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Soft Law in Space: A Legal Framework for Extraterrestrial Mining

Laura C. Byrd

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SOFT LAW IN SPACE: A LEGAL FRAMEWORK FOR EXTRATERRESTRIAL MINING

ABSTRACT

As technology is rapidly expanding in the field of space exploration and the prospect of mining on the moon, asteroids, and other celestial bodies looms nearer, the problems caused by the absence of a legal framework to govern this type of activity in space are becoming more and more evident. The question remains open as to whether space resource extraction is permitted under existing international law, and it is unclear whether governments or private enterprises may assert property rights over such resources. While spacefaring nations appear to be reaching a common understanding that space resource extraction and utilization does not conflict with existing international space laws, such as the Outer Space Treaty, there is no law explicitly addressing this issue. The increasingly urgent need for a set of rules detailing the procedures and safeguards for space resource activities and addressing issues such as property rights is clear, but the proper forum and format for negotiating these rules is up for debate.

This Comment demonstrates the need for efficient and inclusive negotiations on the legal issues surrounding space resource extraction through a proper international forum. It details several major existing domestic and international terrestrial mining laws, as well as the current legal framework governing space. It then analyzes the various approaches to developing a law on space resources that have been proposed by various nations and scholars, arguing that the United States should lead negotiations to develop a set of soft law principles for space resource extraction through an international forum such as the U.N. Committee on the Peaceful Uses of Outer Space. Next, this Comment suggests several principles pulled from existing terrestrial mining laws, such as the 1872 Mining Law and the Antarctic Treaty System, that may be applicable to space resource activities. Finally, this Comment contemplates the various environmental concerns that may be raised when space resource extraction comes to fruition.

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INTRODUCTION

For many, the idea of mining the moon likely brings to mind a vision similar to *The Time Machine*'s infamous scene depicting the world's dim future—an image of the moon shattering and crashing into Earth after humans over-mined and depleted the moon's resources to the point of no return.¹ This cinematic portrayal, however, is not as far off from reality as some might think. Extraterrestrial mining, a concept that once existed only in science fiction, is now becoming a legitimate pursuit both for governments interested in maintaining a presence in space² and for private enterprises looking for the next big profit-making machine.³ In recent years, major tech companies have taken interest in the prospect of asteroid mining as space technology has advanced and scientists have discovered evidence proving that asteroids contain precious metals in quantities that could be worth trillions of dollars.⁴ Astrophysicist Neil deGrasse Tyson has made the grandiose prediction that “[t]he first trillionaire there will ever be is the person who exploits the natural resources on asteroids.”⁵ The more recent discovery of water ice on the moon, a resource that can be used for rocket fuel and would assist in long-term space exploration, has shifted the moon to the forefront of the field of resource extraction.⁶

In an effort to fulfill this dream of future riches, the private sector has begun to dominate the field of space exploration and resource extraction.⁷ Planetary

¹ THE TIME MACHINE (Warner Bros., Dreamworks Pictures 2002).

² See *Insight—Encouraging the Recovery and Use of Space Resources: Recommendations for Governmental Policies and Engagement*, SECURE WORLD FOUND. (Oct. 8, 2020), <https://swfound.org/news/all-news/2020/10/insight-encouraging-the-recovery-and-use-of-space-resources-recommendations-for-governmental-policies-and-engagement> (describing the momentum among spacefaring nations to “formalize and normalize” space resource utilization).

³ See Andrew Glester, *The Asteroid Trillionaires*, PHYSICS WORLD, June 2018, at 31, 33 (explaining the race within the private sector to be the first to mine asteroids for valuable minerals).

⁴ See *id.* at 33–34; Andrew Wong, *Space Mining Could Become a Real Thing—And It Could Be Worth Trillions*, CNBC (May 15, 2018, 12:39 AM), <https://www.cnbc.com/2018/05/15/mining-asteroids-could-be-worth-trillions-of-dollars.html>.

⁵ Katie Kramer, *Build the Economy Here on Earth by Exploring Space: Tyson*, CNBC (May 3, 2015, 9:00 AM), <https://www.cnbc.com/2015/05/01/build-the-economy-here-on-earth-by-exploring-space-tyson.html>; see also Glester, *supra* note 3 (“I’ll make a prediction right now. The first trillionaire will be made in space.” (quoting Sen. Ted Cruz)).

⁶ See Kenneth Chang, *There’s Water and Ice on the Moon, and in More Places than NASA Thought*, N.Y. TIMES (Oct. 26, 2020), <https://www.nytimes.com/2020/10/26/science/moon-ice-water.html?login=smartlock&auth=login-smartlock> (explaining how water ice found on the moon can be broken down for various uses by astronauts, including use as rocket propellant to fuel deep space exploration missions).

⁷ See Glester, *supra* note 3; Jasper Jolly, *US Billionaires Vie to Make Space the Next Business Frontier*, THE GUARDIAN (Feb. 6, 2021, 11:00 AM), <https://www.theguardian.com/business/2021/feb/06/us-billionaires-vie-to-make-space-the-next-business-frontier> (“Commercial companies now account for about 80% of the \$424bn global space industry . . .”).

Resources, founded in 2012, was the first company in the world to announce plans to engage in a commercial deep space exploration program, with its focus on exploring asteroids and determining the feasibility of mining them for water and other resources.⁸ More recently, companies such as Elon Musk's SpaceX and Jeff Bezos's Blue Origin have joined the race to expand civilization into space and become the first private entity to extract and own space resources.⁹ Governments are now beginning to depend on these private companies—and the time and research they have poured into developing space technologies—to fulfill space policy goals.¹⁰ In 2020, for example, SpaceX won the \$117 million “launch contract for NASA’s 2022 mission to explore the mineral-rich asteroid known as ‘Psyche.’”¹¹

There are several roadblocks hindering the progress of the space resource industry, however. Most importantly, these missions are both costly and risky—projects require billions of dollars in funding¹² and there is much legal uncertainty as to the right to extract and own space resources.¹³ The primary law governing space exploration is the Outer Space Treaty of 1967, which prohibits national appropriation of outer space by claims of sovereignty.¹⁴ Whether this prohibition applies to the recovery and use of space resources has been the subject of ongoing international debate.¹⁵ Spacefaring nations are now beginning to engage in conversations to update the legal framework to address

⁸ See Mike Wall, *Asteroid Mining Venture Backed by Google Execs, James Cameron Unveiled*, SPACE.COM (Apr. 23, 2012), <https://www.space.com/15395-asteroid-mining-planetary-resources.html>; Glester, *supra* note 3, at 34.

⁹ See Wong, *supra* note 4; Jolly, *supra* note 7. This competition among private players to colonize outer space, now deemed the “Billionaire Space Race,” has been criticized by many as an expensive and frivolous display of egos that ignores more pressing problems on Earth, such as climate change. Roxanne Roberts, *Billionaires in Space: The Launch of a Dream or Just Out-of-this-World Ego?*, WASH. POST (July 18, 2021, 6:00 AM), <https://www.washingtonpost.com/lifestyle/2021/07/18/billionaire-space-race/>.

¹⁰ Rachael O’Grady, *Space Law: Where No One Is Really Sure of the Rules*, LAW.COM (June 17, 2020, 3:00 AM), <https://www.law.com/international-edition/2020/06/17/space-law-where-no-one-is-really-sure-of-the-rules/?slreturn=20210802101029>.

¹¹ Jonathan Shieber, *SpaceX Wins the \$117 Million Launch Contract to Explore Psyche’s Heavy Metal Asteroid*, TECHCRUNCH (Feb. 28, 2020, 4:57 PM), <https://techcrunch.com/2020/02/28/spacex-wins-the-117-million-launch-contract-to-explore-psyche-heavy-metal-asteroid/>.

¹² See Atossa Araxia Abrahamian, *How the Asteroid Mining Bubble Burst*, MIT TECH. REV., July–Aug. 2019, at 63, 65 (explaining how several asteroid mining companies collapsed due to a shortfall in funding).

¹³ See O’Grady, *supra* note 10.

¹⁴ Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies art. II, Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205.

¹⁵ See O’Grady, *supra* note 10; *Insight—Encouraging the Recovery and Use of Space Resources*, *supra* note 2.

this and other issues that are likely to arise in the future, such as the regulation of space waste.¹⁶

The United States, perhaps unsurprisingly, has taken the lead in moving the legal and political conversation forward with respect to space resource extraction and utilization.¹⁷ In April of 2020, former President Donald Trump signed Executive Order 13914, titled “Encouraging International Support for the Recovery and Use of Space Resources.”¹⁸ Executive Order 13914 sets forth the administration’s intent to engage in commercial exploration and resource extraction on the moon and other celestial bodies. It also reinforces the United States’ view that outer space is not a “global commons” and that space resource use and extraction is not precluded by the Outer Space Treaty.¹⁹ This policy is consistent with those of previous presidents of the United States: in 2015, President Barack Obama, for example, signed the Commercial Space Launch Competitiveness Act, which explicitly states that U.S. citizens engaged in the commercial recovery of space resources have the right to own and use said resources.²⁰ Shortly after Trump signed Executive Order 13914, NASA announced the Artemis Accords²¹—a set of principles intended to encourage international cooperation and responsibility in future lunar activities, including resource extraction, through a series of bilateral agreements between the United States and other spacefaring nations.²²

Despite some initial pushback following the announcement of the Artemis Accords,²³ more than a dozen countries have signed them.²⁴ Still, there remains

¹⁶ See O’Grady, *supra* note 10 (describing the unilateral and bilateral approaches being taken by countries such as the United States, Russia, India, Japan, and Luxembourg).

¹⁷ Alex Gilbert, *Mining in Space Is Coming*, MILKEN INST. REV. (Apr. 26, 2021), <https://www.milkenreview.org/articles/mining-in-space-is-coming?IssueID=40>.

¹⁸ Exec. Order No. 13,914, 85 Fed. Reg. 20,381 (Apr. 6, 2020).

¹⁹ See *id.*

²⁰ U.S. Commercial Space Launch Competitiveness Act, Pub. L. No. 114-90, § 51303, 129 Stat. 704 (2015).

²¹ NASA, THE ARTEMIS ACCORDS (2020).

²² Sean Potter & Cheryl Warner, *NASA, International Partners Advance Cooperation with First Signings of Artemis Accords*, NASA (Oct. 13, 2020), <https://www.nasa.gov/press-release/nasa-international-partners-advance-cooperation-with-first-signings-of-artemis-accords>. The Artemis Accords also set forth the goal of sending the first woman to the moon in 2024. *Id.*

²³ Jason Murdock, *Kremlin Says Trump’s Moon-Mining Plans Need ‘Analysis’ as Artemis Accords Reportedly Set to Initially Shun Russia*, NEWSWEEK (May 7, 2020, 7:56 AM), <https://www.newsweek.com/russia-kremlin-artemis-accords-donald-trump-draft-space-moon-mining-proposals-1502528> (quoting Russian official Dmitry Peskov as saying that “any attempts at ‘privatizing’ outer space . . . would be unacceptable”).

²⁴ The following countries have signed the Artemis Accords as of February 2022: Australia, Brazil, Canada, Israel, Italy, Japan, Luxembourg, Mexico, New Zealand, Poland, the Republic of Korea, Ukraine, the

disagreement over whether these bilateral agreements are the correct route to take moving forward.²⁵ In August of 2020, the Canadian Outer Space Institute issued an open letter signed by space professionals around the world urging the U.N. General Assembly to begin the formal process for developing a new treaty addressing space resource utilization and expressing concern over countries enacting national laws and engaging in bilateral negotiations in the absence of legal certainty.²⁶ At the same time, countries that have not yet signed the Artemis Accords, including major space powers China and Russia,²⁷ have begun to engage in separate conversations with Luxembourg regarding the mutually beneficial extraction of space resources.²⁸ These countries, which have historically remained steadfast in their position that the Outer Space Treaty does

United Arab Emirates, the United Kingdom, and the United States. *Israel Becomes 15th Nation to Join Artemis Accords*, SPACENEWS (Jan. 27, 2022), <https://spacenews.com/israel-becomes-15th-nation-to-join-artemis-accords/>.

²⁵ *Insight—Encouraging the Recovery and Use of Space Resources*, *supra* note 2.

²⁶ Letter from The Outer Space Institute to Tijjani Muhammad-Bande, President, United Nations General Assembly (Aug. 2020), <http://www.outerspaceinstitute.ca/docs/InternationalOpenLetterOnSpaceMining.pdf> (“[N]ational approaches risk the development of separate, possibly inconsistent, governance frameworks, while marginalizing input from developing and non-spacefaring States.”). Canada later signed the Artemis Accords in October 2020. *THE ARTEMIS ACCORDS*, *supra* note 21.

²⁷ China is prohibited from signing the Artemis Accords due to a 2012 act of Congress banning NASA from entering into bilateral agreements with China. Consolidated and Further Continuing Appropriations Act, H.R. 2112, 112th Cong. § 539 (2012); see Morgan McFall-Johnsen, *China and Russia Haven't Signed on to NASA's New Plan to Unify How Humanity Explores Space*, BUS. INSIDER (Oct. 13, 2020, 12:52 PM), <https://www.businessinsider.com/nasa-artemis-accords-deep-space-exploration-moon-mars-asteroids-comets-2020-10>.

