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Towards a New Orbit: Addressing the Legal Void in Space Mining

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TOWARDS A NEW ORBIT: ADDRESSING THE LEGAL VOID IN SPACE MINING

REBEKAH SHIELDS*

Space mining is on the horizon, but the guiding legal framework in the Outer Space Treaty is an outdated instrument. The Treaty contains a provision which prohibits appropriation of the Moon or any celestial object, but it does not explicitly address space mining. With this void, several spacefaring nations who are parties to the Treaty have passed legislation, which establish property rights for private companies over space resources. While these countries assert that this is permissible under the Treaty, other parties disagree.

This Comment will argue that countries passing legislation which gives private companies property rights over the resources they exploit in space are not in compliance with the Treaty. Their attempt to advance their interpretation of the Treaty through subsequent practice is not sufficient to narrow its interpretation because other Signatories are not all in agreement. It argues that the Treaty is outdated, and the international community is ill-prepared for the risks that space mining presents. While acknowledging the challenges presented with the creation of a new international agreement, this Comment proposes a new multilateral treaty to circumvent global conflict. It also proposes an advocacy campaign to bring light to the dangers of no regulation.

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I. INTRODUCTION

Once again, the world finds itself in a space race. However, instead of landing on the Moon, spacefaring nations are seeking to extract resources from it and other celestial bodies.¹ The Moon and other celestial bodies, like asteroids, contain valuable precious metals and rare minerals, which are in high demand in industries that manufacture

1. See Alex Gilbert, *Mining in Space is Coming*, MILKEN INST. (Apr. 26, 2021) [hereinafter Gilbert, *Mining in Space is Coming*], <https://www.milkenreview.org/articles/mining-in-space-is-coming> (emphasizing the value of extraterrestrial resources).

technologies like electric cars and laptops.² Even more significant is the presence of water on the Moon and certain types of asteroids because this can allow deeper exploration into space without the need to return to Earth to refuel.³ Space mining presents many economic and societal opportunities, but existing law, namely, the Outer Space Treaty,⁴ does little to prevent over-exploitation or conflict among competing space-mining countries.⁵ While Article II of the Treaty⁶ prohibits appropriation of any celestial body, the language is vague, and it is widely contested whether this prevents states from asserting property rights in space.⁷ The United States, with other spacefaring nations following suit,⁸ asserts that it is legal for private companies to own space materials.⁹

As the world's technologies and capabilities to participate in space mining continue to progress at a rapid rate, the international community must consider what steps are necessary to maintain safety and peace in a largely unregulated field. Accordingly, this Comment

2. See *id.* (outlining the value of space-based resources due to their potential uses in many technological industries).

3. See *id.* (indicating that rocket fuel can be produced by splitting H₂O into hydrogen and oxygen).

4. See generally 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, 610 U.N.T.S. 205 [hereinafter Outer Space Treaty] (recognizing the Outer Space Treaty as the existing governing law on the subject).

5. See Joshua E. Duke, *Conflict and Controversy in the Space Domain: Legalities, Lethalities, and Celestial Security*, WILD BLUE YONDER (Sept. 29, 2020), <https://www.airuniversity.af.edu/Wild-Blue-Yonder/Article-Display/Article/2362296/conflict-and-controversy-in-the-space-domain-legalities-lethalities-and-celesti> (outlining the gaps in current space-based legislation associated with countries' space mining).

6. See generally Outer Space Treaty, *supra* note 4, art. II (highlighting the article prohibiting claims of sovereignty over "celestial bodies").

7. See Laura Yvonne Zielinski, *Disputes Over Space Mining in the Horizon?*, INT'L BAR ASS'N (Jan. 18, 2023), <https://www.ibanet.org/disputes-over-space-mining-on-the-horizon> (noting that the Outer Space Treaty does not directly account for property disputes between countries).

8. See Jeff Foust, *Japan Passes Space Resources Law*, SPACE NEWS (June 17, 2021), <https://spacenews.com/japan-passes-space-resources-law> (highlighting the trend of space material privatization set by the U.S. and followed by other countries).

9. See U.S. Commercial Space Launch Competitiveness Act, 51 U.S.C. § 51303 (2015) (passing a law that allows private companies and individuals to own resources that they exploit in outer space).

will argue that when major spacefaring nations inevitably pass legislation allowing the ownership of space resources, they will be in violation of Article II of the Outer Space Treaty which prohibits the appropriation of celestial bodies by any state.¹⁰

Part II will begin with an overview of the natural resources that exist in space by highlighting the economic and societal opportunities they offer.¹¹ After discussing the incentives for nations and entities to mine space resources, this section will discuss where technological progress currently stands regarding space mining.¹² This Comment will then provide an overview on the Outer Space Treaty and its interpretation according to the Vienna Convention on the Law of Treaties.¹³ It will also discuss the Moon Agreement and its relevance to international space law.¹⁴ Following that, it will give an outline of the domestic legislation that spacefaring nations have passed to narrow the interpretation of the non-appropriation principle through subsequent practice.¹⁵

Part III will analyze the Outer Space Treaty as applied to the actions of the spacefaring nations discussed in Part II.¹⁶ Additionally, this section will argue that the spacefaring nations' attempt to narrow the interpretation of the non-appropriation principle is unsuccessful under the Vienna Convention on Treaties.¹⁷ Thus, this section argues that spacefaring nations establishing property rights in space over celestial bodies are violating Article II of the Outer Space Treaty.¹⁸

Part III will also highlight the importance of consensus in developing international space law.¹⁹ It argues that the opinions of countries with superior technological abilities and wealth should not carry more weight than those less developed. It is contrary to the Outer

10. See Outer Space Treaty, *supra* note 4, art. II (arguing that the Outer Space Treaty will forbid individual state ownership of space resources).

11. See *infra* Part II.A.

12. See *infra* Part II.A.

13. See *infra* Part II.B.1–2.

14. See *infra* Part II.B.3.

15. See *infra* Part II.C.

16. See *infra* Part III.A.

17. See *infra* Part III.A.

18. See *infra* Part III.A.

19. See *infra* Part III.B.

Space Treaty to give disproportionate consideration to less wealthy and technologically developed Signatories.²⁰ Additionally, this Comment warns of potential conflict that may arise in safety zones envisioned in the Artemis Accords²¹ if countries are not all in agreement on the international space governance for space use and exploration.²²

Part IV will build on the pitfalls of current international space law.²³ The resulting recommendation is the creation of a new multilateral treaty to replace the outdated Outer Space Treaty that leaves too much up to interpretation.²⁴ It will recognize the challenges presented with creating a new multilateral treaty.²⁵ Part IV will also propose a public relations campaign to raise awareness of the dangers of leaving space unregulated and advocate for the adoption of a new multilateral treaty.²⁶ Part V of this Comment will reiterate that spacefaring nations are violating the Outer Space Treaty and new rules are necessary for the future of safety in space.²⁷

II. BACKGROUND

The Outer Space Treaty provides the basic framework for international space law, but there is a lack of governance regarding space mining.²⁸ For contextual purposes, it is important to explore the incentives for nations to engage in space mining.²⁹ These incentives have prompted the passage of national legislation to give private companies the green light to develop technology and embark on

20. See *infra* Part III.B.

21. See generally NAT'L AERONAUTICS & SPACE ADMIN. [NASA], ARTEMIS ACCORDS § 11 (Oct. 13, 2020) [hereinafter Artemis Accords], <https://www.nasa.gov/wp-content/uploads/2022/11/Artemis-Accords-signed-13Oct2020.pdf?emrc=653a00> (creating a set of principles to govern space activities).

22. See *infra* Part III.C.

23. See *infra* Part IV.

24. See *infra* Part IV.

25. See *infra* Part IV.

26. See *infra* Part IV.

27. See *infra* Part V.

28. See Outer Space Treaty, *supra* note 4 (noting the gaps in current laws pertaining to space mining).

29. See Gilbert, *Mining in Space is Coming*, *supra* note 1 (emphasizing the incentives for countries to participate in the mining of space-based resources).

missions to extract space resources.³⁰ Without the explicit legislative permission, private companies and their shareholders may be weary to venture into space because the potential rewards may not be worth the large investment if there are potential legal consequences.³¹ Due to rapid technological advances, the issues that arise with such legislation are on the immediate horizon.³²

A. RESOURCES AND TECHNOLOGY IN OUTER SPACE

Outer Space is filled with innumerable rare natural resources.³³ One of the space mining targets is asteroids, which are lumps of metal, rock, and dust.³⁴ There are three classes of asteroids;³⁵ each are targets for mining.³⁶ There are hundreds of thousands of asteroids in space, and their sizes can range from the size of a house to miles long.³⁷ The critical metals contained in these asteroids are in high demand in many industries.³⁸ For example, batteries in electric cars require substantial

30. *See id.* (highlighting the increased privatization of space mining operations by national actors).

31. *See* Shriya Yarlagadda, *Economics of the Stars: The Future of Asteroid Mining and the Global Economy*, HARV. INT'L R. (Apr. 8, 2022), <https://hir.harvard.edu/economics-of-the-stars> (highlighting NASA's OSIRIS-Rex mission to obtain samples from a near-earth asteroid that will take seven years and cost one billion dollars).

32. *See* Gilbert, *Mining in Space is Coming*, *supra* note 1 (emphasizing the immediacy of space-based legislative issues).

33. *See id.* (noting the various materials found in space that are valuable for terrestrial and space-based uses).

34. *See* William Steigerwald, *New NASA Mission to Help Us Learn How to Mine Asteroids*, NASA (Aug. 8, 2013), <https://www.nasa.gov/solar-system/new-nasa-mission-to-help-us-learn-how-to-mine-asteroids> (highlighting asteroids as one of the largest targets for space mining).

35. *See id.* (explaining that there are "C-type" that have a high amount of water bound up as clay minerals, "S-type" which contain nickel, iron, and cobalt, and "M-class" which are rare and contain ten times more metal than other asteroids).

