ARTICLE

The Legality of Defending National Activities on the Moon

Francesca Giannoni-Crystal[*]

ABSTRACT

This paper explores the issue of defending national activities on the Moon—the first celestial body that will be subject to human activities. Concentrated resources, insufficient project coordination, and uncertainties in the international framework make the lunar surface a ripe arena for stakeholder conflicts. While commercial space companies may try to defend their activities with private security forces, governments will likely be called upon to protect lunar activities. This may include actions taken pursuant to the law of internationally wrongful acts; however, because of nature of space law and paucity of state practice, the legal framework for internationally wrongful acts is unlikely to resolve lunar disputes peacefully and nations may find themselves needing to resort to traditional forms of government protection—i.e., using a country's armed forces—to defend national lunar activities. Such defense of lunar activities would be compliant with international law: the use of force in self-defense is not only allowed by the laws of armed conflicts (LOAC), including as applied vis-à-vis the Outer Space Treaty (OST), but it is also compliant with the OST itself. Furthermore, as this paper discusses, the most active spacefaring nations have also already signaled their acceptance of the legality of such defense in space. While this paper focuses on the Moon as the most urgent issue, the same conclusion applies to Mars, the asteroids, and other celestial bodies given the framework of reference (i.e., space law and the laws of war) is the same.

[*] Francesca Giannoni-Crystal is an international lawyer practicing with Crystal & Giannoni-Crystal LLC, with two JDs (University of Florence, Italy and Charleston School of Law) and an LLM in Space Law from the University of Mississippi School of Law. She assists companies in several industries, including aerospace and defense. The author extends her gratitude to Prof. Maj. Jeremy Grunert for his insights and suggestions during the early stages of this paper, and to her law partner, Prof. Nathan M. Crystal, whose support and encouragement make her scholarly work possible. Email: fgiannoni-crystal@cgcfirm.com.

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INTRODUCTION

Concentrated areas of interest on the Moon, coupled with a lack of coordination in lunar projects and uncertainties in the international framework, are likely to lead to conflicts among lunar stakeholders. [1] While the legal regime that applies to the Moon, Mars, asteroids, and other celestial bodies is the same, the situation with the Moon is more pressing, as it is the first celestial body subject to

[1] Martin Elvis et al., *Concentrated Lunar Resources: Imminent Implications for Governance and Justice*, 379 PHIL. TRANSACTION ROYAL SOC'Y A. 1, 9 (2020).

human activities,[2] with limited areas ideal for critical pursuits such as space resource utilization and scientific research).[3]

This paper explores the legality of the defense of national activities on the Moon, both in the event of an armed conflict and through precautionary measures. "Defense," in the context of this paper, refers to the measures and actions taken by a state to protect the security and operation of its lunar and cislunar[4] activities against threats or acts of aggression in the lunar domain. As used here, the term "defense" further encompasses all actions, including the use of force or the threat thereof to counter or deter unlawful interference, armed attacks, or other hostile actions.

Following the introduction, Part I showcases aspects of the emerging lunar economy, discussing the United States's Artemis Program and China's Chang'e Program. Part II discusses situations where a lunar activity is interfered with (or is threatened to be interfered with) but the interference does not rise to the level of an armed attack and explores the concepts of internationally wrongful acts and private police. Part III analyzes the legal architecture governing the use of force - including the application of Articles 2(4) and 51 of the United Nations (U.N.) Charter,[5] in the context of defending lunar activities. Part III.B addresses the relevance of *jus ad bellum* and *jus in bello* in the realm of space. Specifically, Part III.B discusses the Law of Armed Conflict (LOAC), which could apply as a consequence of an armed attack in outer space and on any celestial body, including the Moon.

Part IV delves into the corpus of international laws relevant to space activities, focusing on provisions that impact the potential defense of national activities. The 1967 Outer Space Treaty (OST), which counts 114 states as parties as of January 2021,[6] is the most important treaty concerning space law, setting out key principles like the freedom to explore and use outer space.[7] As the treaty's full name makes clear, the OST applies without distinction to outer space, the Moon,

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[2] *See, e.g.*, *Why the Moon?*, NASA (Sept. 7, 2023), https://moon.nasa.gov/resources/540/why-the-moon/ [https://perma.cc/CCK4-5NBS] (last visited Sept. 21, 2024).
[3] *See infra* Part I.B.
[4] "Cislunar space" refers to "the region of space from the Earth out to and including the region around the surface of the Moon." 42 U.S. Code § 18302(3).
[5] United Nations, Charter of the United Nations, Oct. 24, 1945, 1 U.N.T.S. XVI, available at https://www.refworld.org/legal/constinstr/un/1945/en/27654 [UN Charter].
[6] U.N. Comm. on the Peaceful Uses of Outer Space, 60th Sess., *Status of International Agreements Relating to Activities in Outer Space as at 1 January 2021*, U.N. Docs. A/AC.105/C.2/2021/CRP.10 (May 31, 2021), https://www.unoosa.org/res/oosadoc/data/documents/2021/aac_105c_22021crp/aac_105c_22021crp_10_0_html/AC105_C2_2021_CRP10E.pdf [https://perma.cc/K3J7-89XM] [hereinafter *Status of International Space Agreements*].
[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 OST]. *See also* Sergio Marchisio, *The Evolutionary Stages of the Legal Subcommittee of The United Nations Committee on the Peaceful Uses of Outer Space (COPUOS)*, 31 J. SPACE L. 219, 226–27 (2005).

and all the other celestial bodies.[8] Article IV of the OST receives special attention in this Part as a provision that could limit—though not prohibit—the defense of lunar activities.[9] This Part also discusses the OST's application during armed conflict. Part V examines the positions of some major spacefaring countries on the defense of their space assets, attempting to anticipate how they might react to security challenges on the Moon, and emphasizing why addressing the legality of defending lunar activities is an urgent question. Recognizing the absence of established state practice governing lunar activities, this analysis relies solely on projections drawn from public declarations and actions within Earth's orbits, drawing on the maxim *historia magistra vitae*.[10] Part V analyses state practice to date supporting the expectation that the major spacefaring countries will want to defend their national lunar activities,[11] which amplifies the significance of the discussion about the legality of defense of lunar activities. While the focus is on the Moon and lunar activities, this legal analysis also applies to forthcoming activities on Mars, asteroids, and other celestial bodies, because the international framework—LOAC and space law—applies identically to the Moon and other celestial bodies.

I. THE LUNAR SETTINGS

A. Lunar Projects

[8] The formal name of the OST is the "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies." Because the law is the same for the Moon and other celestial bodies (every article of the OST either expressly mentions "the Moon, and other celestial bodies" or do not distinguish between the Moon and the other celestial bodies, applying its principles uniformly to outer space, including all celestial bodies), the discussion regarding the legality of the defense of lunar activities also applies to the defense of activities on other celestial bodies.

[9] *See infra* Part IV.E.2. Article IV(2) is the sole OST's provision that limits certain activities exclusively with reference to the Moon and the other celestial bodies: "The *Moon and other celestial bodies* shall be used…exclusively for peaceful purposes. The establishment of military bases, …on *celestial bodies* shall be forbidden.…The use of any equipment or facility necessary for peaceful exploration *of the Moon and other celestial bodies* shall also not be prohibited." (emphases added).

[10] For an example of how this maxim has been applied in other contexts, *see generally* CHARLES TILLY**,** COERCION, CAPITAL, AND EUROPEAN STATES, AD 990-1992 (1993) (emphasizing how historical patterns of state behavior, especially in military and state-building actions, tend to follow predictable paths based on the state's resources, institutional structures, and historical precedents).

[11] *See, e.g.*, Joseph Clark, *Space Officials Outline Key Investments Needed to Ensure U.S. Maintains Edge* (May 21, 2024), https://www.defense.gov/News/News-Stories/Article/Article/3783109/ [https://perma.cc/7BMF-E7TY]; *see also* Courtney Kube & Dan De Luce, *How China is challenging the U.S. military's dominance in space* (Dec. 12, 2023), https://www.nbcnews.com/politics/national-security/china-challenging-us-militarys-dominance-space-rcna128993 [https://perma.cc/84QF-SZ35].

A new "Moon race" among nations has started, fueled by both government programs and private enterprise.[12] The number of prospective lunar stakeholders indicates that conflicts are possible and highlight the importance of discussing the defense of national lunar activities.

The United States and China are among the two most active spacefaring countries with lunar ambitions.[13] The Artemis Program, America's initiative for lunar exploration and development, is expected to bring astronauts back to the Moon in 2026[14] to establish a permanent lunar-orbiting station called the Gateway.[15] Such a station will enable the ground exploration, scientific research, and utilization of lunar resources. While the Artemis Program is a U.S. government-led initiative, it heavily involves the private sector and various U.S. and international companies.[16] For example, the Space Launch System (SLS), which is the primary rocket for all Artemis missions, is a collaborative effort between private companies.[17] Additionally, a consortium consisting of the National Aeronautics and Space Administration (NASA) and American and European companies contributed to the design and construction of the crewed capsule Orion, which is part of the Artemis Program.[18] The private sector is also responsible for the construction of the Gateway, referenced above.[19]

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[12] *See* LEONARD DAVID, MOON RUSH: THE NEW SPACE RACE, 77–80, 89–90 (National Geographic Books, 2019).

[13] *See* NAT'L SPACE INTEL. CTR. & NAT'L AIR AND SPACE INTEL. CTR., COMPETING IN SPACE 5–6, 17 (Air Force Public Affairs, 2nd ed. 2023), https://www.spoc.spaceforce.mil/Portals/4/Images/2_Space_Slicky_11x17_Web_View_reduced.pdf [https://perma.cc/SAZ2-BDGL].

[14] *See* Abbey A. Donaldson, *NASA Shares Progress Toward Early Artemis Moon Missions with Crew* (Jan. 9, 2024), https://www.nasa.gov/news-release/nasa-shares-progress-toward-early-artemis-moon-missions-with-crew/ [https://perma.cc/BTY6-U9ZZ].

[15] *See* Mark J. Sundahl, *Returning to the Moon: Legal Challenges as Humanity Begins to Settle the Solar System: Full Transcript*, 9 GLOBAL BUS. L. REV. 1, 8 (2021).

[16] *See* Lunar and Planetary Institute, *New Companies Join Growing Ranks Of Nasa Partners for Artemis Program,* https://www.lpi.usra.edu/publications/newsletters/lpib/new/new-companies-join-growing-ranks-of-nasa-partners-for-artemis-program [https://perma.cc/HTD7-42TJ]. Many international companies are headquartered in countries that are not traditional U.S. space partners, *see e.g.*, Aaron Reich, *NASA's Artemis I Mission Set to Launch with Israeli Radiation Experiment*, JERUSALEM POST (Aug. 28, 2022), https://www.jpost.com/science/article-715750 [https://perma.cc/YE6C-78W2].

[17] *See Rocket to the Moon, Mars and Beyond*, BOEING, https://www.boeing.com/space/space-launch-system/index.page (last visited Oct. 20, 2024) (explaining the collaboration between the Boeing Company and Northrop Grumman Corporation on SLS) [https://perma.cc/HQ5E-TLEG]. There are currently some indications that the Space Launch System (SLS) program may be discontinued. *See, e.g.*, Victor Tangermann, *Space Launch Schlamassel: It Sounds Like NASA's Moon Rocket Might Be Getting Canceled*, Futurism (Nov. 13, 2024, 3:06 PM EST), https://futurism.com/nasa-sls-moon-rocket-might-be-canceled.

[18] *See* Sundahl, *supra* note 15, at 8.

[19] *See id*. at 9. The Gateway will include living spaces, a research lab, and spacecraft ports. The Artemis Program's Human Landing System will transport astronauts to and from the lunar surface. *NASA Names Companies to Develop Human Landers for Artemis Moon Missions*, NASA (Apr. 30, 2020), https://www.nasa.gov/news-release/nasa-names-companies-to-develop-human-landers-for-artemis-moon-missions/ [perma.cc/Z8MF-8QZJ]. NASA contracted with the private

China's *Chang'e* Program, inaugurated in 2007,[20] has already achieved significant success. The program led to China mapping the lunar surface,[21] then landing twice on the Far Side of the Moon and returning lunar samples.[22] Before the *Chang'e* Program's fourth mission, China successfully positioned a relay satellite named Queqiao beyond the Moon to facilitate communication with the Far Side of the Moon.[23] In 2024, China launched another relay satellite, Queqiao-2, to support the *Chang'e*-6, *Chang'e*-7, and *Chang'e*-8 missions.[24] China is currently planning even more ambitious missions for scientific, economic, and prestige purpose. For example, China envisions landing taikonauts[25] on the lunar surface by 2030 and, with the cooperation of Russia and other countries,[26] building a ground station (International Lunar Research Station or ILRS), on the Moon's South Pole in the 2030s.[27]

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sector to design and develop this system. *About Human Landing Systems Development*, NASA, https://www.nasa.gov/reference/human-landing-systems/ (last visited Oct. 20, 2024) [https://perma.cc/XR6C-6TKV].

[20] *Chang'e 1 - New Mission to Moon Lifts Off*, EUROPEAN SPACE AGENCY (Oct. 24, 2007), https://www.esa.int/Science_Exploration/Space_Science/SMART-1/Chang_e_1_-_new_mission_to_Moon_lifts_off [https://perma.cc/N8QJ-FLJK].

[21] AJEY LELE & GUNJAN SINGH, CHINA'S WHITE PAPERS ON SPACE: AN ANALYSIS, at 7 (2012).

[22] *See China Successfully Launches Chang'e-5 to Collect Moon Samples*, CHINA GLOBAL TELEVISION NETWORK (Nov. 24, 2020), https://newsus.cgtn.com/news/2020-11-24/China-s-Chang-e-5-lunar-probe-lifts-off-to-collect-moon-samples-VFbET6xrAA/index.html [https://perma.cc/9U3W-WNFM]; *see also* BRYANT A. MISHIMA-BAKER, MOON WARS: LEGAL TROUBLE IN SPACE AND MOON LAW 2 (THE REPORTER 2021) 1*, *2. *See also* The Planetary Society, *Chang'e-5: China's Moon sample return mission*, available at https://www.planetary.org/space-missions/change-5. Last visited Oct 17, 2023. *Chang'e-6, collecting the first lunar farside samples*, THE PLANETARY SOCIETY, https://www.planetary.org/space-missions/change-5.

[23] *See* Luyuan Xu, *How China's Lunar Relay Satellite Arrived in Its Final Orbit*, PLANETARY SOCIETY (June 15, 2018), https://www.planetary.org/articles/20180615-queqiao-orbit-explainer [https://perma.cc/6E83-3VX8] (explaining how Queqiao is in a halo orbit around the Earth-Moon Lagrange Point L2).

[24] *China Launches Relay Satellite Queqiao-2 for Earth-Moon Communication*, CHINA GLOBAL TELEVISION NETWORK, (Mar. 20, 2024), https://news.cgtn.com/news/2024-03-20/China-launches-relay-satellite-Queqiao-2--1s7bohupqBG/p.html [https://perma.cc/EA89-Z7Y5].

[25] Taikonaut is the "name used in the West for a Chinese astronaut. It comes from the Chinese word 'taikong' meaning space or cosmos." However, the "official Chinese name is *yuhangyuan* …" *Definition of* Taikonaut, OXFORD REFERENCE, https://www.oxfordreference.com/view/10.1093/oi/authority.20110803101916587 (last accessed Nov. 20, 2023).

[26] *See* Dean Cheng, *China and Space: The Next Frontier of Lawfare*, U.S. INST. PEACE (Aug. 2, 2023), https://www.usip.org/publications/2023/08/china-and-space-next-frontier-lawfare [perma.cc/9HDH-4SS2]. *See also* Anna Prince & Peter W. Singer, *What Venezuela's Moonbase Vow Says About China, Russia, and the USA*, DEF. ONE (July 17, 2023), https://www.defenseone.com/ideas/2023/07/what-venezuelas-moonbase-declaration-says-about-china-russia-and-usa/388590/ [perma.cc/XG4X-3CU4].

[27] Ling Xin, *Details of China's Lunar Station Revealed as Project Expands with a Dozen New Partners*, SOUTH CHINA MORNING POST (Sept. 9, 2024), https://www.scmp.com/news/china/science/article/3277742/details-chinas-lunar-station-revealed-project-expands-dozen-new-partners/ [https://perma.cc/Y8JX-SGXF].

Space resource utilization will be significant in the lunar economy. Many organizations and companies are developing technologies and concepts to utilize the Moon's volatiles (e.g., oxygen, nitrogen, hydrogen, and water), minerals, and energy resources.[28] Some actors plan to perform *in-situ* resource utilization (ISRU), while others aim to transport lunar resources back to Earth.[29] Public and private needs for space exploration and human presence will likely drive the ISRU industry, creating demand for life support gases, rocket propellant, space equipment, and lunar facilities.[30]

Multiple nations are involved in both public and private lunar projects at various stages of the space resource utilization value chain.[31] Early movers in lunar mining include the United States, China, Luxembourg, and the United Arab Emirates.[32] Space mining ambitions are also harbored by Russia, Japan, India, and the European Space Agency.[33] The private sector is expected to lead space resource utilization. The Japanese company ispace plans to robotically extract water from the Moon and envisions a lunar community of a thousand people by 2040, with ten thousand annual visitors.[34] A U.S.-based company TransAstra plans to mine water

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[28] Scot W. Anderson *et al*., *The Development of Natural Resources in Outer Space*, 51 ENVTL. L. REP. 10835, 10835–36 (2021) (highlighting lunar ice's potential for water, oxygen, hydrogen, and helium-3 extraction, supporting economic growth, and also discussing robotic tech and 3-D printing.) *See also* Michael Dello-Iacovo & Serkan Saydam, *Humans Have Big Plans for Mining in Space – but There are Many Things Holding Us Back,* THE CONVERSATION (May 15, 2022), https://theconversation.com/humans-have-big-plans-for-mining-in-space-but-there-are-many-things-holding-us-back-181721 (arguing that the Moon's 2.7-second communication delay is ideal for remote mining) [perma.cc/MQ59-VK6M].

[29] PRICEWATERHOUSECOOPERS, LUNAR MARKET ASSESSMENT: MARKET TRENDS AND CHALLENGES IN THE DEVELOPMENT OF A LUNAR ECONOMY, 26 (2021).

[30] *Id.* at 27.

[31] *Id.* (explaining how prominent instances of such endeavors encompass ESA's PROSPECT (Package for Resource Observation and in-Situ Prospecting for Exploration, Commercial exploitation, and Transportation) demonstrator mission, an array of landers and rovers developed by several private companies, in addition to efforts from national space agencies, like those of China, the United States, Russia, and India.).

[32] *See* Jan Osburg & Mary Lee, *Governance in Space: Mining the Moon and Beyond*, RAND CORPORATION (Nov. 18, 2022), https://www.rand.org/blog/2022/11/governance-in-space-mining-the-moon-and-beyond.html [perma.cc/99E3-P4BG]. For further discussion on each country's planned projects, *see also NASA Selects Companies to Collect Lunar Resources for Artemis Demonstrations*, NASA (Dec. 3, 2020), https://www.nasa.gov/press-release/nasa-selects-companies-to-collect-lunar-resources-for-artemis-demonstrations (explaining that NASA's intention to conduct scientific drilling experiments on the Moon and granting of contracts to four companies for the extraction of small amounts of lunar regolith) [perma.cc/GT3L-4KR4]; Francesca Giannoni-Crystal, *Jurisdictional Choice for Space Resource Utilization Projects: Current Space Resource Utilization Laws*, 22 SANTA CLARA J. INT'L L. 1 (2024) (discussing the four space resource utilization laws passed by the US, Luxembourg, the UAE and Japan).

[33] Alex Gilbert, *Mining in Space Is Coming*, MILKEN INST. REV. (Apr. 26, 2011), https://www.milkenreview.org/articles/mining-in-space-is-coming [perma.cc/X9GJ-EN28].

[34] *See* i-space, *2040 Vision Movie*, YouTube (Dec. 12, 2017), https://youtu.be/r7CW92i0z_o. Last visited Oct 17, 2023. *ispace Raises Record Largest Series A Funding; Announces Plan For Two Lunar Missions by 2020* (Dec. 13, 2017), https://ispace-inc.com/news-en/?p=2581 [https://perma.cc/PBE4-K8KY] (arguing that ispace predicts that by 2040, the Moon will be inhabited by 1,000 people, with over 10,000 visitors every year)

from the Moon to use as propellant and then extract other materials.[35] Interlune, another U.S.-based company, plans to harvest helium-3 from lunar regolith.[36] To cater to these projects, companies like Space X, Blue Origin, and RocketLab are planning launches and support activities in lunar and cislunar space.[37] In addition to space resource utilizations, spacefaring countries are also planning scientific experiments on the Moon. In a 2021 white paper, China detailed several scientific experiments that it will be conducting in the next few years, including on the Moon.[38] NASA regularly seeks input from the scientific community for experiments to be included in upcoming Artemis missions.[39]

B. The Moon as a potential hotbed for conflicts

Considering the multitude of projects mentioned above, which represent only a fraction of projected activities, there will be opportunities for disagreement and interference among lunar stakeholders, making conflicts likely. This is especially true given that these projects are targeting the same areas for mining and scientific experiments.[40] The likelihood of conflicts is also due to considerable private-sector involvement, which creates a multitude of stakeholders on the

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[35] Magdalena Petrova, *The First Crop of Space Mining Companies Didn't Work Out, but a New Generation Is Trying Again*, CNBC (Oct. 9, 2022), https://www.cnbc.com/2022/10/09/space-mining-business-still-highly-speculative.html?&qsearchterm=astroforge [https://perma.cc/KZT6-4K6A].

[36] Gary Lai, *Excavate, Sort, Extract, and Separate: Interlune Core Intellectual Property*, INTERLUNE (Sept. 10, 2024), https://www.interlune.space/blog/excavate-sort-extract-and-separate-interlune-core-intellectual-property#:~:text=By%20the%20early%202030s%2C%20Interlune,before%20deploying%20the%20full%20plant [https://perma.cc/5MG7-M79Y]. Lunar regolith refers to the stratum of loose rocks, pebbles, and dust that blankets the lunar surface, and primarily stems from "meteoroid bombardment." Michelle L. D. Hanlon & Bailey Cunningham, *The Legal Imperative to Mitigate the Plume Effect: An "Aggravation and Frustration" That Imperils Our History and Our Future*, 43 J. SPACE L. 309, 314 (2019).