²⁸ Frans von der Dunk, Othmer Professor of L., Univ. of Neb. L., Panel at the University of Nebraska Space Law Week Conference: Artemis Accords: International Partner and Industry Cooperation and International Space Norms, at 40:24–40:57 (Oct. 6, 2020) (available at <https://mediahub.unl.edu/media/14612>). More recently, China and Russia formally invited international partners to join their International Lunar Research Station (ILRS) project, which promotes long term lunar exploration and resource utilization. Andrew Jones, *China, Russia Open Moon Base Project to International Partners, Early Details Emerge*, SPACENEWS (Apr. 26, 2021), <https://spacenews.com/china-russia-open-moon-base-project-to-international-partners-early-details-emerge/>. This forebodes a further divide among nations with respect to space policy, and countries are likely to choose between supporting the Artemis Accords or the ILRS based on their political allegiances. Rajeswari Pillai Rajagopalan, *The Artemis Accords and Global Lunar Governance*, DIPLOMAT (June 7, 2021), <https://thediplomat.com/2021/06/the-artemis-accords-and-global-lunar-governance/>.

not allow for the extraction of space resources,²⁹ are now beginning to change course out of fear of being left behind.³⁰

While countries appear to be reaching a common understanding that space resource extraction is permissible,³¹ many unanswered questions remain as to how such extraction will proceed. Nations must come to a mutual agreement on the correct forum and format for updating the legal framework, and must do so quickly in order to avoid an “every man for himself” situation in space reminiscent of the 1800s Gold Rush.³² The future of space resource extraction and use is inevitable, however distant it may be.³³ This Comment argues that the United States should take anticipatory steps now to develop a set of nonbinding soft law principles for space resource activities through a multilateral forum.

This Comment proceeds in four Parts. Part I describes the various mining laws and treaties that exist for terrestrial mining and the current legal framework that governs space. Part II examines the various forums proposed by the United States and other countries that may be used in updating the legal framework for space resource extraction. Part III argues that the United States and other nations should engage in the development of a set of nonbinding soft law principles that lay out specific rules for space mining, pulling principles from existing terrestrial mining laws. Finally, Part IV discusses the policy implications that may result from the implementation of this recommendation, particularly with respect to the environment.

²⁹ See Thomas Cheney, Space Generation Advisory Council, Reactions to the U.S. Space Act 2015: Statements at COPUOS (Apr. 21, 2016), (available at <https://www.slideshare.net/thomcheney1991/reactions-to-the-us-space-act-2015-statements-at-copuos>) (summarizing several countries’ reactions to the U.S. Space Launch Competitiveness Act of 2015 during the 2016 session of COPUOS); Elliot Ji, Michael B. Cerny & Raphael J. Piliero, *What Does China Think About NASA’s Artemis Accords?*, DIPLOMAT (Sept. 17, 2020), <https://thediplomat.com/2020/09/what-does-china-think-about-nasas-artemis-accords/> (describing Chinese media’s criticism of the Artemis Accords as a violation of the Outer Space Treaty and a “preposterous attempt’ to unilaterally set ground rules for lunar resource exploitation”).

³⁰ Panel at the University of Nebraska Space Law Week Conference, *supra* note 28, at 44:20–44:44 (remarks by Ken Hodgkins, President, Int’l Space Enter. Consultants).

³¹ *Id.* at 41:43–42:34 (remarks by Frans von der Dunk and Ken Hodgkins); Andrew Jones, *China to Launch Space Mining Bot*, IEEE SPECTRUM (Sept. 16, 2020), <https://spectrum.ieee.org/tech-talk/aerospace/satellites/china-to-launch-space-mining-bot> (describing a Chinese space resources company’s plans to launch a space mining robot to test capabilities in extracting extraterrestrial resources).

³² Ezzy Pearson, *Space Mining: The New Goldrush*, SCI. FOCUS (Dec. 11, 2018, 6:00 PM), <https://www.sciencefocus.com/space/space-mining-the-new-goldrush/>.

³³ Alex Gilbert, *Mining in Space Is Coming*, MILKEN INST. REV. (Apr. 26, 2021), <https://www.milkenreview.org/articles/mining-in-space-is-coming?IssueID=40>.

I. EXISTING LEGAL LANDSCAPE

The terrestrial mining laws in place today in the United States and internationally, as well as the existing framework of domestic laws and international treaties that govern outer space, can help give context as to the types of principles that the United States may use in developing a legal regime for extraterrestrial mining. In analyzing the international treaties that relate to mining and property rights on Earth and in space, it is important to note which of these treaties the United States has signed and its reasoning for rejecting those that it has not. As for the domestic laws enacted by the United States, the international reactions to these laws are of particular relevance in predicting the success of future agreements the United States may propose to other nations with respect to natural resource extraction in space. This Part reviews the most relevant of these laws in depth, paying particular attention to the principles that the United States has been both willing and unwilling to adopt, as well as the international reception and critiques to domestic litigation enacted by the United States.

A. *Domestic and International Mining Laws*

The legal regimes that govern terrestrial mining domestically and internationally share several common principles that may also apply to resource extraction in outer space.³⁴ The primary law governing mining in the United States is the 1872 Mining Law.³⁵ This law is still in place today, though few changes have been made to it since its enactment and it has been slow to adapt to modern needs.³⁶ In the international landscape, several areas have been subject to international mining or territorial claims, such as the deep seabed and Antarctica.³⁷ These areas are governed by the U.N. Convention on the Law of the Sea and the Antarctic Treaty System, respectively.³⁸

³⁴ Lauren E. Shaw, *Asteroids, the New Western Frontier: Applying Principles of the General Mining Law of 1872 to Incentive Asteroid Mining*, 78 J. AIR L. & COM. 121, 154 (2013).

³⁵ General Mining Law of 1872, ch. 152, 17 Stat. 91 (codified as amended at 30 U.S.C. §§ 21–54 (1982)).

³⁶ See Shaw, *supra* note 34, at 149.

³⁷ Barbara E. Heim, *Exploring the Last Frontiers for Mineral Resources: A Comparison of International Law Regarding the Deep Seabed, Outer Space, and Antarctica*, 23 VAND. J. TRANSNAT'L L. 819, 820 (1990).

³⁸ U.N. Convention on the Law of the Sea art. 136, Dec. 10, 1982, 1833 U.N.T.S. 397. The Antarctic Treaty System is comprised of the following treaties: the Antarctic Treaty, Dec. 1959, 12 U.S.T. 794, 402 U.N.T.S. 71 (entered into force on June 23, 1961); Convention on the Conservation of Antarctic Seals, June 1, 1972, 29 U.S.T. 441, 1080 U.N.T.S. 176 (entered into force on March 11, 1978); Convention on the Conservation of Antarctic Marine Living Resources, May 20, 1980, 33 U.S.T. 3476 (entered into force on April 7, 1982); Convention on the Regulation of Antarctic Mineral Resource Activities, June 2, 1988, 27 I.L.M. 868 (not in force); Protocol on Environmental Protection to the Antarctic Treaty, 1991, 30 I.L.M. 1455 (entered into force on January 14, 1998).

1. *The 1872 Mining Law*

The General Mining Law of 1872,³⁹ commonly referred to as the 1872 Mining Law,⁴⁰ was enacted following the California Gold Rush of 1848 and the resulting mining boom that took over the western United States.⁴¹ Before the enactment of the 1866 Lode Law (the predecessor to the 1872 Mining Law), no federal law gave miners the explicit legal right to enter federal lands in search of natural resources.⁴² Miners developed their own rules and customs to govern mining claims, primarily adopting a “first in time, first in right” rule that gave priority to the first miner to stake a claim.⁴³ This principle and other common-law property rights for the acquisition and disposition of property served as the foundation of the 1872 Mining Law,⁴⁴ which remains the primary law governing hard-rock mining on U.S. lands today.⁴⁵

The 1872 Mining Law declared that “all valuable mineral deposits” on federal lands are “free and open to exploration and purchase,” along with the lands on which they are found.⁴⁶ Its purpose was to encourage and incentivize citizens to explore and develop the minerals on public lands and ultimately to settle the West, as well as to regulate the competing claims to these lands and provide for a recording system.⁴⁷ The 1872 Law allowed miners to “patent,” or obtain fee simple title to, lands under federal control on which mineral deposits had been discovered through a process known as the “location” system.⁴⁸ This system allowed miners to enter eligible federal lands, search for valuable mineral deposits, and, once located, remove the minerals without any payment of royalties to the federal government.⁴⁹ Upon discovery of a valuable mineral deposit, miners could file a patent application and obtain fee simple title to both the surface and mineral rights of the land.⁵⁰ In 1994, however, Congress implemented a patent moratorium that remains in place today—therefore, the strongest claim any person has under the 1872 Mining Law today is an

³⁹ General Mining Law of 1872, ch. 152, 17 Stat. 91 (codified as amended at 30 U.S.C. §§ 21–54 (1982)).

⁴⁰ *Id.*

⁴¹ JAN G. LAITOS, *NATURAL RESOURCES LAW* 469–70 (3d ed. 2019).

⁴² *Id.* at 469.

⁴³ Shaw, *supra* note 34, at 143–44; accord LAITOS, *supra* note 41, at 470.

⁴⁴ Shaw, *supra* note 34, at 143–46.

⁴⁵ LAITOS, *supra* note 41, at 470.

⁴⁶ General Mining Law of 1872, ch. 152, 17 Stat. 91, 91 (codified as amended at 30 U.S.C. §§ 21–54 (1982)).

⁴⁷ Shaw, *supra* note 34, at 147.

⁴⁸ LAITOS, *supra* note 41, at 470, 472.

⁴⁹ *Id.* at 472; Shaw, *supra* note 34, at 147–48.

⁵⁰ LAITOS, *supra* note 41, at 472–73, 494.

unpatented mining claim.⁵¹ These claims carry rights such as the exclusive right of possession of all minerals located within the claim and the right to use the land's surface for mining purposes.⁵²

While the 1872 Mining Law was successful in incentivizing private investment in the extraction of minerals from federal lands without granting complete sovereignty,⁵³ it has proven difficult to amend,⁵⁴ leaving us with an antiquated law that no longer serves the public interest of the twenty-first century.⁵⁵ The 1872 Mining Law has drawn much criticism on the basis that the law contains no environmental provisions and generates very little revenue for the federal government.⁵⁶ Environmental protection was not a priority at the time of the law's enactment in 1872, and as a result the law has caused extensive damage to the environment.⁵⁷ Additionally, the law requires no royalty payment to the government, leading to concerns that the government is essentially "giv[ing] away valuable minerals."⁵⁸ Proponents of the law, however, argue that low transaction costs provide the necessary incentive for private enterprises to invest in the extraction of these minerals.⁵⁹ If the 1872 Mining Law is applied to a legal framework for mining in outer space, then both the upsides and the downfalls of this statute must be taken into account.

2. Mining Under the U.N. Convention on the Law of the Sea

The 1982 U.N. Convention on the Law of the Sea (UNCLOS) is the current international legal framework governing the exploration and protection of international waters, including deep-seabed mining.⁶⁰ While over 150 countries have ratified the treaty, the United States has refused to ratify it,⁶¹ in part due to UNCLOS's use of the "common heritage of mankind" principle with respect to the deep seabed and its resources.⁶² By declaring the deep seabed the "common

⁵¹ *Id.* at 473, 497.

⁵² *Id.* at 494, 497.

⁵³ Shaw, *supra* note 34, at 149.

⁵⁴ While the 1872 Mining Law has not been amended to date, it has been supplemented by statutes such as the federal Multiple Mineral Use Act of 1954, the Multiple Surface Use Mining Act of 1955, and the Federal Land Policy and Management Act of 1976. LAITOS, *supra* note 41, at 473.

⁵⁵ *Id.* at 471.

⁵⁶ *Id.*; Shaw, *supra* note 34, at 149.

⁵⁷ Shaw, *supra* note 34, at 150.

⁵⁸ *Id.* at 152.

⁵⁹ *Id.*

⁶⁰ U.N. Convention on the Law of the Sea, *supra* note 38, art. 2.

⁶¹ *Id.* pmb.; Todd Skauge, *Space Mining & Exploration: Facing a Pivotal Moment*, 45 J. CORP. L. 815, 820 (2020).

⁶² U.N. Convention on the Law of the Sea, *supra* note 38; *see* Skauge, *supra* note 61.

heritage of mankind,” UNCLOS prohibits states from “claim[ing] or exercis[ing] sovereignty” over or “appropriat[ing]” the deep seabed and its resources.⁶³ The United Nations chose this language explicitly to avoid commercial exploitation of the sea and its resources by technologically advanced nations and to ensure the riches of the sea are shared equitably among states.⁶⁴ The United States, on the other hand, tends to view natural resources as a common property right, meaning that resources can be owned as private property with no obligation to share those resources with other countries.⁶⁵

As an alternative to signing UNCLOS, the United States instead entered into multilateral agreements with other nations⁶⁶ and adopted the Deep Seabed Hard Minerals Resources Act (DSHMRA) in 1980 to preserve its property interests in deep-seabed mineral resources.⁶⁷ DSHMRA establishes a licensing regime for these mineral resources, with an emphasis on conservation and protection of the marine environment.⁶⁸ It also sets forth criteria that the United States considers necessary to an acceptable international regime.⁶⁹ These criteria “include access for U.S. citizens to deep seabed [mineral] resources” and assurance that any mining activities that U.S. citizens engage in prior to the signing of any international regime will be allowed to continue.⁷⁰

UNCLOS established the International Seabed Authority (ISA) to regulate and control deep-seabed mining activities.⁷¹ The ISA consists of three primary “organs”: the Council, the Assembly, and the Secretariat.⁷² Each of these bodies has separate functions.⁷³ The Council is responsible for administering the regulations for deep-sea mining, the Assembly is responsible for issuing decisions on the sharing of mining revenues, and the Secretariat carries out administrative functions.⁷⁴ The ISA requires entities applying for a mining

⁶³ U.N. Convention on the Law of the Sea, *supra* note 38, art. 137.

