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Innovative Thinking: Modernizing Outer Space Governance

Diane M. Janosek

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INNOVATIVE THINKING: MODERNIZING OUTER SPACE GOVERNANCE

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One must look back to 1967 for the inaugural “Outer Space Treaty,” the first and only binding multilateral agreement¹ for peaceful space use and exploration.² In the subsequent fifty-four years, technologies and space capabilities have evolved; therefore, an updated global treaty and agreement should be developed and evaluated. Both China and Russia have demonstrated their capabilities to degrade and/or destroy their respective adversaries’ satellites in space.³ Space wars are no longer a hypothetical: the future once discussed and anxiously anticipated after Sputnik I is here. While the United States is maximizing efforts to protect and secure its satellites from harm, these efforts may not be enough as international law on space security does not meet today’s needs. Now more than ever, with space security and cybersecurity realms intersecting, and with the achievement of adversarial space capabilities, there is a need to review and update the Outer Space Treaty.⁴ Recent weapons testing and the resultant challenges to keeping satellites in orbit have highlighted the glaring gaps in space governance.⁵ This domain is ripe for new review to prevent the weaponization of outer space and potential international instability, and to secure satellites’ receipt and transfer of vital digital information.

¹ 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, 2411–12 [hereinafter “Outer Space Treaty”].

² David Kuan-Wei Chen, *New Ways and Means to Strengthen the Responsible and Peaceful Use of Outer Space*, 48 GA. J. INT’L & COMP L. 661, 664–65 (2019).

³ Sandra Erwin, *Pentagon Report: China Amassing Arsenal of Anti-Satellite Weapons*, SPACENEWS (Sept. 1, 2020), <https://spacenews.com/pentagon-report-china-amassing-arsenal-of-anti-satellite-weapons/>; see also Pavel Luzin, *Russia is Behind in Military Space Capabilities, But That Only Drives its Appetite*, DEFENSENEWS (Apr. 2, 2020), <https://www.defensenews.com/opinion/commentary/2020/04/02/russia-is-behind-in-military-space-capabilities-but-that-only-drives-its-appetite/>.

⁴ Outer Space Treaty, *supra* note 1 (noting that the treaty was entered into force in 1967).

⁵ Maj. Liane Zivitski, *China Wants to Dominate Space, and the US Must Take Countermeasures*, DEFENSENEWS (June 23, 2020), <https://www.defensenews.com/opinion/commentary/2020/06/23/china-wants-to-dominate-space-and-the-us-must-take-countermeasures/> (stating: “China is determined to replace the U.S. as the dominant power in space. While proclaiming its peaceful intentions, Beijing’s doctrine considers space a military domain, and it is investing heavily in space infrastructure designed to secure both economic and military advantages. To ensure that it continues to compete from a position of strength, the U.S. must invest sufficient resources in preparing its new Space Force to defend America’s national interests and security in space.”).

INTRODUCTION

When the Space Age was born with the Soviet Union's successful launch of Sputnik I in 1957,⁶ no one could have predicted the vast array of satellites now in orbit today or the myriad of ways in which satellites and space exploration have affected and, in many ways, improved our terrestrial way of life.⁷ Within ten years of Sputnik I's launch, the United Nations General Assembly agreed to the Outer Space Treaty, which is still in force today.⁸ The core focus of the treaty is the use of space for peaceful purposes.⁹ Fifty-four years later, this treaty remains the sole international governance document of the space domain, with, to date, 110 signatory countries.¹⁰ Some obvious questions arise when considering the Outer Space Treaty, such as how effective is this treaty in allocating the rights and obligations of nations and other entities that are using space now in ways that were beyond global imagination in 1967?¹¹ What is "peaceful exploration"? This research will raise issues of potential treaty gaps that should be considered, while negotiating a more comprehensive regime of space use by terrestrial sovereign nations, with a view toward updating the Outer Space Treaty.

The Sputnik I launch on October 4, 1957, galvanized immediate investment

⁶ See *Sputnik 1*, NASA (Oct. 14, 2011), https://www.nasa.gov/multimedia/imagegallery/image_feature_924.html (stating: "On Oct. 4, 1957, Sputnik 1 successfully launched and entered Earth's orbit. Thus, began the space age. The successful launch shocked the world, giving the former Soviet Union the distinction of putting the first human-made object into space. The word 'Sputnik' originally meant 'fellow traveler,' but has become synonymous with 'satellite' in modern Russian.").

⁷ *World Space Week: Six Ways Satellites Improve Our Lives*, AUSTRALIAN GOVERNMENT DEPARTMENT OF INDUSTRY, SCI., ENERGY AND RES. (Oct. 2, 2020), <https://www.industry.gov.au/news/world-space-week-six-ways-satellites-improve-our-lives> (stating, "As they orbit above us in space, satellites are supporting more than 7 billion people down on Earth.") [hereinafter "*World Space Week*"].

⁸ Chen, *supra* note 2, at 664–65 (describing the inaugural Outer Space Treaty as a binding multilateral agreement. The catalyst for international cooperation came thirteen years earlier, when Sputnik I was launched by the Soviet Union. Fears of space wars rallied the global community. The United Nations passed the 1967 global Outer Space Treaty).

⁹ See Outer Space Treaty, *supra* note 1 (acknowledging "the importance of international co-operation in the field of activities in the peaceful exploration and use of outer space.").

¹⁰ G.A. Res. 2222 (XXI), at 15 (1966) ("The treaty was signed in London, Moscow and Washington on 27 January 1967."). Twenty-three other signatories have yet to complete ratification.

¹¹ See Jason Krause, *The Outer Space Treaty Turns 50. Can it Survive a New Space Race?*, A.B.A. J. (Apr. 1, 2017), https://www.abajournal.com/magazine/article/outer_space_treaty (noting that "unfortunately, there are a number of key treaty phases that remain opaque" and that there has been no judicial enforcement to resolve the Treaty's ambiguous language).

by the United States.¹² President Dwight Eisenhower intensified the US space program in an effort to accelerate US advances in both space and weapons programs.¹³ Today, the US has launched more space assets than any other country.¹⁴ These activities, and those of Russia and China, collectively illustrate the dramatic evolution of space activity and advances in the past sixty-three years. They also demonstrate the necessity for a new evaluation of the treaty's usefulness in application. Status quo may have brought about a false sense of international security.

The Outer Space Treaty of 1967 recognizes “the common interest of all mankind in the progress of the exploration and use of outer space for peaceful purposes.”¹⁵ The concept underlying peaceful purpose “. . . does not have an authoritarian definition and continues to be a source of contention.”¹⁶ Over time, “peaceful purposes” uses has been interpreted to mean that “. . . outer space can be used for both civilian and military *non-aggression purposes*.”¹⁷ There have been no judicial interpretations of the Outer Space Treaty, so this domain and its terminology remain subject to further interpretation.¹⁸ Meanwhile alarms have been raised, especially by the recent Chinese and Russian anti-satellite testing and their demonstration of potential dominance in space.¹⁹ Furthermore, nation states as well as commercial ventures, such as SpaceX, desire assurances that their space assets and capitalist endeavors will be protected and supported by national and international laws.²⁰

¹² See *Sputnik 1*, *supra* note 6.

¹³ *Id.*; see also *The Launch of Sputnik, 1957*, U.S. DEP'T OF STATE ARCHIVE, <https://2001-2009.state.gov/r/pa/ho/time/lw/103729.htm> (last visited May 12, 2021).

¹⁴ See NAT'L AIR & SPACE INTELLIGENCE CTR., *COMPETING IN SPACE 5* (Dec. 2020), <https://media.defense.gov/2019/Jan/16/2002080386/-1/-1/1/190115-F-NV711-0002.PDF>.

¹⁵ Outer Space Treaty, *supra* note 1.

¹⁶ Chen, *supra* note 2, at 665–66.

¹⁷ *Id.* at 666 (emphasis added).

¹⁸ *Id.* at 665–66; see also MANFRED LACHS, *THE L. OF OUTER SPACE: AN EXPERIENCE IN CONTEMPORARY LAW-MAKING* 97 (Tanja Masson-Zwaan & Stephan Hobe eds., 2010) (stating “there seems to be little doubt as to the real meaning of [the] words” peaceful purpose, which purport to completely disarm and de-militarize space).

¹⁹ See Sandra Erwin, *U.S. Space Command Again Condemns Russia Anti-Satellite Missile*, SPACE NEWS (July 23, 2020), <https://spacenews.com/u-s-space-command-again-condemns-russia-for-anti-satellite-weapon-test/>. US Department of State raised concerns over adversaries' quests for dominance. For example, Christopher Ford, US Assistant Secretary of State was quoted that the latest test “highlights Russia's hypocritical advocacy of outer space arms control, with which Moscow aims to restrict the capabilities of the United States while clearly having no intention of halting its own counterspace program — both ground-based anti-satellite capabilities and what would appear to be actual in-orbit anti-satellite weaponry.” *Id.*

²⁰ Victor L. Shammass & Tomas B. Holen, *One Giant Leap for Capitalistkind: Private Enterprise in Outer Space*, 5 PALGRAVE COMM. 1, 4 (2019).

