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International Space Law in a New Space Age: What Laws Will Regulate Space Mining and NASA's Gateway Program?

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Since the late 1960s, international space law has promoted the peaceful use of outer space between countries. But international space law is insufficient to effectively govern novel outer space activities like space mining and NASA's Gateway Program (a program between several countries to build an international space station that will orbit the moon and conduct missions to Mars). International space law is general, lacks enforceable repercussions, and leaves the door open for countries to create national laws which could result in the commercialization and destruction of celestial bodies like the Moon and Mars. This Comment explores the history of international space law and various international space treaties to explain that international space law will likely develop from companies and countries engaging in the very outer space activities the law seeks to govern. Commercial companies may also have a hand in the development of international space law if they lobby governments for their individual interests. Many scholars agree that international space law is insufficient to govern novel activities like space mining, but they differ as to the solutions.

International space law development may be a question of what comes first: the guide (of how to properly conduct activities in outer space) or the activity the guide seeks to govern, and this Comment argues that the activity will lead to the development of the law, as it often has.

I. Introduction

Originally, human space exploration began as a race to space between the Soviet Union and the United States.[1] The Cold War, a "period of political hostility between the Soviet Union and the United States"[2] sparked an international space race between the two countries. Importantly, prior to any international space laws or space regulation, the Soviet Union and the United States, through the National Aeronautics and Space Administration (NASA), launched many satellites and other spacecrafts into space.[3] It was not until 1967, several years into the space race, that the first international space law, the Outer Space Treaty, entered into force.[4] After the Outer Space Treaty entered into force, NASA and the Soviet Union continued to make advances in space exploration throughout the late 1960s and early 1970s.[5] For example, in 1969, NASA famously sent astronauts to the moon, and in the 1970s, the Soviet Union and NASA successfully sent the first space stations into Earth's orbit.[6]

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[1] NATIONAL GEOGRAPHIC, *The History of Space Exploration*, https://education.nationalgeographic.org/resource/history-space-exploration/.

[2] *Id.*

[3] *Id.*

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

[5] *The History of Space Exploration*, *supra* note 1.

[6] *Id.*

Since the early space exploration activities of the Cold War, the world has only seen advancement in space exploration. This space exploration advancement ranges from NASA discovering over five thousand exoplanets[7] to SpaceX becoming the first private company to successfully launch and recover a spacecraft from Earth's orbit.[8] Concepts once thought to be science fiction, like space mining and space colonization, are becoming a closer reality.[9]

The Space Generation Advisory Council defines space mining as comprising "the exploration, exploitation, and utilization of natural resources to be found in the Moon, other planets and near-Earth asteroids (NEAS); primarily, what can be encountered is a rich diversity of useful materials such as minerals, gases (mainly Helium-3), metals and water."[10] Not only is space mining on the horizon, but so is the launch of NASA's Gateway Program, which is "an international collaboration to establish humanity's first space station around the Moon." [11] Importantly, NASA's Gateway Program is set to launch in 2028 and "will play a key role in helping NASA and its partners test the technologies and capabilities required for a sustained human presence in deep space" including to "chart a path to Mars."[12] With space exploration activities like these in the works, many argue that we are entering the age of a new space race: a race to mine resources in space and to colonize the moon and other planets.[13]

Even with these significant international space exploration activities on the horizon, the international realm still faces the nearly identical problem that it faced during the original space race: there is a serious lack of international space laws and space regulation to govern these kinds of activities.[14] It is likely that countries and commercial companies will address this problem by engaging in unregulated space activities, which will forge a path for international law to follow. It is also likely that presently varied space laws and collaborative developments between countries, like NASA's Gateway Program, will inspire new international space laws.

This paper will begin by providing the legal background for the current state of varied space laws. Part II outlines relevant agreements to contextualize the current space race. Part III will then explore critical recent developments that will spur the development of international space law.

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[7] NASA, *Exoplanets*, (last updated Jan. 26, 2024), https://exoplanets.nasa.gov/ [https://perma.cc/BK3A-KJPB]; NASA, *What is an Exoplanet?*, (last visited Jan. 26, 2024), https://exoplanets.nasa.gov/what-is-an-exoplanet/overview/ (explaining that an exoplanet is any planet beyond our solar system) [https://perma.cc/577X-YCBM] .

[8] Alison Eldridge, *SpaceX*, BRITANNICA, (last updated Jan. 26, 2024), https://www.britannica.com/topic/SpaceX [https://perma.cc/9W36-FX44].

[9] Nicole Mortillaro, *Space mining is getting closer to becoming a reality, and Canada could play a major role*, CBC NEWS (Nov. 4, 2023), https://www.cbc.ca/news/science/space-mining-1.7012869#:~: [https://perma.cc/MM5Z-SWWM].

[10] Space Generation Advisory Council, *Space Mining*, (last visited Jan. 26, 2024), https://spacegeneration.org/sgac-ecsl-un-model/67883-2 [https://perma.cc/4QS5-GUD5]

[11] NASA, *NASA's Gateway Program* (last updated June 12, 2023), https://www.nasa.gov/reference/nasas-gateway-program/, [https://perma.cc/Y5RF-Y3JA].

[12] *Id.*

[13] Royal Museums Greenwich, *The New Space Race*, (last visited Jan. 26, 2024), https://www.rmg.co.uk/stories/topics/new-space-race-astropolitics-power-21st-century#:~ [https://perma.cc/4U5T-EW5X].

[14] Melissa de Zwart, et al., *Space resource activities and the evolution of international space law*, 211 ACTA ASTRONAUTICA 155, 160 (2023).