⁶⁴ Isabel Feichtner, *Mining for Humanity in the Deep Sea and Outer Space: The Role of Small States and International Law in the Extraterritorial Expansion of Extraction*, 32 LEIDEN J. INT’L L. 255, 259 (2019).

⁶⁵ Scot W. Anderson, Korey Christensen & Julia LaManna, *The Development of Natural Resources in Outer Space*, 37 J. ENERGY & NAT. RES. L. 227, 255 (2019).

⁶⁶ *See, e.g.*, Provisional Understanding Regarding Deep Seabed Mining, Aug. 3, 1984, T.I.A.S. 11066, 1409 U.N.T.S. 1985 (providing an agreement between Belgium, France, Germany, Italy, Japan, the Netherlands, the United Kingdom, and the United States).

⁶⁷ Deep Seabed Hard Mineral Resources Act, 30 U.S.C. §§ 1401(b)(3) (2000).

⁶⁸ NOAA OFF. OF GEN. COUNS., DEEP SEABED HARD MINERAL RESOURCES ACT (2021), https://www.gcn.noaa.gov/documents/gcil_dshmra_summary.pdf (providing a helpful summary of the Act).

⁶⁹ *Id.*

⁷⁰ *Id.*

⁷¹ U.N. Convention on the Law of the Sea, *supra* note 38, arts. 156(1), 157(1).

⁷² *Id.* art. 158(1).

⁷³ *See id.* arts. 160(1)–(2)(n), 162(1)–(2)(z), 166(3)–(4), 169(1).

⁷⁴ *Id.* arts. 160(2)(g), 162(2)(o)(ii), 168(2).

permit to pay a \$500,000 application fee⁷⁵ and approves applications on a first-come, first-served basis.⁷⁶ Applicants approved for exploration rights are required to set aside areas for future use by the ISA's commercial arm, the Enterprise.⁷⁷ The Enterprise "act[s] as a partner in joint ventures with licensed contractors" for the mining of deep-seabed resources⁷⁸ or may engage in its own mining operations.⁷⁹ This allows the ISA to perform what some consider to be its "fundamental purpose": to enable the exploitation of the deep seabed "as a form of economic reserve, the last unclaimed mining territory on the planet."⁸⁰

3. *The Antarctic Treaty System*

International exploration of Antarctica is governed by a series of treaties called the Antarctic Treaty System (ATS),⁸¹ which centers around the Antarctic Treaty of 1959.⁸² The Antarctic Treaty was enacted in response to conflicting views among nations in the 1940s and 1950s as to whether countries had the right to make territorial claims in Antarctica.⁸³ Some countries claimed sovereignty rights over parts of the continent they had explored, while others, including the United States, refused to recognize the legality of these claims but reserved the right to make similar territorial claims in the future.⁸⁴ To resolve this growing conflict, the United States initiated negotiations with eleven other countries to develop a legal regime to govern future activities in Antarctica.⁸⁵ The Antarctic Treaty embraced principles such as "international cooperation" and "freedom of scientific investigation," and recognized that "it is in the interest of all mankind that Antarctica shall continue forever to be used for peaceful purposes."⁸⁶

⁷⁵ *Id.* annex III, arts. 3(1), 13(2).

⁷⁶ *Id.* art. 6(3).

⁷⁷ *Id.* art. 8.

⁷⁸ Anderson et al., *supra* note 65, at 254.

⁷⁹ U.N. Convention on the Law of the Sea, *supra* note 38, annex III, art. 9(1).

⁸⁰ Anderson et al., *supra* note 65, at 254.

⁸¹ *See supra* note 38 and accompanying text.

⁸² *See* FABIO TRONCHETTI, THE EXPLOITATION OF NATURAL RESOURCES OF THE MOON AND OTHER CELESTIAL BODIES: A PROPOSAL FOR A LEGAL REGIME 132 (F.G. von der Dunk ed., 2009).

⁸³ *See id.* at 133.

⁸⁴ *Id.* Australia, Argentina, Chile, France, New Zealand, Norway, and the United Kingdom each claimed sovereignty over areas of the continent they had explored. *Id.* Other countries, including Germany and Italy, refused to recognize these claims and did not consider any country, including themselves, to have the right to make such claims. *Id.*

⁸⁵ *See id.* at 136. There are now fifty-four parties to the Antarctic Treaty. *Parties*, SECRETARIAT OF THE ANTARCTIC TREATY, <https://www.ats.aq/devAS/Parties?lang=e> (last visited Feb. 2, 2022).

⁸⁶ The Antarctic Treaty, *supra* note 38, pmbl.

The Antarctic Treaty divides member nations into “consultative” and “non-consultative” parties.⁸⁷ Consultative parties are those that have undertaken “substantial research activity” in Antarctica, and as such, are dominated by industrialized nations.⁸⁸ Consultative parties convene annually to “make consensus-based decisions concerning activities in Antarctica,” whereas non-consultative parties may attend only as observers and have no decision-making authority.⁸⁹ Article IV of the Antarctic Treaty places all claims to territorial sovereignty in suspension⁹⁰—therefore, all territorial claims at the time of the treaty’s enactment in 1959 remain in place, but no new territorial claims may be asserted as long as the treaty is in force.⁹¹ This has allowed for extensive scientific research and exploration activities by participating nations.⁹² Other articles of the treaty prohibit military activities, provide for the freedom of scientific investigation and the exchange of information, and provide methods for the peaceful settlement of disputes.⁹³

One issue that the Antarctic Treaty of 1959 did not address is the exploitation of mineral resources.⁹⁴ This issue was first addressed in 1988 in the Convention on the Regulation of Antarctic Mineral Resources (Antarctic Mineral Convention).⁹⁵ The convention allowed for certain environmental protections against mineral resource activities, such as environmental impact assessment procedures and the prohibition of activities that would cause adverse effects or significant changes to the Antarctic environment.⁹⁶ However, no state has ratified this convention, in part due to its lack of incentive for mining operators, and thus it has never entered into force.⁹⁷ The law currently governing mineral resource exploitation is the Protocol on Environmental Protection to the Antarctic Treaty.⁹⁸ This protocol provides that “[a]ny activity relating to mineral resources, other than scientific research, shall be prohibited,”⁹⁹ effectively

⁸⁷ See Skauge, *supra* note 61, at 821.

⁸⁸ The Antarctic Treaty, *supra* note 38, art. IX. There are currently twenty-nine consultative parties. *Parties, supra* note 85.

⁸⁹ Lynn M. Fountain, *Creating Momentum in Space: Ending the Paralysis Produced by the Common Heritage of Mankind Doctrine*, 35 CONN. L. REV. 1753, 1771 (2003).

⁹⁰ The Antarctic Treaty, *supra* note 38, art. IV.

⁹¹ TRONCHETTI, *supra* note 82, at 137–38.

⁹² *Id.* at 138.

⁹³ The Antarctic Treaty, *supra* note 38, arts. II, III & XI.

⁹⁴ See TRONCHETTI, *supra* note 82, at 141.

⁹⁵ Convention on the Regulation of Antarctic Mineral Resource Activities, *supra* note 38.

⁹⁶ *Id.* arts. II(1)(d)–II(3), III, IV(2)–(4).

⁹⁷ TRONCHETTI, *supra* note 82, at 159–60.

⁹⁸ Protocol on Environmental Protection to the Antarctic Treaty, *supra* note 36.

⁹⁹ *Id.* art. VII.

preventing commercial mining and exploitation of natural resources in Antarctica.¹⁰⁰

B. *Laws and Treaties Governing Space Exploration*

The legal framework governing international activity in space is dominated by the Outer Space Treaty of 1967.¹⁰¹ While other international agreements have been proposed, such as the 1979 Moon Agreement,¹⁰² none have garnered such widespread international support as the Outer Space Treaty—it remains the only space-related treaty onto which most of the world’s countries have signed.¹⁰³ Therefore, all future international agreements and domestic legislation should comply with the Outer Space Treaty. In response to the scarce legal landscape relating to the extraction and use of space resources, countries such as the United States and Luxembourg have enacted unilateral domestic legislation in an effort to assert property rights over space resources.¹⁰⁴

1. *Outer Space Treaty*

The Outer Space Treaty of 1967 is universally understood to be the foundation of international space law.¹⁰⁵ Over 100 countries, including the United States, have ratified the Outer Space Treaty.¹⁰⁶ Adopted in the midst of the Cold War, its purpose was to avoid potential conflict among spacefaring nations and to implement procedures for the exploration, research, and exploitation of resources in space.¹⁰⁷ The Outer Space Treaty is based on the *res communis* theory—the idea that all nations have equal access to the resources of outer space and therefore no individual or entity may make any claims of ownership.¹⁰⁸ The treaty states that the exploration and use of outer space “shall

¹⁰⁰ TRONCHETTI, *supra* note 82, at 158.

¹⁰¹ Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, *supra* note 14.

¹⁰² Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, Dec. 5, 1979, 1363 U.N.T.S. 22.

¹⁰³ Priyank D. Doshi, *Regulating the Final Frontier: Asteroid Mining and the Need for a New Regulatory Regime*, 6 NOTRE DAME J. INT’L & COMPAR. L. 189, 204 (2016).

¹⁰⁴ See, e.g., U.S. Commercial Space Launch Competitiveness Act, Pub. L. No. 114-90, §§ 113, 51303, 129 Stat. 704 (2015); Loi du 20 juillet 2017 sur l’exploration et l’utilisation des ressources de l’espace [Law of July 20th 2017 On The Exploration and Use of Space Resources], art. 1–2, LUX. SPACE AGENCY (Fr.).

¹⁰⁵ Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, *supra* note 14; Anderson et al., *supra* note 65, at 237.

¹⁰⁶ *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies*, U.S. DEP’T OF STATE, <https://2009-2017.state.gov/t/isn/5181.htm#signatory> (last visited February 2, 2022).

¹⁰⁷ Skauge, *supra* note 61, at 818.

¹⁰⁸ Doshi, *supra* note 103, at 203.

be carried out for the benefit and in the interest of all countries . . . and shall be the province of all mankind.”¹⁰⁹ This language prevents spacefaring nations from staking claims in outer space so that developing nations may reserve a future right to space exploration.¹¹⁰

Whether the Outer Space Treaty prohibits the extraction and utilization of space resources has been the subject of extensive international debate—countries such as China and Russia have traditionally maintained that resource extraction and ownership conflicts with the Outer Space Treaty,¹¹¹ while the United States and Luxembourg have enacted legislation explicitly authorizing such activities.¹¹² While the Outer Space Treaty does not specifically address space resource mining, it contains several principles that are relevant to the debate.¹¹³ Article II declares that outer space “is not subject to national appropriation by claim of sovereignty.”¹¹⁴ While this language prohibits claims of ownership by nations, it does not mention whether this applies to private entities or individuals.¹¹⁵ Several countries, including the United States, have recognized this language as a loophole that could justify future commercial extraction and ownership of resources in outer space.¹¹⁶ The U.S. State Department has also maintained that this Article II language only prohibits ownership of space resources that are “in place”—meaning governments and private entities may assert ownership over these resources once they have been extracted and removed from the celestial body itself.¹¹⁷ Additionally, some scholars argue that because the treaty uses the terms “exploration and use,”¹¹⁸

¹⁰⁹ Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, *supra* note 14, art. I.

¹¹⁰ Doshi, *supra* note 103.

¹¹¹ See Ji et al., *supra* note 29; Cheney, *supra* note 29.

¹¹² See U.S. Commercial Space Launch Competitiveness Act, Pub. L. No. 114-90, § 51303, 129 Stat. 704 (2015); SENJUTY MALLICK & RAJESWARI PILLAI RAJAGOPALAN, IF SPACE IS ‘THE PROVINCE OF MANKIND,’ WHO OWNS ITS RESOURCES? AN EXAMINATION OF THE POTENTIAL OF SPACE MINING AND ITS LEGAL IMPLICATIONS 11 (2019).

¹¹³ See Anderson et al., *supra* note 65, at 238–41.

¹¹⁴ Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, *supra* note 14.

¹¹⁵ See Doshi, *supra* note 103.

¹¹⁶ See *id.*; Law of July 20th 2017 On The Exploration and Use of Space Resources, *supra* note 104, art. 7(2).

¹¹⁷ See Brian J. Egan, Legal Adviser, U.S. Dep’t of State, Remarks at Galloway Symposium on Critical Issues in Space Law: The Next Fifty Years of the Outer Space Treaty (Dec. 7, 2016) (available at <https://2009-2017.state.gov/s/l/releases/remarks/264963.htm>) (explaining the U.S. position on space resource extraction dating back several decades). This view raises complicated questions as to how property rights over resources can be realistically separated from the celestial body itself. See Anderson, *supra* note 65, at 239.

