF SPACE: UNITED STATES LIABILITY OVER UNAUTHORIZED SATELLITES

Manal Cheema[*]

ABSTRACT

Private activity in space implicates State responsibility and liability. This Article uses the case study of Swarm Technologies Inc., a United States (US) company, and its unauthorized launch of four satellites, called SpaceBEEs, in India to examine State liability for illicit satellites under international and domestic law. Through an analogy to Uber Technologies Inc., which introduced a terrestrial ridesharing concept, the Article explains the incentives of innovative start-ups and how an ill-fitting licensing and liability regime affects compliance and the future growth of the industry. After establishing that background, the Article clarifies the obligations and liabilities States incur under the international space law regime, as created by the Outer Space Treaty, Registration Convention, and Liability Convention. Specifically, it asserts States can be liable under international law for the unauthorized launch of satellites and that both the US and India are liable for the SpaceBEEs and any damage they might cause. Given US liability under international law, the Article describes the current US regulatory regime and concludes it is unprepared to "authorize and supervise" small satellite companies. The Article demonstrates, in particular, how the US satellite indemnification and licensing regime encourages noncompliance and stifles the growth of the commercial space industry. The Article offers remedies to improve the US space regulatory

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regime's ability to accommodate innovative small satellite start-ups, conform with international law, and achieve the US goal of promoting the growth of the industry.

I. INTRODUCTION

In January 2018, a United States (US) company, Swarm Technologies Inc. (Swarm),[1] launched four satellites, "SpaceBEEs,"[2] from India,[3] as a secondary payload on an Indian Polar Satellite Launch Vehicle C40.[4] At 10 centimeters wide and 2.8 centimeters tall, the SpaceBEEs were the size of a grilled cheese sandwich.[5] The launch was set up by Seattle-based company Spaceflight Industries Inc., which helps satellite operators find ride-shares to share space on their vehicles. Swarm applied for a license from the US Federal Communications Commission (FCC) on April 26, 2017, to deploy and operate the four BEEs and two Earth stations.[6] However, Swarm's satellites were denied US authorization by the FCC due to

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[1] Swarm Techs., Inc., F.C.C. 18-184, Consent Decree 2 (Dec. 20, 2018), https://docs.fcc.gov/public/attachments/FCC-18-184A1.pdf. Swarm's goal is to build the cheapest space-based data network. Ashlee Vance, *Satellite Startup Swarm is Back Online After Defying U.S. Officials*, BLOOMBERG (Aug. 30, 2018), https://www.bloomberg.com/news/articles/2018-08-30/satellite-startup-swarm-is-back-online-after-defying-u-s-officials.

[2] SpaceBEEs, where BEE stands for Basic Electronic Elements, are picosatellites that each employ radar signature enhancement technology and use VHF band frequencies for communications. *Swarm Techs.*, Exhibit A to F.C.C., Form 442 (Apr. 26, 2017), https://apps.fcc.gov/els/GetAtt.html?id=191177&x=.

[3] *See* Marina Koren, *Launching Rogue Satellites in Space Was a "Mistake,"* WASH. POST. (Sept. 7, 2018), https://www.theatlantic.com/technology/archive/2018/09/space-bees-swarm-unauthorized-satellite-launch/569395/.

[4] The primary cargo on the vehicle was a large Indian mapping satellite. Mark Harris, *FCC Accuses Stealthy Startup of Launching Rogue Satellites*, IEEE SPECTRUM (Mar. 9, 2018), https://spectrum.ieee.org/tech-talk/aerospace/satellites/fcc-accuses-stealthy-startup-of-launching-rogue-satellites.

[5] Loren Grush, *Company That Launched Satellites Without Permission Gets New License to Launch More Probes*, VERGE (Oct. 4, 2018), https://www.theverge.com/2018/10/4/17928452/swarm-technologies-spacebees-satellites-spacex-falcon-9-fcc-license. *See also* Aaron Pressman, *How Satellites the Size of a Grilled Cheese Sandwich Could Change the World*, FORTUNE (Jan. 24, 2019), http://fortune.com/2019/01/24/swarm-satellites-startup-space-internet/.

[6] *Swarm Techs.*, Exhibit A to F.C.C., Form 442 (Apr. 26, 2017), https://apps.fcc.gov/els/GetAtt.html?id=191177&x=. Earth stations enable satellite launchers to communicate with one or more satellites.

their size on December 12, 2017.[7] Perhaps to avoid filing more arduous paperwork, exposing itself to more cost, and potentially missing its launch date, Swarm launched anyway.[8]

On March 5, 2018, the FCC discovered Swarm's unauthorized launch and found that the company also communicated with its satellites without a license.[9] In response, the FCC issued a general Enforcement Advisory reiterating that organizations are subject to penalties for launching spacecraft without the appropriate regulatory approvals.[10] This Advisory also affirmed that licensing is a critical aspect of ensuring the US' satisfaction of its international treaty obligations, particularly the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space (OST).[11] On December 20, 2018, the FCC penalized Swarm with a $900,000 fine and stricter compliance procedures for "deploy[ing] and operat[ing] four experimental satellites . . . with no authorization to do so."[12]

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[7] *See* Swarm Techs., Inc., F.T.C., File No. 0305-EX-CN-2017 (Dec. 12, 2017) (dismissed without prejudice), https://apps.fcc.gov/els/GetAtt.html?id=203152&x; Karen Graham, *FCC-Four Unauthorized Satellites Launched into Space*, DIGITAL J. (Mar. 11, 2018), http://www.digitaljournal.com/tech-and-science/technology/fcc-four-unauthorized-satellites-launched-into-space/article/517027.

[8] Swarm Technologies told the FCC "that it went ahead with the January launch because its lawyers advised it might be able to get authorization after the fact." Aaron Pressman, *How Satellite Startup Swarm Returned to Space After an Illicit Launch*, FORTUNE (Dec. 21, 2018), http://fortune.com/2018/12/21/swarm-technologies-fcc-satellite/. Interestingly enough, Swarm had filed an update to its original application on January 7, 2018, five days before the PSLV carrying the SpaceBEEs in India launched. *See Swarm Techs.*, Exhibit A to F.C.C., Form 442 (1U System) (Jan. 7, 2018), https://apps.fcc.gov/els/GetAtt.html?id=203073&x=.

[9] Tim Fernholz, *The First Illegal Satellite Launch Came with a $900,000 Penalty*, QUARTZ (Dec. 20, 2018), https://qz.com/1503575/swarm-technologies-settles-illegal-launch-for-9000000/. *See also* Elizabeth Howell, *Four Cubesats Snuck into Orbit Without Regulatory Approval, FCC Says*, SPACE.COM (Mar. 16, 2018), https://www.space.com/40001-four-cubesats-unauthorized-launch-fcc.html. It is not clear exactly how the FCC found out.

[10] Compliance with Satellite Communications Licensing Requirements is Mandatory and Failure to Comply Can Result in Enforcement Action, F.C.C. Enforcement Advisory No. 2018-01 (Apr. 12, 2018), https://transition.fcc.gov/Daily_Releases/Daily_Business/2018/db0412/DA-18-368A1.pdf.

[11] *Id. See also* Treaty on Principles Governing the Activities in the Exploration and Use of Outer Space, Including the Moon and other Celestial Bodies, Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S 205 [hereinafter Outer Space Treaty].

[12] Swarm Techs., Inc., F.C.C. 18-184, Order (Dec. 20, 2018), https://docs.fcc.gov/public/attachments/FCC-18-184A1.pdf. The FCC's Enforcement Bureau initially recommended a penalty half of $900,000 but, because the situation raised unique questions

The US government's involvement in the regulation of commercial space activity is warranted because private activity in space implicates State responsibility and liability. Under the international space law regime, States are responsible for private actions in space. If a satellite causes damage, the State is obliged to pay.[13] The space community may debate how the international space treaties, [14] developed over the 1960s and 1970s, should extend to the actions of private space actors of today, especially those unauthorized to be in space.[15] But international law—as it currently stands—makes both the US and India responsible for the SpaceBEEs. Under the international space regime, a State is liable when it is considered a "launching State,"[16] "appropriate State,"[17] or "state of Registry."[18] As this Article determines, the US and India are liable under one or more of these categories for the unauthorized launch of the SpaceBEEs.

Activities by Swarm and other start-ups also challenge the US' indemnification and licensing regime, especially where small satellites are involved.[19] Newer companies that use small satellites are conceivably more likely to dodge regulatory requirements precisely because it is easier to operate under the radar. Generally, the expensive nature of licensing and launches, the novelty of the technology and the need to take advantage of the incredibly small time-window in which a satellite, as a whole, can be launched into a particular orbit make a difference when compared to other

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that the FCC had not previously grappled with, the complaint received higher review. Pressman, *supra* note 8. *See also* Press Release, F.C.C., FCC Reaches $900,000 Settlement with Swarm for Unauthorized Satellite Launch (Dec. 20, 2018), https://docs.fcc.gov/public/attachments/DOC-355578A1.pdf [hereinafter FCC Press Release].

[13] Convention on International Liability for Damage Caused by Space Objects arts. II-III, Mar. 29, 1972, 24 U.S.T. 2389, 961 U.N.T.S. 187 [hereinafter Liability Convention].

[14] *See infra* Part II.A (discussing the framework created by the Outer Space Treaty, Registration Convention, and Liability Convention).

[15] *See infra* Part II (discussing some of the debates within international scholarship on how the space treaties apply to private actions in space).

[16] Liability Convention, *supra* note 13, art. I(c).

[17] Outer Space Treaty, *supra* note 11, art. VI.

[18] Convention on Registration of Objects Launched into Outer Space art. I, Jan. 14, 1975, 28 U.S.T. 695, 1023 U.N.T.S. 15 [hereinafter the Registration Convention].

[19] *See, e.g.,* 51 U.S.C. §§ 50901-23 (2018).

technologies.[20] For small satellites, however, it is a lot easier to fly under the proverbial radar because of their size; it is much harder to launch a satellite the size of a school bus without gaining public attention as compared to a satellite the size of a sandwich.

The ability for unauthorized launches of small satellites to occur in this manner threatens the stability of the satellite services environment, both domestically and worldwide. Such launches call into question the ability of satellite companies and launch providers "to comply with US space regulations."[21]

To some, Swarm's "Uber-like"[22] approach of asking forgiveness rather than permission is just a symptom of Silicon Valley's growing investment in aerospace start-ups.[23] Investments in satellite companies continue because these innovative space start-ups seek to deliver highly beneficial services, from global monitoring[24] to widespread internet.[25] Indeed, the activities of these companies do further the US goal to develop the commercial use of space.[26] Nevertheless, Swarm's unauthorized launch reveals the age-old friction between regulation and innovation. Accordingly, this Article explores one way to resolve that friction.

To be sure, until there is an international space agreement reforming or clarifying the current regime,[27] the US must reconsider its decentralized approach to satellite regulation to satisfy its obligations under Article VI of the OST.[28] The US must balance its goals of ensuring compliance with the Treaty and promoting the

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[20] However, small satellites, as compared to larger satellites, tend to be lower in cost and easier to launch, which lends to their attractiveness and accessibility. *See* RAM S. JAKHU & JOSEPH N. PELTON, SMALL SATELLITES AND THEIR REGULATION 6 (2013).

[21] Harris, *supra* note 4.

[22] *See infra* Part I (discussing the business practices of Uber).

[23] Fernholz, *supra* note 9.

[24] *See, e.g., Planet Products*, PLANET (last visited April 21, 2020), https://www.planet.com/products/.

[25] Vance, *supra* note 1.

[26] The Commercial Space Launch Activities Act was designed to promote the commercial use of space. *See* 51 U.S.C. § 50901(a)(4) (2018).

[27] It is imperative for the international community to harmonize its disparate national laws to ensure we avoid a prisoner's dilemma, or coordination failure, in space development. Without harmonized licensing and indemnification regimes across States, the international commercial space system risks a "race to the bottom," with countries competing to offer the most business-friendly regulations. However, the likelihood of an international agreement in the near future appears to be slim. A multilateral treaty addressing space has not been drafted since 1979.

[28] Outer Space Treaty, *supra* note 11, art. VI.

commercial use of space. Centralizing licensing, lowering fees, quickening the approval process and easing insurance obligations for small satellites is key to ensuring the US' domestic space regime is more attractive to innovative space-centered businesses. At the same time, those reforms should not prevent the US from fulfilling its regulatory obligations and managing its liability.

Part II explains the incentives fueling innovative start-ups and how an ill-fitting licensing and liability regime—in regard to small satellites—affects compliance and future growth of the industry by analogizing the nascent commercial space industry to Uber Technologies, Inc. (Uber).

With that background, Part III answers the first major question: whether the US is liable for any damage the SpaceBEEs might cause. It assesses US and Indian liability for the SpaceBEEs under international law. In so doing, it analyzes the three most relevant space treaties: the OST,[29] the Convention on Registration of Objects Launched into Outer Space (Registration Convention),[30] and the Convention on International Liability for Damage Caused by Space Objects (Liability Convention).[31] By analyzing the specific case of the SpaceBEEs, Part III discusses the supervision and authorization duties of States and explores the different modes of attribution of State responsibility for the space activities of US nationals. It will assert that States can be liable under international law for damage caused by unauthorized satellites and both the US and India are liable for the SpaceBEEs. Part III will then explain the consequences of that liability.

Part IV answers the second question of the Article: how the US domestic regime responds to liability. It provides an overview of how the US currently handles international obligations that arise under the space treaties through the Commercial Space Launch Activities Act, related statutes, and the use of administrative agencies like the FCC and the Federal Aviation Administration (FAA). Part IV explains the indemnification and licensing scheme the US employs and the process companies undergo to obtain US permission to launch their satellites.

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[29] Outer Space Treaty, *supra* note 11.

[30] Registration Convention, *supra* note 18.

[31] Liability Convention, *supra* note 13.

Part V describes how the current US regulatory regime is ill-prepared for small satellite companies. It explains the structures of and the problems facing domestic regulations that affect small satellite companies as well as the international consequences of the current regulatory regime.

Part VI offers remedies to improve the ability of the US space regulatory and the international regimes' ability to accommodate and promote compliance by innovative start-ups, especially those that use small satellites to carry out their goals.

II. FRAMING THE PROBLEM: AN ANALOGY TO UBER

Uber, though it brings radically improved services,[32] is not known for following commercial vehicle licensing requirements.[33] The original (simplified) rationale for skirting commercial vehicle licensing was that because (1) Uber's drivers have licenses and (2) the cars are legal to drive, further licensing for its product was unnecessary.[34] As a result, instead of asking for permission, Uber asked for forgiveness.

Indeed, after Uber was launched and gained its reputation, outcries for government regulation began. Starting in the mid-1900s, the government, at the state and local level, imposed entry controls on taxi companies to ensure consumer interest and safety.[35] The growth of Uber challenged that system. The very

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[32] Brishen Rogers, *The Social Costs of Uber*, 82 U. CHI. L. REV. ONLINE 85 (2017) (explaining the positives and negatives of Uber). Uber does improve transportation services for rich consumers, but whether ride-sharing companies increase the mobility of minority and lower-income communities is currently being studied. *See, e.g.,* Anne Elizabeth Brown, Ridehail Revolution: Ridehail Travel and Equity in Los Angeles (2018) (unpublished peer reviewed Ph.D. dissertation, UCLA), https://escholarship.org/uc/item/4r22m57k.

[33] Benjamin Edelman, *Uber Can't be Fixed—It's Time for Regulators to Shut it Down*, HARV. BUS. REV. (June 21, 2017), https://hbr.org/2017/06/uber-cant-be-fixed-its-time-for-regulators-to-shut-it-down.

[34] Matthew Yglesias, *Uber's Toxic Culture of Rule Breaking, Explained*, VOX (Mar. 21, 2017), https://www.vox.com/new-money/2017/3/21/14980502/uber-toxic-culture-rule-breaking-explained.

[35] Bruce Schaller, *Entry Controls in Taxi Regulation: Implications of US and Canadian Experience for Taxi Regulation and Deregulation*, 14 TRANSPORT POL'Y 490 (2007). A small number of cities deregulated taxis in the late 1970s and early 1980s; however, cities experienced largely negative results such as loss of driver productivity due to more taxis that lead to inflated fares, less service to minority communities, and poorer dispatch. Comm. for Review of Innovative Urban Mobility Servs., Transp. Research Bd.,

problem that comes with regulating the commercial space market also surfaces in the regulation of Uber and similar companies: how to "regulat[e] innovation and technology without stifling the field's growth."[36] Some jurisdictions took stringent regulatory approaches to Uber, stifling or limiting its presence.[37] Certain localities banned or limited Uber,[38] and lawsuits abounded.[39]

Still, because of the added value that Uber provided in opening up the transportation economy, anti-Uber protests largely dwindled.[40] Some jurisdictions welcomed Uber with open arms and some cities and states even passed pro-ridesharing legislation.[41] For example, the Washington D.C. City Council legalized Uber and other rideshare-service companies.[42] In the end, most localities have

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Special Report No. 319, Between Public & Private Mobility: Examining the Rise of Technology-Enabled Transportation Services 31 (2015). Within a few years, cities re-regulated entry into the taxi industry. *Id*. at 32.

[36] Hannah Posen, *Ridesharing in the Sharing Economy: Should Regulators Impose Uber Regulations on Uber*, 101 IOWA L. REV. 405, 418 (2016).

[37] *See, e.g.,* 2016 Mass. Acts ch. 187 § 11 (not permitting a prearranged ride through a digital network at Boston Logan International Airport). *But see* H.R. 1041, 191th Leg. (Mass. 2019) (seeking to encourage shared rides to and from Logan Airport).

[38] In 2015, Uber was banned from ten countries and had suspended operations in three countries and six U.S. cities. Simran Khosla & Eva Grant, *Here's Everywhere Uber is Banned Around the World*, BUS. INSIDER (Apr. 8, 2015), http://www.businessinsider.com/heres-everywhere-uber-isbanned-around-the-world-2015-4.

[39] Uber was charged with, inter alia, failing to comply with statutory requirements as to advertising, intentionally interfering with tax services and their driver's contractual claims, and violating local regulations. *See, e.g.*, Yellow Grp. LLC v. Uber Techs., Inc., No. 12 C 7967, 2014 WL 3396055, at *2 (N.D. Ill. July 10, 2014); City of Columbus v. Uber Techs., No. 2014 EVH 060125, 2014 Ohio Misc. LEXIS ii, at *5 (Ohio Mun. Ct. Apr. 30, 2014); Anna Gallegos, *The Four Biggest Legal Problems Facing Uber, Lyft and Other Ridesharing Services*, LXBN (June 4, 2014), http://www.lxbn.com/2014/o6/o4/top-legal-problems-facinguber-lyft-ridesharing-services.

[40] However, ahead of the Uber's IPO, drivers protested the ride-sharing industry, including Uber, for failing "to pay drivers a living wage." Kristin Broughton, *Drivers Lead Protests Ahead of Uber IPO*, WALL STREET J. (May 8, 2019), https://www.wsj.com/articles/drivers-lead-protests-ahead-of-uber-ipo-11557337543.

[41] *Shift Towards a Modern-Day Transportation Ecosystem*, UBER (Oct. 29, 2014), http://newsroom.uber.com/2014/1o/a-shift-towards-a-modern-day-transportation-ecosystem.

[42] WASH, D.C., VEHICLE-FOR-HIRE INNOVATION AMENDMENT ACT, D.C. B. 20-753 (2014). The legislation did not require ridesharing companies like Uber to comply with taxi licensing requirements. Rather, it set minimum insurance requirements, mandated background checks, and other operating requirements. *See id*. §§ 25(4), 26(b), 27..

embraced rideshare company-friendly policies, albeit with some compromise.[43]

Thus, from a cynical point of view, what Uber shows is that a company can break the rules, but, if that company creates a valuable-enough service,[44] people may change those rules rather than holding it accountable for breaking them. Uber was able to tell a good story, become indispensable to consumers, and then ask for forgiveness instead of permission.[45] Regulators responded accordingly.[46] The example of Uber demonstrates the age-old stereotype that existing government regulations are generally not conducive or flexible to innovation. The strategy employed by Uber is called "regulatory entrepreneurship," a business model that acknowledges how changing or operating in a gray zone of "the law is a material part of the company's business plan and vision for success."[47] While the space industry has not taken this strategy as far as companies like Uber, the baseline is similar: disruptive strategies that challenge the regulatory system "through innovation facilitated by technology."[48]

What may motivate such disruptive strategies is a poor fit between regulation and the circumstances of innovative products. In the context of Uber, ridesharing companies were forced to comply with regulations that did not envision rideshare services in a way

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[43] *See* Nestor M. Davidson & John J. Infranca, *The Sharing Economy as an Urban Phenomenon*, 34 YALE L. POL'Y REV. 215, 252–53 (2016) (noting how Uber and localities compromise to obtain the former's services and the latter's location).

[44] In respect to Swarm, it has created an entirely new, inexpensive, time-efficient product that creates an extremely desirable service: a low-cost internet network that provides connectivity worldwide. *See* Pressman, *supra* note 5.

[45] Posen, *supra* note 36, at 398–403.

[46] However, even then, Uber does not remain outside of regulatory scrutiny. Most recently, California considered a bill that would classify Uber drivers as employees rather than drivers. The bill was predicted to be a "devastating burden" to Uber's business and the company is fought the bill's passage. *See, e.g.,* Graham Rapier, *Uber and Lyft are Fighting Tooth and Nail Against a California Bill that Could Make Some Drivers Employees and Bankrupt Both Companies*, BUS. INSIDER (June 21, 2019), https://www.businessinsider.com/uber-lyft-fight-california-dynamex-bill-drivers-employees-2019-6. Ultimately, the bill passed on September 18, 2019, and took effect on January 1, 2020. A.B. 5, 2019–2020 Leg., Reg. Sess. (Cal. 2019),https://legiscan.com/CA/text/AB5/2019.

[47] Elizabeth Pollman & Jordan M. Barry, *Regulatory Entrepreneurship*, 90 S. CAL. L. REV. 383, 392 (2017).

[48] Renee M. Jones, *The Unicorn Governance Trap*, 166 U. PA. L. REV. ONLINE 165, 181 (2017).

that "restrict[ed] innovation and unnecessarily with[eld] services from consumers."[49] In the same way, imposing an international space liability system, which was designed fifty years ago to offer guidelines and principles for State actors, can have undesirable consequences in the current private actor environment. The law may have envisioned private actors, but it was not designed for them.[50]

The case of Swarm and its SpaceBEEs bears some interesting similarities to Uber. After the unauthorized launch came to light, Swarm was subjected to intense scrutiny in the relevant space community. Commentators accused Swarm of acting like Uber in skirting licensing regulations with the unauthorized launch of the SpaceBEEs.[51] As one commentator put it: the "contagion of dismissing regulation has now spread to the space sector with Swarm Technologies."[52] Commentators drew a parallel to Swarm's launch of its satellites without a license.[53]

However, like Uber, Swarm has a noble goal for its satellites. Swarm's goal is to build the cheapest space-based data network of all time by deploying "small two-way communication satellites to enable low-cost, space-based connectivity anywhere in the world, including to facilitate Internet-of-things applications."[54] In some ways, Swarm is pioneering a burgeoning and promising market just like Uber. Many companies like Facebook and SpaceX are now

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[49] Posen, *supra* note 36, at 408.

[50] Outer Space Treaty, *supra* note 11, art. VI (asserting that "[t]he activities of non-governmental entities in outer space, including the moon and other celestial bodies, shall require authorization and continuing supervision by the appropriate State Party to the Treaty").

[51] *See, e.g.,* Aaron Pressman, *How Satellite Startup Swarm Returned to Space After an Illicit Launch*, FORTUNE (Dec. 21, 2018), http://fortune.com/2018/12/21/swarm-technologies-fcc-satellite/; Tim Fernholz, *The First Illegal Satellite Launch Came with a $900,000 Penalty*, QUARTZ (Dec. 20, 2018), https://qz.com/1503575/swarm-technologies-settles-illegal-launch-for-9000000/.

[52] *See* Sinead O'Sullivan, *NewSpace Must be Regulated,* SPACENEWS (Jan. 16, 2019), https://spacenews.com/newspace-must-be-regulated/.

[53] *See, e.g.,* Fernholz, *supra* note 9; Pressman, *supra* note 51.

[54] Swarm Techs., Inc., F.C.C. 18-184, Consent Decree 2 (Dec. 20, 2018), https://docs.fcc.gov/public/attachments/FCC-18-184A1.pdf. *See also* Vance, *supra* note 1.

competing to provide online access through satellite constellation systems similar to the one Swarm uses.[55]

Further, just as there was an initial rough fit between Uber's product and existing regulations, the very rule that was a basis for barring the licensing of the SpaceBEEs fell prey to subsequent scrutiny. For example, the SpaceBEEs were initially believed to be tiny enough to go untracked by the US Space Surveillance Network (an array of telescopes operated by the Department of Defense that follow all satellites), yet big enough to damage other satellites while in orbit.[56] It was on this assumption that caused the FCC to initially deny Swarm's SpaceBEE license.[57] But the FCC later authorized other SpaceBEEs, with slight modifications from the ones that were first, illicitly, launched.[58] And, since then, a publication through the Institute of Electrical and Electronics Engineers questioned the FCC's decision to deny the SpaceBEEs' license where the FCC has had a record of licensing even smaller satellites.[59]

Still, those in the satellite industry feared that Swarm's apparent disregard for the FCC's refusal to grant a license would trigger an overreaction of increased government regulations. And, Swarm itself undoubtedly suffered because of its mistake. Indeed, lack of regard for regulatory compliance does threaten business objectives; in engaging in irresponsible actions, companies are subject to reputational risk. Moreover, "rogue" actors might negatively impact others in the ecosystem, giving investors pause to invest and encouraging regulators to tighten the rules. That said, the FCC only moved to punish Swarm and did not impose any new stringent regulations on the industry as a whole.

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[55] Aaron Pressman, *Facebook, SpaceX, and Dozens of Others are Battling Over Internet Access from Space*, FORTUNE (Jan. 25, 2019), https://fortune.com/2019/01/25/facebook-spacex-internet-access-space/.

[56] Grush, *supra* note 5.

[57] *See also* Swarm Techs., Inc., F.T.C., File No. 0305-EX-CN-2017 (Dec. 12, 2017) (dismissed without prejudice), https://apps.fcc.gov/els/GetAtt.html?id=203152&x.

[58] Experimental Special Temporary Authorization, F.C.C., File No. 0976-EX-ST-2018 (Oct. 1, 2018), https*S*://apps.fcc.gov/els/GetAtt.html?id=217159&x=. *See also* Grush, *supra* note 5.

[59] Mark Harris, *The FCC's Big Problem with Small Satellites*, IEEE SPECTRUM (Apr. 10, 2018), https://spectrum.ieee.org/tech-talk/aerospace/satellites/the-fccs-big-problem-with-small-satellites (finding that "the FCC licensed multiple satellites smaller than 10 cm over the past five years, including some as small as 3.5 by 3.5 by 0.2 cm," from companies like QubeScout, KickSat, Aerocubes).

More broadly, the examples of Uber and Swarm raise the question of why some companies go ahead, in light of risks (such as punitive fines from regulatory agencies), and disregard licensing or other regulatory requirements. One explanation could be sheer ignorance, but another, more compelling justification is that the regulatory regime is considered too burdensome and prohibitive to their product. And the possibility that their product succeeds, despite facing sanction, may be high enough to attempt to skirt licensing.

Whether or not a satellite service like Swarm will experience a similar level of success as Uber—especially where it engages in regulatory entrepreneurship—is unclear. But what Uber demonstrates is that complex regulatory schemes will have to adapt to regulatory entrepreneurs to further the commercial objectives that underline the very creation of those schemes. As such, the analogy raises the question: how should the US regulatory system be reformed, if at all, to facilitate the growth of the commercial satellite sector while still comporting with its OST obligations? Although it is unlikely the international community will come together to devise another space treaty anytime soon, this Article focuses on the need for domestic and international regimes to adapt.[60]

III. U.S. LIABILITY UNDER INTERNATIONAL LAW

Under international space law, States are liable for national activities in outer space, regardless of whether such activities are undertaken by the State itself or a non-State actor.[61] Private operators derive their ability to launch and use space objects from governments. As a result, any choice regarding if and how the US regulates space activities has a direct effect on the international obligations of the US. At the same time, private actions can put the US in violation of its obligations. The international space treaties,

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[60] *See* Ryan Calo & Alex Rosenblat, *The Taking Economy: Uber, Information, and Power*, 117 COLUM. L. REV. 1623, 1687 (2017) (noting how "regulators need to become more adept at discovering potential harm").

[61] *See, e.g.,* Liability Convention, *supra* note 13, arts. II, III.

notably the OST,[62] Registration Convention,[63] and Liability Convention,[64] define these obligations.

A. The Treaty Regime

On December 13, 1963, the United Nations adopted the Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space.[65] Following this declaration were five international treaties, completed between 1967 and 1984.[66] The United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) pioneered their development. These treaties now offer guidelines and principles for (1) States to manage and maintain international cooperation on space activities and (2) States to self-regulate their space activities.[67] Three treaties collectively make up the space *liability regime*: the OST, Registration Convention, and the Liability Convention.[68] The liability regime was "created in an era when the domain of space itself was reserved exclusively for national governments."[69] Now, much of the world's

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[62] ISABELLE DIEDERIKS-VERSCHOOR & VLADIMIR KOPAL, AN INTRODUCTION TO SPACE LAW 10 (3d ed. 2008).

[63] Registration Convention, *supra* note 18.

[64] Liability Convention, *supra* note 13.

[65] G.A. Res. 1962 (XVIII), Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space (Dec. 13, 1963).

[66] The two space treaties not discussed are the Moon Agreement and the Rescue Agreement. Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, Dec. 18, 1979, 1363 U.N.T.S. 3; Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, Apr. 22, 1968, 672 U.N.T.S. 119 [hereinafter Rescue Agreement]. Although they may be informative, the Article is not as concerned with the Moon or with the return or rescue of astronauts or items per se.

[67] Caley Albert, *Liability in International Law and the Ramifications on Commercial Space Launches and Space Tourism*, 36 LOY. L.A. INT'L & COMP. L. REV. 233, 235 (2014).

[68] When discussing the space liability regime, this Articles recognizes that outside of the space treaties, nations still have obligations to one another that source from other bodies of international law. Article III of the OST reaffirms this, stating that "States Parties to the Treaty shall carry on activities in the exploration and use of outer space, including the Moon and other celestial bodies, *in accordance with international law, including the Charter of the United Nations*." Outer Space Treaty, *supra* note 11, art. III (emphasis added). Other sources of international law by which State liability could arise may include the Agreement on the Rescue of Astronauts. *See* Rescue Agreement, *supra* note 66.

[69] Albert, *supra* note 67, at 236. *See also* FRANCIS LYALL & PAUL LARSEN, SPACE LAW: A TREATISE 387 (2d ed. 2018).

space activity comes from private, commercial actors.[70] Indeed, these treaties were drafted before the development of many practices that the international regime is now required to regulate.[71] Still, both the US and India have ratified all three treaties and are, therefore, bound by their terms.[72]

The OST entered into force on October 10, 1967. There are 109 State parties and 23 signatories.[73] The most relevant principles of the OST for this Article are as follows. First, under Article VI, States shall be responsible for their national activities in outer space, whether carried on by governmental or non-governmental entities. Specifically, it is the "appropriate state" that authorizes and supervises activities of its nationals.[74] Second, under Article VIII, States retain jurisdiction and control over any object registered to them and any personnel thereon.[75] Third, under Article VII, States shall be liable for damage caused by their space objects.[76] Fourth, pursuant to Article IX, States also have a responsibility to conduct spacefaring activities with "due regard" to the "corresponding interest" of other parties.[77]

The Registration Convention entered into force on September 15, 1976. It has 69 parties and three signatories.[78] The Convention

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[70] In 2016, the global space economy, including both private industry revenues and government budgets, was $345 billion, only 26% of that revenue constituted government space budgets and commercial human spaceflight. FED. AVIATION ADMIN., THE ANNUAL COMPENDIUM OF COMMERCIAL SPACE TRANSPORTATION 9 (Jan. 2018), https://www.faa.gov/about/office_org/headquarters_offices/ast/media/2018_AST_Compendium.pdf [hereinafter AST].

[71] John Myers, *Extraterrestrial Property Rights: Utilizing the Resources of the Final Frontier*, 18 SAN DIEGO INT'L L.J. 77, 97-100 (2016) (briefly discussing the U.N. member nations' early calls for a space treaty and identifying relevant portions of the hearings that lead to the creation of COPUOS).

[72] How these treaties would apply to a scenario where one or more or even all the countries are not parties is outside of the scope of this Article. Some commentators suggest the provisions of the Outer Space Treaty are customary international law and therefore are binding on non-signatories. *See, e.g.,* DIEDERIKS-VERSCHOOR & KOPAL, *supra* note 62, at 10.

[73] Status of International Agreements Relating to Activities in Outer Space, U.N. Doc. A/AC.105/C.2/2019/CRP.3 (Jan. 1, 2019), http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/status/index.html [hereinafter Space Treaty Status].

[74] OST, *supra* note 11, art. VI.

[75] *Id.* at art. VIII.

[76] *Id.* at art. VII.

[77] *Id.* at art. IX.

[78] Space Treaty Status, *supra* note 73.

sought to create a registration system for space objects to identify them as well as the responsible State Party in the event of damage.[79] The Convention also helps elucidate the concepts of an appropriate State and the State of registry, as suggested in OST Articles VI and VIII.[80] It makes it mandatory for the State to register its space object at the national[81] and international levels,[82] thus claiming responsibility for the object.

Finally, the Liability Convention entered force on September 1, 1972, and governs liability for damage caused by space objects.[83] It was ratified by ninety-six States and signed by an additional nineteen.[84] The Liability Convention gives "a more concrete explanation of state responsibilities," in particular expanding Article VII of the OST.[85] Under the Liability Convention, launching States are liable for damages attributed to their space objects.[86]

The three treaties, together, impose a series of responsibilities on implicated States. They also provide three different categories by which a State can be found responsible for a satellite: a State may be categorized as an appropriate State, a launching State, or a State of registry. Although every launching State will be potentially liable for the damages caused by and attributable to their satellite, only an appropriate State is obliged to authorize and provide continuing supervision over the satellite.[87]

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[79] Jakhu & Pelton, *supra* note 20, at 55.

[80] Registration Convention, *supra* note 18, art. I.

[81] *Id.* at art. II.

[82] *Id.* at art. IV.

[83] Liability Convention, *supra* note 13.

[84] Space Treaty Status, *supra* note 73.

[85] Michael Viets, *Piracy in an Ocean of Stars: Proposing a Term to Identify the Practice of Unauthorized Control of Nations' Space Objects*, 54 STAN. J INT'L L. 168–69 (2018).

[86] Liability Convention, *supra* note 13, art. I(c). Note that terrestrial damage caused by a space object carries absolute liability for the launching State, but space damage is governed under a fault-based standard. *See id.* at arts. II–III.

[87] One question that arises concerns the possible issue of multiple appropriate States. The use of the singular in Article VI when referring "appropriate State" may suggest there can only be one appropriate State. As Lyall and Larsen assert, no matter what "appropriate" is interpreted to mean, "it is clear that the concept is in the singular and that the drafters intended only one state to authorize and supervise, and therefore be responsible for a particular private activity." LYALL & LARSEN, *supra* note 67, at 415. In this author's opinion,, a better reading of the text, as offered by Bin Cheng, is that there may be more than one appropriate State. *See* Bin Cheng, *Article VI of the 1967 Space Treaty Revisited: "International Responsibility," "National Activities," and "The Appropriate State,"* 26 J. SPACE L. 7, 28–29 (1998). First, Cheng looks at the Liability

Further, the State of registry retains jurisdiction and control over the object, but that does not necessarily mean that it is the one providing continuous supervision. The space treaties provide a complicated, but admittedly broad-reaching, scheme to attribute responsibility to a State. What category the US and India fall under, if any, produces potentially variable consequences under international space law. The table on the following page summarizes the categories; the rest of this Part will clarify the categories under which the US and India fall.

Convention, which is *in pari materia* with the Outer Space Treaty. In determining who has liability, the space object must be attributable to a particular launching State. The reason why there may be more than one appropriate State is that there can be multiple launching States. If multiple States continue to be liable under international law, it is unclear why they would allow only one State to be in charge of authorization and supervision. Second, even though the Registration Convention—which is also *in pari materia* with the Outer Space Treaty—permits only one "State of registry," the Outer Space Treaty makes no similar limitation for the "appropriate State." Because States continue to be responsible and liable, it could be the case that all States involved in a given space activity would be "appropriate States" to supervise and authorize the activity. Third, the last sentence of Article VI, which considers activities carried out by an international organization, provides support for multiple appropriate States. The Treaty states that "responsibility for compliance with this Treaty shall be borne *both* by the international organization and *by the State Parties* to the Treaty participating in such organization." Outer Space Treaty, *supra* note 11, art. VI (emphasis added). The upshot of multiple appropriate States is that they would all, at least in some capacity, "need to ensure that the requisite regime of authorization and continuing supervision be established." BIN CHENG, STUDIES IN INTERNATIONAL SPACE LAW 635 (1997). However, Cheng limits the scope of responsibility by asserting that only the State that is actively regulating the space object at the time or place of an incident should be actually held responsible. *Id*. at 660. Thus, even if the US is deemed an appropriate State, that does not forever absolve India of some level of liability precisely because India is the launching State. *See id*.

Table 1. Definitions of Terms of the International Space Treaty Regime

	Appropriate State	***Launching State***	***State of registry***
Provision	OST, Article VI	OST, Article VII & Liability Convention, Articles II, III and V	OST, Article VII & Registration Convention, Article II
Language	"The activities of non-governmental entities in outer space . . . shall require authorization and continuing supervision by the appropriate State."	The State that "launches or procures the launching of an object into outer space," and any State "from whose territory or facility an object is launched."	"[A] launching State on whose registry a space object is carried" under the requirements of the Registration Convention.
Duties	Bears international responsibility for the objects	Liable for damages to other States and their objects	Retains jurisdiction and control over the object while in space

B. States Must Supervise and Authorize

When the OST was negotiated, the US and the Soviet Union were the only two entities engaged in space activities. At the time, the US supported the involvement of private actors in space activities, but the Soviet Union opposed the proposal. The Soviet Union wanted to limit the actors who could undertake space activities to States.[88] Article VI of the OST reflected the compromise: it states that "[t]he activities of non-governmental entities in outer space, including the Moon and other celestial bodies, *shall* require authorization and continuing supervision by the appropriate State Party

[88] *See* Comm. on the Peaceful Uses of Outer Space, Rep. of the Legal Subcomm. on the Work of Its First Session, U.N. Doc. A/AC.105/C.2/L.1, at 4 ¶ 7 (1962); Report of the Comm. on the Peaceful Uses of Outer Space, U.N. Doc. A/5181, annex 3, at 8 (1962). *See also* Paul S. Dempsey, *National Laws Governing Commercial Space Activities: Legislation, Regulation, & Enforcement*, 36 NW. J. INT'L L. & BUS. 6 (2016).

to the Treaty."[89] In other words, private activity is allowed "on the condition that the appropriate State exercises authorization and continuing supervision over its non-governmental entities."[90] Therefore, commercial use of space is permitted only where a State authorizes the private activity.

At the outset, it is essential to note that the obligations of a State do not end simply with the terms of the space treaties. International law generally applies to outer space, as Article III of the OST notes.[91] As a result, if there is a violation of the obligations of international space law, it will also trigger the general duties of State responsibility. This may include a State obligation to take measures of due diligence.[92] Indeed, Article IX of the OST provides that the State also has a responsibility to conduct spacefaring activities with "due regard" to the "corresponding interest" of other parties.[93]

That said, the space treaties do much in creating a regime of liability and responsibility for space activities. As mentioned earlier, Article VI describes the responsibility of States to authorize and supervise space activities. The operative legal term in Article VI is "shall." As a matter of treaty interpretation, the term creates a legal duty for States to bear international responsibility for national and non-governmental space activities, by virtue of its placement in Article VI. If a commercial entity wants to conduct activities in outer space, a government must (1) authorize the activity

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[89] Outer Space Treaty, *supra* note 11, art. VI (emphasis added).

[90] Dempsey, *supra* note 88, at 6.

[91] Outer Space Treaty, *supra* note 11, art. III ("State Parties to the Treaty shall carry on activities . . . in accordance with international law . . . .").

[92] Jan Arno Hessbruegge, *The Historical Development of the Doctrines of Attribution and Due Diligence in International Law*, 36 N.Y.U. J. INT'L L. & POL. 265, 268 (2004). It may be the case that a State that has not signed the OST may still be liable if they cause damage, as general duties of responsibility may be triggered without reference to the space treaties. This Article, however, does not focus on those situations. That said, it is not clear what sort of liability those States may face.

[93] Outer Space Treaty, *supra* note 11, art. IX. The purpose of placing international responsibility of any outer space activity on States was to "ensure that any outer space activity, no matter by whom conducted, shall be carried on in accordance with the relevant rules of international law, and to bring the consequences of such activity within its ambit." MANFRED LACHS, THE LAW OF OUTER SPACE: AN EXPERIENCE IN CONTEMPORARY LAW-MAKING 122 (1972). States "are under obligation to take appropriate steps in order to ensure that natural or juridical persons engaged in outer space activity conduct it in accordance with international law." *Id*. This is likely where the "due diligence" concept present in general international law becomes operational.

and (2) assert regulatory control by continuously supervising that activity.[94] Thus, in considering a State's responsibility for a satellite on-orbit, the first question is whether the State was responsible for authorizing or supervising the launch.

Authorization requires the appropriate State to restrict space activities to only those activities it affirmatively permits.[95] A State can authorize by directing or funding a space program or licensing a program. Supervision likely demands that the appropriate State ensures continued compliance by the actor until its eventual disposal.[96] A State may supervise activities by observing the activity or relying on reports to determine compliance.[97] As outlined in Article VI, whether a State must authorize or supervise a space object is informed by whether the space activities are considered "national activities" of the State.[98]

State parties to the OST are responsible for all private or governmental space activity, regardless of how the State values it or the level in which the State is involved.[99] Thus, actions that (1) fall under personal and territorial jurisdiction, (2) are government or even non-governmental activities of the State and (3) are caused or conducted by a space object linkable to that State should fall under a State's "national activities."[100] The national State—even if the private launch is undertaken from outside the national territory—would qualify as "the State which launches" the object. In other words, "national activities" does not limit the scope of State

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[94] Outer Space Treaty, *supra* note 11, art. VI. Of course, the U.S. is not compelled by the treaty's terms to permit non-governmental space activities, but rather the treaty imposes obligations on the US if it chooses to do so.

[95] *Id.*

[96] Liability Convention, *supra* note 13, art. I(c). Although the treaty does not specifically mention the end of liability, if the launching State disposes of a space object, it cannot logically continue to supervise it.

[97] The Outer Space Treaty does not clarify the scope or substance of supervision standards. However, the State must ensure the conduct conforms to OST obligations. National laws can be used to exercise such requisite control over space activities. *See infra* Part III (discussing the U.S. domestic space regime).

[98] Outer Space Treaty, *supra* note 11, art. VI ("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.").

[99] Viets, *supra* note 85, at 175.

[100] *See* Robert A. Ramey, *Armed Conflict on the Final Frontier: The Law of War in Space*, 48 A.F. L. REV. 1, 75 (2000) (arguing that if a citizen of State X destroyed State Y's satellite, and the citizen acted outside of State X's borders and without State X's knowledge, State X would be responsible).

responsibility from extending to private launches, even those that do not align with the government's interests.[101]

C. The Problem of Unauthorized Launches

States are liable for non-governmental activities under the OST, irrespective of the purpose for which they are carried out. What is not clear is if States are liable for unauthorized non-governmental space activities. The acts of Swarm are of first impression in space law. Although academics have yet to opine on the attribution of State responsibility for unauthorized satellites, some scholars do broach this topic in discussion of State responsibility for authorized satellites.

For example, Professor Marco Pedrazzi asserts that State responsibility should not extend over private entities whose actions would put the State in violation of international space law.[102] Here, the violation of international law occurs when the private entity launches without authorization. Professor Pedrazzi correspondingly argues that, in such circumstances, the State should be able to escape responsibility by demonstrating that the State did not violate its duties of authorization and supervision because the private activity was undertaken out of the reach of the State's control.[103] It is true that no provision in the space treaties expressly refutes this point. Thus, as it is popular to do among international circles, scholars look to analogous bodies of law for an answer. Under the modern view of State responsibility, private acts are rarely attributable to

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[101] To limit "national activities" to merely governmental activities or activities the State affirmatively regulates would propel a gap by which States could engage in motivated reasoning to absolve themselves from private space activities emanating from its jurisdiction. Companies may then choose to operate in States whose interpretation of "national activities" they find more desirable. *But see* Frans G. von der Dunk, *Sovereignty Versus Space Public Law and Private Launch in the Asian Context*, 5 SING. J. INT'L & COMP. L. 22, 28 (2001) (arguing that national activities should be interpreted to "make states internationally responsible precisely for those activities over which they can exercise legal control"); Albert, *supra* note 67, at 259 (arguing it "should involve the nation state's national interest; if not, then the commercial space company should be the ultimate guarantor of liability should something go wrong in space").

[102] Marco Pedrazzi, *Outer Space, Liability for Damage*, *in* MAX PLANCK ENCYC. PUB. INT'L L. (R. Wolfrum ed., 2009).

[103] *Id.*

States,[104] as the act must be committed or authorized by the State to be attributable.[105] This appears to be the case in international environmental law and the law of the sea.[106]

As those bodies of law suggest, it is traditionally the case that if a State denies authorization, liability is placed on the offending private entity.[107] If we accept this framework, a State should be able to avoid responsibility by merely demonstrating it did not violate its duties of authorization and supervision because the private activity was contrary to the State's wishes. Just as a State is not liable for the acts of non-State actors it does not direct or control,[108] scholars might assert here that the US could not be responsible for a satellite it never authorized. That said, India would be responsible under a theory of due diligence by permitting the unlicensed satellites to launch from its territory. Although this is an acceptable conclusion, under this line of reasoning, it also means the US may be absolved of responsibility.

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[104] IAN BROWNLIE, SYSTEM OF THE LAW OF NATIONS: STATE RESPONSIBILITY (PART I) 165 (1983); Frans G. von der Dunk, *Liability Versus Responsibility in Space Law: Misconception or Misconstruction?* 34 PROC. COLLOQ. L. OUTER SPACE 363, 364 (1991).

[105] JAMES CRAWFORD, THE INTERNATIONAL LAW COMMISSION'S ARTICLES ON STATE RESPONSIBILITY 94, 100 (2002); BROWNLIE, *supra* note 104, at 36; von der Dunk, *supra* note 104, at 364.