These developments generally include unilateral laws for space resource mining, plans to mine space resources in the near future, country collaborations with NASA to implement the Gateway Program, and continued expansion of NASA's Gateway Program. Finally, this paper will ultimately conclude that these recent developments will likely indirectly and directly contribute to an increase in international space laws and international space law regulation. And furthermore, commercial companies could have a hand in the development of international space laws.

II. Legal Background

Although the laws and regulations governing international space activities are sparse, they still deserve mention. Currently, these foundational international space laws include the Outer Space Treaty, the Moon Agreement, the Rescue Agreement, the Liability Convention, and the Registration Convention.[15] In addition, the United Nations General Assembly declarations and guidelines adopted by the United Nations Committee on the Peaceful Use of Outer Space (UNCOPUOS) have helped to fill in gaps in guidance and governance between the Cold War era space laws and the current space activities which differ extensively from the activities of the Cold War times.[16] Also, as related to the Gateway Program, the Artemis Accords and the MOUs formed between NASA and its Gateway Partners are especially relevant to governing the activities of the Gateway Program. But as will later be pointed out in parts A-E, many of these sources for international space law are either ambiguous, lack a binding nature on key players in space exploration, or are not very relevant to the legal issues that these space activities raise. These shortcomings ultimately emphasize the need for more international space laws that will provide clear guidance and be binding on key space leaders.

A. The Outer Space Treaty

Despite being the oldest international space law, the Outer Space Treaty is largely still the primary international governing space law, and many countries continue to rely on its text to determine how they will legally mine for space resources.[17] The Outer Space Treaty was originally enacted to set ground rules for international space use, or in other words, to provide for the peaceful and free use of outer space.[18] Although the treaty does not directly prescribe laws governing space mining or NASA's Gateway Program, Articles I-VI of the Outer Space Treaty are of particular relevance and serve as a legal foundation for the peaceful and free use of outer space.[19]

Article I provides in relevant part:

> The exploration and use of outer space, including the moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind. Outer space, including the moon and other celestial bodies,

[15] Space Foundational Editorial Team, *Space Briefing Book: Space Law*, Space Foundation, (last visited Jan. 25, 2024), https://www.spacefoundation.org/space_brief/international-space-law/ [https://perma.cc/N4TU-EUL6].
[16] Symposium, *Current Issues Being Discussed in Space Law*, Istanbul U. Press 117, 118 (2021).
[17] Paul Larsen, *Is There A Legal Path To Commercial Mining On The Moon?*, 83 U. Pitt. L. Rev. 1, 12-13 (2023).
[18] Outer Space Treaty, *supra* note 4 at Art. I-III.
[19] *See id.*

> shall be free for exploration and use by all States without discrimination of any kind, on a basis of equality and in accordance with international law, and there shall be free access to all areas of celestial bodies. There shall be freedom of scientific investigation in outer space, including the moon and other celestial bodies, and States shall facilitate and encourage international co-operation in such investigation.[20]

Given the plain language of Article I, the treaty intended for outer space to be shared equally among the international community.[21] In addition, littered throughout the text are phrases intended to convey the "free" use of outer space, "without discrimination" and "for the benefit and in the interests of all countries."[22] Importantly, Article I is broad; it refers to "the exploration and use of outer space."[23]

Space mining and NASA's Gateway Program would seem to fall under the purview of Article I because space mining is technically the "use" of outer space and NASA's Gateway Program is a form of "exploration."[24] This means that these space exploration activities must be carried out "in the interest of all countries," but this is ambiguous and ultimately unclear guidance. For example, can NASA exclude countries from the Gateway Program, like China, or would this be against Article I? Can commercial companies mine for space resources to the exclusion of other countries? Some may argue that space mining is for the interest and benefit of countries, but others may argue that space mining is exploitive and something akin to destroying the environment. But based on the plain language of Article I, it does not appear that either space mining or NASA's Gateway Program are unlawful, but the other Articles of the Outer Space Treaty must be examined to gain clarity.

Articles II, III, and VI state respectively:

> Outer space, including the moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means.
>
> States Parties to the Treaty shall carry on activities in the exploration and use of outer space, including the moon and other celestial bodies, in accordance with international law, including the Charter of the United Nations, in the interest of maintaining international peace and security and promoting international co-operation and understanding.
>
> States Parties to the Treaty shall bear international responsibility for national activities in outer space, including the moon and other celestial bodies, whether such activities are carried on by governmental agencies or by non-governmental

[20] *Id.* at Art. I.
[21] *See id.*
[22] *Id.*
[23] *Id.*
[24] Outer Space Treaty, *supra* note 4 at Art. I.

> entities, and for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty.[25]

Although these articles state that the parties to the treaty agree that they will not nationally appropriate the moon and other celestial bodies, will carry out space exploration activities in accordance with the "Charter of the United Nations," and will bear international responsibility for national activities in space carried out by governmental and no-governmental entities, these articles do not directly govern space resource mining or a project as complex as NASA's Gateway Program.[26] But Article II does essentially state that no country can assert any property rights in space, which could technically apply to space resource mining and potentially space colonization, which could be achieved through NASA's Gateway Program.[27] Nonetheless, these articles are ambiguous, which is no surprise given that the treaty was entered into force over 50 years ago, when countries were barely scratching the surface of the space technology that the world has today.[28] Overall, the Outer Space Treaty is insufficient and cannot serve as the guiding law for space mining and NASA's Gateway Program, which creates a need for new space laws to govern these activities so that space mining and NASA's Gateway Program can be conducted safely, and lawfully.