¹¹⁸ Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, *supra* note 14, arts. I, III.

the use of space resources was contemplated by the drafters and is therefore not prohibited.¹¹⁹

Throughout international debates over the correct interpretation of the Outer Space Treaty's language, the United States has maintained that the treaty allows for the commercial mining and use of space resources.¹²⁰ The United States' position is reinforced in Executive Order 13914, which states that the United States' policy is "to encourage international support for the public and private recovery and use of resources in outer space."¹²¹ This view has also been backed by the International Institute of Space Law (IISL), an independent, nongovernmental organization of space law professionals from around the world.¹²² The IISL takes the position that because the Outer Space Treaty contains no explicit provision prohibiting the use of space resources, the treaty may be interpreted as permitting the extraction and use of such resources.¹²³ The IISL does note, however, that there is no consensus as to whether "the right of 'free use' includes the right to take and consume non-renewable natural resources."¹²⁴ This Comment proceeds on the assumption that the extraction and use of outer space resources is not precluded by the Outer Space Treaty, while noting much legal uncertainty remains as to space mining procedures.

2. *The Moon Agreement*

The Moon Agreement of 1979 was enacted to address the issue of resource utilization on the moon and other debated issues facing the newly developing space industry.¹²⁵ It has been ratified by only eighteen countries and has never been ratified by China, Russia, or the United States.¹²⁶ As such, the agreement

¹¹⁹ See Anderson, *supra* note 65, at 239.

¹²⁰ See *id.*

¹²¹ Exec. Order No. 13,914, 85 Fed. Reg. 20,381 (Apr. 6, 2020).

¹²² *Introduction*, INT'L INST. OF SPACE L., <https://iislweb.space/introduction/> (last visited Feb. 6, 2022). The IISL is an official observer of the U.N. Committee on the Peaceful Uses of Outer Space (COPUOS) and its Legal Subcommittee, and it produces regular reports on its activities. *Id.* Its purpose is "to promote the further development of space law and the expansion of the rule of law in the exploration and use of outer space for peaceful purposes." *Id.*

¹²³ INT'L INST. OF SPACE L., POSITION PAPER ON SPACE RESOURCE MINING 3 (2015), <https://iislweb.space/iisl-position-paper-on-space-resource-mining/>. The IISL points out that Article I of the Outer Space Treaty provides for indiscriminating free exploration and use of outer space and celestial bodies. *Id.* at 2.

¹²⁴ *Id.*

¹²⁵ Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, *supra* note 102, arts. II(1)–(3), (5); see Doshi, *supra* note 103, at 206.

¹²⁶ *Agreement Governing the Activities of States on the Moon and Other Celestial Bodies*, U.N. TREATY COLLECTION, https://treaties.un.org/Pages/ViewDetails.aspx?src=IND&mtdsg_no=XXIV-2&chapter=24&clang=_en (last visited Feb. 2, 2022) (listing signatories).

is viewed by many as a failed instrument of international law and considered obsolete.¹²⁷ This is in large part due to the fact that the agreement closed the loophole in the Outer Space Treaty that these nations had been using to justify the exploitation of space resources by explicitly prohibiting private entities and individuals from owning the moon's resources.¹²⁸ Article 11 of the Moon Agreement states that the moon and its resources are "the common heritage of mankind" and dictates that "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 nongovernmental organization, national organization or nongovernmental entity or of any natural person."¹²⁹ The United States has consistently hesitated to sign international treaties that apply the common heritage principle to govern natural resource mining, as shown by the United States' failure to ratify UNCLOS.¹³⁰

While the Moon Agreement ultimately did not gain enough traction to give it much force in the international space law regime, it contains some provisions that may be relevant to the United States' development of future space mining laws. One provision that the major spacefaring nations did agree on was the Article 11 directive to establish an international space regime and procedures "to govern the exploitation of the natural resources of the moon."¹³¹ While this provision alone is not enough to overcome the less agreeable aspects of the agreement, it reflects the international consensus that a regulatory body for the exploitation of space resources must be developed while balancing the interests of developing nations with those of the more powerful spacefaring nations.¹³² Additionally, the use of language prohibiting the ownership of moon resources "in place"¹³³ is consistent with the United States' aforementioned position that ownership is permitted once resources have been extracted and removed from the celestial body.¹³⁴

¹²⁷ 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>.

¹²⁸ See Doshi, *supra* note 103, at 206. The goal of the Moon Agreement was to reinforce the idea that outer space was a universal good and could not be divided and exploited among nations. *Id.*

¹²⁹ Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, *supra* note 102, arts. 11(1), (3). Unlike the Outer Space Treaty, this language contemplates the commercial use of space resources and "provides an additional legal barrier to private ownership." Doshi, *supra* note 103, at 206.

¹³⁰ See *supra* Part I.A.2.

¹³¹ Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, *supra* note 102, art. 11; see Doshi, *supra* note 103, at 207.

¹³² See Doshi, *supra* note 103, at 207.

¹³³ Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, *supra* note 102, art. 11(3).

¹³⁴ See *supra* Part I.B.2; Dr. Matthew Stubbs, *Space Mining: Commercial Opportunities and Legal Uncertainties*, 42 BULL.: L. SOC'Y S. AUSTRAL. J. 18, 19 (2020).

3. *U.S. Commercial Space Launch Competitiveness Act of 2015*

In response to the uncertainties surrounding space mining in the international legal sphere, Congress passed the U.S. Commercial Space Launch Competitiveness Act in 2015.¹³⁵ Prior to the enactment of this law, the prospect of asteroid mining had been gaining traction within the private sector,¹³⁶ and the need for clarification over the use and possession of space resources became clear. Title IV, titled the “Space Resource Exploration and Utilization Act,” specifically addresses property rights over space resources.¹³⁷ It guarantees the following:

[A] United States citizen engaged in commercial recovery of an asteroid resource or a space resource . . . shall be entitled to any asteroid resource or space resource obtained, including to possess, own, transport, use, and sell the asteroid resource or space resource obtained in accordance with applicable law, including the international obligations of the United States.¹³⁸

It also contains a disclaimer that “by the enactment of this Act, the United States does not thereby assert sovereignty or sovereign or exclusive rights or jurisdiction over, or the ownership of, any celestial body.”¹³⁹

Whether the Space Law Competitiveness Act complies with the United States’ obligations under the Outer Space Treaty has been a point of international contention.¹⁴⁰ The answer to this question largely depends on whether the Outer Space Treaty’s prohibition on “national appropriation” of celestial bodies extends to ownership of their extracted resources.¹⁴¹ As noted above, the International Institute of Space Law took the position that, because there is no explicit provision in the Outer Space Treaty prohibiting the ownership and use of space resources, such ownership is permitted, and the Space Law Competitiveness Act is therefore in compliance.¹⁴² The Institute did note, however, that the future understanding and development of the non-appropriation principle depends primarily on whether other nations interpret the

¹³⁵ U.S. Commercial Space Launch Competitiveness Act, Pub. L. No. 114-90, 129 Stat. 704 (2015).

¹³⁶ See Doshi, *supra* note 103, at 191–93 (discussing mining among the private sector).

¹³⁷ U.S. Commercial Space Launch Competitiveness Act § 51303.

¹³⁸ *Id.*

¹³⁹ *Id.* § 403. This language necessarily implicates questions concerning property rights over resources and how the United States will recognize these rights when it cannot claim sovereignty. These questions are beyond the scope of this Comment.

¹⁴⁰ Anderson et al., *supra* note 65, at 243.

¹⁴¹ Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, *supra* note 14, art. II; see Anderson et al., *supra* note 65, at 243.

¹⁴² Int’l Inst. of Space L., *supra* note 123, at 3; see *supra* Part I.B.1.

Outer Space Treaty in a manner consistent with the Space Law Competitiveness Act.¹⁴³ Luxembourg's recent adoption of a similar law indicates that the international consensus on property rights to space resources is moving in the direction of the U.S. position that the extraction and ownership of such resources is compliant with the Outer Space Treaty.¹⁴⁴ Luxembourg's law regards space resources as being appropriable and subject to property rights but reinforces the idea that the celestial bodies themselves cannot be claimed.¹⁴⁵

The international reactions to the United States' enactment of the Space Launch Competitiveness Act are indicative of how unilateral acts taken by the United States to develop space law may be perceived by other major international powers. The Space Launch Competitiveness Act was presented at the U.N. Committee on the Peaceful Uses of Outer Space (COPUOS) in 2016.¹⁴⁶ COPUOS is one of the largest committees in the U.N. system, consisting of ninety-five member states, and has traditionally been the primary setting for multilateral conversations on the use of space resources.¹⁴⁷ During the 2016 session of COPUOS, Russia rejected the United States' unilateral adoption of the Act, arguing that all space resource laws should be created in COPUOS due to the risks posed by space mining.¹⁴⁸ Russia took the view that space resources are equivalent to celestial bodies and thus prohibited from appropriation under the Outer Space Treaty.¹⁴⁹ Belgium also opposed the U.S. act, stating that an international approach to developing a space mining law regime was needed rather than the ad hoc enactment of national legislation.¹⁵⁰ Belgium argued that space resources cannot be appropriated by extension of national jurisdiction.¹⁵¹

Despite Belgium and Russia's past insistence that the Outer Space Treaty prohibits the appropriation of space resources,¹⁵² it is important to consider

¹⁴³ Int'l Inst. of Space L., *supra* note 123, at 3.

¹⁴⁴ Law of July 20th 2017 On The Exploration and Use of Space Resources, *supra* note 104, art. 1; see Anderson, *supra* note 65, at 246.

¹⁴⁵ Law of July 20th 2017 On The Exploration and Use of Space Resources, *supra* note 104, art. 2(4); MALLICK & RAJAGOPALAN, *supra* note 112.

¹⁴⁶ G.A. Res. 71/90, International Cooperation in the Peaceful Uses of Outer Space (Dec. 22, 2016).

¹⁴⁷ Ian A. Christensen & Christopher D. Johnson, *Putting the White House Executive Order on Space Resources in an International Context*, SPACE REV. (Apr. 27, 2020), <https://www.thespacereview.com/article/3932/1>.

¹⁴⁸ Cheney, *supra* note 29.

¹⁴⁹ *Id.* Russia's position on the issue has since changed, with the country now joining forces with China to build a new lunar space station with the intention of extracting and utilizing resources on the moon. Andrew E. Kramer & Steven Lee Meyers, *Russia, Once a Space Superpower, Turns to China for Missions*, N.Y. TIMES (June 15, 2021), <https://www.nytimes.com/2021/06/15/world/asia/china-russia-space.html>.

¹⁵⁰ Cheney, *supra* note 29.

¹⁵¹ *Id.*

¹⁵² *Id.*

whether these countries truly opposed the extraction and ownership of space resources or whether they merely opposed the United States' unilateral decision that U.S. citizens may commercially extract and own space resources. In 2019, Russia began negotiations with Luxembourg to develop a framework agreement for cooperation between the two countries in space mining activities.¹⁵³ The following year, however, Russia's space agency, Rocosmos, responded to President Trump's Executive Order 13914¹⁵⁴ by characterizing it as an "[a]ttempt[] to expropriate outer space and aggressive plans to actually seize territories of other planets."¹⁵⁵ Russia has not yet signed the U.S. Artemis Accords.¹⁵⁶ These conflicting actions indicate that major space powers such as Russia are open to negotiating a new legal framework that specifically addresses extraterrestrial mining and allows for the extraction and utilization of resources, but will only do so in a manner that is acceptable to them. Bold, unilateral moves from the United States, such as the Space Launch Competitiveness Act and Executive Order 13914, are typically seen as aggressive power grabs.¹⁵⁷ If the United States hopes to achieve cooperation from other nations in its goals to extract resources in space, it must consider the role that the battle for hegemony—on Earth and in space—plays in the context of international negotiations.

II. PROPOSALS FOR THE DEVELOPMENT OF MINING LAWS IN SPACE

While nations continue to debate the right to own and extract minerals in space, one point of international consensus has prevailed: a legal model to govern the exploration and extraction of these resources must be agreed upon to maintain the peaceful use of outer space and avoid an unregulated "free for all" in space.¹⁵⁸ Governments and scholars disagree, however, on the appropriate route to take in developing this new legal regime.¹⁵⁹ Following the 2016 session

¹⁵³ Vladimir Soldatkin, *Russia Wants to Join Luxembourg in Space Mining*, REUTERS (Mar. 6, 2019, 9:06 AM), <https://www.reuters.com/article/us-luxembourg-russia-space/russia-wants-to-join-luxembourg-in-space-mining-idUSKCN1QN1OQ>.

¹⁵⁴ Exec. Order No. 13,914, 85 Fed. Reg. 20,381 (Apr. 6, 2020).

¹⁵⁵ Adam Smith, *Russia Says Trump's Space Mining Order Is an Attempt to 'Seize' Other Planets*, PC MAG. (Apr. 8, 2020), <https://www.pcmag.com/news/russia-says-trumps-space-mining-order-is-an-attempt-to-seize-other-planets#:~:text=News-,Russia%20Says%20Trump's%20Space%20Mining%20Order,Attempt%20to%20'Seize'%20Other%20Planets&text=It's%20called%20the%201979%20'Moon,Space%20Agency%2C%20have%20ratified%20it>.

¹⁵⁶ Potter & Warner, *supra* note 22.

¹⁵⁷ Smith, *supra* note 155.

¹⁵⁸ Christensen & Johnson, *supra* note 147; see Comm. on the Peaceful Uses of Outer Space, Annotated Agenda on its Fifty-Ninth Session, U.N. Doc. A/AC.105/C.2/L.312 (2020), https://www.unoosa.org/res/oasdoc/data/documents/2020/aac_105c_2l/aac_105c_2l_312_0_html/V2001359.pdf.