[106] United Nations Convention on the Law of the Sea, Dec. 10, 1982, 1833 U.N.T.S. 397. For example, the U.N. Convention on the Law of the Sea contains rules concerning State responsibility in conduct with private conduct in the fields of prospecting, exploration, and exploitation of the sea. It establishes a severe regime of responsibility with respect to private conduct. Article 263(3) in particular established that States "shall be responsible and liable . . . for damage caused by pollution of the marine environment arising out of marine scientific research undertaken by them or on their behalf." The "on their behalf" language appears to cover more situations than the Draft Articles on State Responsibility's Article 8, thereby describing a lower standard of attribution.

[107] *See supra* note 106. *See also* Warsaw Convention, Oct. 12, 1929, 49 Stat. 3000, 137 L.N.T.S. 11 (introducing a negligence based limited liability regime with the carrier—rather than the State—being liable for damage); Brian Beck, *The Next, Small, Step for Mankind: Fixing the Inadequacies of the International Space Law Treaty Regime to Accommodate the Modern Space Flight Industry*, 19 ALB. L. J. SCI. & TECH. 1, 8 (2009). Unless the State authorized the carrier, whether it be on the sea or in the air, or the carrier was acting on the behalf of a State, maritime and aviation liability regimes are fault-based, limited liability regimes that impose liability on carriers rather than States. *See* LARSEN ET AL., AVIATION LAW 267–68 (2006) (discussing the international regulations governing aviation liability).

[108] *See* G.A. Res. 56/83, annex, Responsibility of States for Internationally Wrongful Acts, arts. 8, 11 (Dec. 12, 2001) [hereinafter DASR].

Under the space regime, however, a State cannot "wash its hands of the results of the activities of its nationals."[109] Professors Francis Lyall and Paul Larsen point to the Draft Articles of State Responsibility in asserting that "[t]he failure of a state to authorize would not allow it to escape liability."[110] They do not explain much on this point, and the Draft Articles, standing alone, do not provide the support for their argument. Rather, the Draft Articles must be read in light of the space treaties.

Article 2 of the Draft Articles expresses that "an internationally wrongful act of a State" occurs when the State engages in "conduct consisting of an action or omission . . . [that] constitutes a breach of an international obligation . . . ."[111] Here, "omission" would be a form of attribution. A State can become responsible if a private actor's activities continue despite being unauthorized. Even if a State asserts that it acted with due care, it cannot claim a full exemption from international responsibility for private space activities.

The critical caveat to this broad conception of State liability is that it can only apply to the space context because of the unique underpinnings of space law.[112] The common theme of the space treaties is that States are responsible and liable for private space activities. States generally control access to space,[113] and that control is not conditioned on whether the private activity has been authorized. Under general international law, if the actions of a private entity give rise to damage, "a nexus is constituted between [the outer space activities of a private entity] and the home state sufficient to impute liability on the part of the state."[114] In the space context, however, because the drafters determined space activities to be inherently dangerous, the nexus does not have to be strong.[115] Unlike many other international regimes (such as aviation and maritime law), the drafters were willing to impose absolute liability

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[109] LYALL & LARSEN, *supra* note 69, at 96 n.117.

[110] *Id.*

[111] *See* DASR, *supra* note 108, art. 5 (stating an "entity which is not an organ of the State" may be empowered to exercise elements of governmental authority).

[112] It is hard to imagine States accepting this broad conception of liability in any other context.

[113] LYALL & LARSEN, *supra* note 69, at 416.

[114] *Id.* at 96 n.117.

[115] *Id.* at 60.

or fault-based liability on States, rather than on commercial entities that may be conducting space activities, for damage incurred by space objects.[116]

As a result, and with the purpose of the treaties in mind, a State's obligation does not end because the State failed to grant a license to a commercial or private entity. The OST[117] and the Liability Convention[118] unconditionally attribute responsibility to the State authorizing the precise activity. Whether a State is considered a launching State is not contingent on it being an authorizing State.[119] Thus, if an unauthorized launch occurred, a State may have to take more affirmative steps to ensure the private actor complies with the treaties and stops the offending action.[120] The State may also ultimately be responsible for supervising the object, under Article VI's mandate.[121] Further, the OST details that "State 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 . . . ."[122] Given these principles, State liability extends to unauthorized acts.

To put a finer point on this, if a State does not authorize a private actor's entry into space, that State must ensure that the actor's satellites do not enter orbit.[123] If the object does reach space, it is

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[116] Liability Convention *supra* note 13, art. II. *Cf.* Draft Articles on Prevention of Transboundary Harm from Hazardous Activities [with commentary], Rep. of the Int'l L. Comm., Fifty-third Session, U.N. GAOR, 56th Sess., Supp. No. 10, at 370–436, U.N. Doc. A/56/10 (2001). A point of comparison can be made to air law. The aviation regime, governed by the 1929 Warsaw Convention, fixes liability on the air carrier, whereas the space regime, under the Liability Convention, imposes liability directly on States. *See* Ranjana Kaul & Ram S. Jakhu, *Regulation of Space Activities in India*, *in* NAT'L REG. OF SPACE ACTIVITIES 161 (2010).

[117] Outer Space Treaty, *supra* note 11, art. VII.

[118] Liability Convention, *supra* note 13, arts. II–IV.

[119] *See infra* Part I.D.1 (explaining the different ways a State can be considered a launching State).

[120] Most States impose civil penalties for non-compliance. However, South Korea imposes criminal penalties up to five years in prison. Space Development Promotion Act, Act No. 7538, May 31, 2005, art. 27, amended by Act No. 7538, May 31, 2005 and Act No. 8714, Dec. 21, 2007 (S. Kor.), http://elaw.klri.re.kr/eng_service/lawView.do?hseq=32594.

[121] Outer Space Treaty, *supra* note 11, art. VI.

[122] *Id.*

[123] Consider the following hypothetical: In cases where there is only one State involved, that State will be liable even if it did not authorize the launch. Consider an instance where Company *A* launches a satellite within State *X* through a Company *B*, a

because of a State's omission. As a result, States can be held liable for damage caused by unauthorized satellites. Where two States are involved in such omissions, determining liability becomes more complicated. In this case, if India is responsible for the errant satellites, can the US avoid liability because it did not authorize the launch of the satellites?

D. Who is Responsible: Launching State versus the State of Registry?

States can be liable for damage caused by unauthorized satellites. Still, the fact that Swarm launched its SpaceBEEs from India complicates the analysis of this event. This is especially true when we consider the concept of an "appropriate State" in light of the "State of registry" and "launching State."

Even if a State can be liable for unauthorized launches, one could argue that by launching from India, the SpaceBEEs are solely India's responsibility. Space activities are to be authorized and supervised by the "appropriate State."[124] Regardless of the activity and regardless of whether the State or non-governmental entity coordinates it, the "appropriate State" must ensure this compliance.[125] However, because States continue to be responsible and liable, all States that are involved in space activity may be considered "appropriate States" to supervise and authorize activities.[126]

The following sections demonstrate that India and the US retain liability because they are both launching States. Additionally, because the US actions mirror those required by an appropriate

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private launch company. Both companies are headquartered and incorporated in State *X*. Company *B* allows Company *A* to launch without permission from State *X*. If State *X* can claim that because Company *A* was unauthorized it does not have responsibility, no other country would be able to claim responsibility. Company *A*'s satellites would ostensibly remain unsupervised. Surely, this was not the result envisioned by the drafters of the space treaties. Indeed, such an outcome would render Article I of the Liability Convention devoid of meaning. The Article defines a "launching state" as a "state which launches or procures the launching of a space object [or] a state from whose territory or facility a space object is launched." Liability Convention, *supra* note 13, art. I(c).

[124] *Id.*

[125] *Id.* at art. VII.

[126] *Compare* CHENG, *supra* note 87, at 632 (arguing for multiple appropriate States) *and* LYALL & LARSEN, *supra* note 69, at 415 (arguing for only one appropriate State). *See also* Registration Convention, *supra* note 18, art. I (limiting the State of Registry to one State whereas the OST does not make a similar limitation).

State and because there can be more than one appropriate State, the US is obliged to authorize and supervise the SpaceBEEs.

i. Launching States

A launching State under the Liability Convention may be (1) the State that launches the space object; (2) the State that procures the launch; (3) the State from whose territory the launch occurs; or (4) the State from whose facilities the space object is launched.[127] Thus, in case of an accident, there may be more than one liable State.

In the SpaceBEEs context, India qualifies as a launching State under the Liability Convention's first, third, and fourth definitions of a "launching state." India was the location of the physical launch, and its national space agency controlled the launch. [128] Since India allowed the SpaceBEEs to launch from its territory and facilities, it qualifies as a launching State under the terms of the Liability Convention. As for the US, it may be considered a launching State because of the second definition of a launching State: it—or, at least, its nationals—"procure[d]" the launch. Although the "procuring State" remains undefined in international law, in light of the US' actions concerning the SpaceBEEs, it should be considered a procuring and, therefore, launching State.

One might argue that a private company's actions should not justify the attribution of liability to the US. Indeed, space law scholars have theorized that the procurement of a foreign launch by a private entity, even if it is incorporated or headquartered in the a particular State, should not give rise to that State's liability.[129] The Netherlands and Belgium appear to adopt this view: a private procurement is not sufficiently relevant to implicate State liability.[130]

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[127] Liability Convention, *supra* note 13, art. I(c).

[128] Unlike the U.S., Indian launch abilities are completely controlled by the government. Kaul & Jakhu, *supra* note 85, at 157.

[129] von der Dunk, *supra* note 101, at 39.

[130] Neta Palkovitz & Tanja Masson-Zwaan, *Orbiting Under the Radar: Nano-Satellites, International Obligations and National Space Law*, 55 PROC. COLLOQ. L. OUTER SPACE 571–72 (2012). Netherlands agreed to register a satellite, Triton-1, but declined to become a "launching State" to avoid liability under the Liability Convention. Merely declining liability does not actually absolve a State of liability. *See* SMALL SATELLITES, REGULATORY CHALLENGES AND CHANGES 63 (Irmgard Marboe ed., 2016).

More broadly, it may seem odd that a State, in this case the US, would be responsible as a *launching* State for an authorized launch occurring in another country, in this case India, simply because the private entity happens to be American. Since, for all practical purposes, India assured that the objects reached orbit from India (as opposed to the US), it is not evident why the US should also become the launching State under an impossible burden to prevent a private entity from conducting a launch in another country.

Despite these counterarguments, the US is effectively the launching State for Swarm's unauthorized satellites.[131] In international law, State practice is revealing. The US has shown a willingness and ability to supervise the SpaceBEEs.[132] The US' continued authorization and supervision of Swarm suggests a belief of responsibility and a willingness to accept responsibility. The US not only fined Swarm following their launch, but it moved to license subsequent SpaceBEE launches by Swarm. The actions the US took in regard to Swarm make it the appropriate, liable State under both the formalist[133] and functionalist approaches.[134] Further, even if

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[131] If procurement is broadly interpreted to mean "bringing about" by paying for the space object, then the fact that a US company is the entity "procuring" the launch may suggest, by attribution, the U.S. effectively "procured" it. K.H. Bockstiegel, *The Term "Launching State" in International Space Law*, 37 PROC. COLLOQ. L. OUTER SPACE 81–82 (1995).

[132] For other private actors, it is not clear how many affirmative steps a State can take in regard to regulating the entity before it becomes an appropriate State. This Article will not answer that question.

[133] The formalist view takes the position that the "appropriate State" is the one in the best position to assert jurisdiction and that can physically authorize and supervise the entity. Ricky J. Lee, *Liability Arising from Article VI of the Outer Space Treaty: States, Domestic Law and Private Operators*, 48 PROC. COLLOQ. L. OUTER SPACE 216 (2005). In other words, territorial jurisdiction is more salient than nationality. *See* Stephen Gorove, *Liability in Space Law: An Overview*, 8 ANNALS AIR & SPACE L. 373, 377 (1983). For example, take an instance where Company *A* launches from State *X*, and Company *B* is of State *X* "nationality" but launches in State *Y*. Under this view, State *X* would be more appropriate to authorize and supervise the activities of Company *A* than Company *B*. State *X* is more intimately involved with the launch of Company *A*'s satellites. The fact that the drafters did not use "state of nationality" suggests that the appropriate State can, therefore, be the launching State. *Id*.

[134] In a functionalist approach, the "appropriate State" is defined on a case-by-case basis. Karl-Heinz Bockstiegel, *The Term "Appropriate State" in International Space Law*, 37 PROC. COLLOQ. L. OUTER SPACE 77, 79 (1994). The case-by-case basis would look at which State exercises authority and supervision over the space object, even if it was not the one most intimately involved with the launch of the satellite. In our hypothetical, Company *B* might still be better authorized and supervised by State *X*, even though it

the US did not take these affirmative steps to supervise and authorize the SpaceBEEs, the US could be liable as a launching State because it ostensibly authorized the activities of Spaceflight—the US company that organized the rideshare space launch of Swarm's SpaceBEEs on a PSLV from India.[135]

As a final point of general international law, a State may be held vicariously liable for the acts of all of its officials unless it disowns or disapproves of the acts.[136] Even then, a State must still pay damages.[137] And, under the space regime, States can be held strictly liable. Although the liability regime gives rise to difficul counterarguments, like the ones mentioned above, the multiple definitions of launching State suggest that the drafters of the treaties sought to ensure that States could not escape liability. Further, the liability regime could also be understood as a way to spread the burden of liability appropriately among spacefaring nations. By including the second definition, involving launch procurement, the regime extends liability beyond just territory. The effect of this broad notion of "launching" could be that States that launch many space objects on behalf of other States may not have to bear the brunt of liability for every object they launch. Conversely, States that merely create space objects, but do not launch them, can still be considered launching States under the Liability Convention. Although unauthorized launches create a wrinkle in this analysis, the combination of the strict liability regime and practical purposes of an expansive definition of launching State suggests that even States (like the US in the instant case) that both refuse to license, but also fail to stop the unauthorized launch of, a space object should still be liable.

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launched in State *Y*'s territory. That would be the case if State *Y* had minimal oversight over Company *B*'s law or State *Y* lacked national space laws or the ability to track Company *B*'s satellites. But the fact that Company *B* is incorporated or headquartered in State *X* does not do the work of determining which State has the long-term responsibility in overseeing Company *B*'s activities. Often, the textualist and functionalist approach will result in the same answer, especially when only one State is involved. However, in cases like the SpaceBEEs, where there is an unauthorized launch of a US company's satellite in a foreign country, the functionalist approach might be a better representation of reality.

[135] Spaceflight, as discussed earlier, did not properly assess whether the SpaceBEEs had the appropriate licenses.

[136] LASSA OPPENHEIM, INTERNATIONAL LAW 218 (2d ed. 1912).

[137] CRAWFORD, *supra* note 105, at 201-02; von der Dunk, *supra* note 104, at 364

ii. The State of Registry

More critically, the US has also registered the SpaceBEEs in accordance with the Registration Convention. The Convention clarifies the term "State of Registry" means the launching State on whose registry a space object is carried.[138] Generally, States retain jurisdiction and control over a space object if they register it.[139] Specifically, Article II of the Registration Convention "requires a launching state, or one of the launching states, to register space objects with a national registry and to inform the United Nations of the establishment of the registry."[140] Upon the launch of a space object into Earth's orbit or beyond, the launching State must register the object on its own national registry and with the United Nations.[141] There is no specific time limitation for international registration. Further, the State of registry has complete discretion in the operation and maintenance of its registry.[142]

If there is more than one launching State, the States would decide which would be a "State of registry."[143] Since only one launching State needs to register, "[t]his leaves open the possibility that the link between the state of register and the actual owner/operator of a space object may not be very strong."[144] The State of registry need not necessarily be the State exercising jurisdiction and control over a space object under Article VIII of the OST.[145] Nevertheless, for most instances of satellite launches, an appropriate State will be the State of registry.

The UN Secretariat is processing the registration of unauthorized SpaceBEEs.[146] The US furnished the United Nations with the information in conformity with the Registration Convention on

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[138] Registration Convention, *supra* note 18, art. I.

[139] Outer Space Treaty, *supra* note 11, art. VIII.

[140] Dempsey, *supra* note 88, at 10–11 (citing, G.A. Res. 59/115, Application of the Concept of the Launching State (2004)).

[141] Registration Convention, *supra* note 18, art. II; Dempsey, *supra* note 88, at 10–11 (citing G.A. Res. 59/115, Application of the Concept of the Launching State, (2004)).

[142] Registration Convention, *supra* note 18, arts. II(3), III(2).

[143] Dempsey, *supra* note 88, at 11 (citing Setsuko Aoki, *In Search of the Current Legal Status of the Registration of Space Objects*, 2010 PROC. INT'L INST. OF SPACE L. 245, 246).

[144] LYALL & LARSEN, *supra* note 69, at 87.

[145] CHENG, *supra* note 87, at 474.

[146] *Online Index of Objects Launched into Outer Space*, U.N. OFF. FOR OUTER SPACE AFF. (last visited Apr. 24, 2019), http://www.unoosa.org/oosa/osoindex/search-ng.jspx?lf_id= [hereinafter Registration Document].

January 31, 2019.[147] The information came more than a year after the SpaceBEEs were launched[148] and a month after the FCC imposed severe fines on Swarm.[149] Five SpaceBEEs, which were launched on March 12 and June 29, 2019, with FCC authorization, have yet to be registered but are also listed under the US on the United Nations Office of Outer Space Affair's Online Index of Objects Launched into Outer Space. Because the US is the State of registry, it is therefore primarily responsible for authorizing and supervising the all the SpaceBEEs, including the ones launched without authorization.

E. The US is Responsible for Unauthorized Satellites

As the previous sections suggest, determining State responsibility and liability over unauthorized space objects launched by a company incorporated in another country is complicated if no State willingly takes responsibility. A State in this system may have different types of liability and obligations. First, the appropriate State is responsible for authorizing and supervising the objects. Second, States can be liable for damage caused by unauthorized satellites. Third, just as there can be multiple launching States, there can be numerous appropriate States. Fourth, the State of registry is also a launching State and, by extension, the appropriate State. Fifth, if a State falls into any of those categories, it is liable for any damage the object causes.

Here, India and the US are both liable for the SpaceBEEs. The table on the following page summarizes the different methods by which the two countries can be considered responsible.[150]

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[147] *See id.*

[148] *See id.*

[149] Swarm Techs., Inc., F.C.C. 18-184, Consent Decree 2 (Dec. 20, 2018), https://docs.fcc.gov/public/attachments/FCC-18-184A1.pdf; FCC Press Release, *supra* note 12.

[150] It notes which determinations are likely to be contested or uncontested in the international legal community.

Table 2. Obligations of India and the US over the SpaceBEEs

	Appropriate State	***Launching State***	***State of registry***
INDIA	X (residual responsibility—*uncontested*)	X (launches/ territory/ facilities—*uncontested*)	
US	X (actively supervising and authorizing additional objects for the constellation—*contested*)	X (procuring—*contested*)	X (registered with the United Nations—*uncontested*)

In practice, the duties of authorization and supervision can be separated from the responsibility to make reparations for damage. The OST does not "base liability on whether a space object is listed in the registry."[151] Rather, it bases liability on whether a State is a launching State.[152] For example, if India and the US had jointly launched the SpaceBEEs, they would both be considered launching States. Despite this determination, only one of them would be the State of registry. However, both could be considered appropriate States responsible for the authorization and supervision of the SpaceBEEs. In the event of damage, both India and the US would be considered liable and responsible for appropriate reparations.

Though the US took post facto responsibility for the SpaceBEEs, India is still considered a launching State under the treaty regime. Therefore, even though it is not obligated to supervise the SpaceBEEs, India is subject to liability should they cause damage. Additionally, even if the US had not registered the SpaceBEEs, it would also likely be liable under the procuring State analysis.[153]

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[151] Dan St. John, *The Trouble with Westphalia in Space: The State-Centric Liability Regime*, 40 DENV. J. INT'L L. & POL'Y 686, 700 (2012) (citing NANDASIRI JASENTULIYANA, INTERNATIONAL SPACE LAW AND THE UNITED NATIONS 321, 326–27 (1999); VERSCHOOR & KOPAL, *supra* note 62, at 46). Note that a launching State is also the State procures the lunch, as liability is also created under national responsibility per Article VI.

[152] Outer Space Treaty, *supra* note 11, art. VII.

[153] CHENG, *supra* note 87, at 330 ("[T]he Liability Convention covers all launchings from territories of the contracting parties, whether the authors of the launching are individuals or institutions, authorized or unauthorized, official or private, national or foreign, and the launching intentional or purely accidental.").

They will thus be jointly and severally liable for any damage caused by the SpaceBEEs. This is true, even though the US has registered them. Given this, we can consider the ramifications for U.S. and Indian liability over the SpaceBEEs.

F. The Consequences of Liability

The Liability Convention establishes a "two-tiered tort regime"[154] composed of absolute liability and fault-based liability. The rule distinguishes between surface activities and space activities. Launching States are "absolutely liable to pay compensation for damage caused by its space object on the surface of the [E]arth or to aircraft in flight."[155] If the damage occurs elsewhere, launching States are subject to fault-based liability.[156]

Placing absolute liability on the State for private launch activities is justified because "the [S]tate for whose benefit the risk was created should bear the loss unavoidably entailed in space activities rather than the random victim."[157] Space activities pose a hazard "involving extraordinary risks which cannot be eliminated by the utmost care."[158] Thus, where a launching State's space object causes damage "on the surface of the Earth or to aircraft in flight," the launching State is "absolutely liable" for any damage.[159] Especially because the SpaceBEEs were the secondary payload to the PSLV, both India and the US would be liable had the SpaceBEEs caused any damage while on Indian soil or in its immediate airspace.

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[154] Lalin Kovudhikulrungsri & Duangden Nakseeharach, *Liability Regime of International Space Law: Some Lessons from International Nuclear Law*, 4 JEAIL 291, 300 (2011); David A. Koplow, *ASAT-Isfaction: Customary International Law and the Regulation of Anti-Satellite Weapons*, 30 MICH. J. INT'L L. 1187, 1199 (2009).

[155] Liability Convention, *supra* note 13, art. I

[156] *Id.* at art. III.

[157] W.F. Foster, *The Convention on International Liability for Damage Caused by Space Objects*, 10 CAN. Y.B. 137, 151 (1972). "Benefit" is to be construed broadly. The one exception to absolute liability for space activities is "when a launching State can prove that such damage has resulted wholly or partially for the following reasons: (1) gross negligence; or (2) from an act or omission done with intent to cause damage on the part of a claimant state or of natural or juridical persons it represents." Kovudhikulrungsri & Nakseeharach, *supra* note 154, at 301.

[158] *Id.*

[159] Liability Convention, *supra* note 13, art. II.

For damage that occurs in space, the standard is a simple fault-based one.[160] However, the Liability Convention does not specify the standard for fault,[161] so other areas of international law must serve as guides.[162] Liability is also limited where the damaged State acts with gross negligence or willful intent, while the launching State acts in accordance with international law.[163]

If there is more than one launching State, those States are jointly and severally liable for the damage caused by a space object.[164] In an accident that involves two space objects and causes injury to a third State or its nationals, both launching States are liable to the third State. The State paying the damages may seek indemnification the other.[165] Even a State from whose territory the space object is launched, that is a "passive participant State," is included among the liable States.[166] In summary, if the SpaceBEEs are at fault for damaging another State's property, the US and India would be responsible for compensating those who incurred a loss as a result.

IV. THE RESPONSE: U.S. DOMESTIC SPACE LAW

The US space liability regime is premised on certain assumptions regarding when the US could be held liable for damage. It is difficult to know whether the US would have accepted liability for any damage caused by unauthorized satellites prior to their registration. That said, the US did eventually register the SpaceBEEs, sought to assert control over them by fining Swarm, and gave

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[160] *Id.* at art. III.

[161] *See* Robert F. Stamps, *Orbital Debris: An International Agreement is Needed*, 32 COLLOQ. L. OF OUTER SPACE 152, 154 (1990) ("In order to establish whether a State is at fault for a collision . . . there must first be an accepted standard of care for traffic in outer space, and a breach of that standard of care.").

[162] St. John, *supra* note 151, at 702; JASENTULIYANA, *supra* note 151, at 208.

[163] Liability Convention, *supra* note 13, art. VI.

[164] *Id.* at art. V (creating joint responsibility among launching States). *See generally* HOWARD A. BAKER, SPACE DEBRIS: LEGAL AND POLICY IMPLICATIONS (1989). Even if there is only one appropriate State, there can be multiple launching States and therefore multiple State liable in damages.

[165] Liability Convention, *supra* note 13, art. V. The Outer Space Treaty's and Liability Convention's imposition of joint and several liability further encourages States to enact domestic space law that transfers financial responsibility, at least in part, on private launching companies. Dempsey, *supra* note 88, at 31.

[166] Liability Convention, *supra* note 13, art. V; LYALL & LARSEN, *supra* note 69, at 100.

licenses to other SpaceBEEs in the same constellation. Under these circumstances, the US seems willing to accept liability for any damage caused by the SpaceBEEs.

Given that the US is liable for the SpaceBEEs, the next question is how the domestic regime of the US deals with this liability.[167] The implementation of the authorization and continuing supervision requirement of Article VI and the liability regime of the Liability Convention are left to State discretion.[168] The space treaties do not provide specific guidance on the implementation of their obligations.[169] As a result, the regulatory standards and oversight can and do vary significantly between States.[170] A country's methods of implementing the obligations likely affect its status as a competitive player in the commercial space market. The legislative scheme that States adopt also likely affects how amenable its jurisdiction is to innovation in space activities.

Generally, indemnification offers the opportunity for States to be reimbursed for any outlay States must make on behalf of a private entity, in light of their liability under the Liability Convention.[171] Licensing is the primary mechanism by which States implement the OST.[172] A license is often a prerequisite to space activity, placing restrictions on each launch, overseas launches, or re-entries.[173] The next section describes the legislative measures of the US and its current indemnification and licensing regime.

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[167] This Article focuses on the U.S. domestic regime as India has yet to enact one.

[168] *See* Outer Space Treaty, *supra* note 11, art. VIII ("A State Party to the Treaty on whose registry an object launched into outer space is carried shall retain jurisdiction and control over such object . . . ."); Registration Convention, *supra* note 47, art. II(3) ("The contents of each registry and the conditions under which it is maintained shall be determined by the State of registry concerned.").

[169] Dempsey, *supra* note 88, at 14.

[170] Many States, upwards of 26, like China, France, Russia, Norway, and South Korea have adopted domestic licensing and indemnification regimes for space activities. Scott J. Shackelford, *Governing the Final Frontier: A Polycentric Approach to Managing Space Weaponization and Debris*, 51 AM. BUS. L.J. 429, 477 (2014).

[171] Albert, *supra* note 67, at 235.

[172] *Id.* at 246-47.

[173] Dempsey, *supra* note 88, at 19.

A. The Commercial Space Launch Activities Act and Indemnification

For the US, the Commercial Space Launch Activities Act (CSLAA) serves as the primary body of national law governing commercial launch activities and related international obligations of the US.[174] The two primary mechanisms by which the US regulates space objects under the CSLAA are indemnification and licensing.[175] Enacted in 1984, the CSLAA oversees licensing and regulation. The CSLAA was meant to create stability in both the insurance and indemnification regime to ensure the success of the US launch industry.[176] In creating CSLAA system, Congress sought to level the playing field between foreign launch providers and the US launch industry.[177]

Additionally, the act was meant to ensure the success of the US launch industry by encouraging private sector investment in space technology.[178] The act purported to do so in three ways: by improving launch and re-entry,[179] promoting "economic growth and entrepreneurial activity"[180] and "enabl[ing] the United States to retain its competitive position internationally."[181] The US Department of Transportation is primarily responsible for licensing and regulating commercial space activities, with some exceptions. In carrying out these duties, these government agencies must comply with international obligations.

In attempting to introduce "stable, minimal, and appropriate regulatory guidelines,"[182] the CSLAA was supposed to create a more streamlined and efficient licensing application system than

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[174] 51 U.S.C. § 50901(a)(3) (2018); Timothy R. Hughes & Esta Rosenberg, *Space Travel Law (And Politics): The Evolution of the Commercial Space Law Act of 2004*, 31 J. SPACE L. 1, 11–12 (2005).

[175] Hughes & Rosenberg, *supra* note 174, at 12-13.

[176] H.R. Rep. No. 100-639, at 2 (1988) (stating that the general purpose of the legislation is "to facilitate commercial access to space").

[177] *See* S. Rep. No. 100-593, at 3 (1988) (describing the disparate systems of indemnification among several launching nations).

[178] H.R. Rep. No. 100-639, at 2 (stating that the general purpose of the legislation is "to facilitate commercial access to space").

[179] 51 U.S.C. § 50901(a)(4) ("complement[ing] the launching, reentry, and associated services of the United States Government").

[180] *Id.* § 50901(b)(1).

[181] *Id.* § 50901(a)(5).

[182] *Id.* § 50901(a)(6).

what the US had before.[183] Regulations were to be implemented as necessary to ensure all private activity complied with the nation's international obligations.[184]

The licensing structure created by the Commercial Space Launch Amendments Act, which amended the CSLAA,[185] requires launching entities to possess liability insurance and limits the US's liability under the Liability Convention through risk-sharing.

The CSLAA also provides the "three-tier" launch indemnification system currently used in the US.[186] As a point of clarification, this scheme only affects launch service providers; Swarm was not required to file with the FAA. The Commercial Space Launch Competitiveness Act of 2015 ensured this framework remains operational through 2025.[187] The first tier of the US space indemnification policy consists of an insurance policy that all companies are required to purchase before being awarded a license by the FAA.[188] The FAA determines the amount by calculating the "maximum probable loss" (MPL)—which is "the greatest dollar amount of loss for bodily injury or property damage that is reasonably expected to result from a licensed or permitted activity."[189] The MPL is capped at $500 million per launch[190] and, "subject to the availability of appropriations, [the federal government] will indemnify claims over the MPL."[191] The second tier of indemnification is the coverage that

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[183] *Id.* § 50901(b)(2)(A).

[184] *Id.* § 50901(a)(7).

[185] 51 U.S.C. §§ 50904-23. *Id.* § 70101 (advancing "the goal of safely opening space to the American people and their private commercial . . . enterprises: and granting the Secretary of Transportation the authority to promulgate regulations to encourage private space ventures).

[186] Dan Leone, *U.S. House Approves One-year Launch Indemnity Extension*, SPACENEWS (Dec. 9, 2013), http://www.spacenews.com/article/launch-report/38526us-house-approves-one-year-launch-indemnity-extension. This risk-sharing regime for space activities is mirrored in the National Flood Insurance Program, Overseas Private Investment Corporation, Terrorism Risk Insurance Act, and Price-Anderson Act for the nuclear power industry. Albert, *supra* note 67, at 249. Note that, under international law, the State will always be liable.

[187] AST, *supra* note 70, at 89.

[188] 14 C.F.R. § 440.9 (2019). Albert, *supra* note 67, at 248; U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-12-899, COMMERCIAL SPACE LAUNCHES: FAA SHOULD UPDATE HOW IT ASSESSES FEDERAL LIABILITY RISK 4 (2012) [hereinafter FAA UPDATE].

[189] 14 C.F.R. § 440.3. *See also id.* § 440.7; FAA UPDATE, *supra* note 188, at 4.

[190] 14 C.F.R. § 440.9(c).

[191] *Commercial Space Industry Developments and FAA Challenges: Hearing Before the Subcomm. On Aviation of the H. Comm. On Transportation and Infrastructure*, 114th

the US will provide for a catastrophic loss.[192] The US will pay up to "$3.06 billion in 2015 dollars."[193] The government will not indemnify willful misconduct.[194] The third tier shifts responsibility back to the launch company for any excess damages above the second-tier cap, adjusted for inflation.[195] The launch company need not have insurance for this tier.[196]

B. The Licensing Regime

The licensing scheme, which also requires proof that a company obtained insurance, is far more complex. This section attempts to explain the intricacies of the licensing process that satellite companies like Swarm, and launch companies like Spaceflight, must complete. The case study of Swarm is characteristic of the confusion among satellite companies and launch providers as to what licenses are required and who has the responsibility to ensure licensing requirements are met. For example, Spaceflight did not check that Swarm had the "necessary licenses ahead of time," as it relied on companies "to do their own self-regulation."[197] Thus, this section sets up the necessary background to understand the need to reform the domestic regulatory system.

For non-government satellites, the National Oceanic and Atmospheric Administration (NOAA) issues licenses for remote

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Cong. 6, 7 n.11 (2016) (statement of Gerald L. Dillingham, Physical Infrastructure Director, GAO), https://www.gao.gov/assets/680/678006.pdf. [hereinafter Industry Developments].

[192] 51 U.S.C. § 50915 (2018); FAA UPDATE, *supra* note 188, at 5.

[193] Industry Developments, *supra* note 191, at 7. *See also* 51 U.S.C. § 50915(a)(1)(B) (capping the amount payable to "not more than $1,500,000,000 (plus additional amounts necessary to reflect inflation occurring after January 1, 1989) above that insurance or financial responsibility amount").

[194] 14 C.F.R. § 440.17(c). Dempsey, *supra* note 88, at 33. *See also* U.S. GOV'T ACCOUNTABILITY OFF., GAO-14-328T, COMMERCIAL SPACE LAUNCHES: FAA'S RISK ASSESSMENT PROCESS IS NOT YET UPDATED 5 (2014), http://www.gao.gov/assets/670/660635.pdf.

[195] Albert, *supra* note 67, at 248; FAA UPDATE, *supra* note 147, at 5.

[196] 51 U.S.C. § 50915(a)(A).

[197] Caleb Henry, *FCC Fines Swarm $900,000 for Unauthorized Smallsat Launch*, SPACENEWS (Dec. 20, 2018), https://spacenews.com/fcc-fines-swarm-900000-for-unauthorized-smallsat-launch/.

sensing satellites, the FCC requires licensing for radio communications satellites, and the FAA grants licenses to launch.[198]

For companies like Swarm, one of the first steps in the licensing process is to obtain permission to use radio frequencies and orbital slots from the FCC, as established under the Communications Act of 1934.[199] The FCC also applies international regulations and procedures specified in International Telecommunications Union regulations.[200] An actor may then need to go to NOAA to obtain permission to engage in remote sensing operations.[201]

At the time that Swarm applied for licensing from the FCC for the SpaceBEEs, satellites were initially grouped into two categories: geostationary-satellite and non-geostationary-satellite orbit systems.[202] Thus, Swarm had to apply for an experimental license for a non-geostationary-satellite orbit system. There was no separate category for small satellites until August 2019.

However, the FCC—after undergoing a notice and comment period[203]—streamlined procedures for small satellites.[204] As a result, applicants no longer have to simply resort to the Commission's experimental licensing program, which was limited to non-commercial use.[205] Instead, they may also apply for a "part 25 license," which—among other things—protects communications from harmful interference and permits commercial operations.[206] As part of the FCC's new small satellite licensing procedures, the application

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[198] AST, *supra* note 70, at 88. *See also* Matthew Schaefer, *The Contours of Permissionless Innovation in the Outer Space Domain*, 39 U. PA. J. INT'L L. 103, 117 (2017) (citing 47 U.S.C. §§ 701-69 (2018)).

[199] 47 U.S.C. §§ 151-624 (2018).

[200] International Telecommunication Constitution and Convention, Dec. 22, 1992, 1825 U.N.T.S. 390.

[201] AST, *supra* note 70, at 88.

[202] 47 C.F.R. § 25.114(a) (2019).

[203] Notice of Proposed Rulemaking on Streamlining Licensing Procedures for Small Satellites, F.C.C. 18-44 (proposed Apr. 17, 2018), https://transition.fcc.gov/Daily_Releases/Daily_Business/2018/db0417/FCC-18-44A1.pdf.

[204] Streamlining Licensing Procedures for Small Satellites, F.C.C. 19-81, Order (Aug. 1, 2019), https://docs.fcc.gov/public/attachments/FCC-19-81A1.pdf [hereinafter FCC Small Satellite Order]

[205] FCC Small Satellite Order, *supra* note 204, ¶ 11.

[206] *Id.* ¶ 12.

fee moved from $454,705 to $30,000, which reduces the financial burden many small satellite companies faced.[207]

The full scope of the requirements for part 25 licenses for "small satellites" can be found in Title 47, Parts 25.103 through 25.217 of the Code of Federal Regulations. Of note, among other limitations, only systems that have (1) ten or fewer satellites, (2) deploy satellites below the orbital altitude of the International Space Station or possess propulsion systems, (3) have a total on-orbit lifetime of five years or less and (4) can share a frequency band without precluding future entrants fall.[208] Notably, constellation systems like Swarm's original SpaceBEEs do not qualify: satellites less than ten centimeters in width, height, and length are expressly excluded.[209]

Further, to apply for a small satellite license, applications must—beyond meeting the requirements listed above—among other things,

> (a) certify that operations of its satellites will not interfere with those of existing operators, (b) certify that it will not materially constrain future operators from using the assigned frequency band(s), and (c) provide a brief narrative description illustrating the methods by which both current and future operators will not be materially constrained.[210]

And, on top of the other limitations, the total lifetime for any space station cannot exceed six years.[211]

For launch providers that companies like Swarm use, they are required under the CSLAA to obtain launch operating licenses for

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[207] FCC Small Satellite Order, *supra* note 204, ¶ 99. The licensing fee of $30,000 is still frequently considered too high for small satellite operators' limited budget. *See, e.g.,* Pexer B. de Selding, *In Smallsat Licensing Proposal, FCC Gets an Earful from Small and Large Satellite Operators*, SPACE INTEL REP. (Aug. 9, 2018), https://www.spaceintelreport.com/in-smallsat-licensing-proposal-fcc-gets-an-earful-from-small-and-large-satellite-operators/. Note how universities are still protesting this fee.

[208] 47 C.F.R. § 25.122(c) (2019). *See also* Proposed Rulemaking on Streamlining Licensing Procedures for Small Satellites, F.C.C. 18-44; FCC Small Satellite Order, *supra* note 204, ¶ 19 (listing more requirements).

[209] FCC Small Satellite Order, *supra* note 204, ¶ 19.

[210] FCC Small Satellite Order, *supra* note 204, ¶ 81.

[211] 47 C.F.R. § 25.123(b)(2).

each satellite from the FAA.[212] The launch company will have to buy insurance under the indemnification regime that the CSLAA lays out. Under the FAA's licensing process, it takes around six months to apply, and companies have to "re-apply at 90 days, 30 days, and then [they have] 15 days to file a flight plan."[213] If an operator seeks even to switch launchpads at a spaceport, companies have to essentially apply for a new license. Generally, the agency reviews applications on an ex-ante case-by-case basis.[214] The statutory and regulatory authority to issue launch licenses is broad and not specific to vehicles, including small satellites like the Space-BEEs.[215]

The FAA then, separate from the launch license process, assesses whether the space object presents any issues to public health and safety, national security, foreign policy interests or US international obligations.[216] The applicants must submit information on the proposed launch site operator, launch site, foreign ownership interests and launch site operations.[217] In the event of non-compliance, the agency may suspend or revoke licenses,[218] issue emergency orders[219] and impose civil penalties.[220] Despite making the system less flexible to innovation, the ex-ante examination of the risks of space objects present is often justified in the space context because of the national security hazards and the US's international obligations requiring authorization of commercial space activities.[221]

More broadly, a common theme across these licensing systems is that Congress and the relevant administrative agencies have placed a special emphasis on the importance of developing a vibrant

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[212] Schaefer, *supra* note 198, at 117. It is important to note that companies like Swarm do not need to acquire a launch license when their satellites operate as a payload.

[213] Michael Sheetz, *SpaceX President Slams Space Regulations: "It Requires Heroics" to Make Minor Changes*, CNBC (Oct. 5, 2017), https://www.cnbc.com/2017/10/05/spacex-president-gwynne-shotwell-slams-space-regulations.html.

[214] 51 U.S.C. §§ 50918(a)-(b) (2018). *See also* Dempsey, *supra* note 62, at 26.

[215] *See* Paul B. Larsen, *Small Satellite Legal Issues*, 82 J. AIR L. & COM. 275, 276 (2017).

[216] 51 U.S.C. §§ 50918(a)-(b).

[217] 14 C.F.R. § 420.15 (2019).

[218] *Id.* § 405.3.

[219] *Id.* § 405.5.

[220] 51 U.S.C. § 50917(c)(1).

[221] Schaefer, *supra* note 198, at 116.

commercial space launch capacity in the US.[222] Congress, in particular, claims that licensing conditions with separate frameworks for launch and reentry, remote sensing, and communications "provide clear avenues through which the U.S. government can fulfill its Article VI obligations in relation to the newly contemplated commercial space activities."[223] This decentralized approach may, however, only serve to obfuscate the ability of the US to promote innovative uses for and manage different types of space objects.

To summarize, the duties and abilities of the NOAA,[224] FCC[225] and FAA[226] are spread across separate and complicated regulations that demand different obligations from private launch companies. Further, denial of applications often comes without much explanation, limiting predictability and transparency in the licensing operations.[227]

V. THE CURRENT REGIME IS ILL-PREPARED FOR PRIVATE ACTORS

For innovative technology, the challenge is to determine what regulations such technology is subject to relative to others within

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[222] 51 U.S.C. § 50901(a)(7)-(8) ("[T]he United States should encourage private sector launches, reentries, and associated services and, only to the extent necessary, regulate those launches, reentries, and services to ensure compliance with international obligations of the United States and to protect the public health and safety, safety of property, and national security and foreign policy interests of the United States . . .there is a need to develop a strong space transportation infrastructure with significant private sector involvement.").

[223] *See* Letter from John Holdren, Dir. & Asst. to President for Sci. and Tech., to Sen. Thune and Rep. Smith 3 (Apr. 4, 2016), https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/csla_report_4-4-16_final.pdf.

[224] For example, NOAA licenses parties to operate private remote space sensing systems under 51 U.S.C. § 60121 and 15 C.F.R. § 960.11.

[225] It is required to comply with FCC regulations like 47 C.F.R. § 97.207. The FCC regulates commercial satellites through 47 C.F.R. §§ 25.101–25.701, which covers satellite communications and, specifically, 47 C.F.R. §§ 25.140–25.149, which focuses on technical standards and operations. The rules are pursuant to the Communications Satellite Act of 1962, the International Maritime Satellite Telecommunications Act, and titles I through III of the Communications Act of 1934. *See* 47 C.F.R § 25.101 (2019).

[226] Launch licenses are issued under the FAA under 51 U.S.C. §§ 50901–50923 and the subsequent regulations under 14 C.F.R. §§ 400.1–401.5. The basis for those regulations is the CSLAA of 1984. *See* 14 C.F.R. § 400.1.

[227] Kaitlyn Johnson, *More Than Just Fixing the Rules: Regulating for Innovation*, SPACENEWS (Apr. 27, 2017), https://spacenews.com/more-than-just-fixing-the-rules-regulating-for-innovation/.

the industry.[228] Subjecting innovation to pre-existing laws is not always the solution, as such regulations may be ill-suited to address new technology and may stifle growth. However, letting innovation go unregulated can pose risks to public safety and welfare.[229] In the Uber context, some argue that "regulations should take on a flexible, experimental nature until the contours of the market are more fully developed."[230] The benefit of experimental regulations is that they "allow lawmakers to monitor innovation and growth and better tailor the regulations to any safety problems that may arise in the process."[231]

At this point, the analogy between Uber and SpaceBEEs becomes asymmetrical. Uber's regulatory evasion of labor standards and pay,[232] for instance, is not applicable in the space context. Moreover, unauthorized space objects can cause far more damage to the world than licensed drivers on the roads. For example, the debris created by satellite collisions remains in orbit and can damage other satellites or re-enter the atmosphere and damage foreign territory.[233] States cannot afford to take the same gambles and adopt a completely bottom-up approach as many localities did for Uber. At some point, lines have to be drawn.[234]

Internationally, other States' failure to properly supervise raises the risk of harm to the US as it relies on space for critical activities and operates a large number of satellites. We can easily imagine a situation where a US company's satellite loses orbit and smashes into, say, a European satellite, creating debris that could potentially damage numerous other satellites.[235] International

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[228] Posen, *supra* note 36, at 419.

[229] For regulatory entrepreneurs, "if the relevant regulatory body credibly commits to not enforcing the law on the books, that is roughly as good, from the entrepreneur's perspective, as formally amending the law." Pollman & Barry, *supra* note 47, at 396.

[230] Posen, *supra* note 36, at 429.

[231] *Id.* at 431.

[232] *See generally* Diana Cao, Note, *Regulation Through Deregulation: Sharing Economy Companies Gaining Legitimacy by Circumventing Traditional Frameworks*, 68 HASTINGS L.J. 1085 (2017) (describing, for example, how transportation-network companies like Uber adopt driver-unfriendly insurance policies).

[233] Lauren Bressack, Note, *Addressing the Problem of Orbital Pollution: Defining a Standard of Care to Hold Polluters Accountable*, 43 GEO. WASH. INT'L L. REV. 741, 745–48 (2011).

[234] Calo & Rosenblat, *supra* note 60, at 1671.

[235] Indeed, the European Space Agency had to alter "the trajectory of one of its observation satellites to avoid a collision with a craft operated by Elon Musk's SpaceX" in

space law, as it stands, will not care if a national government, a private start-up, or three people standing in a parking lot launch the satellite. The State is always responsible. That said, drafters of the space treaties did not foresee commercial actors like Swarm flooding the satellite market.[236] Similarly, the regime they designed does not appropriately account for these private entities. A private entity thwarting authorization may be rare, but Swarm has shown it is possible. Swarm's four illicitly-launched SpaceBEE satellites are not coming down any time soon, and their presence in space can have consequences for the US and India.

More broadly, international space law developed very differently than other legal systems. The drafters of the space treaties did not envision commercial space activities.[237] Although space law can look to treaties, customary international law, and judicial decisions, international law does not address the unique challenges of outer space.[238] In contrast to other *lex specialis*, like maritime law, space law did not develop over centuries and become formalized.[239] Instead, space law "started afresh at the international level with broad declarations of principles."[240] Thus, it does not have the benefit of looking to observable State practice, as other areas of law had when their respective conventions were developed.

As it stands, the current space liability regime's State-centric model "is increasingly unworkable for private entities," particularly small satellite companies.[241] It was designed for an outer space dominated by the US and the Soviet Union, not one crowded with other States and many private actors.[242] Due to rapidly changing technology, international space law remains largely informal.

September 2019. *See, e.g.,* Agence France-Presse, *European Satellite in Near Collision with Elon Musk SpaceX Craft*, THE GUARDIAN (Sept. 3, 2019), https://www.theguardian.com/science/2019/sep/03/european-satellite-in-near-collision-with-elon-musk-spacex-craft.

[236] For example, Swarm seeks to launch 150 satellites in the next 18 months. Alan Boyle, *After Satellite Flap, Swarm Technologies Raises $25M for Space-Based IoT Network*, GEEKWIRE (Jan. 29, 2019), https://www.geekwire.com/2019/satellite-controversy-swarm-technologies-raises-25m-space-based-iot-network/.