[37] *See The Moon*, SPACE X, https://www.spacex.com/humanspaceflight/moon/#:~:text=Starting%20with%20Artemis%20III%2C%20Starship,needed%20for%20extensive%20surface%20exploration (last visited Oct. 26, 2024) [https://perma.cc/E3WK-7H2W]; *Blue Moon*, BLUE ORIGIN, https://www.blueorigin.com/blue-moon (last visited Oct. 26, 2024) [https://perma.cc/Z65Y-ECQE]; *Capstone Mission*, ROCKET LAB, https://www.rocketlabusa.com/missions/lunar/ com (last visited Oct. 26, 2024) [https://perma.cc/DC26-VPER]; Jordan McDonald, *NASA Shoots for the Moon as Private Companies Reach for the Stars*, TECH BREW (Aug. 24, 2022), https://www.emergingtechbrew.com/stories/2022/08/24/nasa-shoots-for-the-moon-as-private-companies-reach-for-the-stars [https://perma.cc/XF78-2V7Z].

[38] *2021 China White Paper*, Part IV (*Research on Space Science*), 2. *Science Experiments in Space See generally* STATE COUNCIL INFORMATION OFFICE, CHINA'S SPACE PROGRAM: A 2021 PERSPECTIVE (2022).

[39] John Loeffler, *NASA wants ideas for Artemis 3 moon landing experiments. But time's running out*, available at https://www.space.com/nasa-requests-experiment-ideas-artemis-3-moon-mission. Last visited Dec 31, 2024.

[40] Elvis et al., *supra* note 1, at 2.

Moon.[41] Thus, the Moon is unlikely to be a sanctuary of peace. The concept of outer space as a peace sanctuary has a long tradition in space literature and abstract declarations but has had very little application in the practice of space-faring countries. True, outer space has not seen direct armed conflict yet, but, unfortunately, the general opinion is that it might only be a question of time.[42] As the famous Rumsfeld Space Commission Report explained in 2001:

> We know from history that every medium—air, land and sea—has seen conflict. Reality indicates that space will be no different. Given this virtual certainty, the U.S. must develop the means both to deter and to defend against hostile acts in and from space. This will require superior space capabilities.[43]

Furthermore, as Professor Stephens noted in 2018, "despite international efforts to stem…militarization, outer space is now seen by some as a viable theater of future warfare, no different from its land, sea, or air counterparts."[44] The Moon could thus be the prime spot for space warfare because the necessity for protecting its incipient lunar activities increases due to potential conflicts among lunar stakeholders, which are likely to target the same areas for mining and scientific experiments. [45]

While the Moon is one-fourth the size of Earth and therefore quite substantial in size as a celestial satellite, the areas of interest on the Moon are limited:[46] several upcoming missions in the next decade are expected to focus on a few specific lunar sites of interest, which will likely lead to congestion and disruptions.[47] Indeed, as on Earth, lunar resources are not evenly distributed. Not all lunar localities are also equally suitable for every kind of activity, nor are all localities equally valuable.[48] Thus, the multitude of lunar stakeholders are likely to

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[41] *See* Sundahl, *supra* note 15, at 10.
[42] *See generally* BRUCE W. MACDONALD, CHINA, SPACE WEAPONS, AND U.S. SECURITY (2008), www.cfr.org/report/china-space-weapons-and-us-security (arguing that China's 2007 ASAT test, alongside the U.S. destruction of an out-of-control satellite that same year, indicated that space might not stay a protected zone from military conflicts for much longer).
[43] *Report of the Commission to Assess United States National Security Space Management and Organization Before the Subcomm. on Strategic Forces of the S. Comm.on Armed Forces*, 107th Cong. (2001).
[44] Dale Stephens, *The International Legal Implications of Military Space Operations: Examining the Interplay Between International Humanitarian Law and the Outer Space Legal Regime*, 94 INT'L L. STUD. 75, 77 (2018).
[45] *See* Elvis et al., *supra* note 1, *passim*.
[46] Tim Sharp & Daisy Dobrijevic, *How big is the moon?*, available at https://www.space.com/18135-how-big-is-the-moon.html. Last visited Oct 18, 2023; See also NASA, *Moon facts*, available at https://science.nasa.gov/moon/facts/. Last visited Dec 30, 2024.
[47] *See* Elvis et al., *supra* note 1, at 2–3.
[48] *See id.* (explaining that only a few suitable locations for astronomical telescopes exist, and that the same locations are also coveted for other purposes).

target the same areas for mining and scientific experiments—and therefore will require protection from the competition.[49]

The Moon's Peaks of Eternal Light, areas near its poles, are paradigmatic lunar hotspots for conflicts due to their limited size.[50] These regions hold immense value for their unique features, which include continuous sunlight for solar power and the potential presence of water for sustaining human activities.[51] Additionally, the Peaks' cold traps offer exceptionally low temperatures, permitting the possible preservation of special materials and serving as optimal locations for scientific endeavors.[52] Certain areas of the Moon, like the Far Side's smooth terrain, are ideal for cosmological telescopes due to minimal interference, while lunar pits could provide protected environments for human missions.[53] The Far Side is also shielded from Earth's radio signals, creating a "radio-quiet zone" for telescopes detecting early cosmic signals, but only six areas, including the Mare Moscoviense, simultaneously offer the 200-kilometer diameter and smooth surface for such telescopes.[54] Competition for these prime locations is intense, leading to potential conflicts with other uses. Additionally, high concentrations of helium-3 make Far-Side areas like the Mare Moscoviense appealing for lunar mining.[55] The coexistence of mining and astronomical experiments poses inherent conflicts due to their incompatible nature.[56]

Specific locations, such as Sinus Medii and Lipskiy Crater, may facilitate future technologies like mass drivers and space elevators, making them strategic sites for potential mining and space infrastructure.[57] With multiple stakeholders targeting specific lunar sites for mining and scientific endeavors, competition, congestion, and interference will likely arise, potentially leading to disruptions and conflicts over resources and valuable locations.[58] Escalating geopolitical tensions on Earth, which may extend to lunar territory, could exacerbate interferences and potentially lead to a surge in lunar conflicts in the near future.[59] The legal uncertainties regarding the governance of lunar and cislunar activities[60] likewise

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[49] *See generally id*.
[50] *See id.* at 4.
[51] *Id.*
[52] *See id.*
[53] *See id.* at 5.
[54] *Id.* at 5–6 (indicating that the lunar Far Side's terrain is not as smooth or widespread as the near side, leaving only six suitable areas for such installations).
[55] *Id.* at 6 (arguing that these spots are further desirable as the scars left on the lunar surface by mining activities would not be visible from Earth, reducing possible objections and potential blowback companies might otherwise face).
[56] *See id.* at 5–6.
[57] *Id.* at 7.
[58] *Id.* at 9.
[59] *See* NAT'L INTEL. COUNCIL, GLOBAL TRENDS 2030: ALTERNATIVE WORLDS 5 (2012); *see also* NAT'L INTEL. COUNCIL, GLOBAL TRENDS 2040: A MORE CONTESTED WORLD 62 (2021).
[60] *See infra* Parts IV.A–IV.C and IV.E–IV.F. *See also* Francesca Giannoni-Crystal, *Legal Issues for Lunar Orbiting Satellites and Suggested Solutions,* 47, J. SPACE L. 67 (2023) (exploring the

increase the potential for conflicts.[61] For example, lunar conflicts can be fueled by certain ambiguities regarding legal regimes possibly applicable to space resources, particularly OST Article II, the ambiguity of which could lead to disputes over resource ownership and mining operations.[62] Regulatory lacunae also exist regarding lunar activities,[63] which may trigger a private-sector race to establish national activities, with countries vying to establish their presence in key regions, such as the lunar poles, to lay the groundwork for a foundational legal framework.[64]

Plenty of recent literature exists about how conflicts are likely to occur on the Moon.[65] Business disputes could quickly escalate to international armed conflicts.[66] Paul B. Larsen gives the following scenario as an example: if a Chinese company disputes a lunar mining site chosen by a U.S. company and the U.S. company requests the Department of Defense's (DoD) protection, the Chinese company may, in turn, seek protection from the Chinese government.[67] Remote sensing activities could also escalate into conflict.[68] Potential conflicts or tensions may also arise due to inadequate coordination among projects.[69] For example, the independent operation and lack of coordination between American and Chinese

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legal uncertainties for lunar orbits) [hereinafter *Legal Issues for Lunar Orbiting Satellites*]; *see also* Giannoni-Crystal, *supra* note 32, at 10 et seq..

[61] *See* Cheng, *supra* note 26.

[62] *See infra* Part IV.C.

[63] *See* Cheng, *supra* note 26 (arguing that the absence of a legal framework for lunar activities hinged on the conclusion of the Apollo lunar missions in the 1970s, after which no substantial discussions occurred regarding Moon governance).

[64] *See id.* (arguing that China will strive to create the fundamental legal framework that will govern what they consider a pivotal strategic location). I believe the same will be true for every lunar stakeholder and state practice will shape the rules on the Moon.

[65] *See, e.g.*, Leonard David, *Our Moon: Risks of Crowding and Interference*, available at https://www.leonarddavid.com/our-moon-risks-of-crowding-and-interference/ Last visited Oct 27, 2023 (arguing that interference and conflicts may grow as diverse actors converge on limited lunar sites.); *See, e.g.*, Elvis et al., *supra* note 1, at 9 ("If conflicts over lunar resources arise in the coming decade, as seems probable, they will incentivize searches for creative interpretations of the only applicable treaty with broad
international recognition, the 1967 Outer Space Treaty (OST)"); Caleb White, *Earth, Moon's Cislunar Space Is Becoming Overcrowded, May Result in War,* THE SCIENCE TIMES (Jan. 24, 2023), https://www.sciencetimes.com/articles/42009/20230124/earth-moons-cislunar-space-becoming-overcrowded-result-war-report.htm [https://perma.cc/EM4U-3S8H]. (arguing highlighting the risk of Growing congestion of cislunar space)

[66] Bryant A. Mishima-Baker, *supra* note 22, at 7.

[67] Paul B. Larsen, *Is There a Legal Path to Commercial Mining on the Moon?*, 83 U. PITT. L. REV. 1, 23 (2021) (arguing that "[c]ommercial confrontations could begin a war in outer space").

[68] We can imagine a scenario where an American commercial entity, while using satellites to conduct remote sensing of the Moon, unintentionally captures images of a lunar facility of another country (e.g., China). This other country then disables the American actor's equipment. For a discussion regarding attacks on lunar satellites, *see* Francesca Giannoni-Crystal, *Cyberattacks on Lunar Satellites (and Other Non-Earth Orbiting Satellites): Legal Issues*, 57 CREIGHTON L. REV. 663, 689 (2024).

[69] *See* Larsen, *supra* note 67, at 27.

lunar projects, coupled with the discussed legal ambiguities, could lead to potential conflicts.[70]

Potential conflicts or tensions may arise due to inadequate coordination among the projects.[71] Indeed, the independent operation and lack of coordination between Chinese and American lunar projects, coupled with the discussed legal ambiguities, could lead to potential conflicts.[72]

Finally, as the exploration and development of the Solar System progresses beyond the Moon—starting with Mars[73] and asteroids[74]—conflicts may arise on these bodies as well due to potential stakeholder interference.[75] Thus, firmly understanding how LOAC and the OST, as well as their interaction, apply to possible lunar conflicts will become highly relevant for managing interactions on other celestial bodies.

II. THE DEFENSE OF LUNAR ACTIVITIES: MEASURES OF SHORT WAR

As discussed, interferences on the Moon are likely.[76] Rather than adopting a private-versus-private standpoint that focuses on interferences or damages in civil actions pursued by one lunar stakeholder against another, this article approaches the issue of defending lunar activities from a state-versus-state perspective.[77] Different scenarios could ensue: the violation could fall below the threshold of an armed attack, qualifying as an internationally wrongful act;[78] the violation could

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[70] *See e.g.*, *Legal Issues for Lunar Orbiting Satellites*, *supra* note 60, at 112 *See also* Larsen, *supra* note 67, at 72.
[71] Larsen, *supra* note 67, at 27.
[72] *See e.g.*, *Legal Issues for Lunar Satellites*, *supra* note 60, at 59 (also arguing that the so called "Wolf Amendment" - prohibiting NASA and the White House Office of Science and Technology Policy from engaging in direct bilateral cooperation with China or Chinese-owned companies- hinders China-US coordination in lunar activities. *Id.* at 72.).
[73] *See generally* Robert Zubrin, THE CASE FOR MARS: THE PLAN TO SETTLE THE RED PLANET AND WHY WE MUST (2011).
[74] *See generally* Shriya Yarlagadda, *Economics of the Stars: The Future of Asteroid Mining and the Global Economy*, HARV. INT'L REV. (Apr. 8, 2022), https://www.harvardir.org/articles/economics-of-the-stars-the-future-of-asteroid-mining-and-the-global-economy/ [https://perma.cc/FGV3-G5L5].
[75] As commercial ventures on Mars near, the potential for stakeholder interference increases. *See* Darrell M. West, *Will Mars Become an Object of International Competition?*, BROOKINGS INST. (Feb. 16, 2021), https://www.brookings.edu/articles/will-mars-become-an-object-of-international-competition/ [https://perma.cc/K25V-ZB9Q]. As for asteroids, conflicts are possible but less pressing due to the abundance of asteroids and the projected mining approach (tethering and/or engulfing) on many asteroids, which could reduce the likelihood of interference, as it will result in the asteroid having only one miner. *See* Reed Elizabeth Loder, *Asteroid Mining: Ecological Jurisprudence Beyond Earth*, 36 VA. ENV'T L.J. 275, 301 (2018).
[76] *See supra* Part I.B.
[77] Attribution to a state might occur either because of direct involvement of a state entity or because the actions were carried out by one of its nationals. *See* Art. VI of the OST.
[78] *See infra* Part II.A.

constitute an armed attack and justify self-defense;[79] or the impact on lunar activities could consist of measurable damages caused by a launching state pursuant to Article VII of the OST[80] (which establishes liability for damages caused by objects launched into outer space) and the Liability Convention.[81] This paper will discuss both the internationally wrongful act and the armed attack situations, while it will only hint to the liability framework, which could prove less pertinent on the Moon.[82] Furthermore, this paper analyzes the protection of commercial interests and assets on the Moon by the commercial space entities themselves, considering private policing as a way to possibly avoid conflicts.[83]

A. Interferences with lunar activities as an intentionally wrongful act

If an attack constitutes an internationally wrongful act under international law, then the measures taken in response are legal within the boundaries of international law. Indeed, an attack on lunar activities could constitute an internationally wrongful act resulting in legal responsibility for the offending state. An internationally wrongful act, which is a foundational principle in customary international law, generates a novel legal relationship between states when the breach of an international obligation is attributable to a State. However, the likelihood that the framework for internationally wrongful acts will resolve lunar disputes peaceably, without escalating to war, is questionable.

Article 2 of the Articles on State Responsibility for Internationally Wrongful Acts (ARSIWA) defines an internationally wrongful act as a conduct (either action or omission) that violates a state's primary rule under international law, including violations of treaties and customary international law, that is attributable to the acting state[84] and that initiates a new relationship between the

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[79] *See infra* Part III.B.

[80] Article VII of the OST states:

> Each State Party to the Treaty that launches or procures the launching of an object into outer space, including the Moon and other celestial bodies, and each State Party from whose territory or facility an object is launched, is internationally liable for damage to another State Party to the Treaty or to its natural or juridical persons by such object or its component parts on the Earth, in air or in outer space, including the Moon and other celestial bodies.

[81] Convention on International Liability for Damage Caused by Space Objects, Mar. 29, 1972, 24 U.S.T. 2389, 861 U.N.T.S. 187 [hereinafter Liability Convention]. The Liability Convention remains unused despite occasions where its application could have been warranted. *See* Michał Pietkiewicz, *The "Liability Convention" in a Clash with Practice – Example of the "Kosmos 954" Satellite*, 97 STUDIA IURIDICA 54, 67 (2023) (arguing that the Liability Convention was not utilized in that case and has never been utilized).

[82] *See infra* Part IV.H

[83] *See infra* Part II.B.

[84] *See Report of the International Law Commission to the General Assembly on the Work of Its Fifty-Third Session*, 2 Y.B. Int'l L. Comm'n 34, U.N. Doc. A/CN.4/SER.A/2001/Add.1 (Part 2) [hereinafter ARSIWA]. These Articles are not legally binding on their own. They were drafted by the International Law Commission (ILC) as a set legal of guidelines and principles to codify customary international law regarding state responsibility. ARSIWA delves into the nature of a breach, emphasizing actions deviating from certain obligations.

states that carries legal consequences for the breaching state.[85] Specifically, this new relationship, termed a "secondary rule" in the treaty commentary,[86] encompasses the obligation of the breaching state to cease the wrongful conduct, prevent its recurrence, rectify the situation, pay damages, or give satisfaction in order to support the peaceful resolution of disputes.[87]

While the OST is discussed primarily in Part IV, it is briefly noted here that the treaty establishes the primary rules of conduct in space, the breach of which could constitute an internationally wrongful act.[88] OST Article VI, which provides that states "bear international responsibility for national activities in outer space" whether those activities are performed by governmental or non-governmental entities,[89] considerably simplifies the issue of attribution compared to the terrestrial setting.[90] However, because the obligations set forth in the OST are stated as general principles and no state practice exists (yet) on claiming violations of OST

[85] *See id.* at arts. 28–36 (outlining the legal ramifications of an internationally wrongful act).
[86] *Id*. at 31.
[87] Several provisions demonstrate this possibility. Article 29, which addresses "Continued Duty of Performance," provides that a state can insist on the breaching state's continued duty of performance (which often is a sufficient remedy for rectifying the situation). Article 30, titled "Cessation and Non-repetition," mandates the cessation of the breaching conduct and non-reoccurrence (which is also usually an effective remedy sought by the aggrieved state through diplomatic channels). Article 31, covering "Reparations," obligates the responsible state to fully compensate for the material and moral damages caused by the wrongful act. "Restitution" in Article 35 aims to restore the original state of affairs before the breach occurred. "Compensation" in Article 36 mandates the breaching state to compensate for damages, especially if they cannot be rectified through restitution. Compensation encompasses any financially measurable damage, including loss of profits, once established. "Satisfaction" in Article 36 outlines the breaching state's obligation to provide redress for the injury if it persists despite restitution or compensation (the redress might involve acknowledging the breach, expressing regret, offering a formal apology, or utilizing other appropriate means). *See id*. at arts. 29-31, 35, 36.
[88]. For example, the prohibition against claiming sovereignty over celestial bodies (OST Article II) and the obligation to maintain due regard and avoid harmful contamination of celestial bodies (OST Article IX) represent the primary rules for State conduct in space, the breach of which could generate international responsibility.
[89] OST, *supra* note 7, at art. VI. *See also* Frans G. von der Dunk, *Scoping National Space Law: The True Meaning of "National Activities in Outer Space" of Article VI of the Outer Space Treaty*, 2019 PROCEEDINGS OF THE INTERNATIONAL INSTITUTE OF SPACE LAW 227, 237 (arguing that while the OST does not explicitly define "national activities" in space, academic circles have proposed various theories to clarify this clause: activities limited to nationals, space activities that already attribute liability to a state, and the extension of licensing regimes to non-governmental activities that are already under a state's jurisdiction. Furthermore, more than two dozen countries have established a national regime addressing these concerns).
[90]*See* ARSIWA, *supra* note 84, at arts. 4–11 (outlining when actions by various entities are seen as acts of a state in international law). Articles 4 and 5 encompass actions by state organs or recognized entities, including authorized individuals wielding governmental authority. Articles 6 and 7 clarify that organs provided by one state to another and actions by state entities, even when exceeding authority, are considered state acts. Articles 8 and 9 define state acts as actions under state control or exercised in the absence of official control, both qualifying as state acts. Articles 10 and 11 address actions of insurrectional movements as state acts, attributing related conduct to those states. Article 11 specifies that conduct not directly attributed to a state may be recognized as an act of the state if acknowledged and adopted.

duties as internationally wrongful acts, the scenarios in which such breaches on the Moon could be considered internationally wrongful acts remain highly uncertain.[91]

B. Private security for commercial parties

The employment of private security forces by commercial parties to protect their lunar activities is legal. Given the mentioned likelihood of significant interferences and potential threats to lunar activities from both state and non-state actors, it is anticipated that commercial lunar entities may take measures to protect their interests and assets. On Earth, private security has become integral to protecting corporate plants and facilities, addressing security concerns, mitigating risks, and ensuring uninterrupted corporate infrastructure operations, with specialized security units, contracted by corporations being tasked with safeguarding assets, personnel, and sensitive information.[92] Their presence not only prevents damaging activities but also acts as a deterrent.[93] Containers and tankers also employ armed guards for protection,[94] the presence of which has led to a significant decline in piracy incidents and activities.[95]

Applying these lessons to the Moon remains highly speculative; however, borrowing from concepts rooted in Earth's experience, the role of private security in safeguarding commercial lunar facilities could be pivotal. Using advanced (i.e., robotic) technology and tailored security measures, these forces could enforce safety protocols on the Moon, potentially undertaking tasks like perimeter monitoring and rapid response systems. While these forces could play a fundamental role in diminishing the risk of conflicts on the Moon, some caveats need to be noted. First, to maintain their legality, space companies must ensure that the utilization of private security forces does not equate to employing irregular forces and mercenaries because such actions would be considered instances of indirect aggression prohibited by the U.N. Charter.[96] Second, commercial space companies are subject to the restrictions of the OST in their use of private security

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[91] *See infra* Part IV.

[92] *See What is Private Security and Why is it Important?*, AXON, https://www.axon.com/resources/what-is-private-security-and-why-is-it-important (last visited Sept. 11, 2024) [https://perma.cc/6KE2-X2AR].