While a useful treaty, there are gaps due to ambiguity in the terminology of this half-century old Outer Space Treaty. This is due to technological advances and to many nations and commercial entities participating in space exploration.²¹ Although most space exploration is not concerning, some research activities have yielded pockets of concern. An updated treaty could redefine the parameters and definitions of legitimate activity. For example, the current definition of “peaceful exploration”²² of the current treaty is difficult to enforce under international law, especially with the change in world events and the addition of newer global leaders.²³

Exactly half a century later, the world has changed, and so has space. A bi-polar world has become multipolar, and an optimistic period of multilateralism has given way to a decline in robust international cooperation. Meanwhile, developments in outer space have exploded in complexity, ambition, and commercial promise. The number of entrants and potential entrants has proliferated...One of the key new entrants is China [planning] a permanent Chinese lunar colony as early as 2030.²⁴

Particularly revealing is the Preamble to the Outer Space Treaty, as the General Assembly of the United Nations recognized at the 1499th Plenary Meeting on December 19, 1966, that a discussion was captured in the record that more definitions would be useful, if not essential in the future.²⁵ The United Nations’ Resolution reads:

2222 (XXI) Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies:

The General Assembly . . .

Requests the Committee on the Peaceful Uses of Outer Space . . .

(b) To begin at the same time the study of questions relative to the definition of outer space and utilization of outer space and celestial

²¹ *Reopening the American Frontier: Exploring How the Outer Space Treaty Will Impact American Commerce and Settlement in Space: Hearing Before the Subcomm. on Space, Sci. & Competitiveness of the S. Comm. on Com., Sci., & Transp.*, 105th Cong. 12, 84–85 (2017).

²² G.A. Res. 2222 (XXI), at 15 (1966) (“*Reaffirming* the importance of international cooperation in the field of activities in the peaceful exploration and use of outer space, including Moon and other celestial bodies”).

²³ ULF LINDERFALK, *ON THE INTERPRETATION OF TREATIES: THE MODERN INT’L L. AS EXPRESSED IN THE 1969 VIENNA CONVENTION ON THE L. OF TREATIES 1–7* (Peggy Oscarsson trans., Springer ed. 2007).

²⁴ Melissa Durkee, *The Future of Space Governance*, 48 GA. J. INT’L & COMP. L. 711, 711 (2019) (noting that in 2019, seventy-two nations had space agencies, and fourteen had orbital launch capabilities).

²⁵ G.A. Res. 2222 (XXI), at 15 (1966).

bodies; including various implications of space communications;

(c) To report on the progress of its work to the General Assembly at its twenty-second session.²⁶

Accordingly, while the treaty's signatory nations and the General Assembly of the United Nations acknowledged their work had just begun and requested further resolution, fifty years later there have been no additional definitions.²⁷ Why now? What has changed? Is there a renewed interest in the treaty? There is increased awareness that space security is essential to global safety and prosperity, and as such the time may have come to modernize the treaty to reflect the world's innovation in space.

In 2020, the steady progression of the weaponization of space continued, unnoticed. Space is the newest theater of national strategic risk: space satellites are no longer "safe" in orbit, and space assets have become real targets.²⁸ Space is a new frontier that the United States must defend; the United States is a strong, global world leader, through its decades and centuries of perseverance, toil, innovation, and ingenuity. This innovation must likewise be applied to the space threats. One lesson learned from the COVID-19 pandemic is that while preparation is key, prevention and eradication of threats are not always possible. Thus, strategic risk mitigation is paramount for a healthy US economy and national defense. Warnings of threats to space assets have been present while not being truly heeded, like the global reaction to pandemic warnings before the spread of the COVID-19 virus in 2020.²⁹

In 2020, the world was changed by more than just the pandemic: Russia engaged in concerning space activity, which mimicked earlier equally concerning space activity from China.³⁰ New threats to global space security

²⁶ Outer Space Treaty, *supra* note 1, at Preamble 4(b), (c).

²⁷ *Id.* at art. XV ("Any State Party to the Treaty may propose amendments to this Treaty. Amendments shall enter into force for each State Party to the Treaty accepting the amendments upon their acceptance by a majority of the State Parties to the Treaty and thereafter for each remaining State Party to the Treaty on the date of acceptance of it.").

²⁸ U.S. DEP'T OF DEF., DEF. SPACE STRATEGY SUMMARY 1 (June 2020), https://media.defense.gov/2020/Jun/17/2002317391/-1/-1/1/2020_DEFENSE_SPACE_STRATEGY_SUMMARY.PDF ("In particular, China and Russia present the greatest strategic threat due to their development, testing, and deployment of counterspace capabilities and their associated military doctrine for employment in conflict extending to space. China and Russia each have weaponized space . . . to reduce U.S. and allied military effectiveness and challenge our freedom of operation in space.") [hereinafter "DEF. SPACE STRATEGY SUMMARY"].

²⁹ Stuart Clark, *'It's Going to Happen': Is the World Ready for War in Space?*, GUARDIAN (Apr. 15, 2018), <https://www.theguardian.com/science/2018/apr/15/its-going-to-happen-is-world-ready-for-war-in-space>.

³⁰ See Marcus Weisgerber, *Coronavirus Not Slowing Russian, Chinese Space Activities*, US GENERAL SAYS, DEF. ONE (May 12, 2020), <https://www.defenseone.com/>

and global cybersecurity emerged through the testing of anti-satellite space weapons as well as through cyberattacks.³¹ Now both China and Russia have sophisticated capabilities to harm space assets. On July 15, 2020, “Russia conducted a non-destructive on-orbit test of a space-based anti-satellite weapon,” declared General John “Jay” Raymond.³² This is the same weapon that General Raymond raised concerns over earlier in the year when a Russian space craft maneuvered near a US government satellite.³³

If Russia or China engage in similarly adversarial maneuvers, the US is concerned that there may not be many options to defend assets in space.³⁴ It naturally raises the question: how can this significant emerging threat be appropriately and legally addressed?

As part of its threat assessment, the US will evaluate its adversary’s intentions, or at least what it can glean from its actions. For example, speaking about the Russian space-based anti-satellite weapon, General Raymond remarked, “[this] is further evidence of Russia’s continuing efforts to develop and test space-based systems, and consistent with the Kremlin’s published military doctrine to employ weapons that hold the U.S. and allied space assets at risk.”³⁵ The intentions of Russia do not appear peaceful, but rather a quest for dominance.³⁶ At some point, is an action in space deemed antagonistic or deliberately adversarial? Peaceful exploration seems incompatible with the testing of space-based weapons and ground-based cyberattacks of satellites. With dozens of countries, as well as private individuals and investors now investing in space assets, experts suggest that the US and other countries should re-evaluate these existing space laws.³⁷ At what point does research and development border on treaty violation? When a country can sufficiently demonstrate that testing a weapon 20,000 miles or more above the earth could have adverse impacts to other satellites?

threats/2020/05/coronavirus-not-slowng-russian-chinese-space-activities-us-general-says/165349/.

³¹ Clark, *supra* note 29.

³² Erwin, *supra* note 19 (quoting General Raymond, USAF, Commander, US Space Command and Commander, Air Force Space Command).

³³ *Id.*

³⁴ *See id.* (stating that this cycle will lead to escalation of capabilities, and the types of weapons that Russia tests puts the United States and other allies at risk).

³⁵ *Id.*

³⁶ *Id.*

³⁷ *See* Durkee, *supra* note 24, at 711–12 (“The SpaceX program is making rocket launches available at bargain basement prices, bringing space activities within the reach of a gaggle of startups keen to grab their piece of the commercial pie.”); *see also* Joanne I. Gabrynowicz, *Some Legal Considerations Regarding the Future of Space Governance*, 48 GA. J. INT’L & COMP. L. 739, 742 (2020) (acknowledging ambiguity in current construct).

I. BACKGROUND

A. Who Owns Outer Space?

Who owns outer space? No one nor any nation state: “There is no sovereignty in space.”³⁸ Although there is sovereignty on earth, the same does not apply to space.³⁹ For over thirty-five years, the United Nations Committee on the Peaceful Uses of Outer Space Legal Subcommittee has grappled with the question of where space begins.⁴⁰ The subcommittee notes that “[while contentious,] some nations say this question must be answered.”⁴¹ In 2001, the US, however, adopted the official position that “defining or delimiting outer space is not necessary . . . because [n]o legal or practical problems have arisen in the absence of such a definition.”⁴² According to Joanne I. Gabrynowicz, some states prefer the ambiguity as “[o]ther nations say a formal delimitation between air and space is unnecessary *because everything is working well now*.”⁴³ But if it is no longer working well, what options exist?

Although outer space is, or could be, subject to international law, enforcement and fora for disputes have not been explored or utilized.⁴⁴ With the growing unease in space, legal concerns about effective enforcement are emerging on earth.⁴⁵ US adversaries escalating their anti-satellite testing in 2020 has yielded new developments and concerns. This naturally results in legal scholars and space experts reviewing the history of space treaties and agreements to assess potential options for potential future recourse.⁴⁶

B. Where Does Space Begin?

With increasing use of the air space above the earth, an interesting and probing question often comes to the forefront: where does outer space begin?