[237] St. John, *supra* note 151, at 691.

[238] *Id.* at 692 (internal citations omitted).

[239] *Id.*

[240] *Id.*

[241] *Id.* at 712.

[242] JASENTULIYANA, *supra* note 105, at 321.

States are ultimately liable for damage and, therefore, must weigh national space policies that protect "the [S]tate from liability with unnecessarily chilling domestic commercial space ventures."[243] As a result, States must rely on informal principles to govern space activities.[244] Moreover, to remain relevant, international space law demands an evolving legal structure.

As of now, no international regulatory system directly addresses the safety and navigation of space objects. A multilateral treaty addressing space has not been drafted since 1979.[245] Because international space law is out of date and out of sync, States must "fill that regulatory void with domestic legislation."[246] The consequence is that space law is extremely decentralized. The lack of clarity in international space law does not generate a desirable stable, uniform, or transparent regulatory and level playing field.

To be sure, States may avoid stringent regulations and choose to launch risky satellites both for the revenue that comes from that business relationship and in order to carve out a strong position in the commercial space market. Alternatively, to avoid unfavorable economic requirements from its home State, a satellite company may choose to launch from a State with more convenient regulations.[247] Small States, and even India, see licensing of space activities as a method of generating income.[248] Countries that have yet to implement national space laws[249] may become the launching grounds for satellites that are considered too risky for other States. But without federal legislation, a State "may very well find that its nationals have engaged in unreasonably risky activities and therefore subjected it to an unexpected liability for damages."[250]

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[243] St. John, *supra* note 151, at 712 (internal citation omitted).

[244] *Id.* at 691.

[245] Dempsey, *supra* note 88, at 5.

[246] *Id. See also* Adrian Taghdiri, *Flags of Convenience and the Commercial Space Flight Industry: The Inadequacy of Current International Law to Address the Opportune Registration of Space Vehicles in Flag States*, 19 B.U. J. SCI. & TECH. L. 405, 514 (2013).

[247] William Tetley, *The Law of the Flag, "Flag Shopping," and Choice of Law*, 17 TUL. MAR. L.J. 139, 173–74 (1993).

[248] LYALL & LARSEN, *supra* note 69, at 62 n.81.

[249] FRANCIS LYALL & PAUL B. LARSEN, SPACE LAW: A TREATISE 470 (2009) (India issues "individual launch permits based directly on the rights of the state under the space treaties and international law").

[250] *Id.* at 471.

Space then becomes ripe for a classic tragedy of the commons: without regulation of what is launched into orbit, outer space becomes a de facto dumping ground. And unlike the high seas, orbital space is scarce.[251] Satellites, depending on their function, must operate in certain geostationary or polar orbits to achieve their purpose. Small satellites, in particular, operate in low-Earth orbits (LEO) in massive constellations. As those orbits become more crowded and unregulated, the chances of satellite collisions increase. Thus, while other States benefit from the US' closer supervision, the US' assets and interests in space are potentially harmed by the hazards created by States who do not regulate to the same extent.[252]

In addition to the international difficulties associated with managing outer space, governmental regulation of space activities faces the tension between promoting commercial space investment—to ensure companies are not driven to more flexible regulatory landscapes—and still meeting international and domestic obligations to avoiding creating additional hazards in space.

With that in mind, in addition to the determination that the US is responsible for the space activities of its private commercial entrepreneurs, it is in the US' self-interest to improve the US licensing and supervision regime to account for the issues raised by small satellites and start-ups. To do that, it must start recognizing and addressing the particular problems the current US space system faces.

Licenses for small launches with small payloads pose challenges for regulatory authorities. One problem is, of course, resources. Although statutory licensing requirements may mandate applications to be turned around in 120 days, that often does not happen: licensing staffs are small and poorly funded for the FAA, NOAA, and FCC.[253]

Another problem is balancing the interests that drive licensing. The FCC, in particular, has responded to the growing role of small satellites in commercial space activities and the need for

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[251] *See* Adrian Copiz, *Scarcity in Space: The International Regulation of Satellites*, 10 COMMLAW CONSPECTUS 207, 207, 209 (2002).

[252] Ronald L. Spencer, Jr., *State Supervision of Space Activity*, 63 A.F. L. REV. 75, 126 (2009).

[253] Johnson, *supra* note 227.

finer-tuned regulations to reduce the burden of licensing, by streamlining the small satellite licensing process. But the accommodations the FCC adopted most recently are limited and do not sufficiently address the broader issue of facilitating small satellite use, especially those that exist in bigger constellations. At the same time, regulations are needed to limit orbital debris and protect against harmful interference.

Third, while spacefaring nations have signaled previous good State practice in registering their space objects, recently, States have registered their launched space objects less.[254] For example, all objects launched in 1972 were registered, but 30.5 percent of objects launched in 2004 were unregistered.[255] As of 2017, seven percent of space objects, in total, remain unregistered.[256] Satellites that tend to go unregistered are those that have been launched by non-US launch vehicles and those that have particularly short orbits—which are frequently small satellites.[257] And because there is no time constraint to register, or any verification procedure for the international community to assess whether launched objects have been registered, satellites can skirt registration obligations if States are unaware of their launch. In the context of SpaceBEEs, the FCC became aware two months after the unauthorized launch. These lax registration rules may cause problems with identification, especially if unregistered satellites are involved in accidents.

Regulators are not the only ones challenged by the increased commercial use of space. For start-ups or other new actors seeking to launch small satellites, coordinating domestic and international regulations to obtain a license can be a lengthy, cumbersome, and

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[254] For example, all objects launched in 1972 were registered, but 30.5 percent of objects launched in 2004 were unregistered. INT'L L. ASS'N - SPACE L. COMM., REPORT ON LEGAL ASPECTS OF THE PRIVATISATION AND COMMERICALISATION OF SPACE ACTIVITIES: REMOTE SENSING AND NATIONAL SPACE LEGISLATION 2–3 (2006). As of 2017, seven percent of space objects, in total, remain unregistered. Paul B. Larsen, *Small Satellite Legal Issues*, 82 J. AIR L. & COM. 275, 289 (2017). Intuitively, it seems more like commercial vendors are failing to register their products; however, it is the State that must register the product on the United Nations ledger. Therefore, it is the ultimate failure of the State to register and take measures to ensure they are tracking which space objects fall under the State's responsibility.

[255] INT'L L. ASS'N, *supra* note 254, at 2-3.

[256] Larsen, *supra* note 254, at 289.

[257] JAKHU & PELTON, *supra* note 20, at 55. A potential rationale for actors neglecting to register these satellites is because they are thought to be "too small and insignificant to be considered space objects." Larsen, *supra* note 254, at 289.

time-consuming process. As discussed earlier, the FCC's position on small satellites has been "bizarrely inconsistent."[258] The FCC has licensed multiple satellites measuring less than ten centimeters, including some as tiny as three by three centimeters.[259] Moreover, the FCC has refused launch permission for satellites that are virtually identical to others that were previously authorized.[260] In this uncertain environment, a satellite maker may choose to export her technology rather than risk the denial of an operating license.

Start-ups like Swarm also largely function off of venture capitol, which is frequently contingent on demonstrating the viability and success of the product. If a start-up has to wait too long to obtain a license, it may very well be tempted to push boundaries and take the risk of incurring a penalty for operating without a permit.

For example, by the time the FCC denied Swarm's initial license, the company had poured endless hours and huge expenditures into the design and manufacture of the satellites. Satellite companies must work on completion of their products as they wait on permit issuance; otherwise, delays associated with waiting for a license before securing a launch date would likely put these new companies into bankruptcy. Thus, "[a] million dollar fine in exchange for closing a $40 million funding round seems justifiable when Silicon Valley is flush with cash."[261] Swarm was denied a license because the FCC did not believe the SpaceBEEs were large enough to be traceable; however, later on, it was proved that the existing surveillance technology could, indeed, trace them.[262]

Perhaps Swarm suspected it would incur a relatively small fine and went ahead with the launch, knowing the reason they were denied a license was not much of a concern at all. While most companies do not intentionally seek to circumvent licensing regulations, there are perverse incentives at work. When the bureaucratic process takes too long, and the enforcement mechanism is weak or less than proportional to the infraction, companies may weigh the

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[258] Harris, *supra* note 59.

[259] *Id.*

[260] *Id.* (finding that "the FCC licensed multiple satellites smaller than 10 cm over the past five years, including some as small as 3.5 by 3.5 by 0.2 cm," from companies like QubeScout, KickSat, Aerocubes).

[261] O'Sullivan, *supra* note 52.

[262] Grush, *supra* note 5.

risk of reputational harm and fines against the survival of their venture.

Furthermore, the launch insurance market is fragile due to the high risk of launch activities and the low frequency of launches for insurers to spread their risk of liability.[263] The US Government Accountability Office predicts that "the number of launches and reentries covered by federal indemnification is forecasted to increase" alongside "the federal government's potential exposure to third-party liability claims."[264] As the volume of launches increases, so does the probability of a catastrophic accident that could trigger federal indemnification. Thus, a small number of major failures or a small number of major successes could significantly change the market. In fact, as the insurance industry exists, a single MPL claim could potentially paralyze the market.[265]

Additionally, new disruptive start-ups affect the businesses of other actors. Although their technologies and products can be innovative, they also introduce new dangers into orbit. For example, the SpaceBEEs lack thrusters and are therefore unable to perform speedy evasive maneuvers to avoid collisions with other high-value systems.[266] This danger is compounded by the fact that small satellites, which may comprise massive constellations, will soon crowd low Earth orbits.[267] Malfunctioning satellites will need to be removed, and no current rules govern that process.[268]

In the same vein, if the satellites attempt to use the same frequency bands as other operational satellites, they can cause

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[263] FED. AVIATION ADMIN., COMMERCIAL SPACE AND LAUNCH INSURANCE: CURRENT MARKET AND FUTURE OUTLOOK (2002), https://www.faa.gov/about/office_org/headquarters_offices/ast/media/q42002.pdf. *See also* JAMES A. VEDDA, STUDY OF THE LIABILITY RISK-SHARING REGIME IN THE UNITED STATES FOR COMMERCIAL SPACE TRANSPORTATION 40 (2006),

[264] Industry Developments, *supra* note 191, at 14.

[265] VEDDA, *supra* note 263, at 41 (noting that the number of commercial space launches is still too low to allow insurers to sustain even a single maximum probable loss claim).

[266] *See* Swarm Techs., Inc., F.C.C., File No. SAT-LOA-20181221-00094, Comments of Space Exploration Holdings (Apr. 1, 2019), file:///C:/Users/crobi/Downloads/Comments%20on%20Swarm%20Ap.pdf.

[267] Paul B. Larsen, *Outer Space: How Shall the World's Governments Establish Order Among Competing Interests?* 29 WASH. INT'L L.J. 1, 1–3 (2019).

[268] *Round and Round They Go: The Coming of Low-Earth Orbit Satellites*, THE ECONOMIST (Dec. 6, 2018), https://www.economist.com/leaders/2018/12/06/the-coming-of-low-earth-orbit-satellites.

interference with another company's established services.[269] Bandwidths are finite at the low microwave frequencies allocated for communications and remote sensing services, resulting in both scarcity and an increased risk of harmful interference.[270]

Finally, the availability of timely and low-cost launches also remains a significant constraint on the growth of the small satellite market.[271] If launch opportunities remain limited, companies will compete for launch slots, driving up costs and potentially excluding smaller and newer entrants from the market. They may go to foreign countries, like India, for cheaper opportunities.

VI. REMEDIES

Regulators need to develop "effective and defensible means"[272] of addressing the problems faced by the commercial use of space. Generally, the success of regulatory entrepreneurship by start-ups like Swarm turns on the laws in question. These include the fines and punishments imposed,[273] the ease with which law can be changed,[274] how permissive regulations and regulators are,[275] the disparities between national laws and the ease with which companies can select which jurisdiction to operate.[276]

At the international level, countries must find ways to distinguish acceptable and unacceptable State behavior in developing their space market.[277] But until there is a new international space

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[269] *See, e.g.,* ORBCOMM License Corp, F.C.C., File No. SAT-LOA-20181221-00094, Ex Parte Letter (May 3, 2019), http://licensing.fcc.gov/cgi-bin/ws.exe/prod/ib/forms/reports/related_filing.hts?f_key=-428357&f_number=SATLOA2018122100094.

[270] Thomas W. Hazlett & Evan T. Leo, *The Case for Liberal Spectrum Licenses: A Technical and Economic Perspective*, 26 BERKELEY TECH. L.J. 1037, 1080–82 (2011).

[271] DANIEL QUEREJAZU & LUCIEN RANDAZZESE, SMALL SATELLITES, BIG MISSIONS 6–7 (CSIS 2017).

[272] Calo & Rosenblat, *supra* note 60, at 1687.

[273] Pollman & Barry, *supra* note 47, at 417–18.

[274] *Id.* at 418.

[275] Around twenty companies and institutions, including Ford, Vodafone, and Stanford University, filed letters of support for Swarm with the FCC to help persuade the FCC to grant Swarm the ability to launch and operate its global narrowband satellites constellation. *See* F.C.C. INT'L BUREAU, IBFS INTERNET REPS., SATLOA2018122100094, http://licensing.fcc.gov/cgi-bin/ws.exe/prod/ib/forms/reports/related_filing.hts?f_key=-428357&f_number=SATLOA2018122100094.

[276] Pollman & Barry, *supra* note 47, at 420.

[277] Calo & Rosenblat, *supra* note 60, at 1687 (The line-drawing approach "bites the bullet and seeks to differentiate between legally tolerable and intolerable activities.").

agreement, the US must reconsider its decentralized approach to satellite regulation to meet its obligations under the OST. In altering its regulatory regime, "the U.S. must be sensitive to avoid regulating in a manner that encourages the outflow of innovative space businesses to other spacefaring countries" because of national security and economic interests.[278]

A. Syncing the International Space Regime

Although the current status of responsibility and liability induces States to develop domestic legislation to regulate and control these activities, the current international regime suffers from considerable uncertainty. To ensure that this is a coordination game instead of a prisoner's dilemma, States must come to new agreements on commercial space activities, or, as the private sector becomes more involved in space activities, we may start a deregulation race. In the absence of an international standard, the US commercial space industry may be at a competitive disadvantage to foreign enterprises, who will provide space launch services with fewer protections but at a lower cost, prompting U.S. firms to launch overseas. New agreements and understandings must be worked out to address commercial and private exploitation of space.[279]

A global agreement is likely not possible as the "age of formal space law treaties may have closed."[280] A viable alternative would be to unite the current spacefaring nations through a uniform, multilateral treaty. The over one hundred countries that signed the OST do not need to be part of this agreement; not all of them can launch or build satellites, and most of them are far from developing launch capabilities or building constellation systems of small satellites.[281] Indeed, building consensus among the twelve current spacefaring nations is much easier.[282]

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[278] Schaefer, *supra* note 198, at 174.

[279] LYALL & LARSEN, *supra* note 69, at 73.

[280] LYALL & LARSEN, *supra* note 249, at 468.

[281] *Cf.* North American Free Trade Agreement, U.S.-Can.-Mex., Dec. 8, 1993, 32 I.L.M. 289 (1993). NAFTA was approved by Congress by means of the North American Free Trade Agreement Implementation Act, Pub. L. No. 103-182, 107 Stat. 2057, 19 U.S.C. § 3311 (2018).

[282] FED. AVIATION ADMIN., THE ANNUAL COMPENDIUM OF COMMERCIAL SPACE TRANSPORTATION: 2018 10 (2018).

Any multilateral treaty should clarify liability in the circumstances of foreign launches and define "national activities." It may also demand nations to demonstrate an ability to supervise launches before authorizing space activity. The treaty may have to establish a new space organization to promulgate minimum standards to be implemented by States.[283] That organization could be based on the International Civil Aviation Organization (ICAO) model.[284] The organization would be composed of standing expert commissions that incorporate industry input and produce recommendations to a decision-making council.[285] Further, the treaty should impose a time requirement by which space objects are to be registered in national and international registries, thus ensuring compliance with the Registration Convention. Finally, the agreement must be flexible enough to cover new technologies and uses of space. Currently, the international space regime does not explicitly address on-orbit activities or launches from the high seas. It should.

A second option is to pursue bilateral treaties. When China, Russia, and Ukraine began to provide launch services, the US feared these countries could provide high-quality launch services at extremely low prices. The US reacted by negotiating bilateral agreements to ensure fair competition.[286] The agreements set conditions on how the States would participate in the satellite launch market by (1) demanding that pricing was "comparable" to Western-provided launches and (2) imposing quotas on the number of commercial launches the State could perform per year.[287] Because most satellites and components are comprised of components manufactured in the US and cannot be exported for launch without US

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[283] Spencer, *supra* note 252, at 127.

[284] *See* Convention on International Civil Aviation, Dec. 7, 1944, 61 Stat. 1180, 15 U.N.T.S. 295.

[285] Paul B. Larsen, *Minimum International Norms for Managing Space Traffic, Space Debris, and Near Earth Object Impacts*, 83 AIR L. & COM. 741, 775–77, 784 (2018).

[286] Memorandum of Agreement Regarding International Trade in Commercial Launch Services, U.S.-P.R.C., Jan. 26, 1989, State Dept. 89-116 (1989); Guidelines for U.S. Implementation of the Agreement between the U.S. and Russian Federation Government regarding International Trade in Commercial Launch Services, USTR, 59 Fed. Reg. 11360 (Mar. 10, 1994); Agreement Between the Government of the United States of America and the Government of Ukraine Regarding International Trade in Commercial Space Launch Services, U.S.-Ukr. Feb. 21, 1996, State Dept. No. 96-51.

[287] PETER VAN FENEMA, THE INTERNATIONAL TRADE IN LAUNCH SERVICES: THE EFFECT OF U.S. LAWS, POLICIES AND PRACTICES ON ITS DEVELOPMENT 46 (1999).

permission, the US could insist on these regulatory terms. The Russian and Ukrainian launch agreements expired in 2000, and the Chinese launch agreement ended in December 2001.[288] The US may do well by seeking to negotiate these types of treaties again.

Of course, the US does not have the same bargaining power it did at the time of those bilateral treaties, but the new treaties could consist of provisions that ensure parties do not allow commercial actors to launch without licensing or compliance with safety regulations.[289] They could define the launching State more specifically to reduce confusion in situations like the one presented. The terms should also seek to harmonize indemnification structures and focus on provisions that discourage State-shopping by companies.

B. Reforming US Space Regulations

At the national level, the US must change incentives and the regulatory regime to lessen the likelihood of exploitation or skirting of mandates by companies.[290] The way the law accommodates space start-ups and other active actors is critical to the success of the commercial space market.

In respect to the licensing regime, centralizing licensing and lowering fees and barriers to entry for small satellites is key to ensuring space start-ups can enter the market and play by the rules. The current decentralized regime makes the registration process more onerous and makes it harder to track small satellites. To respond to the booming small satellite industry, regulators must act to expedite the review process.[291] The US should reconsider the

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[288] *See supra* note 286.

[289] They could also deal with transfer and ownership problems to ensure that there is always a State assuming Outer Space Treaty Article VI responsibilities of the "appropriate" State as well as any other emergent liabilities. LYALL & LARSEN, *supra* note 69, at 417. Registration and oversight responsibilities and liability for a privately-owned satellite that is transferred to a new owner located in a State which is not a "launching State," remain with the original launching States "even though the original launching State is no longer the state appropriate to supervise the satellite." *Id.*

[290] *Id.* (The incentives approach "acknowledges that the range of potential abusive behavior is enormous and that it would be very difficult to draw lines between harmful, neutral, and beneficial practices."). Calo and Rosenblat focus on incentives that would structurally change companies' business model, however, this Article focuses on structural changes to the government's regulatory model.

[291] Bryan Bender, *Ready or Not for Small Satellite Boom?* POLITICO (Apr. 12, 2019), https://www.politico.com/story/2019/04/12/virgin-orbit-dan-hart-space-1271107.

efficacy of existing regulatory practices for small satellites and continue to streamline the process.[292] Specifically, the US ought to consider designating "one agency to issue licenses and standard regulations and require that agency to coordinate with other agencies, like NOAA and the FCC, as necessary."[293]

Congress has taken such a view with the House's American Space Commerce Free Enterprise Act (ASCFEA)[294] and the Senate's Space Frontier Act of 2019 (SFA).[295] Although these bills have not gone to vote during the congressional terms in which they were introduced, they provide helpful templates for future bills. These bills seek to consolidate licensing, make it difficult for the government to deny a permit or license and limit the ability of agencies to slow down approval processes. They seek to reduce the regulatory burdens on the operations of US nongovernmental entities in space.[296] Notably, the ASCFEA, unlike the SFA, directly addresses the space treaties and their obligations.

First, the ASCFEA elevates the Office of Space Commerce (OSC) from NOAA to the Office of the Secretary of Commerce.[297] Second, under the proposed scheme, only one permit is needed to operate either a single satellite or an entire constellation of satellites, provided they fulfill the same purpose.[298] The OSC must review the license or permit applications within ninety days of submission.[299] If the application is not reviewed within that time, it will be automatically approved.[300] The period can only be extended

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[292] Johnson, *supra* note 227.

[293] Christopher J. Newman & Michael J. Listner, *A Very British Coup: Lessons From the Draft UK Regulations for Cubesats*, SPACE REV. (Aug. 31, 2015), http://www.thespacereview.com/article/2816/2. The U.K. Space Agency is considering an application portal where companies deal with one interface and the government sorts out which parts of the license application needs to be reviewed by which regulatory authorities. Michael Sheetz, *The British are Coming—for the Rocket-Launching Industry*, CNBC (Apr. 21, 2018), https://www.cnbc.com/2018/04/21/uk-space-agency-aims-100-billion-by-2030.html.

[294] H.R. 2809, 115th Cong. (2018) (After passing in the House, the bill was referred to the Senate Committee on Commerce, Science, and Transportation on April 25, 2018).

[295] S. 919, 116th Cong. (2019).

[296] *See, e.g.,* H.R. 2809 §§ 80305, 80309(b).

[297] *Id.* § 7.

[298] *Id.* § 80102(e)(3).

[299] *Id.* § 80103(b)(1)-(2).

[300] *Id.* § 80103(b)(3).

for 60 days by the President to address national security questions.[301]

If an application poses national security risks, the OSC many deny the application or condition its acceptance on reasonable commercially available efforts.[302] Under no circumstance can a license be denied or conditioned if similar systems or capabilities are publicly available or will be in the next three years.[303] If the Secretary of Commerce "determines, clear and convincing evidence that the proposed operation of a space object" violates the OST, the operation can be conditioned to the extent necessary to prevent a violation of the obligation.[304] Effectively, the ASCFEA flips the burden of proof from the applicant to the government. The government must carry its burden by showing that a space object violates international obligations or challenges national interests to deny the application.[305]

The SFA is a more modest version of the ASCFEA. The SFA was initially introduced in 2018 but failed to win approval in the House.[306] It was re-introduced in April 2019 with modifications.[307] The SFA elevates the OSC to a Bureau,[308] shortens the deadline for the government to render a decision on remote sensing applications,[309] and authorizes funding for LEO commercialization programs.[310] Unlike the ASCFEA, the SFA moves to consolidate authorization and supervision abilities over non-traditional space activities with the Department of Transportation rather than the Commerce Department.[311] Fundamentally, the SFA lacks the bolder reforms of ASCFEA, such as failing to establish a self-certification regime or consider international obligations in the manner

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[301] *Id.* § 80202(b)(4)(A).
[302] H.R. 2809 § 80202(c)(1).
[303] *Id.* § 80202(e).
[304] *Id.* § 80103(c).
[305] *Id.* § 80103(c)(1).
[306] Space Frontier Act of 2018, S. 3277, 115th Cong. (2018).
[307] Space Frontier Act of 2019, S. 919, 116th Cong. (2019). On December 11, 2019, it was placed on the Senate legislative calendar, but as of April 23, 2020, there has been no further action.
[308] *Id.* § 307.
[309] *Id.* § 102(b)(c).
[310] *Id.* § 306.
[311] *Id.* § 105(c)(F).

that ASCFEA does. If Congress is to pass any space legislation, the provisions of ASCFEA are more desirable.

Consolidating regulatory functions within the Department of Commerce and creating a single site for commercial licenses would improve communication and reduce the complexity of the process. It would also allow the FCC and NOAA to focus on their respective core missions of spectrum management and predicting changes in the climate. By centralizing licensing authority for small satellites, operators may better verify compliance data provided to them by customers. However, consolidating licensing authority may create a bottleneck to companies in processing and authorizing licenses without the allocation of appropriate resources to the agencies.[312] Thus, adequate resources should be provided to the Commerce Department—such as the funds for more licensing personnel—so it may perform its mission effectively.

The presumed-approval regime suggested by the ASCFEA would further expedite the process appropriately without necessarily sacrificing national interests. Shortening the licensing review process for satellites that have "the same, or near-identical, technology and capabilities as previous satellites that have already been cleared for license" might be another solution.[313] Tacking the authorization of new satellites to an already-approved license, if they serve in the same constellation and close purposes, rather than requiring separate licenses for every satellite would improve the process.

Further, when denied a license, companies should receive clear advice or direction on how to amend their application to obtain approval. Giving prospective applications an early indication of how likely their mission would be granted, like the traffic light system the United Kingdom recently adopted, may also result in a more streamlined process for licensing.[314] If companies are aware of the likelihood that they will be awarded a license, they can better direct their investments.

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[312] Larsen, *supra* note 256, at 307.

[313] Newman & Listner, *supra* note 293.

[314] *UK's Space Agency's Licensing Process Gets the Green Light…Now Includes a New Traffic Light System*, SATNEWS (Oct. 9, 2018), http://www.satnews.com/story.php?number=1874739368.

As for indemnification, continuance of the risk-sharing system is essential. That being said, astronomically high insurance premiums can present a barrier to the conduct of innovative and untested activities. If insurance is too expensive, new start-ups may be unable to obtain their loans or investments such that they may be unable to undertake their activities.

Therefore, it may also be necessary for the law to address specific activities and assign liabilities accordingly, rather than having a blanket regime or relying solely on the MPL. Adopting a sliding scale approach to insurance may further facilitate innovative work. Low-risk satellite operations may be exempted or reduced from liability insurance, whereas higher-risk activities will require more coverage than typically imposed.[315] This would make it easier for operators to obtain insurance for large constellations of satellites. If insurance barriers are lowered for small satellites, those companies may choose to comply with authorization and supervision requirements rather than skirting them to avoid taking out insurance that may cost more than the satellite itself.

Further, operators should also increase flexibility in launch rebooking opportunities. Pressures to meet launch opportunities may—and likely did so in the Swarm context—incentivize operators to go around the licensing process or go abroad.

Finally, to reduce the risk of liability, Congress should ensure that US companies and their subsidiaries, including those that rely on foreign launch vehicles, receive US authorization.[316] The FCC's attention to Swarm's activities, the imposition of monitoring requirements and the bad publicity generated may theoretically deter other operators from launching without authorization.[317] However, the FCC's willingness to approve Swarm's more recent launches blunts this potential deterrence.[318] Despite being fined by the FCC, Swarm was able to obtain a $25 million investment a month later.[319] If a company violates the regime once, it should not be

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[315] *Id.*

[316] Schaefer, *supra* note 198, at 175.

[317] *See* Swarm Techs., Inc., F.C.C. 18-184, Statement of Commissioner Michael O'Rielly (Dec. 20, 2018), https://docs.fcc.gov/public/attachments/FCC-18-184A3.pdf.

[318] *See* Pressman, *supra* note 8.

[319] Aaron Pressman, *Satellite Startup Swarm Raises $25 Million for Space-Based Internet Plan*, Fortune (Jan, 24, 2019), http://fortune.com/2019/01/24/exclusive-satellite-startup-swarm-raises-25-million-space-internet/.

blacklisted, but appropriate deterrence measures should apply, such as enhanced supervision over the activities.

It is unlikely Swarm itself will skirt FCC regulations again.[320] However, if the government does not enforce its rules, it could invite increasingly audacious violations that threaten responsible space actors. At the same time, imposing devastating penalties on renegade companies could stifle emerging companies. As a result, the US should approach deterrence with caution as not to drive innovation abroad. The US may take a stand by demonstrating it will not tolerate unauthorized launches, but such a stance does not guarantee other spacefaring nations will enforce the same standards.

VII. CONCLUSION

While Swarm's actions were the first of its kind, it is unlikely Swarm will be the last offender.[321] Although the US registered the SpaceBEEs and therefore took responsibility for them, not every country will act in that manner. As in the ridesharing context, commercial space activities are outpacing governmental activities, thus increasing the legal obligations and liability exposure of States.[322] The international regime lags in properly regulating and accounting for unauthorized or unsupervised satellites. Under current international space law, States may be found liable and responsible for unauthorized satellites and therefore have a duty not only to pay their damages but also to provide continuing supervision over them. States cannot abandon responsibilities imposed by international law. Moreover, they must develop regulatory regimes that do not permit their private actors to skirt applicable laws or stifle innovative products that benefit all of humanity.

Given the exponentially decreasing costs of space launches, the expensive nature of satellites, and the increasing use of space by private industries, events akin to this may soon become more

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[320] *Id. See also* Caleb Henry, *Swarm, After FCC Blunder, Hires Satellite Regulatory Veteran Kalpak Gude*, SPACENEWS (Jan. 8, 2019), https://spacenews.com/swarm-after-fcc-blunder-hires-satellite-regulatory-veteran-kalpak-gude/.

[321] Blake Schmidt, *A Millennial's Tiny Satellites Are Helping China Advance in the Space Race*, BLOOMBERG (Dec. 13, 2018), https://www.bloomberg.com/news/features/2018-12-13/a-millennial-s-tiny-satellites-are-helping-china-advance-in-the-space-race (noting the Chinese entrepreneur "was inspired by U.S.-based disruptors" and "now he wants to disrupt them").

[322] Dempsey, *supra* note 88, at 3.

common.[323] A country must balance its desire to support a burgeoning commercial space flight industry and its risk of liability for private actions, especially those unauthorized. In particular, the US must readjust its domestic regime to fill in the gap. In doing so, the US must ensure that any changes to the regime centralize and streamline the process rather than stifle domestic private investment in the industry. Moving forward, the US must apply the lessons localities have learned in dealing with companies like Uber to space.

[323] DIEDERIKS-VERSCHOOR & KOPAL, *supra* note 62, at 55; JASENTULIYANA, *supra* note 151, at 325–26.

UNIVERSAL HUMAN RIGHTS: AN ANALYSIS OF STATES' OBLIGATIONS UNDER THE RIGHT TO LIFE IN OUTER SPACE

Jonathan Tjandra[*]

ABSTRACT

The proliferation of government and commercial activities raises important legal questions about the duties of States to observe and protect human rights in outer space. First, do human rights obligations apply extraterritorially to outer space? Second, if the answer to the former is yes, then what are those rights and to what extent are the rights modified in their application to space? There is very little discussion and analysis of human rights obligations and their application to outer space. In this paper, I analyze the intersection of international outer space law and human rights law to conclude that human rights obligations do apply to outer space. I have restricted the analysis in this paper to the right to life in the International Covenant on Civil and Political Rights and the European Convention on Human Rights, due to limitations in considering every aspect of space/human rights law intersection. This Article is not intended to authoritatively resolve the questions in all areas, but to act as a starting point to stimulate discussion.

I. INTRODUCTION

There is currently sparse literature on the relationship between human rights law and outer space activities.[1] Contributions

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[1] Steven Freeland & Ram S. Jakhu, *The Intersection between Space Law and International Human Rights Law*, *in* ROUTLEDGE HANDBOOK OF SPACE LAW 225, 228 (Ram S. Jakhu & Paul Stephen Dempsey eds., 2016).

in this area have been limited to the impact of activities in outer space on the human rights of individuals on Earth. As such, they often raise more questions than they do answers. Space law is itself an emerging area of law, and there remain many ambiguities about how the two legal frameworks interact in theory or in practice.[2] The aim of this paper is to propose a resolution to some of the issues surrounding the application of international human rights law to space.

I have restricted my analysis to the right to life, particularly in the context of the International Covenant on Civil and Political Rights and the European Convention on Human Rights. The right to life has been used as an example of a non-derogable, fundamental, universal, inalienable human right and is considered "a necessary condition for the enjoyment of all other human rights . . . ."[3] It is particularly interesting to consider the right to life in the context of space activities, both in outer space itself (as space is a hostile environment where humans cannot naturally survive) and on Earth (because space activities can have a significant impact on the life and health of people on Earth).

Two questions prompted this Article. First, do human rights obligations apply to outer space? Second, if the answer to this question is yes, then what are those rights and to what extent are the rights modified in their application to space? Before large-scale commercialization of space occurs, these questions need to be resolved in order to observe and respect the rights of individuals in space.

The structure of this Article is as follows. First, I will set out the legal framework forming the background of outer space and human rights law. There are similarities with both regimes that make comparisons useful, but some distinct differences pose issues for their interaction. Second, I will consider whether States' human rights jurisdiction is applicable in space. There are useful parallels to the jurisdiction of flag States over ships and aircraft registered in that flag State. However, outer space law has some important distinctions that may be relevant to preclude the practical effect of asserting jurisdiction. I will argue human rights obligations apply

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[2] *See id.*

[3] Franciszek Przetacznik, *The Right to Life as a Basic Human Right*, 9 REVUE DES DROITS DE L'HOMME 585, 603 (1976).

extraterritorially in space due to the responsibility of States to supervise national space activities. Finally, I consider the content of the right to life and its applicability in space. This section is not intended to be an exhaustive statement of the right but seeks to highlight some of the issues in applying it to space. I will argue the exact nature and content of obligations may differ as a result of the special environment of space.

II. INTERNATIONAL LEGAL FRAMEWORK

A. Space Legal Framework

International space law is a complex combination of treaties and soft law. Neither the 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), nor any other major space-related treaty, explicitly refers to human rights applying to outer space.[4] This could give rise to the argument that international space law, as the applicable *lex specialis*, covers the field with respect to any State obligations.[5] However, this ignores the international contexts in which space law and human rights law were negotiated, when the development of human rights regulations were at the forefront of many States' agendas.[6]

The provisions of the space-related instruments suggest, at the very least, they are amenable to human rights considerations; indeed, going further, they imply human rights are a fixture of space law.[7] All existing commentary regards this as an indisputable fact of the structure of the space law framework.[8] In addition, Article III of the Outer Space Treaty provides the following:

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[4] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, Jan. 27, 1967, 18 U.S.T 2410, 610 U.N.T.S. 205 [hereinafter Outer Space Treaty].

[5] Milan Mijovic, *Outer Space Treaty 1967 vs. 2017: A lex specialis or Derogation from Human Rights,* 1 PROC. INT'L INST. SPACE L. 109, 113 (2017).

[6] *Id.* at 114.

[7] Michael Potter, *Human Rights in the Space Age: An International and Legal Political Analysis*, 4 J. L. TECH. 59, 70-71 (1989).

[8] *Id. See also* Anél Ferreira-Snyman and Gerrit Ferreira, *The Application of International Human Rights Instruments in Outer Space Settlements: Today's Science Fiction, Tomorrow's Reality* 22 POTCHEFSTROOM ELECTRONIC L.J. 1, 4–5 (2019); Freeland & Jakhu, *supra* note 1, at 229.

> State Parties to the Treaty shall carry on activities in the exploration and use of outer space, including the Moon and other celestial bodies, in accordance with international law, including the Charter of the United Nations, in the interest of maintaining international peace and security and promoting international co-operation and understanding.[9]

Similar text is found in Article II of the Agreement Governing the Activities of States on the Moon and other Celestial Bodies (Moon Agreement).[10] Human rights law does attach to activities in space, to the extent it is reflected in international law. Recall the United Nations (UN) Charter's preamble declares its purpose

> to reaffirm faith in fundamental human rights, in the dignity and worth of the human person, in the equal rights of men and women and of nations large and small . . . .[11]

And one of the purposes of the UN is to

> achieve international co-operation…in promoting and encouraging respect for human rights and for fundamental freedoms for all . . . .[12]

The Outer Space Treaty was never meant to be a comprehensive framework for all future space activities.[13] Representatives of States who co-sponsored the UN General Assembly resolution to adopt the text of the Outer Space Treaty commented that the Treaty was "only the first chapter"[14] and intentionally took a "broad approach" to outer space law.[15] Indeed, Article III itself envisages situations where space law does not have a unique application and refers to other sources of international law to resolve the gap.[16]

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[9] Outer Space Treaty, *supra* note 4, art. III.

[10] Agreement Governing the Activities of States on the Moon and Other Celestial Bodies art. 2, Dec. 18, 1979, 1363 U.N.T.S. 3 (1979) [hereinafter Moon Agreement].

[11] U.N. Charter Preamble.

[12] U.N. Charter art. 1, ¶ 3.

[13] Freeland & Jakhu, *supra* note 1, at 228.

[14] U.N. GAOR, 21st Sess., 1499th plen. mtg. at 12, U.N. Doc. A/PV.1499 (Dec. 19, 1966).

[15] *Id.* at 11.

[16] Outer Space Treaty, *supra* note 4, art. III.

B. International Human Rights Framework

The international human rights legal framework is similarly a mix of hard and soft law. Similar language is used to describe the aims and purposes of both regimes. As I am focusing on the right to life, I shall primarily consider the International Covenant on Civil and Political Rights (ICCPR)[17] and regional human rights treaties, particularly the European Convention on Human Rights (ECHR).[18]

The Universal Declaration of Human Rights (UDHR) proclaims,

> Whereas recognition of the inherent dignity and of the equal and inalienable rights of all members of the human family is the foundation of freedom, justice and peace in the world.[19]

The preamble of the Outer Space Treaty similarly makes reference to principles of "the common interest of all [hu]mankind" and indicates that the exploration and use of outer space be "carried on for the benefit of all peoples."[20] The ICCPR refers to the "equal and inalienable rights" of all humans and recognizes the "ideal of free human beings . . . can only be achieved if conditions are created whereby everyone may enjoy . . ." their rights.[21]

The motivations behind the international human rights system is to promote international cooperation among States to further the ideal of a common humanity, where all individuals enjoy rights arising from their inherent dignity as human persons. The same is true for space law, as it was instituted to recognize the common interest of all humanity in sharing the benefits of space exploration and activities. Indeed, in the discussion of the Outer Space Treaty, one representative noted:

> For the first time in the history of [hu]mankind, all countries, and in the first instance the two world Powers of the day, are not searching for new territorial conquests or for the expansion

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[17] International Covenant on Civil and Political Rights, Dec. 16, 1966, S. Exec. Rep. 102-23, 999 U.N.T.S. 171 [hereinafter ICCPR].

[18] Convention for the Protection of Human Rights and Fundamental Freedoms art. 2 ¶ 1, Nov. 4, 1950, 213 U.N.T.S. 221 (entered into force Sept. 3, 1953) [hereinafter ECHR].

[19] G.A. Res. 217A (III), at 71 (Dec. 10, 1948) [hereinafter UDHR].

[20] Outer Space Treaty, *supra* note 4, Preamble.

[21] ICCPR, *supra* note 17, Preamble.

> of their sovereign rights. On the contrary . . . peace and . . . the unity of all [individuals] . . . are solemnly affirmed.[22]

These sentiments are clearly aspirational. However, the normative force of soft law cannot be ignored.

III. UNIVERSAL RIGHTS, JURISDICTION AND CONTROL

A. Human Rights Jurisdiction

To what extent are human rights universal? More specifically, does the right to life apply extraterritorially to impose obligations on States in their activities in outer space? The idea of universal human rights in the UDHR requires that human rights apply equally to all individuals regardless of geographic location.[23] Later human rights treaties refine this idea. In the ICCPR, States undertake "to respect and to ensure to all individuals within [their] territory and subject to [their] jurisdiction the rights recognized in the present Covenant . . . ."[24] The ECHR has a similar formulation.[25] In each case, the operational words are "territory" and "jurisdiction," meaning States are only bound to respect human rights within their jurisdiction.

The meaning of "jurisdiction" is contested.[26] There are two primary interpretations: a jurisdictional model based strictly on national territory and one based on effective control.[27] In space, jurisdiction cannot be determined by a territorial sovereignty model of jurisdiction because the Outer Space Treaty explicitly prohibits national appropriation by claims to sovereignty.[28] States cannot own

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[22] U.N. GAOR, *supra* note 14, at 12.

[23] UDHR., *supra* note 19, art. 1. *See also* World Conference on Human Rights, *Vienna Declaration and Programme of Action*, ¶ 5, U.N. Doc. A/CONF.157/23 (June 25, 1993).

[24] ICCPR, *supra* note 17, art. 2(1).

[25] The ECHR provides that "The High Contracting Parties shall secure to everyone within their jurisdiction the rights and freedoms defined in Section I of this Convention." ECHR, *supra* note 18, art 1.

[26] Ralph Wilde, *Human Rights Beyond Borders at the World Court: The Significance of the International Court of Justice's Jurisprudence on the Extraterritorial Application of International Human Rights Law Treaties*, 12 CHINESE J. OF INT'L L. 639, 656–58 (2013).

[27] *Id.* at 658.

[28] Outer Space Treaty, *supra* note 4, art. II.

territory in space. This raises issues as the ICCPR clearly refers to "territory" as the source of jurisdiction.

Is a Moon base, for example, a territory within a State's jurisdiction? What happens if a State deprives someone of their rights in a space station owned by another State? United States (US) practice seems to deny territorial jurisdiction over Central Intelligence Agency "black sites"[29] located outside US territory. In fact, the US Office of Legal Counsel advised that the US's obligations did not apply to "black sites" because the US is not the *de facto* authority as the government in those jurisdictions.[30] The ICCPR's *travaux* show the US representative, Eleanor Roosevelt, opined that the ICCPR did not impose any obligations to individuals outside a State's territory.[31] Likewise, early decisions of the European Court of Human Rights (ECtHR) have reinforced the idea that territory is the basis for human rights jurisdiction under the ECHR.[32]

However, there are contrary views and case law. In *General Comment 31*, the UN Human Rights Committee noted the ICCPR applied to individuals "within the power or effective control of that State Party, even if not situated within the territory of that State

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[29] "Black sites" are secret detention facilities set up by the CIA in various countries to hold and interrogate people suspected of being terrorists. The advantage of "black sites" to the CIA is that suspected terrorists can be detained and interrogated in conditions that would likely be illegal if they were so detained or interrogated within U.S. territory. *See* Al Nashiri v. Poland, Eur. Ct. H. R., at ¶ 227 (2014), http://hudoc.echr.coe.int/eng?i=001-146044; Husayn (Abu Zubaydah) v. Poland, Eur. Ct. H. R., at ¶ 227 (2014), http://hudoc.echr.coe.int/fre?i=001-146047. In both cases, Poland was found to have violated various Articles of the ECHR due to their complicity by allowing the applicants' detention and interrogation at "black sites" maintained by the CIA on Polish territory. As the U.S. is not a signatory to the ECHR, the United States' own obligations were not discussed.

[30] Memorandum for John A. Rizo from Steven G. Bradbury, Application of United States Obligations Under Article 16 of the Convention Against Torture to Certain Techniques that May Be Used in the Interrogation of High Value al Qaeda Detainees, at 1-2 (May 30, 2005), https://fas.org/irp/agency/doj/olc/article16.pdf.

[31] Comm'n on Human Rights, 6th Sess., 138th mtg. at 10, UN Doc E/CN.4/SR.138 (Apr. 6, 1950).

[32] *See* Marko Milanovic, *From Compromise to Principle: Clarifying the Concept of State Jurisdiction in Human Rights Treaties*, 8 HUM. RTS. L. REV. 411, 417-18 (2008). The leading case is Bankovic v. Belgium, 2001-XII Eur. Ct. H.R. 333.

Party."[33] This is also supported by later decisions of the ECtHR.[34] Effective control at a minimum requires a State's agents or servants to be present and some kind of exercise of public power or administration.[35] The existence of effective control is enough for the application of human rights obligations to the occupying State, as they have assumed de facto responsibility for the administration of that territory. Consequently, the extent to which human rights obligations are applicable in space must depend on the effective control of the State.

There is also a notion of personal, as opposed to territorial, jurisdiction. Here, jurisdiction arises from the authority and control a State has over individuals, even if those individuals are outside the territory of the State. It is an expansive view of jurisdiction and has been viewed cautiously by human rights jurisprudence. In *Lopez Burgos v. Uruguay*, the UN Human Rights Committee held "individuals subject to its jurisdiction" in art 2(1) of the ICCPR can be interpreted to mean "the relationship between the individual and the State in relation to a [rights] violation . . . wherever they occurred"—in other words, interpreting Article 2(1) as disjunctive rather than conjunctive.[36] Thus, an individual who was kidnapped in Argentina by Uruguayan officials was found to be within Uruguay's jurisdiction.

B. Ships and Aircraft

The test of effective control as requiring exercise of public power is not useful in outer space. Short of founding a colony, it is unlikely States will be exercising sufficient administrative power in the near or even medium term. The ECtHR's decisions with regards

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[33] U.N. Human Rights Comm., *General Comment No 31: The Nature of the General Legal Obligation Imposed on States Parties to the Covenant*, ¶ 10, U.N. Doc. CCPR/C/21/Rev.1/Add.13 (May 26, 2004).

[34] Milanovic, *supra* note 32, at 419. For example, in Öcalan v. Turkey, 2005-IV Eur. Ct. H.R., the Court held that the applicant was within Turkey's jurisdiction as soon as Kenyan officials had delivered the applicant to the custody of Turkish officials at Nairobi Airport, notwithstanding the fact that the airport was not in Turkish territory. *See id.* ¶ 91.

[35] Milanovic, *supra* note 32, at 423.

[36] U.N. Human Rights Comm., Views: Communication No. R.12/52 (Lopez Burgos v. Uru.), ¶¶ 12.1-12.3, U.N. Doc. CCPR/C/13/D/52/1979 (July 29, 1981). *See also* U.N. Human Rights Committee, Views: Communication No 56/1979 (Celiberti de Casariego v Uru.), ¶ 10.3, U.N. Doc. CCPR/C/13/D/56/1979 (July 29, 1981).

to ships and airplanes, on the other hand, offers a useful comparator. In *Bankovic v. Belgium*, the Court said, in *obiter dicta*, the special nature of ships and aircraft under international law ensured that extraterritorial exercise of jurisdiction is exercised by the State in which the craft is registered.[37] However, Milanovic argues this conflates the conceptual distinction between prescriptive jurisdiction and effective control jurisdiction.[38] The former refers to the authority to prescribe laws applying to the territory, while the latter refers to the State's actual control over the territory.