¹⁵⁹ See Christensen & Johnson, *supra* note 147.

of COPUOS, in which the discussion on the U.S. Commercial Space Launch Competitiveness Act took place,¹⁶⁰ the exchange of views between nations on the development of such a model has become an increasingly popular agenda item.¹⁶¹ Since the Moon Agreement in 1979, however, “no new internationally binding legal instruments have been developed [through] COPUOS.”¹⁶² Member nations of COPUOS have begun to accept that a different approach to international agreement, as opposed to developing a binding treaty, may be more appropriate given the immediacy of this issue and the arduous and lengthy process involved in treaty-making.¹⁶³ This Part examines the various approaches proposed by the United States and other countries, analyzes the likelihood of success for each of these approaches in the context of the United States’ and other countries’ willingness to sign such an agreement, and recommends that the United States proceed with a soft law approach.

A. The Artemis Accords: The U.S. Approach

On May 15, 2020, NASA presented the Artemis Accords—the set of principles through which the United States intends to lead the development of international law on space exploration and resource extraction by entering into bilateral agreements with other nations.¹⁶⁴ The purpose of the Artemis Accords is to encourage “the international community to reach a consensus on the legality of space resource [extraction],” as well as persuade other nations to participate in the Artemis Program and future space resource activities.¹⁶⁵ The development of the Artemis Program and the Artemis Accords is part of the goal set forth in Executive Order 13914 “to encourage international support for the public and private recovery and use of resources in outer space” and “negotiate joint statements and bilateral and multilateral arrangements with foreign states regarding safe and sustainable operations for the public and private recovery and use of space resources.”¹⁶⁶

¹⁶⁰ See *supra* Part I.B.3.

¹⁶¹ Christensen & Johnson, *supra* note 147; see Comm. on the Peaceful Uses of Outer Space, Annotated Agenda on its Fifty-Ninth Session, *supra* note 158 (listing the “[g]eneral exchange of views on potential legal models for activities in exploration, exploitation and utilization of space resources” as an agenda item).

¹⁶² Christensen & Johnson, *supra* note 147.

¹⁶³ *Id.* These approaches include bilateral agreements between two countries, mini-lateral agreements between multiple countries, and domestic legislation such as the laws adopted by the United States and Luxembourg. *Id.*

¹⁶⁴ *The Artemis Accords: Principles for a Safe, Peaceful, and Prosperous Future*, NASA, <https://www.nasa.gov/specials/artemis-accords/index.html> (last visited Feb. 2, 2022); see Gouyu Wang, *NASA’s Artemis Accords: The Path to a United Space Law or a Divided One?*, SPACE REV. (Aug. 24, 2020), <https://www.thespacereview.com/article/4009/1>.

¹⁶⁵ Wang, *supra* note 164.

¹⁶⁶ Exec. Order No. 13,914, 85 Fed. Reg. 20,381 (Apr. 6, 2020).

The Artemis Accords include such principles as “peaceful purposes,”¹⁶⁷ “transparency,”¹⁶⁸ “space resources,”¹⁶⁹ and “deconfliction of activities,”¹⁷⁰ emphasizing international cooperation and adherence to the Outer Space Treaty while also encouraging participation in space resource activities.¹⁷¹ With respect to the extraction of space resources, the text of the Accords states that “the extraction of space resources does not inherently constitute national appropriation under Article II of the Outer Space Treaty.”¹⁷² NASA representatives have repeatedly stated that the Accords represent the “common ground” that countries can extract and own space resources under the Outer Space Treaty and “enjoy the fruits of [their] labor.”¹⁷³ Beyond this, however, property rights to space resources are not specifically addressed.

The Artemis Accords are consistent with an “America first” attitude, the traditional U.S. approach to space exploration.¹⁷⁴ However, this approach has its downsides, especially in the context of the extraction of space resources—a concept that is newly developing and upon which not all nations agree.¹⁷⁵ While the Accords emphasize international cooperation, they could very well have the opposite effect.¹⁷⁶ Competition among nations has historically fueled innovation and technological advances in the space industry, beginning with the race to put the first man on the moon in the 1960s.¹⁷⁷ The Artemis Accords could lead to a revival of this space race, creating a new competition among space powers to control space resources and lead the technological advancement of human

¹⁶⁷ *The Artemis Accords*, *supra* note 164 (“[A]t the core of the Artemis Accords is the requirement that all activities will be conducted for peaceful purposes, per the tenets of the Outer Space Treaty.”).

¹⁶⁸ *Id.*

¹⁶⁹ *Id.* (“The ability to extract and utilize resources on the Moon, Mars, and asteroids will be critical to support safe and sustainable space exploration and development. The Artemis Accords reinforce that space resource extraction and utilization can and will be conducted under the auspices of the Outer Space Treaty, with specific emphasis on Articles II, VI, and XI.”).

¹⁷⁰ *Id.* (“NASA and partner nations will provide public information regarding the location and general nature of operations which will inform the scale and scope of ‘Safety Zones.’ Notification and coordination between partner nations to respect such safety zones will prevent harmful interference, implementing Article IX of the Outer Space Treaty and reinforcing the principle of due regard.”). Other principles include “interoperability,” “emergency assistance,” “registration of space objects,” “release of scientific data,” and “orbital debris and spacecraft disposal.” *Id.*

¹⁷¹ *Id.*; *see* Wang, *supra* note 164.

¹⁷² THE ARTEMIS ACCORDS, *supra* note 21, § 10(2).

¹⁷³ Panel at the University of Nebraska Space Law Week Conference, *supra* note 28, at 9:14–9:22, 44:46–44:57 (remarks of Mike Gold, Acting Assoc. Adm’r, Off. of Int’l and Interagency Affs.).

¹⁷⁴ *See* Wang, *supra* note 164 (“[I]n terms of overall objective, the Accords intend to create a favorable international environment for space resources exploitation and utilization led by the United States”); Christensen & Johnson, *supra* note 147.

¹⁷⁵ *See* Wang, *supra* note 164.

¹⁷⁶ *See id.*

¹⁷⁷ *See id.*

activity in space.¹⁷⁸ While such competition can be beneficial in promoting rapid technological advances in the space industry, the line separating space from becoming a healthy competitive environment or a cosmic battleground is thin. To avoid the latter, nations must be united around clear, negotiated standards for space resource activities—standards which the Artemis Accords do not provide. The international response to similar action by the United States was seen in the context of the Space Launch Competitiveness Act of 2015.¹⁷⁹ Countries such as Belgium and Russia refused to accept the unilateral decision by the United States, emphasizing that this type of decision should be reached by consensus through the forum of COPUOS.¹⁸⁰

Other nations have also criticized the Artemis Accords on the basis that they are bilateral rather than multilateral: each country that signs onto the Accords will be bound to a separate agreement with the United States.¹⁸¹ This raises the danger of fragmentation and divergence—the risk that one bilateral agreement will be implemented differently from another and that the United States may show favoritism towards certain nations.¹⁸² In response to this concern, NASA has emphasized that while the agreements themselves are bilateral, the implementation will be done on a multilateral level.¹⁸³ Each country will be agreeing to the same principles under the Accords, which NASA argues are designed to encourage universal compliance with the Outer Space Treaty.¹⁸⁴ However, there is currently no mechanism in place to ensure that the agreements are implemented consistently. Despite NASA's insistence that the Artemis Accords prioritize inclusivity,¹⁸⁵ many of the countries that have signed the Accords thus far are major powers with an existing presence in space.¹⁸⁶

¹⁷⁸ See *id.*

¹⁷⁹ See *supra* Part I.B.3.

¹⁸⁰ See Cheney, *supra* note 29 (summarizing Belgium and Russia's reactions to the U.S. Space Launch Competitiveness Act of 2015 during the 2016 session of COPUOS).

¹⁸¹ See Panel at the University of Nebraska Space Law Week Conference, *supra* note 28, at 10:41–11:07 (remarks by Mike Gold, Acting Assoc. Adm'r, Off. of Int'l and Interagency Affs.).

¹⁸² See *id.* at 20:01–21:06 (remarks by Frank von der Dunk, Othmer Professor of L., Univ. of Neb. L.).

¹⁸³ See *id.* at 24:52–25:39 (remarks by Frank von der Dunk, Othmer Professor of L., Univ. of Neb. L. & Matthew Schaefer, Founding Co-Dir., Space, Cyber, and Telecomms. L. Program).

¹⁸⁴ See *id.* at 4:52–11:13 (remarks by Mike Gold, Acting Assoc. Adm'r, Off. of Int'l and Interagency Affs.).

¹⁸⁵ *Id.*

¹⁸⁶ THE ARTEMIS ACCORDS, *supra* note 21. Countries that have signed the Artemis Accords include Australia, Brazil, Canada, Israel, Italy, Japan, Luxembourg, Mexico, New Zealand, Poland, the Republic of Korea, Ukraine, the United Arab Emirates, the United Kingdom, and the United States. *Israel Becomes 15th Nation to Join Artemis Accords*, *supra* note 24. Canada, Israel, Japan, Luxembourg, the Republic of Korea, the United Kingdom, and the United States each have an existing space program. *Countries with Space Programs 2022*, WORLD POPULATION REV., <https://worldpopulationreview.com/country-rankings/countries-with-space-programs> (last visited Feb. 4, 2022).

Ultimately, while NASA's intent behind the Artemis Accords may be to "unify the world,"¹⁸⁷ bilateral agreements may not be the correct format in which to achieve this.

Another concern is the role that the private sector will play in the Artemis Accords.¹⁸⁸ Many technology companies have ambitions to travel to the moon and Mars for their own purposes, but to do so they will have to buy into the overall vision of the Accords.¹⁸⁹ However, private companies may view certain principles in the Accords, such as interoperability and the release of scientific data, as an impediment to innovation.¹⁹⁰ For space resource extraction to be successful, the government and the private sector must work together to form a common understanding of how their separate goals will be achieved.¹⁹¹ NASA representative Mike Gold stated that "there is no seat at [COPUOS] for the private sector."¹⁹² Moving forward, there must be some forum for input from the private sector in the legal framework that is being developed.¹⁹³

B. The U.N. Multilateral Treaty Process

On the other end of the spectrum are those countries and organizations advocating for a new multilateral treaty, formed through the United Nations' formal treaty-making process.¹⁹⁴ In August of 2020, the Canadian Outer Space Institute issued an open letter to COPUOS urging the committee to begin the formal treaty-making process by which member nations would negotiate a multilateral agreement on space resource exploration and utilization.¹⁹⁵ The letter expressed concern regarding the national and bilateral approaches taken by countries such as the United States, arguing that such approaches "risk the development of separate, possibly inconsistent, governance frameworks, while

¹⁸⁷ Panel at the University of Nebraska Space Law Week Conference, *supra* note 28, at 47:31–47:43 (remarks by Mike Gold, Acting Assoc. Adm'r, Off. of Int'l and Interagency Affs.).

¹⁸⁸ *See id.* at 25:25–25:47 (remarks by Ken Hodgkins, President, Int'l Space Enter. Consultants).

¹⁸⁹ *Id.* at 26:03–26:15.

¹⁹⁰ *See id.* at 29:51–30:35 (remarks by Matthew Shaefer, Founding Co-Dir., Space, Cyber, and Telecomms. L. Program).

¹⁹¹ *See id.* at 25:47–28:41 (remarks by Ken Hodgkins, President, Int'l Space Enter. Consultants & Mike Gold, Acting Assoc. Adm'r, Off. of Int'l and Interagency Affs.).

¹⁹² *Id.* at 28:55–30:01 (remarks by Mike Gold, Acting Assoc. Adm'r, Off. of Int'l and Interagency Affs. & Matthew Shaefer, Founding Co-Dir., Space, Cyber, and Telecomms. L. Program). Gold stressed the need to bring the private and public sectors together to create a likeminded coalition. *Id.*

¹⁹³ *See id.* at 27:02–28:15 (remarks by Ken Hodgkins, President, Int'l Space Enter. Consultants).

¹⁹⁴ Alfred B. Anzaldúa & Cristin Finnigan, *From the Truman Proclamation to the Artemis Accords: Steps Toward Establishing a Bottom-Up Framework for Governance in Space*, SPACE REV. (Oct. 26, 2020), <https://www.thespaceview.com/article/4053/1>.

¹⁹⁵ Letter from The Outer Space Institute to Tijjani Muhammad-Bande, *supra* note 26.

marginalizing input from developing and non-spacefaring States.”¹⁹⁶ The letter also compared outer space to “the high seas, the deep seabed, and Antarctica,” all of which are “governed [by] specific, multilateral agreements” developed through the United Nations.¹⁹⁷ The letter was signed by more than 140 scientists, politicians, and diplomats from around the world.¹⁹⁸ While Canada has since signed the Artemis Accords,¹⁹⁹ experts continue to advocate for the multilateral treaty approach.²⁰⁰

Multilateral discussions on space law have traditionally taken place at COPUOS, particularly within the Legal Subcommittee.²⁰¹ COPUOS consists of ninety-five member states²⁰² who meet annually to discuss questions relating to current and future activities in space.²⁰³ Since 2016, the COPUOS agenda has contained an item titled “General exchange of views on potential legal models for activities in exploration, exploitation and utilization of space resources.”²⁰⁴ The last meeting of the Legal Subcommittee in 2019 focused heavily on revisiting the Moon Agreement,²⁰⁵ which no major spacefaring power has ratified to date.²⁰⁶ This discussion may have been the impetus behind President Trump’s Executive Order 13914, which specifically renounces the Moon Agreement.²⁰⁷

¹⁹⁶ *Id.*

¹⁹⁷ *Id.*

¹⁹⁸ Steven Chase, *Canadian-Led Effort Asking United Nations to Draw Up Global Space Mining Treaty Attracts Significant Endorsements*, GLOBE & MAIL (Aug. 24, 2020), <https://www.theglobeandmail.com/politics/article-canadian-led-effort-asking-united-nations-to-draw-up-global-space/>.