³⁸ Gabrynowicz, *supra* note 37, at 742.

³⁹ *Id.* at 742 n.16 (“Sovereignty is not the legal organizing principle in space as it is on Earth and in airspace.”) (referencing Outer Space Treaty arts. I–II).

⁴⁰ *Id.*

⁴¹ *Id.* (acknowledging that certain nations desire clarity to the “upper limit to sovereignty,” while others say it is unnecessary).

⁴² *Id.* at 743 n.23 (quoting US Dep’t of State, US Statement, Definition and Delamination of Outer Space and the Character and Utilization of the Geostationary Orbit, Legal Subcommittee of the United Nations Committee on the Peaceful Uses of Outer Space at its 40th Session in Vienna (2001)) (explaining that with the creation of US Space Command, the official position of the US could be reviewed).

⁴³ *Id.* at 742 (emphasis added).

⁴⁴ Chen, *supra* note 2, at 663.

⁴⁵ *Id.*

⁴⁶ *Id.* at 667–68.

Space governance can be “settle[d]” only if it is determined “where exactly space begins.”⁴⁷ In the absence of a universal agreement, various countries are now defining differently where space begins, as well as what a space object actually is. For example, Australia defines a “space object” as something that goes to or beyond one hundred kilometers above sea level,⁴⁸ and similarly, Denmark defined “outer space” (vice space object) as above one hundred kilometers above sea level. Compare this to Colombia’s assertion of its sovereignty to its “territories” extending 35,786 kilometers above the Earth’s equator.⁴⁹

In the absence of universally accepted definitions in an Outer Space Treaty, sovereign states taking such opposing positions are potentially problematic. Negotiating after nation states have asserted their positions does not bode well for compromise. Consider the case of Colombia, which has now codified its aforementioned position into the Colombian Constitution.⁵⁰ Moreover, dispute resolutions under international law would be inconsistent and yield different results based on the countries involved. Such fluidity is not optimal for nation states or private investors.⁵¹

C. Space Law Beginning Somewhere: Sputnik I Is Launched and the United Nations Responds

International regulation began shortly after Sputnik I, which was launched on October 4, 1957, by the Soviet Union.⁵² This launch set off an alarm of global proportions and the United Nations General Assembly (G.A.) was called upon to act.⁵³ In 1957, the United Nations G.A. passed its first resolution, which called for the “joint study of an inspection system designed

⁴⁷ Durkee, *supra* note 24, at 714.

⁴⁸ Gabrynowicz, *supra* note 37, at 743 (referencing Australia’s Space Activities Act 1998).

⁴⁹ *Id.* (referencing Denmark’s Outer Space Act and Columbia’s Constitution, who chose the metric of 35,786 kilometers because it is the distance from earth to the arc in the geosynchronous orbit).

⁵⁰ *Id.*

⁵¹ *Id.* (highlighting that in the United States, investors are likewise asking for assurances for proper tax law application, as space is “not within U.S. jurisdiction.”).

⁵² *Sputnik and the Dawn of the Space Age*, NASA (Nov. 19, 2020), <https://history.nasa.gov/sputnik.html> (“ . . . the Soviet Union successfully launched Sputnik I . . . [t]hat launch ushered in new political, military, technological, and scientific developments. While the Sputnik launch was a single event, it marked the start of the space age and the U.S.-U.S.S.R. space race.”).

⁵³ António Guterres, *Remarks on the Sixtieth Anniversary of the Launch of Sputnik-1*, U.N. SEC’Y GEN. (Oct. 4, 2017), <https://www.un.org/sg/en/content/sg/speeches/2017-10-04/sgs-sputnik-1-60th-anniversary-launch-remarks> (“ . . . the launch of Sputnik-1 in 1957 . . . marked the beginning of the Space Age.”).

to ensure that the sending and launching of objects through outer space shall be exclusively for peaceful and scientific purposes.”⁵⁴ Countries sought universal consent that space activities be conducted in the interest of international peace, as all humankind has a “common interest” in outer space.⁵⁵ Of particular note is the Preamble of Resolution 1348 (XIII), which instructs all signatories to avoid “the extension of present rivalries into this new field [of outer space].”⁵⁶

Despite the language in the Preamble, by 1962, the United Nations agreed to assess new potential celestial threats to international peace, such as the safe returning of astronauts who landed in foreign state waters.⁵⁷ The US Representative to the United Nations was vocal in expressing concerns and characterized the Soviet Union space activity this way in 1962:

Outer space is not a new subject; it is just a new place in which all the old subjects come up. The things that go on in space are intimately related to the things that go on here on earth. It would be naïve to suppose that we can insulate outer space from other aspects of human existence.⁵⁸

The Outer Space Treaty signatories agreed only to major principles; concepts falling outside these principles remain unresolved.⁵⁹ Two principles remain solid and unquestioned: (1) the treaty prohibits the placing of nuclear

⁵⁴ See G.A. Res. 1148 (XII), at ¶ 1(f) (Nov. 14, 1957); see also Chen, *supra* note 2, at 664.

⁵⁵ See G.A. Res. 1348 (XIII), at ¶ 1 (Nov. 14, 1957); see also Chen, *supra* note 2, at 664–65.

⁵⁶ See G.A. Res. 1348, *supra* note 55, at ¶ 1; see also Chen, *supra* note 2, at 664–65.

⁵⁷ Elizabeth Howell, *Who Owns the Moon?* SPACE.COM (Oct. 27, 2017), <https://www.space.com/33440-space-law.html>.

⁵⁸ See Chen, *supra* note 2, at 662, n.1.

⁵⁹ *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies*, U.N. OFFICE FOR OUTER SPACE AFFAIRS, <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspacetreaty.html> (last visited Mar. 28, 2021).

[T]he basic framework on international space law, including the following principles: the exploration and use of outer space shall be carried out for the benefit and in the interests of all countries and shall be the province of all mankind; outer space shall be free for exploration and use by all States; outer space is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means; States shall not place nuclear weapons or other weapons of mass destruction in orbit or on celestial bodies or station them in outer space in any other manner; the Moon and other celestial bodies shall be used exclusively for peaceful purposes; astronauts shall be regarded as the envoys of mankind; States shall be responsible for national space activities whether carried out by governmental or non-governmental entities; States shall be liable for damage caused by their space objects; and States shall avoid harmful contamination of space and celestial bodies.

weapons in space,⁶⁰ and (2) the treaty prevents all nations from claiming sovereignty of outer space or any celestial body.⁶¹

Other principles have been subject to ambiguity in application. Article II limits the Moon and all other celestial bodies to peaceful purposes only and establishes that space shall be free for exploration and use by all nations.⁶² Also, Article IV specifically prohibits parties from placing weapons “in orbit around the Earth” with the absolute prohibition of “any objects carrying nuclear weapons or any other kinds of weapons of mass destruction.” The treaty explicitly prohibits any installation of “such weapons on celestial bodies . . . in outer space in any other manner.”⁶³ The treaty’s prohibition of placing nuclear weapons in space remains its most important principle. Further, Article IV states that the Moon and other celestial bodies must be explored for “exclusively peaceful purposes” with an express prohibition on the “establishment of military bases, installations and fortifications.”⁶⁴ Interestingly, the treaty forbids “military maneuvers on celestial bodies,” but it deems that “[t]he use of military personnel for scientific research shall not be prohibited.”⁶⁵ Therefore, the treaty is explicit that all peaceful exploration must be permitted.⁶⁶

Accordingly, one will find ambiguities in common definitions and applications, and resolution is unlikely notwithstanding exponential growth in space activities and threats.

D. United States Creation of Space Command

Naturally, because attacks on US satellites are possible, there is concern about the potential impacts such an attack would have on daily life.⁶⁷ All lives in the US would be partially impacted by satellite attacks because the US broadly depends on satellites and their secure transmission of data for many

⁶⁰ Chen, *supra* note 2, at 667 (referencing Article IV of the Outer Space Treaty); *see also* Gabrynowicz, *supra* note 37, at 741–42 (summarizing international discussions on potential future treaty activity, but none pertaining to revising the nuclear weapon prohibition).

⁶¹ Gabrynowicz, *supra* note 37, at 741–42.

⁶² *See* Durkee, *supra* note 24, at 714.

⁶³ Outer Space Treaty, *supra* note 1, at art. IV.

⁶⁴ *Id.*

⁶⁵ *Id.*

⁶⁶ *Id.* (“ . . . any equipment or facility necessary for peaceful exploration of the Moon and other celestial bodies shall also not be prohibited.”); *see also* Chen, *supra* note 2, at 661.