[93] *See, e.g.*, Kevin Strom et al., *The Private Security Industry: A Review of the Definitions, Available Data Sources, and Paths Moving Forward* (2010) available at https://www.ojp.gov/pdffiles1/bjs/grants/232781.pdf. Last visited Nov 28, 2023 at 2:2.

[94] *See Armed Guards Now Deployed On 80% Of Container Ships, Tankers*, THE MARITIME EXECUTIVE (Sept. 18, 2013), https://maritime-executive.com/corporate/Armed-Guards-Deployed-Container-Ships-Tankers-2013-09-18 [https://perma.cc/9L56-XCSE].

[95] *See id*. (contending that the deployment of armed guards on 80 percent of container ships and tankers has become a widespread deterrent, prompting pirates to seek less fortified targets but challenges persist regarding the legitimacy and oversight of private security services.).

[96] *See* Robert A. Ramey, *Armed Conflict on the Final Frontier: The Law of War in Space,* 48 A.F. L. REV. 1, 62 (2000).

forces.[97] While the OST primarily addresses the activities of states, OST Article VI, which stipulates that states are responsible for national activities in outer space regardless of whether they are governmental, extends the treaty's reach to non-governmental entities, including commercial companies.[98] This means that commercial companies must comply with the OST and that states must oversee and regulate corporate activities to ensure adherence to the treaty's principles.[99] Therefore, the analysis conducted in Part IV with reference to states' defense of lunar activities also applies to non-state actions, including the employment of private security. For example, the use of private police on the Moon has to reckon with OST Article IV, which prohibits the use of certain types of weapons in space and the construction of military bases and installations on celestial bodies, as well as a general indication that celestial bodies must be used exclusively for "peaceful purposes."[100] Part IV.E delves into the scope of these restrictions, arguing that they might be less restrictive than initially perceived. Even if the restrictions of OST Article IV were broadly interpreted, they would not impede the use of private security forces on the Moon, which are not military entities, and the weapons they would utilize do not fall under Article IV's banned categories.[101]

A number of other issues regarding the use of private forces on the Moon, including the legality of using them to defend lunar facilities in the context of an armed conflict (and which rules would apply), exist.[102] The possibility of private forces being used in an armed conflict could prove realistic and would deserve analysis, also borrowing examples from situations on Earth, where the private sector has been involved in all facets of conflicts throughout history. While the issue is significant, it may not require extensive analysis here, because, if an armed conflict ensues, governments will probably step up to protect their national lunar activities, as discussed below and in Part V.

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[97] *See infra* Part IV. This paper does not broadly discuss the reasons why the obligations of the OST directly apply to private parties but assumes they do, either directly or indirectly (i.e., through licensing and supervision).

[98] *See* Frans G. von der Dunk, *The Origins of Authorisation: Article VI of the Outer Space Treaty and International Space Law*, 2011 NATIONAL SPACE LEGISLATION IN EUROPE: ISSUES OF AUTHORISATION OF PRIVATE SPACE ACTIVITIES IN THE LIGHT OF DEVELOPMENTS IN EUROPEAN SPACE COOPERATION 3, 3–28 (discussing states' responsibility for private actors' space activities under Article VI of the OST and arguing that state responsibility, authorization, and supervision make the treaty indirectly applicable to private parties through national governments, which are ultimately accountable for ensuring compliance).

[99] *See, e.g.*, Stephen Gorove, *Interpreting Article II of the Outer Space Treaty*, 37 FORDHAM L. REV. 349, 351–352 (1969).

[100] *See* OST, *supra* note 7, at Article IV.

[101] *See id.*

[102] *See* HANNA BLÜME, PRIVATE MILITARY AND SECURITY COMPANIES IN ARMED CONFLICT, PRIVATISATION OF VIOLENCE AS A CHALLENGE TO CONTEMPORARY INTERNATIONAL HUMANITARIAN LAW, Orebro Universitet 21–33 (2021) (arguing that private security companies in armed conflicts operate outside international law, drawing criticism for civilian harm; arguing also that, despite attempts to regulate them (with limited success), customary rules of engagement should still apply to these contractors).

III. THE USE OF FORCE (OR THE THREAT THEREOF) TO DEFEND LUNAR ACTIVITIES

After outlining the reasons why potential conflicts on the Moon are likely and discussing the legality of both a reaction to a conduct that constitutes an internationally wrongful act and the employment of private security forces, it is worth acknowledging that, while these perspectives may reduce the likelihood of conflicts, the Moon might nevertheless witness a surge in armed conflicts.[103] This underscores the necessity of discussing LOAC in relation to the Moon.

LOAC consists of two distinct bodies of law: *jus ad bellum*, which refers to the rules governing "the right to go to war," and *jus in bello,* which pertains to the laws that regulate the conduct of war.[104] While scholars have proposed that *jus ad bellum* and *jus in bello* should be considered together, since treaties often discuss both sets of obligations in tandem,[105] they still, nevertheless, apply independently,[106] and, as already discussed, both apply on the Moon and to other celestial bodies.[107]

A. Article 2.4 U.N. Charter: Prohibition of the use of force or threat thereof

Defensive lunar activities are lawful in principle but must comply with the limitations set forth in Article 2(4) of the U.N. Charter. Specifically, Article 2(4) provides: "All Members shall refrain in their international relations from the threat or use of force against the territorial integrity or political independence of any state, or in any other manner inconsistent with the Purposes of the United Nations."[108]

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[103] *See supra* Part I.B. This could happen not only for tensions originated on the Moon itself but also due to escalating geopolitical tensions on Earth. See GLOBAL TRENDS 2030: ALTERNATIVE WORLDS 5 (2012) and GLOBAL TRENDS 2040 *supra* note 58.

[104] *See* Christopher Greenwood, *The Relationship between Jus ad Bellum and Jus in Bello*, 4 REV. INT'L STUDIES 221, 221 (1983).

[105] *See* Frans G. von der Dunk, *Armed Conflicts in Outer Space*: *Which Law Applies?* 97 INT'L L. STUD. 188, 203–204 (2021) (arguing the "Hague system" of conventions - stemming from the Hague Peace Conferences of 1899 and 1907 - exemplifies this). The traditional demarcation between these two bodies of law may be blurring, as in the 20th century, the actions of states have muddled the clear boundary between peace and war to an extent where certain scholars question the ongoing legal significance of the distinction between *jus ad bellum* and *jus in bello. See also* Greenwood, *supra* note 3, at 221–222. (advocating for a merger of the two systems as they operate simultaneously once a conflict ensues.).

[106] *See, e.g.*, Vangelis Koutroulis, *And Yet It Exists: In Defence of the 'Equality of Belligerents' Principle*, 26 LEIDEN J. INT'L L. 449, 469–472 (2013) (even if a conflict began through illegal aggression (i.e., a violation of *jus ad bellum*), belligerents are still obligated to adhere to the principles of *jus in bello*).

[107] *See infra* Part III.B 1 and 2; *see also* von der Dunk, *supra* note 105, at 199; Stephens *supra* note 44, at 77-78; OST, *supra* note 7, art. III.

[108] U.N. Charter, *supra* note 5, art. 2, ¶ 4.

The provision articulates the principle of non-aggression, rendering the use of force or threat thereof illegal. This prohibition includes any acts of aggression, military interventions, or the threat of either. It applies both to actions against "the territorial integrity or political independence" of a state and to any use of force or threats that are "inconsistent with the purposes of the United Nations."[109] The reference to territorial integrity is a ban on wars of conquest. The reference to political independence emphasizes the principle of sovereign equality among all U.N. member states. The residual expression of "any other manner inconsistent with the Purposes of the United Nations," however, is worth exploring further because it is relevant for space.[110] The prohibition of war and the commitment of the U.N. member States to resolving controversies through peaceful means are the bedrocks of the U.N. Charter. Even if, per Article II of the OST, sovereignty cannot exist in space and states cannot claim territory,[111] any act of aggression or threat that is not in line with the U.N. Charter is banned by Article 2(4).[112] The scope of Article 2(4)'s prohibition is unclear and has been interpreted in two ways. The predominant view holds that it is an unequivocal prohibition on the use of force, with the exceptions discussed immediately below.[113] Another interpretation limits the prohibition to force used for objectives contrary to the U.N. Charter, such as subjugation or annexation, but allows for other uses of force.[114]

Importantly, even under the more restrictive interpretation, Article 2(4)'s prohibition includes exceptions. In conjunction with Article 51 of the U.N. Charter, the use of force and the threat of the use of force are permitted in two circumstances: (1) the right of self-defense, and (2) actions sanctioned by the U.N. Security Council.[115] This paper focuses on the first exception as the most relevant, given the

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[109] *Id; see also* Ramey, *supra* note 96, at 199.

[110] U.N. Charter, *supra* note 5, at art. 2, ¶ 3–4 ("all Members shall settle their international disputes by peaceful means in such a manner that international peace and security, and justice, are not endangered.").

[111] *See infra* Part IV.C. While Article II of the OST explicitly bans claims of sovereignty or territory in outer space, other provisions of the Treaty acknowledge forms of jurisdiction and control that resemble *lato sensu* territorial authority. For instance, Article VIII provides for 'flag jurisdiction,' and Article XII recognizes the possibility of *de facto* control over portions of territory.

[112] *See* Ramey, *supra* note 96, at 61.

[113] *See id* at 134.

[114] *See id.* (arguing that this view was strengthened by NATO's air campaign in Kosovo).

[115] *See* U.N. Charter, *supra* note 5, art. 51 ("Nothing in the present Charter shall impair the inherent right of individual or collective self-defense if an armed attack occurs against a Member of the United Nations until the Security Council has taken measures necessary to maintain international peace and security. Measures taken by Members in the exercise of this right of self-defense shall be immediately reported to the Security Council and shall not in any way affect the authority and responsibility of the Security Council under the present Charter to take at any time such action as it deems necessary in order to maintain or restore international peace and security.")

likelihood that states will seek to defend their national lunar activities if attacked, as discussed below.[116]

B. Article 51 U.N. Charter: Right of self-defense

Reaffirming a customary principle,[117] Article 51 U.N. Charter provides for the inherent right to self-defense (both as individual states and collective groups of states) when a state suffers an armed attack.[118] The legality of self-defense thus hinges upon the notion of "armed attack."

Self-defense is not without boundaries. A state must respect the principles of necessity and proportionality. The former stands for the proposition that a state must be in a position of necessity to defend itself (i.e., armed force must be used only as a last resort). The latter represents the idea that a state's reaction must be a proportionate response to the harm suffered—otherwise, the state would violate Article 2(4) of the U.N. Charter.[119] Most importantly, the right to use force in self-defense only exists when an armed attack either occurs or is imminent. The latter situation is known as anticipatory self-defense.[120]

Finally, a state exercising its right to self-defense must immediately report any measure taken to the U.N. Security Council,[121] which, under Chapter VII of the U.N. Charter, retains the primary authority to authorize the use of force in response to threats to international peace and security, deciding the measures to maintain or

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[116] *See infra* Part V. Since the right of self-defense is sufficient to justify lunar activities, reliance on U.N. Security Council authorization is less critical, especially given its limited effectiveness in sanctioning military actions in only a few cases.

[117] *See* John Yoo, *Rules for the Heavens: The Coming Revolution in Space and the Laws of War*, U. ILL. L. REV. 123, 145–151 (2020). *See also* Donald R. Rothwell, *Anticipatory Self-Defence in the Age of International Terrorism*, 23 U. QUEENSLAND LAW J. 337, 337–53 (2005) (arguing that self-defense is rooted both in customary international law; discussing an ongoing debate on whether Article 51 fully covers the right of self-defense or if an independent customary right exists. The issue remains unresolved, but the use of "inherent" in Article 51 would imply a pre-existing right of self-defense).

[118] *See* U.N. Charter, *supra* note 5, at art. 51.

[119] *See infra* Part III.A.

[120] *See* Maria Benvenuta Occelli, *"Sinking" the Caroline: Why the Caroline Doctrine's Restrictions on Self Defense Should Not Be Regarded as Customary International Law*, 4 SAN DIEGO INT'L L.J. 467, 474 (2003) (arguing that the Caroline restrictions should not be the test for anticipatory self-defense). The *Caroline* incident of 1837, where British Canadian militia, on British orders, raided and sank the American steamboat Caroline used by Canadian insurgents across the Niagara River led to a renowned exchange of letters between U.S. Secretary of State Daniel Webster and British representative Lord Ashburton. This correspondence is cited as illustrating the principles of customary international self-defense. Webster wrote to Ashburton: "Under these circumstances, and under those immediately connected with the transaction itself, it will be for her majesty's government to show upon what state of facts and what rules of national law, the destruction of the Caroline is to be defended. It will be for that government to show a necessity of self-defense, instant, overwhelming, leaving no choice of means, and no moment for deliberation.".

[121] *See* U.N. Charter, *supra* note 5, at art. 51.

restore international peace and security (including authorizing the use of force in specific situations).[122] These rules hold true even within the space domain.[123]

1. *Jus ad bellum* as applied to space

The U.N. Charter's core restrictions on the use of force, as well as the fundamental exception to it (self-defense) are relevant and applicable to activities in outer space.[124] However, the application of those general concepts to lunar settings is challenging, particularly regarding the notion of an "armed attack," due to the lack of clear definitions and insufficient guidance from authorities.[125]

The existence of an armed attack is crucial because, as mentioned above, it determines the eligibility of a targeted state's right of self-defense pursuant to Article 51 U.N. Charter.[126] While the U.N. Charter lacks a precise definition of "armed attack,"[127] scholars generally view an armed attack as more severe and consequential than mere use of force.[128] The United States, however, takes a different position, historically dismissing the idea of a distinction between uses of force and armed attacks, considering every use of force an armed attack justifying potential forceful defensive responses.[129]

The line between the most severe forms of force (qualifying as an armed attack) and actions implying force, but not reaching that level, remains vague. Nevertheless, international case law provides some guidance.[130] *Nicaragua v. United States of America*[131] introduced the "scale and effects" test to determine whether hostile actions against a state qualify as an armed attack,[132] specifying that

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[122] *See id*., arts. 42 and 39 (Article 42 grants the U.N. Security Council the authority to take military action, and Article 39 of the U.N. Charter establishes the Council's responsibility to determine threats to peace).
[123] *See* Ramey, *supra* note 96, at 62 ("A[s] with the application of numerous international instruments to new situations and technological realities, there is no reason to exclude the terms of Articles 2(4) and 51 from application in outer space.").
[124] For the avoidance of doubt, Article III OST explicitly mentions the applicability of the U.N. Charter to space. OST, *supra* note 7, art. III. *See* von der Dunk, *supra* note 105 *at* 199.
[125] *See* Laurie R. Blank, *Irreconcilable Differences: The Thresholds for Armed Attack and International Armed Conflict*, 96 NOTRE DAME L. REV. 249, 253 (2020).
[126] *See id*. Instead, as discussed in Part III.B, the presence of an armed conflict triggers the application of *jus in bello* for the involved parties.
[127] The *travaux préparatoires* accompanying the negotiations for the drafting of the UN Charter do not contain a detailed explanation, perhaps due to its assumed clarity. United Nations Conference on International Organization held in San Francisco, California, from April 25 to June 26, 1945.
[128] Blank, *supra* note 125, *at* 253.
[129] Michael N. Schmitt, *Over-the-Horizon Operations – Part I: When May Force Be Used?,* LIEBER INSTITUTE (Dec. 16, 2021), https://lieber.westpoint.edu/over-the-horizon-operations-part-i-when-may-force-be-used/ [https://perma.cc/5WKY-T5QY].
[130] *See* Blank, *supra* note 125, at 253 (considering the guidance offered by the international courts as "insufficient").
[131] Military and Paramilitary Activities in and Against Nicaragua (Nicar. v. U.S.), Judgment, 1986 I.C.J. Rep. 14 (June 27).
[132] *Id*.

a minor event like a "border incident" does not qualify as such.[133] Furthermore, physical impact, including territorial intrusion, casualties, or significant property damage, is crucial when defining an armed attack.[134] Bombardments, kinetic attacks, or invasions (excluding mere border incidents) thus qualify as armed attacks if they occur on a substantial scale and have significant effects.[135] Furthermore, U.N. General Assembly Resolution 3314 (XXIX) (Resolution 3314)[136] invokes the concept of the "use of force" in defining aggression as the use of armed force by a state against the sovereignty, territorial integrity, or political independence of another, or in any way inconsistent with the U.N. Charter.[137] Resolution 3314 also establishes that the "first use" of armed force by a state, in violation of the U.N. Charter, is considered *prima facie* evidence of an act of aggression, unless the U.N. Security Council determines otherwise.[138] Article III of the resolution lists examples of aggression, including invasion; bombardment; blockade of ports; attack of land, sea, air forces, or marine and air fleets; and deployment of mercenary troops in another state.[139]

Without further exploring the concept of "armed attack," the preceding discussion highlights its intricacies, which become even more complex when applied to space. Anticipating the application of the principles related to the definition of "armed conflicts" to the lunar setting poses significant challenges due to the limited information and guidance available from international jurisprudence and non-binding documents.[140] The application of these few established principles becomes intricate when considering scenarios devoid of borders, as in outer space per the OST's non-appropriation principle.[141] As such, in the lunar context, traditional understandings of armed conflicts, which hinge upon territorial clashes, become blurred. For instance, the terrestrial notion of localized border encounters, discussed in the *Eritrea-Ethiopia Claims* Commission, becomes enigmatic in a lunar context where borders do not to exist. Furthermore, Resolution 3314's focus on actions taken against territorial integrity becomes convoluted when applied to a celestial body devoid of recognized states and sovereign territory. In such a situation, overarching principles like the "scale and effect" doctrine become

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[133] *Id*. Similarly, the *Eritrea-Ethiopia Claims* Commission determined that "geographically limited clashes" in disputed border regions and "localized border encounters" involving small infantry units, despite resulting in loss of life, do not constitute an armed attack. *Jus Ad Bellum*—Ethiopia's Claims 1–8 (Eth. v. Eri.), Partial Award, 26 R.I.A.A. 457, 465-66 (Eri.-Eth. Claims Comm'n 2005).

[134] *See* Blank, *supra* note 125, at 254.

[135] *Id.* at 254–55. In *Oil Platforms*, the International Court of Justice ruled that even "the mining of a single military vessel could be sufficient to meet the definition of an armed attack." Oil Platforms (Iran v. U.S.), Judgment, 2003 I.C.J. 90 (Nov. 6), (holding that the Court does not dismiss the possibility that the mining of a single military vessel could trigger the inherent right of self-defense).

[136] G.A. Res. 3314 (XXIX), annex, Definition of Aggression (Dec. 14, 1974).

[137] *Id.* art. 1.

[138] *Id.* art. 2.

[139] *Id.* art. 3.

[140] *See* Blank, *supra* note 125, at 253.

[141] *See* OST, *supra* note 7, art. II.

especially useful. For example, are the repercussions of electronic interference or a cyberattack on a country's ability to communicate and manage lunar operations sufficiently similar to a blockade of ports to constitute an armed attack under Resolution 3314? In light of the challenges inherent in such assessments, the "scale and effect" doctrine is central to ascertain what counts as an armed attack in space; nevertheless the "scale and effect" doctrine also introduces challenges by relying on vague interpretations dependent upon a context that is currently unknown. State practice may eventually define what constitutes an "armed attack" in lunar settings.[142] Until such clarity emerges, however, navigating these ambiguous situations will remain a significant obstacle.

The right to self-defense under Article 51 of the U.N. Charter, which includes anticipatory self-defense, persists on the Moon and other celestial entities.[143] This statement should not elicit surprise when considering that self-defense stands firmly entrenched as a customary principle of international law.[144] Even if space is borderless and no sovereignty can be claimed,[145] this does not change the existence of the right of self-defense in space, as Article 2(4) of the U.N. Charter prohibits aggression or threats thereof in violation of the Charter, [146] not only those connected to a territory. Nevertheless, uncertainties about self-defense's specific application to the space domain remain, as Article IV of the OST provides certain limitations to acts of self-defense in space.[147]

2. *Jus in bello* as applied to space

The conduct of hostilities to defend lunar installations must be performed within the constraints of the *jus in bello*.[148] *Jus in bello*, also known as international humanitarian law (IHL), has evolved over centuries[149] and becomes applicable once an armed conflict is initiated.[150] The main customary principles of IHL, which are also applicable to lunar hostilities,[151] are: (1) military necessity, which mandates

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[142] *See* Stephens, *supra* note 44, at 77.
[143] *See* von der Dunk, *supra* note 105, at 199.
[144] *See* Blank, *supra* note 125, at 252.
[145] No sovereignty can be claimed in space under Article II OST. *See* OST, *supra* note 5, art. II.
[146] Article 2(4) of the U.N. Charter supra note 5.
[147] *See infra* Part IV.E (showing the Article IV OST's limitations are narrow).
[148] *See* von der Dunk, *supra* note 105, at 203.
[149] *See* Caitlyn Georgeson & Matthew Stubbs, *Targeting in Outer Space: Exploration of Regime Interactions in the Final Frontier,* 85 J. AIR L. & COM. 609, 612 (2020).
[150] U.S. DEP'T. DEF., OFF. OF GEN. COUNS., LAW OF WAR MANUAL, at 79–80 (2023 ed.) [hereinafter Law of War Manual] ("*Jus in bello* rules apply when a party intends to conduct hostilities."). If a nation opts to respond to an armed attack using military measures, the latter must align with *jus in bello* regulations. This includes adhering to these laws during the planning stages of military operations, well before combat begins, *id.* at 80.
[151] *See, e.g.,* David A. Koplow, *Reverse Distinction: A U.S. Violation of the Law of Armed Conflict in Space,* 13 HARV. NAT'L SEC. J. 25, 57 (2022) (arguing that "[t]he corpus of the law of armed conflict is…fully applicable in space"). *See also* Ramey, *supra* note 96, at 35 (arguing that as no treaties outline specific *jus in bello* principles for space combat, the most authoritative guidance comes from the customary principles of international law of *jus in bello*).

that actions in international armed conflicts must aim for a clear military advantage;[152] (2) distinction, which requires differentiating between civilians and civilian objects on the one hand and combatants and military objects on the other, whether by their nature, location, purpose, or use,[153] and which presents particular challenges in the space context where many objects are dual-use;[154] (3) proportionality, which provides that attacks must not cause excessive civilian damage relative to the military gain, which can be complex in space, especially with dual-use objects like global positioning systems, or GPS;[155] (4) precaution, which mandates attackers to exercise caution in their choice of attack methods;[156] (5) constant care, which means planning the military action while taking care to spare civilians and civilian objects even when not in close proximity to the target;[157] and (6) the principle of avoiding widespread, long-term, and severe damage to the natural environment.[158] Each of these principles applies in space conflicts,[159] even if challenges exist in their application.[160]

The principles of *jus in bello* do not contain specific provisions tailored for operations in outer space, since they are grounded in terrestrial contexts and originated before the space age. Furthermore, the parties of the OST did not explicitly extend these rules to outer space.[161] Nevertheless, there are several bases on which to conclude that these principes *do* extend to actions taken in space to

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[152] *See* INT'L COMM. OF THE RED CROSS, THE PRINCIPLES OF HUMANITY AND NECESSITY (2023), https://www.icrc.org/sites/default/files/wysiwyg/war-and-law/02_humanity_and_necessity-0.pdf [https://perma.cc/52MB-Z288]. S*ee also* Georgeson & Stubbs, *supra* note 149 , at 613.