36. *See* Ramin Skibba, *Things Are Looking Up for Asteroid Mining*, WIRED (Oct. 28, 2023), <https://www.wired.com/story/things-are-looking-up-for-asteroid-mining> (emphasizing that each type of asteroid holds value and is a target for mining).

37. *See* Steigerwald, *supra* note 34 (highlighting the variety of asteroid size and shape).

38. *See* Skibba, *supra* note 36 (noting the expected demand for cobalt to rise by six times by 2050 and nickel to rise by four times if governments transition to clean energy).

amounts of nickel and cobalt.³⁹ Nickel is also used in solar panels, and cobalt is used in wind turbines.⁴⁰ Mining asteroids to retrieve these metals could serve as an alternative to earth mining, which has been associated with various labor and human rights abuses.⁴¹ Space mining is also an attractive venture because unlike Earth, natural resources in space are incomprehensibly abundant.⁴² Smaller asteroids can be worth millions of dollars.⁴³ Even though space mining is an expensive endeavor, the potential profit is well worth it.⁴⁴

In addition to containing valuable metals similar to those found in asteroids, the Moon has significant reserves of helium-3, as well as substantial amounts of water located in the permanently shadowed craters at its lunar poles.⁴⁵ The Moon is an attractive mining target because the water and the helium-3 can be used to create rocket fuel.⁴⁶ Thus, this resource may further space travel without the need to return to Earth to refuel, saving years of time and millions of dollars.⁴⁷

As the demand for these resources continues to rise, private

39. *See id.* (highlighting a potential use of nickel and cobalt, two commonly occurring substances in asteroids).

40. *See id.* (noting potential uses of nickel and cobalt for types of energy technology).

41. *See id.* (citing common problems with terrestrial mining operations, such as the systemic use of child labor, forced labor, and human rights abuses in the Democratic Republic of Congo for cobalt collection).

42. *See Space Mining Market Research*, SIS INT'L RSCH. & STRATEGY, <https://www.sisinternational.com/expertise/industries/space-mining-market-research> (highlighting the importance of space mining as its "unlimited resources" present new solutions for supply and demand problems).

43. *See* Steigerwald, *supra* note 34 (noting that even smaller asteroids hold potentially millions of dollars in value); *see also Asteroid Facts*, NASA, <https://science.nasa.gov/solar-system/asteroids/facts> (explaining that the size of asteroids can range from 33 feet to 329 miles in diameter).

44. *See* Yarlagadda, *supra* note 31 (explaining potential profits of asteroid mining operations based on previously discovered asteroid compositions); *see also Asterank*, ASTERANK, <https://www.asterank.com> (projecting that the ten most cost effective asteroids would produce a \$1.5 trillion profit).

45. *See* Gilbert, *Mining in Space is Coming*, *supra* note 1 (highlighting the value that mining materials on the moon holds).

46. *See id.* (outlining that Helium-3 is used as a fuel source for fusion reactors).

47. *See* Loren Grush, *Why Mining the Water on the Moon Could Open Up Space Exploration*, THE VERGE (Aug. 23, 2018), <https://www.theverge.com/2018/8/23/17769034/nasa-moon-lunar-water-ice-mining-propellant-depots> (emphasizing the cost of space travel and the inability to refuel once in travel).

companies are working to meet these demands through space mining.⁴⁸ For example, AstroForge, a Los Angeles-based company, is testing space mining technology.⁴⁹ The company focuses on M-type asteroids,⁵⁰ and it plans to deploy spacecraft in 2024 to observe a target asteroid.⁵¹ Similarly, Karman+, a Denver-based company, plans to mine the C-type asteroids which contain clay and water, rather than searching for the rare M-type.⁵² In 2026, Karman+ is launching its first mission to a near-Earth asteroid with the goal of exploring and testing excavation equipment.⁵³

B. OUTER SPACE UNDER INTERNATIONAL LAW

In 1967, two years before the first Moon landing,⁵⁴ the international community came together to adopt the Outer Space Treaty.⁵⁵ As of August 2023, there are 114 parties to the Treaty, including the United States, Luxembourg, the United Arab Emirates (U.A.E.), and Japan.⁵⁶ The Moon Agreement, adopted in 1979, reaffirms and elaborates on

48. See Skibba, *supra* note 36 (noting the relationship between rising demands for resources that are prevalent in space, and private companies pushing for space mining).

49. See Matt Gialich & Jose Acain, *An Update on our Progress Towards Mining in Space*, ASTROFORGE (Dec. 11, 2023), <https://www.astroforge.io/updates/2023-update> (outlining the extent to which AstroForge's space mining operations are successful and what progress remains).

50. See *Asteroid Facts*, *supra* note 43 (explaining that M-type asteroids are metallic, containing nickel and iron).

51. See Amy Gunia, *Minerals are in Short Supply on Earth. This Startup Wants to Mine Asteroids*, CNN (Apr. 23, 2024), <https://www.cnn.com/world/astroforge-asteroid-mining-nasa-spc-scen> (stating that an AstroForge spacecraft will be checking out the composition and taking pictures of an asteroid in late 2024).

52. See Skibba, *supra* note 36.

53. *Karman+ Announces Call for Proposals: High Frontier Payloads*, KARMAN+ (Nov. 27, 2023), <https://www.karmanplus.com/karman-announces-call-for-proposals-high-frontier-payloads>.

54. See *Apollo 11*, NASA, <https://www.nasa.gov/mission/apollo-11> (noting the date of the Apollo 11 Mission on July 16, 1969).

55. See Outer Space Treaty, *supra* note 4 (forming a multilateral treaty that provides governance for states' uses and explorations of Outer Space, such as scientific investigations and experiments into space debris removal).

56. *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies: Participants*, U.N. OFF. FOR DISARMAMENT AFFS., https://treaties.unoda.org/outer_space/participants.

the Outer Space Treaty.⁵⁷ Because the provisions of this Agreement are more specific and restrictive than the Outer Space Treaty, only eighteen countries ratified it.⁵⁸ The Vienna Convention on the Law of Treaties, although adopted after the Outer Space Treaty, is accepted as customary international law and is used to interpret treaties.⁵⁹ The following subsections of this Comment discuss Article II of the Outer Space Treaty, how the Treaty is interpreted under the Vienna Convention on the Law of Treaties, and why the Moon Treaty has not garnered the same success.⁶⁰

1. Article II of the Outer Space Treaty

Article II of the Outer Space Treaty states that, “Outer Space, including the moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means.”⁶¹

The definition of appropriation in Article II is a widely debated topic in international space law.⁶² When the Outer Space Treaty was

57. See Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, Dec. 5, 1979, 1363 U.N.T.S. 3 [hereinafter *The Moon Agreement*] (stating that this agreement is meant to define and develop the provisions of the Outer Space Treaty).

58. See Stefan-Michael Wedenig & Jack Wright Nelson, *The Moon Agreement: Hanging by a Thread?*, INST. OF AIR & SPACE L. (Jan. 26, 2023), <https://www.mcgill.ca/iasl/article/moon-agreement-hanging-thread> (discussing the difficulty the Moon Agreement has had with gaining relevance).

59. See CONG. RSCH. SERV., TREATIES AND OTHER INTERNATIONAL AGREEMENTS: THE ROLE OF THE UNITED STATES SENATE 43 (2001) (explaining that the Vienna Convention on the Law of Treaties is treated as a primary source of international law concerning treaties, even for non-parties).

60. See *infra* Part II.B.1–3.

61. Outer Space Treaty, *supra* note 4, art. II.

62. Compare John G. Wrench, *Non-Appropriation, No Problem: The Outer Space Treaty is Ready for Asteroid Mining*, 51 CASE W. RESV. J. INT’L L. 437, 447 (2019) (stating that it is incorrect to interpret the non-appropriation principle as a blanket ban on resource ownership); with Zielinski, *supra* note 7 (explaining that nations that allow for the extraction and commercialization of space resources do not view the activity as an appropriation); and Ricky J. Lee, *Article II of the Outer Space Treaty: Prohibition of State Sovereignty, Private Property Rights, or Both*, 11 AUSTL. INT’L L. J. 128, 130, 133 (2004) (remarking that the Chinese translation of Article II merely prohibits appropriation of the Moon and other celestial bodies by the State, not private entities).

first adopted, most viewed the non-appropriation principle as a broad concept that did not allow any assertion of rights over any celestial body.⁶³ That view has since narrowed tremendously with many scholars believing that appropriation only applies to a country claiming national sovereignty over a celestial body because the Treaty does not specifically prohibit ownership over resources.⁶⁴ Some argue that the new interpretations of this principle that embrace ownership rights in space undermine the Treaty authors' intentions.⁶⁵ The authors emphasized that the use and exploration of space should be for the benefit and interest of all mankind and that space shall be the province of all mankind.⁶⁶ These ideals are irrespective of a country's degree of wealth or technological development.⁶⁷

The Outer Space Treaty is silent on the issue of exclusive property rights.⁶⁸ This is likely not a coincidence, as the drafters of the Treaty may have intentionally not addressed space mining and left the issue unaddressed until it became a reality.⁶⁹ At best, the Treaty is vague.⁷⁰

63. See Abigail D. Pershing, *Interpreting the Outer Space Treaty's Non-Appropriation Principle: Customary International Law from 1967 to Today*, 44 *YALE J. INT'L L.* 149, 161 (2019).

64. See *id.* (stating that the Outer Space Treaty bans ownership of real property in space rather than ownership of extracted resources); see also Lee, *supra* note 62, at 130 (explaining that Article II does not prohibit all forms of appropriation, but merely "national" appropriation).

65. See Brandon C. Gruner, *A New Hope for International Space Law: Incorporating Nineteenth Century First Possession Principles into the 1967 Space Treaty for the Colonization of Outer Space in the Twenty-First Century*, 35 *SETON HALL L. REV.* 299, 325 (2004) (emphasizing that the Preamble states that the use of Outer Space should benefit all mankind).