B. THE MOON AGREEMENT

A little over 10 years after the Outer Space Treaty entered into force, the Moon Agreement entered into force in 1984.[29] Notably, though, only eleven countries signed the Moon Agreement, and of those that signed, four countries (France, Guatemala, India and Romania) never ratified it.[30] This means that the Moon Agreement is not binding on these four countries. In addition, only a total of eighteen countries have either ratified or accessioned to the Moon Agreement, and Saudi Arabia, who originally accessioned, withdrew from the Moon Agreement in 2023.[31]

The Moon Agreement provides a basis of agreements between a few countries on how to use the Moon, and it is more relevant for an inquiry regarding space mining because it specifically prohibits the parties to the treaty from claiming ownership over the resources that they extract from the Moon.[32] An important distinction between the Outer Space Treaty and the Moon Agreement, however, is that key players like the U.S., Russia, Canada, Japan, and Luxembourg have not signed, ratified or accessioned to the Moon Agreement, and notably, as previously mentioned, Saudi Arabia withdrew from the agreement in 2023.[33] Therefore, the Moon Agreement has almost no relevancy in international law, but it is still helpful to examine, because it is an international space

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[25] *Id.* at Art. II-III, IV.
[26] *See id.*
[27] *See id.*
[28] *See id.*
[29] Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, Dec. 18, 1979, 1363 U.N.T.S. 187 [hereinafter Moon Agreement].
[30] *Id.*
[31] *Id.*; Stefan-Michael Wedenig & Jack Wright Nelson, *The Moon Agreement: Hanging by a Thread*, McGill Institute of Air & Space Law, (Jan. 26, 2023) https://www.mcgill.ca/iasl/article/moon-agreement-hanging-thread [https://perma.cc/D9MK-VKE].
[32] *See* Moon Agreement, *supra* note 29 at Art. 11 ¶¶ 1-6.
[33] Moon Agreement, *supra* note 29; Wedenig & Nelson, *supra* note 31.

treaty that has a binding effect on a few countries, which could influence the future market of lunar mining products.[34]

Article 6 and Article 11 respectively state:

> 2. In carrying out scientific investigations and in furtherance of the provisions of this Agreement, the States Parties shall have the right to collect on and remove from the moon samples of its mineral and other substances. Such samples shall remain at the disposal of those States Parties which caused them to be collected and may be used by them for scientific purposes. States Parties shall have regard to the desirability of making a portion of such samples available to other interested States Parties and the international scientific community for scientific investigation. States Parties may in the course of scientific investigations also use mineral and other substances of the moon in quantities appropriate for the support of their missions.[35]
>
> 3. Neither the surface nor the subsurface of the moon, nor any part thereof or natural resources in place, shall become property of any State, international intergovernmental or non- governmental organization, national organization or non-governmental entity or of any natural person. The placement of personnel, space vehicles, equipment, facilities, stations and installations on or below the surface of the moon, including structures connected with its surface or subsurface, shall not create a right of ownership over the surface or the subsurface of the moon or any areas thereof.[36]

Although Article 6 of the Moon Agreement allows for the collection and removal of "moon samples of its mineral or other substances", Article 11 prevents all of the parties to the treaty from claiming ownership of these resources.[37] This effectively makes it unlawful for any of the parties to the Moon Agreement to even participate in a lunar mining market, because they are prohibited from claiming ownership of any moon natural resources.[38] Because of these negative implications, this could explain why Saudi Arabia withdrew from the Moon Agreement on January 5, 2023, and it could spell a bleak future for the Moon Agreement as other countries realize with time that a lunar mining market is in the near future and they could be missing out.[39]

Overall, although the Moon Agreement addresses and essentially prohibits lunar mining for profit, the Moon Agreement is an insignificant international law because it lacks the signature and ratification of key space exploration leaders like the U.S., Russia, Canada, Japan and Luxembourg.[40] On the other hand, the Moon Agreement could serve as a starting point for new international space laws. But it could likely only do this with the caveat of not entirely prohibiting space mining for profit. This is because countries might only want to withdraw from an agreement

[34] *See* Moon Agreement, *supra* note 29. Larsen, *supra* note 17, at 13.
[35] Moon Agreement, *supra* note 29, at Art. 6 ¶ 2.
[36] *Id.* at Art. 11 ¶ 3.
[37] *Id.* at Art. 6 ¶ 2, Art. 11 ¶ 3.
[38] *See id.*; Wedenig & Nelson, *supra* note 31.
[39] *See* Wedenig & Nelson, *supra* note 31.
[40] *See* Moon Agreement, *supra* note 29, at Art. 6 ¶ 2, Art. 11 ¶ 3.

of this nature, especially if they realize they could be missing out on a highly profitable market of natural resources like water, gases, and metals.[41]

C. The Rescue Agreement, The Liability Convention, and The Registration Convention

The Rescue Agreement, the Liability Convention and the Registration Convention are other international space agreements that entered into force either during or shortly after the Cold War.[42] But though these laws are also foundational international space laws, like the Outer Space Treaty and the Moon Agreement, they offer insufficient guidance regarding space activities like space mining and NASA's Gateway Program.[43] For example, the Rescue Agreement has almost no bearing on space mining and NASA's Gateway Program because it deals with countries rescuing and returning astronauts that have unintentionally landed in a place on Earth under another country's jurisdiction.[44] Although this law would likely apply to astronauts involved in space mining or NASA's Gateway Program, this treaty does not get to the legality of either space mining or NASA's Gateway Program; it simply deals with what happens if these sort of space projects fail and leave astronauts stranded in other lands.[45] Therefore, though the Rescue agreement is arguably less ambiguous than the Outer Space Treaty, and binding on more key space leaders, unlike the Moon Agreement, it still ultimately lacks the kind of guidance needed for space activities like space mining and NASA's Gateway Program.