[153] See Protocol Additional to the Geneva Conventions of 12 August 1949, and relating to the Protection of Victims of International Armed Conflicts (Protocol I) art. 48, June 8, 1997, 1125 U.N.T.S. 3 [hereinafter Additional Protocol I].

[154] *See* Georgeson & Stubbs, *supra* note 149, at 614–17.

[155] *See* Additional Protocol I, *supra* note 154, art. 51(5)(b). *See also* Georgeson & Stubbs, *supra* note 149, at 617.

[156] *See* Additional Protocol I, *supra* note 154, art. 57(1). *See also* Georgeson & Stubbs, *supra* note 149, at 621–22.

[157] *See* Additional Protocol I, *supra* note 154, art. 57(2)(a). *See also* Georgeson & Stubbs, *supra* note 149, at 623.

[158] Georgeson & Stubbs, *supra* note 149, at 624. *See also* ICRC Database, Customary IHL, Causing Serious Damage to the Natural Environment, https://ihl-databases.icrc.org/en/customary-ihl/v1/rule45 [https://perma.cc/7TTR-L6LN] ("The use of methods or means of warfare that are intended, or may be expected, to cause widespread, long-term and severe damage to the natural environment is prohibited. Destruction of the natural environment may not be used as a weapon.").

[159] *See generally* Dale Stephens & Cassandra Steer, *Conflicts in Space: International Humanitarian Law and Its Application to Space Warfare*, 40 ANNALS OF AIR AND SPACE LAW 30 (2020).

[160] As an example, we should consider that as any disruption to essential lunar satellites could lead to disastrous outcomes, an attack on these satellites may conflict with IHL principles, particularly regarding proportionality, since the potential consequences could greatly exceed acceptable limits and cause indiscriminate harm. *See* Giannoni-Crystal, *supra* note 68, at 706.

[161] *See* Kubo Mačák, *Silent War: Applicability of the Jus in Bello to Military Space Operations*, 94 INT'L L. STUD. 1, 10–12 (2018) (arguing that parties did not discuss *jus in bello* probably because the Cold War situation made them reluctant to address the issue in a multilateral treaty).

defend lunar activities.[162] First, when states venture into new domains, their actions cannot be considered as happening in a legal vacuum: the general principles of international law must continue to apply to their actions in the new settings. An analogy can be drawn with cyberspace: notwithstanding some challenges, international law has been deemed to continue to apply in cyberspace.[163] In principle, a similar approach should be taken regarding a state's conduct of hostilities in outer space.[164]

Therefore, the absence of explicit provisions in the *jus in bello* rules explicitly confirming their applicability to outer space should not be interpreted as evidence against applicability.[165] Second, OST Article III[166] requires that states conduct their space activities in compliance with international law, of which *jus in bello* is part.[167] Third, the applicability of IHL to the lunar context is confirmed by Common Article I of the Geneva Conventions,[168] which states: "The High Contracting Parties undertake to respect and to ensure respect for the present Convention *in all circumstances*"[169] (emphasis added). Fourth, the International Court of Justice held that IHL covers all forms of warfare and weapons, past,

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[162] *See* Stephens, *supra* note 44, at 77. While the notion of armed conflict in outer space encompasses both the deployment of force within outer space and the utilization of space assets to achieve military impact across air, land, and sea domains, this paper focuses on the use of force in outer space itself. *See also* Stephens & Steer, *supra* note 159, at 30–51 (2020).

[163] *See* Mačák, *supra* note 161, at 12-13.

[164] *See id.* at 12. Some provisions of the OST would seem to defeat the analogy with cybersecurity because the OST would seem to provide for a conflicting legal architecture. *See infra* Part IV.A (discussing the reasons why LOAC (including *jus in bello*) preempts space law in time of conflicts).

[165] *See* Stephens & Steer, *supra* note 159, at 30–51.

[166] *See infra* Part IV.D.

[167] *See* Mačák, *supra* note 161, at 14.

[168] *See* Geneva Convention for the Amelioration of the Condition of the Wounded and Sick in Armed Forces in the Field art. 1, Aug. 12, 1949, 6 U.S.T. 3114, 75 U.N.T.S. 31. *See also* Geneva Convention for the Amelioration of the Condition of Wounded, Sick and Shipwrecked Members of Armed Forces at Sea art. 1, Aug. 12, 1949, 6 U.S.T. 3217, 75 U.N.T.S. 85; Geneva Convention Relative to the Treatment of Prisoners of War art. 1, Aug. 12, 1949, 6 U.S.T. 3316, 75 U.N.T.S. 135; Geneva Convention Relative to the Protection of Civilian Persons in Time of War art. 1, Aug. 12, 1949, 6 U.S.T. 3516, 75 U.N.T.S. 287). These four Geneva Conventions– together with three Protocols of 1977 (Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of International Armed Conflicts art. 1, June 8, 1977, 1125 U.N.T.S. 3 (Protocol I); Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of Non-International Armed Conflicts art. 1, June 8, 1977, 1125 U.N.T.S. 609 (Protocol II); Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Adoption of an Additional Distinctive Emblem art. 1, Dec. 8, 2005, 2404 U.N.T.S. 261 (Protocol III)) are collectively known as "Geneva Law". "The 1949 Geneva Conventions serve primarily as protection for individuals suffering as a result of armed conflict." Ramey, supra note 96, at 50. For a discussion about the "Geneva Law", *see id.* at 50–56.

[169] Convention for the Amelioration of the Condition of the Wounded and Sick in Armed Forces in the Field art. 1, Aug. 12, 1949, 6 U.S.T. 3114, 75 U.N.T.S. 31. *See also* Mačák, *supra* note 161 161, at 15 (specifying that Common Article 1 is widely regarded as reflecting customary international law).

present, or future.[170] The DoD takes the same position.[171] Contrary opinions, however, exist.[172]

In conclusion, IHL principles apply to armed conflicts in outer space,[173] including the Moon and other celestial bodies. However, since space is also governed by the OST, one must consider whether the application of IHL is altered by the OST or vice versa.[174]

IV. THE OUTER SPACE TREATY, THE OTHER SPACE TREATIES, AND INTERNATIONAL DOCUMENTS

The OST is widely regarded as the "Constitution" of space,[175] enshrining fundamental principles, including the freedom to explore and utilize outer space, and standing as a prominent achievement in contemporary international law. The treaty represents a balanced compromise between the collective interests of all nations, the broader goals of humanity, and states' individual interests.[176] Brian J. Egan, former legal advisor to the U.S. Department of State, referred to the OST as a cornerstone in the international legal regime for outer space.[177] Rather than explicitly resolving all legal issues or regulating specific activities, the OST has, for over fifty years, provided the framework for states to collaboratively manage evolving space capabilities and the legal complexities resulting from space activities.[178] The OST contains several principles regulating conduct in space. Article I, for example, encompasses the freedom to explore and use outer space, as well as the freedom of scientific investigation and international cooperation in such investigations. Article II sets forth the principle of non-appropriation. Article IV provides for the principle of denuclearization of outer space.[179] Article VI establishes the principle of international responsibility, making states accountable

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[170] Legality of Threat or Use of Nuclear Weapons, Advisory Opinion, 1996 I.C.J. 226, 86 (July 8). *See* INT'L COMM. RED CROSS, WEAPONS: ICRC STATEMENT TO THE UNITED NATIONS, 2015, (2015) ("[A]ny hostile use of outer space in armed conflict ... must comply with IHL, in particular its rules of distinction, proportionality and precautions in attack."). *See, e.g., Georgeson & Stubbs,* s*upra* note 149, at 614. (discussing the elements of a two-prongs test at *id*. 615-617.).

[171] *See* Law of War Manual, *supra* note 150, at Ch. 3.

[172] *See* Georgeson & Stubbs, *supra* note 149, at 615. Russia takes the position that IHL does not apply to outer space. RUSSIAN FEDERATION, STATEMENT ON COUNTERPRODUCTIVE NATURE OF CONSIDERATION OF THE APPLICABILITY OF INTERNATIONAL HUMANITARIAN LAW (IHL) TO OUTER SPACE ACTIVITIES (OPEN-ENDED WORKING GROUP ON REDUCING SPACE THREATS 2022) (arguing that it is acceptable to consider the relevance of IHL only in areas where active military operations might take place, while the peaceful designation of outer space precludes any discussion of IHL within that domain.).

[173] *See* Georgeson & Stubbs, *supra* note 149, at 612.

[174] *See infra* Part IV.A. *See also* Stephens, *supra* note 44, at 77–78.

[175] Joanne Irene Gabrynowicz, *The Outer Space Treaty and Enhancing Space Security*, 30 Journal of Space Law, 227, 227–38 (2004).

[176] *See* Marchisio, *supra* note 7, at 226–27.

[177] *See* U.S. DEP'T ST., GALLOWAY SYMPOSIUM ON CRITICAL ISSUES IN SPACE LAW (2016), https://2009-2017.state.gov/s/l/releases/remarks/264963.htm [https://perma.cc/V583-2BQ6].

[178] *Id.*

[179] *See* Marchisio, *supra* note 7, at 227.

for national activities in outer space, whether conducted by governmental or non-governmental entities.[180]

A. The interaction between LOAC and the OST

Opponents of the legality of the defense of lunar activities ground their dissent in certain language within the OST.[181] Specifically, they argue that the OST represents a limit on the ability to defend lunar infrastructures and that, not only are LOAC and the OST inconsistent, but that, where there are differences between the two regimes, the OST takes precedence and limits the use of force in outer space.[182] This position argues that it cannot be assumed that LOAC applies in its entirety to armed conflict in outer space due to the distinctive nature of the environment and that, because the OST plays a key role in establishing a basic legal order, it cannot be suspended or terminated to permit the application of conflicting LOAC principles.[183] Most importantly, according to this view, Article IV OST precludes offensive and defensive military activity *on* celestial bodies.[184] This paper disagrees, taking the position that the OST does not represent a limit to the possibility of defending lunar activities, even with the use of armed force.

First and foremost, it must be stated at the outset that the OST *does* continue to apply during armed conflicts in space, but it is "subject to general legal rules that prioritize the right of self-defense, as well as IHL."[185] In other words, the OST remains in effect subject to LOAC. Indeed, the International Law Commission (ILC) indirectly suggested as much when it recommended that the Vienna Convention on the Law of Treaties[186] (hereinafter "Vienna Convention") was the appropriate resource for determining the continued applicability of a treaty during times of war. [187] According to the ILC, the examination should focus on whether the treaty contains a particular provision governing its application during times of armed conflicts, [188] which the OST does not. [189] In the absence of such a provision, the analysis shifts to the treaty's substantive content to ascertain whether it

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[180] *Id*. at 228.
[181] *See e.g*., Arjen Vermeer, *The Laws of War in Outer Space: Some Legal Implications for the Jus ad Bellum and the Jus in Bello of the Militarisation and Weaponisation of Outer Space*, THE NEW ORDER OF WAR CH.1, *passim* (2010).
[182] *See id*., *passim*.
[183] *See Id.* at 74.
[184] *See Id*. at 73.
[185] *See* Stephens, *supra* note 44, at 78.
[186] Vienna Convention on the Law of Treaties, *opened for signature* May 23, 1969, 1155 U.N.T.S. 331.
[187] *Report of the International Law Commission on the Work of Its Sixty-Third Session*, U.N. Doc. A/66/10 (2011), *reprinted in* [2011] 2 Y.B. INT'L LAW COMM'N 108, U.N. Doc. A/CN.4/SER.A/2011/Add.1 [hereinafter Draft Articles on the Effect of Armed Conflicts on Treaties].
[188] *See* Stephens, *supra* note 4444, at 81–82.
[189] *See id*.

encompasses aspects of IHL,[190] which the OST does.[191] As such, the OST must be interpreted to extend to an armed conflict in space.[192]

However, one must not read the OST's provisions to limit the right to defend lunar infrastructures under LOAC. Scholars, such as von der Dunk, who have taken the position that the OST and LOAC are incompatible in certain parts,[193] have framed their analysis as a clash of two distinct bodies of laws: space law, which is considered "*ratione geographiae*," (i.e., by reason of the location), and LOAC, which is seen as *"ratione materiae*" (i.e., by reason of the matter).[194] These scholars posit that no unified, comprehensive legal framework exists to address the question of supremacy, and that if the two bodies of law clash, there is no "prioritization tool" to decide which one should take precedence over the other;[195] they conclude further that the core principles of the OST, as *ratione geographiae*, take precedence over all other international laws, including LOAC, in case of inconsistency. While they seem to consider the *ratione geographiae* as more important than *ratione materiae*, they fail to explain why that is the case and treat it simply as axiomatic.[196]

While their argument is well taken, it rests on the fundamentally incorrect notion of a clash between space law and LOAC. Nevertheless, even if one accepts the premise of a clash, the argument still fails because, in the event of an armed conflict in space, the right of self-defense would still displace *every* provision—core or not—of the OST and all other space agreements. First, Article III of the OST provides that, in space, states, "shall carry on activities…in accordance with international law, including the Charter of the United Nations,"[197] thereby importing the entire corpus of international law, including, by name, the U.N. Charter, into the OST regime. Article 103 of the U.N. Charter provides:

In the event of a conflict between the obligations of the Members of the United Nations under the present Charter and their obligations under any other international agreement, their obligations under the present Charter shall prevail.[198]

In light of these two provisions and given that the U.N. Charter preserves the inherent right of self-defense in Article 51, whenever the exercise of this right is frustrated by an OST provision, the right of self-defense must "prevail" over any

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[190] *See id.* at 81–82.
[191] *See* Stephens, *supra* note 4444, at 82.
[192] *See* von der Dunk, *supra* note 105, at 198 (arguing the core principles of the OST "apply to military space activities" being those core principles "the legal status of outer space" (Article II), the attribution of private activities to States (Articles VI and VII of the OST), and the quasi-territorial jurisdiction over space objects (Article VIII of the OST)).
[193] *See, e.g., id.* at 190.
[194] *See id.* at 191.
[195] *See id.* at 192–193.
[196] *See id.* at 198.
[197] *See* OST, *supra* note 7, art. III.
[198] U.N. Charter, *supra* note 5, at art. 103.

conflicting provisions, including core principles. Indeed, Article 103 of the U.N. Charter does not distinguish between principles to be displaced based on their relative importance. Second, the right of self-defense is deeply rooted in customary international law, pre-dating the U.N. Charter, and carries considerable weight given its long-standing practice[199] and the deeply engrained consensus among states as to its centrality.[200] As such, any efforts to diminish it must meet with strong disapproval. Compared with the right of self-defense's "long-standing history in international relations and international law,"[201] space law does not boast such a pedigree: While the OST is over fifty years old and widely ratified, it has not achieved universal adherence by any means.[202] Third, in light of the U.N. Charter's fundamental ban on the use of armed force as a peremptory norm in Article 2(4), the right of self-defense holds a unique and elevated status as an exception.[203] Indeed, it is considered an "inherent" right of customary international law.[204] Fourth, during war, LOAC (including the right of self-defense) serves as *lex specialis*, and thus overrides any conflicting laws such as the peace-time OST framework.[205] In sum, the right of self-defense trumps any inconsistent provisions of the OST. Therefore, the application of the OST during an armed conflict is subject to the right of self-defense.[206]

This last argument is also valuable in understanding why any OST provision that is an obstacle to or in conflict with the right of self-defense must be subordinate to it.[207] While no state practice exists regarding a real conflict in space and the position taken in states' military manuals—which are an authoritative form of state practice—[208] is often unclear on the matter,[209] unofficial manuals clarify the issue

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[199] *See* Rothwell, *supra* note 119 at 337 (noting that "the inclusion of the word 'inherent' in Article 51 suggests that the right of self-defence was one which pre-existed the Charter.").

[200] RUSSELL BUCHAN & NICHOLAS TSAGOURIAS, REGULATING THE USE OF FORCE IN INTERNATIONAL LAW: STABILITY AND CHANGE 42, 43 (2021).

[201] *See id.*

[202] *See Status of International Space Agreements*, *supra* note 6, at 10 (showing only 134 nations have either signed or ratified the OST).

[203]*See* Peace Palace Library, https://peacepalacelibrary.nl/start-your-research-6-peremptory-norms-international-law-jus-cogens **(**last visited Oct. 30, 2023) [https://perma.cc/D7AA-TWUC**].**

[204] *See* von der Dunk, *supra* note 105, at 202 ("In contrast to space law … the law of armed conflict represents a conglomerate of principles, rules, rights, and obligations that have developed over many centuries and that are enshrined in a multitude of treaties and customary international law regimes.").

[205] *See, e.g.*, *Lex specialis*, ICRC, https://casebook.icrc.org/a_to_z/glossary/lex-specialis (last visited Oct. 26, 2024) [https://perma.cc/6R3C-YHGY]; Law of War Manual, *supra* note 152, at 9.

[206] Draft Articles on the Effect of Armed Conflicts to Treaties, *supra* note 189, at 117.

> A State exercising its inherent right of individual or collective self-defense in accordance with the Charter of the United Nations is entitled to suspend in whole or in part the operation of a treaty to which it is a Party insofar as that operation is incompatible with the exercise of that right.

[207] The foregoing analysis of specific provisions of the OST will demonstrate that the alleged inconsistencies between the OST and the right of self-defense are more apparent than real.

[208] *See* Stephens, *supra* note 44, at 88.

[209] Law of War Manual, *supra* note 150, at 953 (providing that "[c]ertain provisions of these treaties may not be applicable as between belligerents during international armed conflict."). *See*

of self-defense's preeminence. For example, Rule 4 of the Oslo Manual—an authoritative manual restating treaties and customary law—[210] provides: "Without prejudice to the Charter of the United Nations, the principles and rules of LOAC are the *lex specialis* during armed conflict and prevail over the general law of Outer Space."[211] The Commentary to Rule 4 further explains that the space regime "is peacetime law" that does not address the potential for armed conflicts. As such, LOAC takes precedence in instances of armed conflicts involving space—including lunar—operations, superseding any conflicting peacetime regulations. "By definition, the principles and rules of LOAC—which apply only in situations of armed conflict—are more specific than the peacetime principles [of the OST], which are "*lex generalis*."[212] Thus, not only does the specific right of self-defense—enshrined in the U.N. Charter—take precedence over the OST (and other space treaties), but, if a conflict develops on the Moon or other celestial bodies, all LOAC principles take precedence over inconsistent OST provisions. [213]

Moreover, an analysis of relevant OST provisions, presented below, shows that, far from denying the right of self-defense of lunar activities, these provisions, when interpreted correctly, stand for the proposition that defending lunar activities aligns with the OST's guiding principles.[214] As such, there is actually *no clash* between the OST and LOAC. Indeed, an interpretation of the OST that limits the right to self-defense[215] would hinder the right of free use articulated in OST Article I[216] and could potentially increase the likelihood of conflicts,[217] frustrating the treaty's principle of peaceful purposes.[218] Thus, such an interpretation should be

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also id. at 954 (specifying that "[d]uring an international armed conflict between the two nations concerned, however, the law of armed conflict would apply unless it was trumped by the principle of noninterference with space systems … There appears to be a strong argument that the principle of noninterference established by these agreements is inconsistent with a state of hostilities …").

[210] The Oslo Manual is one of the "unofficial manuals intended to restate existing treaty and customary law." Michael N. Schmitt, *The Status and Influence of Expert Manuals*, LIEBER INSTITUTE (June 21, 2024), https://lieber.westpoint.edu/status-influence-expert-manuals [https://perma.cc/C5Z2-8WS3].

[211] YORAM DINSTEIN & ARNE WILLY DAHL, OSLO MANUAL ON SELECT TOPICS OF THE LAW OF ARMED CONFLICT: RULES AND COMMENTARY 5 (1st ed. 2020) [hereinafter Oslo Manual]. *See also* Georgeson & Stubbs, *supra* note 149, at 657 (contending that the principles and rules of IHL take precedence during armed conflicts, serving as *lex specialis* over general laws of outer space).

[212] Oslo Manual, *supra* note 211, at 5.

However, not even LOAC can override the principles outlined in the U.N. Charter. *See id*.

[214] See *infra* Part IV.B.

[215] *See, e.g.*, OST, *supra* note 7, at arts. III, VIII, IX, and XII.

[216] *See* OST *supra* note 7, at art. I(2) ("Outer space, including the Moon and other celestial bodies, shall be free for exploration and use by all States without discrimination of any kind, on a basis of equality and in accordance with international law, and there shall be free access to all areas of celestial bodies …").

[217] As the Roman writer Vegetius famously stated, "*Igitur qui desiderat pacem, praeparet bellum*" (Let him who desires peace prepare for war." Jeremy Norman's History of Information.com, *Publius Flavius Vegetius Renatus: The Only Ancient Manual of Roman Military Instructions that Survived Intact,* https://www.historyofinformation.com/detail.php?id=2151 (last accessed Oct. 12, 2024) [https://perma.cc/8YGS-NZBX].

[218] *See* OST, *supra* note 7, at art. IV.

rejected in favor of a more assertive stance on permissiveness of lunar defense activities.