In *Medvedyev v. France*, the applicants were crew members on a Cambodian-flagged ship suspected of drug-trafficking.[39] France obtained permission from Cambodia to search and seize the ship, detained the crew and brought the ship to a French port to be tried. The applicants complained that their detention for the duration of the voyage to the port was unlawful. Although the Court reiterated its *dicta* in *Bankovic*, it held France exercised "full and exclusive control" over the ship, and the crew thus fell within France's jurisdiction for the purposes of the ECHR.[40]

Consequently, there is a distinction between the prescriptive jurisdiction of a vessel's flag State and effective control for the purposes of human rights jurisdiction. If a violation occurs in a State-registered vessel within its territorial waters, there is a clear nexus. However, if the violation occurs in a State-registered vessel on the high seas, the fact that the vessel is registered in a State is not determinative of whether it has any human rights obligations. It is the presence of authority and control that is needed to give rise to the State's jurisdiction.

C. Application in Space

It is important to note State jurisdiction over activities in space differ from jurisdiction in respect of air law and the law of the sea in key aspects. The Outer Space Treaty specifies that a State on whose registry a space object is registered retains "jurisdiction and control" over the object and any personnel onboard.[41] The Outer

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[37] Bankovic, 2001-XII Eur. Ct. H.R. ¶ 73.
[38] Milanovic, *supra* note 32, at 424-25.
[39] Medvedyev v. France, 2010-III Eur. Ct. H.R. ¶ 9.
[40] *Id.* ¶ 67.
[41] Outer Space Treaty, *supra* note 4, art. VIII.

Space Treaty also specifies that States have "international responsibility" for national activities in outer space; requires "authorization and continuing supervision" of non-governmental activities; and ensures States are "internationally liable" for damage caused by its space objects.[42] The Moon Agreement contains similar provisions.[43]

The Convention on the Registration of Objects Launched into Outer Space (Registration Convention) elaborates on the definition of a launching State and a State of registry but does not expand on "jurisdiction and control" beyond specifying that when there are multiple launching States, they may jointly determine which one has jurisdiction and control.[44] The Convention on International Liability for Damage Caused by Space Objects (Liability Convention), although not expressly dealing with human rights, assigns liability to the launching State for any damage caused by its space objects.[45]

The launching State or State of registry is analogous to the flag State of a vessel. The question is whether "jurisdiction and control" means something more than the prescriptive jurisdiction of the flag State. Prescriptive jurisdiction clearly applies to space objects, as national laws of the State apply to its space objects. However, this is only the starting point of an analysis. The test is whether the State has any actual or effective control over the object and its personnel.

The *travaux* of the Outer Space Treaty have some useful explanations that elaborate on the relationship between jurisdiction and control in space and on Earth. The Argentinian representative, when discussing this provision in the Legal Subcommittee of the UN Committee on the Peaceful Uses of Outer Space (COPUOS), explained that jurisdiction and control flow from the principle that "provisions of international law, and above all the UN Charter, should govern the relations among States in outer space and on celestial bodies."[46] The Mongolian representative was of the opinion

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[42] *Id.* at arts. VI, VII.

[43] Moon Agreement, *supra* note 10, art. 12.

[44] Convention on the Registration of Objects Launched into Outer Space arts. I, II, Jan. 14, 1975, 28 U.S.T. 695, 1023 U.N.T.S. 15 [hereinafter Registration Convention].

[45] Convention on International Liability for Damage Caused by Space Objects art. II, Mar. 29, 1972, 24 U.S.T. 2389, 961 U.N.T.S. 187 [hereinafter Liability Convention].

[46] Comm. on the Peaceful Uses of Outer Space, Summary Rec. of the Sixtieth Mtg. of the Legal Subcomm., U.N. Doc. A/AC.105/C.2/SR.60, at 3 (Oct. 20, 1966).

the terms included at least the ability to control access by other States' representatives.[47] In this sense, the meaning of jurisdiction is closely associated with its meaning on Earth.

Similarly, the *travaux* of the Declaration of Legal Principles Governing the Activities of States in the Exploration and Uses of Outer Space, which formed the basis of the Outer Space Treaty, are also useful. The Soviet representative preferred to speak of the "rights" of States over objects rather than "jurisdiction," which implies a prescriptive jurisdiction to assert laws.[48] The Italian representative explained that "jurisdiction" is "more immediately related to the concept of the flag flown by such vehicles than to the concept of ownership," suggesting a direct comparison to flag States of ships and aircraft.[49] The representative of the United Kingdom explained the need to consider that liability for incidents involving space vehicles should rest on the State which had "jurisdiction, in the sense of effective control."[50] Consequently, there are strong arguments that States view jurisdiction in space as having a similar meaning to effective control and jurisdiction of flag States on Earth.

The Human Rights Committee in *Lopez Burgos* relied on the idea of universality of human rights and held that it would be "unconscionable" to permit one State to commit human rights violations outside of its territory when it could not do so on its own territory.[51] This concept has been cited with approval by subsequent cases and the ECtHR[52]. The argument is based on the philosophical ideals of the universality of human rights. It follows that there is no reason to restrict its application only to Earth, as human rights arise everywhere humans are, including in space.

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[47] Comm. on the Peaceful Uses of Outer Space, Summary Rec. of the Seventy-First Mtg. of the Legal Subcomm., U.N. Doc A/AC.105/C.2/SR.71, at 11-12 (Oct. 21, 1966).

[48] Comm. on the Peaceful Uses of Outer Space, Rep. of the Legal Subcomm., 22nd mtg. at 5, U.N. Doc A/AC.105/C.2/SR.22 (Apr. 26, 1963).

[49] Comm. on the Peaceful Uses of Outer Space, Summary Rec. of the Twentieth Mtg. of the Legal Subcomm., U.N. Doc A/AC.105/C.2/SR.20, at 6 (Jun. 27, 1963).

[50] Comm. on the Peaceful Uses of Outer Space, Summary Rec. of the Tenth Mtg. of the Legal Subcomm., U.N. Doc. A/AC.105/C.2/SR.10, at 6 (Aug. 21, 1962).

[51] U.N. Human Rights Comm., Views: Communication No. R.12/52 (Lopez Burgos v. Uru.), ¶ 12.3, U.N. Doc. CCPR/C/13/D/52/1979 (Jul. 29, 1981).

[52] For example, the case of Issa v. Turkey, Eur. Ct. H.R. (2004), http://hudoc.echr.coe.int/eng?i=001-67460, the Court held that "Article 1 of the [ECHR] cannot be interpreted so as to allow a State party to perpetrate violations of the [ECHR] on the territory of another State, which it could not perpetrate on its own territory." *Id.* ¶ 71.

Consider hypothetical States *A* and *B* and a potential violation during a government space activity. There are three possible scenarios of jurisdiction:

1. The violation occurs on a space object registered by State *A* and staffed by agents of State *A*;

2. The violation occurs on a space object registered by State *B*, but the only personnel present are agents of State *A*;

3. The violation occurs on a celestial body or territory not subject to any State's jurisdiction and the violation is done by State *A's* agents.

Scenario 1 is the simplest, as it occurs exclusively within State *A's* jurisdiction and control—not only is *A* the State of registry, but the object remains entirely under *A's* control, either through its agents or through control via a ground station.

Scenarios 2 and 3 have many parallels to the cases regarding flag States of ships and aircraft. While the State of registry or launching State may be a starting point, the proper test is which State had effective control over the impugned activities. In scenario 2, State *B* is not liable for *A's* violations simply because it occurred on an object on *B's* registry.

It would be difficult to argue a State had actual control over an uncrewed space object that they lost contact with for technical reasons. This could be resolved by interpreting "jurisdiction and control" as including the right of the State to assert control. An exercise of legal power asserting a State's legal rights over an object is likely sufficient to attract human rights jurisdiction. The distinction between effective control as physical control compared to the right of a State to assert control could be useful in these scenarios.

D. Non-government Space Activities

On Earth, it is unclear whether States can be held responsible for human rights violations of private persons or corporations within their jurisdiction.[53] Does a State's duties impose the positive obligation to take all reasonable measures to prevent private

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[53] Danwood Chirwa, *The Doctrine of State Responsibility as a Potential Means of Holding Private Actors Accountable for Human Rights*, 5 MELB. J. INT'L L. 1, 18 (2004).

entities from violating human rights? Broadly speaking, the answer would lie in the degree of effective control the State has over the private entity.[54]

It is enshrined in the Outer Space Treaty that all space activities, including commercial and non-government activities, must be authorized and be under the continual supervision of a State.[55] The importance of supervision is reinforced in UN General Assembly resolutions adopted well after the ratification of the Outer Space Treaty. Resolution 59/115 of December 10, 2004, recommends that States, in fulfilling their obligations under the various space treaties, consider "implementing national laws authorizing and providing for continuing supervision of the activities in outer space of non-governmental entities under their jurisdiction."[56] Resolution 68/74 of December 11, 2013, recommends that States should include several elements in their national regulations, including

> The conditions for authorization should be consistent with the international obligations of States [potentially including treaty obligations regarding human rights], in particular under the United Nations treaties on outer space, and with other relevant instruments, and may reflect the national security and foreign policy interests of States; the conditions for authorization should help to ascertain that space activities are carried out in a safe manner and to minimize risks to persons . . . .
>
> Appropriate procedures should ensure continuing supervision and monitoring of authorized space activities by applying, for example, a system of on-site inspections or a more general reporting requirement; enforcement mechanisms could include administrative measures, such as the suspension or revocation of the authorization, and/or penalties, as appropriate.[57]

Since continuing supervision is an obligation under space law, States are in a position in which they must exercise a higher degree

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[54] Robert McCorquodale and Penelope Simons, *Responsibility Beyond Borders: State Responsibility for Extraterritorial Violations by Corporations of International Human Rights Law,* 70 MOD. L. REV. 598, 606 (2007).

[55] Outer Space Treaty, *supra* note 4, art. VI.

[56] G.A. Res. 59/115, Application of the Concept of the "Launching State", ¶ 1 (Dec. 10, 2004).

[57] G.A. Res. 68/74, Recommendations on National Legislation Relevant to the Peaceful Exploration and Use of Outer Space, ¶¶ 4-5 (Dec. 11, 2013).

of control over non-governmental and commercial activities in space than they do on Earth. At a minimum, States have a legal basis upon which to assert a right to control non-governmental activities more stringently than they do on Earth.

States are given a lot of discretion when it comes to implementing domestic regulations governing space activities. Not all States have implemented such domestic regulations, and those that have provide varying levels of supervision.[58] Australia has one of the most detailed schemes, which includes: the requirement that the proposed activity of poses minimal risk to public health or safety; government approval of design and engineering plans for spacecraft; and financial and technical fitness tests.[59] Argentina imposes a minimalist scheme, requiring only disclosure and notification to the government of planned space activities, with no authorization, safety measures or continuing supervision.[60] However, even given the differing levels of regulation, the fact that States have a right under international law to assert supervision over non-government space activities is likely sufficient for human rights jurisdiction.

IV. THE RIGHT TO LIFE IN SPACE

The right to life is protected by various international and regional treaties. Analysis in this paper will be restricted to the ICCPR and ECHR. Article 6 of the ICCPR provides:

> Every human being has the inherent right to life. This right shall be protected by law. No one shall be arbitrarily deprived of his life.[61]

The ICCPR also contains provisions regarding the death penalty. Article 2 of the ECHR provides:

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[58] *See* Paul S. Dempsey, *National Legislation Governing Commercial Space Activities,* 1 J. SPACE SAFETY ENGINEERING 44, 45 (2014).

[59] *See Space Activities Amendment (Launches and Returns) Act 2018* (Cth) (Austl.).

[60] Julian Hermida, *Regulation of Space Activities in Argentina*, *in* NATIONAL REGULATION OF SPACE ACTIVITIES 23, 27 (Ram S. Jakhu ed., 2010).

[61] ICCPR, *supra* note 17, art. 6 ¶ 1.

> Everyone's right to life shall be protected by law and no one shall be deprived of his life intentionally….[62]

The ECHR details circumstances in which the deprivation of life will not be regarded as a violation, which relate to the use of force when absolutely necessary for a designated purpose.[63] The right to life is generally regarded to have three main components.[64] These are the duty to: 1) refrain from arbitrary or intentional deprivation of life;[65] 2) investigate suspicious deaths;[66] and 3) take reasonable steps to protect life from avoidable loss.[67] The analysis in this paper will focus on these three aspects of the right to life, recognizing that these categories are artificial and may not be a complete representation of the content of the right. However, they are useful categories to begin analyzing human rights issues in outer space.

In applying the right to outer space, the unique environment of space must be considered. Space is inherently a hostile and lethal environment for humans—to survive in space, humans need to either bring the essential components for life (such as oxygen, food and water) with them, or develop the technology to synthesize these essential components in outer space itself. While the special nature of the space environment cannot provide for outright exceptions to the human rights framework, the factual circumstances may result in different factors being accorded weight when applying the right to life to space.

A. Negative Obligation Against Deprivation of Life

On Earth, with few exceptions, States cannot intentionally or arbitrarily deprive anyone of life. There is no reason why this cannot be applied directly to outer space. States should be prohibited

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[62] Convention for the Protection of Human Rights and Fundamental Freedoms art. 2 ¶ 1, Nov. 4, 1950, 213 U.N.T.S. 221.

[63] *Id.* at art. 2(2).

[64] U.N. Human Rights Comm., General Comment No. 36 (2018) on Article 6 of the International Covenant on Civil and Political Rights, On the Right to life, 124th Sess., U.N. Doc. CCPR/C/GC/36, at 2 (Oct. 30, 2018) [hereinafter General Comment No. 36].

[65] *See, e.g.,* McCann v. United Kingdom, 324 Eur. Ct. H.R. (ser. A) ¶ 148 (1995).

[66] Salman v. Turkey, 2000-VII Eur. Ct. H.R. ¶ 60.

[67] Osman v. United Kingdom, 1998-VIII Eur. Ct. H.R. 3159, ¶ 115.

from killing individuals arbitrarily in outer space. The special nature of space does not provide for any conceivable exceptions.

The primary way this category has been engaged is the use of lethal force by law enforcement. The principle that space be used for exclusively peaceful purposes may prevent abuses of the right to life caused on Earth as a result of military activities, but still leaves room for the use of force by law enforcement. As conventional weapons are not explicitly banned in space, there is still the possibility lethal force could be used. Given the harsh environment of space, there is a higher risk that use of force would result in death, due to the potential for otherwise small or minor accidents to snowball into life-threatening catastrophes as well as the lack of access to comprehensive medical assistance in the event of an injury.[68]

States are required to take all necessary measures to prevent arbitrary deprivations of life by their officials, which can include providing adequate training and guidelines to armed officials.[69] In space, the control a State has over its officials may be weaker than on Earth, and such officials may enjoy a greater autonomy. However, the ECtHR has held that even in fluid situations (such as chaotic police chases), proper administrative and legal frameworks on the use of force should avoid some risks.[70] Thus, States are obliged to ensure their officials are adequately trained, including on the specific risks of using lethal force in space.

Finally, the Human Rights Committee considers the threat or use of weapons of mass destruction as incompatible with respect for the right to life.[71] As space law prohibits the placement of nuclear and other weapons of mass destruction in space, this is an area of confluence for the two frameworks.[72] However, there remains the possibility of the placement and use of conventional weapons in space; conventional weapons are not expressly prohibited in the same way as are weapons of mass destruction.

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[68] For example, the *Columbia* disaster was apparently caused by a piece of insulation foam puncturing the shuttle wing. *See* HAROLD W. GEHMAN JR. ET AL., REPORT OF THE COLUMBIA ACCIDENT INVESTIGATION BOARD 9 (2003).

[69] *McCann,* 324 Eur. Ct. H.R. (ser. A) ¶ 151.

[70] Makaratzis v. Greece, 2004-XI Eur. Ct. H.R. 1, 3.

[71] General Comment No. 36, *supra* note 64, ¶ 66.

[72] Moon Agreement, *supra* note 10, art. 3; Outer Space Treaty, *supra* note 4, art. IV.

B. Positive Obligation to Investigate

The right to life extends to the duty of States to investigate suspicious deaths, particularly those arising from the actions of States against individuals. The investigation must be effective and capable of ensuring accountability for deaths occurring under the State's responsibility.[73] In the event of a violation, full reparation must be provided, including adequate compensation.[74] States must have adequate provisions in their legal systems for making investigations into incidents that cause death, even if the death is caused by accident or by non-government entities.[75]

There are some practical difficulties in applying this concept to space. States are required to authorize and continually supervise national activities in space, meaning a duty to investigate thoroughly could occur in every instance of a life-threatening incident in space. This could be a prohibitive cost for many poorer States. In space, accidents can be catastrophic, and full investigations are often beneficial in order to prevent future accidents. However, data may be sparse or difficult to acquire, and investigators may not possess the technical capability to adequately investigate a space incident. Criminal investigations are often an important component of the duty to punish and deter wrongdoers, which raises questions of jurisdiction and State immunity.[76]

The Liability Convention stipulates that the launching State is "absolutely liable" for damage caused by its space objects on Earth and liable under a fault-based scheme if damage occurs in space, even if such damage is caused by non-government space activities.[77] Although it does not specifically deal with human rights violations, the Liability Convention considers loss of life in the

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[73] Al-Skeini v. United Kingdom, 2011-IV Eur. Ct. H.R. ¶¶ 164, 178.

[74] General Comment 36, *supra* note 64, ¶ 28.

[75] For example, Calvelli and Ciglio v. Italy, 2002-I Eur. Ct. H.R., establishes the principle that States are obliged to have adequate legal protection for its citizens against medical negligence by both public or private hospitals and to maintain adequate independent judicial systems to investigate the cause of any patients' death while in the care of the medical profession, whether in the public or private sector. *Id.* ¶ 49. Similarly, in Öneryildiz v. Turkey, 2004-XII Eur. Ct. H.R., the Court held that a State is required to make provision for adequate investigation into the context of an environmental accident. *Id.* ¶ 94.

[76] U.N. Human Rights Comm., Views: Communication No 1560/2007 (Marcellana v. Phil.), ¶ 7.2, U.N. Doc. CCPR/C/94/D/1560/2007 (Oct. 30, 2008).

[77] Liability Convention, *supra* note 45, arts. II, III.

context of outer space. This incentivizes the State to ensure a proper investigation is held to find those ultimately responsible. Many States, when authorizing non-governmental space activities, will require the private entity to indemnify the State or take sufficient insurance for damage.[78] This passes the risk from States to private entities.

However, there are limitations to any potential legal action. Compensation under the Liability Convention does not guarantee an effective investigation beyond identifying which State is liable to pay the compensation. Individuals have no rights to claim compensation themselves, as only States which have suffered damage either to themselves or their persons have the standing to make a claim. The Convention does not apply to nationals of the launching State nor foreign nationals participating in the operation of that space object.[79] Thus, there are no duties under the Liability Convention for State nationals or participating individuals, even though they are covered by human rights obligations through the ordinary operation of human rights law if the individuals are on Earth, or the extraterritorial operation of such laws if they are in space. States complying with the Convention would need to take additional measures to provide for investigation and compensation to cover the gap and meet their obligations under the right to life as applied to the context of space.

C. Positive Obligation to Protect Life

Finally, the right to life includes a State's duty to take all appropriate or reasonable steps to safeguard the lives of those within their jurisdiction. This extends to all threats to the right to life, including environmental threats and industrial activities, which, because of their nature, are especially dangerous.[80] It also includes appropriate measures to prevent deprivation of life by other States within their jurisdiction or corporate entities in extraterritorial

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[78] Steven Freeland, *Up, Up and…Back: The Emergence of Space Tourism and Its Impact on the International Law of Outer Space,* 6 CHICAGO J. INT'L L. 1, 16 (2005).

[79] Liability Convention, *supra* note 45, art. VII.

[80] *Öneryildiz*, 2004-XII Eur. Ct. H.R. ¶¶ 71, 110.

activities, where their activities have a direct and foreseeable impact on the right to life.[81]

Space activities are inherently dangerous. So, what does "all appropriate measures" means in the space context? Although States are given a wide margin of discretion as to which appropriate measures to take, legislative or administrative frameworks aimed at preventing or reducing the risk to life are often appropriate. Other relevant factors include the significant costs associated with space activity and the desire to not place disproportionate burdens on States. National regulations must be geared to the special risks and dangers associated with space activities in order to cover the inherent risks of outer space. Frameworks must be in place to deal with the potential for a large-scale disaster should a catastrophe in space occur.

Recall that in implementing their obligation to continually supervise nongovernmental space activities, some States have taken only minimal action, while others have created stringent safety requirements. The interaction of space law and human rights law duties arguably leads to a conclusion that strict State oversight over the safety of proposed space activities is necessary to comply with the duty to protect life. There is a problem of the capacity of smaller States to comprehensively oversee all their space activities, but this can be considered part of their margin of appreciation in implementing the duty. The fact that international space law gives a right of States to assert jurisdiction over their space objects may therefore give rise to a duty under international human rights law to exercise that right in order to protect the lives of individuals involved.

A situation may arise in which a State knowingly sends astronauts on a "suicide mission"—a mission in which there is a high risk or likelihood of death. For example, with current technology, a staffed mission to Mars is possible, but it is not possible to bring any personnel back from Mars.[82] Any astronaut going to Mars will

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[81] U.N. Human Rights Comm., Views: Communication No 2285/2013 (Yassin v. Can.), ¶ 6.5, U.N. Doc. CCPR/C/120/D/1285/2013 (Oct. 26, 2017); General Comment No. 36, *supra* note 64, ¶ 28.

[82] See for example the Mars One project that was meant to send individuals on a one-way mission to Mars (to much criticism) before being liquidated in 2019. Jonathan O'Callaghan, *Goodbye Mars One, The Fake Mission To Mars That Fooled The World*, Forbes (Feb. 11, 2019),

inevitably die when supplies run out. Hikmah argues sending humans to Mars presently would violate their right to life.[83] This thought process is consistent with the interpretation of the right to life as requiring adequate or reasonable steps to safeguard the lives of those within a States' jurisdiction. Therefore, there is likely an obligation to avoid knowingly sending humans into space without adequate essential resources, particularly if those humans are unaware of the risk they are taking. The situation may differ if the individuals concerned are fully informed of and voluntarily assume the risk. The closest analogy is the applicability of the right to life in the ECHR to military contexts or in times of war.[84]

In *Smith v. Ministry of Defence* (a case before the Supreme Court of the United Kingdom (UK)), the claimant alleged that the UK Ministry of Defence had breached their obligation under Article 2 of the ECHR by failing to adequately safeguard her son's life while the son was on military duty in Iraq.[85] Following the expansion of the definition of jurisdiction as outlined previously in this Article, the Court held unanimously that the deceased soldiers were within the personal jurisdiction of the UK.[86] More relevantly, Lord Hope DPSC (with whom Baroness Hale and Lord Kent JJSC agreed) held that Article 2 could apply to require States to take reasonable measures to protect the lives of their own military service personnel, although the extent to which Article 2 obligations applied were modified by the "inherently unpredictable" nature of military operations and that the same standard could not be applied to "civilians who had not undertaken the obligations and risks associated with life in the military."[87] States are therefore afforded a wide margin

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https://www.forbes.com/sites/jonathanocallaghan/2019/02/11/goodbye-mars-one-the-fake-mission-to-mars-that-fooled-the-world/#2cadf03b2af5.

[83] *See* Barikatul Hikmah, Multi-planetary Human Rights Protection, Presentation at UNOOSA Expert Meeting on Human Space Technology (Dec. 4-6, 2018), http://www.unoosa.org/documents/doc/psa/activities/2018/hsti_expert_meeting_vienna/Presentations/Session4_12_Barikatul_Hikmah.pdf.

[84] Consider, for example, that Article 15(2) of the ECHR makes an exception for "deaths resulting from lawful acts of war." ECHR, *supra* note 18, art 15(2).

[85] Smith v. Ministry of Defence [2014] AC 52 (UKSC) 103.

[86] *Id.* at 117.

[87] *Id.* at 120, 122.

of appreciation in carrying out their obligations, modified by the inherently risky nature of military operations.[88]

There are limitations to this wide margin of appreciation. For example, the ECtHR has recognized that States' protection obligations may have a higher standard with respect to conscripts, as conscripts do not voluntarily assume the inherent risk of military life but are instead compelled to do so by the State. To wit, the ECtHR has found breaches of Article 2 where a State did not take adequate measures to prevent a conscript with known mental health issues from committing suicide with his own weapon while on duty,[89] and where institutionalized bullying and physical/verbal hazing of conscripts led to the death of a conscript.[90] The ECtHR also left open the possibility that deaths, conscript or otherwise, occurring in military training contexts could support a breach of Article 2, as the risks of training activities are more predictable than actual operations.[91] Consequently, it is reasonable to conclude that although Article 2 obligations may apply to the context of space, the content of the obligations may be modified in order to take into account the inherently risky nature of space activities and the applicable *lex specialis*. There are examples of how State obligations are modified to reflect the hostile environment of space. The Outer Space Treaty provides that astronauts are to be regarded as "envoys of [hu]mankind," employing similar language to that utilized by universal human rights standards.[92] Astronauts of one State are obliged to render all possible assistance to astronauts of other States.[93] While the treaties do not specifically refer to the right to life, States are under a stronger obligation to take "all possible assistance" instead of "all

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[88] This view is supported by the International Court of Justice (ICJ) in Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion, 1996 I.C.J. Rep. 226 (July 8). In that Advisory Opinion, the ICJ noted that "[i]n principle, the right not arbitrarily to be deprived of one's life applies also in hostilities. The test of what is an arbitrary deprivation of life, however, then falls to be determined by the applicable *lex specialis*, namely the law applicable in armed conflict which is designed to regulate the conduct of hostilities." *Id.* at 240.

[89] Ataman v. Turkey, Eur. Ct. H.R. (2006), http://hudoc.echr.coe.int/eng?i=001-75207; Kilinc v. Turkey, Eur. Ct. H.R. (2005), http://hudoc.echr.coe.int/eng?i=001-69269.

[90] Mosendz v. Ukraine, Eur. Ct. H.R. (2008), http://hudoc.echr.coe.int/fre?i=001-115887.

[91] Stoyanovi v. Bulgaria, Eur. Ct. H.R. ¶ 61 (2010), http://hudoc.echr.coe.int/eng?i=001-101678.

[92] Outer Space Treaty, *supra* note 4, art. V.

[93] *Id.*

appropriate steps" to secure the lives of astronauts within their jurisdiction and control.

The Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space (Rescue Agreement) places similar duties on States to personnel of spacecraft. In the event of an emergency landing in a territory of a State, the State must "take all possible steps to rescue them and render them all necessary assistance."[94] If information is received, there is a duty to share it with the launching authority, and if the accident takes place in any place not under the jurisdiction of the State, States "in a position to do so shall, if necessary extend assistance" to the rescue efforts.[95]

These two examples do not set out the duties in terms of individual or human rights; instead, it is a duty of a State to other States. Consequently, these examples may be of limited use to individuals whose rights have been violated.

V. CONCLUSION

International human rights law is applicable to outer space, and States have an obligation to respect and protect the enjoyment of human rights in space. The nature of State jurisdiction in space is sufficient to activate human rights obligations. The special environment of space does not detract from these obligations; indeed, several space treaties have developed precise rules related to the protection of the right to life, incidentally promoting and protecting specific aspects of the right. Therefore, the intersection of these two frameworks has led to some protection for the right to life in space.

Ultimately, any lack of clarity can only be resolved by the introduction of clear legal rules, such as by the development of a widely-accepted treaty. The current international human rights framework emerged in response to the atrocities of World War II, but States have an opportunity to define the scope of human endeavors in outer space before such atrocities occur as a result of space activities. Human rights frameworks can play an important role in guiding how we use space for the benefit of all humanity.

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[94] Agreement on the Rescue of Astronauts, The Return of Astronauts and the Return of Objects Launched into Outer Space art. II, Apr. 22, 1968, 19 U.S.T. 7570, 672 U.N.T.S. 119.

[95] *Id.* at arts. 3, 4.

AD ASTRA PER MARIS: USING THE LAW OF THE SEA TO PROTECT THE SPACE ENVIRONMENT

Sara Raye Flenniken[*]

ABSTRACT[1]

As of 2020, there has been inadequate environmental research relating to space, thus there are few environmentally-focused laws in place for the space sector. The development and incorporation of such laws will be critical for environmental protection as the frequency of space operations continues to increase, particularly as they relate to private space actors. As space law continues to develop, the environmental concept of the tragedy of the commons and the current legal framework governing the law of the sea may provide the best guidance on how to model that development.

This Article will review the effect of State and private space activities on the space environment through exploration of the current pollution issues attributable to space operations and applying the tragedy of the commons model to space. It will then examine the law of the sea's relevance to the development of space law as a solution to the problems arising out of the tragedy of the commons and apply the concept of the tragedy of the commons and the principles found in the law of the sea to three current issues in space law—pollution of Earth's orbit, jurisdiction and mineral resources. Finally, this Article will suggest a model for a dispute settlement authority, similar to that used in the law of the sea, to resolve future legal questions regarding space as they inevitably arise.

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[1] *Ad astra* is Latin for "to the stars" and interestingly, is how NASA Administrator Jim Bridenstine signs off on his emails. *Ad astra per maris* is Latin for "to the stars, through the seas."

I. INTRODUCTION

> Thank God men cannot as yet fly, and lay waste the sky as well as the earth. We are safe on that side for the present.
> – Henry David Thoreau, 1861[2]

While Thoreau's remarks were true when he made them, it is no longer the case that humankind's impact is confined to our planet. Thoreau foresaw the potential advancements in flight technology that the Wright brothers would bring to fruition in 1903[3] and that the Soviet Union would expand upon in 1959 with the launch of *Luna 1*.[4] He further anticipated that those advancements would lead to atmospheric environmental issues similar to those that we face terrestrially due to humankind's failure to consider environmental factors when developing new technologies. This was remarkably prescient given the lack of research available in the 1800s concerning environmental preservation.

Today, we rely on satellites in nearly every aspect of our lives—from the Global Positioning System to get us to our homes, to the military surveillance that keeps us safe in those homes. Satellites also serve significant environmental purposes, monitoring weather patterns to warn us of hurricanes and charting world climate changes to warn us of more severe, long-term environmental obstacles, such as deforestation and overfishing.[5] As such, there is an immediate need for policy development to set the parameters for the continued exploration and use of space. Further, essentially no laws exist relating to space activities' bearing on the environment,

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[2] Henry David Thoreau, Journal Entry (Jan. 3, 1861), *available at* https://www.walden.org/wp-content/uploads/2016/02/Journal-14-Chapter-6.pdf.

[3] *Id*. While the first motorized airplane flight was a monumental achievement, the flight itself lasted only twelve seconds. *1903 Wright Flyer*, SMITHSONIAN NAT'L AIR & SPACE MUSEUM, https://airandspace.si.edu/collection-objects/1903-wright-flyer/nasm_A19610048000 (last visited June 15, 2020).

[4] *Luna 1* was the first spacecraft to escape Earth's gravity, but the mission was only partially successful as it did not reach the Moon, its intended destination. For additional information on the mission, see *Luna 1*, NASA, https://nssdc.gsfc.nasa.gov/nmc/spacecraft/display.action?id=1959-012A (last visited July 12, 2020).

[5] For a summary review of how space benefits the terrestrial environment see *Benefits of Space: Environment*, U.N. OFF. OUTER SPACE AFF., https://www.unoosa.org/oosa/de/benefits-of-space/environment.html (last visited July 5, 2020). For a list of active satellites belonging to the National Oceanic and Atmospheric Association (NOAA), see *Currently Flying*, NOAA, https://www.nesdis.noaa.gov/content/currently-flying (last visited June 15, 2020).

and very little research has been conducted to determine how our environment is impacted by space activities terrestrially, atmospherically and even in outer space. Therefore, it is critical that as space law develops, the importance of environmental concerns do not fall by the wayside. This effort will be best achieved by modeling space law after the law of the sea.

However, the development of space law must not proceed in a belated and ad hoc manner as did the evolution of the law of the sea. The principal focus of the law of the sea has traditionally been the use of the oceans instead of their protection and this is the exact issue that space law legislators should aim to avoid. The vastness of the oceans led to the widespread misconception that we need not worry about their contamination, though we now know that human activity can be very detrimental to the marine environment.[6] The same is true of the space environment, and the law of the sea provides the best analogical framework from which to examine the development of environmental considerations in space law while the field is in its relative infancy.

The predominant treaties of international space law include the 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),[7] the Convention on International Liability for Damage Caused by Space Objects (Liability Convention)[8] and the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (Moon Agreement),[9] though there are many other treaties, regulations and soft law sources as well.[10] In addition, the United States (US) has the National Aeronautics and Space Act (Space Act)[11] and regulations such as those

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[6] MATTHEW J. KLEIMAN, JENIFER K. LAMIE & MARIA-VITTORIA "GIUGI" CARMINATI, THE LAWS OF SPACEFLIGHT: A GUIDEBOOK FOR NEW SPACE LAWYERS 205 (2012).

[7] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205 [hereinafter Outer Space Treaty].

[8] Convention on International Liability for Damage Caused by Space Objects, Mar. 29, 1972, 24 U.S.T. 2389, 961 U.N.T.S. 187 [hereinafter Liability Convention].

[9] Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, Dec. 18, 1979, 1363 U.N.T.S. 3 [hereinafter Moon Agreement]. The US is not a party to the Moon Agreement.

[10] *See Status of International Agreements Relating to Activities in Outer Space as at 1 Jan. 2019*, U.N. Doc. A/AC.105/C.2/2019/CRP.3 (2019).

[11] 51 U.S.C. §§ 10101–71302 (2018).

of the Federal Aviation Administration (FAA).[12] However, although the FAA regulates launch and re-entry, it has no authority in space.[13] The United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) serves as a governing body that studies and discusses legal issues that arise out of the use of space.[14] The Outer Space Treaty and the Space Act contain fundamental provisions concerning the use and exploration of space and COPUOS has been instrumental in international space law policy development; however, environmental interests have been mostly overlooked by all three.[15] Just as problematic, international environmental law has paid relatively little attention to the space sector.[16] According to Lotta Viikari, "[e]ffective management of environmental problems related to space activities is impossible using the current international law of outer space"[17] because these treaties were developed at a time when environmentalism was, at best, a minor concern in the political sphere. These space treaties were drafted over fifty years ago and have arguably become counterproductive to any environmental interests in the space environment they were intended to regulate. As the world becomes increasingly dependent on the use, exploration and exploitation of space and its resources, public and private actors must cooperatively develop and implement transnational rules to ensure the protection of our environment, without stifling the growth of the space industry.

As space law continues to develop, the environmentally-based concept of the tragedy of the commons and the current legal framework governing the law of the sea may provide the best guidance on

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[12] Particularly important for environmental concerns is FAA Order 1050.1F, which requires compliance with federal mandates to review environmental impacts before taking agency action. FED. AVIATION ADMIN, FAA ORDER NO. 1050.1F, ENVIRONMENTAL IMPACTS: POLICIES AND PROCEDURES (2015), https://www.faa.gov/air_traffic/environmental_issues/ared_documentation/media/Order_1050_1F(07162015_final_version).pdf.

[13] MATTHEW J. KLEIMAN, THE LITTLE BOOK OF SPACE LAW 147 (2013).

[14] *Committee on the Peaceful Uses of Outer Space*, U.N. OFF. OUTER SPACE AFF., http://www.unoosa.org/oosa/en/ourwork/copuos/index.html (last visited July 12, 2020).

[15] However, Article IX of the Outer Space Treaty does address forward and reverse contamination. It requires that space activities avoid the "harmful contamination" of celestial bodies and "adverse changes in the environment of the Earth resulting from the introduction of extraterrestrial matter." Outer Space Treaty, *supra* note 7, art. IX.

[16] Lotta Viikari, *Environmental Aspects of Space Activities, in* HANDBOOK OF SPACE LAW 761 (Frans von der Dunk & Fabio Tronchetti eds., 2015).

[17] *Id.* at 765.

how to direct that development. This Article will review the effect of State and private space activities on the environment and the potential impact of including environmental considerations in the development of space law. Part II of this Article begins with an exploration of the current pollution issues attributable to space operations by applying the tragedy of the commons model to outer space. In Part III, this Article examines the law of the sea's[18] relevance to space law development as a solution to the problems arising out of the tragedy of the commons. In Part IV, this Article applies the concept of the tragedy of the commons and the principles found in the law of the sea to three current issues in space law—pollution of Earth's orbit, jurisdiction and mineral resources. Finally, in Part V, this Article suggests a model for a dispute settlement authority, similar to that used in the law of the sea, to resolve future legal questions regarding space as they inevitably arise.

II. THE TRAGEDY OF THE COMMONS

> There are a thousand things that can happen when you go light a rocket engine, and only one of them is good.
> – Tom Mueller[19]

The tragedy of the commons is a dilemma often referenced in environmental law. It directly applies to, and partially explains, environmental concerns resulting from space activity, such as atmospheric pollution and space debris.[20] When people or nations try to maximize their individual gain without a proportional increase in resources, the loss is spread amongst everyone.[21] Each individual's gain is more than that individual's loss, but the total loss to society,

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[18] This discussion will focus on both the customary and conventional international law of the sea.

[19] Andrew Chaikin, *Is SpaceX Changing the Rocket Equation?* AIR & SPACE MAG. (Jan. 2012), https://www.airspacemag.com/space/is-spacex-changing-the-rocket-equation-132285884/?page=2 (Tom Mueller was propulsion chief technology officer at SpaceX at the time of this statement.).

[20] The Trump administration recently issued an Executive Order encouraging commercial use of space resources and indicating that the US does not view space as a global commons or believe that further international treaties would be necessary for off-Earth resource mining. Exec. Order No. 13914, 85 Fed. Reg. 20,381 (Apr. 6, 2020), https://www.govinfo.gov/content/pkg/FR-2020-04-10/pdf/2020-07800.pdf.

[21] W. F. LLOYD, TWO LECTURES ON THE CHECKS TO POPULATION 473, 479 (1833).

of which he or she is a member, is equal to his or her gain.[22] The tragedy of the commons is often explained through an example of herdsmen.[23] If every herdsman adds more cows to his herd, he sees the benefit of increased profits associated with a larger herd. However, without more resources, all of the herdsmen will face the loss associated with overgrazing.[24] To each individual herdsman, the collective loss will not be felt as significantly as his individual gain and thus will not act as a deterrent to increasing the size of his herd.[25] Regarding the pollution of the environment, the tragedy of the commons can be applied in the reverse; the issue is not the removal of something from the commons, but the addition of something, be it emissions into our atmosphere or space debris into orbit.[26]

The concept of sustainable development endeavors to reconcile the need for development and the need for environmental protection. This concept can be found in the law of the sea as well, as articulated in the *Gabčíkovo-Nagymaros* dispute,[27] the first instance in which the International Court of Justice addressed sustainable development.[28] At issue was whether environmental harms constituted a "state of necessity" defense[29] permitting one nation to breach a contract with another nation without incurring "international responsibility."[30] In deciding on breach of contract claims made by both Hungary and Slovakia, "[t]he case presented an opportunity for the consideration of the extent to which environmental concerns could justify the substantial reformation or termination of a treaty-based regime."[31] Applying this to the space

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[22] *Id.*

[23] Garrett Hardin, *The Tragedy of the Commons*, 162 SCIENCE 1243, 1244 (1968).

[24] *Id.*

[25] *Id.*

[26] *Id.* at 1245.

[27] *See* Case Concerning the Gabčíkovo-Nagymaros Project (Hung. v. Slovk.), Judgment, 1997 I.C.J. Rep. 7 (Sept. 25)

[28] Stephen Stec, *Do Two Wrongs Make a Right? Adjudicating Sustainable Development in the Danube Dam Case*, 29 GOLDEN GATE U. L. REV. 317, 319 (1999).

[29] A state of necessity defense exception may be invoked when a nation's "sole means of safeguarding an essential interest threatened by a grave and imminent peril is to adopt conduct not in conformity with what is required of it by an international obligation to another State." Mari Nakamichi, *The International Court of Justice Decision Regarding the Gabcikovo-Nagymaros Project*, 9 FORDHAM ENVTL. L. REV. 337, 349 (1998).

[30] *Gabčíkovo-Nagymaros*, 1997 I.C.J. Rep. at 36.

[31] Stec, *supra* note 28, at 320.

environment, attempting to meet the needs of present generations without compromising the ability of future generations to meet their own needs will require a divergence from the current patterns of space operations. Further complicating the issue is the emergence of a more commercialized space industry. It is clear that the private sector will continue to expand its role in the conduct of space activities, and therefore it is imperative to create a legal framework within which the private sector must operate.

A. Terrestrial Environment

An immense amount of energy is required to launch even small vehicles into space. Consider the following explanation of the requisite energy to launch; note that the majority of vehicles launched into space are much larger than that used in this example:[32]

> The amount of energy required to lift an object the size of a fighter jet into outer space for suborbital spaceflight—where the spacecraft reaches outer space, but does not have enough energy to complete a single orbit around Earth—would enable a car to drive about two-thirds of the way around the globe. Yet this spacecraft would only reach a maximum speed of about 3,000 miles per hour and would only remain in outer space for a few minutes, quickly falling back to Earth after reaching the top of its ballistic arc. In order to remain in orbit, the spacecraft would need to accelerate to about 17,500 miles per hour. The amount of energy required to accelerate to this orbital velocity would take the car around the globe six times.[33]

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[32] An F-15 fighter jet is 63.8 feet long with a wingspan of 42.8 feet, weighing 45,000 pounds. *See F-15 Technical Specifications*, BOEING, https://www.boeing.com/defense/f-15/#/technical-specifications (last visited June 15, 2020). By comparison, a Falcon 9 rocket is 229.6 feet tall and weighs over one million pounds. *See Falcon 9*, SPACEX, https://www.spacex.com/falcon9 (last visited June 15, 2020). Falcon 9s were the most frequently launched rocket from the US in 2019. *See Long March, Soyuz and Falcon Rockets Topped 2019's Launch Leaderboard*, SPACEFLIGHT NOW (Jan. 2, 2020), https://spaceflightnow.com/2020/01/02/long-march-soyuz-and-falcon-rockets-topped-2019s-launch-leaderboard/.

[33] KLEIMAN, *supra* note 13, at 1–2 (referencing Gen. William L. Shelton, Commander, Air Force Space Command, Keynote Speech at the 15th Annual FAA Commercial Space Transportation Conference (Feb. 16, 2012), *available at* http://www.parabolicarc.com/2012/02/20/video-gen-shelton-of-air-force-space-command-at-faa-conference).

Given the technical complexities associated with launching an object into space and the tremendous amount of combustible propellant required,[34] launch is the riskiest stage of spaceflight. Because of the high risk for accidents, environmental groups have challenged NASA's decisions to launch vehicles powered by nuclear power sources for the *Galileo*,[35] *Ulysses*[36] and *Cassini*[37] planetary probes, arguing that "(1) NASA's EIS[38] failed to consider all relevant risks and underestimated their magnitude, and (2) NASA failed to thoroughly consider alternatives, particularly the use of solar power sources."[39] These three cases were based on the National Environmental Policy Act (NEPA),[40] which "requires federal agencies to assess the environmental effects of their proposed actions prior to making decisions."[41] For an agency action to be set aside, a court must find such an action to have been "arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law."[42] In all three cases, federal courts denied the request of the environmental groups to stop the launches because NASA's actions did not meet the requisite arbitrary and capricious standard.[43] However, the concerns of such environmental groups are not unfounded. There are cases in which nuclear-powered satellites have

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[34] A rocket is about eighty-five percent propellant. For an explanation of the "rocket equation" as it relates to the conservation of momentum, see Don Pettit, *The Tyranny of the Rocket Equation*, NASA (May 1, 2012), https://www.nasa.gov/mission_pages/station/expeditions/expedition30/tryanny.html.

[35] Florida Coal. for Peace & Justice v. Bush, 1989 U.S. Dist. LEXIS 12003.

[36] Florida Coal. for Peace & Justice v. Bush, 1990 U.S. Dist. LEXIS 13345.

[37] Hawaii Cty. Green Party v. Clinton, 980 F. Supp. 1160 (D. Haw. 1997).

[38] An EIS, or Environmental Impact Statement, is a document that details the potential effects of a proposed Agency action on the environment and is required by the National Environmental Policy Act (NEPA) before such action is taken.

[39] KLEIMAN, *supra* note 13, at 45.

[40] National Environmental Policy Act, 42 U.S.C. §§ 4321-4370h (2018). *See also* Marsh v. Oregon Nat. Res. Council, 490 U.S. 360 (1989) (holding that an agency's EIS can only be set aside if it is arbitrary, capricious, or an abuse of discretion).

[41] *What is the National Environmental Policy Act?* EPA, https://www.epa.gov/nepa/what-national-environmental-policy-act (last visited June 15, 2020).

[42] 5 U.S.C. § 706(2)(A).

[43] *See Florida Coal.*, 1990 U.S. Dist. LEXIS at 14; *Florida Coal.*, 1989 U.S. Dist. LEXIS at 14 ("The Court finds that there is no evidence that NASA's decision was arbitrary and capricious. . . [T]his Court must defer to 'the informed discretion of the responsible federal agencies' since the matter 'requires a high level of technical expertise.' Thus the Court will not set aside NASA's decision." (citing *Marsh v. Oregon Nat. Res. Council*)); *Hawaii Cty.*, 980 F. Supp. at 1167.

reentered the atmosphere and caused the release of hazardous waste when they collided with Earth[44] and other instances in which nations have shot down their own satellites to prevent such harms from reentry.[45]

Vehicles and other objects enter and reenter the atmosphere traveling at hypersonic speeds,[46] often generating enough heat to vaporize the object as it attempts to pass through the atmosphere.[47] However, when an object is too large and not enough heat is generated, it can result in an enormous amount of debris that falls back to Earth.[48] In fact, between ten and forty percent of reentering objects survive the impact with Earth's atmosphere.[49] The 1972 Liability Convention provides that the "launching State" of a space object is strictly liable for damage caused by its space objects on Earth.[50] Further, the Convention defines "damage" as the "loss of life, personal injury or other impairment of health; or loss of or damage to property of States or of persons, natural or juridical, or

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[44] In 1978, Cosmos 954, a Russian satellite, fell back to Earth after a failed launch and spread radioactive debris over an area in northwest Canada. Luckily, this was an uninhabited area, so there were no injuries. However, had it remained in orbit slightly longer and crashed into a populated area, the effects could have been much worse. *See* Alexander F. Cohen, *Cosmos 954 and the International Law of Satellite Accidents*, 10 YALE J. INT'L L. 78 (1984).

[45] In 2008, the US shot down USA-193, a nonoperational satellite, to avoid the risk of its toxic propellant from contaminating a populated area as it reentered the atmosphere. *See* GEOFFREY FORDEN, A PRELIMINARY ANALYSIS OF THE PROPOSED USA-193 SHOOT-DOWN (Mar. 12, 2008), http://web.mit.edu/stgs/pdfs/Forden_Preliminary_analysis_USA_193_Shoot_down.pdf.