Similarly, the Liability Convention lays out ground rules in the event that space objects damage a country's or an international space organizations' property.[46] For example, Article II states that "a launching State shall be absolutely liable to pay compensation for damage caused by its space object on the surface of the earth or to aircraft in flight."[47] In addition, Article IV states that "in the event of damage being caused elsewhere than on the surface of the earth to a space object of one launching State or to persons or property on board such a space object by a space object of another launching State."[48] But importantly, the Liability Convention does not prescribe rules for when a country or an international organization damages a celestial body, like the Moon, or when it damages a spacecraft or object already in space.[49] Although the Liability Convention has some relevance to space mining and NASA's Gateway Program before they launch, once these types of projects and activities enter outer space, the rules within the Liability Convention do not seem to apply.[50] In addition, especially regarding space mining, countries that have not ratified the

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[41] *See id.*; Wedenig & Nelson, *supra* note 31.
[42] Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, Apr. 22, 1968, 672 U.N.T.S. 119 [hereinafter Rescue Agreement]; Convention on International Liability for Damage Caused by Space Objects, Mar. 29, 1972, 961 U.N.T.S. 187 [hereinafter Liability Convention]; Convention on Registration of Objects Launched Into Outer Space, Sept. 15, 1976, 1023 U.N.T.S. 15 [hereinafter Registration Convention].
[43] *See* Rescue Agreement, *supra* note 42 at 120-122; Liability Convention, *supra* note 44 at 189; Registration Convention, *supra* note 42 at 17-19.
[44] Rescue Agreement, *supra* note 42 at 121-124.
[45] *Id.*
[46] *See* Liability Convention, *supra* note 42 at 189-192.
[47] Liability Convention, *supra* note 42 at Art. II.
[48] *Id.* at Art. IV.
[49] *See id.* at 189-195.
[50] *Id.*

Liability Convention would certainly not be liable for damage caused to the surface of the Earth or to other country's or international space organizations' when launching space crafts.[51] But it is notable that for NASA's Gateway Program, the U.S., through NASA, would likely be liable if it caused any damage to the Earth or other countries' space crafts in the launching of the lunar space station.[52] Overall, the Liability Convention, like the other foundational space laws, does not give sufficient guiding laws regarding space mining activities and NASA's Gateway Program.

The Registration Convention is the final foundational international space law that deserves mention. The Registration Convention is primarily concerned with the parties to the treaty registering their launched space objects with the appropriate registry and properly informing the Secretary-General of the United Nations of this established registry.[53] In addition, it states that "when there are two or more launching States in respect of any such space object, they shall jointly determine which one of them shall register the object," and it prescribes the kind of information that each State of the registry must submit to the Secretary-General of the United Nations.[54] Given what this treaty states, it is clear that countries or companies who engage in space mining must register their space objects with the Secretary General of the United Nations.[55] In addition, it is particularly notable that the majority of countries who are leaders in space mining or other space activities, like the U.S., Japan, Luxembourg, and the United Arab Emirates, have either accessioned or ratified this treaty, meaning that it is binding for some of these potential key players in space mining.[56] As related to NASA's Gateway Program, the U.S. will need to register both the "component parts" of the lunar international space station and its "launch vehicle and parts thereof" with the Secretary General of the United Nations upon the launch of NASA's Gateway Program, which is currently scheduled for 2028.[57]

Despite this clear guidance that countries to the treaty must properly register space objects, this law is still insufficient. This is because this law does not touch on the specifics of space mining or NASA's Gateway Program. Therefore, since space mining and NASA's Gateway Program are on the horizon, there is a need for space laws that will address some of these legal issues. New international space laws might address how space mining should be conducted and whether NASA's Gateway Program can be legally instrumental in colonizing Mars and the Moon.

D. United Nations Committee on the Peaceful Uses of Outer Space and United Nations General Assembly Declarations and Resolutions

The United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUS) was created "to govern the exploration and use of space for the benefit of all humanity: for peace, security and

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[51] *Id.* at 188.
[52] *See* Liability Convention, *supra* note 42 at Art. II.
[53] *See* Registration Convention, *supra* note 42 at 17.
[54] Registration Convention, *supra* note 42 at Art. II. ¶ 2, Art IV.
[55] *See id.* at Art. II. ¶ 1.
[56] United Nations, *Treaty Index*, vol. 610 https://treaties.un.org/Pages/showDetails.aspx?objid=08000002800361b4&clang=_en [https://perma.cc/F7AE-9FL7].
[57] *See* Registration Convention, *supra* note 42 at Art. I. (a)-(b), Art II. ¶ 1-2. *NASA's Gateway Program*, *supra* note 11.

development" and it issues guidelines related to outer space law.[58] Relatedly, there are five General Assembly declarations and legal principles that are relevant to international space law: (1) The "Declaration of Legal Principles," (2) The "Broadcasting Principles," (3) The "Remote Sensing Principles," (4) The "Nuclear Power Sources" Principles, and (5) The "Benefits Declaration."[59] Notably, even though these guidelines and principles can be helpful in spurring international space law development, they are not binding international law. But UNCOPUS "was instrumental in the creation of the five treaties and five principles of outer space,"[60] so it could also be instrumental in creating new international space laws related to space mining and NASA's Gateway Program.

Instead of investigating the five legal principles and UNCOPUS's early guidelines, it is more helpful to begin by looking at a recent General Assembly Resolution titled "International cooperation in the peaceful uses of outer space" that was adopted on December 12, 2022.[61] Although this resolution is not binding international law, it highlights the General Assembly's concerns "about the possibility of an arms race in outer space" and "the fragility of the space environment and the challenges to the long-term sustainability of outer space activities."[62] This resolution also "requests the Committee to continue to consider, as a matter of priority, ways and means of maintaining outer space for peaceful purposes" and "emphasizes that regional and interregional cooperation in the field of space activities is essential to strengthen the peaceful uses of outer space."[63]

This resolution ultimately reiterates the importance of peaceful international space cooperation.[64] In addition, it draws from the Outer Space Treaty and attempts to encourage Member States to continue to promote these values.[65] But the resolution is notably silent regarding space mining.[66] In contrast, though, the resolution is relevant to NASA's Gateway Program because the resolution has language that suggests the General Assembly's approval of a type of project that incorporates peaceful international space exploration, like NASA's Gateway Program.[67] It is possible that resolutions or declarations of this nature could inspire the framework of future international space laws.