B. The OST principle of "peaceful purposes"

A discussion about the meaning of "peaceful" as used in the OST is necessary because the legality of the defense of lunar activities turns on its interpretation.[219] The OST refers to the concept of "peaceful purposes" in its Preamble,[220] which is not binding; Article IV(2), which also references the related concept of "peaceful exploration;"[221] and Article IX.[222] While it is undisputable that the OST intends to promote peace in space and encourage cooperation,[223] the exact meaning of "peaceful" is debatable, as the OST does not define the term.[224] The presence of "peaceful purposes" in Article IV(2)—which applies only to the Moon and other celestial bodies—requires particular analysis vis-à-vis the legality of actions taken to defend lunar activities because it specifies that such use be "*exclusively* for peaceful purposes" (emphasis added).[225]

This paper agrees with the position of those arguing that, as long as the conduct on the Moon adheres to the U.N. Charter's rules against using force to threaten political independence or territorial integrity or act inconsistently with the Charter's purposes, no separate debate on the peaceful use of outer space is necessary.[226] Additional obligations or restrictions that the language "exclusively for peaceful purposes" would impose beyond the existing requirements for peaceful use set by international law, particularly per the U.N. Charter, are questionable.[227] Drawing this reasoning to its obvious consequence, "peaceful" would mean "not inconsistent with the U.N. Charter." In attempting to pin down a definition, some scholars have relied on the U.N. Charter's language, where "peaceful" usually

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[219] To be precise, if the thesis supported by this paper regarding the pre-eminence of LOAC over the OST holds true, then whichever the interpretation of "peaceful" is adopted, it would not affect the legality of defending lunar activities, as such defense would still be permissible under LOAC.
[220] OST, *supra* note 7, at pmbl. (repeating twice that "[e]xploration and use of outer space [must be] for *peaceful purposes*" (emphasis added)).
[221] OST, *supra* note 7, at art. IV.
[222] *Id.* at art. IX.
[223] Andrea Harrington, *National and International Security in Space: International Law Implications of Space Force and Planetary Defense*, 48 GA. J. INT'L & COMPAR. L. 767, 770 (2020).
[224] *See* STEPHAN HOBE, ET AL., COMMENTARY ON SPACE LAW 288 (Stephan Hobe et al. eds., COLOGNE COMMENTARY ON SPACE LAW: Vol. I (Carl Heymanns Verlag 2009) at 71 ("COLOGNE COMMENTARY") (arguing that the OST lacks a defining element that would clarify terms such as "military", "weapons", "peaceful uses" preventing a clear distinction between "peaceful" and "exclusively peaceful").
[225] Bin Cheng, *Properly Speaking, Only Celestial Bodies Have Been Reserved for Use Exclusively for Peaceful (Non-Military) Purposes, but Not Outer Void Space*, 75 INT'L L. STUDIES 81, 94 (2000) (arguing that that the term "exclusively" in "exclusively for peaceful purposes" is significant. This paper contests the idea that the inclusion of "exclusively" would alter the meaning of "peaceful purposes").
[226] Harrington, *supra* note 223, at 770.
[227] *Id.*

means "non-aggressive."[228] While this view is persuasive, uncertainties persist, since the interpretation of the principles within the U.N. Charter is also somewhat ambiguous. For other scholars, including those arguing against the legality of the defense of lunar activities, the definition of "peaceful purposes" as used by the OST necessarily stands alone.[229] The following definitional analysis shows why the former position is correct.

Historically, two interpretations of the term "peaceful" exist: "peaceful" as "non-military" and "peaceful" as "non-aggressive."[230] Advocates of the "non-military" stance contend that "peaceful purposes" should exclude military use,[231] while those favoring the "non-aggressive" interpretation argue that the language only forbids actions which are inherently aggressive, violating "the U.N. Charter and international law."[232] Most spacefaring countries, including the United States, favor the "non-aggressive" view,[233] which is also the position this article supports.

While a separate definition of "peaceful" beyond the U.N. Charter is unnecessary, should one be called for, "peaceful" must mean "non-aggressive,"[234] consistently with the U.N. Charter's meaning. While applying the Vienna Convention's mandate that treaty interpretations accord with ordinary meaning requires considering the common meaning of "peaceful purpose" as "non-violent," this does not resolve the question of whether defensive actions constitute peaceful purposes.[235] This is because "military," as in defensive measures taken by a

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[228] Bin Cheng, *supra* note 225, at 95, 99.

[229] Matthew G. Looper, *International Space Law: How Russia and the U.S. are at Odds in the Final Frontier*, 18 S.C. J. INT'L L. & BUS. 111, 112 (2022).

[230] *See, e.g.*, Bin Cheng, *supra* note 225 and Vermeer, *supra* note 181, at 71.

[231] *See, e.g.*, Bin Cheng, *supra* note 225 at 95 ("Insofar as Article IV(2) is concerned, there is little doubt that the word 'peaceful' means 'non~military' and not 'non~aggressive.'") and Vermeer, *supra* note 181, at 6 (arguing that "non-aggressive" stance would support the idea of establishing military installations on celestial bodies for self-defense, which is a viewpoint that the author cannot endorse. Demilitarizing celestial bodies can be viewed as a collective measure designed to prevent threats to peace. *Id*. at 6).

[232] Looper, *supra* note 229, at 112–13.

[233] *See* Looper, *supra* note 229, at 113. *See also* Koplow, *supra* note 151, at 60 (arguing that the OST "has been widely understood to bar only *aggressive* operations, not to inhibit military operations directed at lawful self-defense"). For a criticism of the position of the majority of the spacefaring countries that "peaceful" means "non-aggressive," see Bin Cheng, *supra* note 225225, at 87–88.

[234] *See, e.g.*, Looper, *supra* note 229, at 113. *See also* Jeremy Grunert, *The "Peaceful Use" of Outer Space?*, WAR ON THE ROCKS (June 22, 2021), https://warontherocks.com/2021/06/outer-space-the-peaceful-use-of-a-warfighting-domain/ [https://perma.cc/29D8-6H3P]; Fabio Tronchetti, *Legal Aspects of the Military Uses of Outer Space*, *in* HANDBOOK OF SPACE LAW 331, 331-81 (Frans G. von der Dunk et al. eds, 2015) (arguing that "[d]espite being popular in legal doctrine…the 'non-military' interpretation appears to be contradicted by states' practices."). A contrary view exists. *See e.g.* Vermeer, *supra* note 181, at 71.

[235] *Peaceful*, CAMBRIDGE DICTIONARY, https://dictionary.cambridge.org/dictionary/english/peaceful (last visited Dec. 1, 2023) [https://perma.cc/KRU9-GTXB].

country's military, does not necessarily mean "violent."[236] Additionally, "non-violent" is only one common interpretation of "peaceful," and there is additional evidence that points more strongly in favor of "non-aggressive" as the correct interpretation of "peaceful" in this context. First, applying Article 3 of Resolution 3314,[237] which clarifies what constitutes "aggression" without a declaration of war,[238] demonstrates that "peaceful" must have a narrower scope compared with the more inclusive notion of "military purposes," which can encompass nearly anything tangentially linked to the military.[239] Second, as numerous space technologies are inherently dual-use,[240] serving both civilian and military purposes—a fact accepted and encouraged by several nations—,[241] the interpretation of "peaceful purposes" cannot be "non-military."[242] Third and most compellingly, major spacefaring countries[243] have developed a practice of utilizing (or at least acknowledged that others have utilized) space for military purposes since the 1950s. [244] They have also stated that space carries national security implications.[245] Over time, spacefaring countries' practice has shifted from seeing space as a "sanctuary" for peace to allowing certain military actions as "peaceful" space activities.[246] This coincides with the international community's essential silence on U.S., Chinese, and Russian military developments in space.[247] At times, the Soviet Union, of which Russia was the largest and most influential constituent republic until 1991, and China have presented a different position regarding the

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[236] *Military*, Cambridge Dictionary, https://dictionary.cambridge.org/dictionary/english/military (last visited Dec. 1, 2023) [https://perma.cc/MBC6-5TVH]. ("military" means "relating to or belonging to the armed forces").

[237] G.A. Res. 3314 (XXIX), *supra* note 139, art 3.

[238] *Id*. (exemplifying as: (a) invasion, attack, or temporary military occupation of another state's territory; (b) bombardment or use of weapons against another state's territory; (c) blockade of another state's ports or coasts; (d) attack of another state's land, sea, air forces, or marine and air fleets; (e) using armed forces in another state without complying with the conditions of an agreement or extending their presence beyond the agreement; (f) allowing one's territory to be used for an act of aggression against a third state; (g) the sending by a state of armed groups or mercenaries to engage in acts of significant armed force against another State).

[239] Looper, *supra* note 229, at 114 (explaining that many space technologies have military uses, especially in surveillance so that an interpretation of "peaceful" as "military" would rule out the legality of this application; most nations see the strict "non-military" interpretation as impractical. Satellite reconnaissance, widely used by the U.S. and shared with allies, is accepted internationally without violating the "peaceful purposes" clause of Article IV of the OST).

[240] Georgeson & Stubbs, *supra* note 149, at 617.

[241] Looper, *supra* note 229, at 114.

[242] *See* Georgeson & Stubbs, *supra* note 149, at 617.

[243] *See, e.g.*, Law of War Manual, *supra* note 150, at 957.

[244] *See* CONG. RSCH. SERV., IF11895, SPACE AS A WARFIGHTING DOMAIN: ISSUES FOR CONGRESS 1 (2021).

[245] *See* STEPHEN M. MCCALL, CONG. RSCH. SERV., IF10337, CHALLENGES TO THE UNITED STATES IN SPACE 2 (2020).

[246] *Id*. at 1; *See, e.g.*, Letter to Nikolai Bulganin, Chairman, Council of Ministers, U.S.S.R, 1 PUB. PAPERS 75 (Jan. 13, 1958) (admitting that "[b]oth the Soviet Union and the United States are now using outer space for the testing of missiles designed for military purposes").

[247] Stephens, *supra* note 44, at 89.

interpretation of "peaceful" within the OST.[248] However, their actions have often diverged from their stated positions.[249]

In conclusion, even if one were to concede that the term "peaceful" in the OST deserves to be interpreted separately from the U.N. Charter, it must nevertheless still be interpreted as "non-aggressive." And once "peaceful purposes" are interpreted as "non-aggressive," consistently with the prevailing view, there is not much in the OST that impedes the defense of national activities on the Moon.

C. Article II OST

Likely seeking to prevent the "colonization" of outer space,[250] the drafters of Article II of the OST provided that "[o]uter space, including the moon and other celestial bodies" was not to be "subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means."[251] The majority opinion holds that the non-appropriation principle applies both to states and to private actors.[252]

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[248] *See, e.g.*, Press Release, U.N. GAOR, *'Outer Space Should Never Be an Arena for Militarization', Delegate Tells General Assembly Debate on Moscow's Veto of Resolution Aimed at Curbing Arms Race*, U.N. Press Release GA/12597 (May 6, 2024) (explaining that on the occasion of a draft resolution introduced by the United States and Japan—co-sponsored by over 60 nations—seeking to reaffirm existing obligations under the Outer Space Treaty and specifically prohibiting the placement of weapons of mass destruction (WMDs) in Earth's orbit, Russia exercised its veto because the draft resolution proposed an amendment calling for a complete prohibition of all types of weapons in outer space, re-emphasizing the dangers posed by Western military doctrines, which, according to Russia, envision the military exploitation of outer space, and reiterating that Russia's goal is to prevent outer space from becoming an arena for militarization and military confrontation. China abstained). *See also infra* Part V.B.

[249] *See* China Aerospace Studies Institute, *PLA Aerospace Power: A Primer on Trends in China's Military Air, Space, and Missile Forces 4th Edition*, AIR UNIV. (July 22, 2024), https://www.airuniversity.af.edu/CASI/Display/Article/3840174/pla-aerospace-power-a-primer-on-trends-in-chinas-military-air-space-and-missile/#:~:text=We%20have%20seen%20remote%20proximity,space%20for%20a%20long%20time [https://perma.cc/MLJ8-5Z5K]; Jim Garamone, *Military Experts Highlight Space Opportunities, Threats at Aspen Conference*, U.S. DEP'T DEF. (July 18, 2024), https://www.defense.gov/News/News-Stories/Article/Article/3843526/military-experts-highlight-space-opportunities-threats-at-aspen-conference [https://perma.cc/SY57-VA5G].

[250] *See* Jack D. Eller, *Space Colonization and Exonationalism: On the Future of Humanity and Anthropology*, 2 HUMANS 148–60 (2022).

[251] *Id.*

[252] *See, e.g.*, 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, 129 (2004) (highlighting how the prohibition must include private entities, because per Article VI, "any act of national appropriation by private entities would be subject to the direction or influence of the State."); B. SANDEEPA BHAT, *Answering the Legal Challenges Posed by Recent Developments in Space Activities*, *in* SPACE LAW: THE EMERGING TRENDS 11 (B. Sandeepa Bhat ed., 2018). The minority position argues that the word "national" in Article II OST limits the non-appropriation principle to states. *See* Gorove, *supra* note 99.

At a first glance, Article II's prohibition on celestial territorial claim could be interpreted as proscribing states from asserting to be victim of an armed attack and defending their national lunar activities in response. As previously mentioned, however, the inability of states to claim territory on the Moon does not preclude the possibility of an armed attack occurring there[253] as the prohibition of the use of force or threat under Article 2(4) of the U.N. Charter does not necessitate territorial aggression.[254]

Article II OST is also relevant from another perspective, as its lack of clarity provides fodder for potential conflicts in relation to lunar mining.[255] Certain interpretations of Article II suggest that it would prevent the establishment of property rights in space resources.[256] The prevailing view among scholars and states is that Article II's prohibition on appropriation applies only to resources in their original location (*in situ*) and does not extend to extracted resources.[257] This position is further supported by the fact that the restrictive interpretation of Article II could create conflicts on the Moon, contrary to the OST's instance on peaceful purposes, by fueling questions of resource ownership, the ability to establish mining operations, or interfering or damaging unrecognized mining premises.[258] State practice favorable to the exercise of property rights on extracted resources will contribute to diminishing the likelihood of those conflicts.[259]

D. Article III OST

Article III provides that the states "shall carry on activities…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."[260] The analysis of this article focuses on the article's invocation of the U.N. Charter, specifically Articles 2(4) and 51.[261] As discussed, these two provisions taken together stipulate that the use of force and the threat thereof are prohibited except in the event of self-defense or U.N. Security Council

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[253] *See* Ramey, *supra* note 96, at 61.
[254] *Id*.
[255] *See, e.g.*, Giannoni-Crystal, *supra* note 32, at 10–11.
[256] Larsen, *supra* note 67, at 13 (describing the perspective held by certain states and experts that Article II of the OST would prohibit rights to lunar properties, including ownership of mines).
[257] *Id*.
[258] *Id.* at 18 (arguing that the uncertainty surrounding the legitimacy of lunar mining raises the question of how ownership rights to lunar materials could be established unequivocally). *See also* Giannoni-Crystal, *supra* note 32, at 14–15.
[259] Giannoni-Crystal, *supra* note 32, at 15.
[260] OST, *supra* note 7, at art. 3. *See* Hitoshi Nasu, *Targeting a Satellite: Contrasting Considerations between the Jus ad Bellum and the Jus in Bello*, 99 INT'L L. STUD. 142, 146 (2022) ("This clause is designed to establish the international rule of law over human activities in outer space and on celestial bodies by operating as a conduit to project various rules of international law into outer space.").
[261] For a discussion of which part of international law applies to outer space, see COLOGNE COMMENTARY *supra* note 224 at 67-68.

authorization.[262] Because Article III of the OST explicitly mentions the applicability of the U.N. Charter to space,[263] the U.N. Charter's core restrictions on the use of force, as well as the fundamental exceptions to it—including self-defense—are relevant to the discussion about the defense of lunar activities,[264] clarifying that the OST intended to subordinate itself to the U.N. Charter.

E. Article IV OST

The discussion about defending lunar activities must consider Article IV of the OST, as it represents the only substantial provision within the OST concerning military use.[265] Despite Article IV's seemingly restrictive language, it does not present an obstacle to the legality of the *defense* of lunar activities for the reasons below. Article IV, drafted in general terms, establishes a few basic principles: (1) it prohibits the placement, installation, or stationing (as opposed to mere transit) of nuclear weapons or weapons of mass destruction in orbit or on celestial bodies;[266] (2) it mandates the use of the Moon and other celestial bodies—as opposed to empty space—exclusively for "peaceful purposes;"[267] (3) it forbids the establishment of military bases, installations, and fortifications; (4) and it bans the testing of any weaponry, and prohibits the execution of military maneuvers on celestial bodies.[268] Article IV's language, however, lacks critical definitions, including terms like "weapons of mass destruction," "peaceful," and "military."[269]

1. *Article IV(1)* of the OST

Article IV(1) prohibits the placement in Earth's orbit, the installation on celestial bodies, or the stationing in outer space of "nuclear weapons or any other kinds of weapons of mass destruction."[270] Considering that Article IV(1) does not impose limitations on non-nuclear weapons and non-mass destruction weapons,[271]

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[262] *See* COLOGNE COMMENTARY at 65 ("A major imperative for declaring international law, including the UN Charter, applicable to outer space, was the overriding concern for the maintenance of international peace and security, which, after all, is the primary purpose and responsibility of the United Nations (UN), and the fear for an arms race in outer space. Thus, generally accepted rules and principles, such as the prohibition on the use of force and the right of self-defense, would also be in force in outer space.")

[263] OST, *supra* note 7, at art. III.

[264] von der Dunk, *supra* note 105, at 199.

[265] For further discussion on Article IV OST, see for example COLOGNE COMMENTARY *supra* note 224, at 70-93.

[266] OST, *supra* note 7, at art. IV(1).

[267] OST, *supra* note 7, at art. IV(2) OST.

[268] *Id.*

[269] *See* COLOGNE COMMENTARY, *supra* note 224, at 288.

[270] This paper does not discuss the definitional issue of what exactly constitutes a nuclear weapon or a weapon of mass destruction under article IV. For more on that discussion, see Tronchetti, *supra* note 234.

[271] Law of War Manual, *supra* note 150, at 953 (explaining the ban on positioning weapons of mass destruction "in orbit around the Earth" specifically applies to their placement in a complete orbit.

the provision holds limited sway over a state's ability to defend and safeguard its lunar activities because it is unlikely that nuclear weapons or weapons of mass destruction—which are sparingly used on Earth[272]—will be used in space to prevent or respond to attacks on lunar activities.[273] Not only are these weapons unnecessary, but they would also conflict with the principle of proportionality, which governs the use of lawful response to armed attacks in self-defense. Because weapons other than nuclear or mass destruction weapons are not prohibited, deploying such weapons in outer space appears to be permissible.[274]

2. *Article IV(2)* of the OST

The defense of lunar activities finds a more complicated facet in Article IV(2), which provides that "the Moon and other celestial bodies shall be used … exclusively for peaceful purposes." [275] On its face, the provision seems to put into question the possibility of defending a nation's activities on the Moon.[276] A closer analysis, however, puts such an interpretation to rest. As the proceeding analysis has shown, "peaceful" is most logically interpreted as "non-aggressive."[277] This interpretation subsequently renders Article IV(2) a simple reiteration of Article 2(4) of the U.N. Charter—one that does not limit the ability of a state to defend its lunar infrastructures and activities. Several reasons support this viewpoint.[278] First, the right of self-defense, as enshrined in Article 51 of the U.N. Charter, stands as a firmly established norm of customary international law,[279] the significance and authority of which should not be affected by as broadly framed a provision as the OST's Article IV(2)—especially considering that the preceding article of the same treaty explicitly references the U.N. Charter.[280] Second, in the context of armed conflicts, LOAC constitutes a specialized legal framework that takes precedence over the OST.[281] Article 103 of the U.N. Charter emphasizes that U.N. member

Consequently, the OST does not prohibit the deployment of nuclear or other weapons of mass destruction capable of entering partial orbit or engaging in suborbital flights).

[272] History.com Editors, *Atomic Bomb History*, A&E TELEVISION NETWORKS (Nov. 9, 2022), https://www.history.com/topics/world-war-ii/atomic-bomb-history [https://perma.cc/XV8S-8C5Q].

[273] *See, e.g.*, Allison Parshall, *What Happens if a Nuke Goes Off in Space?* SCIENTIFIC AM. (Aug. 22, 2023), https://www.scientificamerican.com/article/what-happens-if-a-nuclear-weapon-goes-off-in-space/ (recalling the 1962 Starfish Prime event, which destroyed or damaged a third of the satellites in orbit, and explaining why detonating nuclear weapons in space would be disastrous: destruction of satellites, disruption of communications via electromagnetic pulse, creation of lasting radiation belts, danger to astronauts, and escalation of international tensions, crossing a red line in warfare.) [https://perma.cc/8HCD-DXP6].

[274] Tronchetti, *supra* note 234, at 337.

[275] OST, *supra* note 7, at art. IV(2).

[276] *See, e.g.*, Vermeer, *supra* note 181, at 70–71.

[277] *See supra* Part IV.B.

[278] Some of these same reasons have been discussed earlier to argue the pre-eminence of LOAC over the OST. *See supra* Part IV.A.

[279] *See* JAMES CRAWFORD, *Use or Threat of Force by States*, BROWNLIE'S PRINCIPLES OF PUBLIC INTERNATIONAL LAW 721 (9th ed. 2019).

[280] OST, *supra* note 7, at art. III.