[46] For examples of average long-distance flight times compared to flights of those same distances at hypersonic speed, see Eric Limer, *How Fast Is Supersonic Speed, Really?* POPULAR MECHANICS (Sep. 28, 2017), https://www.popularmechanics.com/flight/a28426/hypersonic-speed-math-examples/.

[47] This can be observed when looking at "shooting stars," which aren't actually stars at all. During a meteor shower, small meteoroids, sometimes no bigger than a grain of rice, burn up in the upper atmosphere and generate streaks of light, which are visible from Earth.

[48] The *Columbia* disaster generated more than 80,000 pieces of debris that fell across a 28,000 square mile area in eastern Texas and western Louisiana. *See Worst Space Debris Events of All Time*, SPACE.COM (Mar. 8, 2013), https://www.space.com/9708-worst-space-debris-events-time.html; Clara Moskowitz, *Debris from Space Shuttle Columbia Disaster Found in Texas*, SPACE.COM (Aug. 2, 2011), https://www.space.com/12518-space-shuttle-columbia-debris-texas.html.

[49] Vito De Lucia & Viviana Iavicoli, *From Outer Space to Ocean Depths: The "Spacecraft Cemetery" and the Protection of the Marine Environment in Areas Beyond National Jurisdiction*, 49 CAL. W. INT'L L.J. 345, 368 (2019).

[50] Liability Convention, *supra* note 8, art. I(a).

property of international intergovernmental organizations,"[51] but does not acknowledge potential environmental damages regarding anything that could not be considered "property."[52] Moreover, the Outer Space Treaty does not account for terrestrial environmental damage aside from those "resulting from the introduction of extra-terrestrial matter."[53]

The marine environment is also at risk under current space practices—in an area of the southern Pacific Ocean known as the South Pacific Ocean Uninhabited Area (SPOUA),[54] one can find the "spacecraft cemetery."[55] The farthest point from any land on Earth, SPOUA is devoid of human life, but is certainly still home to a range of marine life and vulnerable ecosystems. Since 1971, nearly two hundred and fifty pieces of space debris have been sunk in this area by spacefaring nations.[56] It has even been suggested that the International Space Station might be de-orbited in SPOUA at the end of its operational life.[57] The "controlled de-orbiting" of space debris into the ocean is known as a "splashdown"[58] and is the recommended solution of many domestic and international guidelines regarding space debris.[59] While splashdowns work to alleviate the

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[51] *Id.*

[52] *Id.*

[53] Outer Space Treaty, *supra* note 7, art. IX.

[54] SPOUA is also known as the Oceanic Pole of Inaccessibility and centers around "Point Nemo," named after the character of Captain Nemo in Jules Verne's *Ten Thousand Leagues Under the Sea.* Ella Davies, *The Place Furthest From Land is Known as Point Nemo,* BBC.COM (Oct. 5, 2016), http://www.bbc.com/earth/story/20161004-the-place-furthest-from-land-is-known-as-point-nemo#:~:text=Ducie%20Island%20(one%20of%20the,is%20a%20rather%20peculiar%20place.

[55] Lucia & Iavicoli, *supra* note 49, at 346.

[56] *Id.* at 367. Over one hundred and ninety pieces are remnants from Russia's *Mir* Space Station and three other Russian military space stations. Fifty-six pieces are remnants of the US *Skylab*, eight are European and six are Japanese.

[57] *See* Corey S. Powell, *The ISS Was Never Supposed to End Like This*, NBC NEWS (Feb. 22, 2018), https://www.nbcnews.com/mach/science/iss-was-never-supposed-end-ncna848771.

[58] Lucia & Iavicoli, *supra* note 49, at 348.

[59] *Id. See also* U.S. GOVERNMENT ORBITAL DEBRIS MITIGATION STANDARD PRACTICES, NOVEMBER 2019 UPDATE 5 (2019), https://orbitaldebris.jsc.nasa.gov/library/usg_orbital_debris_mitigation_standard_practices_november_2019.pdf (re-entry trajectories is one of two "preferred disposal options" and should consider "targeted reentry away from landmasses, to further reduce reentry human casualty risk."); EUROPEAN CODE OF CONDUCT FOR SPACE DEBRIS MITIGATION 9 (2004), https://www.unoosa.org/documents/pdf/spacelaw/sd/2004-B5-10.pdf (a nonoperational space object should be disposed of "in decreasing order of preference . . . by performing a

orbital environmental concern of space debris, however, they also work against the terrestrial environmental concern of ocean preservation.

B. Atmospheric Environment

The primary environmental impacts of the operation of launch vehicles are atmospheric. Specifically, the pollution from the release of particulate matter and ozone-depleting compounds. To appreciate how launch operations affect the atmospheric environment, it is helpful to first understand how the potential energy stored in a vehicle's propellant is converted into the thrust necessary to overcome gravity and lift the vehicle into outer space. Simply stated, this series of events is the simple application of Newton's second[60] and third[61] laws of motion. Reaction engines are the most common type of engine used in launch vehicles and generate thrust by converting propellant into reaction mass.[62] During launch, that reaction mass is then expelled out the engine's nozzle toward the ground.[63] According to Newton's laws, the vehicle will move in the opposite direction of the mass expelled and the faster the mass is expelled, the faster the vehicle will accelerate.[64] From an environmental perspective, the issue is that this reaction mass is expelled directly into the atmosphere as exhaust.

The current annual ozone loss attributable to launch vehicles is considered "insignificant" at .03 percent, but experts report that launch vehicles have the potential to become a "significant

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direct re-entry of the space system; or by limiting the orbital lifetime of the space system to less than 25 years after its operational phase; or by transferring the space system to a disposal orbit.").

[60] When a force is applied to an object, the change in momentum of that object is proportional to, and in the direction of, the applied force. *See* Jim Lucas, *Newton's Laws of Motion,* LIVESCIENCE (Sep. 27, 2017), https://www.livescience.com/46558-laws-of-motion.html.

[61] For every action, there is an equal and opposite reaction. *See id.*

[62] *Rocket Principles*, NASA (Jun. 12, 2014), https://www.grc.nasa.gov/www/k-12/rocket/TRCRocket/rocket_principles.html.

[63] *Id.*

[64] *Rocket Thrust*, NASA (Jun. 12, 2014), https://www.grc.nasa.gov/WWW/K-12/rocket/rktth1.html.

contributor" to ozone depletion.[65] The Space Shuttle program originally planned to launch weekly and would have pushed the annual ozone loss attributable to launch vehicles to .2 percent, which has been characterized as the "possible upper bound that defines 'acceptable ozone loss.'"[66] However, nearly forty years later, SpaceX has announced plans to launch its Super Heavy/Starship program every two weeks, the yearly emissions of which are predicted to be more than the total yearly emissions currently generated by all launches at NASA's Kennedy Space Center combined.[67] In addition, smaller companies like RocketLab[68] hope to launch at least monthly and the number of private launching companies will only increase as the space industry becomes more commercialized and economically accessible. Without regulations in place to limit launch frequency or encourage technological advancements to mitigate atmospheric pollution, the only hurdle to jump is NEPA, and courts will not decide against an agency unless its actions are clearly arbitrary and capricious.[69] The operation of launch vehicles is a complex endeavor that is understood by only a small number of people and therefore, arbitrary and capricious agency actions are at risk of going undetected because they are not "clearly" defined as such. Moreover, the actions of private space companies are even more difficult to assess in their appropriateness because they do not have the same obligations of governments to other citizens and are harder still to govern without the proper regulations in place.

III. THE LAW OF THE SEA

> [T]here is [a] fundamental reason why we look at the sky with wonder and longing—for the same reason that we

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[65] Martin Ross, Darin Toohey, Manfred Pienemann, & Patrick Ross, *Limits on the Space Launch Market Related to Stratospheric Ozone Depletion*, 7 ASTROPOLITICS 50, 52 (2009).

[66] *Id* at 58.

[67] In addition to these launches, a static test fire will take place prior to each launch, emitting just as many ozone-depleting compounds. *See* DRAFT ENVIRONMENTAL ASSESSMENT FOR THE SPACEX STARSHIP AND SUPER HEAVY LAUNCH VEHICLE AT KENNEDY SPACE CENTER (Aug. 1, 2019), https://netspublic.grc.nasa.gov/main/20190801_Final_DRAFT_EA_SpaceX_Starship.pdf.

[68] Rocket Lab advertises its newest launch vehicle, *Electron*, as a satellite delivery method that launches with "unprecedented frequency." *See Electron*, ROCKET LAB (2020), https://www.rocketlabusa.com/electron/#Plug

[69] 5 U.S.C. § 706 (2018).

> stand, hour after hour, gazing at the distant swell of the open ocean. – Gerald Waxman[70]

The exploration of outer space and Earth's oceans have long been compared[71] and considered humankind's "final frontiers."[72] Partly due to the similarities in the mysterious nature of exploring the seas and space, along with the often-unforeseeable issues that arise with any unprecedented endeavor, the law of the sea is an appropriate model to look to in developing the law of outer space.[73] Moreover, as the law of the sea has already confronted many of the problems currently seen in space, it can provide a framework for space law development to tackle the issues presented by the concept of the tragedy of the commons.

The law of the sea is governed by three principles—the principle of freedom,[74] the principle of sovereignty[75] and the principle of the common heritage of humankind.[76] Each of these principles can be applied to the space sector as policy develops surrounding the uses and restrictions of outer space, but the common heritage of humankind will lead to the most beneficial results regarding the environment. The principles of the common heritage of humankind can be summarized as follows:

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[70] GERALD D. WAXMAN, ASTRONOMICAL TIDBITS: A LAYPERSON'S GUIDE TO ASTRONOMY xiii (2010).

[71] For a discussion between Sylvia Earle and Neil DeGrasse Tyson on the similarities and differences in sea and space exploration, see *Exploring Deep Sea and Deep Space Are Surprisingly Similar*, NAT'L GEOGRAPHIC (Nov. 2017), https://www.nationalgeographic.com/magazine/2017/11/star-talk-sylvia-earle-neil-degrasse-tyson/#close.

[72] Substantial debate exists, however, over which, sea or space, is the most important to explore. *Compare* PRESIDENT'S PANEL FOR OCEAN EXPLORATION, DISCOVERING EARTH'S FINAL FRONTIER: A U.S. STRATEGY FOR OCEAN EXPLORATION (2000), https://oceanexplorer.noaa.gov/about/what-we-do/program-review/presidents-panel-on-ocean-exploration-report.pdf (reporting on the Panel's recommendations regarding ocean exploration), *with* James Kitfield, *The Permanent Frontier*, 33 THE NAT'L J. 780 (2001) (arguing that space is not only the final frontier, but a permanent frontier).

[73] While the sea may contain a more limited amount of resources overall, it is difficult to assess what percentage of space resources we will actually be able to access.

[74] The principle of freedom seeks to promote the use of the seas by nations. YOSHIFUMI TANAKA, INTERNATIONAL LAW OF THE SEA 16–17 (2d ed. 2015).

[75] The principle of sovereignty seeks to promote the interests of coastal nations. *Id.* at 18-19.

[76] "[T]he principle of the common heritage of mankind seeks to protect the interests of mankind as a whole" instead of the interests of individual nations. *Id.* at 19.

> 1. The area is not subject to national appropriation. 2. The area is free for scientific investigation. 3. All States share in the management of the area. 4. The benefits derived from exploitation of an area's resources must be shared with the developing States regardless of the level of participation. 5. The area must be used only for peaceful purposes; and 6. The area must be preserved for future generations.[77]

Because individual nations do not have exclusive rights to any one area in space, the most applicable legal framework is that of the high seas, the portion of our oceans that is shared by all nations and cannot be appropriated by any nation.[78] In fact, the Outer Space Treaty uses similar language in discussing the idea that all nations may "use" outer space, but that outer space, including the Moon and other celestial bodies, cannot be appropriated by any nation.[79] However, with the commercialization of space, the issue becomes less that a nation will unlawfully appropriate asteroid or lunar resources and more that private companies will appropriate these resources without any laws to impede them. In fact, the US enacted a law in 2015 that promotes the private appropriation of space resources.[80] While the Outer Space Treaty does specify that States are internationally liable for the space activities of their nationals, including non-governmental entities,[81] it remains unclear what responsibility government agencies or non-government entities really bear. Further, the Outer Space Treaty only applies to those nations that are State parties.

The sea has been referred to as the property of no one (*res nullius*), a common possession (*res communis*) and public property (*res publica*); these principles can be applied to outer space as well.[82] These approaches can be viewed as a sliding scale, but each will lead to a different result. Therefore, it will be important to carefully consider the consequences of each interpretation in deciding how space will be categorized and used. *Res nullius* is the most

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[77] FABIO TRONCHETTI, THE EXPLOITATION OF NATURAL RESOURCES OF THE MOON AND OTHER CELESTIAL BODIES: A PROPOSAL FOR A LEGAL REGIME 89 (2009).

[78] TANAKA, *supra* note 74, at 179.

[79] Outer Space Treaty, *supra* note 7, art. II.

[80] Space Resource Commercial Exploration and Utilization Act of 2015, 51 U.S.C. §§ 51301-51303 (2018).

[81] *See* Outer Space Treaty, *supra* note 7, art. VI.

[82] For an analysis of these principles, see HUGO GROTIUS, MARE LIBERUM (1609).

restrictive and is thus likely to seriously inhibit the exploration and use of space. On the other end of the spectrum, *res publica* is the least restrictive, arguably less restrictive even than current regulations. Consequently, we are left with the principle of *res communis*, which most closely aligns with both the solution to the tragedy of the commons and the approach taken in developing the law of the sea. The common heritage of humankind finds its antecedents in the *res communis* theory, which, while preventing rights of sovereignty, still allows for the exploitation of resources. Under the law of the sea, this approach is applied as the "freedom of the high seas."[83] The Outer Space Treaty closely mirrors principles of both *res publica* and *res communis*, but also adds elements, such as the requirement that the use of outer space be for the benefit of all humankind, that are incompatible with this idea of free exploitation.[84]

The law of the sea divides the seas up into zones and each zone has different regulations associated with its uses and restrictions.[85] This may be a good model for determining similar uses and restrictions in space, but currently, there is no established legal definition or demarcation of where Earth's atmosphere ends and outer space begins. The most widely accepted altitude is one hundred kilometers above sea level, called the Kármán Line, because to remain airborne at that altitude "a plane would have to fly so fast to generate aerodynamic lift that it would reach orbital velocity."[86] In some regulations, the US defines space as "any area not within the jurisdiction (as recognized by the United States) of a foreign country, possession of the United States, or the United States, and not in international water."[87] However, the US Air Force considers the end of Earth's atmosphere and the beginning of space to be twelve miles below the Kármán Line.[88] Belarus purports only to have

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[83] Convention on the High Seas, Apr. 29, 1958, 450 U.N.T.S. 11, https://www.gc.noaa.gov/documents/8_1_1958_high_seas.pdf.

[84] *See, e.g.,* Outer Space Treaty, *supra* note 7, art. I.

[85] TANAKA, *supra* note 74, at 4–9.

[86] KLEIMAN, *supra* note 13, at xii.

[87] 26 C.F.R. § 1.863-8(d)(1)(i) (2019).

[88] United States Air Force Instruction 11-402, 2.3.2 (2010), https://static.e-publishing.af.mil/production/1/aetc/publication/afi11-402_aetcsup_i/afi11-402_aetcsup_i.pdf ("A USAF rated officer qualified to perform duties in space (50 miles above the earth's surface) who completes a minimum of one operational mission is eligible for the astronaut qualifier."). One hundred kilometers equates to sixty-two miles, so the departure from

sovereignty over the airspace up to 20.1 kilometers (about 12.5 miles) above the Earth's surface.[89] These differences present an issue in the development of international space law because all nations will need to agree on the same altitude to determine where new laws will apply.

IV. APPLICATION OF ENVIRONMENTAL LEGAL FRAMEWORK TO SPACE

It stands to reason that the consequences for polluting in outer space should mirror the recognized penalties of other forms of terrestrial pollution, such as the "polluter pays" principle.[90] However, the Liability Convention states that a nation is liable for damage caused in outer space only "if the damage is due to its fault or the fault of persons for whom it is responsible,"[91] referring primarily to physical damages as opposed to environmental damages because the definition for damage is confined to people and property.[92]

The *Trail Smelter* arbitration upheld the principle that the use of one's property cannot impede on the use of another's property.[93] In the *Trail Smelter* dispute, smoke from smelting operations in Canada crossed over the US-Canadian border into Washington state, leading to complaints by residents.[94] An investigation completed by the US Department of Agriculture found both visible damage, such as "burned leaves [and the] effects of declining soil productivity" and invisible damage, such as "stunted growth [and] lower food value."[95] Though damages were limited to only those

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the use of the Kármán Line to define where space begins and the reduction to fifty miles above sea level may be due to a hesitancy to adopt the metric system.

[89] U.N. Gen. Assembly, *National Legislation and Practice Relating to the Definition and Delimitation of Outer Space*, U.N. Doc. A/AC.105/865/Add.4 (Feb. 2, 2009) ("Outside classified airspace (above an altitude of 20,100 m), which is considered outer space, the provisions of international agreements apply.").

[90] The "polluter pays" principle is applied just as one would expect; the party responsible for the pollution is also responsible for paying for the damage done by the pollution. This is one of the central pillars of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) enacted in 1980. *See* 42 U.S.C. §§ 9607–9609 (2018).

[91] Liability Convention, *supra* note 8, art. III.

[92] *Id.* at art. I(a).

[93] *See* Trail Smelter Case (U.S. v. Can.), 3 R.I.A.A. 1905 (1938, 1941).

[94] *Id.* at 1912.

[95] JOHN D. WIRTH, SMELTER SMOKE IN NORTH AMERICA: THE POLITICS OF TRANSBORDER POLLUTION xiv (2000).

visible impacts, the *Trail Smelter* tribunal held that Canada was liable for the transnational pollution and thus owed damages to the US.[96] Regarding the pollution of space, and especially of Earth's orbit with space debris, all space faring nations' ability to use space is impeded due to the safety concerns for both people and property caused by the accumulation of space debris.[97] While space is not currently considered the property of any one nation, the standard set forth in *Trail Smelter* should be more generally applied to the space environment.

A. Pollution of Earth's Orbital Environment

While launch is the riskiest stage of spaceflight, the most severe hazards to the space environment take place after this stage, most significantly in the form of space debris.[98] It is estimated that "more than 500,000 man-made objects larger than a centimeter, and millions of objects smaller than a centimeter," are currently circling Earth.[99] Of these objects, only about .02 percent are operational spacecraft, placing the remaining 99.98 percent in the category of space debris.[100] Despite efforts to address the problem of space debris, there are no binding international regulations to mitigate the issue.[101] In fact, none of the United Nations space law treaties directly addresses space debris at all.[102] In 1995, NASA issued the first comprehensive orbital debris mitigation guidelines.[103] Two years later, the US created standard practices for space debris mitigation,[104] but these standards are difficult to enforce and do not include any listed penalties for failure to comply. While it is important for each nation to recognize the importance of implementing space debris mitigation policies, it is an inherently

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[96] *See Trail Smelter*, 3 R.I.A.A. at 1933.

[97] *Space Debris*, NASA, https://www.nasa.gov/centers/hq/library/find/bibliographies/space_debris (last visited July 12, 2020).

[98] Viikari, *supra* note 16, at 717.

[99] *Frequently Asked Questions: Orbital Debris*, NASA, http://www.nasa.gov/news/debris_faq.html (last visited June 15, 2020); KLEIMAN, *supra* note 13, at 71.

[100] KLEIMAN, *supra* note 13, at 71.

[101] Viikari, *supra* note 16, at 718.

[102] *Id.* at 756.

[103] *Orbital Debris Mitigation*, NASA, http://orbitaldebris.jsc.nasa.gov/mitigation/ (last visited July 12, 2020).

[104] UNITED STATES GOVERNMENT ORBITAL DEBRIS MITIGATION STANDARD PRACTICES, http://orbitaldebris.jsc.nasa.gov/library/USG_OD_Standard_Practices.pdf.

international issue because no one nation can regulate or enforce regulations regarding space debris around the entire planet.[105] Beyond the fact that this would be an enormous, and enormously expensive, task for any one nation, there are issues of jurisdiction that have not yet been addressed. In one promising move, the International Institute of Space Law has charged its members, who hail from nearly fifty countries, with the task of cooperating to promulgate international solutions to the issue of space debris.[106]

Inconsistent compliance with space debris mitigation policies is a significant problem because, for many nations, the short-term costs of compliance seem to outweigh the long-term losses resulting from debris impact over time.[107] In an attempt to combat this issue, COPUOS has also implemented debris mitigation guidelines as well as long-term sustainability guidelines but both remain voluntary.[108] The regulation of space debris removal presents yet another problem for space policy legislators to tackle. One matter to address between nations in trying to develop policies for space debris removal will be how to determine which nation should bear the costs. While it should be an international effort to clear the space environment of as much space debris as possible, it is often impossible to track each individual piece of debris and its country of origin. There is also a potential for issues of national security if a nation were to collect pieces of space debris that originated from another country. Even if national security is not at stake, the removal of space debris by anyone other than the original owner has the potential to introduce questions of intellectual property rights. These issues illuminate the complex overlapping of international, domestic and even individual concerns and responsibilities that must be evaluated in the development of space law as it relates to environmental issues.

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[105] In an effort to lessen the extent of space debris, COPUOS has also created voluntary mitigation guidelines. U.N. OFF. OUTER SPACE AFF., SPACE DEBRIS MITIGATION GUIDELINES OF THE COMMITTEE ON THE PEACEFUL USES OF OUTER SPACE (2010), https://www.unoosa.org/pdf/publications/st_space_49E.pdf.

[106] Kai-Uwe Schrogl, President, Int'l Inst. of Space Law, Address at the 70th International Astronautical Congress: A Grand Tour of Global Space Policy Issues (Oct. 22, 2019).

[107] Viikari, *supra* note 16, at 767.

[108] Comm. on the Peaceful Uses of Outer Space, *Guidelines for the Long-term Sustainability of Outer Space Activities*, U.N. Doc. A/AC.105/2018/CRP.20 (June 27, 2018).

One of the most important policy development issues regarding space debris will be preventing further debris creation. There are currently more than two thousand satellites in orbit around Earth,[109] and an average of three satellites per week have to be moved to avoid hitting or being hit by space debris.[110] Moreover, there were nearly two hundred "close encounters" per week in 2010.[111] As the creation of satellite mega constellations[112] increases, it is expected that avoidance maneuvers will become more and more frequent.[113] The European Space Agency has even gone so far as to say that manual avoidance maneuvers will become "impossible" due to these mega constellations[114] in response to having to move one of its satellites to avoid a collision with a SpaceX satellite after SpaceX declined to do so.[115] Unfortunately, as is typical with environmental law, regulation surrounding space debris has

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[109] *USC Satellite Database*, UNION OF CONCERNED SCIENTISTS (Apr. 1, 2020), https://www.ucsusa.org/resources/satellite-database.

[110] Comm. on the Peaceful Uses of Outer Space, *Towards Long-term Sustainability of Space Activities: Overcoming the Challenges of Space Debris*
A Report of the International Interdisciplinary Congress on Space Debris, U.N. Doc. A/AC.105/C.1/2011/CRP.14, at 21 (Feb. 3, 2011).

[111] *Id.*

[112] Mega constellations are large systems of communication satellites that have become controversial because many people believe that they contribute to the issue of "space junk" and will disrupt other space activities such as astronomical observation. Further, some believe that mega constellations are an example of the flaws with current regulatory practices and that private companies are trying to skirt the rules. *See* Johnathan O'Callaghan, *SpaceX's Application For 30,000 Extra Starlink Satellites Highlights Concerns About Regulation*, FORBES (Oct. 16, 2019), https://www.forbes.com/sites/jonathanocallaghan/2019/10/16/spacex-accused-of-evading-rules-with-proposal-for-30000-extra-starlink-satellites/#19bde94b54f8.

[113] Johnathan O'Callaghan, *SpaceX Declined to Move a Starlink Satellite at Risk of Collision With a European Satellite*, FORBES (Sept. 2, 2019), https://www.forbes.com/sites/jonathanocallaghan/2019/09/02/spacex-refused-to-move-a-starlink-satellite-at-risk-of-collision-with-a-european-satellite/#799189761f62 ("ESA noted that it performed 28 collision avoidance maneuvers in 2018, but it was mostly to avoid dead satellites or bits of space debris. Maneuvers to avoid active satellites were 'very rare,' they said, but the arrival of mega constellations like Starlink raises concerns that many more such maneuvers will be needed in future.").

[114] ESA Operations (@esaoperations), TWITTER (Sept. 2, 2019, 11:02 AM), https://twitter.com/esaoperations/status/1168539686819770368.

[115] O'Callaghan, *supra* note 113. The head of the ESA Space Debris Office said "[t]here are no rules in space," and that "[n]obody did anything wrong. Space is there for everybody to use. There's no rule that somebody was first here."

historically been reactive rather than proactive.[116] However, the Federal Communications Commission (FCC) recently released a Notice of Proposed Rulemaking[117] regarding the mitigation of space debris which suggests, among other things, that laws and regulations regarding space debris should become more forward-looking to keep up with the exponentially increasing launch of satellites. Furthermore, it has been suggested that, much like England's maritime laws served as a model for the international law of the sea, US laws may serve as a starting point for space law.[118]

B. Environmental Jurisdiction

In analyzing the jurisdictional issues that space activity presents, there are several aspects of the law of the sea that can provide guidance. The Death on the High Seas Act,[119] which allows the recovery of damages for deaths occurring beyond US territorial waters, is an example of an extension of jurisdiction beyond a nation's sovereign territory. Similarly, the Deep Seabed Hard Mineral Resources Act[120] sets out a difference between a claim of sovereignty and a claim of jurisdiction. Under the Law of the Sea Convention,[121] nations are under a direct obligation to ensure the availability of recourse for compensation in respect to damage caused by pollution.

One of the foreseeable legal issues in space is private companies that refuse to associate with any one nation and claim that, because they are not government agencies, the current laws do not apply to them. In their attempt to evade regulation, however, these companies also surrender the protections afforded to government agencies of a nation. In this respect, private space companies that decline to adhere to the regulations in place are effectively

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[116] However, most US presidents have expanded slightly on the issue since the Reagan administration. For a review of US national policy on space debris, see Brian Weeden, *US Space Policy, Organizational Incentives, and Orbital Debris Removal,* THE SPACE REV., (Oct. 30, 2017), https://www.thespacereview.com/article/3361/1.

[117] As required by the Administrative Procedure Act, a Notice of Proposed Rulemaking is issued by an agency when it wants to create, revoke, or otherwise amend a rule. *See* OFF. OF THE FED. REG., A GUIDE TO THE RULEMAKING PROCESS, https://www.federalregister.gov/uploads/2011/01/the_rulemaking_process.pdf.

[118] *See generally* LYALL & LARSEN, SPACE LAW: A TREATISE xii (2009).

[119] 46 U.S.C. §§ 30301–08 (2018).

[120] 30 U.S.C. §§ 1401–73 (2018).

[121] United Nations Convention on the Law of the Sea, Dec. 10, 1982, 1833 U.N.T.S. 397 [hereinafter UNCLOS].

operating as pirates. Piracy on the high seas is one of the oldest and most well-attested examples of universal jurisdiction, under which each individual nation contributes to the collective welfare and interests of all nations.[122] Under the law of the sea, pirates are treated as outlaws and are thus denied the protections of the flag State.[123] Without these protections, they may be apprehended and prosecuted by any nation and the prosecuting nation is free to determine the actions taken and the penalties imposed.[124] Private space companies that choose to operate outside of the laws in place should be regarded similarly. In Article 109, the Law of the Sea Convention addressed a similar issue, that of so-called "pirate radio" ships, which illegally broadcast over radio waves from the high seas.[125] While these ships do not meet the traditionally understood definition of pirates, by international authorities, they are considered pirates nonetheless.[126] The United Nations Security Council has urged all nations to criminalize piracy under domestic law to ease subsequent prosecution, and has explicitly recognized piracy as a crime subject to universal jurisdiction.[127] Moreover, the Law of the Sea Convention places an explicit obligation on every nation to cooperate with the suppression of piracy to the fullest extent that it is able,[128] including the suppression of "pirate radio" ships[129] and this should be mirrored in space law as well.

Returning to the so-called "spacecraft cemetery," SPOUA is located beyond any nation's jurisdiction and as such, its protection should be the responsibility of all nations. Article 192 of the Law of the Sea Convention establishes a duty of all nations to preserve the marine environment including areas beyond national jurisdiction,

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[122] *See id.* at arts. 100–07. *See also* M.D. Evans, *The Law of the Sea*, *in* INTERNATIONAL LAW 637 (2d ed. 2006).

[123] UNCLOS, *supra* note 121, art. 101.

[124] *Id.* at art. 105.

[125] Pirate radio ships were famously an issue for British lawmakers in the 1960s. For a brief overview of the pirate radio ship upon which the 2009 film *Pirate Radio* (known in the UK as *The Boat That Rocked*) was based, see Vicki Barker, *The Real Story Behind Britain's Rock 'N' Roll Pirates* (Nov. 13, 2009), https://www.npr.org/templates/story/story.php?storyId=120358447.

[126] UNCLOS, *supra* note 121, art. 109.

[127] *See* S.C. Res. 1976 (Apr. 11, 2011).

[128] UNCLOS, *supra* note 121, art. 100.

[129] *Id.* at art. 109.

which should extend to the disposal of space debris.[130] Further, Article 195 of the Law of the Sea Convention, titled "Duty not to transfer damage or hazards or transform one type of pollution into another," relates not only to the transfer of pollution from one location to another, but also to the transformation of one kind of pollution into another kind of pollution.[131] Under the law of the sea, both elements of this provision would be violated by sinking terrestrially-originating objects in the ocean. Arguably, there should be no legal distinction between those objects and splashdowns that, while reentering from space, still originated on Earth.

C. Mineral Resources

Regarding the future of off-Earth resource mining, the space industry has many new opportunities, but must also address new risks. Humankind's historically irresponsible use of resources is extensive,[132] so a significant re-engineering of both laws and human habits will be critical in adjusting for the environmental realities. In considering issues associated with space resource mining, the space industry has "been far more adept at identifying the scientific, engineering, and technological challenges"[133] and pursuing solutions for those identified challenges than it has been in addressing the legal and regulatory problems presented. A stable and reliable legal framework for space resource mining is necessary and a central issue will be how best to limit the use of these resources in the research and discovery phase so as to ensure their long-term economic viability. The potential benefits associated with resource

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[130] *Id.* at art. 192.

[131] *Id.* at art. 195.

[132] The overexploitation of natural resources leads to a number of problems, including environmental, economic and health issues. World Wide Fund for Nature (WWF) reported that to keep up with the amounts of goods and service we use, humankind "currently needs the regenerative capacity of 1.6 Earths." WWF, LIVING PLANET REPORT 201613 (2016), https://www.wwf.org.uk/sites/default/files/2016-10/LPR_2016_full%20report_spread%20low%20res.pdf. The World Health Organization has stated that nine out of ten people are breathing highly polluted air and that seven million people die each year due to air pollution. *9 out of 10 People Worldwide Breathe Polluted Air, but More Countries Are Taking Action*, WORLD HEALTH ORG. (May 2, 2018), https://www.who.int/news-room/detail/02-05-2018-9-out-of-10-people-worldwide-breathe-polluted-air-but-more-countries-are-taking-action.

[133] RAM S. JAKHU, JOSEPH N. PELTON & YAW OTU MANKATA NYAMPONG, SPACE MINING AND ITS REGULATION 20 (2017).

mining in space are also applicable on Earth. According to Planetary Resources,[134]

> In orbit, spacecraft propellant is a multi-billion-dollar industry with each pound of fuel worth more than an equivalent pound of gold on Earth. Certain asteroids are loaded with hydrogen and oxygen, the components of rocket fuel. These asteroids can provide a fuel source that is 100 times closer—and, thus, less expensive—than the Apollo-era "bring-everything-with-you" propellant used today.[135]

While the law of the sea will be most applicable to outer space resource extraction, the tragedy of the commons can be applied to this topic as well. The resources found on other celestial bodies should be considered part of the global commons and there are only a limited number of spacefaring countries that have the technological and economic capabilities to mine and utilize these resources.[136] As such, it is imperative to take advantage of the opportunity given to us by the Outer Space Treaty, currently the only international law with widespread acceptance that addresses resource mining in space,[137] to create a fair and equitable system for resource utilization instead of one based on "first come, first

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[134] In 2015, Planetary Resources became the first private company to directly deal with the acquisition of space resources and claims that it has had a "Copernican shift in thinking" regarding the fueling of launch vehicles. *See Planetary Resources – The Market Problem and Radical Solution*, PLANETARY RES., http://www.planetaryresources.com/company/why-asteroids/ (last visited June 15, 2020)(embedded video). Planetary Resources has since been acquired by ConsenSys, Inc. following financial issues. *See* Jeff Foust, *Asteroid Mining Company Planetary Resources Acquired by Blockchain Firm*, SPACE.COM (Nov. 2, 2018), https://www.space.com/42324-asteroid-mining-company-planetary-resources-acquired.html.

[135] JAKHU, PELTON & NYAMPONG, *supra* note 133, at 19.

[136] However, more and more countries are creating national space agencies. The United Arab Emirates and Australia have both established national space agencies in the past five years, but neither has defined plans regarding space vehicle development, and Australia has not yet set forth mission goals. *See* AUSTRALIAN SPACE AGENCY, ADVANCING SPACE: AUSTRALIAN CIVIL SPACE STRATEGY 2019-2028 (2019), https://publications.industry.gov.au/publications/advancing-space-australian-civil-space-strategy-2019-2028.pdf; *Emeritus Mars Mission*, MOHAMMED BIN RASHID SPACE CENTRE, https://www.mbrsc.ae/emirates-mars-mission (last visited June 15, 2020).

[137] Outer Space Treaty, *supra* note 7. Articles I and II are the most relevant, stating that the "use" of "the moon and other celestial bodies" is for the benefit of all humankind, not individual nations, and that celestial bodies are not subject to claims of sovereignty by means of that use.

served." However, it has been suggested as a matter of statutory interpretation that small asteroids should not be considered celestial bodies under the Outer Space Treaty.[138] Further still, some private companies such as Shackleton Energy have formed for the sole purpose of lunar mining under the auspices of using lunar water as fuel.[139] NASA has already launched spacecraft to bring back samples from asteroids[140] and comets[141] and even probe beneath their surfaces.[142]

The International Seabed Authority (ISA) governs mining in the seas and breaks mining into three stages: prospecting, exploration and exploitation.[143] While the ISA only governs the exploration and exploitation phases, a precautionary principle still applies to prospecting, though it may be freely undertaken.[144] A similar international authority could help to address like questions and concerns regarding mining in space, including the adoption of the Authority's application process for private enterprises. However, the ISA was met with backlash from industrialized nations, such as the US, that did not want their mining activities to be regulated by an international authority.[145] In fact, the Law of the Sea Convention, which created the ISA, was not initially ratified by many industrialized nations, including the US, because of Article 144, which required technology transfer between nations.[146] Referencing the

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[138] JAKHU, PELTON & NYAMPONG, *supra* note 133, at 21.

[139] Shackleton Energy compares lunar water to the California Gold Rush and the operation of in-orbit refueling stations to building a new offshore oil rig, both of which are examples of a mismanagement of resources. For an overview of the company's plans, see *Program*, SHACKLETON ENERGY, www.shackletonenergy.com/program#program1 (last visited June 15, 2020).

[140] The *OSIRIS-REx* mission launched in September 2016 with the goal of bringing a sample back from a near-Earth asteroid.

[141] The *Stardust* mission launched in February 1999 and was the first mission targeting a comet.

[142] The *Deep Impact* mission launched in January 2005 and was the first to probe beneath the surface of a comet.

[143] *See* UNCLOS, *supra* note 121, Annex III.

[144] *Id.*

[145] *See* Steven Groves, *The U.S. Can Mine the Deep Seabed Without Joining the U.N. Convention on the Law of the Sea*, THE HERITAGE FOUND. (Dec. 4, 2012), https://www.heritage.org/report/the-us-can-mine-the-deep-seabed-without-joining-the-un-convention-the-law-the-sea.

[146] *See* ROBIN WARNER, PROTECTING THE OCEANS BEYOND NATIONAL JURISDICTION: STRENGTHENING THE INTERNATIONAL LAW FRAMEWORK 42 (2009); TANAKA, *supra* note

technology transfer provision, President Reagan stated that "while most provisions of the draft convention [were] acceptable and consistent with U.S. interests, some major elements of the deep seabed mining regime [were] not acceptable."[147]

Notably, the ISA has supranational jurisdiction that applies to all natural and legal persons undertaking operations in the deep seabed area and no person, natural or juridical, may engage in activities in the area without the approval of the ISA.[148] Incorporating a similar jurisdictional provision into an international space mining authority would be critical, as this would require all private space mining companies to follow the same application procedures as government agencies. To be approved by the ISA, an applicant must sign a contract giving the Authority control over its activities and provide written assurance that all obligations under the contract will be fulfilled in good faith.[149] The applicant must also agree to comply with the provision relating to technology transfer,[150] the provision that led many industrialized nations to decline to initially ratify the Law of the Sea Convention.[151] The Convention was later ratified by some industrialized nations only after the 1994 Implementation Agreement,[152] which removed the technology transfer provision. However, the US has still not signed the Convention and is therefore not a party.

The Convention subjects private mining companies to more stringent rules than government agencies. When a private entity seeks approval from the ISA for mining activities, its application must identify two mining sites.[153] If the application is approved, the company will have the right to exploit the resources of the first site, but the second site will be reserved for developing nations that are not currently economically or technologically capable of mining the

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74, at 29 (The US "voted against the [Law of the Sea Convention] mainly because the deep seabed regime provided for in Part XI did not meet US objectives.").

[147] President Ronald Reagan, *U.S. Policy and the Law of the Sea*, *in* 82 DEPARTMENT OF STATE BULLETIN NO. 2060 54 (1982).

[148] UNCLOS, *supra* note 121, art. 187.

[149] *Id.* at Annex III, art. 4(6).

[150] *Id.*

[151] With the exception of Iceland, all of the nations that signed the Convention were developing countries. TANAKA, *supra* note 74, at 227.

[152] G.A. Res. 48/263, Agreement Relating to the Implementation of Part XI of the United Nations Law of the Sea Convention of 10 December 1982 (Aug. 17, 1994).

[153] *See* UNCLOS, *supra* note 121, art. 153.

deep seabed.[154] In deciding whether to approve a private mining company's application, the ISA reserves the right to deny an application if the mining activities would cause significant harm to the marine environment or if the applicant is sponsored by a nation that has already sponsored an excessive amount of mining activity.[155] This anti-monopoly clause relies on two tests, both based on percentages of the area of the sea subject to mining. However, neither is applicable in the space sector because we are not able to quantify the size of space. Despite the undeniable vastness and possible infinite nature of space, the space resources that humankind is currently able to access are certainly not infinite because we are limited to our known neighborhood in space and cannot say what other resources may or may not be available beyond it. Regarding the rights of nations or private companies to mineral and other resources found on celestial bodies, legislation might be modeled after the Deep Seabed Hard Mineral Resources Act to avoid the issue of a nation seemingly declaring sovereignty over celestial bodies that are mined by companies originating from that nation.

V. DISPUTE SETTLEMENT

> Peace is not the absence of conflict, but the ability to cope with conflict by peaceful means. – Ronald Reagan[156]

As space law policy develops and as space operations become more common, it is inevitable that international disputes will become more frequent. The Law of the Sea Convention established a unique and complex mechanism for dispute settlement that combines voluntary and compulsory procedures in an effort to reconcile the free choice of nations with the need for mandatory practices. The Convention created the International Tribunal on the Law of the Sea (ITLOS), a new judicial body to handle all international maritime disputes.[157] ITLOS itself is modeled after the International Court of Justice, which has long provided oversight on

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[154] *Id.*

[155] *Id.* at Annex III, art. 6(3).

[156] President Ronald Reagan, Commencement Address at Eureka College (May 9, 1982) (transcript available at https://www.reaganfoundation.org/media/128700/eureka.pdf).

[157] *See* UNCLOS, *supra* note 121, art. 186.

international disputes of all kinds. It seems that a similar body will become essential to deal with the rising international issues in space.

The Law of the Sea Convention requires that nations first seek to peacefully settle disputes by means of their own choice. One such option is voluntary conciliation, where an impartial and disinterested committee will make recommendations to the parties.[158] The committee is composed of five members, two appointed by each party and a fifth agreed upon and appointed by both parties.[159] In the event that it is not possible for the parties to settle the dispute through other methods, the dispute may then be submitted to ITLOS or other tribunal with jurisdiction (such as the ICJ), the decision of which will be binding.

In addition to creating ITLOS to hear disputes, the Law of the Sea Convention created another non-permanent body in the form of a special arbitral tribunal consisting of five experts in four particular fields.[160] Interestingly, these experts are not necessarily lawyers and the disputes must be limited to the fields of expertise. Due to the extreme overlap in fields and complexity associated with the operation of launch vehicles, the creation of a similar arbitration body would be most useful for space dispute settlement. Under the Law of the Sea Convention, these fields are fisheries, protection and preservation of the marine environment, marine scientific research and navigation.[161] For space activity-related disputes, the experts serving on the tribunal might more appropriately focus on engineering, biological interests, environmentalism, or economics.

VI. CONCLUSION

> The Earth is the cradle of humanity, but one cannot remain in the cradle forever. – Konstantin Tsiolkovsky[162]

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[158] *Id.* at art. 284.

[159] If the parties cannot agree on a fifth member, the U.N. Secretary General will make the fifth appointment.

[160] *See* UNCLOS, *supra* note 121, Annex VIII.

[161] *Id.* at Annex VIII, art. 2.

[162] Tsiolkovsky is considered one of the fathers of rocketry and aeronautics. See *Konstantin E. Tsiolkovsky*, NASA (Sep. 22, 2010), https://www.nasa.gov/audience/foreducators/rocketry/home/konstantin-tsiolkovsky.html.

There is an immediate need to integrate environmental considerations into space law, and the responsibility to protect and preserve our environment is one that rests on the shoulders of all nations. While it is important for the US to implement environmental laws addressing the exploration and exploitation of space, it is equally important for the rest of the spacefaring nations to do the same. Further, even non-spacefaring nations have a vested interest in the preservation of the space environment because of the risk of reentering space debris and the interests of future generations that may be spacefaring.[163]

The tragedy of the commons is directly applicable to the space sector—through the introduction of pollution and space debris and through the future extraction of space resources. Environmental principles, such as the polluter pays principle, modeled after those already recognized in the law of the sea will be particularly important to incorporate into space law. This is especially true regarding space debris, as it is one of the biggest risks to the space environment and has the potential to become even more threatening with the increased number of objects launched into orbit. The law of the sea has been evolving for centuries, and space policy makers should look to it for guidance. While the law of the sea has developed somewhat slowly, space law must develop much more quickly to keep up with the technology and advancements in the industry. Moreover, the creation of a dispute settlement authority will be critical in addressing issues that are not yet codified in law or have not yet been interpreted by a court.

Most important, however, is the cooperative action by all of humankind to implement the necessary treaties and regulations to protect the space environment for continued human use. A collective effort will be the only successful effort, and as President John F. Kennedy expressed, the "opportunity for peaceful cooperation may never come again."[164]

Per aspera ad astra.[165]

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[163] *See* UNCLOS, *supra* note 121, art. 124 (laying out rules regarding the rights to the seas of land-locked nations).

[164] President John F. Kennedy, Moon Speech at Rice University (Sep. 12, 1962) (transcript available at https://er.jsc.nasa.gov/seh/ricetalk.htm).

[165] "Through hardship, to the stars."

PROMOTING GLOBALIZATION IN SPACE POLICY: A LOOK AT UNITED STATES EXPORT CONTROLS

Charles H. Ellzey[*]

ABSTRACT

The forum of outer space is becoming more competitive than ever, with many commercial entities entering the picture. Given that space corporations are primarily based in larger, spacefaring nations, these spacefaring countries often take advantage of international trade tools to regulate the flow of technology. As such, international trade law has become a vital organ of the commercial space process. While the laws governing outer space have not been modified in nearly fifty years, States are actively utilizing international trade law to regulate space technology through options such as export controls. States already operating in space relax export controls in order to open space markets for States currently without space access. This, in turn, could reignite the consensus once found in international space law.

I. INTRODUCTION

Commercial space operations are more prevalent today than ever before. While many assume the growth and promise of a competitive market will incentivize selfish behavior among nations, such commercial operations may actually present a unique and effective way to promote international cooperation. This may be especially true in the realm of outer space law. International space law developed as a result of a hard-fought consensus on certain fundamental principles, which, over the past fifty years, it has

[*] J.D. Candidate, University of Mississippi School of Law, December 2020. I want to express great thanks to those who helped make this piece possible, most notably Professors Antonia Eliason and Michelle Hanlon. I also want to thank Professor Charles Stotler for answering my various questions along the way. Without the support of my loving family, Kaelyn and Flint and friends I could never have finished this work. Lastly, I want to thank Major Jeremy Grunert for his tremendous editing assistance.

struggled to advance beyond. Addressing the problems associated with the widely-used mechanism of export controls presents a promising catalyst in achieving the next fundamental space law agreement. By relaxing export controls on space technology, spacefaring countries can improve not only their own economy, but that of foreign countries as well.

Through the sale of objects and technology, spacefaring nations can incentivize those with fledgling, or non-existent, space industries to cooperate with them; these less space-capable countries in turn may be more open to policies protecting the activities of private entities in outer space. Policies providing for private appropriation of space resources are the current heart of international disagreement as to the concept of appropriation under the Outer Space Treaty (OST).[1] Providing countries with the ability to participate in the activity they are condemning would very likely change their view on outer space property law. Using the United States' (US) framework as a primary example, this Article will review the effects of domestic space technology export controls on foreign relations, international trade, and subsequently, globalization[2] in outer space.

This Article will first provide a brief overview of export controls in general, under the General Agreements on Tariffs and Trade (GATT). Next, the Article will provide a summary of the US domestic mechanism for implementing such export controls, with specific attention to those controls which apply to outer space technologies. An explanation of two crucial, recent US export control reforms will then be given: 1) the transfer of items from the US Munitions List (USML)[3] to the Commerce Control List (CCL);[4] and 2) the transition from the see-through rule to the integration rule. The Article will then describe both the early consensus in international

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[1] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, Oct. 10, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205 [hereinafter Outer Space Treaty].

[2] "Globalization" in this paper will be defined as "a multidimensional set of social processes that create, multiply, stretch, and intensify worldwide social interdependencies and exchanges while at the same time fostering in people a growing awareness of deepening connections between the local and the distant." MANFRED B. STEGER, GLOBALIZATION: A VERY SHORT INTRODUCTION 13 (2003).