The General Assembly also adopted a declaration in 2017 on the fiftieth anniversary of the Outer Space Treaty.[68] This declaration "reiterate[s] the Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space,"[69] one of the five legal principles mentioned above. Importantly, this 2017 declaration also requests the "Office for Outer Space

[58] United Nations, Office for Outer Space Affairs, *Committee on the Peaceful Uses of Outer Space*, (last visited Feb. 2, 2024), https://www.unoosa.org/oosa/en/ourwork/copuos/index.html [https://perma.cc/2H6X-WU4V].
[59] United Nations, Office for Outer Space Affairs, *Space Law Treaties and Principles*, (last visited Feb 2, 2024), https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties.html [https://perma.cc/C3EF-96XZ].
[60] *Committee on the Peaceful Uses of Outer Space*, *supra* note 58.
[61] G.A. Res. 77/121, 1 (Dec. 12, 2022).
[62] *Id.* at 2.
[63] *Id.* at 5, 7.
[64] *See id.* at 1-8.
[65] *Id.*
[66] *Id.*
[67] *See* G.A. Res 77/121, 1-8. *NASA's Gateway Program*, *supra* note 11.
[68] G.A. Res. 72/78, 1 (Dec. 7, 2017).
[69] *Id.* at ¶ 1.

Affairs to continue fostering capacity-building in space law and policy for the benefit of all countries."[70] This is important because even the UN General Assembly, the main policy-making organ of the UN, recognizes the need for international space law development, which further demonstrates that there is a need for new international space laws.[71] In addition, significantly, the UN General Assembly requested that the Office of Outer Space Affairs (UNOOSA) play a role in developing space law.[72] UNOOSA could play a big role in international space law development because it "assists any United Nations Member States to establish legal and regulatory frameworks to govern space activities."[73] If the UN General Assembly continues to issue declarations and resolutions of this nature, and Member States begin to cooperate with UNOOSA to develop space laws, these groups could work together to develop space laws and policies aimed at peaceful, sustainable space mining and other space exploration activities.

E. THE ARTEMIS ACCORDS AND NASA'S USE OF MOU'S IN NASA'S GATEWAY PROGRAM

In the same way that the Moon Agreement is more relevant to space mining, the Artemis Accords are especially relevant to NASA's Gateway Program because one of the primary goals of NASA's Gateway Program is to carry out the Artemis missions within the Artemis Accords.[74] The Artemis Accords are a "non-binding, set of principles designed to guide civil space exploration and use in the 21st century" led by the U.S. through NASA and agreed upon by thirty-four countries.[75] Although the Artemis Accords are non-binding, similar to the effect of the Moon Agreement, the Artemis Accords are still significant and provide some important ground rules that future laws could eventually be based on.[76] For example, Section 1, the purpose and scope of the Artemis Accords, states:

> The purpose of these Accords is to establish a common vision via a practical set of principles, guidelines, and best practices to enhance the governance of the civil exploration and use of outer space with the intention of advancing the Artemis Program. Adherence to a practical set of principles, guidelines, and best practices in carrying out activities in outer space is intended to increase the safety of operations, reduce uncertainty, and promote the sustainable and beneficial use of space for all humankind. The Accords represent a political commitment to the principles described herein, many of which provide for operational implementation of important obligations contained in the Outer Space Treaty and other instruments.

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[70] *Id.* at ¶ 18.
[71] *See id.*
[72] *Id.*
[73] United Nations, Office for Outer Space Affairs, *About Us*, (last visited Feb. 3, 2023), https://www.unoosa.org/oosa/en/aboutus/index.html [https://perma.cc/CKY6-ZDQC].
[74] *See NASA's Gateway Program, supra* note 11; The Artemis Accords: Principles for Cooperation in the Civil Exploration and Use of the Moon, Mars, Comets, and Asteroids for Peaceful Purposes, Oct 13, 2020, https://www.nasa.gov/wp-content/uploads/2022/11/Artemis-Accords-signed-13Oct2020.pdf?emrc=653a00 [https://perma.cc/8DAF-73TG] [hereinafter Artemis Accords].
[75] U.S. Dep't of State, *Artemis Accords*, (last visited Jan. 28, 2024), https://www.state.gov/artemis-accords/ [https://perma.cc/BCR2-PLTC].
[76] *See* Artemis Accords, *supra* note 74 at 2-7.

> The principles set out in these Accords are intended to apply to civil space activities conducted by the civil space agencies of each Signatory. These activities may take place on the Moon, Mars, comets, and asteroids, including their surfaces and subsurfaces, as well as in orbit of the Moon or Mars, in the Lagrangian points for the Earth-Moon system, and in transit between these celestial bodies and locations. The Signatories intend to implement the principles set out in these Accords through their own activities by taking, as appropriate, measures such as mission planning and contractual mechanisms with entities acting on their behalf.[77]

Based on the plain language of section 1 of the Artemis Accords, this is a political commitment between the Signatories with an overall goal of peaceful space exploration and an intention for the principles within the Artemis Accords to uniformly apply to all Signatories.[78] The Artemis Accords also clearly contemplated the use of space in the way that NASA's Gateway Program intends to use space because the Artemis Accords contemplate activities that "may take place on the Moon, Mars, comets, and asteroids, including their surfaces and subsurfaces, as well as in orbit of the Moon or Mars . . . and in transit between these celestial bodies and locations."[79] NASA's Gateway Program is aimed at precisely the kind of activities that the Artemis Accords mention because the program's focus is to create an international space station that will orbit the Moon and conduct the Artemis missions where astronauts will likely visit the surface of the Moon and Mars.[80] In addition, space mining could certainly fall under this description because it is mining on the surface and subsurface of potentially the Moon and Mars.[81] But although the Artemis Accords may contemplate these types of activities, this alone does not hold great significance because the agreement is *not legally binding*.[82] Despite this significant shortcoming of the Artemis Accords, its language could still be useful to draw from as a base for new international space laws to govern NASA's Gateway Program and space mining in the future.