[281] *See, e.g.*, *Lex specialis*, *supra* note 207; Law of War Manual, *supra* note 150, at 9.

states' obligations under the U.N. Charter supersede those of any other international agreement in cases of conflict.[282] In other words, LOAC, as *lex specialis* in armed conflict, would prevail over Article IV(2) in the event of such conflict.[283] In particular, when the application of Article IV(2) would result in a frustration of the right of self-defense, Article IV(2) would be simply "preempted" by the right of defense. Third, the term "peaceful" in Article IV(2) should be understood as "non-aggressive" rather than "non-military," as discussed above.[284]

Article IV(2) further prohibits "the establishment of military bases, installations, and fortifications, the testing of any type of weapons, and the conduct of military maneuvers on celestial bodies."[285] The provision, however, makes two exceptions. Specifically, it explicitly excludes from the prohibition (1) the use of military personnel for scientific research or other peaceful purposes;[286] and (2) the use of equipment or facilities necessary for the peaceful exploration of the Moon and other celestial bodies.[287] It is this paper's contention that either of these exceptions offer substantial flexibility in the implementation of deterrence and defense measures to safeguard lunar activities. For example, many lunar activities—at least initially—will serve purposes such as conducting scientific research, facilitating experiments, and enabling other activities,[288] thus fitting within the criteria of "scientific research or other peaceful purposes." Consequently, deploying "military personnel" to defend these activities and deter their interference falls within this exception. Moreover, the second exception, regarding "peaceful exploration," might justify the use of necessary military equipment or facilities to deter attacks on and safeguard explorative lunar activities. As such, these two exceptions should be interpreted to permit the deployment of military personnel to the Moon, as well as the positioning of equipment and facilities on the lunar surface, for the limited purposes set forth in the provisions.

To better understand why this interpretation ought to prevail, an analogy could be drawn with the Antarctic legal regime. The Antarctic Treaty, signed in 1959, designates Antarctica as a scientific preserve, prohibiting military activity (in addition to nuclear testing and waste disposal) on the continent.[289] Nevertheless,

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[282] *Restatement (Third) of Foreign Relations Law of the United States* § 323 cmt. b (Am. L. Inst. 1987) ("Article 103 of the Charter of the United Nations places that agreement above all other commitments. Even if a later agreement does not refer to the Charter, the later agreement is assumed to be concluded subject to the provisions of the Charter.")

[283] For a general discussion about the primacy of LOAC over the OST see Section VI(A).

[284] *See supra* Part IV.B. *But see, e.g.*, Bin Cheng, *supra* note 225 ("no activity whatsoever of a military nature is permitted on the moon and the other celestial bodies").

[285] OST, *supra* note 7, at art. IV.2.

[286] *Id.*

[287] *Id.*

[288] Ben Burress, *NASA's Artemis Missions to Set Up Base Camp on the Moon*, KQED (Nov. 13, 2020), https://www.kqed.org/science/1970873/nasas-artemis-missions-to-set-up-base-camp-on-the-moon [https://perma.cc/FNN4-JLQF].

[289] The Antarctic Treaty 12 UST 794, 402 U.N.T.S 71 (1980), Cmnd 1535, ATS 12 (1961) [hereinafter Antarctic Treaty].

many countries have both sent military personnel to Antarctica to provide logistical and operational support[290] for sanctioned scientific research activities,[291] and established fixed military presences on the continent.[292] Similar to the Antarctic Treaty, which permits the presence of military personnel for scientific research and logistical support[293] while prohibiting military activities,[294] the OST allows at least as much for the Moon. The presence of the military for logistic activities enables operational readiness and strategic flexibility, which are crucial for maintaining military power and project strength, [295] which inherently acts as a deterrent. Attention must be paid to ensure that military personnel stationed on the Moon are genuinely engaged in scientific exploration or support, rather than in military missions under the guise of scientific activities. In Antarctica, the roles of military personnel revolve around providing logistical assistance, transportation, maintenance, and support for scientific missions conducted by civilian researchers.[296] Their responsibilities include operating aircraft and vessels that support scientific expeditions, maintaining research stations, providing medical assistance, managing communications, and facilitating supply logistics in the challenging Antarctic environment.[297] However, the personnel in Antarctica might

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[290] Seth Robson, *US Military Is Delivering People, Cargo to Antarctica as Scientific Research Season Begins*, STARS AND STRIPES (Oct. 5, 2022), https://www.stripes.com/branches/air_force/2022-10-05/antactica-science-research-mcmurdo-military-7581313.html [https://perma.cc/78BK-EGWS].

[291] *See* Jonathan Lehrfeld, *How the Military Helps Keep Research Operations in Antarctica Going*, AIR FORCE TIMES (Oct. 6 2022), https://www.airforcetimes.com/news/your-air-force/2022/10/06/how-the-military-helps-keep-research-operations-going-in-antarctica/ [https://perma.cc/38SS-STHS]. *See also* Air Force News Service, *Multi-force Operation Deep Freeze underway in Antarctica*, U.S. NAT'L GUARD (Oct. 3, 2012) https://www.nationalguard.mil/News/Article/574921/multi-force-operation-deep-freeze-underway-in-antarctica/ [https://perma.cc/5R68-2N5K].

[292] The U.S. operates research stations in Antarctica under the National Science Foundation's oversight. These stations, such as McMurdo Station and Amundsen-Scott South Pole Station, have a contingent of military personnel, often from the U.S. Navy, Air Force, or Coast Guard. Their roles mainly involve providing logistical support, transportation, and maintenance necessary for scientific research conducted in the region. *See Chapter 7: Stations and Ships*, *in* ANTARCTIC PROGRAM PARTICIPANT GUIDE, 2016-2018 65–66, 74–75 (NAT'L SCI. FOUND., 2018). *See also* U.S. Antarctic Program, *About USAP Participants*, NAT'L SCI. FOUND., https://www.usap.gov/aboutusapparticipants/ (last visited Oct. 27, 2024) [https://perma.cc/RVT8-ZZWZ].

[293] Antarctic Treaty, *supra* note 289, at art. 1(2) ("The present Treaty shall not prevent the use of military personnel or equipment for scientific research or for any other peaceful purpose").

[294] *Id*., at art. 1(1) ("Antarctica shall be used for peaceful purposes only. There shall be prohibited, inter alia, any measures of a military nature, such as the establishment of military bases and fortifications, the carrying out of military maneuvers, as well as the testing of any type of weapon.").

[295] *See e.g*., Marta Pawelczyk, *Contemporary Challenges in Military Logistics Support,* 20 Sec. & Def. Q. 85, 87 (2018), https://doi.org/10.5604/01.3001.0012.4597.

[296] *See, e.g.*, U.S. Antarctic Program, *supra* note 296.

[297] *See, e.g., Know Your Region: Antarctica and the Military*, THE COVE (Mar. 18, 2022), https://cove.army.gov.au/article/kyr-antarctica-military (last visited Oct. 27, 2024) [https://perma.cc/L5QN-7ZAU].

also conduct training exercises to maintain readiness in extreme conditions,[298] which would align with their overall purpose of supporting the scientific missions. Likewise, lunar military readiness exercises would be necessary to cope with the Moon's harsh conditions. They would thus be similarly considered as measures taken to support research or other peaceful activities, consistent with the OST, rather than as "military maneuvers" prohibited under Article IV(2).

The parallel to Antarctica stops short of supporting the possible legality of lunar military experiments, including possible projects pursued by the U.S. Defense Advanced Research Projects Agency (DARPA) to develop technologies for military purposes.[299] Indeed, revelations of a DARPA project aimed at developing technologies for manufacturing large structures in space and on the Moon sparked considerable discussion in 2021.[300] There is, however, a precedent that could justify DARPA's role: the International Space Station (ISS). Although the ISS is as a civilian endeavor[301] and its use for peaceful purposes is reiterated several times in its foundational agreement,[302] countries participating in the program (especially

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[298] *See, e.g.*, Catharine Schmidt, *LC-130 Aircrew Completes South Pole Mission Despite Extreme Weather Conditions*, U.S. AIR FORCE (Nov. 14, 2017), https://www.109aw.ang.af.mil/News/Article-Display/Article/1372209/lc-130-aircrew-completes-south-pole-mission-despite-extreme-weather-conditions [https://perma.cc/NU47-SVC2]; Shawn Monk, *171st ARW Firefighters Brave Extreme Conditions During Antarctica Mission*, PA NAT'L GUARD (Sept. 10, 2024), https://www.pa.ng.mil/Site-Management/News-Article-View/Article/3900421/171st-arw-firefighters-brave-extreme-conditions-during-antarctica-mission [https://perma.cc/CNP3-QWBE].

[299] In fact, while there might be limited involvement or interest from defense agencies in specific scientific research conducted in extreme environments, no available unclassified knowledge or documented information exist that would suggest any significant involvement of DARPA (or other military agency of other countries) in Antarctic research or operations. For example, DARPA's publicly known polar research efforts have focused more on the Arctic region than on Antarctica. Programs like Assured Arctic Awareness (AAA) aim to develop sensor systems to monitor the Arctic, yet similar large-scale DARPA initiatives for Antarctica are not apparent in unclassified sources. *See* Hope Hodge Seck, *As Arctic Tensions Heat Up, DARPA Wants to Control Ice Formation Like Princess Elsa*, MILITARY.COM (Sept. 30, 2022), https://www.military.com/daily-news/2022/09/30/arctic-tensions-heat-darpa-wants-control-ice-formation-princess-elsa.html [https://perma.cc/75S5-MCJW].

[300] Theresa Hitchens, *DARPA Space Manufacturing Project Sparks Controversy*, Breaking Defense (Feb. 12, 2021) https://breakingdefense.com/2021/02/darpa-space-manufacturing-project-sparks-controversy/#:~:text=WASHINGTON%3A%20DARPA%27s%20new%20project%20to,under%20the%20Outer%20Space%20Treaty [https://perma.cc/69UP-FL8E] (arguing that DARPA's recent project aiming to pioneer off-earth manufacturing for large space and lunar structures stirred controversy because -while focusing on communication antennas and solar power arrays-, its dual use for civilian and military purposes could clash with Article IV of the OST).

[301] 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 art 1, Jan. 29, 1998, T.I.A.S. 12927 [hereinafter IGA Agreement].

[302] *Id.* at art 1 ("[t]he object of this Agreement is to establish a long-term international cooperative framework among the Partners … for the detailed design, development, operation; and utilization of a permanently inhabited civil international Space Station for *peaceful* purposes...'); *id.* at art 9(3) ("each Partner may use and select users for its allocations for any purpose consistent with the object of this Agreement a… except that: …(b) the Partner providing an element shall determine whether

Russia, a major spacefaring country) have carried out military experiments and research on the station. In the 2010s, RKK Energia, which is responsible for the Russian ISS segment, carried out a program called "VPEI," which included lunar research in radio-electric warfare, target condition monitoring, defense of space assets, and other military-related areas.[303] Furthermore, state practice in space has often blurred the distinction between civilian scientific experiments and military ones. For example, the Russian Academy of Sciences, the foremost entity for scientific aspects of space exploration, serves as the primary patron for numerous scientific missions. It maintains longstanding connections with Russia's Ministry of Defense and is recognized for conducting research that serves military interests.[304] Recently, the United States has also begun conducting military-related research on the ISS. In fact, in 2023, a SpaceX resupply mission to the ISS delivered a $35 million payload developed under the U.S. Space Test Program, which included military-sponsored experiments.[305] The situation on the Moon is unlikely to be different.

3. *Article IV(2) OST* does not apply to lunar orbits

Article IV(2) should be interpreted to apply only to the Moon and celestial bodies themselves, and not their orbits, which are part of the "outer void space"[306] and therefore governed solely by Article IV(1). This is for several reasons, the foremost of which is that Article IV(2)'s limits over celestial bodies is an exception to the general principle of the "freedom of use" of space established by OST Article I.[307] Therefore, as an exception, it should be interpreted narrowly. Second, certain orbits, like Earth's, have been utilized for military purposes shortly after the beginning of the space age - and continue to be utilized for such purposes - without

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a contemplated use of that element is for *peaceful* purposes"); *id.* at art 14.1 ("the Space Station … shall remain a civil station, and its operation and utilization shall be for *peaceful* purposes, in accordance with international law") (emphasis added for all).

[303] Anatoly Zak, RUSSIAN MILITARY AND DUAL-PURPOSE SPACECRAFT: LATEST STATUS AND OPERATIONAL OVERVIEW 4 (2019). Such "dual-use experiments" included "monitoring and early warning," "radio electronic warfare," "high speed telecommunications," "defense space assets," and "lifespan extension." *Id.* at 30–31. Conversely, in 2019, the Director General of the Russian Federal Space Agency, Roskosmos stated that the ISS, "due to its international nature," was not appropriate for military experiments; he confirmed that did not intend to carry out any military experiments on the station. *Id.* at 32.

[304] Zak, *supra* note 303, at 30.

[305] Stephen Clark, *U.S. Military Experiments Hitching Ride to Space Station on SpaceX Cargo Ship*, SPACEFLIGHT NOW (Mar. 13, 2023), https://spaceflightnow.com/2023/03/13/u-s-military-experiments-hitching-ride-to-space-station-on-spacex-cargo-ship/ [https://perma.cc/8DZS-VCYT] (discussing how the experiments focused on dual-use technologies like in-space laser power beaming and atmospheric monitoring, which could have both civilian and military applications.).

[306] Bin Cheng, *supra* note 225, at 83–85.

[307] OST, *supra* note 7, at art I ("Outer space, including the Moon and other celestial bodies, shall be free for exploration and use by all States without discrimination of any kind, on a basis of equality and in accordance with international law, and there shall be free access to all areas of celestial bodies"). The centrality of this provision has been widely acknowledged. *See, e.g.*, COLOGNE COMMENTARY, *supra* note 224, at 27 (stating "Article I …[a]s the first provision of this Agreement, … is designed to have a lead function.").

significant objections from any state.[308] This constitutes a relevant state practice per Article 31.3(b) of the Vienna Convention, which must be considered in interpreting the OST.[309] Third, in line with the Vienna Convention's Article 31.3(c), "any relevant rules of international law applicable in the relations between the parties" [310] must be considered when interpreting a treaty. Thus, the right of self-defense in Article 51 of the U.N. Charter is relevant to the interpretation of Article IV of the OST,[311] since – apart from one exception - all parties to the OST are U.N. members.[312] Because an expansive interpretation of Article IV(2) could impede the exercise of the right of self-defense, potentially hindering military protection of lunar installations, it is advisable to refrain from broadly construing Article IV(2) to include lunar orbits. Finally, the Moon Agreement, [313] which the international community essentially rejected, serves as an instrument of ex contrariis interpretation: if the Moon Agreement addresses a particular issue, it may indicate that the OST, which was concluded prior to the U.N. General Assembly's adoption of the Moon Agreement, does not cover that specific aspect.[314] This is the case for Article 1(2) of the Moon Agreement, which explicitly defines the "Moon" as encompassing the "orbits around or other trajectories to or around it," and Article 3, which offers a more detailed framework for regulating military activities on the Moon. Thus, applying ex contrariis reasoning, because these provisions were

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[308] For a recognition of the military use of space, see Letter to Nikolai Bulganin, *supra* note 246, para. (IV)(3)(a) (openly acknowledging the United States' use of Earth's orbit for military purposes). Notable examples of the exclusive military use of space by the United States include Starfish Prime and the Strategic Defense Initiative (SDI). Starfish Prime was a high-altitude nuclear test conducted by the U.S. in 1962, aimed at studying the effects of nuclear explosions in space. *See* Parshall, *supra* note 277. SDI, launched by President Reagan in 1983, aimed to counter missile threats by intercepting and destroying them in space before they reached the U.S. or its allies. Though scaled back over time, SDI marked a pivotal point in space-based defense and shaped future missile defense policies. *See* Mallory Stewart, Assistant Secretary, Bureau of Arms Control, *Deterrence and Stability*, Remarks at George Washington University Space Policy Institute (Apr. 28, 2023), in U.S. DEP'T ST. REMARKS & RELEASES.

[309] Vienna Convention, *supra* note 186, at art. 31.3(b) ("There shall be taken into account, together with the context: …
(b) any subsequent practice in the application of the treaty which establishes the agreement of the parties regarding its interpretation").

[310] *Id.* at art. 31.3(c).

[311] *Restatement (Third) of Foreign Relations Law of the United States*, supra note 282, at § 323 cmt. b.

[312] *See Member States*, UNITED NATIONS, https://www.un.org/en/about-us/member-states [https://perma.cc/9KFB-L48T] (last visited Oct. 27, 2024); *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and other Celestial Bodies (Status List)*, DEP'T ST. (Mar. 21, 2024), https://www.state.gov/wp-content/uploads/2024/04/website-1-Outer-Space-Treaty-Turkiye-Update.pdf [https://perma.cc/66J8-JK8D]. The Holy See is an exception, as it is a member of the OST while holding the status of a non-member observer at the U.N. *See, e.g.*, United Nations, *Non-Member States having received a standing invitation to participate as Observers in the sessions and the work of the General Assembly and maintaining Permanent Observer Missions at Headquarters*, https://www.un.org/en/about-us/non-member-states.

[313] *Agreement Governing the Activities of States on the Moon and Other Celestial Bodies*, Dec. 5, 1979, 18 I.L.M. 1434, 1363 U.N.T.S. 3.

[314] For a discussion of the Moon Agreement, see Part IV(H)(2).

included in the Moon Agreement, the OST may be said to not have contemplated them. As such, stationing military personnel and equipment in lunar orbit with the intent of deterring potential attacks on ground activities or preparing to intervene if an attack occurs may be legal under the OST even beyond Article IV(2)'s exceptions. This position is also consistent with an interpretation of Article IV in the sense that the ground of celestial bodies needs to be completely demilitarized.[315]

F. Concluding considerations on the defense of lunar activities in light of Article IV of the OST

As the above analysis has shown, it would be legal for countries to station military personnel and equipment to protect their national lunar activities. First, Article IV of the OST, does not prohibit deploying military personnel around the Moon.[316] Second, as in the case of Antarctica, countries could also maintain some military presence on the lunar ground for logistical and operational assistance to lunar exploration, which—as discussed—is allowed based on the two exceptions of Article IV of the OST. [317] Such measures are not only consistent with the OST but could actually promote the OST's overarching principle of peaceful exploration of space and celestial bodies[318] by potentially deterring aggression through the presence of defensive capabilities.[319] To be clear, this would be a militarization of the Moon (i.e., bolstering military capability without inhibiting others from

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[315] MINISTRY FOR ARMED FORCES, SPACE DEFENSE STRATEGY, (2019), https://cd-geneve.delegfrance.org/IMG/pdf/space_defence_strategy_2019_france.pdf?2194/80ea1f07a5171e4ee796a52752c9bce695d34acb (Fr.). *Id.* at 15 (providing:

> "1.1.2 A liberal legal framework.
> Although international law states that space must be used for peaceful purposes, that does not mean that all military activity in space is prohibited. The Outer Space Treaty permits the militarization and even weaponisation of Earth orbits, provided that weapons of mass destruction are not deployed there, as well as the use of force, strictly within the framework of the United Nations Charter. However, the Moon, celestial bodies and their orbits are entirely demilitarized.") [https://perma.cc/24X2-VKBL].

[316] *See supra* Part IV(E)(3) (providing a detailed analysis of Article IV of the OST).

[317] *See supra* Part IV(E)(2). The two exceptions are: (1) use of military personnel for scientific research or other peaceful purposes and (2) use of equipment or facilities necessary for peaceful exploration.

[318] For the United States, the military personnel engaged on the Moon would come from the U.S. Space Force. It is worth mentioning that some within U.S. national security circles advocate for an immediate or near-term cislunar presence of the U.S. Space Force, primarily to safeguard commercial interests. *See* Jessy Kate Schingler *et al.*, *Don't Delay Getting Serious About Cislunar Security*, WAR ON THE ROCKS (July 6, 2022), https://warontherocks.com/2022/07/dont-delay-getting-serious-about-cislunar-security/ [https://perma.cc/2N37-9PE5].

[319] Deterrence in space (i.e., implementing measures to discourage adversaries from initiating hostilities or actions) is crucial to avoid conflicts. *See* Mir Sadat & Timothy Georgetti, *The Failure Points of an 'Integrated Deterrence' Strategy in Space*, The Hill (Sept. 25, 2023), https://thehill.com/opinion/national-security/4216571-the-failure-points-of-an-integrated-deterrence-strategy-in-space/ [https://perma.cc/KEW8-BZDZ].

employing comparable capabilities), but it would not be a weaponization of the same.[320]

G. Other OST Provisions

Evidence of the legality of defending lunar activities is also suffused throughout other OST provisions.[321] For example, Article VIII provides:

> 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 thereof, while in outer space or on a celestial body. Ownership of objects launched into outer space, including objects landed or constructed on a celestial body, and of their component parts, is not affected by their presence in outer space or on a celestial body or by their return to the Earth. …

The registration allows a registering state to assert "jurisdiction and control," which *de facto* means authority.[322] Article VIII therefore establishes a sort of "flag" (quasi-territorial) jurisdiction over the space object which is registered by a state.[323] For example, a crewed orbital station around the Moon would fall under the jurisdiction of the state that officially registered that object.[324] Moreover, an attack on a space object flagged with a certain state would be treated similarly to an attack on an airplane flagged with that state, invoking comparable legal and territorial considerations.[325]

Article VIII, however, is limited in its application to objects that are "launched" from Earth and therefore cannot apply to objects constructed in space,

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[320] McDonald, *supra* note 52 at 5 (distinguishing "militarization" from "weaponizing", which could involve actions aimed at preventing adversaries from using space for military operations, including "offensive counterspace capabilities").

[321] *See, e.g.*, Stephen Gorove, *Sovereignty and the Law of Outer Space Re-Examined*, 2 Annals Air & Space L. 311 (1977) (discussing several states' forms of control and authority as emerging from the OST, including Article VII).

[322] Michael Chatzipanagiotis & Rafael Moro-Aguilar, *Criminal Jurisdiction in International Space Law: Future Challenges in view of the ISS IGA*, 57 PROC. INT'L INST. SPACE L. 323, 328 (2014):

> The registry of a space object has the same legal consequences as registering a ship or an aircraft. The only difference is that in Space Law, inclusion in the national registry does not confer nationality *de jure* to the spacecraft, only jurisdiction and control thereon. However, in practice such inclusion entitles the State of registry to exercise its sovereignty over the registered object. This amounts to a quasi-nationality or nationality *de facto* of the space object.

[323] *See* Ram S. Jakhu et al., *Critical Issues Related to Registration of Space Objects and Transparency of Space Activities*, 143 ACTA ASTRONAUTICA 406, 406–07 (2018) (explaining the requirements of Article VIII of the OST as a provision that requires states to register an object sent into outer space in order to retain jurisdiction and control over that object).