[3] 22 C.F.R. § 121.1 (2019).

[4] 15 C.F.R. § 738.2 (2019).

space law and the breakdown of such consensus as illustrated by the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies' (Moon Agreement)[5] failure to receive widespread acceptance. The Article concludes with a three-part argument in favor of relaxing US export controls: 1) US export controls damage international relations and the US economy, while often failing to achieve their stated objective; 2) relaxing US export controls benefits US firms, the US economy and foreign consumers and investors; and 3) increased trade in the face of relaxed export controls is a push towards globalization of commercial space industries.

Given their broad international applicability, export controls provide unique bargaining leverage in foreign policy negotiations. Export controls allow for discrimination based on the technology's end destination or use, which is permissible under the GATT. Such discriminatory export controls, however, often cause more harm than good. These controls can damage the US economy by hampering international trade and damaging international relations, as they can create animosity between the US and even some of its closest allies. As export controls often fail to achieve their stated objective (such as keeping technology from China), they should be relaxed in order to stimulate international trade beneficial to both the US and foreign countries.

Usually, the larger spacefaring nations are in a better position to relax export controls, as they are often the producers of sensitive technologies. The US is one such example, having reformed its export controls on satellite technology in 2013.[6] These reforms greatly increased US aerospace firms' market share of commercial space operations. Such reforms also provide non-spacefaring States with access to systems greatly increasing their efficiency in areas such as disaster response coordination, topographic mapping and natural resource location. These reforms alleviate the negative effects of the restrictive US system on both US aerospace firms as well as foreign consumers and investors. Such reforms encourage joint

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[5] Agreement Governing the Activities of States on the Moon and Other Celestial Bodies Preamble, Dec. 5, 1979, 1363 U.N.T.S. [hereinafter Moon Agreement].

[6] Many items were removed from the USML and placed on the CCL in 2013. The most notable technology transferred was that of satellites. Jeff Foust, *Export Control Reform (Almost) Reaches the Finish Line*, THE SPACE REVIEW (May 27, 2014), https://www.thespacereview.com/article/2521/1.

operations with non-spacefaring countries and allow them to flourish alongside their space-capable peers even in the absence of domestic launch capability.

By allowing other countries (or their citizens) to buy their way into space, the US can encourage trade relationships between States — resulting in increased economic interdependency of States' commercial space sectors. As these industries specialize labor, they move towards economic interdependency:[7] when national industries rely on the industries of one or more other States to produce critical components.[8] Once globalized interdependency begins, it is increasingly likely that States will band together to save resources — just as some major players already have.[9] Joint space operations will encourage non-spacefaring nations to cooperate with their space-capable peers. Given the current divide in interpretation of the Outer Space Treaty's ban on national appropriation of space,[10] interests acquired through the relaxation of export

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[7] Creating an interdependent global commercial space sector is now more important than ever. At the time of this article, the COVID-19 pandemic is in full swing. Many countries, such as the US, have made efforts to "partially undo globalization by forcing companies to move supply chains out of China [or other rival countries] and restricting trade in certain critical sectors." Keith Johnson, *An Economic Pandemic*, FOREIGN POL'Y MAG. (Mar. 9, 2020), https://foreignpolicy.com/2020/03/09/coronavirus-economic-pandemic-impact-recession/. However, "[t]he economic fallout of the virus is making clear just how interdependent the global economy really is." *Id.* For example, oil prices plunging in New York and London drug down stock markets in Europe and Asia. In the long run, the virus could "encourage more populism and undo these value chains." *Id.* (quoting Richard Baldwin). Encouraging globalization of commercial space sectors can likely combat these effects, in the commercial space industry at least, and add more stability to international relations through the sharing of defense-critical technologies.

[8] Interdependence grows as nations increasingly depend on products, funds and even security contributed by other States. Flemming Splidsboel Hansen, *Trade and Peace: A Classic Retold in Russian*, 9 EUR. FOREIGN AFF. REV. 303, 305 (2004).

[9] For example, Sea Launch was a consortium of four companies from Norway, Russia, Ukraine and the US which shared a command center aboard a ship and a launch pad atop an oil rig platform. *What Ever Happened to Sea Launch?* SPACE DAILY (Oct. 31, 2017), http://www.spacedaily.com/reports/What_Ever_Happened_to_Sea_Launch_999.html.

[10] The divide in interpretation of the Outer Space Treaty comes from Article II, which prevents national appropriation. Countries such as the US argue that a distinction exists between national appropriation and private claims of property rights. These countries find this distinction to mean that the Treaty does not preclude granting of property rights to commercial entities extracting space resources. Countries critical of this position argue legislation such as the American SPACE Act, granting property rights in extracted resources to private citizens, provides rights analogous to claims of sovereignty and national appropriation, which are completely barred by Article II. *See*

controls might be the push the international community needs in order to achieve a consensus on commercial property rights in outer space. Non-spacefaring countries that seek technology and knowledge from those relaxing export controls, would likely be more willing to negotiate rights to outer space resources in the presence of a partnership with foreign entities performing such work.

As countries become more familiar, and more willing to share technology, they will also likely be more open to expanding, or further developing, outer space law. While more advanced spacefaring countries may interpret the non-appropriation provision differently, they might be more willing to share scientific data in the presence of healthy trading relationships. Likewise, non-spacefaring countries might be more willing to embrace the notion of commercial property rights in extracted space resources if they were simultaneously getting access to those very resources themselves. Ideally, these tools can be used to bridge the current divide in the appropriation debate and restore an international consensus under which no State feels compelled to act unilaterally. States already operating in space can use the relaxation of export controls in order to open space markets for countries without space access, and in turn, re-ignite the consensus once found in international space law.

II. EXPORT CONTROLS BACKGROUND

Export controls are restrictions applied by national governments to the transfer of items to foreign persons and destinations.[11] Such items can be commodities, software, technical data, the provision of a defense service and/or the provision of technical assistance.[12] Governments enact these controls not only to protect national security, but also to preserve policy interests. Such policy interests might include technological superiority.[13] While each State

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Brian Bozzo, *Not Because It Is Easy: Exploring National Incentives for Commercial Space Exploration Through a Geopolitical Lens*, 11 DREXEL L. REV. 597, 641-42 (2019).

[11] Juan Santos, *Pre-Proposal Conference (PPC) for APD SMEX & MO*, NASA 1, 3 (May 2, 2019), https://explorers.larc.nasa.gov/2019APSMEX/pdf_files/7_APD_SMEX_MO_Preproposal-Export_Control_2_May_2019_v2.pdf.

[12] *Id.*

[13] For instance, as US Secretary of Commerce Penny Pritzker stated during a 2015 conference hosted by the Bureau of Industry and Security: "[Export controls] exist to ensure our technological superiority is never employed against us on the battlefield. . . ."

enacts its export controls differently via its own domestic policy, the authority for such controls is found in international law within the GATT.[14] Although the GATT generally proscribes such restrictions, it does make an exception in the name of national security interests.[15] This Article focuses on the US as an example framework for such policies. The US has recently implemented export control reforms which illustrate the benefits, both domestically and abroad, of relaxing export controls on space technology.

A. Export Controls as a Viable Bargaining Chip Under the GATT

The GATT generally prohibits export restrictions, but export controls provide increased flexibility. As Dr. Michael Rom writes, "[i]n principle, discrimination is prohibited, and export duties have to be imposed in accordance with the most-favoured-nation [MFN] treatment (Article I)."[16] Article XI of the GATT itself more explicitly prohibits export restrictions.[17] There are, however, several exceptions described in other provisions of the GATT under which restrictions are permitted.[18] The exceptions to Article XI exist for a variety of different reasons.[19] Article XXI enumerates the national security exceptions permitting export controls relating to: "fissionable materials and their raw materials b(i); arms, munitions and

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Penny Pritzker, Secretary, Dep't of Com., Remarks at the Bureau of Industry and Security Annual Update Conference (Nov. 2, 2015), *available at* https://www.bis.doc.gov/index.php/all-articles/173-about-bis/newsroom/speeches/speeches-2015/946-penny-pritzker-remarks-at-the-2015-update-conference (last visited Apr. 13, 2020).

[14] General Agreement on Tariffs & Trade, Oct. 30, 1947, 61 Stat. A-11, 55 U.N.T.S. 194 [hereinafter GATT].

[15] *Id.* at art. XXI.

[16] Michael Rom, *Export Controls in GATT*, 18 J. WORLD TRADE L. 125, 125 (1984). MFN treatment means that "any advantage, favour, privilege or immunity granted by any contracting party to any product originating in or destined for any other country shall be accorded immediately and unconditionally to the like product originating in or destined for the territories of all other contracting parties." GATT, *supra* note 14, art. I(1). In essence, any contracting party of the GATT may not treat products from or destined for any one country any better than like products from any other contracting party by way of taxes, export formalities, or other similar measures.

[17] *See* GATT, *supra* note 14, art. XI.

[18] Rom, *supra* note 16, at 125.

[19] *See e.g.*, GATT, *supra* note 14, art. XI(2)(a) (to prevent or relieve critical shortages of foodstuffs or other essential products); art. XI(2)(b) (when necessary to the application of standards or regulations for the classification, grading or marketing of commodities); art. XV(9)(b) (for foreign exchange control purposes).

military supplies b(ii); measures taken in time of war or other emergency in international relations b(iii); or in pursuance of obligations under the UN charter for the maintenance of international peace and security (c)."[20] Article XXI will be the focus of this Article as all export controls on outer space technology fall under this provision. Not only are these export controls a way of preventing foreign access to vital technology and developmental assistance, but their unique application to specific, individual countries is seemingly legal under GATT Article XXI.

Article XI's restraint on the behavior of World Trade Organization (WTO) members is substantially weakened by Article XXI's allowance of discriminatory measures in the name of national security under which it exempts the invoking member from all other GATT provisions.[21] A careful reading of its language indicates that Article XXI is an "all-embracing exception to GATT obligations."[22] In 1949, Czechoslovakia brought a case against the US under Article XXIII,[23] arguing the US breached its obligations under Articles I and XIII by its administration of export licensing.[24] The US justified the controls on the basis of "security reasons" under Article XXI(b)(ii) and the Contracting Parties rejected the Czech claim by a vote of seventeen to one.[25] In rendering the decision, the Chairman "indicated that Article XXI 'embodied exceptions to the general rule contained in Article I.'"[26]

The Chairman's statement that Article XXI provided an exception to the most-favored nation rule of Article I meant that other obligations imposed by the GATT would also be excepted under

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[20] Rom, *supra* note 16, at 126.

[21] Raj Bhala, *National Security and International Trade Law: What the GATT Says, and what the United States Does Symposium on Linkage as Phenomenon: An Interdisciplinary Approach*, 19 U. PA. J. INT'L ECON. L. 263, 265 (1998).

[22] *Id.* at 268.

[23] Article XXIII is the "Nullification or Impairment" provision, which gives a WTO contracting party recourse when it considers "any benefit accruing to [them] directly or indirectly under this Agreement is being nullified or impaired or that the attainment of any objective of the Agreement is being impeded as a result of (a) the failure of another contracting party to carry out its obligations under this agreement; (b) the application by another contracting party of any measure, whether or not it conflicts with the provisions of this Agreement; or (c) the existence of any other situation." GATT, *supra* note 14, art. XXIII(1).

[24] Bhala, *supra* note 21, at 268.

[25] *Id.*

[26] *Id.*

Article XXI.[27] Thus, Article XXI acts as an affirmative defense to all GATT provisions. Article XXI further weakens restraints because in practice it is broadly interpreted. While the GATT purports to bar the discriminatory treatment of export restrictions in Article XIII(1)[28] and enumerates strict exceptions in Article XXI, these exceptions are often interpreted more broadly in practice.[29] Indeed, "a substantial part of current discriminatory export controls are carried out under this exception."[30] WTO members, most notably the US, have invoked this provision to justify actions which were not explicitly authorized by the text of Article XXI.[31]

In this regard, the most important and controversial portion of GATT Article XXI is Article XXI(b).[32] Article XXI(b) states that "[n]othing in this Agreement shall be construed to prevent any contracting party from taking any action which *it* considers necessary for the protection of its essential security interests."[33] The provision's use of "it" allows the WTO member invoking Article XXI measures the sole discretion to determine whether an action conforms to the requirements set forth in Article XXI(b).[34] Such interpretation is evident from Ghana's statement concerning its boycott of Portuguese goods in 1961, which mentioned that "each contracting party was the sole judge of what was necessary in its essential security interest."[35] The implication of this interpretation means that no WTO member, group of members, panel, or adjudicatory body has any right to determine whether a measure satisfies Article XXI(b)'s requirements.[36] Sole discretion for this determination is

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[27] *Id.*

[28] GATT, *supra* note 14, art. XIII(1) ("No prohibition or restriction shall be applied by any contracting party . . . on the exportation of any product destined for the territory of any other contracting party, unless . . . the exportation of the like product to all third countries is similarly prohibited or restricted.")

[29] Rom, *supra* note 16, at 145.

[30] *Id.*

[31] The Export Control Act "authorizes the President to prohibit or curtail exports in line with U.S. foreign policy. No such reference existed in GATT unless the U.S. foreign policy export restrictions are applied in the context of Article XXI(c) which refers to the obligation under the U.N. Charter to maintain international peace and security." *Id.*

[32] Bhala, *supra* note 21, at 268.

[33] GATT, *supra* note 14, art. XXI(b) (emphasis added).

[34] Bhala, *supra* note 21, at 268.

[35] *Id.* at 269.

[36] *Id.* at 268-69.

afforded to WTO members invoking Article XXI, which allows for quite a broad practical application of the authority.

Article XXI's broad discretion has given rise to numerous measures which are not found in the provision's text. For example, the text does not explicitly permit the maintenance of a stock of essential foods and other essential raw materials for security reasons, nor the restriction of their export as a permanent policy of government, but many countries implement such policies and justify them on the basis of security reasons.[37] Specific examples include when the

> United States applied export controls for instance against Uganda, and against South-East Asia, and these, as well as the non-application of the [most favored nation status] against Czechoslovakia . . . were not in line with Article XXI, and are sufficient examples to indicate that despite the rather restricted exceptions in the GATT, in practice a much wider use is made of them.[38]

While the GATT aims to bring a modicum of law and order to international economic relations, the GATT security exception can reopen the door to arbitrary abuse by a country possessing the advantage of economic power.[39]

Few safeguards exist within the GATT to prevent a WTO member from becoming a "cowboy" by invoking Article XXI's broad discretion to justify unilateral, discriminatory measures. The exercise of Article XXI rights does not require the invoking member to give prior notice of such measures, nor does it require the invoking member to justify its determination to the WTO or its members.[40] Nothing in Article XXI(b) requires that a member face a danger that has manifested itself in a concrete sense, such as a physical invasion or armed attack, before imposing a national security measure.[41]

Only two weak checks exist that might restrain "cowboy" behavior: 1) the November 30, 1982 Falkland Islands decision; and 2)

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[37] Rom, *supra* note 16, at 145.
[38] *Id.* at 146.
[39] *Id.*
[40] Bhala, *supra* note 21, at 269.
[41] *Id.* at 270.

the introductory chapeau to Article XXI(b).[42] The *Decision Concerning Article XXI of the General Agreement*, adopted by the Contracting Parties after discussing the Falkland Islands crisis, noted that "contracting parties should be informed *to the fullest extent possible* of trade measures taken under Article XXI."[43] The decision's ruling carries little weight as the sanctioning member decides whether notice is "possible."[44] Similarly, the chapeau to Article XXI(b) requires the invoking member to make sure its measures are "necessary" for the "protection" of that member's "essential security interests."[45] The content of clauses (i), (ii) and (iii) following the chapeau to Article XXI(b) indicate actual aggression is not a prerequisite because trade sanctions would be ineffective after a country already acquired nuclear weapons, amassed non-nuclear arms, or began a physical invasion.[46] The only real restraint from the chapeau is that the threat addressed is *credible*.[47] While these checks exist, an affected member's claim brought under the WTO has little impact on Article XXI measures.

Members affected by Article XXI measures may still bring suit against the invoking member as the Contracting Parties did not interpret Article XXI to immunize the invoking member from an Article XXIII action.[48] The interpretation is solidified by the previously mentioned Falkland Islands decision, which specified that all contracting parties retain their full rights under the General Agreement when action is taken under Article XXI.[49] Unfortunately for the affected members, the right to bring an Article XXIII action means almost nothing in practice.[50] As the analysis above indicates, invocation of the national security exception is left to the discretion

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[42] *Id.* at 270-71.

[43] GATT Doc. L/5426, *Decision Concerning Article XXI of the General Agreement*, ¶ 1 (Nov. 30, 1982).

[44] Bhala, supra note 21, at 270-71.

[45] GATT, *supra* note 14, art. XXI(b) chapeau. *See also* Bhala, *supra* note 21, at 271-72.

[46] GATT, *supra* note 14, art. XXI(b) chapeau. *See also* Bhala, *supra* note 21, at 274-75.

[47] *See* GATT, *supra* note 14, art. XXI(b) chapeau. *See also* Bhala, *supra* note 21, at 275.

[48] *See* Bhala, supra note 21, at 278.

[49] *See* GATT Doc. L/5426, *supra* note 43, at ¶ 2.

[50] Bhala, *supra* note 21, at 279.

of the invoking member.[51] Realpolitik[52] demands that members retain this sovereign prerogative, and many legislators believe encroaching upon it is one of the surest ways to damage the WTO.[53] Therefore, a WTO panel is unlikely to rule on substantive Article XXI arguments in the future.[54]

The only recent WTO case addressing the interpretation of Article XXI occurred in April of 2019.[55] The 2019 matter of *Russia – Measures Concerning Traffic in Transit* provides clarification of Article XXI, but its analysis is limited to that of GATT Article XXI(b)(iii).[56] Article XXI(b)(iii) actions taken in time of war or other emergency in international relations, are separate from export controls, which fall under Article XXI(b)(ii) as they relate to the traffic of arms, ammunition and implements of war or other goods for the purpose of supplying a military establishment.[57] However, the panel noted that it is left to every member to define what it considers to be its essential security interests.[58] The report continues by saying a member's discretion to designate particular concerns as "essential security interests" is limited only by the obligation to

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[51] *Id.* at 268.

[52] Realpolitik is defined as politics based on practical and material factors rather than on theoretical or ethical objectives. *Realpolitik*, MERRIAM -WEBSTER, https://www.merriam-webster.com/dictionary/realpolitik (last visited May 10, 2020).

[53] Bhala, supra note 21, at 279.

[54] *Id.* at 279.

[55] As of the date of this Article, there is a pending matter regarding the interpretation of Article XXI(b) on which the WTO has not yet made a decision. China has challenged the US imposition of "25 percent and 10 percent of additional import duty respectively on certain steel products and aluminum products, from all countries except Canada, Mexico, Australia, Argentina, South Korea, Brazil and the European Union, which took effect 23 March 2018." Request for Consultations by China, *United States – Certain Measures on Steel and Aluminum Products*, WTO Doc. WT/DS544/1 (Apr. 9, 2018). The US argument is, in essence, that "Article XXI(b) is an exception for a Member to take any essential security 'action' it considers necessary." Opening Statement of The United States of America at the First Substantive Meeting of the Panel, *United States – Certain Measures on Steel and Aluminum Products*, ¶ 11, WTO Doc. WT/DS556 (Nov. 12, 2019). Due to the complexity of this matter, the "[p]anel expects to issue its final report to the parties no earlier than autumn 2020." Communication from the Panel, *United States – Certain Measures on Steel and Aluminum Products*, WTO Doc. WT/DS544/10 (Sept. 10, 2019).

[56] Panel Report, *Russia—Measures Concerning Traffic in Transit*, WTO Doc. WT/DS512/R (adopted Apr. 26, 2019).

[57] GATT, *supra* note 14, art. XXI(b)(ii).

[58] Panel Report, *supra* note 56, at 56 ¶ 7.131.

interpret and apply Article XXI in good faith.[59] The panel only addressed whether there was a war or emergency in international relations[60] as required by Article XXI(b)(iii), if the measures were taken during this time,[61] and whether the measures at issue were too remote from the emergency to be plausibly implemented for the protection of Russia's essential security interests arising out of that emergency.[62] Again, the matter of "necessity" of these measures is left up to Russia.[63] Having found that Russia had satisfied all of the above requirements, the panel concluded the measures were justified under Article XXI(b) and thus did not serve as violations to the other provisions of the GATT.[64]

The case again avoided the substantive arguments of Article XXI's invocation, leaving most of the Article's broad discretion intact. Article XXI clearly acts as an affirmative defense, providing immunity to its invoking member despite its actions being inconsistent with obligations under agreements such as the GATT. So long as a member can meet the minimal standards above, they are able to justify unilateral measures under Article XXI. Given this precedent, a WTO member is left to modify, remove and adjust its application of export controls in whatever way it desires. As such, it may freely bargain with any prohibited county for removal of such controls.

B. The US Domestic Export Control Regime

US exports of space technologies are controlled through one of two mechanisms: 1) the International Traffic in Arms Regulations (ITAR)[65]; or 2) the Export Administration Regulations (EAR).[66] The ITAR controls the "export of goods and technical data that are principally used in military or intelligence applications, including

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[59] *Id.* at 56 ¶ 7.132. The obligation of good faith merely requires that members not use the exceptions in Article XXI as a means to circumvent their obligations under the GATT. *Id.* at 56 ¶ 7.133.

[60] *Id.* at 54 ¶ 7.123.

[61] *Id.* at 55 ¶ 7.124.

[62] *Id.* at 58 ¶ 7.145.

[63] Panel Report, *supra* note 56, at 58 ¶ 7.146.

[64] *Id.* at 67 ¶ 7.196.

[65] 22 C.F.R. §§ 120-30 (2019).

[66] 15 C.F.R. §§ 730-74 (2019).

critical defense articles, services, and technologies."[67] ITAR-controlled goods are identified on the USML[68] and include certain items listed in the Missile Technology Control Regime (MCTR) Annex.[69] The EAR controls dual-use "goods and technologies that have civil, commercial, military, and intelligence applications."[70] EAR controlled goods are identified on the Commerce Control List (CCL)[71] and also include certain items found in the MCTR Annex. In determining the actual classification of an item or product, a US company must compare the technical specifications of its item against the relevant USML and CCL entries, in that order, to see if the item is specified on either list.[72] It is important to note that, should an item appear on both the USML and the CCL, the item will be deemed a "defense article" meaning the USML will govern, and there is no need to review the CCL regarding that item.[73] USML restrictions are also more stringent than CCL restrictions as they regard specifically military technology. While these lists control the export of countless items, only the categories of each list giving rise to export controls over space technologies are discussed below.

The USML divides its controlled items into twenty-one categories, several of which contain technology either necessary or beneficial to operations in outer space. Launch vehicles, guided missiles, ballistic missiles, rockets, torpedoes and mines comprise one category, which includes numerous propulsion systems used by outer space objects.[74] The following category, containing explosives and energetic materials, propellants, incendiary agents and their constituents, likely covers all remaining fuels utilized by outer space objects.[75] Aircraft and related vehicles are also covered by the USML[76] as well as all military electronics.[77] Export of critical

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[67] Santos, *supra* note 11, at 5.

[68] 22 C.F.R. § 121.1.

[69] *Id.* § 121.16

[70] Santos, *supra* note 11, at 5.

[71] 15 C.F.R. § 774.

[72] John Sturtevant, *Jurisdiction, Classification and Licensing: A Primer*, GLOB. TRADE & SEC. SOLS. (Apr. 3, 2018), http://news.ctp-inc.com/jdx-class-license-primer.

[73] 15 C.F.R. § 774, Supp. 4(a).

[74] 22 C.F.R. § 121.1, Category IV (2019).

[75] *Id.* § 121.1, Category V.

[76] *Id.* § 121.1, Category VIII.

[77] *Id.* § 121.1, Category XI.

onboard space technology such as fire control systems, range-finding equipment and optical guidance systems are also controlled.[78] Experimental materials can also fall subject to the USML.[79] Broadly, spacecraft and all related articles comprise their own section of the list.[80] While this list of USML controlled exports is not by any means exhaustive, it represents the major categories under which outer space technologies are classified.

It is important to note that "ITAR governs not only the international trade of actual products, but also the technical data associated with ITAR-controlled products."[81] This aspect of ITAR regulations can severely impede business operations as the "extensive definition of 'export' includes sending items on the USML outside of the country as well as sharing technical data with foreign persons or governments."[82] Thus, "a professor at a US university sharing restricted technical data with a foreign research assistant would fall under the purview of ITAR restrictions and requirements."[83] The defense industry argues these restrictions are "very cumbersome and restrictive" given their "myriad of paperwork requirements, which in the case of the US State Department alone could be any one of 13 different forms."[84]

All items and services described on the USML require export authorization by the State Department; items require licenses and services require approved agreements such as a Technical Assistance Agreement (TAA).[85] Absent a criminal record, a US person may receive a license or other approval to export items on the

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[78] *Id.* § 121.1, Category XII.

[79] *Id.* § 121.1, Category XIII.

[80] 22 C.F.R. § 121.1, Category XV.

[81] Clinton Long, *An Imperfect Balance: ITAR Exemptions, National Security, and US Competitiveness*, 2 NAT'L SEC. L. J. 43, 48 (2013).

[82] Long, *supra* note 81, at 49. "Foreign person" means any natural person who is not a lawful permanent resident as defined by 8 U.S.C. § 1101(a)(20) or who is not a protected individual as defined by 8 U.S.C. § 1324b(a)(3). It also means any foreign corporation, business association, partnership, trust, society or any other entity or group that is not incorporated or organized to do business in the US, as well as international organizations, foreign governments and any agency or subdivision of foreign governments (e.g. diplomatic missions). *See* 22 C.F.R. § 120.16.

[83] *Id.*

[84] *Id.* at 50.

[85] DEP'T OF COM. & FED. AVIATION ADMIN., INTRODUCTION TO US EXPORT CONTROLS FOR THE COMMERCIAL SPACE INDUSTRY 20 (2d ed. 2017).

USML.[86] USML licenses given to foreign individuals or groups are limited to foreign governmental entities in the US, re-export or re-transfer approval and approval for brokering activities.[87] ITAR also has a regularly-updated list of countries to which its policy is to deny licenses.[88] Even companies with ITAR exemptions must apply for a license if a "foreign person" from any of these countries is involved.[89] USML restrictions are of the highest order within US export controls, and represent the most closely guarded technologies. "The USML now functions as a 'positive control list' describing the few items and services remaining under ITAR, with the rest falling to EAR."[90] These technologies are much harder to obtain for foreign individuals than those governed by the EAR and listed on the CCL.

The CCL also divides controlled items into ten categories, with many categories containing technologies essential to operations in outer space. Electronics[91] and computers[92] are both broadly covered by the CCL. The export of telecommunications and information security data, services and software are closely monitored by the CCL.[93] All laser and sensing technology also falls under the CCL unless it is specifically mentioned on the USML.[94] Navigation and avionic systems not deemed "defense items" are also controlled under the CCL.[95] Lastly, non-defense propulsion systems, space vehicles and any related equipment are subject to the CCL.[96] Unlike the USML, however, each CCL category contains several five-digit Export Control Classification Numbers (ECCNs).[97]

ECCNs are distributed throughout the CCL and are found within three of the CCL's four tiers of licensing requirements. The first tier is home to the most stringent controls, while the lowest tier requires no license at all. The first tier, "600 series" controls less sensitive military items, which no longer warrant control on

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[86] 22 C.F.R. § 120.1(c)(1) (2019).
[87] *Id.* § 120.1(c)(1)(i)-(iii).
[88] *Id.* § 126.1(d).
[89] Santos, *supra* note 11, at 12.
[90] DEP'T OF COM. & FED. AVIATION ADMIN., *supra* note 85, at 8.
[91] 15 C.F.R. § 774, Supp. 1, Cat. 3 to Part 774 (2019).
[92] *Id.* § 774, Supp. 1, Cat. 4 to Part 774.
[93] *Id.* § 774, Supp. 1, Cat. 5 to Part 774.
[94] *Id.* § 774, Supp. 1, Cat. 6 to Part 774.
[95] *Id.* § 774, Supp. 1, Cat. 7 to Part 774.
[96] *Id.* § 774, Supp. 1, Cat. 9 to Part 774.
[97] Sturtevant, supra note 72.

the USML.[98] 600 series items are subject to more flexible licensing than under ITAR, but are still subject to stricter export and re-export licensing controls than most other items controlled under the EAR.[99] The second tier, "ECCN 9A004," applies to the International Space Station (ISS) and all of its specifically designed components, as well as the James Webb Space Telescope and most of its specifically designed components.[100] The second tier also includes certain space launch vehicles, spacecraft, spacecraft payloads, on-board systems or equipment.[101] The third tier, ".x & .y Controls" acts as a catch-all by capturing specifically designed items not previously enumerated in a given ECCN.[102] The fourth and final tier, "EAR99," consists of low-technology consumer goods and does not require a license in many situations.[103] However, the export of an EAR99 item "to an embargoed country, an end-user of concern, or in support of a prohibited end-use" may require an export license.[104] In essence, one must find the ECCN corresponding to their technology and use that ECCN to determine what licensing requirements may apply.

If the item in question is described by one of the CCL's ECCNs, then it is probable that any related technical data could rise to the level of controlled "development technology," "production technology," and/or "use technology" as defined under the EAR.[105] CCL monitored items are subject to the licensing authority of the Bureau of Industry and Security (BIS), a branch of the Department of Commerce.[106] Companies then must compare the "Reasons for Control" listed in the ECCN entry against their export destination on the Commerce Country Chart.[107] If there is an "X" in the box at the intersection of the export destination and the applicable reason(s) for control, an export license is required from BIS.[108] On the other hand, if the item in question is not described on the CCL, then the

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[98] DEP'T OF COM. & FED. AVIATION ADMIN., *supra* note 85, at 27.
[99] *Id.*
[100] *Id.* at 28.
[101] *Id.*
[102] *Id.* at 29.
[103] *Id.* at 30.
[104] DEP'T OF COM. & FED. AVIATION ADMIN., *supra* note 85, at 30.
[105] Sturtevant, *supra* note 72.
[106] 15 C.F.R. § 774 (2019).
[107] 15 C.F.R. § 738.4. *See also* 15 C.F.R. § 738, Supp. 1 to Part 738.
[108] Sturtevant, *supra* note 72.

technology will default to a classification of EAR99 and the company *will not* have to obtain an export license from BIS.

C. US Export Control Reform Initiative

The US presents an instructive example of export control reform given its recently enacted Export Control Reform Initiative (ECR). Under the ECR, two significant changes have taken place: 1) items have been moved from the USML to the CCL; and 2) transition from the See-Through Rule to the Integration Rule. Both of these changes are ways a country can relax export controls in an effort to increase international cooperation. Countries which are now allowed to purchase such technology benefit from increased access to space while domestic US "[a]erospace and defense companies [which] rely heavily on the international market for sales"[109] enjoy a larger consumer market. These options are designed to benefit both the American seller and the foreign buyer without compromising national security objectives. Policy options such as the ones described below would serve as a valuable tool in increasing space access for nations currently lacking it and would subsequently push nations new to space to protect interests similar to those of the current spacefaring nations.

i. Transfer of items from USML to CCL

One of the biggest components of the ECR was "changing the jurisdiction of thousands of military items, mostly parts and components, that do not provide a critical military or intelligence capability . . ." from the USML to the CCL.[110] "In many instances, a simple definition modification of an item's classification reduces the regulatory burden preventing a product from being exported."[111] Items transferred in this way are "identified under new Export Control Classification Numbers (ECCNs), known as the 600 series."[112] The transfer has benefits for foreign countries, including greater

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[109] *Export Control Reform*, NAT'L DEF. INDUS. ASS'N, https://www.ndia.org/policy/international/export-control-reform (last visited Apr. 17, 2020).

[110] DEP'T OF COM. BUREAU OF INDUS. AND SEC., UNITED STATES EXPORT CONTROL REFORM INITIATIVE (Oct. 27, 2015), available at https://www.bis.doc.gov/index.php/documents/pdfs/1319-ecr-brochure-1/file (last visited Apr. 17, 2020).

[111] NAT'L DEF. INDUS. ASS'N, *supra* note 109.

[112] DEP'T OF COM. BUREAU OF INDUS. AND SEC., *supra* note 110.

interoperability among allies and licensing exceptions. Likewise, it also benefits domestic US companies by easing the licensing burden on large-scale operations and encouraging foreign participation in US space projects. The US regime itself also benefits from "focusing controls on items of greater sensitivity. . . ."[113]

The ECR also "allow[s] for greater interoperability among the US, NATO countries, and other allied countries."[114] "Items subject to the ITAR are generally subject to the same worldwide controls with little variation, and few country-based exceptions."[115] Controls over items subject to the EAR, however, "can be tailored depending on the sensitivity of the item, country of destination, end use, and end user."[116] CCL controls being tailored to specific items or purchasing countries allows for easier acquisition of space technologies by other countries. Those countries are not all on equal footing and thus the flexibility of CCL controls allows for the use of export controls as a bargaining chip in international negotiations as the US may apply these export controls unequally amongst WTO member countries without violating international law.

Items subject to the CCL are subject to licensing exceptions in many cases. The Strategic Trade Authorization (STA) exception,[117] "allows for license-free exports and reexports to 36 countries for ultimate end use by the country's armed forces, police, paramilitary, law enforcement, customs, correctional, fire, or search/rescue agency, or for return to the US"[118] Exceptions such as the STA "avoid the need for prior approval from the US Government for transactions of less concern, such as trade with US allies."[119] While these countries are already US allies, many of them do not have a space program at all, much less the capability to launch their own satellite. Thus, being able to purchase space-related technology

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[113] *Id.*

[114] *Id.*

[115] *Id.*

[116] *Id.*

[117] STA authorized destinations include "Argentina, Australia, Austria, Belgium, Bulgaria, Canada, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Italy, Japan, Latvia, Lithuania, Luxembourg, Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, South Korea, Spain, Sweden, Switzerland, Turkey, and the United Kingdom." DEP'T OF COM. BUREAU OF INDUS. AND SEC., *supra* note 110.

[118] *Id.*

[119] *Id.*

from the US is a huge boost to the development of a domestic space industry. Additionally, such assisted development is further facilitated as "[m]ost 600 series parts and components may be exported under a license exception to replace defective or worn parts and components abroad."[120] Foreign firms and governments greatly benefit from this rule as they may seek replacement parts for previous purchases without having to go through the licensing process all over again.

Easing licensing burdens on domestic US firms has resulted in a significant increase in international trade of commercial space technology. "[W]hen [export] controls become too restrictive and time consuming for US suppliers, . . . [t]his adversely affects the competitiveness of key US manufacturing and technology sectors, and gives customers the option of buying from foreign competitors with fewer restrictions."[121] "[T]ransferring less sensitive commercialized items from the [USML] . . . to the more flexible [CCL] . . . objectively clarifies the end use determination of an item, and reduces hold-ups in the licensing approval process."[122] Given these reforms, US aerospace companies may now operate with greater capacity as international deals on space technology have become less complicated.

Relaxing these licensing requirements has also driven foreign involvement in US aerospace firms. Notable foreign firms such as Richard Branson's Virgin Orbit and New Zealand founded Rocket Lab have both set up their headquarters in the US.[123] "[I]n 2017, major investors channeled $3.9 billion into commercial space startups. Of that total, $3.25 billion was invested in US firms."[124] In addition, "[s]atellite export control reform has created a less restrictive environment for foreign nationals working on US space projects."[125] Under the ECR, "an organization can maintain

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[120] *Id.*

[121] NAT'L DEF. INDUS. ASS'N, *supra* note 109.

[122] *Id.*

[123] Greg Autry, *Implications of Foreign Competition and Investment in US Commercial Spaceflight Markets*, GEO. J. INT'L AFF. ONLINE (Aug. 29, 2019), https://www.georgetownjournalofinternationalaffairs.org/online-edition/2019/8/28/implications-of-foreign-competition-and-investment-in-us-commercial-spaceflight-markets.

[124] *Id.*

[125] DEP'T OF COM. & FED. AVIATION ADMIN., *supra* note 85, at 9.

appropriate controls on ITAR-controlled parts while allowing foreign nationals to work on the rest of the spacecraft, if it is controlled by the EAR."[126] As mentioned previously, US aerospace firms heavily rely on international participation to succeed and relaxed licensing incentivizes such business.

Lastly, the US itself also benefits from the ECR by being able to direct its export control efforts at the most sensitive items. "By focusing controls on items of greater sensitivity, the US Government will be able to more efficiently direct its resources to reviewing items providing greater military utility or transactions of greater concern."[127] In handing off control of several technologies to the Department of Commerce, the State Department is able to narrow its focus to those items which pose the most severe risks to national security. In summary, the transfer of items from the USML to the CCL benefits foreign consumers and investors, domestic US aerospace firms and the US government itself.

ii. Transition from the See-Through Rule to the Integration Rule

Transferring items from the USML to the CCL succeeded in opening new international markets for outer space technology, but these transfers would have been far less effective had a previously active rule, the See-Through Rule, remained in effect. Articulated simply, the See-Through Rule mandated that the presence of *any* ITAR-restricted component in a larger system (for instance, an ITAR-controlled microchip in an otherwise non-ITAR controlled satellite) would render that *entire system* subject to ITAR's restrictions.[128] This unwritten interpretation of the export control regulations, which governed how the USML and the CCL regimes interacted with one another, has now been superseded by the "Integration Rule," under which larger objects usually "remain subject to EAR controls even if they contain ITAR-controlled parts or components."[129] The See-Through Rule radically expanded the number of systems and items subject to ITAR export control restrictions

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[126] *Id.* at 10.
[127] DEP'T OF COM. BUREAU OF INDUS. AND SEC., *supra* note 110.
[128] *See* DEP'T OF COM. & FED. AVIATION ADMIN., *supra* note 85, at 23.
[129] *Id.*

when it was in effect and often subjected primarily commercial objects to an unnecessary, higher licensing burden.[130]

The See-Through Rule created significant problems in the transfer of items from the USML to the CCL and it was crucial the US address situations in which only a small number of components were subject to ITAR's USML, while others were merely subject to the EAR's CCL. US reform which transferred items from the USML to the CCL would be worthless should a space object subject to the CCL become wholly controlled by the USML due to one or a few parts being subject to ITAR. In order to prevent this, the US replaced the See-Through Rule with the Integration Rule. The Integration Rule removed the See-Through Rule's broad interpretation of export-controlled systems, instead interpreting the regulations in such a way that larger technological systems or products "generally remain subject to EAR controls even if they contain ITAR-controlled parts or components."[131]

This monumental shift in US export controls is best described by the Department of Commerce and Federal Aviation Administration's jointly produced Introduction to US Export Controls for the Commercial Space Industry:

> Export Control Reform brought a paradigm shift for EAR controlled satellites containing ITAR controlled components. The inclusion of such components in a satellite no longer 'flips' its jurisdiction from EAR to ITAR, as it did under the old 'see-through rule.' Under the new 'integration rule,' an ITAR

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[130] As Undersecretary of Commerce Eric Hirschhorn stated during a June 2013 speech, prior to the alteration of the "See-Through Rule:"

> Right now, our ability to compete and cooperate is burdened by overly complicated or overbroad regulations such as the "see-through rule." Under the "see-through rule," the presence of a single, non-critical ITAR-controlled part, such as a switch or a bolt, will render an entire foreign-made end product, such as an Airbus A-320 passenger aircraft, subject to US reexport controls.

Eric L. Hirschhorn, Undersecretary, Dep't of Com., Remarks at American Association of Exporters and Importers 92nd Annual Conference in Washington, D.C., (June 18, 2013), *available at* https://www.bis.doc.gov/index.php/about-bis/newsroom/speeches/103-about-bis/newsroom/speeches/speeches-2013/553-remarks-of-eric-l-hirschhorn-92nd-annual-conference-in-washington-dc.

[131] DEP'T OF COM. & FED. AVIATION ADMIN., *supra* note 85, at 23.

> controlled component moves to EAR control upon its (irreversible) integration into an EAR spacecraft.[132]

Furthermore, "adding an ITAR-controlled hosted payload to an EAR-controlled satellite does not 'flip' the satellite to ITAR."[133] Had the integration rule not been implemented, the See-Through Rule would have effectively nullified much of the export control reform by mandating ITAR licensing of primarily EAR controlled spacecraft. Such a situation would potentially be even more of an incentive for foreign firms to participate in "the 'ITAR-Free' movement in which foreign manufacturers design out US origin space-related items and technology to avoid application of the 'ITAR See-Through Rule.'"[134] Luckily for US firms and foreign consumers alike, the Integration Rule reigns supreme today.

Both the transfer of thousands of items from the USML to the CCL and the implementation of the Integration Rule have proven useful policy tools for the US. These policies have led to increased revenue for US aerospace firms as they can more easily sell their product to overseas consumers. The facilitating of these transactions is critical for the industry as it relies heavily on foreign capital.[135] In addition, the countries with increased access to space technology benefit from being able to use such space-based assets. Licensing exceptions under the new reforms build confidence and trust amongst friendly nations. With the flow of international aerospace trade comes a level of economic interdependency that spurs consensus. As countries without access to space are able to buy their way in, they will likely become increasingly willing to commit to an international consensus which protects the rights of each country, and their private sector, in outer space.

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[132] *Id.* at 22.

[133] *Id.* at 23.

[134] Matthew Goldstein, *Export Control Reform Impacts in Space*, FARHANG & MEDCOFF (Mar. 1, 2014), https://farhangmedcoff.com/2014/03/01/export-control-reform-impacts-in-space/.

[135] "In 2018, the industry contributed $151 billion in export sales to the U.S. economy. Its positive trade balance of nearly $88 billion that year was the largest trade surplus of any manufacturing industry . . . . At the end of 2018, foreign direct investment (FDI) into the U.S. aerospace industry totaled nearly $22 billion." *Aerospace Spotlight*, SELECTUSA, https://www.selectusa.gov/aerospace-industry-united-states (last visited Apr. 24, 2020).

III. THE CURRENT STATUS OF INTERNATIONAL SPACE LAW

International space law was born by achieving a hard-fought consensus. Unfortunately, widespread international cooperation all but died in 1979 with the failure of the Moon Agreement to achieve widespread ratification.[136] Nearly all the States with space launch capabilities, as well as those States that are close to developing such capabilities, have ratified the OST. While the OST does many things in building the foundation of international space law, there are also many things it lacks. This is evident in part from the three subsequent international conventions that built off OST principles.[137] Below is a short history of international outer space law with a specific attention to the ideas and concepts which brought countries into agreement as well as those which currently prevent consensus in respect of the establishment of an international regime governing outer space.

A. The Outer Space Treaty: Underlying Principles of International Agreement

The OST lays out several fundamental principles of international space law, all of which were agreed upon by a majority of both spacefaring and non-spacefaring States. The OST acts as the basis for all subsequent international law in space, as all later agreements expand on its premises. Below are the articles of the OST which are most relevant to the international consensus once found in space law. It is many of these concepts which led most countries

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[136] None of the major spacefaring nations such as the US, China, Russia or Japan have ratified the treaty. Only eighteen nations have ratified the Moon Agreement: Armenia, Australia, Austria, Belgium, Chile, Kazakhstan, Kuwait, Lebanon, Mexico, Morocco, The Netherlands, Pakistan, Peru, The Philippines, Saudi Arabia, Turkey, Uruguay and Venezuela. United Nations, *Agreement Governing the Activities of States on the Moon and Other Celestial Bodies* 1 (2020), https://treaties.un.org/doc/Publication/MTDSG/Volume%20II/Chapter%20XXIV/XXIV-2.en.pdf.

[137] Between the Outer Space Treaty and the Moon Agreement, three additional outer space treaties were signed: (1) Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, Nov. 3, 1967, 19 U.S.T. 7570, 672 U.N.T.S. 119 [hereinafter Rescue Agreement]; (2) Convention on International Liability for Damage Caused by Space Objects, Nov. 9, 1972, 24 U.S.T. 2389, 961 U.N.T.S. 187 [hereinafter Liability Convention]; and (3) Convention on Registration of Objects Launched into Outer Space, Nov. 15, 1976, 28 U.S.T. 695, 1023 U.N.T.S. 15 [hereinafter Registration Convention].

of the world to bind themselves to the enumerated principles even at the height of the Cold War.

Article I mandates that the exploration and use of outer space "be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all [hu]mankind."[138] The Article continues, "States shall facilitate and encourage international cooperation in such investigation."[139] The language suggests that the international community wanted to assure no single State would attempt to dominate space. Essentially, Article I was specifically written to protect the interests of States with fledgling space industries and their ability to access space both before and after they obtain the ability to do so.[140]

Article II of the treaty is most often cited when countries discuss space resource utilization. For example, some argue that the US Commercial Space Launch Competitiveness ("SPACE") Act[141] (US Space Act) violates international law because it unilaterally permits a company's to appropriate space resources.[142] Article II of

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[138] Outer Space Treaty, *supra* note 1, art. I.

[139] *Id.*

[140] In a 1964 meeting of COPOUS, Romania's delegate stated,

> [t]he concept of the sovereign equality of States was fundamental to all international law and to the law which was beginning to be established with respect to outer space. While activities in outer space were at present the prerogative of only a few states, all States were likely to be affected by such activities and the time would come when many, if not all, States would be able to participate in them.

U.N. COPUOS, 3rd Sess., 29th-37th mtg. at 20, U.N. Doc. A/AC.105/C.2/SR.29-37 (Aug. 24, 1964).

[141] 51 USC. § 51303 (2018). The Act indicates that a

> United States citizen engaged in commercial recovery of an asteroid resource or a space resource . . . shall be entitled to any asteroid resource or space resource obtained, including to possess, own, transport, use, and sell the asteroid resource or space resource obtained in accordance with applicable law, including the international obligations of the United States.

Id.

[142] The strongest opposition to the Act's legality was voiced by Brazil and Russia. *See* Mark Sundahl, *Don't Muddy the Message to Space Mining Companies*, SPACENEWS (June 9, 2016), https://spacenews.com/op-ed-dont-muddy-the-message-to-space-mining-companies/. "Critics argue that because the U.S. has now created laws allowing their citizens to take ownership of resources found on celestial entities, they have effectively asserted a claim of sovereignty, or national appropriation, over outer space." Frank E. Waliczek, *The SPACE Act, an Expanding Commercial Space Sector, and U.S. National*

the OST, provides that the Moon and other celestial bodies are "not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means."[143] This outright ban on *national* appropriation lies at the heart of today's conflict over operations such as space mining.[144] While many spacefaring States, including the US, interpret the treaty to only ban *national* appropriation,[145] other States read it to ban appropriation by private entities as well.[146]

Article III mandates the exploration and use of outer space take place "in accordance with international law, including the Charter of the United Nations, in the interest of maintaining

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Security, NAT'L SEC. L. BRIEF (Mar. 19, 2018), https://nationalsecuritylawbrief.com/2018/03/19/the-space-act-an-expanding-commercial-space-sector-and-u-s-national-security. Alexander Soucek, head of legal the services department at the European Space Agency in 2015, stated the act was "very controversial." Tanja Masson-Zwaan, president of the International Institute of Space Law and deputy director of the International Institute of Air and Space Law at Leiden University in the Netherlands, in 2015 said the US move will inevitably be viewed as a provocation in many nations. *See* Peter B. de Selding, *New U.S. Space Mining Law's Treaty Compliance May Depend on Implementation*, SPACENEWS (Dec. 9, 2015), https://spacenews.com/u-s-commercial-space-acts-treaty-compliance-may-depend-on-implementation/.