66. See *id.* (referencing the Preamble and Art. I of the Outer Space Treaty); see also Outer Space Treaty, *supra* note 4, art. I (highlighting the intention of the drafters that the use of Outer Space be for the benefit of all countries).

67. See Gruner, *supra* note 65 (quoting the Preamble of the Outer Space Treaty).

68. See Lee, *supra* note 62, at 137 (stating the Art. II is seemingly silent on the topic of exclusive property rights); Outer Space Treaty, *supra* note 4.

69. See MICHAEL BYERS & AARON BOLEY, *WHO OWNS OUTER SPACE? INTERNATIONAL LAW, ASTROPHYSICS, AND THE SUSTAINABLE DEVELOPMENT OF SPACE* 149 (2018) (referring to a discussion regarding the Drafted version of the Outer Space Treaty in which it was remarked that the treaty could only deal with their current problems, while future developments would give rise to new problems which will require a subsequent solution).

70. See Dennis O'Brien, *Will a Five-Year Mission by COPUOS Produce a New International Governance Instrument for Outer Space Resources?*, *THE SPACE REV.*

Nonetheless, spacefaring nations that allow for the exploitation of space materials assert that this is not considered appropriation.⁷¹

2. *Vienna Convention on the Law of Treaties*

The relevant provision of the Vienna Convention for this Comment is Article 31(3)(b) which states, “There shall be taken into account, together with the context: any subsequent practice in the application of the treaty which establishes the agreement of the parties regarding its interpretation.”⁷²

Subsequent practice is a way to interpret a treaty after it is finalized based on the parties’ conduct and its application.⁷³ Subsequent practice potentially narrows or widens the interpretation of a treaty, but it cannot amend or modify it.⁷⁴ An agreement under subsequent practice requires a common understanding of the interpretation which the parties are aware of and accept.⁷⁵ Furthermore, there is not a set number of parties that must engage in the subsequent practice to establish an agreement; however, silence may constitute acceptance of the subsequent practice.⁷⁶

Spacefaring countries like the United States, Luxembourg, the U.A.E., and Japan are passing national legislation to establish

(Feb. 20, 2023), <https://www.thespacereview.com/article/4534/1> (arguing that the establishment of a Working Group to gather information and study the current framework shows there is agreement that the Outer Space Treaty does not adequately cover space resource activity).

71. See Zielinski, *supra* note 7 (stating that the states which allow for the extraction and commercialization of space resources view the activity as an authorized use of outer space under the Treaty).

72. Vienna Convention on the Law of Treaties art. 31(3)(b), May 23, 1969, 1155 U.N.T.S. 331, 340 [hereinafter Vienna Convention].

73. See Int’l L. Comm’n [ILC], Rep. on the Work of Its Seventieth Session, U.N. Doc. A/73/10, at 27 (2018) [hereinafter ILC] (explaining how subsequent practice can influence the interpretation of a treaty).

74. See *id.* at 51 (concluding that subsequent practice can result in narrowing, widening, or otherwise alters the range of possible interpretations of a treaty, but cannot amend or modify it).

75. See *id.* at 75 (stating that subsequent practice can only change the way a treaty is interpreted if it is the common understanding of the treaty which the parties are aware of and accept).

76. See *id.* (discussing that there is no set number of parties which are required to actively engage to establish an agreement under subsequent practice).

subsequent practice to narrow the scope of the non-appropriation principle,⁷⁷ paving the way for a future in space mining.⁷⁸ By engaging in this conduct, it is the hope of these nations that their purported interpretation becomes the accepted meaning of the agreement.⁷⁹

An important consideration to keep in mind when determining whether subsequent agreement establishes a certain interpretation of a treaty is the reaction of other parties to the Treaty.⁸⁰ If there is no consensus among the parties to the agreement as to how a term should be applied, then the interpretation cannot be widened or narrowed.⁸¹ Thus, if parties express disagreement to how a party is applying the treaty, this shows that there is no consensus.⁸² For instance, Dmitry Rogozin, Director General of the Russian Space Agency, said, “We will not, in any case, accept any attempts to privatize the Moon. It is

77. See Outer Space Treaty, *supra* note 4, art. II (“Outer space, including the moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means.”).

78. BYERS & BOLEY, *supra* note 69, at 152–53 (referring to the legislation adopted by the United States, Luxembourg, the U.A.E., and Japan regarding commercial space mining); see also U.S. Commercial Space Launch Competitiveness Act, 51 U.S.C. § 51303 (2015) (providing a comprehensive law governing activities related to space exploration and exploitation); LOI DU 20 JUILLET 2017 SUR L’EXPLORATION ET L’UTILISATION DES RESSOURCES DE L’ESPACE [LAW OF JULY 20, 2017 ON THE EXPLORATION AND USE OF SPACE RESOURCES] art. 1 (Lux.) [hereinafter Luxembourg 2017 Space Law] (stating that “the resources of space are susceptible to appropriation”); U.A.E. SPACE AGENCY, SPACE RESOURCES REGULATION: REGULATORY FRAMEWORK ON SPACE ACTIVITIES OF THE UNITED ARAB EMIRATES art. 7 (2023), <https://space.gov.ae/Documents/PublicationPDFFiles/POLREG/SpaceResources-EN.pdf> [hereinafter U.A.E. Space Resources Regulation] (establishing that space resources may be explored, exploited, or used); Act on the Promotion of Business Activities for the Exploration and Development of Space Resources, Act No. 83 of 2021, art. 5 (Japan) [hereinafter Japan Space Resources Act] (granting ownership of space resources that have been mined to the person/business who conducts the activity).

79. See BYERS & BOLEY, *supra* note 69, at 152–53 (discussing how multiple nations may pass legislation in order to affect subsequent interpretation of a treaty).

80. See *id.* at 153.

81. See *Draft Articles on the Law of Treaties with Commentaries*, [1966] 2 Y.B. Int'l L. Comm'n 187, 222, U.N. Doc. A/CN.4/SER.A/1966/Add.1 (discussing how the Commission established that every party needs to accept the practice in order for it to become an authentic interpretation).

82. See ILC, *supra* note 73, at 75 (stating that parties must be aware of and accept a common interpretation of a treaty).

illegal, it runs counter to international law.”⁸³ Additionally, other parties to the Treaty, like Norway, have called attention to the fact that there is no consensus regarding the interpretation of the international legal framework surrounding space resources.⁸⁴

3. *The Moon Agreement*

Although only eighteen countries have ratified the Moon Agreement, it remains important in the context of international space law.⁸⁵ This section will discuss the Moon Agreement in the context of spacefaring nations’ resistance to adopt new space governance.⁸⁶ Article 11(3), which prohibits any property rights over any natural resources on the Moon, will be most relevant for this discussion.⁸⁷

The Moon Agreement envisioned an international regulatory scheme and established the Moon as a global common.⁸⁸ It prohibited all forms of ownership in resources extracted from the moon via space mining.⁸⁹ Thus, the United States and spacefaring nations rejected it, viewing it as an impediment to progress.⁹⁰ Consequently, only eighteen countries have ratified this agreement, and it is considered a failure.⁹¹

83. *Russia Will Not Accept Attempts to Privatize the Moon, Says Roscosmos CEO*, TASS (May 25, 2020) [hereinafter *Russia Will Not Accept Attempts to Privatize the Moon*], <https://tass.com/science/1159969>.

84. U.N. Comm. on the Peaceful Uses of Outer Space [UNOOSA], *Norway – Input to the Working Group on Legal Aspects of Space Resource Activities*, U.N. Doc. A/AC.105/C.2/2023/CRP.19 (Mar. 20, 2023) [hereinafter *Norway Working Group Submission*].

85. See Wedenig & Wright Nelson, *supra* note 58 (highlighting the importance of the Moon Agreement despite its struggle to gain signatories).

86. See *infra* Part II.B.3.

87. See *The Moon Agreement*, *supra* note 57 (explaining that the United States, Luxembourg, the U.A.E., and Japan are not parties to this Treaty).

88. See *id.* (establishing that the Moon shall be the province of all mankind).

89. Wrench, *supra* note 62, at 447.

90. See *L5 News: U.N. Moon Treaty Falling to U.S. Opposition Groups [From L5 News, March 1982]*, NAT’L SPACE SOC’Y, <https://nss.org/15-news-un-moon-treaty-falling-to-us-opposition-groups> (citing heavy criticism from U.S. businesses and scientific communities because the Moon Treaty would have prohibited commercial development in space).

91. See Michael Listner, *The Moon Treaty: Failed International Law or Waiting in the Shadows?*, THE SPACE REV. (Oct. 24, 2011), <https://www.thespacereview.com/article/1954/1> (stating that the Treaty is considered a failure because major

C. OUTER SPACE UNDER DOMESTIC LAW

Attempting to advance their own interpretation⁹² of “appropriation” under the Outer Space Treaty, the United States, Luxembourg, the U.A.E., and Japan have each passed national legislation.⁹³ This legislation establishes property rights for private companies that extract natural resources in space.⁹⁴ Each nation asserts that its national legislation is compliant with the Outer Space Treaty.⁹⁵

In 2015, the United States Congress passed the Commercial Space Launch Competitiveness Act.⁹⁶ This law addresses many aspects of commercial space, including space resource rights.⁹⁷ It gives U.S. companies rights over resources acquired in space.⁹⁸ Eric Stallmer, President of the Commercial Spaceflight Federation, applauded the passage of this bill, saying, “[b]y removing the regulatory unknowns that suppress and repel investment, this bill unleashes and incentivizes the creativity that leads to unknown breakthroughs in innovation.”⁹⁹ This move facilitated private companies to secure funding for space mining projects.¹⁰⁰

spacefaring nations have not signed onto or ratified it).

92. *Id.* (describing the Big Three’s stances on the Moon Treaty and appropriation in general).

93. *See* Zielinski, *supra* note 7 (discussing that the legislations passed by Japan, Luxembourg, and the U.A.E. are based on the one passed by the United States).