¹⁹⁹ The Canadian Press, *Canada Joins U.S.-Led Artemis Accords to Send Human Explorers Back to Moon and Beyond*, CBC (Oct. 14, 2020, 7:12 AM), <https://www.cbc.ca/news/technology/artemis-accords-1.5761456>.

²⁰⁰ See O’Grady, *supra* note 10.

²⁰¹ Christensen & Johnson, *supra* note 147.

²⁰² *Members of the Committee on the Peaceful Uses of Outer Space*, U.N. COMM. FOR OUTER SPACE AFFS., <https://www.unoosa.org/oosa/en/members/index.html> (last visited Feb. 2, 2022).

²⁰³ *Committee on the Peaceful Uses of Outer Space and its Subcommittees*, U.N. COMM. FOR OUTER SPACE AFFS., <https://www.unoosa.org/oosa/en/ourwork/copuos/comm-subcomms.html> (last visited Feb. 2, 2022). The 2020 session of COPUOS was cancelled due to COVID-19. *Committee on the Peaceful Uses of Outer Space: 2020*, U.N. COMM. FOR OUTER SPACE AFFS., <https://www.unoosa.org/oosa/en/ourwork/copuos/2020/index.html> (last visited Feb. 2, 2022).

²⁰⁴ Comm. on the Peaceful Uses of Outer Space, Annotated Agenda on its Fifty-Ninth Session, *supra* note 158; Christensen & Johnson, *supra* note 147.

²⁰⁵ Legal Subcommittee: 2019, *IISL/ECSL Space Law Symposium 2019 “The Moon Agreement Revisited: The Road Ahead,”* U.N. COMM. FOR OUTER SPACE AFFS., <https://www.unoosa.org/oosa/en/ourwork/copuos/lsc/2019/symposium.html> (last visited Feb. 2, 2022).

²⁰⁶ Christensen & Johnson, *supra* note 147.

²⁰⁷ Exec. Order No. 13914, 85 Fed. Reg. 20,381 (Apr. 6, 2020); see Christensen & Johnson, *supra* note 147.

The multilateral treaty-making process is appealing for several reasons: a new international treaty developed through COPUOS “would have widespread legitimacy,” would provide for clear, binding rules for the extraction of space resources,²⁰⁸ and would be inclusive and accessible to all ninety-five member nations.²⁰⁹ However, there are many downsides to the formal treaty-making process that outweigh its benefits, particularly the lengthy and arduous process required for members to negotiate, come to an agreement, and sign and ratify the treaty.²¹⁰ The last treaty negotiated through COPUOS was the Moon Agreement, which entered into force in 1984.²¹¹ Negotiations began in 1971 and the treaty was adopted and opened for signature in 1979.²¹² At the end of this thirteen-year process, only eighteen nations ratified the Moon Agreement,²¹³ and today it is widely viewed as a failed, problematic treaty.²¹⁴ Another example outside of space law is the development of the International Seabed Authority within UNCLOS to regulate deep-seabed mining activities.²¹⁵ The International Seabed Authority took nearly thirty years to come into force and under it no commercial mining of the deep seabed has yet taken place.²¹⁶

Aside from the potentially decades-long process it may take for member nations of COPUOS to come to an agreement on the appropriate regulations for space resource activities, multilateral treaties are nearly impossible to amend and may become quickly outdated or irrelevant due to technological, political, or economic advances.²¹⁷ In a rapidly advancing industry such as space exploration, it would be difficult for such large-scale negotiations to keep up with changing practices, and implementing binding rules for an activity that has not yet occurred would appear premature and ill-advised.²¹⁸ Finally, the formal treaty-making process leaves out non-state actors like the private sector and academia²¹⁹—groups that have proven essential in carrying out the United

²⁰⁸ Christensen & Johnson, *supra* note 147.

²⁰⁹ O’Grady, *supra* note 10.

²¹⁰ See Christensen & Johnson, *supra* note 147.

²¹¹ Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, *supra* note 102; see *Space Law Treaties and Principles*, U.N. COMM. FOR OUTER SPACE AFFS., <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties.html> (last visited Feb. 2, 2022).

²¹² G.A. Res. 34/68, ¶ 2 (Dec. 5, 1979).

²¹³ STATUS OF INTERNATIONAL AGREEMENTS RELATING TO ACTIVITIES IN OUTER SPACE AS AT 1 JANUARY 2020, at 2 (n.d.), <https://www.unoosa.org/documents/pdf/spacelaw/treatystatus/TreatiesStatus-2020E.pdf>.

²¹⁴ Christensen & Johnson, *supra* note 147.

²¹⁵ U.N. Convention on the Law of the Sea, *supra* note 38, arts. 156–57(1).

²¹⁶ Anzaldúa & Finnigan, *supra* note 194.

²¹⁷ See *id.*; Christensen & Johnson, *supra* note 147.

²¹⁸ See *Insight—Encouraging the Recovery and Use of Space Resources*, *supra* note 2.

²¹⁹ Christensen & Johnson, *supra* note 147.

States' ambitious plans for space exploration.²²⁰ Ultimately, it is highly unlikely that the major space powers will wait for a multilateral treaty to be developed before proceeding with their own goals for space resource utilization.

C. *An Implementation Plan for the Moon Agreement*

A less popular solution to the legal grey area surrounding space resources is an implementation plan for the Moon Agreement.²²¹ As mentioned previously,²²² no major space power has ever ratified the 1979 treaty, and it is widely viewed as flawed and incomplete.²²³ One reason for this view is that Article 11 requires an implementation agreement to create a legal framework for the private exploitation of space resources on the moon, which was never created.²²⁴ Without this regime in place, there is great uncertainty as to the viability of commercial activities²²⁵ because the Moon Agreement specifically prohibits the appropriation of resources on the moon.²²⁶ One academic organization, The Space Treaty Institute, which claims to be “dedicated to peace and sustainability in outer space,”²²⁷ has published a Model Implementation Agreement for the Moon Agreement²²⁸ as an alternative to the Artemis Accords.²²⁹ The Model Implementation Agreement centers around four organizational principles, including a proposal to “[t]rade private property rights for public policy obligations.”²³⁰ The idea behind this model is that private actors

²²⁰ O’Grady, *supra* note 10; *see also* Shieber, *supra* note 11 (describing NASA’s award to SpaceX of a \$117 million launch contract “to explore the mineral-rich asteroid known as Psyche”).

²²¹ Dennis O’Brien, *The Artemis Accords: Repeating the Mistakes of the Age of Exploration*, SPACE REV. (June 29, 2020), <https://www.thespacereview.com/article/3975/1>.

²²² *See supra* Part II.B.

²²³ Christensen & Johnson, *supra* note 147.

²²⁴ Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, *supra* note 102, art. 11(5) (“States Parties to this Agreement hereby undertake to establish an international regime, including appropriate procedures, to govern the exploitation of the natural resources of the moon as such exploitation is about to become feasible.”); *see* O’Brien, *supra* note 221.

²²⁵ O’Brien, *supra* note 221.

²²⁶ Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, *supra* note 102, art. 11(3).

²²⁷ *The Space Treaty Institute*, SPACE TREATY INST. (Oct. 8, 2019), <http://spacetreaty.org/>.

²²⁸ Dennis O’Brien, *Legal Support for the Private Sector: An Implementation Agreement for the Moon Treaty*, 3 ADVANCES IN ASTRONAUTICS SCI. & TECH. 49, 61 (2020), https://www.researchgate.net/publication/341522997_Legal_Support_for_the_Private_Sector_An_Implementation_Agreement_for_the_Moon_Treaty.

²²⁹ *See id.*

²³⁰ *Id.* at 50. The complete set of principles are as follows:

1. The Agreement must be comprehensive and support all private activity;
2. The Grand Bargain: Trade private property rights for public policy obligations;
3. Defer issues currently at impasse

will use any location on the moon for any purpose in exchange for adherence to the public policy obligations laid out in the Moon Agreement,²³¹ such as protecting the environment, preserving areas of “special scientific interest,”²³² and allowing “free access to all areas” by other parties.²³³ The Model Implementation Agreement is intended to be adopted in conjunction with the Moon Agreement and to encourage countries to sign onto the Moon Agreement by filling in the gaps left open by Article 11.²³⁴

While the principles and rationale behind the Space Treaty Project’s Model Implementation Agreement set forth an appropriate balance between public and private interests, the lack of a legal regime for resource exploitation is not the only reason the Moon Agreement has been rejected by the United States and other countries.²³⁵ As discussed in Part I.B.2, the United States has refused to ratify the Moon Agreement because of its use of the “common heritage of mankind” language²³⁶—the same language that prevented the United States from signing UNCLOS with respect to deep-seabed mining.²³⁷ Executive Order 13914 specifically renounces the Moon Agreement, stating that “the Secretary of State shall object to any attempt by any other state or international organization to treat the Moon Agreement as reflecting or otherwise expressing customary international law,”²³⁸ while the Artemis Accords contain explicit language authorizing parties to extract and utilize resources.²³⁹ There have even been suggestions that Australia, one of the only parties to the Moon Agreement to sign the Artemis Accords, may consider withdrawing from the Moon Agreement to avoid the legal consequences of potentially violating the Agreement.²⁴⁰ It is highly unlikely that the United States and other countries

(e.g., monetary sharing of benefits) by creating a governance process for making future decisions;

4. Build upon and integrate current institutions and processes.

Id.

²³¹ *Id.* at 51.

²³² Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, *supra* note 102, art. 7.

²³³ *Id.* art. 9(2).

²³⁴ *See id.* art. 11; O’Brien, *supra* note 228, at 50.

²³⁵ *See* Doshi, *supra* note 103, at 206.

²³⁶ Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, *supra* note 102, art. 11(1).

²³⁷ U.N. Convention on the Law of the Sea, *supra* note 38, art. 136; *see* Skauge, *supra* note 61, at 820.

²³⁸ Exec. Order No. 13,914, 85 Fed. Reg. 20,381 (Apr. 6, 2020).

²³⁹ Panel at the University of Nebraska Space Law Week Conference, *supra* note 28, at 9:14–9:31 (remarks by Mike Gold, Acting Assoc. Adm’r, Off. of Int’l and Interagency Affs.).

²⁴⁰ *See* Mark Whittington, *How the United States Plans to Make Space Exploration Pay*, THE HILL (Apr. 26, 2020, 6:00 PM), <https://thehill.com/opinion/technology/494730-how-the-united-states-plans-to-make->

would abandon the Artemis Accords in favor of revisiting an old treaty they have already firmly rejected.²⁴¹

D. *The Development of Private Law in Space*

Another, more radical legal model that some scholars have proposed is the development of a body of private law to govern space resource extraction.²⁴² Proponents of this model argue that a body of rules grounded in consensual practices, rather than sovereign authority, “can lay the foundations for future space activities, without sparking a governmental scramble to project power.”²⁴³ The theory is that private governance will avoid the conflicts that may arise from “jurisdictional claim-staking” in space and will eliminate the suspicion of political motives, which has caused countries such as China and Russia to reject the United States’ current approach.²⁴⁴ These scholars have compared the commercial space sphere with international commerce: trade between nations is governed by a private body of self-enforcing law and commercial disputes are privately adjudicated with the help of international arbitration organizations such as the International Chamber of Commerce.²⁴⁵ Applied to space, scholars believe that under this model, private entities will be able to enforce property rights to space resources without acknowledgement from sovereigns,²⁴⁶ with governments playing a regulatory role.²⁴⁷

However, giving the private sector free rein in outer space without a set of predetermined rules or principles in place is not a viable solution in this context. There are far too many risks and unknown factors involved in space resource extraction to allow these rules to evolve on their own through commercial practices.²⁴⁸ For example, there are environmental concerns associated with commercial space activities, such as the regulation of space debris and the risk

space-exploration-pay (“Australia would be obliged to withdraw from the Moon Treaty if it accepts an offer to join the Accords.”).

²⁴¹ Exec. Order No. 13,914, 85 Fed. Reg. 20,381 (Apr. 6, 2020).

²⁴² Alexander William Salter, *Outer Space Needs Private Law*, SPACE REV. (Aug. 31, 2020), <https://www.thespaceview.com/article/4015/1>.

²⁴³ See *id.*; Alexander W. Salter & Peter T. Leeson, *Celestial Anarchy: A Threat to Outer Space Commerce?*, 34 CATO J. 581, 583 (2014).

²⁴⁴ See Salter, *supra* note 242; Salter & Leeson, *supra* note 243.

²⁴⁵ See Salter, *supra* note 242.

²⁴⁶ See Salter & Leeson, *supra* note 243.

²⁴⁷ See Salter, *supra* note 242.