[143] Outer Space Treaty, *supra* note 1, art. II.

[144] The Treaty bans appropriation of the Moon or any celestial bodies. Outer Space Treaty, *supra* note 1, art. II. However, the Treaty is silent as to resources extracted therefrom.

[145] The 2015 US SPACE Act "specifically disclaims territorial sovereignty, which is tied directly to the non-appropriation principle in Article II." P.J. Blount & Christian J. Robison, *One Small Step: the Impact of the U.S. Commercial Space Launch Competitiveness Act of 2015 on the Exploration of Resources in Outer Space*, 18 N.C. J. L. & TECH. 160, 180 (2016). "Title IV [of the US SPACE Act represents] *a* valid interpretation of Article II but not necessarily *the* valid interpretation of Article II." *Id*. at 181. "Title IV represents a possible avenue through which States may engage in cooperative efforts to preserve the Article II regime while at the same time facilitating the development of commercial resource extraction in outer space." *Id*. at 182-83. Other countries, such as Luxembourg and the United Arab Emirates, have either enacted laws similar to the US SPACE Act or issued statements in support of the American approach. Jeff Foust, *White House Looks for International Support for Space Resource Rights*, SPACENEWS (Apr. 6, 2020), https://spacenews.com/white-house-looks-for-international-support-for-space-resource-rights/. China, Japan and India are also among those countries following on the path of the US and Luxembourg. Senjuti Mallick & Rajeswari Pillai Rajagopalan, *If Space is 'The Province of Mankind', Who Owns Its Resources?* OBSERVER RES. FOUND. (Jan. 24, 2019), https://www.orfonline.org/research/if-space-is-the-province-of-mankind-who-owns-its-resources-47561/.

[146] "Russia's official position on asteroid mining is that it is forbidden under the 1967 OST—which states that space is the 'province of [hu]mankind.'" Mallick & Rajagopalan, *supra* note 145.

international peace and security and promoting international cooperation and understanding."[147] Despite Cold War tensions, nobody wanted an arms race, nor an armed conflict, in space.[148] The parties also wanted to assure that activities in space were not seen as outside the jurisdiction of international laws.[149] The OST's mention of international law in Article III gives rise to the inference that space activities, and a State's export controls on space technology, must be in accordance with international trade law as well.

Article IX notes that exploration and the use of outer space "shall be guided by the principle of cooperation and mutual assistance . . ." and that each State "shall conduct their activities in outer space . . . with due regard to the corresponding interests of all other State Parties to the Treaty.[150] The international community recognized the need for States engaged in space operations to respect one another and agree not to intentionally interfere with one another's exploration.[151] Essentially, this Article imposes a good faith requirement on those operating in outer space.

Article XII outlines a particular requirement, that "[a]ll stations, installations, equipment and space vehicles [...] be open to representatives of other State Parties to the Treaty on a basis of reciprocity."[152] As most countries are quite hesitant to allow others to inspect their spacecraft, there often is no basis of reciprocity to trigger this obligation. Initially, the international community

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[147] Outer Space Treaty, *supra* note 1, art. III.

[148] In the meeting leading up to the Outer Space Treaty, Czechoslovakia's representative noted

> [a]nother important and relevant document was General Assembly resolution 1884 (XVIII) . . . which called upon all States to refrain from placing in orbit around the earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction. That resolution had been adopted by the General Assembly after the USSR and the United States had agreed to comply with its terms, thus manifesting a desire to contribute to the elimination of the danger of nuclear war in outer space.

U.N. COPUOS, *supra* note 140, at 13.

[149] "It was . . . imperative that the international legal norms to regulate outer space activities should be codified and adopted without delay. As many representatives had stressed, space flight must not be allowed to develop in a legal vacuum." *Id*. at 10.

[150] Outer Space Treaty, *supra* note 1, art. IX.

[151] "The principles of the free exploration of space was linked with that of the security of States . . . The phrase 'freedom of space' could not be interpreted as a sanction for espionage activities in outer space." U.N. COPOUS, *supra* note 140, at 14.

[152] Outer Space Treaty, *supra* note 1, art. XII.

hoped that outer space would be a welcoming, cooperative environment.[153] Rather, space operations remain rather secretive.

While not all of the OST articles are mentioned here, those noted above will be the ones focused on by this Article as they are the ones which can be built upon through international cooperation in outer space operations. Each one of the Articles above represents a belief so foundational that it has united countries across all political lines, but from these beliefs insurmountable differences have now emerged. The OST laid the framework for space law, but it also laid the foundation for some big controversies. The subsequent space agreements identify and build upon those points of unification, while the failure of the Moon Agreement to receive ratification by the major spacefaring States illustrates the climax of embedded controversies.

B. Breakdown of International Consensus: The Moon Agreement

i. The Agreement

The Moon Agreement begins by recalling the four previous space treaties.[154] It then emphasizes the "need to define and develop the provisions of these international instruments . . . having regard to further progress in the exploration and use of outer space."[155] Having stated its goals, the Agreement then lays out a radically monist regime—one which would soon be rejected by most spacefaring nations. The Moon Agreement applies to the Moon and all celestial bodies within our solar system.[156] Theoretically, operations outside of the solar system would not be subject to this agreement.

Building on the sentiments of the previous documents, the Moon Agreement proclaims that operations conducted on the Moon

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[153] "The number of states actively engaging in space activities was bound to grow and it could not be a matter of indifference to any State if outer space was allowed to become a further source of international tension rather than a new opportunity for human cooperation." U.N. COPUOS, *supra* note 140, at 11.

[154] The Moon Agreements aims to build on the principles laid down in the Outer Space Treaty, the Rescue Agreement, the Liability Convention and the Registration Convention. *See* Moon Agreement, *supra* note 5, at Annex.

[155] *Id.*

[156] *Id.* at art. 1.

and other celestial bodies shall be carried out in accordance with international law, "in the interest of maintaining international peace and security and promoting international cooperation and mutual understanding and with due regard to the corresponding interests of all other States Parties."[157] It elaborates that the Moon shall be used "exclusively for peaceful purposes."[158] "[E]stablishment of military bases, installations and fortifications, the testing of any type of weapons and the conduct of military manoeuvres on the Moon shall be forbidden."[159] However, the use of military personnel for scientific research or for any other peaceful purpose shall not be prohibited.[160]

Beginning in Article 4, the Moon Agreement becomes increasingly more monist with explicit safeguards against first-mover advantage. It declares the Moon to be "the province of all [hu]mankind" and mandates due regard "be paid to the interests of present and future generations . . . to promote higher standards of living and conditions of economic and social progress and development . . . ."[161] States are mandated to inform the United Nations of their activities concerning the Moon.[162] They must also share results of scientific research on a prompt basis,[163] notify other States operating in the vicinity of where they themselves intend to conduct space activities[164] and publicly share any information they find or develop related to danger to human life or evidence of organic life.[165]

While the Moon Agreement gives State parties the right to collect and remove mineral samples on the Moon, a State that does so has an obligation to make a portion of the sample available to other interested State parties.[166] Article 6 provides that State parties may use only as much outer space material as is appropriate for the support of a given mission.[167] Environmental protection measures

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[157] *Id.* at art. 2.
[158] *Id.* at art. 3.
[159] *Id.* at art. 3(4).
[160] Moon Agreement, *supra* note 5, at art. 3(4).
[161] *Id.* at art. 4(1).
[162] *Id.* at art. 5(1).
[163] *Id.*
[164] *Id.* at art. 5(2).
[165] *Id.* at art. 5(3).
[166] Moon Agreement, *supra* note 5, at art. 6(2).
[167] *Id.* at art. 6(2).

are also imposed as a national responsibility and must be reported to the United Nations.[168]

Article 8 goes further in mandating that activities of States "shall not interfere with the activities of other State Parties on the Moon."[169] It continues in Article 9 with the immediate notification requirement of any stations, demanding they be installed in a manner that does not impede the free access to all areas of the Moon.[170] Emergency assistance from the international community is ramped up by Article 10's "shall offer shelter" provision.[171]

The most contentious portion of the Moon Agreement begins in Article 11, declaring that the "Moon and its natural resources are the common heritage of [hu]mankind . . . ."[172] Article 11 explicitly prohibits national appropriation by any means.[173] Not only does it forbid State ownership, it also forbids appropriation by any entity or natural person.[174] In addition, it prevents adverse possession by stating that structures erected on the Moon "shall not create a right of ownership over the surface or the subsurface of the Moon or any areas thereof."[175] Most notably, Article 11 imposes an obligation on State parties to establish an international regime to govern the exploitation of the natural resources of the Moon.[176] Such a regime was, and is, considered a deal-breaker for larger spacefaring nations who could already see space mining on the horizon of their commercial industries.[177]

Finally, Article 15 provides for open access to the facilities of all other State parties so each State may assure itself that others are complying with the Moon Agreement.[178] This requirement that all Moon facilities be open to other States Parties is a significant

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[168] *Id.* at art. 7.
[169] *Id.* at art. 8(3).
[170] *Id.* at art. 9.
[171] *Id.*
[172] Moon Agreement, *supra* note 5, art. 11(1).
[173] *Id.* at art. 11(2).
[174] *Id.* at art. 11(3).
[175] *Id.* at art. 11(3).
[176] *Id.* at art. 11(5).
[177] The "controversial 'Moon Treaty' elicited heavy opposition from U.S. business and scientific communities because, critics charged, it would have prohibited commercial development in outer space . . . ." L5 News, *UN Moon Treaty Falling to US Opposition Groups*, NAT'L SPACE SOC'Y (Mar. 1982), https://space.nss.org/l5-news-un-moon-treaty-falling-to-us-opposition-groups/.
[178] Moon Agreement, *supra* note 5, art. 15(1).

disincentive for those States that would likely be the first to build on the Moon. Essentially, were they to go ahead and engage in Moon colonization or construction, these States could lose competitive advantages in intellectual property by being forced to allow less technologically advanced nations access to their facilities.[179] Article 15 also provides that any aggrieved party is to request consultations and both sides are to seek a mutually beneficial settlement.[180] Each side is to enter consultations without delay. The Moon Agreement fails to create an international regime for dispute settlement and simply directs those who cannot reach a settlement to the United Nations Secretary General.[181]

ii. Differing Opinions on Appropriation

Widespread international consensus in outer space died alongside the Moon Agreement as two schools of thought emerged: 1) the larger, predominantly spacefaring nations' conception that resource extraction by private entities does not rise to the level of State appropriation;[182] and 2) the mostly non-spacefaring countries with little or no access to space belief that anything so extracted is an appropriation in violation of the OST.[183]

The larger, spacefaring States refused to ratify the Moon Agreement in the face of policies they feared might limit their corporate markets.[184] These States felt they would be risking significant costs for minimal or non-existent gain, as other States could free-ride and simply demand access to their facilities, scientific findings and other proprietary information through the Article 11 regime.[185] These countries feared such a market would have great

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[179] US opposition groups expressed fear that the treaty "would have 'socialized' future lunar and planetary bases and space stations." L5 News, *supra* note 177.

[180] Moon Agreement, *supra* note 5, art. 15.

[181] *Id.* at art. 15(3).

[182] *See supra* note 145. *See also* Abigail D. Pershing, *Interpreting the Outer Space Treaty's Non-Appropriation Principle: Customary International Law from 1967 to Today*, 44 YALE J. INT'L L. 149, 160-61 (2019).

[183] As early as 1966, a Belgian delegate stated "his country had taken note of the interpretation of the term 'non-appropriation' advanced by several delegations-apparently without contradiction-as covering both the establishment of sovereignty and the creation of titles to property in private law." Pershing, *supra* note 182, at 156.

[184] L5 News, *supra* note 177.

[185] *Id.* "Opponents predicted that this new authority would likely be a body in which developed countries would potentially be outnumbered and outvoted; and therefore, as a

difficulty attracting investment.[186] Due to this perceived economic risk, spacefaring nations likely feared the loss of such competitive advantage by first movers in the industry would stifle any commercial attempts to conduct space operations.[187]

In light of such economic concerns, most of the larger States ultimately refused to ratify the Moon Agreement. As the larger, spacefaring States backed away, the non-spacefaring ones became even more concerned about their ability to capitalize on space based natural resources.[188] Non-spacefaring States, which are often smaller or developing countries, have little to no access to space. Moreover, export controls prevent many non-spacefaring States from buying their access to space as larger, more powerful States are seemingly reluctant to share what they see as a competitive advantage. As their opportunities to reach space are few and far between, non-spacefaring States cannot be blamed if they feel their only hope is to press for a more centralized international regime under which they can receive increased bargaining power, or alternatively, actual access to space resources.[189]

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body predominantly controlled by developing countries, this new authority would insist on technology transfer and payment of international taxes as part of the new 'regime' of lunar exploration." Timothy G. Nelson, *The Moon Agreement and Private Enterprise: Lessons from Investment Law*, 17 ILSA J. INT'L & COMPARATIVE L. 393, 397 (2011).

[186] The proposed regime created a "specter of a private actor, having spent millions (or billions) on research on exploration and prospecting, suffering 'ex post facto' appropriation of their investments by a nebulous future international regime' with power to tax or veto any future exploitation of the very resources the private actor had just located." Nelson, *supra* note 185, at 399.

[187] "[I]ndustrialized nations still fear sharing resources because it reduces the return on their investment and acts as a disincentive." Jeremy L. Zell, *Putting a Mine on the Moon: Creating an International Authority to Regulate Mining Rights in Outer Space*, 15 MINN. J. INT'L L. 489, 513 (2006).

[188] "[T]he 'common heritage of [hu]mankind' was aggressively embraced by developing nations . . . [who interpreted] the principle that celestial body resources are the common property of all the nations, and to require international control of celestial body resources for the purpose of redistributing wealth and technology among nations." Nelson, *supra* note 185, at 397.

[189] Pershing, *supra* note 182, at 170. *See also* Nelson, *supra* note 185, at 397.

IV. WHERE INTERNATIONAL SPACE LAW STANDS TODAY

A. Demanding Respect for the Private Actor

Once upon a time, the very thing that drew States together in support of the space treaties was their outright respect for State sovereignty.[190] The signatory States bonded together as they respected each other's right to not be constrained by the courts of another in resolving disputes while also giving concessions such as a one-year statute of limitations on claims for compensation.[191]

Nowadays, it seems the divide comes not from the lack of respect of sovereigns, but from the lack of respect for the rights of non-governmental and private entities. Larger States with rapidly advancing commercial space industries refuse to adhere to an interpretation they believe will stifle the progress of such entities merely because other States, who often lack such industries, interpret Article II differently.[192] Even large States, such as Russia, who initially were critical of the US SPACE Act and private appropriation of extracted resources, are beginning to believe they must follow in the wake of the US policies.[193]

As the smaller States become more rigid in their views, larger ones have opted for unilateral action. Given the legal limitation of any international regime, States such as the US feel they can shift the interpretation of OST Article II through State practice, which

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[190] When the Committee on the Peaceful Uses of Outer Space engaged in the task of drawing up international agreements governing the activities of States in outer space, "the Sub-Committee would have to bear in mind the fact that contemporary international law and the Charter both recognized the principle of the sovereignty of national States . . . ." U.N. COPUOS, *supra* note 140, at 19.

[191] Liability Convention, *supra* note 137, art. X.

[192] *See, e.g.,* US rejection of claims its SPACE Act violates Article II of the Outer Space Treaty by allowing personal claims of ownership over celestial resources. Bozzo, *supra* note 10, at 641. *Cf.* Brazil and Russia's statements accusing the US of "acting unilaterally with 'total disrespect for international law order [sic]' in enacting legislation that contains 'inconsistencies' with the Outer Space Treaty (OST), specifically the Article II prohibition of national appropriation." Sundahl, *supra* note 142 (internal citations omitted).

[193] "Even as Russia's official position on asteroid mining is that it is forbidden under the 1967 OST – which states that space is the 'province of [hu]mankind' – the Russian industry players are of the view that they must follow the lead taken by the US and Luxembourg." Mallick & Rajagopalan, *supra* note 145.

becomes widely accepted as law.[194] With no higher authority to rule on the validity of a given interpretation, the larger States claim their interpretation of the treaty is the correct one. After all, what other State or organization has the power to contradict them in a meaningful way? As unilateral action continues, and smaller States fear they will never be able to access such resources, the divide between the two schools of thought grows ever deeper.

B. Examples of Unilateral Action: US & Luxembourg

The recent passage by the US of the US Space Act[195] is an example of unilateral action in the face of the growing resource utilization debate. The most relevant portion of the Act reads as follows:

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[194] "[T]he United Nations has acknowledged that '[t]o determine the existence of a rule of customary international law and its content, it is necessary to ascertain whether there is a general practice accepted as law.' These two element—(1) a general and consistent State practice that is (2) widely accepted as law (*opinion juris*)—constitute the basis for determining whether customary international law exists . . . . This two-element approach is widely supported by State practice and has been accepted for the purposes of establishing evidence of customary international law in international tribunals."

Pershing, *supra* note 182, at 153 (internal citations omitted). *See also* Bozzo, *supra* note 10, at 642 ("[H]ow party nations behave in the wake of an international treaty can be indicative of both the intent and the effect of the treaty itself.").

Some believe the US is seeking to achieve the necessary widespread acceptance of its resource extraction rules through its new set proposed bilateral agreements it calls the Artemis Accords. Description of the Accords, details of which have not been released to the public at the time of this writing, indicate that they aim to build upon the universally accepted principles of the Outer Space Treaty, while clarifying new principles specifically relevant to resource utilization and noninterference in commercial operations. *See The Artemis Accords,* NASA, https://www.nasa.gov/specials/artemis-accords/index.html#:~:text=International%20space%20agencies%20that%20join,which%20facilitates%20exploration%2C%20science%2C%20and (last visited July 12, 2020) [hereinafter Artemis Accords]. Henry Hertzfeld, director of the Space Policy Institute at George Washington University, believes "the U.S. may be seeking to unilaterally define aspects of space law" in light of the Accords' Proposed Principles and President Trump's April 6, 2020 Executive Order on Encouraging International Support for the Recovery and Use of Space Resources. Leonard David, *NASA Proposes New Rules for Moon-Focused Space Race*, SCI. AM. (May 21, 2020), https://www.scientificamerican.com/article/nasa-proposes-new-rules-for-moon-focused-space-race/?print=true.

[195] 51 USC. § 51303 (2018). The Act has since been expanded upon by Exec. Order No. 13914, 85 Fed. Reg. 20381 (Apr. 6, 2020) ("Americans should have the right to engage in commercial exploration, recovery, and use of resources in outer space, consistent with applicable law.").

> A United States citizen engaged in commercial recovery of an asteroid resource or a space resource under this chapter shall be entitled to any asteroid resource or space resource obtained, including to possess, own, transport, use, and sell the asteroid resource or space resource obtained in accordance with applicable law, including the international obligations of the United States.[196]

Many critics, such as Brazil and Russia, felt this act violated international law, primarily Article II of the OST, by "legalizing" appropriation of outer space by nationals of the US.[197] The US felt it must pass such legislation to ensure growth of its domestic commercial space industry in the face of uncertainty in interpretation of the Outer Space Treaty.[198]

In August 2017, Luxembourg "became the first European country that officially allows space resources to be "appropriated" by commercial groups based in the country."[199] According to Luxembourg's Deputy Prime Minister Etienne Schneider, the idea was to attract lucrative new space industries away from the US.[200] "Luxembourg's idea is to spur investment by removing regulatory uncertainty," because the 1967 Outer Space Treaty does not expressly condone or forbid mining.[201] Since the law was enacted, more than 60 space start-ups have asked to set up shop in Luxembourg.[202] Start-ups like these, according to Goldman Sachs, have

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[196] *Id.*

[197] Sundahl, *supra* note 142. Critics of the US Space Act argue this legislation violates the Outer Space Treaty by creating laws allowing for personal claims of ownership over celestial resources. They find these rights analogous to the claims of sovereignty and national appropriation prohibited by Article II. Bozzo, *supra* note 10, at 641.

[198] "By removing the regulatory unknowns that suppress and repel investment, this bill unleashes and incentivizes the creativity that leads to unknown breakthroughs in innovation." Jeff Foust, *House Passes Commercial Space Bill*, SPACENEWS (Nov. 16, 2015), https://spacenews.com/house-passes-commercial-space-bill/. *See also* Bozzo, *supra* note 10, at 642 (The US passed the SPACE Act to clarify that a distinction exists between national appropriation and private claims of property rights.); Exec. Order, *supra* note 195 ("Uncertainty regarding the right to recover and use space resources, including the extension of the right to commercial recovery and use of lunar resources, however, has discouraged some commercial entities from participating in this enterprise.").

[199] Aliya Ram, *US and Luxembourg Frame Laws for New Space Race*, FINANCIAL TIMES (Oct. 19, 2017), https://www.ft.com/content/af15f0e4-707a-11e7-93ff-99f383b09ff9.

[200] *Id.*

[201] *Id.*

[202] *Id.*

attracted $13.3 billion in investments since 2010.[203] Stable governance and a well-managed economy have also contributed to attracting foreign talent and investments to Luxembourg.[204]

Both the US and Luxembourg passed domestic legislation to reduce regulatory uncertainty and spur the growth of their domestic commercial space industries. According to one industry representative, "US and Luxembourg laws provide certainty for our industry and for our investors and allow us to focus our efforts on technology and mission development."[205] By removing this uncertainty, countries such as the US and Luxembourg have opened the door for their domestic aerospace companies to compete.

V. PROPOSED SOLUTION TO LACK OF INTERNATIONAL CONSENSUS IN SPACE LAW

As aerospace companies compete, new and powerful technology is created. The competition of such commercial actors has seen an exponential increase in commercial space assets since the time the OST was agreed.[206] Unfortunately, the concentration of these companies tends to be in States that have already achieved access to space. Not surprisingly, each State producing space technology demands to regulate the flow of space technology given its dual-use capability as a military asset. As the more developed States closely guard such technology, those without it feel they are at a disadvantage as they cannot access resources in outer space. The non-spacefaring States fear the resources in outer space may be completely used up before they even reach orbit.[207] Their lack of a

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[203] *Id.*

[204] Autry, *supra* note 123.

[205] Ram, *supra* note 199.

[206] STEVE LAMBAKIS, FOREIGN SPACE CAPABILITIES: IMPLICATIONS FOR US NATIONAL SECURITY 4 (National Institute for Public Policy, Sept. 2017).

[207] Developing nations argue that an international regime in outer space based on a first-come, first-served theory of property acquisition should be feared. "By the time space-incapable nations develop the technological prowess and capital reserves to fund meaningful development of outer space, the earlier spacefaring nation left unchecked, might already have locked up the most accessible and valuable resources." Ezra J. Reinstein, *Owning Outer Space*, 20 NW. J. INT'L. L. & BUS. 59, 64 (1999). Many warn against what they see as a "space gold rush." Pershing, *supra* note 182, at 161. "Without an internationally agreed-upon principle to guide State and private practice, . . . norms [such as equitable access and peaceful use] could become unobtainable and the fundamental spirit of the Outer Space Treaty would again be violated." *Id.* at 170. Proponents

domestic space industry only further hampers a non-spacefaring State's ability to reach outer space. Thus, many countries are left on the outside looking in, for want of access to space-related technology.

Even States without the ability to access space themselves seek to obtain space-related technology such as satellites due to their countless benefits.[208] Satellites provide countless resources, including weather monitoring capabilities; early warning systems and disaster response guidance; world-wide communications; atomic clocks for stock exchanges; GPS; and of course, military guidance and other systems.[209] In addition to the advantages of satellites, the lucrative concept of space objects mining natural resources from celestial bodies has recently arisen. As room for objects in orbit dwindles,[210] and the number of space objects rises rapidly, those States without space assets have become adamant about gaining entry to space.[211] Without domestic capacity to launch a space object, their natural progression is seeking to purchase one.

By prohibiting foreign purchases and investment, US export controls damage the US economy as well as international relations. The unwillingness of spacefaring States to share technology can be changing non-spacefaring States' view of international relations to

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of today's Artemis Accords have echoed the same sentiment. David, *supra* note 194 ("Whether or not these potential resources are developed on a first come, first served basis to the exclusion of others depends, to some degree, on how, and if, the Artemis Accords or other similar policy suggestions are adopted.").

[208] "In Ghana, Sky and Space Global (SAS) has [recently] signed a five-year deal with telecoms provider Universal Cyberlinks to help government agricultural projects and public services, including monitoring cocoa production across 5,000 buying centres and checkpoints." Tim Bowler, *The Low-cost Mini Satellites Bringing Mobile to the World*, BBC NEWS (Feb. 23, 2018), https://www.bbc.com/news/business-43090226.

[209] LAMBAKIS, *supra* note 206, at 3.

[210] *See, e.g.,* Carol R. Buxton, *Property in Outer Space: The Common Heritage of Mankind Principle vs. the First in Time, First in Right, Rule of Property,* 69 J. AIR L. & COMM. 689, 700 (2004) (Noting that "satellite orbit slots could become a finite resource, as an orbit slot can only accommodate a fixed number of satellites."); Reinstein, *supra* note 207, at 64 ("The GSO [Geo-Stationary Orbit], however, limited to a narrow band 35,800 km above the equator, is already cluttered, both with electromagnetic interference from rival satellites – of which there are more than 750 – and with 'space-junk,' debris from past launches that threatens to rip holes in the orbiting equipment.").

[211] "[Nigeria] said it was no longer disputed that space technology was imperative to sustainable development." U.N. GAOR, 66th Sess., 4th Comm., 9th mtg., U.N. Doc. GA/SPD/485 (Oct. 13, 2011). "Malaysia had continued to seek out opportunities to collaborate globally in the peaceful uses of outer space." *Id.*

a zero-sum-game[212] rather than a collaborative effort. Under such a mindset, these States may come to see every successful space mission of another State as detrimental to their own. Rather than striving for cooperation, States may strive instead to continually best their international peers. They could come to believe the gain of others inherently means some sort of loss occurred on their part. A zero-sum-game mindset greatly hampers globalization as it emphasizes one's own best interests above the interests of others.

The zero-sum environment could leave non-spacefaring States even less willing to compromise on their strict interpretation of OST Article II prohibiting private property rights. Rather, as their industries attempt to compete, these States may feel they must actively try to utilize international lawmaking regimes to slow down those more advanced than themselves. The Moon Agreement is a classic example of such action, proposing a regime to govern resource extraction which includes "[a]n equitable sharing by all States Parties in the benefits derived from those resources, whereby the interests and needs of developing countries . . . shall be given special consideration."[213] The OST also had clear protections on freedom of access and exploration in space.[214] Many States now feel they must interpret those provisions in a way which prevents private entities from appropriating resources through operations such as mining.[215] These States do so out of fear that they might miss out on potential space resources in light of domestic authorizations for private appropriation such as the US Space Act.[216]

While export controls often serve as barriers to outer space entry, the relaxing of such controls can actually provide substantial benefits to both the US as well as foreign consumers and investors. International trade is sure to increase in the face of US export control relaxation. As the controls are relaxed, such trade gives rise to economic interdependency as each State's commercial space sector specializes its labor. Economic interdependency then gives rise to

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[212] "A zero-sum game is a situation, especially a competitive one, in which there is no net gain among the participants. If one gains, it means others have to lose an equivalent amount." *Zero Sum Game*, GRAMMARIST, https://grammarist.com/usage/zero-sum-game/ (last visited May 13, 2020).

[213] Moon Agreement, *supra* note 5, art. 11(7)(d).

[214] Outer Space Treaty, *supra* note 1, art. I.

[215] *See, e.g.*, Bozzo, *supra* note 10, at 641.

[216] *See* Reinstein, *supra* note 207, at 64.

globalization, which dramatically increases the prevalence of States' desire to solve disputes diplomatically as well as the prevalence of international cooperation. As joint operations occur, those participating can once again embody the principles laid down through international agreement in the OST. Such embodiment of OST principles, coupled with increased cooperation, may just be the answer to re-igniting the consensus once found within international space law.

A. Export Controls Damage International Relations and the US Economy While Failing to Achieve Their Own Objectives

Restrictive export control regimes, such as the USML, often prevent other countries from accessing domestically produced outer space technology. Countries with less advanced domestic space industries often seek assistance from the international community. Export controls act as barriers to such assistance by inhibiting US vendors from selling space objects or technology essential to foreign objects or interests. Without the ability to seek help from US firms, a country is forced to either painstakingly produce the part or component domestically or find somewhere else to buy it. Unfortunately for those without launch capability, non-US suppliers are often more expensive. Additionally, States other than the US might not be able to sell such technology either due to the reexport license requirements of ITAR.[217]

In order to truly grasp the effects of the restrictive US export control regime, one need only look to the past twenty years of USML/CCL application and the after-effects of each major reform. The 1999 Defense Authorization Bill moved satellites and related items from the CCL to the USML.[218] Effects like those of the 1999 shift can push other countries towards a zero-sum-game mentality under which they competitively guard their own industries while fighting for outer space access. Due to such unforeseen consequences, export controls may often hurt more than they help by creating distrust between nations. Relaxing such controls will increase

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[217] *See* 22 C.F.R. § 120.1 (2019).

[218] Strom Thurmond National Defense Authorization Act for Fiscal Year 1999, H.R. 3616, 105th Cong. § 1513(a) (1998). *See also* Foust, *supra* note 6.

accessibility for other nations through greater international trade, thus benefitting both the US and others.

Throughout history, the US has pressed other States toward the zero-sum-game mentality by refusing to share satellite technology or remote sensing data subject to ITAR. Some of these States are even significant US allies. During and after the Yom Kippur War, for instance, the US denied Israeli requests for satellite "services," purchase of a $1 billion satellite system and "full and equal access" to an existing US satellite.[219] Israel was a small country surrounded by enemies and requested access to remote sensing data and satellites so they could prepare defenses. For the Israelis, "the enhanced warning capabilities provided by satellites meant survival."[220] However, the US withheld such information and access, creating to a "zero-sum" mentality which ultimately resulted in the US and Israel competing against one another.

Had the US allowed Israel to purchase a satellite, or to access remote sensing data, Israel would have been able to achieve its goal of remote sensing capability much more quickly and easily. Because of the US denial, Israel was forced to take unilateral action. "For the Israelis, the lesson was immediate and unmistakable: they would have to acquire an independent space reconnaissance capability."[221] As Israel was unable to purchase its way into a remote sensing network, they turned their focus to producing one domestically rather than seeking cooperation with others. While the war occurred in 1973, it was not until 1995 that Israel was able to satisfy its desire of an independent space reconnaissance capability.[222] The US refusal to sell satellites to Israel slowed its entry into outer space by over twenty-years, but ultimately resulted in a greater proliferation of sensitive technology (via the Israeli development of its own systems) than would have occurred if the US *had* agreed to sell to Israel. Because of the US stance, Israeli officials, already surrounded by enemies, viewed the US remote sensing network as something they must compete with rather than utilize as they were not given much access. Such an isolationist mentality makes

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[219] E.L. Zorn, *Israel's Quest for Satellite Intelligence*, CIA (Aug. 3, 2011), https://www.cia.gov/library/center-for-the-study-of-intelligence/kent-csi/vol44no5/html/v44i5a04p.htm#Author.

[220] *Id.*

[221] *Id.*

[222] *Id.*

countries like Israel much less willing to cooperate with others in the international space community.[223]

Other States were forced to simply look elsewhere as they could not feasibly expect domestic production of certain technologies. Rather than purchase from vendors subject to ITAR, many foreign consumers opt to focus on "ITAR-free" designs.[224] One US firm complained, "international customers . . . constantly tell them 'they will always buy a non-US sourced part even for substantially more money to avoid [the] EAR and especially ITAR.'"[225] While "some European governments and companies [are] adopting 'ITAR-free' as either an express policy or informal practice;" even "US companies have endeavored to develop ITAR-free product lines in order to remain competitive in European Markets."[226] Some British divisions of American-owned companies even went as far as to adopt "an unofficial and unstated 'Buy American Last' policy due to unsatisfactory experiences with the US export control bureaucracy."[227] In effect, the US was unintentionally surrendering the benefits of domestically built products as they became more difficult to export. As foreign industries moved away from US aerospace products, their States (who were not at all targets of the 1999 export control change) lost the benefits of access to affordable American goods and services.

By slowing down the ability of US aerospace firms to trade overseas, export controls inadvertently slowed down the US domestic industry. "Prior to the change in export controls in 1999," one author notes, "the US dominated the commercial satellite-

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[223] Note that Israel merely competes with US remote sensing from a commercial standpoint. Neither Israel, nor Palestine, have to fear the US remote sensing companies will sell sensitive images of their country due to the Kyl-Bingaman Amendment to the US National Defense Authorization Act. "It prevents US satellite operators and retailers from selling or disseminating images of Palestine-Israel at a resolution higher than that available on the non-US market." Zena Agha, *The US Law Restricting Satellite Imagery of Palestine-Israel,* ALSHABAKA (July 21, 2019), https://al-shabaka.org/memos/the-us-law-restricting-satellite-imagery-of-palestine-israel/.

[224] *See* Nadine Tushe, *US Export Controls: Do They Undermine the Competitiveness of US Companies in the Transatlantic Defense Market?,* 41 PUB. CONT. L. J. 57, 69 (2011).

[225] *Id.* at 70.

[226] *Id.*

[227] *Id.*

manufacturing field with an average market share of 83 percent."[228] The 1999 Defense Authorization Bill moved satellites and related items from the CCL to the USML.[229] By 2006, "the [US] market share ha[d] declined to fifty percent."[230] The rules drove "small suppliers out of the US export marketplace as they usually lack the economies of scale to respond properly to export requirements."[231] The designation made it difficult for remaining US companies to export items even to close allies as similar items became widely available outside the US.[232] Further, it incentivized foreign firms to participate in the "ITAR-Free" movement where manufacturers could "design out US origin space-related items and technology to avoid application of the 'ITAR See-Through Rule.'"[233]

Avoidance of US aerospace products meant big losses for both private firms and the US economy as a whole. "Nearly all members of the space community, foreign and domestic, consider the US export control rules to be burdensome and onerous."[234] Consumers easily went somewhere else for their needs, as "the controls that the United States unilaterally imposes through ITAR and the EAR are often more demanding than individual country and multilateral export control regimes."[235] After the 1999 change, the "US launch industry revenues dropped from $2.7 billion in 2000 to $1.5 billion in 2005," and similarly, "satellite manufacturing revenues fell from $6 billion to $3.12 billion in 2004."[236] As noted previously, an animosity was born between aerospace purchasers and ITAR subject firms, with many instituting unofficial "Buy American Last" policies.

Not only did the regulations scare off buyers, but they often "discourage[d] US bidding on contracts that might have large ITAR problems, such as Koreasat 5, due to its 'combined military and civil

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[228] Ryan Zelino, *The Effects of Export Control on the Space Industry*, THE SPACE REVIEW (Jan. 16, 2006), https://www.thespacereview.com/article/533/1. *See also* Long, *supra* note 81, at 52.

[229] Foust, *supra* note 6.

[230] Zelino, *supra* note 228. *See also*, Long, *supra* note 81, at 52.

[231] James D. Rendleman, *Brave New Worlds of Hosted Payloads*, J. SPACE L. 129, 168 (2013).

[232] Foust, *supra* note 6.

[233] Goldstein, *supra* note 134.

[234] Rendleman, *supra* note 231, at 168.

[235] Tushe, *supra* note 224, at 68.

[236] P.J. Blount, *The ITAR Treaty and Its Implications for US Space Exploration Policy and the Commercial Space Industry*, 73 J. AIR L. & COM. 705, 712-13 (2008).

uses.'"[237] One 2006 article noted, "US satellite manufacturers have loss [sic] somewhere between $2.5 and $6.0 billion since 1999 due primarily to ITAR regulations."[238] In essence, the US control regime was so complex that even domestic firms became afraid to sell and foreign firms simply used parts from elsewhere to avoid cumbersome licensing procedures. Due to ITAR regulations, a majority of firms simply either built their own technology or purchased it elsewhere free of US export controls.

Forcing a country to either build its own aerospace parts or space technologies, or find somewhere else to purchase these items can be dangerous to the US. Indeed, "[s]ome have argued that unreasonable export controls are in fact jeopardizing US security because they encourage non-Americans to either develop an indigenous capability or to seek the technology elsewhere."[239] The goal of export controls is to prevent transfer of sensitive technology, but this goal cannot be obtained should suspect purchasers simply buy "ITAR-Free," since, "[u]nlike purchases from American industry, which may be monitored and regulated, the US government has no control over these activities."[240] One study of Canadian firms found that "71% of the respondents reported that they had conducted internal R&D to compensate for the restricted access to US space technology."[241] The US would be better off relaxing export controls and bringing in more business for its domestic industries, as this would allow the federal government to retain some aspect of control over these transactions, rather than being completely in the dark. Relaxation would bring in federal tax revenue, boost the domestic space economy and improve access of other States to essential technologies. Further, export controls also "drive[] a wedge between the United States and its allies . . ." especially in the case of reexport controls.[242] Such a wedge may potentially be more damaging than the negative economic effects.

Arguably more important than the trade relationships, international alliances and cooperation also suffered in the wake of the

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[237] *Id.* at 714.

[238] Zelino, *supra* note 228.

[239] Eric Choi, *The Impact of US Export Controls on the Canadian Space Industry*, 22 SPACE POL'Y 29, 33 (2006).

[240] *Id.*

[241] *Id.*

[242] *Id.*

1999 transfer of items from the CCL to the USML. "Overly restrictive US export policies have chilled collaboration on defense and technology matters with even our closest allies, and the resulting tension has eroded trust with traditional partners."[243] Such erosion of trust has pushed countries back to the zero-sum mindset of old as they became more standoffish towards others. Put simply, "[t]he rules undermine international partnerships."[244] One example of export controls creating animosity comes from reexport licenses.

The ITAR re-export license requirement also prevents other States from selling or retransferring items subject to the USML even once they are no longer owned by a US entity. Re-export licensing became a dividing wedge between the US and Canada—one of its closest allies. Before 1999, there was an exemption allowing relatively free transfer of space and defense related technologies across the US–Canadian border.[245] Exceptions such as this one, mirrored by today's STA licensing exception,[246] provide easy access to crucial systems for friendly nations. In April 1999, the Canadian exception was suspended for fears that "Canadian companies had retransferred technology to a number of countries against which the USA maintains embargoes, including China, Sudan, Libya and Iran."[247] While this exception has essentially been reinstated today, under the STA, substantial harm to the US space industry still occurred as consumers of US aerospace technology went elsewhere.

Due to licensing conflicts, several foreign based consumers of American space technology simply moved on to other suppliers, costing US firms billions: "US firms lost an estimated US $5 billion over the first 18 months [of the more stringent export control restrictions]."[248] Telesat Canada launched a mission aboard its first spacecraft purchased outside the US in 2005 and worked closely with its manufacturer to "ensure that it would not be dependent on US components."[249] Elsewhere, "Chinese satellite operators have avoided satellites with ITAR controls, Arabsat awarded two satellites to Astrium over Lockheed Martin (Arabsat's usual vendor) . . .

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[243] Tushe, *supra* note 224, at 72.
[244] Rendleman, *supra* note 231, at 168.
[245] Eric Choi, *supra* note 239, at 30.
[246] *See supra* note 117.
[247] Choi, *supra* note 239, at 30.
[248] *Id.* at 31.
[249] *Id.* at 33.

and Intelsat has awarded a satellite contract to Astrium to avoid the implications of ITAR."[250] Despite recent implementation of the ECR, significant damage had already been done to the business relationships of foreign consumers and US producers. Additionally, not just private sector cooperation suffered: "In 2005, the European Space Agency pulled out of a joint venture with NASA for a Mars rover because ITAR would '[make] cooperation too complicated to be feasible.'"[251] Finding ways to facilitate international trade in the space sector, such as the 2013 move of items from the USML to the CCL,[252] are vital to both US interests as well as foreign ones.

China, the primary target of Congress' decision to transfer of satellites from the CCL to the USML in the late 1990's, represents a country that "the USML has not prevented . . . from gaining the technology; [rather] it has encouraged them to find satellites from other sources and create them on their own."[253] Thales Alenia, a European satellite producer, built a satellite for China which launched in 2012 symbolizing that although "ITAR was modified to include satellites specifically to prevent such an acquisition by China . . . the restrictions have encouraged foreign companies to fill the void."[254] While there has been little consequence to China, "the United States has lost jobs and market share."[255] Not only had the US failed to achieve its policy goal of preventing critical systems from being acquired by the Chinese, it has also shot its domestic aerospace industry in the foot in the process.

Not only has the US undermined its own industries, but it has undermined its international agreements as well through its broad application of the USML. Export controls not only failed to achieve their stated security goals, but also created a new potential animosity among US allies. By increasing access to US-produced outer space systems, data and technical information, the US can not only keep a watchful eye over the technologies, but also build value

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[250] Blount, *supra* note 236, at 714.

[251] *Id.*

[252] Foust, supra note 6.

[253] Long, *supra* note 81, at 54. *See also* David, *supra* note 194 (Joan Johnson-Freese, a professor of national security affairs at the US Naval War College remarked: "The exclusive approach simply propelled China to develop their own technology, and likely faster, than cooperation might have.").

[254] *Id.*

[255] *Id.*

adding alliances through international trade. Many States do not have domestic launch capability, nor the capability to manufacture critical components, but they do have the purchasing power to buy required technologies or to pay for launch services. Should they be able to buy their way into space, these States might feel less inclined to try and limit commercial expansion in space after becoming a part of it. By becoming part of the spacefaring group, such States would also be incentivized to participate in any future international regime securing their rights in outer space.[256] As international trade increases in the space sector, both the US and its consumers benefit. As revenue increases for all in the presence of economic interdependency, international cooperation subsequently increases.

B. Relaxing Export Controls is Beneficial to US Firms, the US Economy and Foreign Consumers/Investors

The US relaxation of its export control regime has proven to be a significant benefit to both the US economy and foreign consumers. Export controls act as barriers to trade by preventing or complicating international transfer of aerospace technology by both foreign and domestic firms. By hampering the flow of business for domestic aerospace firms, the US has also restricted the flow of *its own* international trade. "[S]pace has become a big business, with $300 billion in annual revenue,"[257] and the negative effects from lack of trade due to export controls are experienced by both the US economy, primarily its domestic aerospace firms and the international trade community. Such negative effects have been partially countered through relaxation of US export control policies which focus on increasing international trade. The 2013 transfer of countless items, including satellites, from the USML to the CCL is a

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[256] The Artemis Accords, newly proposed by the US, represent one such opportunity to participate in a new international regime governing the appropriation of space resources which also offers scientific benefits. "The Artemis Accords reinforce that space resource extraction and utilization can and will be conducted under the auspices of the Outer Space Treaty. . . ." Artemis Accords, *supra* note 194. In addition, the Accord partners should vow to "strive to support interoperability" and "release[e] their scientific data publicly to ensure that the entire world can benefit." *Id.*

[257] Matthew Weinzierl, *Space, the Final Economic Frontier*, 32 J. ECON. PERSP. 173, 173 (2018).

prime example of one such policy.[258] Relaxing export controls facilitates international trade, leading to the prevalence of economic interdependency as revenues for all involved to increase.

Being a sector that is worth billions, increasing trade in the commercial space industry brings benefits to both the US and the countries it shares such technology with. "[R]evenues in the space sector have climbed from less than $200 billion in 2005 to more than $300 billion in recent years, with the vast majority of that activity related to satellite technology for telecommunications and other services."[259] Global space revenues from 2018 are estimated at $383.51 billion, "of which $211.45 billion was fully commercial activity."[260] It is critical for American aerospace producers to capitalize on this rapidly growing market, which, as Bank of America Merrill Lynch estimates, "will grow to $2.7 trillion over the next 30 years."[261] The bigger share of the commercial space market any one country gets, the more economic benefit it will inevitably receive through increased trade.

Recent legislation relaxing export controls has helped to ease the aforementioned side effects of the 1999 change. Not until 2013 did the federal government "tak[e] most commercial satellites and components for them off the USML" and place them on the CCL.[262] "Prior to 2014 the US industrial base suffered because it was difficult to export space-related goods and services."[263] After the relaxation of space technology export controls, US firms' participation in the international market dramatically increased as satellites represent a very large share of the commercial space market.[264] This is because "[a]erospace and defense companies rely heavily on the international market for sales."[265]

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[258] Foust, *supra* note 6.

[259] Weinzierl, *supra* note 257, at 179.

[260] Autry, *supra* note 123.

[261] *Id.*

[262] Foust, *supra* note 198.

[263] Debra Werner, *Companies Look to Trump Administration to Further Ease Export Rules for Space Technology*, SPACENEWS (Apr. 17, 2018), https://spacenews.com/companies-look-to-trump-administration-to-further-ease-export-rules-for-space-technology/.

[264] "Approximately $260 billion or 80 percent of the space revenue in the United States in 2016 was related to satellite and telecommunication companies and endeavors." Kristyn Kadala, *The Depths of the Space Industry*, BERKLEY SCI. REV. (Mar. 22, 2019), https://berkeleysciencereview.com/2019/03/space-industry/.

[265] NAT'L DEF. INDUS. ASS'N, *supra* note 109.

Relaxing export controls will help eliminate negative effects on not only US firms, but also foreign consumers of American aerospace goods and services. The executive director of Antrix Corp Ltd., the commercial arm of the Indian Space Research Organization, stated "ITAR is the most challenging and difficult regulation we have to contend with,' claiming that 'there is more risk to non-US players."[266] ITAR "compliance imposes detailed (and expensive) access, record-keeping and training requirements."[267] Relaxing of ITAR controls would significantly reduce production costs. US regulations often also cause extensive delays which can entail significant cost and contractual obligations.[268] British industry leaders over ordered, despite it being unwise business practice, because of the burdens imposed by ITAR.[269] Such impractical business measures would likely be unnecessary under a relaxed export control regime, as many exceptions apply.

Additionally, relaxation could reduce "restrictions on reexports to third countries, a vital issue for a country such as Sweden, which relies on exports and economies of scale to sustain its defense industry."[270] Easing these burden alleviates practical concerns, namely that "dependence on ITAR-controlled systems limits states' ability to modify and adjust their systems to changing missions in real time and repair them without obtaining prior approval from the United States or relying on US suppliers."[271] In summary, relaxation of export controls can help to prevent a product with US components from becoming "comparatively more complicated and more expensive" and presenting more "security-of-supply concerns than an equivalent product outside the US export control regime."[272]

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[266] Blount, *supra* note 236, at 714.