94. *See id.* (explaining that the legislation does not determine the extraction of space resources to constitute a national appropriation, allowing for private companies to claim private property of space resources).

95. *See* BYERS & BOLEY, *supra* note 69, at 152 (stating that national legislation can help to clarify the interpretation of a treaty provision).

96. *See* U.S. Commercial Space Launch Competitiveness Act, 51 U.S.C. § 51303 (2015) (“A United States citizen engaged in commercial recovery of an asteroid resource or a space resource under this chapter shall be entitled to any asteroid resource or space resource obtained including to possess, own, transport, use, and sell the asteroid resource or space resource obtained in accordance with applicable law, including the international obligations of the United States.”).

97. *See* Jeff Foust, *House Passes Commercial Space Bill*, SPACE NEWS (Nov. 16, 2015), <https://spacenews.com/house-passes-commercial-space-bill> (describing the contents of the Bill, including the section on space resource rights).

98. *See id.* (stating that the Bill grants rights to resources extracted in space by U.S. companies).

99. *Id.*

100. *See* James T. Walsh & R. Paul Stimers, *Politics Stops at the Atmosphere’s Edge*, THE HILL (Dec. 9, 2015), <https://thehill.com/blogs/pundits-blog/technology/262580-politics-stops-at-the-atmospheres-edge> (stating the law would advance the

The passage of the Commercial Space Launch Competitiveness Act prompted several other spacefaring nations to pass similar legislation giving private companies ownership over materials acquired in space.¹⁰¹ In 2017, Luxembourg passed the Law of 2017 on the Exploration and Use of Space Resources. Article 1 of the law explicitly states, “Space resources are capable of being owned.”¹⁰² Even though Luxembourg is a small country, it is an economic powerhouse and has played a significant role in satellite development.¹⁰³ Like the United States, it stands to gain by commercializing space via a narrower interpretation of appropriation.¹⁰⁴

In 2019, the U.A.E. also passed the Space Resources Regulations, which establishes standards for space-related activities, including extracting space resources.¹⁰⁵ Article (7)(1) gives ownership rights over space resources, stating, “An Operator shall be entitled to exercise ownership rights . . . over any Space Resources which the Operator has explored, exploited, or used through its Space Resources Activities. . . .”¹⁰⁶ The U.A.E. also views this interpretation of “appropriation” as a commercial opportunity to diversify its oil-based

sector by unlocking more private-sector funding for space mining companies).

101. See Laurent Thailly, *Filling the Void: Luxembourg Leads the Way in Europe by Regulating the Ownership of Space Resources*, OGIER (Aug. 1, 2017), <https://www.ogier.com/news-and-insights/news/the-luxembourg-space-law> (stating similarities between Luxembourg law and U.S. law).

102. See Luxembourg 2017 Space Law, *supra* note 78, art. 1 (holding “the resources of space are susceptible to appropriation”).

103. See Cecilia Jamasmie, *Luxembourg to Set up Europe Space Mining Centre*, MINING.COM (Nov. 18, 2020), <https://www.mining.com/luxembourg-to-create-space-resources-centre> (stating Luxembourg has a significant place in the space industry and the development of satellite communications); see also BYERS & BOLEY, *supra* note 69, at 153 (pointing out that Luxembourg is home to the two largest operators of geosynchronous communications satellites).

104. See BYERS & BOLEY, *supra* note 69, at 153 (stating Luxembourg, like the U.S., is a country seeking a narrower interpretation and has adopted legislation along those lines to facilitate the commercialization of space).

105. See U.A.E. Space Resources Regulation, *supra* note 78 (“Ownership rights include, in particular, the right of ownership, purchase, sale, trade, transportation, storage, use, or dispose of any Space Resources extracted in the course of authorized Space Resources Activity.”).

106. See *id.* art. 7(1).

economy.¹⁰⁷ The U.A.E. seeks to transform into a knowledge economy in which growth comes from the ability to capitalize on scientific discoveries and applied research, rather than primarily relying on oil production.¹⁰⁸ The U.A.E. currently oversees seven synthetic aperture radar (SAR) satellites.¹⁰⁹ It also has a scientific probe called “Hope” that orbits Mars and collects data.¹¹⁰ By expanding its scope beyond satellites, the U.A.E. could further diversify its economy through the commercialization of space, which drives its motivation to pursue a narrower interpretation of the Outer Space Treaty.¹¹¹ Consequently, space mining could be the next scientific frontier for this country.¹¹²

Like the aforementioned countries,¹¹³ Japan has also advanced this

107. See BYERS & BOLEY, *supra* note 69, at 153 (listing the U.A.E. alongside countries such as the U.S. and Luxembourg as those that have passed legislation aimed at facilitating the commercialization of space); *U.A.E. Space Sector Enhances Global Competitiveness, Contributes to Economy*, BUS. STANDARD (Sept. 4, 2023), https://www.business-standard.com/world-news/uae-space-sector-enhances-global-competitiveness-contributes-to-economy-123090400549_1.html (“For the U.A.E., space economy is a pivotal pillar in its ambitious journey . . . for a diversified economy.”).

108. See *United Arab Emirates: Country Commercial Guide*, INT’L TRADE ORG. (Nov. 24, 2023), <https://www.trade.gov/knowledge-product/united-arab-emirates-market-overview> (stating the U.A.E.’s goal is to diversify quickly and transform into a knowledge economy); Adam Hayes, *What is the Knowledge Economy? Definition, Criteria, and Example*, INVESTOPEDIA (Jan. 22, 2021), <https://www.investopedia.com/terms/k/knowledge-economy.asp> (stating that a knowledge economy is a “marketplace for the production and sale of scientific and engineering discoveries”).

109. See *Bayanat, Yahsat and ICEYE Expand Domestic Earth Observation Satellite Fleet to Seven Spacecraft Covering the Middle East*, ICEYE (Nov. 13, 2023), <https://www.iceye.com/press/press-releases/bayanat-yahsat-and-iceye-expand-domestic-earth-observation-satellite-fleet-to-seven-spacecraft-covering-the-middle-east>.

110. See *About EMM*, U.A.E. SPACE AGENCY, <https://www.emiratesmarsmission.ae> (conveying that the Hope Mission is meant to answer key questions about the Martian atmosphere).

111. See *U.A.E. Space Sector Enhances Global Competitiveness, Contributes to Economy*, *supra* note 107 (stating that space economy is crucial to laying a foundation for a diversified economy).

112. See Nadine Kahil, *U.A.E. Space Agency Invites Private Sector to Join Emirates Mission to Asteroid Belt*, WIRED (June 21, 2024), <https://wired.me/business/uae-space-agency-private-sector> (stating the U.A.E. Space Agency has specifically been collaborating with private companies on how to develop a lander for asteroid touchdown and mining).

113. See U.S. Commercial Space Launch Competitiveness Act, 51 U.S.C. § 51303 (2015); Luxembourg 2017 Space Law, *supra* note 78, art. 1; U.A.E. Space

interpretation of “appropriation” with the goal of exploiting space resources on the Moon.¹¹⁴ It passed legislation that allows companies to extract and utilize space resources.¹¹⁵ One Japanese space company, “inspace,” expressed that this new legislation would give them the ability to have a continuous presence on the Moon for mining and extraction purposes.¹¹⁶ This legislation gives investors legal certainty before developing expensive technologies.¹¹⁷

The effort to establish this interpretation of “appropriation” continued in 2020 with President Trump’s Executive Order on National Space Policy and the adoption of the Artemis Accords.¹¹⁸ These actions signaled that the Administration did not want the Outer Space Treaty to prevent space mining or rights over space resources.¹¹⁹

The Order explicitly rejects the Moon Treaty,¹²⁰ which considers the Moon and other celestial bodies as global common property.¹²¹

Resources Regulation, *supra* note 78, art. 7.

114. See BYERS & BOLEY, *supra* note 69, at 153 (listing Japan alongside the U.S., the U.A.E., and Luxembourg as those who have passed legislation aimed at facilitating the commercialization of space).

115. See Japan Space Resources Act, *supra* note 78, art. 5 (“A person who conducts business activities related to the exploration and development of space resources shall acquire the ownership of space resources that have been mined. . .”).

116. See *iSpace Applauds Japan’s Passage of Space Resources Law*, ISPACE (June 15, 2021), <https://inspace-inc.com/news-en/?p=5228#> (stating that the new legislation would allow iSpace to further develop the lunar economic zone).

117. See BYERS & BOLEY, *supra* note 69, at 153 (highlighting a statement from iSpace that confirmed its welcoming of the legislation because it allowed it to operate continuously in a fixed location on the Moon).

118. See Exec. Order No. 13914, 85 Fed. Reg. 20381 (Apr. 6, 2020) (“Americans should have the right to engage in commercial exploration, recovery, and use of resources in outer space, consistent with applicable law.”); Artemis Accords, *supra* note 21, § 10(1) (“The Signatories note that the utilization of space resources can benefit humankind by providing critical support for safe and sustainable operations.”).

119. See BYERS & BOLEY, *supra* note 69, at 159 (discussing how the passing of the Artemis Accords clearly indicated the Trump Administration’s desire for the Outer Space Treaty not to preclude property rights over space resources).

120. See The Moon Agreement, *supra* note 57, art. 11. The United States and other major Spacefaring nations are not Parties to this agreement, which has only been ratified by 18 countries.