⁶⁷ EXEC. OFF. OF THE PRESIDENT, NAT’L SPACE POL’Y OF THE U.S.A. 1 (2020) (“Our way of life on Earth is greatly enhanced by space and the United States acknowledges the importance of space to the advancement of all humanity.”).

critical infrastructure sector services.⁶⁸ With both China and Russia demonstrating their potential, but unverified, capability to destroy US satellites, action is needed.⁶⁹ While no longer racing to get into space first, the US is exploring all international and military options to protect and secure space satellites from harm.⁷⁰

The use of the military is one avenue. For example, one military option is to centralize defense space activities under common leadership and control, should a military response become necessary.⁷¹ Accordingly, the United States Space Command was formed in 2020 to “organize, train, and equip space forces in order to protect U.S. and allied interests in space and to provide space capabilities to the joint forces,” in an effort to invest in national defense beyond borders and earth’s atmosphere.⁷² The US has a particular reliance on the companies that support the Pentagon, frequently referred to as the “defense industrial base” by policy makers.⁷³ As such, a broader coalition across government and the private sector is necessary if genuine attention and change has an opportunity to flourish.

⁶⁸ Richard Hollingham, *What Would Happen if All Satellites Stopped Working?*, BBC (June 9, 2013), <https://www.bbc.com/future/article/20130609-the-day-without-satellites>.

⁶⁹ See NAT’L AIR & SPACE INTELLIGENCE CTR., *supra* note 14, at 1.

⁷⁰ DEF. SPACE STRATEGY SUMMARY, *supra* note 28 (“Ensuring the availability of these capabilities is fundamental to establishing and maintaining military superiority across all domains and to advancing U.S. and global security and economic prosperity.”).

⁷¹ *Id.*

The Department is taking innovative and bold actions to ensure space superiority and to secure the Nation’s vital interests in space now and in the future. Establishing the U.S. Space Force (USSF) as the newest branch of our Armed Forces and the U.S. Space Command (USSPACECOM) as a unified combatant command, as well as undertaking significant space acquisition reform across the DoD, has set a strategic path to expand space power for the Nation.

⁷² Staff Sgt. Brittany E. N. Murphy, *CSO Visits VAFB During MMIII Launch*, U.S. SPACE COMMAND (Aug. 6, 2020), <https://www.spacecom.mil/MEDIA/NEWS-ARTICLES/Article/2303349/cso-visits-vafb-during-mmiii-launch/>.

⁷³ Mikhail Grinberg, *The Defense Industrial Base of the Future*, CNAS (July 23, 2020), <https://www.cnas.org/publications/commentary/the-defense-industrial-base-of-the-future>.

Since America relies on critical infrastructure that is primarily owned and operated by the private sector, the government cannot defend the nation alone. The public and private sectors, along with key international partners, must collaborate to build national resilience and reshape the cyber ecosystem in a manner that increases its security, while imposing costs against malicious actors and preventing attacks of significant consequence.

E. Opportunity to Leverage US Business Interests

Another avenue to increase attention to the risks of satellite attacks is to focus business leaders' attention as they explore their own commercial interests as well as their security.⁷⁴ The public sector and academia provide the framework for prosperity in the United States.⁷⁵ In 2019, the US Gross Domestic Product was \$21.43 trillion, the largest in the world.⁷⁶ The strength of the US economy is largely due to the US Constitution and the rule of law, to the reserved authorities of state and local governments, to the commercial incentives available to the private sector, and to the US's robust educational system. With such global ranking, there is tremendous influence and an opportunity to lead in the international arena. The private sector is being leveraged more and more to help drive change and demand security in space.⁷⁷

The US economy runs and relies on private enterprise. In fact, it is estimated that the private sector owns and operates somewhere between 60 and 80 percent of the digital infrastructure, the indispensable highway upon which almost all our commerce is conducted.⁷⁸ In the US, sixteen business areas are designated as "critical infrastructure sectors," which are all primarily managed and operated by American commercial enterprises.⁷⁹ A critical infrastructure sector, as defined by Presidential Policy Directive 21, includes the business assets, systems, and networks, whether physical or virtual, that are "considered so vital to the United States" that their incapacitation or destruction would have a "debilitating effect on security, national economic security, national

⁷⁴ See Diane M. Janosek, *Critical Infrastructure: Space Security and Cybersecurity Intersect*, CAPITOL TECH. U., <https://www.capttechu.edu/blog/part-1-critical-infrastructure-space-security-and-cybersecurity-intersect> (last visited May 12, 2021).

⁷⁵ See *id.*

⁷⁶ See *Gross Domestic Product 2019*, WORLD BANK (July 1, 2020), <https://databank.worldbank.org/data/download/GDP.pdf>; see also Janosek, *supra* note 74.

⁷⁷ See Mike Wall, *New Space Mining Legislation is 'History in the Making'*, SPACE.COM (Nov. 20, 2015), <https://www.spacecom/31177-space-mining-commercial-spaceflight-congress.html> (noting that the investment in space activities is growing, and that with such investments, investors want assurances and a "solid framework.").

⁷⁸ Marguax Constantin et al., *As National Borders Consider Reopening, a Partnership Between Governments and the Tourism Industry Will Be Essential*, MCKINSEY & CO. (Aug. 5, 2020), <https://www.mckinsey.com/industries/travel-logistics-and-transport-infrastructure/our-insights/reimagining-the-9-trillion-tourism-economy-what-will-it-take#> (noting that the exact percentage in the United States has not been determined, but government officials generally reference this 60 to 80 percent estimate); see also Janosek, *supra* note 74.

⁷⁹ *Critical Infrastructure Sectors*, CYBERSEC. & INFRASTRUCTURE SEC. AGENCY (Oct. 21, 2020), <https://www.cisa.gov/critical-infrastructure-sectors#:~:text=Presidential%20Policy%20Directive%2021%20%28PPD-21%29%3A%20Critical%20Infrastructure%20Security,7.%20Guidance%20on%20the%20Essential%20Critical%20Infrastructure%20Workforce.>

public health or safety, or any combination thereof.”⁸⁰ All of these sectors, to some degree, rely on secure cyber networks that increasingly obtain their information from US satellites.⁸¹

F. Essential Assets: US Critical Infrastructure Sectors

During the COVID-19 pandemic, President Donald Trump and the Secretary of the Department of Homeland Security declared that workers in sixteen critical infrastructure sectors are essential workers.⁸² Dr. Brad Sims, President of Capitol Technology, remarked: “[from] the most basic aspects of life—having clean air to breathe and water to drink—to the more complex—coordinating airplane traffic and securing nuclear reactors, life as we know it depends on these 16 critical infrastructure [sectors.]”⁸³ The sixteen sectors are: Chemical, Commercial Facilities, Communications, Critical Manufacturing, Dams, Defense Industrial Base, Emergency Services, Energy, Financial Services, Food and Agriculture, Government Facilities, Healthcare and Public Health, Information Technology, Nuclear Reactors, Materials, and Waste, Transportation Systems, and Water and Wastewater Systems.⁸⁴

Therefore, daily life in the US would be severely impacted by an attack on its space assets, as all of the above critical infrastructure sectors have a reliance and strict dependence on space satellites.⁸⁵ If any one of the above sectors experienced a ‘hit’ to a satellite upon which it relied, a degradation or complete cessation of service would occur; and possibly a national emergency would ensue.⁸⁶

⁸⁰ Press Release, White House Office of the Press Secretary, Presidential Policy Directive—Critical Infrastructure Sec. & Resilience (Feb. 12, 2013), <https://obamawhitehouse.archives.gov/the-press-office/2013/02/12/presidential-policy-directive-critical-infrastructure-security-and-resil>; see also Janosek, *supra* note 74.

⁸¹ See *World Space Week*, *supra* note 7 (identifying six everyday things that satellites affect: agriculture, weather forecasting, urban living, communications, entertainment, and shopping).

⁸² See Advisory Memorandum from CISA Acting Director Brandon Wales on Ensuring Essential Critical Infrastructure Workers’ Ability to Work During the COVID-19 Response (Dec. 16, 2020).

⁸³ Janosek, *supra* note 74.

⁸⁴ *Critical Infrastructure Sectors*, *supra* note 79.

⁸⁵ See DEF. SPACE STRATEGY SUMMARY, *supra* note 28, at 1 (stating adversaries’ technological advances are “create[ing] challenges in protecting critical technology, ensuring operational security, and maintaining strategic advantages.”).

⁸⁶ See *id.* at 3 (noting that China and Russia have “analyzed U.S. dependencies on space” and have “weaponized space as a way to deter and counter a possible U.S. intervention during a regional military conflict”).

G. US Space and Satellite Investments

All of these US critical infrastructures sectors rely on space and satellite technology in some way, e.g., for Global Positioning System (GPS), time, location, weather, and traffic. Common users of data transmitted by satellite are automated teller machines (ATMs), video conferencing, satellite television and radio, inventory control, pay-at-pump gas stations, telephone and broadband, air traffic control systems, sea navigation systems, and the navigation features people use in their autos every day.⁸⁷ The list is endless. Satellites provide safety, ease, and convenience; daily life depends on space and satellite security.⁸⁸

The critical infrastructure sector's reliance on satellites means that all of them require cybersecurity and other forms of protection.⁸⁹ Freedoms are maintained with this protection. How is the United States prepared and protected in space from cyberattacks?⁹⁰ What really happens in space when space security and cybersecurity intersect?