In addition, the Artemis Accords lay out unique implementation mechanisms that have inspired binding agreements like Memorandums of Understanding (MOUs) between NASA and its Gateway Partners.[83] Section 2 of the Artemis Accords states:

> 1. Cooperative activities regarding the exploration and use of outer space may be implemented through appropriate instruments, such as *Memoranda of Understanding*, Implementing Arrangements under existing Government-to Government Agreements, Agency-to-Agency arrangements, or other instruments. These instruments should reference these Accords and include appropriate provisions for implementing the principles contained in these Accords.
> (a) In the instruments described in this Section, the Signatories or their subordinate agencies should describe the nature, scope, and objectives of the civil cooperative activity;(b) The Signatories' bilateral instruments referred to above are expected to contain other provisions necessary to conduct such cooperation, including those

[77] Artemis Accords, *supra* note 74 at § 1.
[78] *See id.*
[79] *Id.*
[80] *See NASA's Gateway Program*, *supra* note 11.
[81] *See Space Mining*, *supra* note 10.
[82] *See* Artemis Accords, *supra* note 74 at 1.
[83] *See NASA's Gateway Program*, *supra* note 11.

> related to liability, intellectual property, and the transfer of goods and technical data; (c) All cooperative activities should be carried out in accordance with the legal obligations applicable to each Signatory; and (d) Each Signatory commits to taking appropriate steps to ensure that entities acting on its behalf comply with the principles of these Accords.[84]

Since the Artemis Accords are essentially a set of non-binding principles, they attempt to shift implementation to agreements like MOUs, Government-to-Government Agreements, and Agency-to-Agency agreements that can and often do have a legally binding effect between the two parties.[85] But importantly, these other agreements, like MOUs, may not be as effective as other binding international laws between more than two countries, like the Outer Space Treaty, because MOUs tend to be more contractually focused and less concerned with the goals of peaceful space exploration. For example, NASA's MOU with the Government of Japan is primarily based on Japan providing the critical components to NASA's Gateway Program, like the "Habitation Capability Infrastructure Functions" and "Logistics Resupply."[86] In addition, although this MOU is binding on both NASA and the Government of Japan, its enforcement mechanisms for breach are likely not an adequate deterrent because the agreement allows for either party's voluntary withdrawal from the Program with one year's notice[87] and provides that settlement of any disputes shall be resolved by the Gateway Program's managing members[88] instead of the International Court of Justice (ICJ). For example, Article 21 of the Japan MOU states that "Parties agree to consult with each other, and as necessary, with other Gateway partners, when a question of interpretation or implementation of the terms of this MOU arises."[89] Further, it states that a question of interpretation or implementation of the terms must be referred to members of the Gateway Program's management as the issue escalates: first to the Gateway Program Control Board (GPCB) members, next to the Gateway Multilateral Program Board (GMPB) members, and finally to the Gateway Multilateral Program Board (GMPB).[90] If the issue is still not resolved, then it can be referred to the NASA administrator or the Minister of Education, Culture, Sports, Science and Technology of Japan, and after this, it may be pursued in accordance "with the relevant provisions of the IGA."[91] Essentially, the Japan MOU sets up a self-governing structure instead of referring the matter to an international court, or providing damages for breach, which could make countries more likely to violate the agreement, given a lack of effective enforcement. Therefore, MOUs of these nature are insufficient space laws alone, even if they are aimed at governing new space projects like NASA's Gateway Program.

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[84] Artemis Accords, *supra* note 74 at § 2 (emphasis added).
[85] *See id.*
[86] *See* Memorandum of Understanding between the United States of America and the Government of Japan Concerning Cooperation on the Civil Lunar Gateway, Dec. 31, 2020, U.S.C. 113, at Art. 5.5(d) [hereinafter Japan MOU].
[87] *Id.* at Art. 24.3.
[88] *See id.* at Art. 21.
[89] Japan MOU, *supra* note 86 at Art. 21.
[90] *Id.*
[91] *Id.* at 21.4.

In addition, the IGA that the Japan MOU references is the prior international space station agreement between many of the same countries collaborating on NASA's Gateway Program.[92] In regard to the relevant provisions of the IGA, it provides similar mechanisms of dispute resolution as the Japan MOU, with the addition of dispute resolution through "conciliation, mediation, or arbitration.[93] Again, however, these kinds of dispute resolution mechanisms might not allow for the proper resolution of claims, as compared to the International Court of Justice (ICJ).

In addition to signing a binding MOU with Japan, NASA has also signed similar binding MOUs with the European Space Agency (ESA), and the Canadian Space Agency (CSA).[94] NASA appears to be following the spirit of the IGA in signing MOUs with these countries, because the IGA references old MOUs that were signed between the U.S. and the other countries involved in the IGA.[95] Therefore, NASA may be setting the stage for an IGA-like agreement with the MOUs it has already agreed to. But it is notable that NASA has not yet created another agreement like the IGA to govern NASA's Gateway Program,[96] and the MOUs alone may not prove to be a sufficient framework because they lack effective enforcement mechanisms and are primarily focused on two countries agreeing to provide resources to the International Space Station to orbit the Moon,[97] rather than governing the activities that the countries will partake in. Therefore, this reiterates the need for new international space laws that will govern the activities of NASA's Gateway Program.