121. See Jeff Foust, *White House Looks for International Support for Space Resource Rights*, SPACE NEWS (Apr. 6, 2020), <https://spacenews.com/white-house-looks-for-international-support-for-space-resource-rights> (noting that the Executive

Trump described space as a “unique domain of human activity” that is not a “global common.”¹²² Additionally, he encouraged, “international support for the . . . private recovery . . . of resources in outer space.”¹²³

The United States adopted the Artemis Accords in 2020 as a non-binding set of principles to guide modern civil space exploration through peaceful cooperation.¹²⁴ Article 10(2) explicitly states that the extraction of space resources does not inherently constitute national appropriation under the Outer Space Treaty, further advancing the agenda of narrowing the scope of the non-appropriation principle.¹²⁵

Moreover, Section 11 of the Artemis Accords discusses “safety zones,” which are areas where a country conducts space activities.¹²⁶ Parties to the agreement are required to give notification and coordinate with other actors to avoid interference with each other’s use of outer space in their activities.¹²⁷ Essentially, one actor cannot come into the safety zone of another actor without giving notice, coordinating with the zone’s user, and giving notice of the establishing party’s presence.¹²⁸

III. ANALYSIS

Under the Vienna Convention on the Law of Treaties, the

Order opposes the Moon Agreement, which calls the moon and other celestial bodies the “common heritage of mankind”).

122. *See id.* (“Outer space is a legally and physically unique domain of human activity, and the United States does not view it as a global commons.”).

123. Exec. Order No. 13914, 85 Fed. Reg. at 20381.

124. *See Artemis Accords, supra* note 21, pmb. § 1. As of June 2024, signatories include the following: Angola, Argentina, Australia, Bahrain, Belgium, Brazil, Bulgaria, Canada, Colombia, Czech Republic, Ecuador, France, Germany, Greece, Iceland, India, Israel, Italy, Japan, Luxembourg, Mexico, Netherlands, New Zealand, Nigeria, Peru, Poland, the Republic of Korea, Romania, Rwanda, Saudi Arabia, Singapore, Slovakia, Spain, Sweden, Switzerland, Ukraine, the United Arab Emirates, the United Kingdom, the United States, and Uruguay.

125. *See id.* art. 10(2) (“The Signatories affirm that the extraction of space resources does not inherently constituted national appropriation.”).

126. *See id.* 11(7) (stating that a ‘safety zone’ is an area in which nominal operations of a relevant activity, or an anomalous event, could reasonably cause harmful interference to another nation’s activity).

127. *See id.*

128. *See id.* art. 11(10) (noting that signatories of the Accords must commit to respecting reasonable safety zones to avoid harmful interference).

spacefaring countries cannot promote their own interpretation of the Outer Space Treaty without the agreement of the other Signatories.¹²⁹ Thus, the national legislation that those countries enact is not binding under the Outer Space Treaty.¹³⁰ Because the Treaty is vague, new rules need to be passed so that new developments like space mining can take place in a safe way.¹³¹ In the spirit of the Outer Space Treaty, all Signatories should be involved in the creation of a new instrument even if they do not have technological capabilities equal to those of spacefaring countries.¹³²

A. SPACEFARING NATIONS CANNOT UNILATERALLY NARROW THE INTERPRETATION OF THE NON-APPROPRIATION PRINCIPLE

Although the interpretation of treaties can evolve over time, the United States, Luxembourg, the U.A.E., and Japan cannot unilaterally narrow the scope of the non-appropriation principle because not all the parties to the Treaty agree.¹³³ Subsequent practice is a means to treaty interpretation that can narrow or widen the effect of a term, but certain requirements must be met.¹³⁴

1. Agreement of All Parties Must be Demonstrated

For subsequent practices to establish agreement of a certain treaty

129. See Vienna Convention, *supra* note 72, art. 31(3)(b) (holding that any practice in the application of a treaty to be used in interpretation of a treaty must be established by the agreement of the parties regarding its interpretation).

130. See ILC, *supra* note 73, at 37, 51, 75 (stating that subsequent practice, under the Vienna Convention may consist of legislative actions, and can contribute to treaty interpretation or clarification, but need not be legally binding).

131. See O'Brien, *supra* note 70 ("The Outer Space Treaty does not adequately address space resource activity and how the benefits of outer space are to be shared.").

132. See Outer Space Treaty, *supra* note 4, art. I (emphasizing that the exploration and use of outer space includes all countries, regardless of wealth or scientific development).

133. See Vienna Convention, *supra* note 72, art. 31(3)(b).

134. See ILC, *supra* note 73, at 27, 43, 51, 70, 75 (stating subsequent practice can be used for interpretation or clarification that results in the narrowing or widening possible interpretations, but only when the subsequent practice is consistent and embraces all the parties); Rahim Moloo, *When Actions Speak Louder Than Words: The Relevance of Subsequent Party Conduct to Treaty Interpretation*, 31 BERKELEY J. INT'L L. 39, 68–69 (2013).

interpretation, the parties to the Treaty must agree.¹³⁵ In the commentaries for Draft Articles on the Law of Treaties, the International Law Commission emphasized the necessity of a common understanding of the parties as to the meaning of the debated term.¹³⁶ Consequently, Courts and Tribunals follow this guidance.¹³⁷

In a case before the European Court of Human Rights, the Court considered whether homosexual couples have the right to marry.¹³⁸ The couple argued that Article 9 of the Charter gave them a right to marriage.¹³⁹ The government argued that while there had been major social changes in the institution of marriage, there was not any European consensus on granting same-sex couples the right to marry.¹⁴⁰ Ultimately, the Court held that it could not interpret the Charter to include a right to same sex marriage since there was not a general consensus among European countries.¹⁴¹

135. See ILC, *supra* note 73, at 43, 75 (stating the parties must have a common and accepted understanding regarding the interpretation of the subsequent practice to be used).

136. See *Draft Articles on the Law of Treaties with Commentaries*, [1966] 2 Y.B. Int'l L. Comm'n 187, 222, U.N. Doc. A/CN.4/SER.A/1966/Add.1 (clarifying that while the text omitted "all" from "establishes the understanding of all the parties," in the 1964 provisional text, the phrase is intended to consider the parties as a whole, and "all" was removed to avoid the misconception that every party has to engage in the practice for it to be considered subsequent practice).

137. See *Canadian Cattlemen v. U.S.*, Award on Jurisdiction, ¶ 183 (NAFTA Ch. 11/UNCITRAL Arb. Trib. 2008), <https://www.italaw.com/sites/default/files/case-documents/ita0114.pdf> (reaffirming that subsequent practice may be referenced where it "clearly establishes the understanding of all the parties regarding its interpretation").

138. See *Schalk & Kopf v. Austria*, App. No. 30141/04 (June 24, 2010), <https://hudoc.echr.coe.int/fre?i=002-912> ("The applicants alleged . . . they were discriminated against as, being a same-sex couple, they were denied the possibility to marry or to have their relationship otherwise recognized by law.").

139. See *id.* ¶¶ 11, 24 (arguing that the legal impossibility of their marriage was an attack on their rights given the guarantees of Article 9); Charter of Fundamental Rights of the European Union art. 9, Dec. 18, 2000, 2000 O.J. (C 364) 1, 10 ("The right to marry and to found a family shall be guaranteed in accordance with the national laws governing the exercise of these rights.").

140. See *Schalk & Kopf v. Austria*, ¶¶ 27–28, 43. At the time of this case, only six out of 47 member states granted same-sex couples access to marriage (Belgium, the Netherlands, Norway, Portugal, Spain, and Sweden).

141. See *id.* ¶ 105 (holding that the lack of majority legal recognition among European states meant there was no established consensus, and therefore no right).

Similarly, there is not a consensus among the parties of the Outer Space Treaty that the non-appropriation principle only applies to claims of national sovereignty and not natural resources.¹⁴²

There is not a required number of parties that must take part in the conduct constituting subsequent practice.¹⁴³ Although subsequent practice does not require the participation of all parties in a large multilateral treaty, it is very difficult to establish subsequent practice with only one or a few parties.¹⁴⁴ It is a high threshold because there needs to be a showing of substantial agreement.¹⁴⁵

In the case of the Outer Space Treaty, there are only four countries which have passed national legislation in attempt to establish subsequent practice: the United States, Luxembourg, the U.A.E., and Japan.¹⁴⁶ With 114 parties to the Outer Space Treaty, this is not enough to constitute subsequent practice.¹⁴⁷

There is an argument that the Artemis Accords,¹⁴⁸ which currently have forty-three Signatories, demonstrate a stronger showing of subsequent practice because there is a growing number of Signatories.¹⁴⁹ But one country in particular, Australia, presents an

142. See *Norway Working Group Submission*, *supra* note 84 (confirming there is no consensus when it comes to the interpretation of legal framework that pertains to space resource activities).

143. See ILC, *supra* note 73, at 75 (asserting that the number of parties that must actively engage in a subsequent practice to establish an agreement can vary).

144. See *Moloo*, *supra* note 134, at 68–69; Appellate Body Report, *European Communities – Customs Classification of Frozen Boneless Chicken Cuts*, ¶ 259, WTO Doc. WT/DS269/AB/R (adopted Sept. 12, 2005) (holding that it would be too difficult to find subsequent practice on the basis of one or very few parties to a multilateral treaty).

145. See Melissa J. Durkee, *Interstitial Space Law*, 97 WASH. U. L. REV. 423, 471 (2019).

146. See U.S. Commercial Space Launch Competitiveness Act, 51 U.S.C. § 51303 (2015); Luxembourg 2017 Space Law, *supra* note 78, art. 1; U.A.E. Space Resources Regulation, *supra* note 78, art. 7; Japan Space Resources Act, *supra* note 78, art. 5.

147. See Durkee, *supra* note 145, at 471 (stating that “subsequent practice” could only be determined by showing substantial agreement among all parties of the treaty).

148. See Artemis Accords, *supra* note 21, § 13(3) (conveying how States could become signatories to the Accords in the future).

149. See Robert Lea, *Artemis Accords: What Are They & Which Countries Are Involved?*, SPACE.COM (June 3, 2024), <https://www.space.com/artemis-accords->

interesting contention.¹⁵⁰ Australia is party to both the Moon Agreement and to the Artemis Accords.¹⁵¹ Because the Moon Agreement explicitly prohibits the ownership of any space resources,¹⁵² and the Artemis Accords clearly suggest that ownership of space resources is permissible,¹⁵³ the two agreements are at odds with each other and put Australia in a complex position.¹⁵⁴ Some speculate whether Australia will withdraw from the Moon Agreement because of this conflict.¹⁵⁵ Although Australia is torn between the treaties' obligations, being a party to the Moon Agreement could put Australia in a position to lead the way in responsible decisions regarding space mining and other uses of space.¹⁵⁶ For instance, in a submission to the United Nations Office for Outer Space Affairs Working Group on Space Resources, Australia asserts that the elements of Articles I and II of the Outer Space Treaty need to be considered in a space resources context.¹⁵⁷

explained (listing the 42 States that have become signatories to the Artemis Accords, including Peru and Slovakia in 2024).