While satellites are launched in different orbits at different distances from the earth, there is connected ground station that processes the data collected and/or transmitted by the satellite. During the transmission or processing phases, the ground states can be subject to cyber attacks. Depending on the type and/or functionality of the satellite, adversaries' interests may be piqued, and lead to greater cyberattacks due to the sensitivity of the data being transmitted.⁹¹ There are four principal purposes of the satellites, which are:

⁸⁷ See generally *World Space Week*, *supra* note 7 (identifying six everyday things that satellites affect: agriculture, weather forecasting, urban living, communications, entertainment, and shopping).

⁸⁸ See *id.* (noting that satellites benefit "7 billion people on Earth" and that they provide us with "incredible benefits and worlds of opportunity").

⁸⁹ U.S. CYBERSPACE SOLARIUM COMM'N., CYBERSPACE SOLARIUM COMM'N. REP. 4–6 (2020), <https://www.solarium.gov/report> (recommending actions to "reshape the cyber ecosystem," operationalize cybersecurity collaboration with the private sector," and "preserve and employ the military instrument of national [power.]"); see also DEF. SPACE STRATEGY SUMMARY, *supra* note 28, at 1 (noting that the Department of Defense is "taking innovative and bold actions to ensure space superiority and to secure the Nation's vital interests in space now and in the future").

⁹⁰ U.S. CYBERSPACE SOLARIUM COMM'N., *supra* note 89, at 98.

. . . [T]he U.S. government should focus on national critical functions that: (1) [d]irectly support or underpin national security programs or government or military operations; (2) [c]onstitute essential economic functions or underpin the national distribution of goods and services; (3) [s]upport or underpin public health and safety or are so foundational that their disruption could endanger human life on a massive scale.

⁹¹ *Types of Satellites: What is a Satellite, Types and Uses of Satellites*, EDUCBA.COM (Feb. 1, 2021), <https://www.educba.com/types-of-satellites/>; see also *7 Key Benefits of Satellite Communication You Must Know*, TELECOM TECH OUTLOOK (Sept. 7, 2020),

intelligence, surveillance, reconnaissance and remote sensing; communications, navigation, and science and technology.⁹² Thus, as the US has the greatest reliance in space, it also has the most to lose.⁹³ Space security is a strategic imperative for US sovereignty and national security.⁹⁴ Clarity in space governance is equally as imperative.

H. US Satellites in Orbit

In 2020, the US had hundreds of satellites in orbit, including 353 intelligence, surveillance, reconnaissance and remote sensing; 391 communications; thirty-one navigational; ninety-four science and technological.⁹⁵ And yet with all these US sovereign resources in orbit, as well as other countries' satellites in orbit, is there truly useful, enforceable protection in international law if a nation state or non-state actor became adversarial in space? The applicability and enforcement of the Outer Space Treaty may not be reliable, as in the time since its ratification "the world has changed, and so has space."⁹⁶ The weaponization of space is now here.

As an analogy, if an unarmed person is engaged in an unfriendly encounter with an armed person whose intentions are unknown, what options does the unarmed person have for protection? Not many, except to stay away and keep one's distance. For outer space, the option to "stay away" is not available as satellites are in fixed orbits, and there is no self-defense (at least not yet developed) for adversarial attacks such as projectiles or anti-satellite weapons launched from a neighboring satellite. International space governance may be the only option. Thus, the "absence of conflicts in space in the past is not guaranteed in the future."⁹⁷

<https://www.telecomtechoutlook.com/news/7-key-benefits-of-satellite-communication-you-must-know-nwid-254.html> (noting what an artificial satellite is and the various functions they serve).

⁹² See NAT'L AIR & SPACE INTELLIGENCE CTR., *supra* note 14, at 4 (noting countries and organizations with assets in space and the primary purposes of said assets).

⁹³ See *id.* at 1, 4 (a descriptive visual of United States assets in space and noting how other world powers are challenging US superiority in space).

⁹⁴ DEF. SPACE STRATEGY SUMMARY, *supra* note 28, at 1 (explaining how countries such as China and Russia have weaponized space to potentially harm the US and other closely related allies).

⁹⁵ See NAT'L AIR & SPACE INTELLIGENCE CTR., *supra* note 14, at 6–7.

⁹⁶ Durkee, *supra* note 24, at 711.

⁹⁷ Chen, *supra* note 2, at 673, 681 (quoting Comm. on the Peaceful Uses of Outer Space, Rep. of Work of Its Sixty-Second Session, U.N. Doc. A/74/20, at ¶ 50–69 (July 3, 2019) ("the absence of conflicts in space in the past could not be regarded as a guarantee of peace.")).

II. THE VOID IN SPACE GOVERNANCE WITH REGARD TO RESPONSIBLE AND PEACEFUL USE OF OUTER SPACE

A. Can One Enforce Space Governance?

Conflicts in space are likely to occur, especially with the involvement of new nations.⁹⁸ Enforcement of international law of the Outer Space Treaty has never been exercised.⁹⁹ As a United Nations observer noted, “The absence of conflicts in space in the past [can] not be regarded as a guarantee of peace.”¹⁰⁰ So what can assist in guaranteeing peace? Is there not a duty to seek peace by world leaders to preserve peaceful exploration and non-militarization of space?

While the United Nations seeks to find common voluntary resolutions, it has been unsuccessful in its attempts to arrive at any international agreement to update space governance and fill in the gaps identified by current anti-satellite activity.¹⁰¹ However, most emerging issues, such as space mining rights by commercial entities seeking rare and valuable minerals through space exploration with the intent to salvage and return discovered minerals to earth, are addressed by individual countries.¹⁰² The most successful space agreement pertains to the International Space Station and how it allocates rights and expenses to the fifteen member nations.¹⁰³ At the international level, the Hague International Space Resources Governance Working Group was established with representatives from government, civil society, industry, and academia.¹⁰⁴ The group has made some progress and adopted “Building Blocks for the Development of International Framework on Space Resources Activities.”¹⁰⁵ Countries are exploring whether there can be a voluntary agreement on extracted space resources.¹⁰⁶ Looking even further ahead, to another unresolved issue, is how countries will cooperate if human beings land and then reside on the moon; with no sovereignty in space, earthly sovereignty

⁹⁸ See generally G.A. RES. 72/250, ¶ 3 (Jan. 12, 2018) (highlighting practical measures for the prevention of an arms race in space); Chen, *supra* note 2, at 673.

⁹⁹ Chen, *supra* note 2, at 669.

¹⁰⁰ *Id.* at 673, 681 (quoting Comm. on the Peaceful Uses of Outer Space, Rep. of Work of Its Sixty-Second Session, U.N. Doc. A/74/20, at ¶ 54 (July 3, 2019)).

¹⁰¹ See Howell, *supra* note 57 (listing the four UN treaties enacted to support the Outer Space Treaty, including The Rescue Agreement of 1968, The Liability Convention of 1972, The Registration Convention of 1975, and The Moon Agreement of 1979).

¹⁰² See Wall, *supra* note 77 (discussing space mining and if a country can assert or retain ‘property rights’ to rare minerals extrapolated from the moon and other celestial bodies).

¹⁰³ *Id.* (highlighting a recent bill that extends US commitment to the International Space Station through at least 2024).

¹⁰⁴ Gabrynowicz, *supra* note 37, at 746.

¹⁰⁵ *Id.*

¹⁰⁶ *Id.* at 745.

approaches and claims to sovereignty are not applicable.¹⁰⁷ How would disputes involving this issue be resolved?

B. Without A Guarantee of Peace, Is the United States Prepared?

Space is becoming a “place” where countries can assert dominance over one another by destroying or degrading another’s space assets, which in turn, causes terrestrial impacts.¹⁰⁸ Outer space is the next battlefield,¹⁰⁹ as well as the emerging hottest sector for commercialization and investment.¹¹⁰ Dependence on space technologies can have a devastating impact if those technologies are under attack. What if an adversary attacked US satellites, like China did to its own weather satellite? What if Russia attempted to demonstrate that it could? What effect could such an attack have on daily lives in both the immediate and medium term? An evaluation of satellite uses yields a definite dependence on technology. What if just one significant satellite started to fail?

When and if a satellite is attacked, the initial challenge will be proper attribution to a specific actor or nation state. As no one can “see” an attack in space, it would be difficult to ascertain an actor. Possibly, only a retrospective review could assist if there was collection technology, which had the necessary data with enough fidelity and precision.¹¹¹ Adding to the difficulty is that generally, satellite failure becomes known only when there is a terrestrial technology alert or degradation of service; thus, it is not necessarily in real time that a country could assess a suspected attack.¹¹² Terrestrial impacts may include: [t]elevision networks no longer able to broadcast, an internet degradation or failure, denial of service, and ATMs malfunctioning.¹¹³

¹⁰⁷ *Id.* at 742.

¹⁰⁸ See NAT’L AIR & SPACE INTELLIGENCE CTR., *supra* note 14, at 1, 3 (explaining that hijacking of another’s space asset is now technologically possible).

¹⁰⁹ Zivitski, *supra* note 5 (stating “space is the new high ground in great power competition”).

¹¹⁰ Shammass & Holen, *supra* note 20, at 13 (“No longer terra nullius, space is now the new terra firma of capitalistkind: its naturalized terroir, its next necessary terrain. The logic of capitalism dictates that capital should seek to expand outwards into the vastness of space. . .”).