[267] Tushe, *supra* note 224, at 69. Costs of doing business with US firms under ITAR are high as "'[e]ven the most straightforward license or agreement application may involve many hours of work by company staff, requiring reference to external consultants in the more complex cases[,]' with much of staff's time consumed with nonsubstantive changes such as nationality of employees." *Id.* at 67 (citing EXPORT GRP. FOR AEROSPACE & DEFENCE, ITAR REFORM: A CONTRIBUTION FROM THE UK'S EXPORT GROUP FOR AEROSPACE AND DEFENCE 3 (2009)).

[268] Tushe, *supra* note 224, at 68.

[269] *Id.*

[270] *Id.*

[271] *Id.*

[272] *Id.* at 69.

If the US can continue to reform its space technology export controls in such ways, revenue is likely to rise along with international cooperation. "When expectations of future trade are high and improving, however, the expected value from trade will be positive, and peaceful behavior will more likely be preferred."[273] Hansen expands on this concept in depth:

> By projecting a policy of continued cooperation and avoiding unnecessary uncertainties, state leaders may escape the 'trade-security dilemma' where states impose trade restrictions on each other in a spiral-like manner . . . simply because they misinterpreted the intentions of the other states. Conscious and well-executed policies may, in other words, help maintain and increase the momentum of economic exchange as leaders in one state are convinced that their colleagues in other states can be trusted and that they also work to advance the common welfare aim.[274]

It is this sort of cooperation which will lead world leaders to cooperate with one another once again in outer space to yet again uphold the values they once agreed on in the Outer Space Treaty and to break the current gridlock in international consensus.[275]

Projection of a policy of continued cooperation by the US, through easing of export controls, is beneficial to all involved. Both the US and foreign consumers stand to gain financially from a relaxation of the country's export control regime. A healthy export market is crucial for international trade, and international trade is crucial for globalization. When companies of different nations rely on one another for goods or services, the mutual benefit often outweighs the incentive to being hostile. Economic interdependency forms as those companies specialize their labor based on ease of access to foreign technologies. Without export-driven economic interdependency, countries are much less likely to cooperate with one

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[273] Hansen, *supra* note 8, at 307.

[274] *Id.*

[275] The Artemis Accords present an attractive offer for such cooperation. The Accords seek to "establish a common set of principles to govern the civil exploration and use of outer space . . . grounded in the Outer Space Treaty of 1967. . . ." Artemis Accords, *supra* note 194. The Accords also promise to "support interoperability" and "releas[e] [signatories'] scientific data publicly to ensure that the entire world can benefit." *Id.*

another as they have nothing to lose from the souring of relations with the other State.

C. Increased Trade in the Face of Relaxed Export Controls: A Push Towards Globalization of Commercial Space Industries

As demonstrated, the relaxation of US export controls on space technology leads to an increase in international trade within the commercial space sector. Continuous international trade then leads to economic interdependence of commercial space industries as they specialize their own labor according to what components they can purchase overseas. As economic interdependency of commercial space programs increases, globalization prevails over both hostilities and the more protectionist policies of large and small commercial space industries. As revenue rises, so too does the level of international cooperation. As countries cooperate more closely, the tendency for joint operations to occur increases. Relaxation of export controls on space technology increases the likelihood of joint commercial space operations, and joint operations provide mutual benefits which further lead countries toward globalization. With export controls relaxed, countries are no longer afraid to share information.[276] As the flow of information has increased, so do benefits from joint operations as each country can bear expenses while also sharing the benefit of any research, etc. In presence of such agreements, the international community might once again be able to achieve consensus on an international space law regime, or at least customary norms.

Economic interdependence is a system by which many companies, and subsequently their home countries, become economically dependent upon each other through labor specialization.[277] Firms who cannot manufacture a component, focus their efforts on efficiently producing what they are able to make as it is cheaper to purchase what they cannot than attempt to design it from

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[276] The US is a prime example of such conclusion, given it has recently proposed the Artemis Accords calling for increased international cooperation and sharing of data in space since its 2015 change in export control laws. Artemis Accords, *supra* note 194.

[277] *How Does Specialization Lead to Economic Interdependence? (EA)* http://clic.cengage.com/uploads/8a303fc1d0f89763eeebdc28c6346ffa_1_1901.pdf (last visited Apr. 17, 2020).

scratch.[278] Labor specialization occurs frequently in the commercial space industry as countries who cannot produce a specific component or technology of a spacecraft seek it from foreign sources.[279] As companies specialize, they seek increasingly more components from other countries whose industry can produce such items more efficiently.

Just as economic interdependence has significant benefits for private companies and industries, so too does it have a positive effect on the relationship between States. "Commercial liberals argue," for instance, "that a growth in the volume of economic exchange between two or more states may . . . inhibit interstate hostilities. . . ."[280] As Professor Flemming Splidsboel Hansen notes, "[t]he key concept in this argument is 'interdependence: [a]s nations increasingly depend on products, funds, and even security contributed by other states," he writes, "it becomes harder to solve national problems by military means."[281] Under such circumstances, "it is patent that joint international action would be more effective than separate national action."[282] Nations will be encouraged to settle disputes diplomatically and will likely seek to establish some updated set of international norms for outer space, if not a regime, at some point. Trading nations seek to improve their position through a better allocation of resources, "[t]hey need not conflict if the sum of total benefits is increasing."[283] The commercial space industry serves as a perfect vehicle for such interdependence, as it ties together products, funds and security all under one common umbrella.

Increased economic exchange between foreign countries and/or corporations will be the mechanism through which to achieve interdependence. Such exchange occurs through international trade of aerospace goods and services. International deals allow multiple companies, and often multiple countries, to benefit from a single mission or company's presence. One example of such a deal is the Cloud Constellation Corporation of Los Angeles' 2018 $100 million investment from Hong-Kong-based HGH Group to develop Space

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[278] *Id.*
[279] *Id.*
[280] Hansen, *supra* note 8, at 304-05.
[281] *Id.* at 305.
[282] *Id.* at 306.
[283] *Id.*

Belt, a system of secure data satellites.[284] Economic interdependence increases as foreign consumers increasingly seek completed space objects, or their components, from US firms. Increased foreign investment can also lead to interdependence, as US firms benefit from foreign investment quite often.[285]

Cooperation can also take place amongst countries, in addition to agreements between foreign corporations. Rocket Lab, a New Zealand founded company, moved its headquarters to California; Rocket Lab launches from New Zealand, but those launches are governed under US law by the FAA.[286] "Cooperation of this nature is a win-win for the entrepreneurs—New Zealand and the United States."[287] "As a nominally American firm, Rocket Lab will gain access to capital and customers, and is already launching NASA payloads into its orbital class Electron rocket."[288] New Zealand also benefits from conducting launch operations in its territory by "gaining infrastructure and expertise that will likely evolve into independent national capabilities."[289] As cooperation like this increases, so too does the prevalence of joint operations between foreign countries or corporations.

Joint operations allow for multiple countries and/or corporations to benefit from a single firm or mission, while mitigating costs and liability amongst sovereign States. One example of joint operations came in the form of Sea Launch. Sea Launch was a joint venture of companies from Russia, Ukraine, the US and Norway launched in 1995 where the companies operated a launch site atop an oil rig platform.[290] Sea Launch successfully deployed nearly three dozen commercial satellites into orbit between 1999 and 2014.[291] As countries and international corporations work together

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[284] Autry, *supra* note 123.

[285] *See id.* $3.25 billion has been invested in US commercial space startups alone.

[286] *Id.*

[287] *Id.*

[288] *Id.*

[289] *Id.*

[290] Unfortunately, the project was mothballed in 2014 due to crisis in Ukraine, which led to the halt of the production of the system's Russian-Ukrainian produced rockets. *Sea Launch Platform Stripped of Foreign Equipment, Ready to Leave US for Russia*, SPACE DAILY (Oct. 9, 2019), http://www.spacedaily.com/reports/Sea_Launch_platform_stripped_of_foreign_equipment_ready_to_leave_US_for_Russia_999.html.

[291] *Id.*

in this way, those countries will increasingly seek to work out issues through diplomatic channels.

As international cooperation from thriving trade, international aerospace sales and investment occurs, States might once again be willing to expand upon the widely accepted principles expressed in the OST. When firms from less advanced space industries partner with those of spacefaring States, they both uphold OST principles by operating in the benefit and interest of all countries irrespective of development, and by facilitating and encouraging international cooperation.[292] By sharing space technologies through agreements such as the STA exception to the USML, the US is promoting the OST principles of international peace and security, as well as international cooperation and understanding.[293] States and companies operating in joint missions would certainly be guided by the OST principle of cooperation and mutual assistance given they are in a joint agreement for the benefit of both.[294] Lastly, such companies and governments participating in these joint missions might re-invigorate the idealist environment of reciprocally open space installations amongst OST parties as mutual benefit increases.[295]

Given these joint operations uphold the principles nations of the world were able to agree upon long ago, perhaps they will spur further international consensus. Relaxing export controls helps facilitate such economic interdependency. As commercial space sectors become increasingly interdependent, globalization occurs.[296] Globalization causes countries to feel more connected to those abroad and subsequently more willing to cooperate with other nations as countries risk losing economic benefits should relations turn sour.[297] Additionally, as foreign actors increasingly rely on one another for components, the presence of joint operations increases. Nations will not likely condemn commercial expansion in space if they are allowed to be an integral part of such operations. As countries work together, they begin to again embody the OST principles

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[292] Outer Space Treaty, *supra* note 1, art. I.
[293] *Id.*
[294] *Id.*
[295] *Id.*
[296] Hansen, *supra* note 8, at 305-06.
[297] *Id.* at 306.

they once agreed on. As such international cooperation grows, so too does the consensus in international space law.

VI. CONCLUSION

Spacefaring countries such as the US should use the relaxation of export controls in order to open space markets for countries without space access, and in turn, re-ignite the consensus once found in international space law. The US export control regime damages international relations, as well as the US economy. Further, these restrictions often fail to achieve their stated objective: keeping sensitive technologies from certain countries. The controls restrict access to space technologies for foreign public and private consumers and investors. Without access to US produced goods and services, foreign companies and governments are forced to either purchase the items elsewhere or painstakingly figure out how to produce them domestically. US National Security might actually be harmed by this as the federal government has no insight whatsoever into such deals. Re-export controls, among others, have caused serious controversy between the US and even some of its most steadfast allies. The souring of these relations often leads countries to believe the commercial space economy is a zero-sum game, resulting in distrust and animosity between nations. US export controls often damage both the US economy and foreign relations, usually without achieving their stated purpose.

Relaxing the restrictive US export control regime has and will again benefit both the US economy as well as foreign consumers and investors. Space is a multi-billion-dollar industry, and the US commercial aerospace companies can see huge benefits from international business. The negative effects of US export controls are exhibited upon both domestic aerospace firms and the international trade community at large. Luckily, these negative effects can be countered by reform such as the 2013 transfer of thousands of items from the USML to the CCL. The US also has full discretion in adjusting such controls under the GATT. As trade increases, so too will commercial space industries' reliance on one another, leading to a push for globalization over hostilities and protectionism. The US can see great benefit from promoting a policy of cooperation through relaxed export controls and its international effort to clarify the application of the OST principles through the Artemis

Accords. [298] As revenues for all involved increase, so too does such international cooperation. With increased cooperation comes increased willingness of other nations to participate in the Artemis Accords regime protecting such operations in space.

The combination of less restriction on international trade, along with international deals and investment, will push countries of the world toward globalization, and thus, global stability. Increased international trade leads to economic interdependency, and that leads to globalization. Globalization causes international cooperation on a higher level than previously achieved and leads to the increase of joint ventures between entities of different countries. These joint ventures embody the core principles of the Outer Space Treaty that once brought all countries together. As they embody such principles, countries and corporations reap exponential rewards of their joint ventures. Such joint ventures will be the key to re-igniting the since thriving consensus in international space law. With the prevalence of such stability, the countries home to such entities will be increasingly willing to either establish an international regime protecting outer space interests, or at least subscribe to some international norms.

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[298] The US's newly announced Artemis Accords, in the wake of relaxed export controls, is a prime example of such push for globalization over hostility. David, *supra* note 194 ("[W]e, as an international community, need to be prepared to manage activities on the lunar surface in a peaceful, effective and efficient way. The Artemis Accords are the first concrete offering from a spacefaring nation on how to tackle vexatious issues. . . . NASA is anticipating-and planning against-the inevitable onset of competitive, perhaps even commercial, lunar resource extraction and utilization.").

JOHN J. KLEIN, UNDERSTANDING SPACE STRATEGY: THE ART OF WAR IN SPACE

*Review by Jeremy Grunert**

In one of the most iconic science fiction battles of cinema, Luke Skywalker and his comrades in the Rebel Alliance pilot X-Wing starfighters through outer space in what appears to be a suicidal attempt to destroy the Galactic Empire's ultimate weapon: the planet-destroying Death Star. The battle is part aerial dogfight, part suppression of enemy air defenses (SEAD, in military acronym parlance), and, in its most famous sequence (Luke's successful, Force-assisted shot down the Death Star's exhaust port and into its main reactor) part air-to-surface precision strike. With the Death Star's destruction, a key "center of gravity" of the Galactic Empire is eliminated, the Rebellion lives to fight another day, and the Empire's ability to lay waste the galaxy degraded. *Star Wars* certainly sounds like it could present a case-study in outer space warfare, from both the strategic and tactical perspectives. But is space strategy really about epic space battles, laser weapons, and massive space battle stations?

The modern world lacks the technological (and laws of physics-defying) wizardry of a "galaxy far, far away," and despite the public's fantastical, *Star Wars*-inspired vision of what "space warfare" would look like, the reality of military space operations is more mundane. Tracking satellites and space debris, preventing collisions of space objects, using state-of-the-art Earth observation satellites to collect intelligence data across the electromagnetic spectrum and limited experiments with space object-targeting (or, perhaps, even space-based) conventional weapons seem to be as far as

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most States have progressed in military uses of outer space. As John Klein, a senior fellow and strategist at Falcon Research Inc. and adjunct professor at the George Washington University Space Policy Institute, examines in his new book *Understanding Space Strategy: The Art of War in Space*, however, this does not mean that military activity in space takes place outside the realms of grand and military strategy, operational art or tactics. Indeed, as outer space becomes ever more critical to all aspects of life in the 21st Century, the recognition of space as a potential area of conflict—and of the necessity of developing doctrine, strategy, and tactics to govern military operations there—has become increasingly accepted in military and political circles across the globe. The United States' creation of a sixth military branch, the United States Space Force (USSF), in December 2019 is simply the most recent reflection of the perception that outer space is destined to become, if it is not already, a warfighting domain.

In *Understanding Space Strategy*, Klein does not argue the wisdom of viewing outer space as a domain of potential conflict, nor debate the pros and cons of space-focused military organizations like the new USSF. This is not the purpose of his work. Instead, accepting space warfare as, essentially, a reality, Klein seeks to "provide a framework for considering war in the space domain" and to put space war and warfare within the context of the general theory of strategy and provide a cogent foundation for discussing space strategy as a practical matter."[1] Through reference to all of the well-known, and many of the lesser-known, military strategists of the past—classic strategic masters, like Sun Tzu, Thucydides, and Carl von Clausewitz; more modern theorists like B.H. Liddell-Hart, J.C. Wylie, and Mao Tse-tung; and, in particular, maritime and naval strategists, like Alfred Thayer Mahan, Julian S. Corbett, Raoul Castex, and others—and drawing from his own previous work, *Space Warfare: Strategy, Policy, and Principles*,[2] Klein elucidates general strategic theories related to space early in the work, before turning to the specific strategies employed by various categories of spacefaring countries.

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[1] JOHN KLEIN, UNDERSTANDING SPACE STRATEGY: THE ART OF WAR IN SPACE ix (2019).

[2] JOHN J. KLEIN, SPACE WARFARE: STRATEGY, POLICY, AND PRINCIPLES (2006).

In the first chapter of *Understanding Space Strategy*, "Space as a warfighting domain," Klein seeks to frame his discussion of space strategy by examining the *nature* of warfare, in general, and the *character* of space warfare, in particular. Beginning with a paraphrase of Thucydides' observations concerning the Peloponnesian War (that States "go to war based on an assessment of fear, honor, and interest") and including the obligatory references to Clausewitz's description of war as "an extension of policy by other means," Klein uses the first part of this chapter to describe the largely unchanging *nature* of war. In contrast to war's *character*—the unique time-, place-, culture-, and technology-specific details of how and why a war is fought—its nature is largely static. War is an instrument of national policy, used by States when necessary to achieve wider political aims; it is characterized by violence and risk, friction and chance; it involves the bringing to bear of force upon an enemy; and it requires the flexibility to adapt to rapidly changing circumstances. In the second part of the chapter, Klein examines the character of war in outer space, examining the specific facets of current space regulations and activities that would affect the way space warfare is likely to be waged. Specifically, Klein describes the types of national activities in which States engage in space ("civil, commercial, intelligence, and military" activities); the nature of the outer space legal regime, specifically the Outer Space Treaty and the other international treaties concerning space activities; the use of commercial business practices and "soft" norms to regulate private and national behavior in space; and the challenges presented by aspects of the space and physical environment, including debris, the dangers of proximity operations, and electromagnetic spectrum crowding.

Chapter 2, "Space strategy," sees Klein delving deeper into his space-specific subject matter, examining current military thinking concerning strategy in outer space, while framing space strategy within the wider context of military strategy more generally. Using a number of national space strategies as guides, Klein describes the purpose of space strategy as "ensur[ing] access to and use of space."[3] Klein compares this to similar goals in the air and naval realms, and explains the concept of "control" or "command" of outer space

[3] KLEIN, UNDERSTANDING SPACE STRATEGY, *supra* note 1, at 21.

in the military context. He also examines offensive and defensive strategies for space-based military activities, ideas of dispersal and concentration of forces in space, and (in a section that, at times, echoes Everett Dolman's treatment of the same issue in his famous, or infamous, work *Astropolitik: Classical Geopolitics in the Space Age*[4]) the importance of certain physical positions (specific orbits, space-based or terrestrial "choke points," etc.) in the space environment.

Because outer space, like airspace, is a realm inaccessible to human beings without the assistance of external, mechanical means, all human activity in outer space is dependent on the technology available to place and maintain both manned or unmanned space objects outside of the Earth's atmosphere. There is little argument, then, that advanced technology is *necessary* for a State to engage in even rudimentary military activities in space. But is a State's possession of advanced outer space technology *sufficient* for that State to be "victorious" in a space war (or a terrestrial war utilizing space assets); in other words, is having the "best" space technology a guarantee of success in space conflict? Chapter 3, "Technology and space warfare," addresses this question—the tension between technological advantage and national will/individual resolve that exists, and has existed, in all domains of warfare—and the effects of space-related technology upon the development of strategy. Providing historical examples of States' applications of new technology to military strategy (maritime applications of aircraft by the U.S. Navy prior to WWII, German use of submarine warfare during both World Wars, and the deployment of nuclear weapons by both sides of the Cold War) and emphasizing the central importance of the resolve of the fighting men and women of a State's military, Klein warns that while technology may contribute to the development of a comprehensive strategic theory of space warfare, a State's technological prowess alone is neither a panacea for preventing conflict nor a guarantor of victory.

Chapter 4, "Space deterrence and the law of war," sees Klein examining deterrence and dissuasion (also called "pre-deterrence"

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[4] For Dolman's more in-depth description of the outer space environment and the role the physical characteristics of orbital mechanics, types of space (i.e. near-Earth vs. cislunar space), gravity wells, etc. play in his theory of astropolitics, *see* EVERETT C. DOLMAN, ASTROPOLITIK: CLASSICAL GEOPOLITICS IN THE SPACE AGE 52-74 (2002).

or "deterrence by denial"[5]) theories as applied to outer space, as well as the role of alliances, rules of engagement, and ideas related to both responsive and anticipatory self-defense in the space environment. Klein also examines the deterrence theories of Russia and China, stressing that "different cultural and social understandings of deterrence and escalation control" exist between the United States and at least some of its potential adversaries.[6] Klein's caution that misapplications of deterrence theory resulting from these differing understandings of deterrence's basic premises could cause dramatic, unanticipated conflict escalation is extremely important for strategists and policy-makers concerned with conflict between the United States and its so-called "near-peer" competitors.

Perhaps the most interesting chapters in *Understanding Space Strategy* are chapters 5, 6, and 7: "Space strategy for great powers," "Space strategy for medium powers," and "Space strategy for emerging powers," respectively. Here, Klein puts real, practical meat onto the bones of the strategic theories elaborated in previous chapters by, first, dividing nations into three categories on the basis of a framework originally articulated by Deganit Paikowsky, an Israeli expert on international relations and space policy: (1) great space powers, which have "the indigenous capability to launch, develop, and control satellites," as well as "the indigenous capability of human spaceflight;" (2) medium space powers, which have indigenous launch and satellite production capabilities, but lack human spaceflight capability; and (3) emerging space powers, which can "indigenously . . . develop, maintain and control satellites," but have no indigenous launch capability.[7] Klein uses each of these chapters

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[5] KLEIN, UNDERSTANDING SPACE STRATEGY, *supra* note 1, at 81. Dissuasion is generally thought of as describing activities that are meant "to influence the decision calculus of potential adversaries" by "discourage[ing] the initiation of military competition." *Id.* In contrast to deterrence, which is based around the idea of unacceptable retaliation in response to an attack and, thus, is ultimately reliant on fear (as Peter Sellers' character Dr. Strangelove put it in the movie of the same name: "[d]eterrence is the art of producing, in the mind of the enemy, the *fear* to attack," DR. STRANGELOVE: OR HOW I LEARNED TO STOP WORRYING AND LOVE THE BOMB (Columbia Pictures 1964)), dissuasion's power lies in convincing an adversary of the *futility* of a military action—that is, that an attack or another hostile military act would "be ineffectual in achieving the desired effect." KLEIN, UNDERSTANDING SPACE STRATEGY, *supra* note 1, at 82.

[6] KLEIN, UNDERSTANDING SPACE STRATEGY, *supra* note 1, at 83.

[7] *Id.* at 96.

to examine the real and theoretical space strategies these types of nations are, or theoretically could be, pursuing.

Chapter 5, "Space strategy for great powers," presents the space strategies of the United States, Russia, and China, the only three States to have developed indigenous manned spaceflight programs. Existing elements of each nation's space strategy are explicated, and applications of both grand strategy and space-specific strategic theory—the use of information warfare, economic pressure, and attempts to divide alliances to degrade a space power's ability to operate; attacking celestial lines of communication (CLOCs) to sever a space power's ability to communicate with its satellites; and even the use of anti-satellite weapons to deny space access to an adversary—are expounded.

Chapter 6, "Space strategy for medium powers," examines the outer space activities of India and Iran, two States with widely-divergent space capabilities, but both of which have successfully developed the indigenous ability to launch satellites into orbit. It also examines the space strategies available to such "medium" powers, including the importance of alliances (potentially with "great" space powers), the significance of their mere presence and capability (both in outer space itself and in multinational bodies where space law and policy are developed on an international level), and even, drawing on the analogy of maritime strategy, the potential benefits of a so-called outer space "force in being."

Finally, chapter 7, "Space strategy for emerging powers," details the space activities of Canada and Saudi Arabia, examining the ways in which even these modest actors can exert influence in relation to the outer space domain (Canada through the development of the advanced technology, such as the Canadarm on-orbit mechanical system, for instance, and Saudi Arabia through its maintenance of Arabic-language telecommunications satellites and business partnerships with commercial space actors). The limited ways in which emerging space powers could participate in outer space conflict is described, and the possible actions non-state actors and terrorist groups could take to affect another State's space activities are also described.

In the final chapter before his conclusion—chapter 8, "Space as a business domain"—Klein recognizes the significant influence of private enterprise on the outer space domain, and the striking

role private space activity is set to play in the near future. Detailing the activities of NewSpace private actors, like SpaceX and Blue Origin, and foreign actors, particularly Chinese commercial space companies, Klein examines the ways in which commercial activity in space may contribute to the development of norms, the normalization and expansion of access to space, and, perhaps, even the promotion of peace in space (the theory being that as States expand their economic interests in space, there is likely to be less willingness to permit the threats to these interests presented by space-based conflict).

Klein's final chapter, "Looking up and forward," offers a concluding context for potential space conflict, including a discussion of the perennial question: is warfare in space inevitable? Klein concludes, based on history and strategic theory, that the answer is likely "yes," and he offers three steps the United States (or, indeed, any State) could take to prepare for space conflict. These steps are: (1) improving space situational awareness; (2) improving mission assurance and the resilience of space systems, as well as instituting measures promoting dissuasion; and (3) contributing to the development, at the international level, of "common and practical" answers (or definitions) to critical space conflict-related questions, such as "what constitutes conflict in space, acceptable behavior, and hostile intent."[8] Klein ends his work by detailing current challenges in the United States' implementation of space strategy, including the formation and development of the USSF (which had not been officially created at the time of *Understanding Space Strategy's* publication), and ultimately concluding that space strategy will—and must—continue to evolve as it becomes more and more likely that conflict in space will actually occur.

In an essay on space strategy that examined, in part, Klein's previous work (*Space Warfare: Strategy, Policy, and Principles*[9]), John B. Sheldon and recently-deceased international affairs and strategic studies expert Colin S. Grey noted the complexity of developing an enduring military strategy for outer space:

> A theory of spacepower has to explain and translate action in space into strategic effect on Earth, and *vice versa*. It must take

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[8] *Id.* at 222.

[9] *See generally* KLEIN, SPACE WARFARE, *supra* note 2.

> into account not only spacepower itself, but also the influence of land, air-, and seapower, nuclear and information operations, as well as special operations upon each other and upon spacepower. A theory of spacepower also has to consider the roles and influence of science, technology, politics, law, diplomacy, society, and economics, among others.[10]

In profound understatement, Sheldon and Grey conclude that explicating space strategy "is a daunting subject."[11] With *Understanding Space Strategy*, Klein has once again stepped up to the plate to address this "daunting subject," and while he certainly makes extensive reference to his previous ideas from *Space Warfare*, thirteen years of refining his strategic theories—and, perhaps more importantly, thirteen years of observing national space security policy development by the United States, China, and others—has allowed Klein to write an even more comprehensive work. It remains to be seen whether Klein's theories regarding unique space strategy, and his (and others') applications of terrestrial strategy to outer space warfare, will prove enduring. For the moment, however, *Understanding Space Strategy* provides an excellent, single-volume introduction to both a wide range of theoretical strategic thinking regarding space conflict, as well as the actual space security policies of significant space actors. Especially as the United States and a number of other States begin to stand up military services devoted to protecting outer space assets, the ideas contained in *Understanding Space Strategy* ought to be read and considered by a wider audience.

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[10] John B. Sheldon & Colin S. Grey, *Theory Ascendant? Spacepower and the Challenge of Strategic Theory*, *in* TOWARD A THEORY OF SPACEPOWER: SELECTED ESSAYS 6, 6 (Charles D. Lues, et al. eds. 2011).

[11] *Id.*

AN INTRODUCTION TO SPACE LAW

Reviewed by Michelle L.D. Hanlon[*]

Given that many of the conveniences humans enjoy today are supplied directly by, or with the support of, satellites that are now crowding our orbit; that technological advancements have catapulted more and more States, and private entities, into realms once monopolized by two dominant spacefaring nations; that more and more entities are looking, realistically, at extracting and utilizing precious metals and other resources found in space; that a nascent space tourism industry, currently affordable only to the very rich, is on the cusp of unimaginable expansion; that multiple nations are committed to returning humans to the Moon, and even building permanent habitats on the Moon; that the United States has created a standing Space Force which pundits and commentators will no doubt compare to Steve Carell's farcical *Space Force*, especially considering recent revelations about who owns the copyright to the name; and, ultimately, that the space economy was predicted (pre-COVID) by at least one analyst to reach one trillion dollars in 2020, it surprises me that people still pause when they are introduced to a space lawyer.

We have all endured, and perhaps many of us have contributed to, the endless jokes about getting "beamed up," having "trouble with tribbles," or "going with the Force." But the truth of the matter is that most people—especially those who don't realize that the answer to life, the universe and everything is 42—do not give a second thought to outer space, how it contributes to our lives, and how the many activities that occur in space are regulated. They should.

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There will soon come a time when every aspect of human life will have a connection to space. Thus, at the very least, every attorney has a responsibility to their clients to understand space activities and how they are regulated. Attorneys who advise governments in particular need to understand this final frontier of public international law and public policy, not least because it remains a work-in-progress, continuing to evolve and open to innovation.

And *Introduction to Space Law* is exactly where to start.

When Professor Isabella Diederiks-Verschoor debuted the first edition of *An Introduction to Space Law* in 1993, it was heralded for being able to identify and present essential aspects of space law in a carefully organized and short volume. Second and third editions followed in 1999 and 2007—which added Professor Vladimír Kopal as a co-author—and continued the tradition of clarity, breadth and brevity. Tanja Masson-Zwaan and Mahulena Hofmann, self-described disciples of the original authors, prepared this fourth edition as an homage to their predecessors, keeping the format of the book, preserving its concision even as it embraces the burgeoning developments in space law.

The fact that there are only 180 pages of content (this page count does not include the annexed copies of the space treaties) is nothing short of miraculous, given that lawyers generally tend to the verbose (present company included). As someone who teaches and regularly presents on all aspects of space law, I approached this slim offering with skepticism. I read each of the thirteen chapters looking for that "gotcha" moment, ready point out a glaring gap. Instead, I was treated to a quick and satisfying read. To be clear, while this is an introduction to space law, even experienced space lawyers and professors will benefit from its text because it reminds us how to succinctly capture the salient points of ongoing debate. The first chapter, for example, closes with a discussion of the territorial scope of outer space, summarizing in six short paragraphs the importance of delimitation and where the debate stands today. Sometimes, looking out over the weeds like this, brings clarity and inspires new visions to solve even decades-old problems.

The chapters themselves are short, well-organized and broken into easy-to-follow sections. Indeed, reading through the Table of Contents is like reading through an index of space law—each subheading the topic of innumerable law review and law journal

articles. The tone of the text itself is factual. These authors are clearly not trying to make a persuasive argument, and lovers of *Dragnet* will be reminded of Joe Friday's famous "just the facts, ma'am" quip. That said, each chapter concludes with, mainly neutral, remarks outlining open issues and offering muted observations. For example, chapter 3 closes with the important reflection that while United Nations resolutions may not "officially qualify as clarifications or elaborations of the [space] treaties, the fact that States may follow the recommendations they contain means that State practice and *opinion iuris* may evolve and eventually result in new rules of customary international law, binding upon all States."[1]

A brief historical outline (chapter 1) is followed by a review of the space law treaties (chapter 2). While the Outer Space Treaty itself is given Article-by-Article treatment, the Rescue Agreement, the Liability Convention, the Registration Convention and the Moon Agreement are treated more summarily. Chapter 3 introduces the myriad "soft law" sources of space law and chapter 4 offers descriptive narratives of the respective roles of the European Space Agency and the European Union in space activities.

Chapter 5 commences the actual discussion of how the law itself relates to current space activities. Here, as with all of the chapters, the reader is reminded that international laws apply in space, and Masson-Zwaan's and Hofmann's discussion, though spare, awakens the inspiration to learn more. Here too the authors offer the opinion, hardly controversial, that "space law must continue to help to restrain military activities and at the same time place proper limitations on commercial and civil actors to keep them from upsetting the fragile stability of the space domain."[2] Similarly, the authors offer, in chapter 7, which is devoted to the discussion of space resource activities, that "[w]ithout any doubt, a multilateral regime of space resources activities complementing national laws would be the best option for developing activities related with space resources because it would prevent uncertainties and harmonize

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[1] TANJA MASSON-ZWAAN & MAHULENA HOFMANN, INTRODUCTION TO SPACE LAW 50-1 (4th. ed. 2019).

[2] *Id.* at 77. Note that attribution for Chapter 5 is given to Dr. P.J. Blount.

the application of national legislations regulating its authorization and supervision."[3]

Additional chapters adeptly address human space activities, space debris, space communication, small satellites, global navigation satellite systems and remote sensing—each with an astonishing combination of briefness and thoroughness. I offer only two, very minor critiques. The first is semantic. Especially today, words are important, and I was disappointed to see the constant reference to "mankind." While it is true that the space treaties and most soft law use the term "mankind" throughout, we need to take steps to move away from that term—after all it seems to rule out at least half the global population. As we progress beyond our Earth, we must strive to be as inclusive as possible, the simple addition of two letters, "h" and "u," broadens our vision and, importantly, reminds us that we are all one *hu*man species and we should strive as *hu*mans to put our terrestrial squabbles behind us as we move forward to our destiny.

My second criticism is more of a yearning than a reproach. Having flown through the chapters, I would have liked to see the authors offer a more general conclusion—perhaps even one anchored in their own opinions and thoughts. While this is not customary for a textbook, or a "tool" as they describe their work, it seems an optimum opportunity to challenge readers to study space law in more depth.

But these, as noted, are the barest of critiques, and I highly recommend taking the time to read this book.

In the conclusion to Chapter 6, Human Space Flight, the authors recognize that it is humankind's "nature"[4] to push boundaries. This is true with respect to space and so, they argue, it remains important to "continue to study the legal aspects of human space flight."[5]

I would argue that the very future of humanity depends on the continuing evolution of all of space law, not just the law governing human space flight. In a recent webinar, Frank White – the author

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[3] *Id.* at 105.
[4] *Id.* at 95.
[5] *Id.*

of the seminal books, *The Overview Effect*[6] and its follow on, *The Cosmo Hypothesis,*[7] informed the group that he likes to start discussions with young students by asking: "who here wants to go to space?" When hands are raised, he responds something to the effective of: "congratulations, you made it."

It is too easy for us to forget that the Earth is part of, not somehow separate from, space. Humans will continue to explore space, and in that irascible way we do, we will continue to innovate and harness its many resources to support our lives here on Earth and beyond. Space is already inextricably a part of nearly every human being's daily life. And human reliance on space will continue to grow. Now more than ever, not only does space need lawyers, people need lawyers who understand space law.

I submit that every law student and every government policy advisor should be given an introduction to space law. And this book is a perfect start.

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[6] FRANK WHITE, THE OVERVIEW EFFECT: SPACE EXPLORATION AND HUMAN EVOLUTION (1998).

[7] FRANK WHITE, THE COSMA HYPOTHESIS: IMPLICATIONS OF THE OVERVIEW EFFECT (2019).

2001: AN ODYSSEY **REVISITED, KUBRICK'S MASTERPIECE IN THE CONTEXT OF THE 1960s**

Review by: Sean Patrick Taylor[*]

Stanley Kubrick's film, *2001: A Space Odyssey*[1] stands as a singular work of science fiction, having now influenced generations of filmmakers, intellectuals and explorers. For those engaged in space activities at any level, the questions raised in the film are even more relevant as we progress into new phases of both military activity in space and commercial spaceflight. The film was a turning point in cinema that put science fiction on a level of high art by fusing classical music with realistic technical designs, creating an immersive elegance for the journey into the unknown. Released in the spring of 1968, it was the first serious film interpretation of a future in space which offered enough of a cultural anchor to create a genuine sense of realism. In addition to the groundbreaking aesthetics, its subtle examination of the origin and trajectory of our species, particularly the question of whether or not we are alone in the universe, captivates us today as it has for millennia. While the plot spans millions of years, the film itself is very much a product of its era, capturing both extremes of humanity—scientific achievement and creative expression, as well as our primal urges toward hostility and aggression.

2001: A Space Odyssey was conceived during the mid-1960's, which saw a cultural awakening that began to question the role of the United States (US) in world affairs, particularly in regards to Vietnam. Whether it was the protest songs of Bob Dylan *(Blowing in the Wind, A Hard Rain's Gonna Fall, Masters of War, Times They*

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[1] 2001: A SPACE ODYSSEY (Metro-Goldwyn-Mayer 1968).

Are A Changin'), the speeches and writings of the Reverend Dr. Martin Luther King, Jr. or the films of Stanley Kubrick, conventional wisdom was not only called into question, it was mocked for the hypocrisy that allowed for unjust social conditions and the threat of unfathomable destruction in the nuclear age.

Beginning with US involvement in the failed Bay of Pigs invasion against Castro and the subsequent threat to humanity that was the Cuban Missile Crisis, through the continuing horrors of the Vietnam conflict, it became clear the path of perpetual aggression was one of self-destruction. President Kennedy slowly began to realize this and conveyed these thoughts to the graduates of American University in June 1963, which he gave with suspicious proximity to his assassination later that year. The speech addressed the misplaced priorities on the part of both the US and the Soviet Union.

> [W]e are both devoting massive sums of money to weapons that could be better devoted to combating ignorance, poverty, and disease. We are both caught up in a vicious and dangerous cycle in which suspicion on one side breeds suspicion on the other, and new weapons beget counter weapons.[2]

After Kennedy's sudden departure from the world stage, the crisis he created in Vietnam would spiral out of control into an epic tragedy. Two million young men and nearly 7,500 women,[3] sent across the world, abandoned by their bumbling elders to endure and perpetuate a decade of suffering. To quote Nobel Laureate Dylan's *It's All Over Now, Baby Blue,* "[y]onder stands your orphan with his gun, crying like a fire in the sun."[4]

On the other extreme, President Kennedy's inspiration was a driving force behind the US space program, which accomplished something so remarkable that fifty years later, the achievements

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[2] President John Fitzgerald Kennedy, Address at American University's Commencement (June 10, 1963).

[3] *Vietnam Statistics,* THE UNITED STATES WAR DOGS ASSOC., INC., http://www.uswardogs.org/vietnam-statistics/#:~:text=9%2C087%2C000%20military%20personnel%20served%20on,represents%209.7%25%20of%20their%20generation. (last visited July 12, 2020).

[4] BOB DYLAN, THE LYRICS: 1961-2012, 159 (2016). *See also, Bob Dylan, Facts*, NOBELPRIZE.ORG., https://www.nobelprize.org/prizes/literature/2016/dylan/facts/ (last visited July 6, 2020).

still have not been fully appreciated. In less than a century, humanity went from the steam engine to the stars; from Morse Code to the Mars Rover.

Two weeks following the assassination of President Kennedy, the United Nations General Assembly adopted the Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space.[5] The member nations understood the importance of seizing the opportunity to define future exploration in a manner that would not repeat the conflicts that have plagued our species. Around this same time, Bob Dylan was recording the bulk of his early catalog at Columbia Studios in midtown and Arthur C. Clarke was living at the Hotel Chelsea in lower Manhattan, working on the short stories he would sell to Kubrick that became *2001*.[6] All of this activity within roughly fifty blocks.

To understand the backstory of *2001*, we have to travel back to the end of 1963, when Stanley Kubrick was preparing to release *Dr. Strangelove or How I Learned to Stop Worrying and Love the Bomb*, a dark comedy about a rogue American general who threatens to launch a nuclear strike against the Soviet Union.[7] The film cemented Kubrick's status as one of the most innovative directors in cinema and allowed him greater autonomy for the rest of his career. As Steven Spielberg, far and away the most successful film director of all time,[8] opined "[t]he best in history; nobody could shoot a movie better than Stanley Kubrick *in history*. . . Every film he's ever shot, the craft is impeccable."[9]

With the momentum from his early successes, Kubrick wanted to make an ambitious science fiction film, which would re-define the genre. Kubrick's goal for the film was to explore "the reasons for believing in the existence of intelligent extraterrestrial life, and

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[5] G.A. Res. 1962 (XVIII), (Dec. 13, 1963).

[6] 2001: A SPACE ODYSSEY – MAKING OF A MYTH (ACF & Lucida Productions 2001).

[7] DR. STRANGELOVE OR: HOW I LEARNED TO STOP WORRYING AND LOVE THE BOMB (Columbia Pictures 1964).

[8] John Lynch, *The 15 Top-Earning Movie Directors of All Time at the US Box Office,* BUSINESS INSIDER (Aug. 11, 2017) https://www.businessinsider.com/highest-earning-movie-directors-of-all-time-us-box-office-2017-8.

[9] STANDING ON THE SHOULDERS OF KUBRICK – THE LEGACY OF 2001: A SPACE ODYSSEY (Warner Brothers Entertainment 2007).

what it would mean if we discovered it."[10] This led to his connection with Clarke and ultimately the commissioning of a screenplay, which the novel was based on.

The original short story which they started to build the screenplay from was called "The Sentinel." It featured a sort of teaching machine left by aliens to inform the emerging species. Douglas Trumbull, who worked on the special effects for *2001* explained the appeal of Clarke's writing to Kubrick, "[h]e didn't write about fanciful things, he wrote about real science, real technology. . . The whole project was suffused with a determination to make everything look believable."[11]

The journey begins, literally, at the dawn of humankind. After waking to discover a mysterious monolith, a fledgling tribe from our common ancestral species somehow found enlightenment from the frequency it emitted. The defining moment of enlightenment comes as the ape (Moonwatcher) understands the potential function of an object as a tool; a weapon. After utilizing his new advantage in defense of a watering hole and in the process committing the first act of (hu)manslaughter, the triumphant ape launches his tool of conquest in exultation towards the vast heavens. As the club of victory reaches its apex, we are launched forward three million years in a single cut. Offering a stark reminder that from the cattle's rib to nuclear powered space stations, the upward evolution of humanity has often been fueled by aggression, or the fear of aggression. The space race was no exception.

As part of the special features included with the digital edition of the film, the documentary *2001: A Space Odyssey—Making of a Myth*[12] offers insight from Clarke who indicated that the first stations we are witnessing after the cut to the space age are actually nuclear *armed* space stations. It is interesting this is not made more prominent in the film, as the sophistication of a nuclear armed

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[10] Dan Chiasson, *2001: A Space Odyssey": What it Means and How It was Made,* THE NEW YORKER (Apr. 4, 2018), https://www.newyorker.com/magazine/2018/04/23/2001-a-space-odyssey-what-it-means-and-how-it-was-made
(last visited July 6, 2020)

[11] Matt Hurwitz, *2001: A Space Odyssey' Influenced Generations of Filmmakers Like Nolan, Cameron,* VARIETY (May 11, 2018), https://variety.com/2018/film/news/2001-a-space-odyssey-influenced-generations-of-filmmakers-like-nolan-cameron-1202796566/
(last visited July 12, 2020)

[12] *Supra* note 6.

space station would provide a fascinating juxtaposition to the original weapon, at once demonstrating the dual extremes of achievement and aggression. Perhaps Kubrick was holding out hope for a cessation of the nuclear arms race, unlikely considering his previous work (*Dr. Strangelove*). However, many aspects of the film as with other celebrated works of art and literature, utilize a more subtle, ambiguous approach, which allows for more audience interpretation and thus giving the work more of a universal appeal. Conversely, the more specific the creative expression, the more limited the potential audience.

As Kubrick slowly introduces his audience to the magnificence of space travel, Johann Strauss' *Blue Danube Waltz* creates a sense of elegance and calm that serves to enhance the feeling of awe and simultaneously offers yet another reminder of how humanity has evolved from our lowly origin as a species. Years later in an example of life imitating art, NASA used the *Blue Danube Waltz* to wake up the astronauts aboard Space Shuttle Atlantis mission STS-98 to the International Space Station, which took place in the year 2001.[13]

Transitioning to the interior of one of the space stations, we become acquainted with Dr. Heywood Floyd, who is traveling to the Moon Base Clavius. After making a video call to his daughter, he engages with three Russian scientists, among them his old friend Dr. Dimitri Moisevitch. After some friendly small talk Dr. Moisevitch inquires about rumors from Clavius, indicating concern over a Soviet space vehicle in distress which had been denied permission to make an emergency landing. Moisevitch continues pressing Floyd and shares the rumor of a pandemic outbreak at the base. After admitting it was a subject he was not at liberty to discuss, Dr. Floyd politely ends the discussion and we are then enlightened as to the real situation on Clavius.

The scene speaks to the mistrust that existed between the US and the Soviet Union in the height of the Cold War as well as Kubrick's cynicism that this mistrust would continue for centuries. It also broaches issues that were debated at the United Nations regarding the rescue of astronauts and the obligation of space faring nations to help explorers of other nations in times of distress.

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[13] MICHELLE GRAY, HOUSTON WE HAVE A WAKEUP CALL 46 (2011).

After Dr. Floyd's experience on the Moon, the audience is introduced to a second crew aboard a ship called Discovery One, continuing the mission beyond the Moon to the planet Jupiter. The ship is staffed by two astronauts, Captain David Bowman and his deputy, Frank Poole. There are three additional astronauts frozen in deep sleep pods, to be revived once the ship reaches its destination.

Along the journey, the audience is acquainted with a new kind of character, HAL 9000 (HAL). No aspect of the film demonstrated Clarke and Kubrick's foresight as much as the issue of our interactions with, and dependence on, artificial intelligence. A half-century later, every smart phone owner has access to similar technology as HAL's voice interface in the form of Apple's Siri, Amazon's Alexa and Assistant by Google. The initial sequences aboard Discovery One also show what appears to be an early tablet computer.

The voyage of Discovery One faces an unexpected technical malfunction that threatens the success of the mission, as well as the trust between the astronauts and their HAL9000. The entire sequence prompts a question as to the future of space exploration and the role of both humans and artificial intelligence in that pursuit. As we attempt more ambitious goals in space, we must consider to what degree of dependence on artificial intelligence we are comfortable with for human spaceflight. What safeguards must be put in place by programmers, engineers and designers to ensure the safety of passengers on space voyages will be an ever more pressing question as commercial activities in space, including tourism, continue to grow alongside the capability of artificial intelligence in the decades ahead.

At the same time the film was being released to the general public on April 3, 1968, Martin Luther King was speaking at Mason Temple in Memphis, Tennessee to support a group of striking sanitation workers. The speech would be his last as he would succumb to the bullet of an assassin the following evening and, like Abraham Lincoln a century prior, now he belongs to the ages. The speech he gave on April 3 is commonly known for its prophetic conclusion wherein Reverend King offers a vision from the mountaintop, the promised land as our destination, rejecting the fear of death before a final exultation of the century old *Battle Hymn of the Republic,*

"My eyes have seen the glory of the coming of the lord . . ."[14] However, it was a line early in the speech that rings even more true in 2020 than in 1968. "The nation is sick. Trouble is in the land. Confusion all around . . .But I know, somehow, that only when it is dark enough, can you see the stars."[15]

One of the common elements of great art that endures through generations is the ability of the work to inspire and spark the imagination as well as to question the audience's understanding of their own humanity and our shared human experience. By both standards, *2001* is a triumph. Let us continue the struggle for understanding as we continue our journey into the infinite.

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[14] Reverend Doctor Martin Luther King, Jr., Address at Mason Temple (Apr. 3, 1968)
[15] *Id*.

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