150. See Stacey Henderson, *To the Moon and Beyond: Australia's Space Activities and Obligations Under International Law*, AUSTL. INST. OF INT'L AFFS. (Apr. 3, 2023), <https://www.internationalaffairs.org.au/australianoutlook/to-the-moon-and-beyond-australias-space-activities-and-obligations-under-international-law> (discussing how Australia may soon find itself torn between its obligations under international space law and its ever-developing space activities).

151. See The Moon Agreement, *supra* note 57, at 52; Artemis Accords, *supra* note 21, at 8; Lea, *supra* note 149.

152. See The Moon Agreement, *supra* note 57, art. 11 (“Neither the surface nor the subsurface of the moon, nor any part thereof or natural resources in place, shall become property of any State, international intergovernmental or non-governmental organization, national organization or non-governmental entity or of any natural person.”).

153. See Artemis Accords, *supra* note 21, § 10(2) (“The Signatories note that the utilization of space resources can benefit humankind by providing critical support for safe and sustainable operations.”).

154. See Henderson, *supra* note 150.

155. See *id.* (“Australia may soon be forced to decide whether it is in the national interest to follow Saudi Arabia’s lead and also withdraw from the Moon Agreement, or whether it can continue to balance its competing international obligations.”); see also Wedenig & Wright Nelson, *supra* note 58 (discussing how Saudi Arabia withdrew from the Moon Agreement shortly after signing the Artemis Accords).

156. See Henderson, *supra* note 150.

157. See U.N. Comm. on the Peaceful Uses of Outer Space [UNOOSA], *Australia – Input to the Working Group on Legal Aspects of Space Resource Activities 2–3*, U.N. Doc. A/AC.105/C.2/2023/CRP.7 (Mar. 20, 2023) [hereinafter *Australia’s*

Thus, because there is not enough agreement among the Signatories of the Outer Space Treaty on narrowing the interpretation of the non-appropriation principle, the United States, Luxembourg, the U.A.E., and Japan's actions to pass national legislation to advance this interpretation is not enough to establish subsequent practice.¹⁵⁸ The Artemis Accords, although presenting a stronger argument, also do not sufficiently establish subsequent practice for the same reasons.¹⁵⁹ Moving forward, it will be important to observe how Australia reconciles being a Signatory of both the Moon Agreement and the Artemis Accords as international space law progresses and what actions it chooses to take.¹⁶⁰

2. Party Silence Can Constitute Acceptance

In treaty interpretation, silence can constitute acceptance when considering if subsequent practice shows agreement.¹⁶¹ If a reaction would be expected in response to the actions of other parties, and there is no reaction, agreement can be assumed.¹⁶² Courts view lack of protest and failure to react to acts openly performed to constitute recognition of a claim or acceptance of a certain interpretation.¹⁶³ For example, in a border dispute between Argentina and Chile concerning the Beagle Channel, the Court found that Argentina's acquiescence to Chile openly occupying islands in the channel supported Chile's

Response to the Invitation] (referring to the Outer Space Treaty as the cornerstone of the international legal framework regulating the use and exploration of outer space and emphasizing compliance with its Articles).

158. See generally Moloo, *supra* note 134, at 68–69 (pointing to caselaw that does not find subsequent practice where very few of the parties agree).

159. See *id.*

160. See Henderson, *supra* note 150.

161. See Moloo, *supra* note 134, at 66 (citing *Costa Rica v. Nicaragua* where the Judge stated that “continued failure to react to acts openly performed . . . tend[s] to give some support to that interpretation of it which alone could justify such acts.”)

162. See *id.* at 66, 72; see also ILC, *supra* note 73, at 75 (“Silence on the part of one or more parties may constitute acceptance of the subsequent practice when the circumstances call for some reaction.”).

163. See *Dispute Regarding Navigational and Related Rights (Costa Rica v. Nicar.)*, Judgment, 2009 I.C.J. 214, 285, ¶ 9 (July 13) (separate opinion by Skotnikov, J.) (viewing Nicaragua's lack of protest to Costa Rica's use of the San Juan River for tourism purposes as a recognition of Nicaragua that Costa Rica acted as of right).

interpretation of the treaty that the islands were within its borders.¹⁶⁴

Silence as acceptance does not apply within the Outer Space Treaty because there are parties to the Treaty who are vocal objectors.¹⁶⁵ States have directly criticized the passage of legislation like the U.S. Commercial Space Launch Competitiveness Act¹⁶⁶ and the adoption of the Artemis Accords.¹⁶⁷ States have also criticized the unilateral nature of developing space law through national legislation rather than through international cooperation in the United Nations.¹⁶⁸

3. *Weight of Subsequent Practice*

The weight afforded to subsequent practices depends on several things: (1) the clarity and specificity of the subsequent practice;¹⁶⁹ and (2) on whether and how the subsequent practice is repeated.¹⁷⁰

Parties advocating for the narrower definition of “appropriation” may find appeal in this subsection. The assertion that ownership of space resources is compliant with international obligations (the Outer

164. See *Beagle Channel Arb. (Arg. v. Chile)*, 21 R. Int'l Arb. Awards 53, 187, ¶¶ 169(a)–(b) (1977).

165. See generally *Russia Will Not Accept Attempts to Privatize the Moon*, *supra* note 83 (accusing the United States of adopting laws that are counter to international law).

166. See *id.*

167. See Leonard David, *Cooperation on the Moon: Are the Artemis Accords Enough?*, SPACE.COM (Feb. 27, 2024), <https://www.space.com/artemis-accords-moon-cooperation-pros-cons-signing> (describing comments made by a researcher in the United Nations Institute for Disarmament Research where she points out that Russia and China have criticized the Artemis Accords for being too U.S.-centric).

168. See GRP. OF 77, STATEMENT OF THE G-77 AND CHINA DURING THE SIXTY-SIXTH SESSION OF THE UNITED NATIONS COMMITTEE ON THE PEACEFUL USES OF OUTER SPACE, AGENDA ITEM 7: REPORT OF THE LEGAL SUBCOMMITTEE ON ITS SIXTY-SECOND SESSION 7–8 (2023) (noting that the Group is committed to the development of an “equitable, inclusive, constructive, collaborative and consensus based approach” for the future use of space resources); see also U.N. Comm. on the Peaceful Uses of Outer Space [UNOOSA], *Reviewing Opportunities for Achieving the Vienna Consensus on Space Security Encompassing Several Regulatory Domains: Working Paper Submitted by the Russian Federation* 6–7, U.N. Doc. A/AC.105/C.1/2016/CRP.15 (Feb. 16, 2016) (criticizing the U.S. for bypassing the Committee and ignoring the international draft code of conduct produced by the European Union).

169. See ILC, *supra* note 73, at 70.

170. See *id.*

Space Treaty) is clearly stated and repeated in legislation and policy.¹⁷¹ The U.S. Commercial Space Launch Competitiveness Act explicitly gives ownership rights over space resources, and it asserts it is in accordance with the international obligations of the United States.¹⁷² Additionally, Trump's Executive Order encourages private recovery and use of space materials, also asserting that it is consistent with applicable law (the Outer Space Treaty).¹⁷³ Furthermore, the Artemis Accords say, "the extraction of space resources does not inherently constitute national appropriation under Article II of the Outer Space Treaty."¹⁷⁴ Similarly, the Japanese Legislation states that the enforcement of its law will not hinder the implementation of treaties and other international agreements that Japan is a party to.¹⁷⁵

Even though these states clearly and continuously repeat the assertion that owning space resources follows international obligations, it is not enough to establish subsequent practice.¹⁷⁶ These assertions are the voice of only four countries and other parties have signaled disagreement which means the "weight of subsequent practice" requirement is not met.¹⁷⁷

4. *Relevant Considerations for Non-Parties*

Subsequent practice is judged only by the conduct of the parties in

171. See U.S. Commercial Space Launch Competitiveness Act, 51 U.S.C. § 51303 (2015); Exec. Order No. 13914, 85 Fed. Reg. 20381 (Apr. 6, 2020); Artemis Accords, *supra* note 21, §10(2); Japan Space Resources Act, *supra* note 78, art. 6(2).

172. 51 U.S.C. § 51303 ("A United States citizen engaged in commercial recovery of an asteroid resource or a space resource under this chapter shall be entitled to any asteroid resource or space resource obtained, including to possess, own, transport, use, and sell the asteroid resource or space resource obtained in accordance with applicable law, including the international obligations of the United States.").

173. See Exec. Order No. 13914, 85 Fed. Reg. at 20381 ("Americans should have the right to engage in commercial exploitation, recovery, and use of resources in outer space, consistent with applicable law.").

174. See Artemis Accords, *supra* note 21, §13(3).

175. See Japan Space Resources Act, *supra* note 78, art. 5.

176. See Durkee, *supra* note 145, at 471 (showing that there must be substantial agreement among the parties of the Outer Space Treaty to establish subsequent practice).