III. Recent Developments that will Spur International Space Law Development

The overall lack of relevant, on-point, binding, international space law will likely be addressed by several important recent developments. First, several countries, including the United States, Luxembourg, Japan, and the United Arab Emirates have enacted unilateral laws for space resource mining;[98] second, several countries, including the U.S., plan to mine space resources in the very near future;[99] third, several countries have entered into MOUs with NASA to implement the Gateway Program and have publicly pledged their cooperation, and NASA is continuing to expand NASA's Gateway Program by adding more international partners as the program nears its official launch;[100] and lastly, the U.S.'s recent developments in space laws, and its status as a space leader

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[92] Agreement Among the Government of Canada, Governments of Member States of the European Space Agency, the Government of Japan, the Government of the Russian Federation, and the Government of the United States of America Concerning Cooperation on the Civil International Space Station, Jan. 29, 1998, 80 Stat. 271; 1 U.S.C. 113 [hereinafter IGA].
[93] *Id.* at Art. 23.
[94] *NASA's Gateway Program*, *supra* note 11.
[95] IGA at 2.
[96] *See NASA's Gateway Program*, *supra* note 11.
[97] *See* Japan MOU, *supra* note 86 at Art. 5; The European Space Agency, *Gateway MoU and Artemis Accords – FAQs*, (last visited Feb 8, 2024), https://www.esa.int/Science_Exploration/Human_and_Robotic_Exploration/Gateway_MoU_and_Artemis_Accords_FAQs [https://perma.cc/CM7H-VYEU].
[98] Alex Gilbert, *Mining in Space Is Coming*, MILKEN INSTITUTE REVIEW (Apr. 26, 2021), https://www.milkenreview.org/articles/mining-in-space-is-coming [https://perma.cc/P2XR-UXUU].
[99] Jan Osburg & Mary Lee, *Governance in Space: Mining the Moon and Beyond*, RAND CORP., (November 18, 2022), https://www.rand.org/blog/2022/11/governance-in-space-mining-the-moon-and-beyond.html [https://perma.cc/GB6T-N274].
[100] *NASA's Gateway Program*, *supra* note 11.

will likely lead to another race to space, but this time the space race will be a race to space resources and space colonization of the Moon and other planets like Mars, through NASA's Gateway Program. These recent developments will likely indirectly and directly contribute to an increase in international space laws and international space law regulation. In addition, commercial companies, like SpaceX, could have a hand in the development of international space laws if they continue to pursue commercial activities. Just as law is made through changing circumstances, international space law will likely develop when countries and other actors begin to engage in these kinds of unregulated space activities.

A. UNILATERAL SPACE MINING LAWS

The United States, Luxembourg, the United Arab Emirates, and Japan have all enacted unilateral laws for space mining,[101] and though these laws are not international space laws, they are nonetheless important and could serve as the basis for future international space laws. This paper will first examine the U.S. Commercial Space Launch Competitiveness Act,[102] then the Luxembourg Law of July 20th 2017 on the Exploration and Use of Space Resources[103], then the Japanese Act on the Promotion of Business Activities for the Exploration and Development of Space Resources,[104] and finally, the United Arab Emirates (UAE) Space Law.[105] In addition, this paper will examine the text of these laws and the similarities and differences of these laws to attempt to predict what international space mining laws and other space exploration laws might look like in the future.

1. United States: U.S. Commercial Space Launch Competitiveness Act

In 2015, Congress passed the U.S. Commercial Space Launch Competitiveness Act to "facilitate a pro-growth environment for the developing commercial space industry by encouraging private sector investment and creating more stable and predictable regulatory conditions."[106] Within this act, Congress also passed the Space Resource Commercial Exploration and Utilization Act.[107] The Space Resource Commercial Exploration and Utilization Act is the heart of the U.S. Commercial Space Launch Competitiveness Act, and it will likely be the act that U.S. commercial companies look to for guidance to legally mine for space resources. The most relevant section of the act, Section 51303, states:

> A United States citizen engaged in commercial recovery of an asteroid resource or a space resource under this chapter shall be entitled to any asteroid resource or space resource obtained, including to possess, own, transport, use, and sell the

[101] Osburg & Lee, *supra* note 99.
[102] U.S. Commercial Space Launch Competitiveness Act, 51 U.S.C. §§ 101-117, §406 (2015).
[103] Loi du 20 juillet 2017 sur l'exploration et l'utilisation des ressources de l'espace [Law of July, 20 2017 on the Exploration and Use of Space Resources], Mémorial A, n° 674, July 28th 2017 (Lux.) [hereinafter Luxembourg Law].
[104] Act on the Promotion of Business Activities for the Exploration and Development of Space Resources, Act No. 83 of 2021 [hereinafter Japan Law].
[105] Federal Law No. (12) of 2019 22 Rabi' AL-Akhar 1441H. (U.A.E.) [hereinafter UAE Law].
[106] 51 U.S.C. §§ 101-117.
[107] Space Resource Commercial Exploration and Utilization Act, 51 U.S.C. §§ 51301–51303 (2015) [hereinafter Act].