²⁴⁸ See Samuel Stockwell, *Legal ‘Black Holes’ in Outer Space: The Regulation of Private Space Companies*, E-INT’L RELS. (July 20, 2020), <https://www.e-ir.info/2020/07/20/legal-black-holes-in-outer-space-the-regulation-of-private-space-companies/>.

of environmental contamination,²⁴⁹ that the private sector cannot be trusted to prioritize without some form of regulation in place. One foreshadowing example is the 1800s Gold Rush Era, which many have compared to the commercialization of space.²⁵⁰ When miners in the 1800s were given the opportunity to develop their own set of rules and customs to govern mining claims, environmental concerns took a backseat to the property interests of miners,²⁵¹ resulting in significant environmental damage that was not recognized until the following century.²⁵²

Additionally, it is likely that allowing the private sector to make their own rules for resource extraction will only extend the existing wealth inequalities on Earth into outer space.²⁵³ Unlike gold mining in the 1800s, space exploration missions are highly exclusive—the number of private enterprises with the resources to fulfill these missions confines the players in this industry to a “narrow, ‘cosmic elite.’”²⁵⁴ While these private companies are fond of discourse that portrays them as “pioneers” of space who intend to save humanity from extinction through extraterrestrial colonization,²⁵⁵ the reality is that “commercial resource extraction serves the exclusive interests of their private shareholders at the expense of the vast majority of the global population.”²⁵⁶ With language such as “asteroid trillionaires” being used,²⁵⁷ it is hard to imagine that private enterprises will have the best interests of humanity in mind.

E. The Soft-Law Approach: Non-Binding Principles Through Multilateral Forums

A final, middle-ground approach has been offered by scholars and space law organizations as an alternative to international binding legal instruments: the development of a bottom-up, soft law instrument through a multilateral forum such as COPUOS.²⁵⁸ This approach allows for the inclusivity and cooperation of multilateral discussions without the lengthy negotiation process and concrete

²⁴⁹ *See id.*

²⁵⁰ *See Shaw, supra* note 34, at 122, 125; Pearson, *supra* note 32.

²⁵¹ *See Shaw, supra* note 34, at 143.

²⁵² *See id.* at 150.

²⁵³ *See* Stockwell, *supra* note 248.

²⁵⁴ *See id.*

²⁵⁵ *See id.*

²⁵⁶ *See id.*

²⁵⁷ Glester, *supra* note 3.

²⁵⁸ *See Insight—Encouraging the Recovery and Use of Space Resources, supra* note 2; Anzaldúa & Finnigan, *supra* note 194.

nature of a formal, binding international treaty.²⁵⁹ Proponents of this approach have urged the United States and other nations to engage in discussions through COPUOS to develop a set of nonbinding, tightly-focused legal principles on space resource extraction and utilization.²⁶⁰ While a formal, binding multilateral treaty is not appropriate for an activity that has not yet taken place (and may not even be appropriate thereafter), the unilateral, country-by-country adoption of national laws on the subject is not an appropriate answer either.²⁶¹ International coordination and agreement is still necessary in this arena to provide legal certainty on issues such as property rights and to mitigate the risks involved in pursuing this type of activity.²⁶²

Soft law is typically characterized as a set of nonbinding legal principles that aim to establish standards and best practices for a particular activity.²⁶³ In the realm of outer space, soft law has often been used as a means to expand on principles and resolve ambiguities within existing treaties or other hard laws.²⁶⁴ For example, the U.N. Legal Subcommittee has developed several sets of soft law principles to expand on specific issues that have arisen relating to outer space, such as the use of nuclear power sources in outer space.²⁶⁵ A common critique of soft law is that it is typically not legally binding,²⁶⁶ which raises the concern that countries may agree to a soft law instrument and then violate those principles in practice, as there is no formal obligation to adhere to them. However, if designed properly, soft law instruments can create obligations in two other ways: (1) if adopted by all parties to a binding treaty, soft law instruments can become an authoritative basis for interpreting the treaty; and (2) soft law instruments can create procedural obligations by setting forth specific

²⁵⁹ See Christensen & Johnson, *supra* note 147.

²⁶⁰ See *Insight—Encouraging the Recovery and Use of Space Resources*, *supra* note 2; Anzaldúa & Finnigan, *supra* note 194.

²⁶¹ See *Insight—Encouraging the Recovery and Use of Space Resources*, *supra* note 2 (“For example, one cannot create a claims system without some level of mutual recognition and protection, be that on a bilateral, plurilateral, or multilateral basis.”).

²⁶² See *id.*

²⁶³ Jennifer Ann Urban, *Soft Law: The Key to Security in a Globalized Outer Space*, 43 *TRANSP. L.J.* 33, 46 (2016).

²⁶⁴ *Id.*; see Jack M. Beard, *Soft Law’s Failure on the Horizon: The International Code of Conduct for Outer Space Activities*, 38 *U. PA. J. INT’L L.* 335, 347 (2017) (“[S]oft law initiatives should be embraced as a key building block for norm-setting and regulation of the outer space environment.”).

²⁶⁵ G.A. Res. 47/68 (Dec. 14, 1992) (“[T]he use of nuclear power sources in outer space shall be restricted to those space missions which cannot be operated by non-nuclear energy sources in a reasonable way.”); see Urban, *supra* note 263, at 46–47.

²⁶⁶ See Beard, *supra* note 264, at 348.

technical standards and guidelines.²⁶⁷ Additionally, well-designed soft law instruments often lead to the development of binding, coordinated domestic legislation and international agreements.²⁶⁸

In an area such as space law, in which the technology is rapidly evolving, this type of soft law instrument can be beneficial in creating specialized standards and practices for space resource extraction without having to go through the long and arduous treaty-making process.²⁶⁹ As mentioned above, treaties sometimes take decades to come into effect.²⁷⁰ This runs the risk that in the time it takes for a new treaty to be negotiated and agreed upon, new technologies or issues may arise within the realm of space resource extraction that could not have been foreseen at the time negotiations began. A soft law instrument would allow for space resource extraction principles to mold to needs as they arise and evolve alongside the industry.²⁷¹ As expressed previously in this Part, the actual extraction of natural resources from a celestial body has not yet taken place, but once it becomes evident what form such practices will take, these soft law principles may then serve as a basis for a binding hard law, if feasible. Soft law is a “long established, vital component of the space law regime” and the international community has come to increasingly rely on its flexibility.²⁷² Therefore, soft law is an ideal starting point for developing norms and procedures for space resource extraction.

One model for this type of soft law instrument is the most recent success that came out of COPUOS in 2019: the Guidelines for Long-Term Sustainability of Outer Space Activities (“Guidelines”).²⁷³ These Guidelines represent “a collection of internationally recognized measures for ensuring the long-term

²⁶⁷ *Id.* at 348–49. One example of this is the non-binding recommendations put forth by the International Telecommunications Union for the regulation of satellites. *Id.* at 349. If governments fail to comply with these regulations, they risk being isolated from the telecommunications industry due to “non-matching standards or outdated equipment.” *Id.* at 350.

²⁶⁸ *Id.* at 350–52. For example, many nonbinding principles from the U.N. General Assembly Resolution on “Principles Relating to Remote Sensing of the Earth from Outer Space” have been incorporated into legally binding domestic licensing regulations of numerous countries. *Id.* at 350.

²⁶⁹ See Urban, *supra* note 263, at 47–48.

²⁷⁰ See *supra* Part III.B.

²⁷¹ See Urban, *supra* note 263, at 49. As globalization of space occurs, the interests of future space actors are likely to change. *Id.* One example of this is the rise of the private sector to the forefront of the space technology industry.

²⁷² Beard, *supra* note 264, at 352.

²⁷³ *Long-Term Sustainability of Outer Space Activities*, U.N. OFF. FOR OUTER SPACE AFFS., <https://www.unoosa.org/oosa/en/ourwork/topics/long-term-sustainability-of-outer-space-activities.html> (last visited Feb. 2, 2022) (“The Guidelines provide guidance on the policy and regulatory framework for space activities; safety of space operations; international cooperation, capacity-building and awareness; and scientific and technical research and development.”); see *Insight—Encouraging the Recovery and Use of Space Resources*, *supra* note 2.

sustainability of outer space activities and for enhancing the safety of space operations.²⁷⁴ The purpose of these Guidelines is to provide a policy and regulatory framework for space activities, focusing on international cooperation, the safety of space operations, and scientific research and development.²⁷⁵ While these Guidelines are not binding, they were adopted by an absolute consensus of all ninety-two member nations of COPUOS at the time,²⁷⁶ and the committee urges its members to “voluntarily take measures to ensure that the guidelines are implemented to the greatest extent feasible and practicable.”²⁷⁷ In developing these Guidelines, COPUOS first established a Working Group on the Long-Term Sustainability of Outer Space Activities in 2010. The group was comprised of experts in outer space sustainability and was tasked with identifying areas of concern in long-term space activities, proposing measures to enhance sustainability, and drafting the Guidelines.²⁷⁸ The first set of Guidelines were agreed upon in 2016 and the final Guidelines were officially adopted in 2019.²⁷⁹

A starting point in applying this type of multilateral coordination effort to space resource extraction and utilization is the Building Blocks for the Development of an International Framework on Space Resource Activities, published by The Hague International Space Resources Working Governance Group in November 2019.²⁸⁰ The group, which represents a wide range of viewpoints, consists of more than thirty members of academia, government, and industry and is tasked with the common goal of creating a structured legal environment for space resource activities.²⁸¹ The purpose of the Building Blocks is to serve as the basis for a potential future international agreement.²⁸² The Building Blocks contain a number of principles that the Hague group views as

²⁷⁴ Peter Martinez, *The U.N. COPUOS Guidelines for the Long-Term Sustainability of Outer Space Activities*, SECURE WORLD FOUND. (Nov. 2019), https://swfound.org/media/206891/swf_un_copuos_its_guidelines_fact_sheet_november-2019-1.pdf.

²⁷⁵ *Long-Term Sustainability of Outer Space Activities*, *supra* note 273.

²⁷⁶ Martinez, *supra* note 274.

²⁷⁷ *Long-Term Sustainability of Outer Space Activities*, *supra* note 273.

²⁷⁸ *Id.*; see Martinez, *supra* note 274.

²⁷⁹ *Long-Term Sustainability of Outer Space Activities*, *supra* note 273.

²⁸⁰ THE HAGUE INT’L SPACE RES. GOVERNANCE WORKING GRP., BUILDING BLOCKS FOR THE DEVELOPMENT OF AN INTERNATIONAL FRAMEWORK ON SPACE RESOURCE ACTIVITIES 1 (2019). The Hague International Space Resources Working Governance Group is organized through the International Institute of Air and Space Law, a reputable international academic research institute within Leiden University in the Netherlands. *International Institute of Air and Space Law*, UNIVERSITEIT LEIDEN, <https://www.universiteitleiden.nl/en/law/institute-of-public-law/institute-of-air-space-law> (last visited Feb. 2, 2022).

²⁸¹ *Id.*; see Christensen & Johnson, *supra* note 147.

²⁸² THE HAGUE INT’L SPACE RES. GOVERNANCE WORKING GRP., *supra* note 280; see Christensen & Johnson, *supra* note 147.

“necessary to enable space resources utilization in a manner consistent with international law and providing industry legal certainty,”²⁸³ with an emphasis on establishing rights to resources, technical and safety standards, and addressing environmental risks.²⁸⁴ These principles may act as a reference point for any future multilateral discussions that take place through COPUOS.

A soft law instrument would allow the United States to benefit from the cooperation of a multilateral forum without the lengthy negotiation period associated with the treaty-making process. Pursuing this approach does not mean the United States has to abandon the Artemis Accords and its negotiations with other nations. As NASA representatives have said, the Artemis Accords are only a small, modest step forward in developing a regime for resource extraction in space.²⁸⁵ A multilateral discussion through COPUOS can take place at the same time as the United States’ bilateral negotiations through the Artemis program—the former will simply take a more focused, prescriptive approach to the extraction of natural resources in space and associated property rights, a concept which the Artemis Accords skirt around.²⁸⁶

III. APPLYING PRINCIPLES FROM EXISTING MINING LAWS TO A SOFT LAW APPROACH

Ultimately, the most efficient and appropriate method for developing an internationally recognized framework for the extraction and utilization of space resources is the development of soft law principles through an international forum. This approach allows countries to develop a set of evolving principles for best practices in space resource extraction that accounts for the needs of a rapidly changing industry while avoiding the lengthy treaty negotiation process. Thus, a final question remains: which principles should be included in such an approach? The best way to answer this question is by looking at both the successes and failures of existing mining laws on Earth. This Part examines the various principles of the terrestrial mining laws discussed in Part I.A and applies those principles to the concept of space resource extraction in a soft law context.

²⁸³ Christensen & Johnson, *supra* note 147.

²⁸⁴ THE HAGUE INT’L SPACE RES. GOVERNANCE WORKING GRP., *supra* note 280, at 3–4 (arts. 8, 10(a), 11.1-11.2).

²⁸⁵ Panel at the University of Nebraska Space Law Week Conference, *supra* note 28, at 5:39–5:45 (remarks by Mike Gold, Acting Assoc. Adm’r, Off. of Int’l and Interagency Affs.).

²⁸⁶ *Id.* at 33:05–33:19.

A. *Principles from the 1872 Mining Law*

One of the most important aspects of the 1872 Mining Law was the ability for miners to obtain a patent for the land on which they discovered valuable minerals and thus obtain fee simple title to the land and its resources.²⁸⁷ The realm of outer space, however, is different from that of the Wild West: while the U.S. government's priority under the 1872 Mining Law was to settle and develop the West,²⁸⁸ the potential settling of outer space has been a primary point of contention among nations.²⁸⁹ Most proposed frameworks, including the Artemis Accords and the Hague Building Blocks, emphasize compliance with existing international space law.²⁹⁰ The Outer Space Treaty explicitly prohibits the national appropriation of outer space,²⁹¹ and a common concern raised in arguments against the extraction of resources is that it may lead to the colonization of space.²⁹² Therefore, any set of soft law principles for the use of space resources must address the extent of property rights in space.