177. See ILC, *supra* note 73, at 70 (noting that the United States, the U.A.E., Luxembourg, and Japan are the only four out of 115 parties to the Treaty to adopt national laws that grant space resource rights, which are infrequent repetitions that do not carry sufficient weight).

the application of a treaty; however, conduct by non-State actors may also be relevant in the assessment.¹⁷⁸ For instance, courts have used the UNHCR Handbook¹⁷⁹ on Procedures and Criteria for Determining Refugee Status when interpreting the 1951 Convention and the 1967 Protocol relating to the Status of Refugees.¹⁸⁰ The UNHCR Handbook is written by the U.N. Refugee Agency, which is a non-state actor, and courts use it while applying the Refugee Convention to their laws.¹⁸¹ For example, in *Pushpanathan v. Canada*, the Court referred to portions of the *travaux préparatoires* of the Refugee Convention and the UNHCR Handbook when determining an interpretation of whether an individual, not acting on behalf of a state, could commit an act that is contrary to the purposes and principles of the U.N.¹⁸² While the UNHCR Handbook is not determinative and does not display state practice, it is a valid source that courts can use in interpretation.¹⁸³

There are not any existing non-State documents that define “non-appropriation” for a court or tribunal to rely on in the interpretation of this treaty provision.¹⁸⁴ Accordingly, the only factors that would be considered in interpreting the Outer Space Treaty are the actions of the parties.¹⁸⁵ Thus, the factors to be considered would be the passage of space resource legislation in the United States, Luxembourg, the

178. *See id.* at 37 (“Accordingly, the term ‘any conduct’ . . . is not limited to conduct of the organs of a State but may also cover conduct of private actors acting under delegated public authority.”).

179. *See* U.N. HIGH COMM’R FOR REFUGEES [UNHCR], HANDBOOK ON PROCEDURES AND CRITERIA FOR DETERMINING REFUGEE STATUS AND GUIDELINES ON INTERNATIONAL PROTECTION (1979), <https://www.refworld.org/policy/legal/guidance/unhcr/2019/en/123881>.

180. *See* Moloo, *supra* note 134, at 71.

181. *See* Regina v. Sec’y of State for the Home Dep’t, *ex parte Adan*, [1999] 3 W.L.R. 1274 (HL) 1296 (U.K.) (“While the Handbook is not by any means itself a source of law, many signatory states have accepted guidance which on their behalf the UNHCR was asked to provide, and in those circumstances it constitutes, in our judgment, good evidence of what has come to be international practice within article 31(3)(b) of the Vienna Convention.”)

182. *Pushpanathan v. Canada*, [1988] S.C.R. 982, 1060 (Can.).

183. *Id.* at 1021–22.

184. *See* Moloo, *supra* note 134, at 72 (showing that non-state documents are used by courts to interpret treaties).

185. *See* ILC, *supra* note 73, at 37 (stating that although non-state conduct may be relevant, subsequent practice consists of the conduct of the parties).

U.A.E., and Japan and the reactions from other Treaty Signatories.¹⁸⁶ These reactions point to the conclusion that there is no consensus in narrowing the interpretation of the non-appropriation principle.¹⁸⁷

B. THE IMPORTANCE OF CONSENSUS REGARDING THE NON-APPROPRIATION PRINCIPLE

Allowing the wealthiest and most technologically advanced spacefaring nations to dictate international standards for space mining would be unfair and contrary to the principles of the Outer Space Treaty.¹⁸⁸ Additionally, without the affirmation of non-spacefaring nations in the Global South, there is a lack of legitimacy associated with the narrower interpretation.¹⁸⁹ There is a glaring power imbalance between spacefaring and non-spacefaring countries,¹⁹⁰ but that does not mean that spacefaring nations should be given more weight in determining how to interpret the Treaty.¹⁹¹ Indeed, the international space law regime has had success up to this point because the Outer Space Treaty was agreed upon unanimously—not just by the United States and Soviet Union during the Space Race.¹⁹²

History suggests that the effectiveness of an agreement is linked to

186. *See id.* (stating that subsequent practice can consist of legislative functions).

187. *See id.* at 75 (requiring a common understanding of the treaty which the parties are aware of and accept).

188. *See* Outer Space Treaty, *supra* note 4, art. I (“The exploration and use of outer space, including the moon and other celestial bodies, shall be carried out for the benefit and in the interest of all countries, irrespective of their degree of economic or scientific development, and shall be the province of mankind.”).

189. *See* John Hickman, *Opinion – The Unimpressive Nature of the Artemis Accords*, E-INT’L RELS. (Oct. 19, 2020), <https://www.e-ir.info/2020/10/19/opinion-the-unimpressive-nature-of-the-artemis-accords> (noting that signatures from the space agency directors of the Global South are missing from the Artemis Accords due to the current differences in ability to travel to space and this detracts from its legitimacy).

190. *See supra* Part II.A.

191. *See* BYERS & BOLEY, *supra* note 69, at 154 (describing how a power imbalance between spacefaring states and non-spacefaring states raises serious problems for subsequent practice).

192. *See* Hickman, *supra* note 189 (explaining that while the major superpowers signed the Outer Space Treaty as a nuclear arms agreement for space, the rest of the world signed it because it was a means to prevent outer space from transforming into another imperialist rivalry).

the level of consensus.¹⁹³ For example, the Helsinki Protocol on Reduction of Sulphur Emissions¹⁹⁴ is considered an ineffective agreement because it did little to solve the environmental problem.¹⁹⁵ The states contributing the most to the pollution were reluctant to regulate their emissions because it would affect their economies detrimentally, and they wanted more scientific certainty before action was taken.¹⁹⁶ Even though the agreement was eventually signed, there were a few detrimental compromises made due to the lack of consensus on how to approach and solve the problem that led to the agreement's ineffectiveness.¹⁹⁷ In the same vein, states should strive for strong consensus in international space governance in any agreement to avoid ineffectiveness.¹⁹⁸

Furthermore, the Outer Space Treaty is not a regular treaty; it affects each country and all of humanity.¹⁹⁹ The treaty should give equal weight to non-spacefaring and spacefaring nations as opposed to a "might is right" approach, which asserts that those in power determine what is acceptable.²⁰⁰ In fact, some argue in other instances that less powerful, non-spacefaring states, should be given disproportionate weight as state practice and evidence of *opinio juris*.²⁰¹ Although all states have a right to participate in the process of customary international law, the voices of the strong states often overpower the

193. See Karrin Scapple, *Is Consensus Necessary for Effective Environmental Treaties?*, 7 J. OF ENV'T & DEV. 364, 382 (1998).

194. Protocol to the 1979 Convention on Long-Range Transboundary Pollution on the Reduction of Sulphur Emissions or their Transboundary Fluxes by at Least 30 Per Cent, July 8, 1985, 1480 U.N.T.S. 215.

195. See Scapple, *supra* note 193, at 372–73 (noting that almost ten years after the adoption of the treaty, "sulfur deposition has yet to drop below the levels recorded at the 1950s").

196. See *id.* at 372.

197. See *id.* at 373.

198. See *id.* at 373, 382 (showing that treaty effectiveness is linked to consensus).

199. See Tim Marshall, *The New Space Race*, ROYAL MUSEUMS GREENWICH, <https://www.rmg.co.uk/stories/topics/new-space-race-astropolitics-power-21st-century> (discussing the global impact of space activities).

200. See BYERS & BOLEY, *supra* note 69, at 154; see also *Opinio Juris (International Law)*, CORNELL L. SCH. LEGAL INFO. INST., [https://www.law.cornell.edu/wex/opinio_juris_\(international_law\)](https://www.law.cornell.edu/wex/opinio_juris_(international_law)) (defining *opinio juris* as the subjective element of customary law, which is required to establish a legally binding custom).

201. See BYERS & BOLEY, *supra* note 69, at 154.

weaker states, unless the weaker states act in unison.²⁰² Because it is more difficult for those weaker states to take an oppositional position against powerful states, the showing of this deep commitment should arguably give weaker states' opinions more weight.²⁰³

Overall, the less wealthy and technologically advanced Signatories of the Outer Space Treaty should not be ignored when creating a new international space law regime because their consensus adds an important factor of legitimacy which is imperative for effectiveness of any agreement.²⁰⁴ Outer space transcends politics and borders, so it is crucial to consider of all of humanity.²⁰⁵

C. POTENTIAL CONFLICT IN SPACE WITH NON-ARTEMIS PARTIES

The Artemis Accords envision safety zones to notify Signatories of space activities and coordinate with each other to avoid "harmful interference."²⁰⁶ But as discussed above,²⁰⁷ the Artemis Accords are nothing more than principles.²⁰⁸ Since there are no binding legal obligations, there is risk of selective application and abuse of this standard.²⁰⁹

Additionally, although there is a growing number of countries adopting these principles,²¹⁰ they are nevertheless not internationally agreed upon, and there still remains a significant amount of

202. See Michael Byers, *Custom, Power, and the Power of the Rules*, 17 MICH. J. INT'L L. 109, 156 (1995) (discussing the interplay of less powerful states and more powerful states).

203. See BYERS & BOLEY, *supra* note 69, at 154 (noting parallels between the role of power in development and change of customary international law).

204. See Scapple, *supra* note 193, at 373, 382 (showing that treaty effectiveness is linked to consensus); Hickman, *supra* note 189.

205. See Danielle Kutchel, *Australia's Role in International Space Law*, LSJ (June 6, 2023), <https://lsj.com.au/articles/for-a-peaceful-future-australias-role-in-international-space-law> (explaining that part of the mission of the United Nations Committee on the Peaceful Uses of Outer Space is to ensure everyone, including those in less developed countries, can benefit from space use).