[324] *Id.*

[325] *Id.*

like a facility erected on lunar ground.[326] For objects built on the Moon, another OST is relevant. Article XII provides:

> All stations, installations, equipment and space vehicles on the moon and other celestial bodies shall be open to representatives of other States Parties to the Treaty on a basis of reciprocity. Such representatives shall give reasonable advance notice of a projected visit, in order that appropriate consultations may be held and that maximum precautions may be taken to assure safety and to avoid interference with normal operations in the facility to be visited.

At first glance, this provision appears to merely establish a right of access to someone else's facility. However, if the OST did not account for any control by a state over a facility, the OST would not have needed to establish a right of access.[327] Article XII is rather broad, encompassing "stations, installations, equipment, and space vehicles."[328] Thus, the aforementioned right of access implies that a country may assert control and jurisdiction over such objects. The use of the term "facility" appears to serve as a more encompassing term than the aforementioned specifics. [329] Hence, it seems logical that Article XII includes any form of facility located "on the moon and other celestial bodies." [330] Furthermore, the reference to "normal operations" within the article indicates that it pertains to operational facilities, such as a mining facility. [331] In sum, Article XII—establishing a right of control on lunar facilities—constitutes support for the proposition that, in the case of an armed attack on one of those facilities, the attacked country can legally exercise its right of self-defense.

Other provisions of the OST are also an indirect support for the right to defend lunar operations. Due regard in Article IX,[332] which is primarily a "duty of care," [333] is "an explicit restriction on the principle of free access in that it requires

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[326] Lachlan Blake, *Jurisdiction on the Final Frontier: Facilities, Jurisdiction and Control in International Space Law*, 46 ANNALS AIR & SPACE L. 177, 184–85 (2021).

[327] *Id.* Blake notes also how the right of access is not absolute because the access: (a) must happen "on a basis of reciprocity;" (b) is upon "reasonable advance notice;" (c) is subject to optional "appropriate consultations" and possibility of taking "maximum precautions…to assure safety and to avoid interference." Therefore, however indirectly, Article XII stands for the proposition that a state has jurisdiction and control over a facility on the lunar ground. *Id.* at 205.

[328] *Id.* at 196–199.

[329] *Id*. at 198.

[330] *Id*.

[331] *Id*. at 199.

[332] OST, *supra* note 7, at art. IX.

> "In the exploration and use of outer space, including the Moon and other celestial bodies, States Parties to the Treaty shall be guided by the principle of cooperation and mutual assistance and shall conduct all their activities in outer space, including the Moon and other celestial bodies, with due regard to the corresponding interests of all other States Parties to the Treaty. …

[333] Michael J. Listner, *The Paradox of Article IX and National Security Space Activities*, 1 ÆTHER: A J. STRATEGIC AIRPOWER & SPACEPOWER, 21, 23 (2022).

States to temper their rights and interests with regard to those of other States."[334] The due regard obligation in Article IX not only imposes a duty of care on states to consider the activities of others when conducting their own operations in space, but it also implicitly grants a corresponding right to those states being considered, which have the right to carry out their activities with the expectation that this duty of care will be respected.[335] The breach of the obligation of due regard could be the basis for an internationally wrongful act[336] or for the use of force in self-defense if the disruption qualifies as an armed attack.[337] However, all this is speculative: the scope of due regard is unclear because the provision has never been invoked,[338] resulting in a lack of established state practice. States also seem hesitant or reluctant to directly reference the concept of "due regard."[339] Nevertheless, as the lunar economy expands and potential conflicts arise, state parties may become more inclined to employ "due regard" to safeguard their operations. Only time will reveal the extent of this shift.

Another provision of Article IX with at least an indirect impact on the legality of defending lunar activities is that of harmful interference. Specifically, Article IX provides that, if a party anticipates that its space-related activity might harmfully interfere with other countries' activities, it must engage in international consultations before proceeding with that activity. Similarly, if a party believes that another country's planned space activity could potentially interfere with other's

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[334] Blake, *supra* note326, at 201. Due regard is the basis for safety zone provisions of the Artemis Accords. See *The Artemis Accords Principles for Cooperation in the Civil Exploration and Use of the Moon, Mars, Comets, and Asteroids for Peaceful Purposes,* October 13, 2020, 62 I.L.M. 888, § 11.07 (a-d) [hereinafter Artemis Accords].

[335] An example illustrating the issue of lack of due regard is the interference between radio telescopes and lunar mining. For instance, a mining company from State A starts operations near a radio telescope owned by an entity from State B, causing severe disruption to the telescope's functionality, for example, as a result from the mining vibrations.

[336] *See supra* Part II.A.

[337] *See supra* Part III.A.

[338] While the due regard provision of Article IX of the OST has never been invoked, there are precedents from similar provisions in other areas of international law. *See, e.g.,* In re Arbitration Between the Republic of the Philippines and the People's Republic of China, PCA Case No. 2013-19, Award (July 12, 2016) (where an arbitral tribunal under the auspices of the Permanent Court of Arbitration (PCA) found that China violated the due regard provision in Article 58(3) of the United Nations Convention on the Law of the Sea (UNCLOS) by obstructing Filipino fishermen's access to fishing grounds, constructing artificial islands like Mischief Reef within the Philippines' EEZ, causing environmental damage, and using military patrols to assert control over maritime zones). In other words, China's actions infringed on the Philippines' rights under UNCLOS, demonstrating how the principle of due regard has been applied in other contexts. *Id.*

[339] Michael J. Listner, *China, Article V, Starlink, and Hybrid Warfare: An Assessment of a Lawfare Operation*, SPACE REV. (Sept. 11, 2023) https://www.thespacereview.com/article/4650/1 [https://perma.cc/A5DR-XUZX]. On December 6, 2021, China filed a note verbale with the U.N. Secretary General, citing two occasions where SpaceX's Starlink satellites almost collided with China's space station. China submitted its notification under Article V OST (not Article IX). *Id.* China acknowledged the relevance of Article IX only in a statement from China's Foreign Ministry spokesperson during a February 10, 2023, press conference, where he indirectly referred to the U.S. response on January 28th. *Id. See also* Listner, *supra* note 333, at 28 (discussing states' reluctance to resort to Article IX OST).

peaceful space exploration, it has the right to request such consultations. This clause holds potential in addressing interferences on the Moon before they turn into conflicts. However, the ambiguity surrounding the definition of "potential harmful interference"[340] and the absence of established state practices cast doubts on the concept's effective application on the Moon unless clarified through a soft-law instrument or practice.

H. Other space treaties

Between 1968 and 1976, several other space treaties were adopted: the Rescue Agreement,[341] the Liability Convention,[342] and the Registration Convention.[343] However, only the Liability Convention is pertinent to assessing the legality of defending lunar activities. Specifically, the Convention could apply if interference with lunar ground activities causes measurable damage and victim-state seeks compensation.

1. Liability Convention

The Liability Convention relates to a discussion on the defense of lunar activities because it provides partial protection of states' economic interests by addressing liability for damages, which is relevant to safeguarding space operations. The Liability Convention is essentially an expansion on OST Article VII [344] and establishes state liability for damage caused by objects launched into space, including to the Moon and other celestial bodies, whether the damage occurs on Earth, in air, or in outer space.[345] Although the Convention applies to lunar activities, its focus is on damages caused by objects *launched* into outer space.[346] This is in contrast with the nature of the emerging lunar economy, where the emphasis lies on developing infrastructures *on the Moon itself*.[347] There might be scenarios where the liability outlined in Article VII OST and the Liability

[340] Stephens, *supra* note 44, at 87-88.
[341] The Agreement on the Rescue of Astronauts and the Return of Objects Launched in Outer Space, Apr. 22, 1968, 19 U.S.T. 7570, 672 U.N.T.S. 119 [hereinafter Rescue Agreement].
[342] Liability Convention, *supra* note 81.
[343] The 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].
[344] *See* COLOGNE COMMENTARY, *supra* note 224, at 129 ("While the LIAB [Liability Convention] is significant for its system of third-party liability claims procedure, it should be noted that Article VII of the Outer Space Treaty may include third party damage within its scope.").
[345] *See* Liability Convention, *supra* note 81, at arts II and III. For a broader discussion of the Liability Convention, *see, e.g.*, Stephan Hobe, Bernhard Schmidt-Tedd & Kai-Uwe Schrogl eds., *Cologne Commentary on Space Law* vol. 2 (Rana Stubbe, assistant ed., 2013) at 82 and the following.
[346] *See* Liability Convention, supra note 81, at art. I–II. The Liability Convention mentions "outer space" in the Preamble ("Recognizing the common interest of all mankind in furthering the exploration and use of outer space for peaceful purposes"), while it does not explicitly use the term "outer space" or "celestial bodies" in the text. *Id.* Instead, the Liability Convention refers to damage occurring "elsewhere than on the surface of the Earth" in Article III, which includes outer space and celestial bodies. *Id.* at art. III.
[347] *See, e.g.,* PricewaterhouseCoopers, *supra* note 29.

Convention could apply, such as when a space object launched from Earth causes damage upon landing on the Moon, affecting lunar infrastructures.[348] For instance, a lander originating from a space object in lunar orbit might damage lunar-based facilities.[349] However, various forms of damage could arise that are unrelated to objects launched from Earth, such as a robotic space miner deployed by Company X encroaching on Company Y's mining facility or the implosion of a device wholly constructed by a company on the Moon from raw materials that causes harm to other companies' personnel and operations. In these cases, the Liability Convention would not apply.[350] Moreover, even for damages caused by "launched objects," applying the Liability Convention to damages occurring beyond the Earth's surface entails a complex liability balance, wherein, under Article III of the Convention, a launching state is liable only if the damage results from its fault or that of its associated entities.[351] This undermines the Convention's ability to swiftly resolve interference issues on the Moon. Such complexities exist even before delving into the intricate procedures for determining damages as outlined in Articles VIII-XX of the Liability Convention, which undermine the practicality of applying the Convention on the Moon.

The Liability Convention is important in another aspect: it stands for the proposition that the body of space law itself implicitly acknowledges the potential for deliberate destruction of space objects under specific circumstances. Specifically, Article VI of the Convention imposes liability for "an act or omission done with intent to cause damage."[352]

2. The Moon Agreement

Despite its anticipated potential for managing lunar ground activities, the Moon Agreement, adopted by the U.N. General Assembly in 1979,[353] ultimately

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[348] The relevant provisions would be Article III of the Liability Convention. Liability Convention, *supra* note 81, at art. III.

[349] *Id.*

[350] *See* Liability Convention, *supra* note 81, at art I–III (stating that liability under the convention is limited to damages caused by "launched" (art I-II) objects and centers on the concept of a "launching state" (art I(c)).

[351] *See id.* at art. III (providing that "the event of damage being caused elsewhere than on the surface of the Earth to a space object of one launching State or to persons or property on board such a space object by a space object of another launching State, the latter shall be liable only if the damage is due to its fault or the fault of persons for whom it is responsible.") For a discussion about the concept of "fault" in the Liability Convention, see Joel A. Dennerley, *State Liability for Space Object Collisions: The Proper Interpretation of 'Fault' for the Purposes of International Space Law*, 29 EUR. J. INT'L L. 281 (2018).

[352] *See* Ramey, *supra* note 96, at 135 (arguing that Article VI of the Liability Convention offers immunity from absolute liability for damages caused by a state's space objects to the Earth's surface or to aircraft in flight. This immunity is granted when the claimant state or the entities it represents are responsible for the damage due to gross negligence or an intentional act or omission aimed at causing harm. A comprehensive interpretation of the expression "intent to cause damage" sheds light on the Convention's anticipation of the potential use of force against space objects.).

[353] *See generally* Moon Agreement, *supra* note 313.

faltered due to its limited acceptance, with most major spacefaring nations rejecting it.[354] Consequently, the Moon Agreement holds little significance—notwithstanding some opinions to the contrary—[355] in determining the legality of the defense of lunar activities, except that it can be used "*ex contrario*" to provide insights into interpreting the OST.[356] Notably, Article 1(2) of the Moon Agreement specifically includes the "orbits around or other trajectories to or around it" in the concept of Moon, and Article 3[357] provides seemingly explicit prohibitions regarding military activities on the Moon, including a ban on the "use of force or any other hostile act or threat of hostile act."[358]

The inclusion of these provisions in the later Moon Agreement, but not in the OST, could indicate that Article IV of the OST should not be read to have included lunar orbits within its scope nor to be as restrictive regarding military activities on the Moon.

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[354] *See, e.g.*, *Status of International Space Agreements*, *supra* note 7. A total of 17 states are parties (by ratification or accession), including Australia and India, but excluding major space powers such as the United States, Russia, China, and most European countries. *See also* Encouraging International Support for the Recovery and Use of Space Resources, 85 Fed. Reg. 20381 (April 6, 2020) (where President Trump signed an executive order specifically rejecting the Moon Agreement.)

[355] *See e.g.*, Michael Listner, *The Moon Treaty: Failed International Law or Waiting in the Shadows?*, SPACE REV. (Oct. 24, 2011), https://www.thespacereview.com/article/1954/1 (arguing that although only a few nations ratified the Moon Treaty, the participation of countries like Australia, France, and India as signatories create "a shadow of customary law which could grow" so that non-parties might feel the indirect influence of the Moon Agreement unless they object to it) [https://perma.cc/2553-3QSP].

[356] This approach suggests that, if the Moon Agreement deemed it necessary to address a particular issue, it may mean that the OST does not encompass that specific aspect, nor should its provisions be interpreted to include it. *See generally* Moon Agreement, *supra* note 313. *See also supra* Part IV.E.3 (discussing *ex contrariis* analysis).

[357] *See* Moon Agreement, *supra* note 313, at art. III (providing:

> "1. The moon shall be used by all States Parties exclusively for peaceful purposes.
>
> 2. Any threat or use of force or any other hostile act or threat of hostile act on the moon is prohibited. It is likewise prohibited to use the moon in order to commit any such act or to engage in any such threat in relation to the earth, the moon, spacecraft, the personnel of spacecraft or man-made space objects.
>
> 3. States Parties shall not place in orbit around or other trajectory to or around the moon objects carrying nuclear weapons or any other kinds of weapons of mass destruction or place or use such weapons on or in the moon.
>
> 4. The establishment of military bases, installations and fortifications, the testing of any type of weapons and the conduct of military maneuvers on the moon shall be forbidden. The use of military personnel for scientific research or for any other peaceful purposes shall not be prohibited. The use of any equipment or facility necessary for peaceful exploration and use "of the moon shall also not be prohibited.")

[358] *See id.*

G. The Artemis Accords

"[T]o help guide upcoming lunar activities and establish principles for cooperation among multiple governments" [359] by establishing a clearer framework,[360] NASA entered into bilateral arrangements with other countries' space agencies, known as the Artemis Accords.[361] The Accords, which reaffirm the commitments made under the OST and have been quite successful,[362] function as evidence of state practice in the interpretation of various OST's principles, especially due regard and harmful interference and influence the discourse on conflicts on the Moon. Specifically, the Accords not only reiterate their signatories' intention to act in accordance with those OST principles but also elaborate them by operationalizing them and demonstrating how they can be applied in practice. The growing number of signatories also signifies an emerging consensus on how to implement these OST principles.

Section 11 of the Accords addresses deconflicting space activities, reaffirming the signatories' commitment to the OST, including its provisions regarding due regard and the prevention of harmful interference. Section 11.3 reiterates the signatories' commitment to exercising due regard as outlined in Article IX OST. If a signatory perceives or experiences harmful interference, the section also provides for consultations with the authorizing signatory of the conflicting activity. Section 11.4 expresses the signatories' intention to refrain from deliberate actions that could result in harmful interference. Sections 11(7)-11(11) provide that, to fulfill their OST obligations, signatories will give notice of their activities and will cooperate to prevent harmful interference, designating their operating areas as "safety zones"—an "area in which nominal operations of a relevant activity or an anomalous event could reasonably cause harmful interference."[363]

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[359] ALEXANDER Q. GILBERT, SAFETY ZONES FOR LUNAR ACTIVITIES UNDER THE ARTEMIS ACCORDS 7 (2022).

[360] *See* Blake, *supra* note 326, at 184 (explaining that the inspiring values are cooperation, transparency, and sustainability in space exploration).

[361] *The Artemis Accords Principles for Cooperation in the Civil Exploration and Use of the Moon, Mars, Comets, and Asteroids for Peaceful Purposes* (October 13, 2020), [*Artemis Accords*], available at https://www.nasa.gov/wp-content/uploads/2022/11/Artemis-Accords-signed-13Oct2020.pdf, at pmbl. *See also* Abigail Bowman., *The Artemis Accords: Principles for a Safe, Peaceful, and Prosperous Future,* NASA (Oct. 13, 2024), https://www.nasa.gov/artemis-accords/ [https://perma.cc/BAK3-ZTBN]; Robert Lea, *What are the Artemis Accords?,* SPACE.COM (Oct. 17, 2024) https://www.space.com/artemis-accords-explained (explaining that the purpose of these Accords was to establish a shared set of principles guiding the responsible execution of missions within the Artemis Program) [https://perma.cc/6JBB-9JY3].

[362] As of November 2024, there are 48 signatories to the Artemis Accords. See U.S. Dep't of State, *Artemis Accords*, https://www.state.gov/artemis-accords/ (last visited Dec. 8, 2024).

[363] Artemis Accords, *supra* note 339, at § 11(7). The Accords provide that safety zones' characteristics, notice, and coordination should depend on the specific operation's nature and environment. *See id.* at § 11(7)(a). These zones should be determined reasonably, reflecting commonly accepted scientific principles, *see id.* at § 11(7)(b), and adapt as operations change, ending when the relevant activity concludes, *see id.* § 11(7)(c).

Signatories must promptly inform each other and the U.N. Secretary-General about creating, changing, or concluding safety zones, in line with Article XI OST.[364] The existence of a "safety zone" causes two types of consequences. First, on the part of the establishing signatory, it creates a commitment to protect public and private interests in "establishing, maintaining, or ending" a safety zone.[365] Second, on the part of all the other signatories, it triggers a commitment to respect the safety zone "to avoid harmful interference…including by providing prior notification to and coordinating with each other before conducting operations in a safety zone."[366] Section 11(11) contains a commitment to generally use safety zones in a way that promotes scientific exploration, technological demonstration, and the safe, efficient extraction, and use of space resources for sustainable space exploration and other operations.[367]

Regarding the likelihood of lunar conflicts, safety zones could, on the one hand, diminish the prospect of conflicts by fostering coordination among Artemis members. However, on the other hand, they could worsen lunar relations and stimulate possible conflicts because interfering with a safety zone could—depending on the intensity—be seen as an armed attack, potentially triggering the right to self-defense, or as an internationally wrongful act, warranting non-forceful countermeasures.[368]

V. THE POSITION OF SPACEFARING COUNTRIES ON THE DEFENSE OF LUNAR ASSETS

The reality that major spacefaring nations like the United States, China, and Russia will likely seek to defend their national activities on the Moon (and other celestial bodies) if the defense is economically or strategically justified amplifies the need to determine the legality of such potential conduct.[369] Because no state

[364] *See id.* at § 11(7)(d). Section 11(8) provides that the Signatory responsible for the safety zone will share the area's specifics, as per each Signatory's national rules and regulations, upon request of any other Signatory. *See id.* § 11(8).
[365] *See id.* at § 11(9). Also, the Signatory will share relevant safety zone information with the public, taking into account proprietary and "export-controlled" data. *Id.*
[366] *See id.* at § 11(10).
[367] *See id.* at § 11(11). In other words, safety zones should be used sparingly and not as a way to *de facto* appropriate areas of the Moon for no reason, impeding scientific and technology advancement and efficient mining. In addition, Section 11(11) certifies signatories' commitment to adhere to the OST principle of free access (and all the other OST provisions) and to adjust their usage of safety zones over time based on shared experiences and consultations. *Id.*
[368] *See* OST, *supra* note 7, at art. II. Repercussions from safety zone violations could be outlined in a protocol among the signatories, possibly involving the exclusion of the offending party from shared benefits (such as common services envisioned for implementation on the Moon). Also, because safety zones may necessitate physical or electronic barriers (such as using solar panels to encircle excavation sites), the establishment of a "safety zone" requires careful analysis under the point of view of compatibility with Article II OST. *Id.*
[369] The defense of national activities through the use of force is often a calculated decision based on the potential economic and strategic benefits, particularly national security interests, which aligns

practice—not even in the form of declarations—exists as to how states will respond to security challenges on the Moon, any understanding of spacefaring nations' attitude towards defending lunar activities, relies on speculative projections derived from public declarations and actions within Earth's orbit. While calls to bolster the protection of Earth's orbit have been made, the same urgency has not been expressed regarding the lunar domain. [370] Nevertheless, as national lunar activities become more prominent, states' interest in defending them will inevitably grow. Therefore, countries' positions as to their possible defensive measures to protect assets in Earth's orbit provide a logical basis for extrapolative analysis as to the lunar domain. Such an analysis, furthermore, demonstrates that when the United States and other spacefaring nations perceive assets as crucial for national security, they take measures to defend them. The perception of lunar installations as crucial will drive similar defensive actions.

A. The Position of the United States and NATO on the defense of national activities in space

A review of U.S. space policies promulgated by both the White House and the DoD shows a consistent emphasis on national security in space and on the defense of space assets,[371] their lack of particular attention on cislunar interests notwithstanding. While different in tone, language, and approach, the 2006 National Space Policy (NSP06) issued under then-President George W. Bush[372] and the 2010 National Space Policy (NSP10) issued under then-President Barack Obama[373] both emphasized the need to defend U.S. interests and assets in space, unequivocally affirming that the United States will, when necessary, protect its capabilities in space.[374] Compared with NSP06, NSP10 adopted a more cooperative

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with the pragmatic view that countries act to protect their economic and strategic assets when it is deemed necessary and beneficial. *See, e.g.,* Gordon de Brouwer, *Bringing Security and Prosperity Together in the National Interest*, CTR. FOR STRATEGIC AND INT'L STUD (Feb. 12, 2020), https://www.csis.org/analysis/bringing-security-and-prosperity-together-national-interest [https://perma.cc/WQL9-66FE]; Katherine Yon Elbright, *Unilateral Use of Force in the "National Interest": Taiwan Doesn't Meet the Test*, JUST SEC. (Nov. 12, 2021), https://www.justsecurity.org/79172/unilateral-use-of-force-in-the-national-interest-taiwan-doesnt-meet-the-test/ [https://perma.cc/59AD-LRAB].