¹¹¹ John Klein, *To Deter Attacks on Satellites, U.S. Needs a Strategy to Identify Bad Actors*, SPACENEWS (June 5, 2020), <https://spacenews.com/op-ed-to-deter-attacks-on-satellites-u-s-needs-a-strategy-to-identify-bad-actors/> (explaining that attribution is necessary in order to appropriately respond to hostile or malicious action).

¹¹² See Leonard David, *Russian Satellite Hit By Debris from Chinese Anti-Satellite Test*, SPACE.COM (Mar. 8, 2013), <https://www.space.com/20138-russian-satellite-chinese-space-junk.html>.

¹¹³ See NAT’L AIR & SPACE INTELLIGENCE CTR., *supra* note 14, at 8.

Financial networks that depend on exact timing provided by GPS technology would freeze, and some traffic and railroad signals that also rely on GPS technology would malfunction; additionally, air traffic control, reliant on GPS and weather information plants, would fail.¹¹⁴

Action is always better than reaction. In outer space today, however, reaction may be the only option. US Congressman Jim Bridenstine accurately assessed the lack of options when he said, “If someone attacks us in space, we reserve the right to respond terrestrially.”¹¹⁵ This approach is not optimal for international and US national security.¹¹⁶ Thus, signatories may be forced to address matters unilaterally or bilaterally, absent an international agreement.¹¹⁷

III. ARE THE CURRENT THREATS TO THE US CRITICAL INFRASTRUCTURE VALID CONCERNS?

A. Adversarial Tactics

Foreign competitors and adversaries can conduct electronic attacks to disrupt, deny, deceive, or degrade space services by attacking the segments in space, on the ground, or through the user or the links themselves.¹¹⁸

These threats take multiple forms. The first is jamming, which is a method used to prevent users from receiving intended signals. Jamming can be accomplished by two primary methods, uplink jamming (directed toward the satellite) or downlink jamming (directed at the users on the ground).¹¹⁹ The second is spoofing, which is a method used to make data or signals appear to be legitimate when they are not. This could tragically hurt an operation when knowing the location of something or someone is the key to a successful mission.¹²⁰ The Center for Advanced Defense, a non-profit defense-related think tank on global security and conflict issues, reported in 2019 that Russia conducted nearly 10,000 GPS spoofing incidents in 2018.¹²¹ The report *Above*

¹¹⁴ *See id.* at 15.

¹¹⁵ Krause, *supra* note 11.

¹¹⁶ DEF. SPACE STRATEGY SUMMARY, *supra* note 28, at 1 (“Ensuring the availability of these capabilities is fundamental to establishing and maintaining military superiority across all domains and to advancing U.S. and global security and economic prosperity.”).

¹¹⁷ EXEC. OFF. OF THE PRESIDENT, *supra* note 67, at 3–4 (“The United States considers the space systems of all nations to have the right to pass through and conduct operations in space without interference. Purposeful interference with space systems, including supporting infrastructure, will be considered an infringement of a nation’s rights.”).

¹¹⁸ *See* NAT’L AIR & SPACE INTELLIGENCE CTR., *supra* note 14, at 15.

¹¹⁹ *See* CTR. FOR ADVANCED DEF., ABOVE US ONLY STARS: EXPOSING GPS SPOOFING IN RUSS. AND SYRIA 9–10 (Nov. 2018), <https://www.c4reports.org/aboveusonlystars>.

¹²⁰ *Id.* at 9.

¹²¹ *Id.* at 3.

us Only Stars: Exposing GPS Spoofing in Russia and Syria found that those incidents put ships off course and kept drones out of sensitive air space.¹²² It is notable that Russian spoofing is widespread. As the report concluded, “[w]hether for profit, protection, or disruptions, illicit actors, writ large, stand to gain from the proliferation of these capabilities.”¹²³

Accordingly, this raises the legal issue of whether spoofing and jamming meets the definition of “peaceful purpose.” These new and novel ways to compromise space assets may have reached the limits of any “peaceful exploration of space” claim.¹²⁴ As such, this expansion in space activities calls into question the reach of key phrases in the Outer Space Treaty. In as much as some technologies today were not even in the scientific community’s vernacular at the time of the passage of the treaty,¹²⁵ one would be hard pressed to associate current interpretations and boundaries with these activities. Absent clarity on interpretation, cyberattack violations would be challenging to assert, and enforcement would become impossible, thus diminishing the utilitarian value of the Outer Space Treaty.¹²⁶

B. Case Studies: China & Russia

The Outer Space Treaty provides for “peaceful exploration” in space.¹²⁷ The exemplars below are real time case studies on whether the activity conducted by China and Russia is permissible, and whether current activities can be construed as engagements for a peaceful purpose.¹²⁸ If one concludes that these activities are definitively peaceful, then the Outer Space Treaty should be re-visited and adjusted.¹²⁹ Such activities will continue to take place, if not increase and/or proliferate, and they will do so without proper governance.¹³⁰ International law is not the optimal enforcement mechanism when facts and legal application are gray.¹³¹ Considering multiple nation states rely on peaceful and lawful use of space for satellite use, clear

¹²² *Id.* at 15–16.

¹²³ *Id.* at 51.

¹²⁴ *Id.* at 26.

¹²⁵ *Id.* at 3 (“spoofing” in terms of disruptions of satellite functionality is new and the disruption capability did not previously exist).

¹²⁶ Outer Space Treaty, *supra* note 1.

¹²⁷ *Id.* at art. IV

¹²⁸ *Id.*

¹²⁹ Krause, *supra* note 11.

¹³⁰ *Id.*

¹³¹ Jana Maftai & Coman Varvara, *Interpretation of Treaties*, 8 ACTA UNIVERSITATIS DANUBIUS 16, 16 (2012) (stating the challenge that presents in treaties in the “imprecision of used terms” which then requires legal interpretation).

boundaries are necessary.¹³² Long-term safety and sovereignty could be in question.

1. *China*

Back in 2007, China demonstrated how space can become a combat zone by conducting an anti-satellite mission test.¹³³ The country shot down its own weather satellite with a kinetic kill vehicle.¹³⁴ China sent a clear message to the world: satellites can be destroyed from Earth. Additionally, open-source material confirms that the nascent capability has matured with greater precision.¹³⁵ Major Liane “Trixie” Zivitski, of the United States Air Force, currently serving as J32 Chief of Operations Branch, reported in a publication that the kinetic kill vehicle is now assessed as operational and capable of targeting low-orbit satellites.¹³⁶ There is also evidence, according to Zivitski, that China may be developing up to three different anti-satellite missiles. Further, on May 5, 2020, there was a reported Chinese launch of the Long March-5B rocket, the design of which is suspected to be for transport into space.¹³⁷ Such weapons testing immediately caused tremendous space debris.¹³⁸ The volume of space debris alone will have residual effects for at least two decades, as both small and large pieces of the destroyed satellite remain in outer space in more than one orbit.¹³⁹

Even the smallest specimen of space debris can have devastating impacts on a satellite if lodged—as one can imagine, there is no self-help or nearby human

¹³² Krause, *supra* note 11 (noting the rise of commercial rockets that could take private “tourists” to space, which may require more specific boundaries to be drawn).

¹³³ See Zivitski, *supra* note 5.

¹³⁴ *Id.*

¹³⁵ See *generally id.* (“Beijing’s rapidly improving [space] capabilities. . . are clear to see.”)

¹³⁶ See *id.*

China is determined to replace the U.S. as the dominant power in space. While proclaiming its peaceful intentions, Beijing’s doctrine considers space a military domain, and it is investing heavily in space infrastructure designed to secure both economic and military advantages. To ensure that it continues to compete from a position of strength, the U.S. must invest sufficient resources in preparing its new Space Force to defend America’s national interests and security in space.

¹³⁷ *Id.*

¹³⁸ See Mike Gruss, *U.S. Official: China Turned to Debris-field ASAT Tests Following 2007 Outcry*, SPACE NEWS (Jan. 11, 2016), <https://spacenews.com/u-s-official-china-turned-to-debris-free-asat-tests-following-2007-outcry/#:~:text=11%2C%202007%2C%20China%20deliberately%20destroyed,used%20belt%20of%20Earth%20orbit> (quoting State Department that the 2007 anti-satellite test by the Chinese military a “remarkable incident of irresponsible behavior” and that the 2007 “action, which was widely condemned throughout the international space community, left a cloud of potentially hazardous debris in a heavily used belt of Earth orbit.”); see also David, *supra* note 112.

¹³⁹ See Outer Space Treaty, *supra* note 1, at art. IV.

being to dislodge the space debris.¹⁴⁰ A millimeter particle can have debilitating effects on an innocent “bystander satellite” owned by a different sovereign nation.¹⁴¹ Some say that these flagrant activities may very well be clear indicators that the Chinese “are determined to replace the U.S. as the dominant power in space.”¹⁴² Six years after the 2007 Chinese anti-satellite launch, on January 22, 2013, a Russian satellite was impacted by its space debris.¹⁴³ The collision involved the Chinese “space junk” and Russia’s small Ball Lens In The Space (BLITS) retroreflector satellite.¹⁴⁴ The BLITS was only seventeen pounds, and it began immediate degradation with a change in spin cycle from 5.6 seconds to 2.1 seconds.¹⁴⁵ As expected, attribution is challenging, and to this day, Russia has not been compensated nor has China admitted that its space debris caused the damage.¹⁴⁶ This article does not opine on this conclusion, but rather asks if these activities are “peaceful exploration.”