206. Artemis Accords, *supra* note 21, § 11(10).

207. See *supra* Part II.C.1.

208. See Artemis Accords, *supra* note 21, § 1.

209. See BYERS & BOLEY, *supra* note 69, at 174.

210. See Lea, *supra* note 149 (noting that the most recent countries to adopt the Artemis Accords are Peru and Slovakia, which signed the accords on May 30, 2024).

spacefaring nations that do not intend to adopt the Artemis Accords.²¹¹ Because of that, what prevents another state, who is not a party to the Artemis Accords, from coming into the zone?²¹² There is also risk that Artemis Signatories will not coordinate with non-Signatories like China, and their space activities could collide.²¹³ This is a serious issue as the National Aeronautics and Space Administration (NASA) and China both have interest in landing and surface operations on the same area of the Moon,²¹⁴ especially since the Artemis Accords do not have a mechanism to settle space disputes.²¹⁵

Safety zones also bring up non-appropriation issues because these safety zones must be temporary and non-exclusive to be compliant with the Outer Space Treaty.²¹⁶ Although the Accords stipulate that the zone will be temporary,²¹⁷ a declaration of a safety zone implied an obligation onto other states to stay out of the area, which consequently restricts free access into that zone.²¹⁸ Because of the Outer Space Treaty's principle of free access to all areas of celestial bodies,²¹⁹ any governance on safety zones should require the consent of all international actors in designating a safety zone.²²⁰ At the

211. See Mark R. Whittington, *Will Russia Rejoin the International Community Through Space, post-Putin?*, THE HILL (Oct. 16, 2022), <https://thehill.com/opinion/international/3688772-will-russia-rejoin-the-international-community-through-space-post-putin> (commenting on Russia's resistance to the Artemis Accords and how it views them as a means for the United States to dominate space); Eliot Ji, Michael B. Cerny, & Raphael J. Pileri, *What Does China Think About NASA's Artemis Accords?*, THE DIPLOMAT (Sept. 17, 2020), <https://thediplomat.com/2020/09/what-does-china-think-about-nasas-artemis-accords> (noting China's skepticism about the Artemis Accords).

212. See BYERS & BOLEY, *supra* note 69, at 174.

213. See *id.*

214. See Alexander Q. Gilbert, *Implementing Safety Zones for Lunar Activities Under the Artemis Accords*, 10 J. SPACE SAFETY ENG'G 103, 106 (2023) [hereinafter Gilbert, *Implementing Safety Zones*].

215. See David, *supra* note 167.

216. Outer Space Treaty, *supra* note 4, art. II.

217. See Artemis Accords, *supra* note 21, § 11(7)(c) ("Safety zones will ultimately be temporary, ending when the relevant operation ceases. . .").

218. See Gilbert, *Implementing Safety Zones*, *supra* note 214, at 106.

219. Outer Space Treaty, *supra* note 4, art. 1 ("Outer space, including the moon and other celestial bodies, shall be free for exploration and use by all States without discrimination of any kind . . . and there shall be free access to all areas of celestial bodies.").

220. See Jessie Kate Schingler, *Imagining Safety Zones: Implications and Open*

present, there is only a political commitment from the Signatories of the Artemis Accords to give notification of their presence.²²¹ The lack of consensus and binding rules presents a problem that could result in global conflict.

IV. RECOMMENDATIONS

A. NEW MULTILATERAL TREATY

To correct the aforementioned issues,²²² the Signatories of the Outer Space Treaty should create a new multilateral treaty that defines terms such as “appropriation” in a space mining context. It should explicitly address whether exploiting space resources is considered appropriation.²²³ Additionally, there should be a provision dedicated to safety zones and how parties should interact with each other in a space mining situation.²²⁴ Having a clear set of internationally agreed upon rules will also help circumvent any conflict that may arise.²²⁵ As of now, there is not a universally defined or accepted understanding of a safety zone and what its purpose should be.²²⁶ As such, a new multilateral treaty would define the term and state its purpose in the context of space mining, while ensuring that any safety zone does not impede free access to any celestial body.²²⁷

Further, there should be a provision dedicated to outlining a mechanism for resolving space disputes that may arise from activities such as space mining.²²⁸ This could potentially be an arm of the U.N. Office for Outer Space Affairs (UNOOSA) or the U.N. Committee on

Questions, THE SPACE REV. (June 8, 2020), <https://www.thespacereview.com/article/3962/1>.

221. Artemis Accords, *supra* note 21, § 11(5).

222. See *supra* Part III.A–C. (including faulty treaty interpretation, lack of consensus, and potential conflict).

223. See *Australia's Response to the Invitation*, *supra* note 157 (recommending that the working group consider Articles I and II in terms of outer space resources).

224. See Gilbert, *Implementing Safety Zones*, *supra* note 214, at 104.

225. See BYERS & BOLEY, *supra* note 69, at 174 (discussing the conflict that may arise among Artemis versus non-Artemis parties).

226. See Gilbert, *Implementing Safety Zones*, *supra* note 214, at 104.

227. See *id.* at 106 (emphasizing the importance of free access in space).

228. See David, *supra* note 167 (noting that a pitfall of the Artemis Accords is the lack of mechanisms to settle space disputes).

the Peaceful Uses of Outer Space (COPUOS) where the dispute is arbitrated.²²⁹ Such a treaty should also include provisions on environmental safety measures so that private mining companies do not shake space dust or debris into lunar orbits or inadvertently expose life forms to different celestial bodies.²³⁰

B. ADVOCACY CAMPAIGN

While the best case scenario to avoid any of the problems above is to create a new multilateral treaty, it will be difficult to convince any spacefaring nation like the United States, Luxembourg, the U.A.E., or Japan to sign onto any agreement that would restrict their commercial abilities and pose a threat to funding for space expenditures.²³¹ To illustrate that issue, look to the failed Moon Agreement.²³² For that reason, an international body, like UNOOSA, should launch a public relations campaign that highlights the dangers of not having a uniform and internationally agreed upon set of regulations to guide space mining.²³³

An effective advocacy campaign should outline that private companies are profit-driven, not safety or environmentally driven.²³⁴ Without any internationally agreed upon regulations surrounding space resource extraction, it is a race to the bottom where private companies will compete for their desired result of maximized profits by not prioritizing safety or the environment.²³⁵ Leaving space largely unregulated means that private companies, who are seeking to maximize their profits, have a lot of flexibility, which can lead to

229. See *Roles and Responsibilities*, U.N. OFF. FOR OUTER SPACE AFFS., <https://www.unoosa.org/oosa/en/aboutus/roles-responsibilities.html>; see also *Committee on the Peaceful Uses of Outer Space*, U.N. OFF. FOR OUTER SPACE AFFS., <https://www.unoosa.org/oosa/en/ourwork/copuos/index.html>.

230. See Sarah Scoles, *Dust from Asteroid Mining Spells Danger for Satellites*, NEWSIDENTIST (May 27, 2015), <https://www.newscientist.com/article/mg22630235-100-dust-from-asteroid-mining-spells-danger-for-satellites>.

231. See Wedenig & Wright Nelson, *supra* note 58 (refusing to join the Moon Agreement because it discourages commercial activity).

232. See *supra* Part II.B.3.

233. See BYERS & BOLEY, *supra* note 69, at 164–69 (highlighting the dangers of no internationally agreed upon space regulations).

234. See *id.* at 168.

235. See *id.* at 163, 168.

potential dangers such as creating more space debris.²³⁶ It is also important that space mining takes into account every state's interests because space involves all of humanity, not just a few states.²³⁷

In an advocacy campaign, it is important to bring light to how volatile the environment in outer space is and how small changes in space can pose a danger to scientific endeavors.²³⁸ It is crucial to exercise caution in launching any technology into space or engaging in any type of mission because a small mistake can have devastating consequences, especially when it comes to planetary protection.²³⁹ For instance, Israeli SpaceIL unknowingly placed thousands of Tardigrades²⁴⁰ on a robotic lander.²⁴¹ Fortunately, there were no consequences from this mistake because the moon is uninhabitable for living things.²⁴² However, things could have turned out very differently if

Additionally, the public may be unaware of the negative impacts that space mining can have on satellites in the lunar orbit.²⁴³ Space dust and space debris are other large risks that cannot be overlooked.²⁴⁴ Lunar dust is already a challenge to accessing the Moon because it is

236. See Scoles, *supra* note 230 (warning that asteroid mining missions could easily dislodge dust particles and potentially cause serious damage to the satellites they come into contact with).

237. See BYERS & BOLEY, *supra* note 69, at 163.

238. See *id.* at 164.

239. See Christopher D. Johnson et al., *The Curious Case of the Transgressing Tardigrades*, THE SPACE REV. (Aug. 26, 2019), <https://www.thespacereview.com/article/3783/1> (defining planetary protection as the notion that space exploration missions are dangerous because of the risk posed by biological contamination, which could ruin scientific investigations).

240. See Alina Bradford & Mindy Weisberger, *What are Tardigrades and Why Are They Nearly Indestructible?*, LIVE SCIENCE (last updated Feb. 23, 2024), <https://www.livescience.com/57985-tardigrade-facts.html> (explaining that tardigrades are microscopic animals that can survive extremely harsh conditions, including outer space).

241. See Keren Shahar & Dov Greenbaum, *Lessons in Space Regulations from the Lunar Tardigrades of the Beresheet Hard Landing*, 4 NATURE ASTRONOMY 208, 208 (2020); Johnson et al., *supra* note 239 (recalling how a non-profit organization placed tardigrades on the artifact that it was sending on SpaceIL without telling the Israeli Space Agency).

242. See BYERS & BOLEY, *supra* note 69, at 164–65.

243. See *id.* at 165–67.

244. See *id.*

fine and abrasive, and it has the potential to be exacerbated by space mining.²⁴⁵ This could in turn limit accessible lunar orbits.²⁴⁶

Overall, showing the dangers of leaving space unregulated and highlighting a few of the negative impacts that nonregulation or non-uniform regulation can cause is important.²⁴⁷ It can have the ability to mobilize the public into putting pressure on their respective governments to adopt internationally agreed upon rules to avoid these issues.

V. CONCLUSION

Major spacefaring nations such as the United States, the U.A.E., Luxembourg, and Japan, are violating the non-appropriation principle of the Outer Space Treaty by passing legislation that allows the extraction and ownership space resources. The vagueness of the Outer Space Treaty has permitted these states to circumvent their international obligations by advancing their own interpretations of the treaty for the sake of commercial competitiveness. There is a clear need to create a new treaty to avoid environmental disaster and conflict in space.

245. *See id.* at 167–68.

246. *See id.* at 166 (explaining that space mining can lead to uncontrolled outbursts of material that can occur during the mining process).

247. *See id.* at 162–68.