[370] Sandra Erwin, *Space Force General's Warning on Satellite Defense Vulnerability*, SPACENEWS (Feb. 29, 2024), https://spacenews.com/space-force-general-warns-of-window-of-vulnerability-in-satellite-defense/ [https://perma.cc/UYD7-JE4E].

[371] Ramey, *supra* note 96, at 137.

[372] EXEC. OFF. PRESIDENT, U.S. NATIONAL SPACE POLICY (2006) [hereinafter NSP06], https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/national-space-policy-2006.pdf [ttps://perma.cc/3HGD-MMJJ].

[373] EXEC. OFF. PRESIDENT, NATIONAL SPACE POLICY OF THE UNITED STATES (2010) [hereinafter NSP10], https://obamawhitehouse.archives.gov/sites/default/files/national_space_policy_6-28-10.pdf [https://perma.cc/2QJG-877G].

[374] NSP10 sought to soften NSP06's language and move towards more cooperation and consideration for international space regulations. NSP10 differed significantly from NSP06: NSP06 had an assertive and potentially confrontational tone, suggesting the use of military force to defend against threats in space, which drew criticism for potentially violating international space treaties. The assertion that the United States may "deny, if necessary, adversaries the use of space capabilities

stance, emphasizing both self-defense and collaboration with allies for space security.[375] It also hinted at a greater willingness to consider stricter international regulations regarding space armaments, signaling a shift toward a more diplomatic approach in shaping space policy; nevertheless, it fundamentally carried forward the same national security posture as articulated in NSP06.[376] Former President Donald J. Trump's 2020 National Space Policy (NSP20)[377] reiterated the United States' commitment to defending and preserving U.S. and allied space assets in the interest of national security and to ensuring unhindered access and space operational freedom.[378] Considering the deliberate disruption of space systems a violation of the United States' right to use outer space,[379] NSP20 highlighted the importance of countering threats to space interests, specifying that any attack or deliberate disruption of space interests will prompt a strategic and deliberate response at the United States' discretion.[380] Recognizing space as a "warfighting domain,"[381] NSP20 aimed to bolster U.S. security systems,[382] identifying the U.S. Space Force (USSF)[383] as the main branch of the U.S. Armed Forces responsible for space operations.[384] Originally suggested by President Trump's Space Policy Directive-4,[385] the USSF was subsequently established as an independent service branch by National Defense Authorization Act for Fiscal Year 2020.[386] Its primary mission is to organize, train, and equip space personnel and assets and to protect

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hostile to U.S. national interests" was - to Russia - especially in conflict with the OST. NSP06, *supra* note 372 at 2. *See also* Todd Barnet, *United States National Space Policy, 2006 and 2010*, 23 FLA. J. INT'L L. 277, 282 (2011).

[375] *See* Looper, *supra* note 229, at 121.

[376] *See* NSP10, *supra* note 379, at 3.

[377] EXEC. OFF. PRESIDENT, NATIONAL SPACE POLICY OF THE UNITED STATES (Dec. 8, 2020) [hereinafter NSP20], https://trumpwhitehouse.archives.gov/wp-content/uploads/2020/12/National-Space-Policy.pdf [https://perma.cc/KG8C-B7A5].

[378] *Id*. at 3.

[379] *Id*. at 3-4.

[380] *Id*. at 3–4.

[381] NSP20, *supra* note 377, at 27.

[382] *Id.* at 27–28 (detailing the following principles: (a) Improving space awareness for threat detection; (b) Clearly communicating what constitutes unacceptable space activities; (c) Establishing credible responses for space defense; (d) Developing strong "space missions" against adversaries; and (e) Coordinating diplomatic, military, and economic strategies to deter adversaries from threatening actions).

[383] *Id.* NSP20 tasked the Secretary of Defense with protecting space for both national security and economic purposes. *Id*. at 30.

[384] National Defense Authorization Act for Fiscal Year 2020, Pub. L. No. 116–92, 133 Stat. 1198, § 951-961 (2019). [hereinafter NDAA FY20].

[385] Establishment of the United States Space Force, 84 Fed. Reg. 6049 (Feb. 19, 2019).

[386] NDAA FY20, *supra* note 384 383, at § 951–961. To avoid confusion, it is essential to clarify the distinction between the USSF and the U.S. Space Command (SPACECOM). The former stands as a separate entity, responsible for the training, procurement, and logistic, while the latter operates as a unified combatant command within the United States Department of Defense, which holds the responsibility for military operations in outer space (everything over the Karman Line), including the Moon. *See Frequently Asked Questions*, U.S. SPACE COMMAND, https://www.spacecom.mil/About/Frequently-Asked-Questions/ (last visited Oct. 10, 2024) [https://perma.cc/H72C-VLPZ].

U.S. and allied interests in space.[387] Its jurisdiction includes activities related to satellite operations, missile warning systems, space surveillance, and other space-related functions.[388] While the USSF is tasked with ensuring the security and integrity of U.S. space assets and capabilities,[389] it also holds non-exclusively military responsibilities, such as managing the GPS system.[390] Interestingly, while space policies have not dealt directly with defense of cislunar activities, the NSP20 issued under President Trump mentioned "cislunar orbits, and…lunar surface," [391] even if their reference solely pertained to expanding public-private partnerships. The U.S. National Science & Technology Council's 2022 National Cislunar Science & Technology Strategy (Cislunar Strategy) provides further insight into the United States' possible attitude toward the defense of lunar activities.[392] The Cislunar Strategy intends to guide U.S. government action in advancing scientific, exploratory, and economic development in cislunar space.[393] It includes objectives related to cislunar space situational awareness[394] and developing cislunar communication and positioning, navigation and timing (PNT) capabilities,[395] highlighting a growing interest in cislunar security.[396] It is reasonable to expect this awareness of security aspects to soon translate into state practice safeguarding lunar activities.[397] Unclassified information further indicates that the U.S. military's

[387] NDAA FY20, *supra* note 391, at § 9081(c)–(d).
[388] Kari A. Bingen et al., *U.S. Space Force Primer*, CTR. FOR STRATEGIC AND INT'L STUD. (Jan. 3, 2023) https://www.csis.org/analysis/us-space-force-primer [https://perma.cc/2FKX-CSLK]. The establishment of the USSF faced criticism. *See, e.g*., Joseph N. Pelton & Ram S. Jakhu, *Concerns that Flows from Possible Space Force Establishment*, 5 J. OF SPACE SAFETY ENGINEERING, 132–34 (2018). *But see* Harrington, *supra* note 223, at 768–69. (arguing that the establishment of the USSF—structured with specific missions focused on advancing global peace and security—has the potential to improve collaboration, openness, and the establishment of trust within the realm of outer space). Also, Pelton and Jakhu's criticism overlooks that many other countries also employ similar centralized structures for managing space-related affairs, and that no aspect of international law prohibits such arrangements.
[389] *Id*.
[390] *Fact Sheet: Global Positioning System*, U.S. SPACE FORCE, https://www.spaceforce.mil/About-Us/Fact-Sheets/Article/2197765/global-positioning-system/ [https://perma.cc/6CJR-MMAH] (last visited Oct. 27, 2024).
[391] NSP20, *supra* note 377, at 23 ("Continue to grow partnerships with the commercial space sector to enable safe, reliable, and cost-effective transport of crew and cargo to destinations in low Earth and cislunar orbits, and to the lunar surface.").
[392] NAT'L SCI & TECH COUNCIL, EXEC. OFF. PRESIDENT, NATIONAL CISLUNAR SCIENCE & TECHNOLOGY STRATEGY (2022) https://www.whitehouse.gov/wp-content/uploads/2022/11/11-2022-NSTC-National-Cislunar-ST-Strategy.pdf [https://perma.cc/767H-SXDU].
[393] *Id*. at 2.
[394] *Id*. at 11.
[395] *Id*. at 12.
[396] Schingler, *supra* note 318.
[397] *Id*.

attention to cislunar security has been increasing, with DARPA[398] and the Air Force Research Lab[399] playing leading roles.

To discourage adversaries from initiating hostilities or actions in Earth's orbits, the United States employs resilient space assets and integrated deterrence, with the former aiming to dissuade adversaries by making space attacks difficult, and the latter threatening proportional retaliation in different domains.[400] The United States should clearly communicate the strategic significance of its planned lunar installations, both governmental and commercial,[401] and its commitment to defending them using suitable countermeasures. This would establish a clear escalation protocol,[402] which, if communicated with the intent to establish a legal position, could count as an instance of state practice under international law. It is likely that the framework of military space cooperation[403] initiated during the Obama Administration within the framework of NSP10 would extend to the Moon. Such cooperation is prevalent in Earth orbital activities, offering cost reduction, enhanced deterrence, and increased resilience.[404]

In Earth's orbits, various U.S. governmental agencies (including the USSF and the DoD more broadly) use commercial space capabilities to improve the resiliency of the national security space architecture.[405] There is no reason to think

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[398] DARPA's NOM4D program aims to pioneer technologies for off-earth manufacturing, targeting the creation of space and lunar structures. *See* Michael Byers and Aaron Boley, *Cis-lunar Space and the Security Dilemma*, 78 BULL. ATOMIC SCIENTISTS, 18 (2022), https://thebulletin.org/premium/2022-01/cis-lunar-space-and-the-security-dilemma/ [https://perma.cc/Y5UE-73SF].

[399] The Air Force Research Lab is involved in cislunar space security projects, including data sharing agreements and the development of a "lunar intelligence dashboard" by private company Rhea Space. *See* Schingler, *supra* note 318.

[400] *See* Sadat & Georgetti, *supra* note 319.

[401] My contention is that the Moon will likely continue the trend of space exploration and development witnessed in Earth's orbit, with the commercial sector driving significant changes in U.S. space capabilities vis-à-vis its adversaries.

[402] *See* Sadat & Georgetti, *supra* note 319 (lamenting that current U.S. strategy fails to address the credibility of countermeasures caused by lack of clarity in communication about the significance of satellites and the escalation strategies, arguing that declared escalation strategies are fundamental, and advocating a shift from a culture of secrecy to one of open discussion in order to prevent future conflicts in space).

[403] *See* James C. Moltz, *The Changing Dynamics of Twenty-First Century Space Power*, 13 STRATEGIC STUD. Q. 66, 82 (2019) (contending that Strategic Command has entered into 83 international data-sharing agreements and that this expansion coincided with the opening of the Combined Space Operations Center in summer 2018 at Vandenberg Air Force Base. Additionally, the U.S. military's space exercises routinely involve American allies).

[404] *Id.* at 82 (discussing the concept of a military space "network" and exemplifying it with the Wideband Global SATCOM system funded by the United States and eight allies who contribute financially, in exchange for bandwidth from a constellation of communication satellites).

[405] EMMI YONEKURA, ET AL., COMMERCIAL SPACE CAPABILITIES AND MARKET OVERVIEW: THE RELATIONSHIP BETWEEN COMMERCIAL SPACE DEVELOPMENTS AND THE U.S. DEPARTMENT OF DEFENSE (2022) (arguing that the commercial space sector presents diverse services meeting USSF and DoD needs: satellite communications, imagery, and evolving areas like space awareness,

the same will not be true for the Moon.[406] Similar to NASA's extensive utilization of the private sector for the Artemis Program,[407] one could expect that the USSF and the DoD will engage with private entities for lunar activities.[408] In conclusion, although, as discussed, there is no explicit official position regarding the defense of lunar assets, as the lunar economy develops, the growing focus on cislunar security suggests that the United States is prepared to deter and defend against potential threats to its lunar installations.

In the event of an attack on U.S. space assets, self-defense may be coordinated through the North Atlantic Treaty (NATO). [409] Formed in 1949, NATO stands as a political and military alliance uniting North American and European nations.[410] At its core lies collective defense, enshrined in Article 5 of the treaty: NATO members pledge to perceive an attack against any member as an attack against the entire alliance, invoking a collective obligation to respond. [411] NATO has shifted its attention towards safeguarding its members' satellites in recent years, recognizing their pivotal role in communication, navigation, reconnaissance, and military activities.[412] It is debatable, however, whether Article 5 of the NATO Treaty[413] is relevant for defense of member states' space activities. On one hand, it could be said, as at least one scholar has pointed out, that Article 5 refers to attacks "in Europe or North America," which should be read to "exclude[-] attacks on member-State assets in outer space."[414] On the other hand, because a space object may be considered an extension of a state's territory,[415] NATO's collective self-defense could still be relevant in space. As such, while no NATO pronouncement regarding cislunar defense exists, as lunar economy develops, NATO may begin to shift its attention to the defense of activities on the Moon.

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weather monitoring, and satellite servicing.) With advancements, choices abound on leveraging commercial capabilities, selecting applications, and acquisition methods for military use. *Id.* at 1.

[406] Using commercial capabilities offers the advantage of faster technological updates and potential cost savings for the DoD. *See id.* at 2–3 (noting that this is not always a blanket rule and requires thorough cost-benefit analysis for each specific scenario).

[407] *See supra* Part I.A.

[408] The expectation is justified by the "ever-increasing entanglement of U.S. national security space programs with their civil and commercial counterparts." Koplow, *supra* note 151 at 28 (discussing the current situation of Earth's orbit but providing a relevant basis for this contention regarding lunar activities).

[409] North Atlantic Treaty, art. 5, Apr. 4, 1949, 63 Stat. 2241, 34 U.S.T. 243 [hereinafter NATO Treaty].

[410] *NATO member countries*, NORTH ATLANTIC TREATY ORGANIZATION (Mar. 11, 2024) https://www.nato.int/cps/en/natohq/topics_52044.htm [https://perma.cc/UV4W-9594].

[411] NATO Treaty, *supra* note 409, at art. 5.

[412] This shift was highlighted in 2019 when NATO formally acknowledged space as an operational domain, equivalent in importance to air, land, sea, and cyberspace. *See, e.g.*, Martin Banks, *NATO Names Space as an 'Operational Domain,' but Without Plans to Weaponize It,* DEFENSENEWS (Nov. 20, 2019) https://www.defensenews.com/smr/nato-2020-defined/2019/11/20/nato-names-space-as-an-operational-domain-but-without-plans-to-weaponize-it/ [https://perma.cc/Y5TN-3PYG].

[413] NATO Treaty, *supra* note 409, at art. 5.

[414] von der Dunk, *supra* note 105, at 189 n. 3.

[415] This happens through quasi-jurisdiction under Article VIII OST. *See supra* Part IV.G.

B. The position of China and Russia on the defense of space assets

While China[416] and Russia[417] publicly endorse the peaceful use of outer space, their practices reveal significant military objectives, creating global strategic ambiguities and potential tensions. China's ambiguous space defense strategy can be discerned from its promotion of its BeiDou Navigation Satellite System for civilian use worldwide, aimed to foster global interdependency that bolsters its strategic leverage.[418] This approach could extend to future lunar communication and positioning technologies. Additionally, China's establishment of its Information Support Force and creation of both its Aerospace Force and Cyberspace Force[419] highlight the country's strategic focus on enhancing space military capabilities through space informatization and intelligence. This blurring of civilian and military space activities creates ambiguity and potential misunderstandings with rival nations[420] and suggests unsettling possibilities regarding the dual-use nature of China's lunar program.[421]

Russia, guided by Federal Law No. 5663,[422] emphasizes the protection of state, military, and commercial secrets in its space activities.[423] Military operations have played a significant role in Russia's space activities since the dawn of the space age, and, according to Russian space experts, military space will continue "to be an important part of the space programme."[424] Prioritizing public over private space enterprises has hindered Russia's space competitiveness, leading to industry

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[416] ST. COUNCIL INFO. OFF. CHINA, CHINA'S SPACE PROGRAM: A 2021 PERSPECTIVE § 1, ¶ 3 (2022), https://english.www.gov.cn/archive/whitepaper/202201/28/content_WS61f35b3dc6d09c94e48a467a.html (re-affirming that China has always advocated for peaceful purposes and opposed any attempt of space weaponization or arms race in outer space.) [https://perma.cc/P3Q2-5NPS].

[417] *See* Looper, *supra* note 229, at 117–18.

[418] Sarah Sewall, Tyler Vandenberg & Kaj Malden, CHINA'S BEIDOU: NEW DIMENSIONS OF GREAT POWER COMPETITION 1 (2023).

[419] Masaaki Yatsuzuka, *New Chinese Reform Addresses Overlaps, Reflects Challenge of Military Control*, AUSTL. STRAT. POL'Y INST.: STRATEGIST (Apr. 22, 2024) https://www.aspistrategist.org.au/new-chinese-reform-addresses-overlaps-reflects-challenge-of-military-control/ (arguing that the move intends to address organizational overlaps and improve combat capability but also reflects ongoing challenges with corruption within the military) [https://perma.cc/9LMD-52QS]. *See also* John Costello & Joe McReynold, CHINA'S STRATEGIC SUPPORT FORCE: A FORCE OF A NEW ERA 13 (2018).

[420] *See* Schingler, *supra* note 318, at 117.

[421] Ashwin Prasad & Rakshith Shetty, *China's Military-Civil Fusion Space Program*, DIPLOMAT (Apr. 27, 2024), https://thediplomat.com/2024/04/chinas-military-civil-fusion-space-program/ [https://perma.cc/ZBA9-G6UG] (discussing concerns, including those raised within NASA, that China's civilian space program is, in reality, a military one, and arguing that China is advancing rapidly in space, with a focus on dual-use technology under its military-civil fusion strategy, which allows the military to leverage civilian technologies for defense purposes).

[422] *See* Looper, *supra* note 229, at 117.

[423] *Id*. at 117–18.

[424] PAVEL PODVIG, RUSSIAN SPACE SYSTEMS AND THE RISK OF WEAPONIZING SPACE 34 (2021).

stagnation.[425] However, Russia is actively developing antisatellite systems and orbital maneuvering satellites, indicating its broader intentions to target reconnaissance and communication satellites. Such investments reflect Russia's concerns about space weaponization[426] and suggest that Moscow's advocacy for peaceful space utilization may be more a consequence of its current technological inferiority rather than a genuine commitment.[427]

In sum, while both China and Russia publicly endorse the peaceful use of outer space, their practices reveal significant military objectives, creating global strategic ambiguities and potential tensions. Thus, as the lunar economy is poised to launch and the Moon potentially becomes a focal point for conflict, major spacefaring nations - including China and Russia - will likely seek to protect their national lunar activities from one another. Their defense of lunar activities will ultimately constitute new state practice that may shed interpretive light on the meaning of the OST, vis-à-vis LOAC.

CONCLUSION

Considering the increasing number of lunar projects, involvement of diverse stakeholders, overlapping interests in key lunar regions, and lack of coordination among major spacefaring countries with lunar ambitions, the incipient lunar economy is likely to witness conflicts.[428] Although the framework of responsibility for internationally wrongful acts is applicable to some disputes that may arise, the likelihood that it will resolve lunar disputes peaceably without escalating is questionable.[429] In the commercial sphere, the use of private security force by space companies to defend their own activities is permitted under international law but will also likely be insufficient to protect lunar activities.[430]

The potential for conflict and the established state practice regarding defense of space assets raises the prospect that spacefaring countries will soon seek to defend their lunar activities, giving new urgency[431] to the question of whether

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[425] *See e.g.*, Bruce McClintock, *The Russian Space Sector: Adaptation, Retrenchment, and Stagnation*, 10 SPACE & DEF. 3, 3 (2017).

[426] Zak, *supra* note 303, at 2 (noting that Russia has increasingly "viewed the United States to be its biggest threat in space").

[427] *Russia Pinpoints Cause of Moon Shot Failure, Looks to Bring Next Missions Forward,* REUTERS (Oct. 3, 2023), https://www.reuters.com/world/europe/russia-says-moon-shot-failed-due-control-unit-malfunction-2023-10-03/ [https://perma.cc/ZB73-AGV8] (discussing the crash of Luna-25 spacecraft as evidence of Russia's decreasing strength in space exploration).

[428] *See* David, *supra* note 12, at 69, 76, 81–82; Elvis et al., *supra* note 1, at 2–3. *See also* Alex Hughes, *World War Moon: Here's How a Major Lunar Conflict Could Soon Unfold*, BBC (June 34, 2024), https://www.sciencefocus.com/space/moon-wars [https://perma.cc/CH8V-RJ74].

[429] *See supra* Part II.A (analyzing the potential application of ARSIWA to the lunar context).

[430] *See supra* Part II.B (discussing the prospect of using private security forces to protect lunar activities).

[431] See McDonald, *supra* note 42 at 5 (distinguishing "militarization" from "weaponizing," which could involve actions aimed at preventing adversaries from using space for military operations that might encompass offensive counterspace capabilities).

such actions are legal under international law. Analyzing their legality, however, is complicated by uncertainties regarding the interaction between LOAC and the OST. Nevertheless, as discussed, an analysis of LOAC and the OST reveals that international law *does* permit the defense of lunar activities. While this paper focused on the Moon, its discussion is also applicable to defending activities on Mars, the asteroids, and other celestial bodies, given that the legal frameworks of refence—LOAC and space law—is the same.

While state practice regarding the defense of lunar activities does not yet exist, it is foreseeable that the United States and other spacefaring nations will view lunar activities and installations as crucial to national security. Hopefully, these countries will soon issue declarations regarding their positions on the defense of such interests to establish some state practice, which will further clarify international law and the interaction between LOAC and space law. In the meantime, lest the analysis fall to the goodwill of academia, [432] governments should foster, support, and sponsor rigorous studies regarding the defense of space assets and the intertwinement of LOAC and space law.[433]

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[432] *See, e.g.*, WOOMERA MANUAL ON THE INTERNATIONAL LAW OF MILITARY SPACE ACTIVITIES AND OPERATIONS (Jack Beard, Dale Stephens & David Koplow, eds., 2024) (clarifying and outlining the existing international law governing military operations in space).

[433] The commendable initiatives to promote and contribute to Science, Technology, Engineering, and Mathematics (STEM) for space endeavors do not include space law studies. S*ee, e.g., About NASA STEM Engagement*, NASA (July 3, 2024), https://www.nasa.gov/learning-resources/stem-engagement/ [https://perma.cc/29NK-XTKJ].