2. *Russia*

On July 15, 2020, Russia conducted a non-destructive on-orbit test of a space-based anti-satellite weapon.¹⁴⁷ Russia used one satellite to “attack” another: a “projectile” was released from Russian satellite Kosmos 2543 toward Russian satellite Kosmos 2542.¹⁴⁸ The Russians, however, deny this was an anti-satellite weapon test and assert it was an “inspection” mission.¹⁴⁹

The testing of the anti-satellite weapon worried global leaders almost

¹⁴⁰ See Neel V. Patel, *Astronauts on the ISS are Hunting for the Source of Another Mystery Air Leak*, MIT TECH. R. (Sept. 30, 2020), <https://www.technologyreview.com/2020/09/30/1009150/astronauts-iss-hunting-mystery-air-leak-micrometeoroids/> (experiencing recent leaks due to space debris, the International Space Station is one example of the challenge caused by a small leak to a space asset because the origination and/or cause is extremely difficult to discover).

¹⁴¹ See Outer Space Treaty, *supra* note 1, at art. IV.

¹⁴² See Zivitski, *supra* note 5.

¹⁴³ See David, *supra* note 112.

¹⁴⁴ See *id.*

¹⁴⁵ Wall, *supra* note 77; David, *supra* note 112.

¹⁴⁶ Wall, *supra* note 77; David, *supra* note 112.

¹⁴⁷ Evan Gough, *Russia Just Tested an Anti-Satellite Weapon*, UNIVERSE TODAY (July 28, 2020), <https://www.universetoday.com/147182/russia-just-tested-an-anti-satellite-weapon/>.

¹⁴⁸ *Id.*

¹⁴⁹ See Larisa Brown, *Russia Fires ‘Star Wars’ Missile: Britain and US Brand Kremlin Launch of First-Ever Anti-Satellite Weapon in Space a ‘Threat to Peace’*, DAILY MAIL (July 23, 2020), <https://www.dailymail.co.uk/news/article-8553793/Putin-tests-anti-satellite-weapon-space-UK-say-Russia-threatened-peace-space.html> (quoting a UK defense source stating: “This is using a satellite as a space weapon. It is a step in the direction of turning space into a new frontline.”).

immediately.¹⁵⁰ Russia launched one satellite, Kosmos 2542, and then eleven days later had the second satellite separate from the first.¹⁵¹ The second satellite, Kosmos 2543, released a projectile weapon eight months later.¹⁵² It was a novel, very deliberate weapon testing in many ways and is still being studied.¹⁵³ Experts have now assessed that the July 2020 anti-satellite testing by Russia is notable from many perspectives: nation-state sovereignty, diplomatic relations, treaty enforcement, military capabilities, academic advances, as well as the pure technological changes.¹⁵⁴ As such, these aspects all raise alarms.

3. *Review of Two Case Studies*

Now that two nation states not allied with the US can and have tested space satellites as weapons, what is at risk? The US has more satellites and equipment in space than any other nation.¹⁵⁵ Each of these space assets transmits sensitive data that makes them potential targets for US adversaries to hack or destroy.¹⁵⁶ Once again, this article does not opine on this conclusion, but rather asks if these activities are “peaceful exploration.”¹⁵⁷

The two case studies of China and Russia, therefore, at a minimum, lead one to infer that the Outer Space Treaty is not adequate enough to account for technology changes and sophistication arising from the past five decades.¹⁵⁸ The extensive space debris caused by the Chinese ASAT SC-19 alone has potential repercussions for decades to come, because the space debris will continue to orbit for some time, and each orbit has the potential to “hit” another sovereign country’s satellite.¹⁵⁹ What remedies, if any, are afforded to

¹⁵⁰ *See id.* (“The weapon’s debris alone threatens the satellites the world depends on, according to the head of the UK military’s space directorate.”)

¹⁵¹ *Id.*

¹⁵² Jonathan O’Callaghan, *Russia Accused Of Firing ‘Anti-Satellite Weapon’ From One Of Its Satellites In Space*, FORBES (July 24, 2020), <https://www.forbes.com/sites/jonathanocallaghan/2020/07/24/worrisomerussia-accused-of-firing-a-projectile-in-space-from-one-of-its-satellites/?sh=1b811c8865a5>.

¹⁵³ *Id.*

¹⁵⁴ *See* Hollie McKay, *Space Force on Alert: Behind Russia’s Mysterious Testing of Deadly Anti-Satellite Weapons in Orbit*, FOX NEWS (July 29, 2020), <https://www.foxnews.com/tech/space-force-russia-orbit-anti-satellites-testing.print>.

¹⁵⁵ Katharina Buchholz, *The Countries with the Most Satellites in Space*, STATISTA (July 14, 2020), <https://www.statista.com/chart/17107/countries-with-the-most-satellites-in-space/#:~:text=While%20the%20U.S.%20is%20the,cooperations%20come%20in%20third%20place.>

¹⁵⁶ *See* NAT’L AIR & SPACE INTELLIGENCE CTR., *supra* note 14, at 6.

¹⁵⁷ *See* Zivitski, *supra* note 5.

¹⁵⁸ *See id.*; *see also* Gough, *supra* note 147.

¹⁵⁹ *See* Zivitski, *supra* note 5; *see also* *The Posture of the U.S. Strategic Command Before Strategic Forces Subcommittee*, 110th Cong. 12 (2007) (statement of General James Cartwright).

that impacted country? As mentioned above, Congressman Bridenstine assessed the lack of options if attacked: “If someone attacks us in space, we reserve the right to respond terrestrially.”¹⁶⁰ Terrestrial responses mean that a war started in space may also become a ground war, and with all domains impacted, this could mean global “all-out” war. No sovereign state desires this outcome. As of today, however, there are few alternatives if there are aggressions in space. Accordingly, the time is ripe for a review and update of outer space governance documents.

4. *Call to Action*

The above case studies support the notion that the global landscape and technologies have dramatically altered since 1957, when the first satellite was launched.¹⁶¹ The US National Space Policy recognizes that cyber defense and education are integral to a strong long-term space strategy.¹⁶² Likewise, the US National Cyber Strategy recognizes that robust cyber education for the youth is imperative for the nation’s future pipeline of cyber professionals.¹⁶³ Whether it is about assets in space or cyber networks attacking those space assets, there are three key elements to US policy success in this emerging arena: Collaboration, Education, and Innovation—all across the space governance (legal) paradigm.¹⁶⁴

a. *Collaboration*

In outer space, no one country can completely “go it alone.”¹⁶⁵ The United

¹⁶⁰ Krause, *supra* note 11.

¹⁶¹ See Shammas & Holen, *supra* note 20, at 5 (signing the 2010 National Space Policy, President Barack Obama emphasized “promoting and supporting a competitive U.S. commercial space sector” considered vital to continued progress in space); see also EXEC. OFF. OF THE PRESIDENT, *supra* note 67, at 5; see also Clara Moskowitz, *How Sputnik Changed the World 55 Years Ago Today*, SPACE.COM (OCT. 4, 2012), <https://www.space.com/17894-sputnik-anniversary-changed-the-world.html>.

¹⁶² EXEC. OFF. OF THE PRESIDENT, *supra* note 67, at 7–8 (espousing the goal to “incorporate cybersecurity principles across all phases of space systems design, development, acquisition, and deployment” so that newly built space assets can be defended from cyber-attacks).

¹⁶³ U.S. DEP’T OF DEF., NAT’L CYBER STRATEGY OF THE U.S.A. 6 (Sept. 2018), https://media.defense.gov/2018/Sep/18/2002041658/-1/-1/1/CYBER_STRATEGY_SUMMARY_FINAL.PDF.

¹⁶⁴ *Id.* at 1–2.

¹⁶⁵ EXEC. OFF. OF THE PRESIDENT, *supra* note 67, at 1.

Our way of life on Earth is greatly enhanced by space and the United States acknowledges the importance of space to the advancement of all humanity.

States must partner to confront the growing threat in cyber and outer space.¹⁶⁶ There is no alternative, as satellite security is essential to protecting people's livelihoods across the United States.¹⁶⁷

b. Education

Novel education approaches for a skilled workforce will be crucial in facing the space security threat.¹⁶⁸ As space security threats are constantly evolving, awareness across all business sectors is needed.¹⁶⁹ Bringing space security and cyber education programs to the future leaders of the US is also a key component to national security.¹⁷⁰

The United States will lead and strengthen *enduring international partnerships* to preserve and sustain space for future activity and so that all nations and all people can benefit from space and improve our way of living on Earth and in space.

¹⁶⁶ See Shammass & Holen, *supra* note 20, at 10.