Because most countries have agreed that any framework for space resource extraction must comply with the Outer Space Treaty, which prohibits national appropriation of space,²⁹³ claims over space resources extracted by private entities should resemble an unpatented claim under the 1872 Mining Law.²⁹⁴ This would grant private entities exclusive possession over any space resources and minerals extracted in addition to surface rights for the purpose of mining activities only. While the patent moratorium under the 1872 Mining Law essentially eliminated the incentive component of the law and thus diminished its success,²⁹⁵ the same concern does not apply to outer space. An "unpatented" claim to space resources would still provide incentive to private entities to

²⁸⁷ LAITOS, *supra* note 41, at 472–73.

²⁸⁸ Shaw, *supra* note 34, at 147.

²⁸⁹ Ji et al., *supra* note 29.

²⁹⁰ See THE ARTEMIS ACCORDS, *supra* note 21, § 10(2) (“[T]he extraction and utilization of space resources, including any recovery from the surface or subsurface of the Moon, Mars, comets, or asteroids, should be executed in a manner that complies with the Outer Space Treaty”); THE HAGUE INT’L SPACE RES. GOVERNANCE WORKING GRP., *supra* note 280, at 3 (art. 8.3) (“The international framework should ensure that the utilization of space resources is carried out in accordance with the principle of non-appropriation under Article II OST.”).

²⁹¹ Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, *supra* note 14, art. II.

²⁹² Cheney, *supra* note 29 (describing arguments raised by Belgium and Russia, in response to the U.S. Space Competitiveness Act of 2015, that space resources are equivalent to celestial bodies and therefore may not be appropriated by extension of national jurisdiction under the Outer Space Treaty).

²⁹³ Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, *supra* note 14, art. II.

²⁹⁴ LAITOS, *supra* note 41, at 494.

²⁹⁵ See Shaw, *supra* note 34, at 146–47 n.133.

engage in space exploration and resource extraction because the value lies primarily in the space minerals themselves, rather than the surface rights to the land.²⁹⁶

B. Principles from Deep-Sea Mining Laws

As discussed in Part I.A.2, UNCLOS was never ratified by the United States due to its use of the “common heritage of mankind” principle, which prohibits states from claiming sovereignty over the deep seabed and its resources.²⁹⁷ The United States instead chose to adopt the Deep Seabed Hard Minerals Resources Act (DSHMRA), a multilateral agreement that sets forth criteria that the United States considers necessary to an acceptable international deep sea mining regime, including access for U.S. citizens to deep-seabed mineral resources and assurance that any mining activities that U.S. citizens engage in prior to the signing of any international regime will be allowed to continue.²⁹⁸ Therefore, these same principles must be included in any set of soft law principles for space resource extraction and utilization to avoid a failure similar to the United States’ refusal to sign UNCLOS.²⁹⁹

Another failure of UNCLOS that should be avoided in this context is the establishment of the International Seabed Authority to regulate and control deep-seabed mining activities.³⁰⁰ As discussed in Part II.B, the process took nearly thirty years to come into force and no commercial mining of the deep seabed has yet taken place under the ISA’s regulation.³⁰¹ Additionally, the ISA requires mining applicants to pay a hefty royalty payment and also requires the sharing of mining revenues among nations.³⁰² This is contrary to the U.S. view of natural resources as a “common property right”³⁰³ and eliminates any incentive for private enterprises to engage in space exploration. Incentives were part of the success of the 1872 Mining Law, which required no royalty payments or sharing of revenues.³⁰⁴ An alternative concept included in UNCLOS that should be applied to a framework for outer space mining is the concept of “due regard” for the interests of other nations.³⁰⁵ UNCLOS acknowledges the freedom of the high

²⁹⁶ See Glester, *supra* note 3, at 34–35; Wong, *supra* note 4.

²⁹⁷ U.N. Convention on the Law of the Sea, *supra* note 38, arts. 136–37.

²⁹⁸ Deep Seabed Hard Mineral Resources Act, *supra* note 68.

²⁹⁹ See *supra* Part I.A.2.

³⁰⁰ U.N. Convention on the Law of the Sea, *supra* note 38, arts. 156–57.

³⁰¹ Anzaldúa & Finnigan, *supra* note 194.

³⁰² U.N. Convention on the Law of the Sea, *supra* note 38, annex III, art. 3.

³⁰³ Anderson et al., *supra* note 65, at 255.

³⁰⁴ Shaw, *supra* note 34, at 149.

³⁰⁵ U.N. Convention on the Law of the Sea, *supra* note 38, art. 87.

seas to all nations, but states that “[t]hese freedoms shall be exercised by all States with due regard for the interests of other States.”³⁰⁶ A similar concept has been proposed in the Hague Building Blocks, stating that “[t]he international framework should provide that States and international organizations responsible for space resource activities shall give due regard to the corresponding interests of all countries and humankind.”³⁰⁷ This “soft” approach to the idea of sharing space and its resources allows for cooperation among nations and the recognition of other nations’ interests without hindering the private incentive to explore and utilize space.

C. Principles from the Antarctic Treaty System

The Antarctic Treaty System emphasizes scientific research and exploration, and centers around an overall concept of the peaceful use of Antarctica and its resources.³⁰⁸ Thus, there are many relevant principles from the Antarctic Treaty System that can and should be applied to a soft law framework for space resource extraction. For instance, Articles II and III of the Antarctic Treaty provide for the freedom of scientific investigation and the exchange of information and encourage cooperation among nations with a scientific interest in Antarctica.³⁰⁹ Similar principles have been proposed in both the Artemis Accords and the Hague Building Blocks.³¹⁰ For example, Section 8 of the Artemis Accords reads, “The Signatories are committed to the open sharing of scientific data . . . [and] plan to make the scientific results obtained from cooperative activities under these Accords available to the public and the international scientific community, as appropriate, in a timely manner.”³¹¹ This same section, however, makes it clear that this obligation does not apply to private sector operations.³¹² Therefore, any set of soft law principles on space resource extraction will need to clearly differentiate between the rights and obligations of sovereign states and private enterprises.

Another concept from the Antarctic Treaty System that may be successful if applied to outer space is its two-tier regulatory structure,³¹³ as opposed to the

³⁰⁶ *Id.*

³⁰⁷ THE HAGUE INT’L SPACE RES. GOVERNANCE WORKING GRP., *supra* note 280, at 3 (art. 9).

³⁰⁸ The Antarctic Treaty, *supra* note 38 and accompanying text.

³⁰⁹ The Antarctic Treaty, *supra* note 38, arts. II, III, XI.

³¹⁰ *See* THE ARTEMIS ACCORDS, *supra* note 21, § 8; THE HAGUE INT’L SPACE RES. GOVERNANCE WORKING GRP., *supra* note 280, at 5 (sec. 14).

³¹¹ THE ARTEMIS ACCORDS, *supra* note 21, § 8.

³¹² *Id.*

³¹³ *See* Skauge, *supra* note 61, at 827.

single governing body implemented by UNCLOS (the ISA).³¹⁴ As discussed in Part I.A.3, the Antarctic Treaty System divides member nations into “consultative” and “non-consultative” parties.³¹⁵ Consultative parties are those nations that have contributed to substantial research activities in Antarctica and have decision-making authority, while non-consultative parties may attend only as observers.³¹⁶ This model allows industrialized countries, which have the most stake in the scientific exploration of Antarctica, to have primary authority in decision-making while also allowing developing nations to participate.³¹⁷ Applied to space mining, this system could allow developing nations to participate in the expanding space economy while avoiding the wealth sharing mechanisms, as used in UNCLOS, that the United States typically opposes.³¹⁸

IV. ENVIRONMENTAL IMPLICATIONS OF SPACE RESOURCE EXTRACTION

If a soft law instrument establishing principles for space resource extraction is agreed upon and the practice goes into effect, there will necessarily be policy implications, particularly with respect to environmental considerations. A common argument made by advocates for space resource extraction is that mining in space is the solution to the depletion of natural resources on Earth.³¹⁹ These proponents point to scientific evidence that many key natural resources, such as the rare earth metals used in renewable energy production, are becoming increasingly scarce.³²⁰ They argue that mining for these resources in space is not only beneficial but also essential to preserve the environment on Earth.³²¹ Scientists project that asteroids contain millions of tons of such resources, including gold, cobalt, iron, and platinum, and that there are at least one million asteroids with the potential to be mined.³²² Additionally, asteroids and other celestial bodies contain elements that are particularly scarce on Earth; one such element is Helium-3, which may “be used as a low-cost, efficient energy source” with relatively little pollutive effect.³²³

On the other side of the environmental argument, however, are scholars that caution against treating outer space as an unlimited source of natural resources

³¹⁴ U.N. Convention on the Law of the Sea, *supra* note 38, arts. 156–57.

³¹⁵ TRONCHETTI, *supra* note 82, at 139, 150.

³¹⁶ The Antarctic Treaty, *supra* note 38, art. IX; *see* TRONCHETTI, *supra* note 82, at 139.

³¹⁷ *See* Skauge, *supra* note 61, at 821.

³¹⁸ U.N. Convention on the Law of the Sea, *supra* note 38, annex III, art. 3.

³¹⁹ Doshi, *supra* note 103, at 197.

³²⁰ *Id.*

³²¹ *Id.*

³²² *Id.* at 198.

³²³ *Id.* at 198–99.

with no environmental consequences.³²⁴ As Alex Gilbert, a fellow in the Colorado School of Mines Space Resource Program, has pointed out, this is precisely the view that led to overexploitation of the West during the 1800s Gold Rush.³²⁵ Gilbert argues that environmental protection and sustainability values must be expanded to cover the extraterrestrial environment and that these values must be at the forefront of any efforts to pursue space resource extraction.³²⁶ If plans to mine space resources are successful, an entirely new set of environmental concerns outside the realm of those on Earth will arise, as the extraterrestrial environment is particularly fragile due to its low-gravity nature and issues such as how to manage space debris will need to be addressed.³²⁷

Another aspect of the environmental debate is the impact that rocket launches and other space exploration ventures may have on Earth's atmosphere.³²⁸ Rocket launches expel billions of particles into the air, including soot and carbon dioxide, both of which have a negative impact on air quality and "contribut[e] to global climate change."³²⁹ On the one hand, while "[s]pace launch emissions are not a significant contributor to greenhouse gases currently," increasing space exploration missions and introducing new rocket models may have a larger effect on the environment in the future.³³⁰ On the other hand, recent scientific studies have estimated that the environmental impact on Earth of mining rare metals in outer space, which takes into account the launch and re-entry of spacecrafts, would be exponentially smaller than the impact of mining the same metal on Earth.³³¹ Scientists anticipate that extraterrestrial mining could have significant environmental benefits on Earth by relocating certain terrestrial mining activities to space.³³² Additionally, the environmental

³²⁴ Resources Radio, *Space Resources: Exploring the Final Frontier, with Alex Gilbert*, RES. MAG. (Sept. 22, 2020), <https://www.resourcesmag.org/resources-radio/space-resources-exploring-final-frontier-alex-gilbert/>.

³²⁵ *Id.* (comparing the argument that space resources are virtually unlimited to those arguments used in the past during the settling of the West).

³²⁶ *Id.* Gilbert also points to an open legal question: whether the National Environmental Policy Act (NEPA) applies to outer space, a question that warrants its own Comment. *Id.*

³²⁷ *Id.*

³²⁸ See Hunter Sutherland, *The Stakes Are Out of this World: How to Fix the Space Act of 2015*, 22 VT. J. ENV'T L. 100, 109 (2021).

³²⁹ See Erin C. Bennett, *To Infinity and Beyond: The Future Legal Regime Governing Near-Earth Asteroid Mining*, 48 TEX. ENV'T L.J. 81, 93 (2018).

³³⁰ *Id.* at 94–95.

³³¹ See Andreas M. Hein, Hortense Tollu & Michael Saidani, *Exploring Potential Environmental Benefits of Asteroid Mining*, at 4 (2001) (69th Int'l Astronautical Cong., IAC-18-D4.5.11, 2018).

³³² *Id.* at 1.

impact of rocket launches could be reduced by the use of “green propellants” and other eco-design principles.³³³

Ultimately, if private actors or governments find a way to tap into these extraterrestrial resources, there will be vast implications for the environment, both on Earth and in space. These implications will likely lead to policy debates over which environment to prioritize—our native environment on Earth or the extraterrestrial environment that may hold the key to our future. While this existential question could be debated endlessly, it is important to recognize that both sides of the argument exist and must be addressed in any future space resource regime, whether developed through soft or hard law.

CONCLUSION

The eventual attempt by private enterprises and governments to extract and utilize space resources is inevitable. With lofty claims being made by space experts as to the value of minerals on asteroids and the moon, as well as the rapidly advancing technology in the space exploration industry,³³⁴ private companies are likely to pursue space mining activities as soon as it is financially feasible, whether there is a legal system in place or not. For this reason, it is crucial to get ahead of the industry and begin serious international conversations about the issues and rights surrounding space resource extraction, and quickly. While the Artemis Accords are a step in the right direction, the best way to ensure a common understanding as to the future of space resources is through a set of carefully designed soft law principles that specifically address space resource extraction through an international, multilateral forum.

Laura C. Byrd*

³³³ *Id.* at 5.

³³⁴ *See supra* Introduction.

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