Wilbur Ross, President Trump's Secretary of Commerce, eagerly supported the private space industry by pushing the dismantling of regulatory frameworks. As Ross emphatically stated, 'The rate of regulatory change must accelerate until it can match the rate of technological change!' He also spoke before the National Space Council, commenting appreciatively that 'space is already a \$330 billion industry' that was set to become a 'multitrillion-dollar one in coming decades'. He noted that private corporations needed 'all the help we can give them' and said it was 'time to unshackle business activity in space.'

¹⁶⁷ DEF. SPACE STRATEGY SUMMARY, *supra* note 28 ("Space is vital to our Nation's security, prosperity, and scientific achievement. Space-based capabilities are integral to modern life in the United States and around the world and are an indispensable component of U.S. military power.").

¹⁶⁸ U.S. CYBERSPACE SOLARIUM COMM'N., *supra* note 89, at 43.

The challenge of achieving effective security and defense in cyberspace depends on people as much as it does on technology or policy . . . [o]verall government approaches to successfully deepen and diversify [the] candidate pool should include: (1) [d]eveloping programs to bring in new employees via apprenticeships, promoting cooperative study, and expanding training programs so that existing workers can enhance their career trajectories; (2) [r]esearching and implementing measures of competency alongside more commonly used certifications; (3) [s]trengthening processes and reducing institutional barriers to onboarding cyber talent quickly; and (4) [i]dentifying opportunities and building hiring pathways for members of underrepresented communities.

¹⁶⁹ See *id.* at 8, 19, 43.

¹⁷⁰ See *id.* at 18–19. Space security is paramount as a countermeasure to weapons in space, as is the protection of the communication between satellites and their ground stations. New ideas to better safeguard satellites and the ground stations must be sought in light of cyberattacks initiated terrestrially but with impacts 20,000 miles above. This is a whole new subset of security and law that is ripe for creative ideas. *Id.*

c. *Innovation*

The word innovation comes from the Latin word “innovare,” which means “to renew or restore.”¹⁷¹ Today is the day to renew the approach to space governance. The United States’ strength is innovation, and thus, it can find the solutions to security in space and cyberspace, so the world is stronger and more prepared.¹⁷²

d. *Space Governance*

Even if the increased collaboration, education, and innovation take root, because of the heightened interest in and review of this changing space landscape, all could be naught without a corollary update in the space governance (legal) paradigm.¹⁷³

In summary, all these areas need concurrent investments.¹⁷⁴ By collaborating, educating, and innovating,¹⁷⁵ some limited protective measures can be developed, but all nations need to be prepared that it may not be enough.¹⁷⁶ There must be key renewed focus in updating laws and treaties, along with focused investments in all cybersecurity and space security disciplines so that peace on earth and in space is preserved.¹⁷⁷ Now, more than

¹⁷¹ *Innovate*, ONLINE ETYMOLOGY DICTIONARY, <https://www.etymonline.com/word/innovate> (last visited May 12, 2021).

¹⁷² See EXEC. OFF. OF THE PRESIDENT, *supra* note 67, at 1, 13.

¹⁷³ *Id.* (commercializing space is a \$330 billion industry); see Shammass & Holen, *supra* note 20, at 7–8 (“In this respect, outer space is ideal: it is boundless and infinite. As Earth comes to be blanketed by capital, it is only to be expected that capital should set its sights on the stars above.”).

¹⁷⁴ See Shammass & Holen, *supra* note 20, at 10; EXEC. OFF. OF THE PRESIDENT, *supra* note 67, at 1, 13.

¹⁷⁵ See EXEC. OFF. OF THE PRESIDENT, *supra* note 67, at 10–11 (“The primary goals of space professional development are to achieve mission success in space operations and acquisition; stimulate innovation to improve commercial, civil, and national security space capabilities; and advance science, exploration, and discovery.”)

¹⁷⁶ U.S. CYBERSPACE SOLARIUM COMM’N., *supra* note 89, at 24.

[T]he U.S. government *collaborates with the private sector to reduce vulnerabilities and deny benefits to adversaries*. The strategy for this layer of deterrence is to force adversaries to make difficult choices regarding resources, access, and capabilities. When U.S. vulnerabilities are reduced and adversaries are forced to expend more resources, burn sensitive accesses, or utilize unique and expensive cyber weapons to achieve their desired results, cyberattacks will be reduced. Actions in this layer include, but are not limited to, expanding operational collaboration between government and private sector, prioritizing support to systemically importantcritical infrastructure . . .

¹⁷⁷ EXEC. OFF. OF THE PRESIDENT, *supra* note 67, at 3–4.

The United States considers the space systems of all nations to have the right to

ever, the space security and cybersecurity realms intersect.¹⁷⁸ The Outer Space Treaty did not anticipate such threats and technological advancements. Signatories to the Outer Space Treaty will begin demanding greater protection or assurances.

IV. CONCLUSION—THE INFLECTION POINT IS NOW

This research on the Outer Space Treaty raised issues of relevance, questionable modern-day application, as well as enforcement gaps.¹⁷⁹ Due to the proliferation of space assets, the proliferation of nation states and individuals engaged in space activity, and sophisticated technological advancements in satellite and space technology, space governance is now definitely valued.¹⁸⁰ However, the current construct may not fit the bill.¹⁸¹ Because weapons launch is not solely tethered to the earth, and China and Russia have both successfully tested anti-satellite capability *from* space,¹⁸² effective space governance must evolve.¹⁸³

pass through and conduct operations in space without interference. Purposeful interference with space systems, including supporting infrastructure, will be considered an infringement of a nation's rights. Consistent with the defense of those rights, the United States will seek to deter, counter, and defeat threats in the space domain that are hostile to the national interests of the United States and its allies. Any purposeful interference with or an attack upon the space systems of the United States or its allies that directly affects national rights will be met with a deliberate response at a time, place, manner, and domain of our choosing.

¹⁷⁸ U.S. CYBERSPACE SOLARIUM COMM'N., *supra* note 89, at 33.

Finally, the National Cyber Strategy should articulate a framework for how the U.S. government should put the approach into operation that is organized around six pillars: reform the U.S. government's structure and organization for cyberspace, strengthen norms and non-military tools, promote national resilience, reshape the cyber ecosystem toward greater security, operationalize cybersecurity collaboration with the private sector, and preserve and employ the military instrument of power.

¹⁷⁹ NAT'L AIR & SPACE INTELLIGENCE CTR., *supra* note 14, at 1.

Over the past two decades, an emergent China and a resurgent Russia developed advanced technologies [and now] [p]otential adversaries are developing and proliferating anti-satellite capabilities supported by an array of sensors to characterize and target space systems. Multiple attack options (e.g., cyber, electronic, or directed-energy weapons; anti-satellite missiles; or space-based weapons) enable potential adversaries to achieve a range of damaging effects.

¹⁸⁰ *Id.* at 2–3.

¹⁸¹ *See id.* at 2.

¹⁸² *See* Shammass & Holen, *supra* note 20, at 2.

¹⁸³ U.S. CYBERSPACE SOLARIUM COMM'N., *supra* note 89, at 19.

The United States thus stands at a strategic inflection point. While America

The weaponization of space via weapons launched in space to attack other assets in space was once unthinkable and certainly not anticipated in 1967 when the Outer Space Treaty was passed.¹⁸⁴ As a result, the treaty signatories should demand renewed talks to negotiate a more comprehensive and unambiguous governance regime.¹⁸⁵ With obvious research and testing activities by China and Russia that appear to have the sole objective of space dominance over all others, threats to nations' satellites and sovereignty exist.¹⁸⁶ If a country can unilaterally assert dominance and control in space, it naturally follows, then such superiority can or will follow on earth.

With these increased adversarial capabilities, all space assets need assurance of protection, especially the US, which owns the highest number of satellites.¹⁸⁷ The US and other signatories can call for a review of the Outer Space Treaty with the aim of updating it to ensure the safety of earth and space for the next fifty years.¹⁸⁸ Americans should expect no less.

looks forward to the potential of cyberspace and associated technologies to improve the quality of human life, threats continue to grow at an accelerating pace. America is facing adversary nation- states, extremists, and criminals that are leveraging emerging technologies to an unprecedented degree (emphasis added).

¹⁸⁴ See NAT'L AIR & SPACE INTELLIGENCE CTR., *supra* note 14, at 2.

¹⁸⁵ See Krause, *supra* note 11 (asserting that "unfortunately, there are a number of key treaty phases that remain opaque").

¹⁸⁶ Jonathan Marcus, *UK and US Say Russia Fired a Satellite Weapon in Space*, BBC (July 23, 2020), <https://www.bbc.com/news/world-europe-53518238>.

¹⁸⁷ See O'Callaghan, *supra* note 152 (cautioning US military leaders on the risk of sitting idle, General Raymond stated, "The United States, in coordination with our allies, is ready and committed to deterring aggression and defending the Nation, our allies and vital U.S. interests from hostile acts in space.").

¹⁸⁸ Durkee, *supra* note 24, at 714 (citing Gabrynowicz, *supra* note 37, at 739) (Professor Gabrynowicz agrees that perhaps we are at an inflection point, and that "future commentators may look back to this moment to mark the dawn of a new era in space governance.").