> asteroid resource or space resource obtained in accordance with applicable law, including the international obligations of the United States.[108]

Given the plain language of this Act, a U.S. Citizen can commercially mine for space resources, including asteroids resources, water, abiotic materials or other minerals.[109] Also, this Act refers to section 50902 of the U.S. code to define U.S. citizen and there it is defined as follows:

> **(**1) "citizen of the United States" means-- (A) an individual who is a citizen of the United States;(B) an entity organized or existing under the laws of the United States or a State; or(C**)** an entity organized or existing under the laws of a foreign country if the controlling interest (as defined by the Secretary of Transportation) is held by an individual or entity described in subclause (A) or (B) of this clause.[110]

This is significant because, based on the definition above, U.S. entities like companies and even foreign entities held by either an individual U.S. citizen or a U.S. entity would qualify as U.S. citizens, meaning that based on section 51303, they could legally mine for space resources and thereafter sell these space resources (like asteroids, water, and other minerals like iron) for a profit.[111] As an illustrative example, given the plain language of this Act, it is likely that SpaceX could commercially mine for space resources because it is a U.S. entity.[112] In addition, the definition of a U.S. citizen combined with section 51303 could even open the door for foreign entities to engage in tactics to establish themselves as a "U.S. citizen" by either being acquired by an individual U.S. citizen or company.[113]

This is another reason an international space law that covers space mining is needed, because with unilateral space mining laws like the Space Resource Commercial Exploration and Utilization Act, companies might engage in potentially exploitative tactics related to commercial space mining. As the Act is currently written, it does not provide for any kind of commercial space mining limitations, and this could be a huge problem as it stands, especially if U.S. and foreign companies begin to take advantage of the breadth of freedom inherent in the Act. Without an international law to govern and limit these kinds of activities, U.S. and foreign companies could effectively create a new, unregulated market, subject to unlimited exploitation. Given the lack of guidance and limitations on space mining in this Act, the international realm could improve a law like this by adding limitations to the practice of space mining, instead of allowing a particular group of people to commercially mine without limitations.

Despite the Act's allowance of commercial space mining, it importantly establishes by way of a disclaimer that "it is the sense of Congress 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."[114] This means that though Congress has authorized U.S. companies to commercially mine for space resources, this does not give the U.S. any right to claim

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[108] 51 U.S.C. § 51303.
[109] 51 U.S.C. § 51303, § 51301 (1)-(3).
[110] 51 U.S.C. § 50902 (1)(A)-(C).
[111] *See id.*; 51 U.S.C. § 51303, § 51301 (1)-(3).
[112] *See id.*; Eldridge, *supra* note 8.
[113] *See* 51 U.S.C. § 50902 (1)(A)-(C); § 51303, § 51301 (1)-(3).
[114] 51 U.S.C. § 403.

or assert jurisdiction over the Moon, Mars, or any other celestial object just because various U.S. citizens or companies might be there to mine for space resources.[115] This disclaimer is also in line with the Outer Space Treaty because the Outer Space Treaty, which is binding on the U.S., states that "Outer space, including the moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty."[116] It is likely that the U.S. wrote this disclaimer with the Outer Space Treaty's language in mind. This is significant because it means that the U.S. is still bound by the Outer Space Treaty's language, but because the Outer Space Treaty is more ambiguous regarding space mining, the U.S. was able to enact its own law before international space law could govern over U.S. citizens space mining activities. This too could also serve as a spur for the enactment of future international space laws. If countries do not want space resources exploited, they need to come together to agree on laws that would provide the kind of limitations that would prevent unchecked space resource exploitation.

Finally, it is significant that the Space Resource Commercial Exploration and Utilization Act essentially promotes commercial space mining.[117] Section 51302 states:

> (a) The President, acting through appropriate Federal agencies, shall—
> (1) facilitate commercial exploration for and commercial recovery of space resources by United States citizens; (3) promote the right of United States citizens to engage in commercial exploration for and commercial recovery of space resources free from harmful interference, in accordance with the international obligations of the United States and subject to authorization and continuing supervision by the Federal Government.[118]

This is significant because not only does the Act allow unchecked commercial space mining, but in addition, it requires the President to facilitate commercial space mining and "promote the right of United States citizens in commercial exploration for and commercial recovery of space resources."[119] This is significant because although Congress put in a disclaimer about not claiming sovereignty of celestial objects, it appears that through this section, Congress could be attempting to get around the plain language of the Outer Space Treaty by encouraging U.S. citizens to claim rights in place of the U.S.[120] For example, if U.S. citizens were to commercially mine for space resources as a big group, they might effectively be keeping other countries off the surface of one section of the Moon by being stationed there. There is an inherent difficulty in the U.S. allowing commercial space mining but not allowing the U.S. to claim sovereignty. Given this, international space law could take this law and improve upon it by providing commercial space mining limitations.

2. Luxembourg: Law of July 20, 2017 on the Exploration and Use of Space Resources

[115] *See id.*
[116] Outer Space Treaty, *supra* note 4 at Art. II.
[117] *See* 51 U.S.C. § 51302(a)(1), (3).
[118] 51 U.S.C. § 51302(a)(1), (3).
[119] 51 U.S.C. § 51302(a)(1), (3).
[120] *See id.*

Two years after the U.S. enacted the U.S. Commercial Space Launch Competitiveness Act, Luxembourg enacted its own space mining law.[121] On its face, Luxembourg's space mining law has more limitations than the U.S. Commercial Space Launch Competitiveness Act.[122] For example, Articles 1 and 2 respectively provide:

> Space resources are capable of being owned.
>
> (1) No person can explore or use space resources without holding a written mission authorisation from the minister or ministers in charge of the economy and space activities (hereinafter "the ministers"). (2) No person shall be authorised to carry out the activity referred to in paragraph 1 either through another person or as an intermediary for the carrying out of such activity. (3) The authorised operator may only carry out the activity referred to in paragraph 1 in accordance with the conditions of the authorisation and the international obligations of Luxembourg. (4) This Law shall not apply to satellite communications, orbital positions or the use of frequency bands.[123]

Article 2 already provides more limitations than the U.S. Commercial Space Launch Competitiveness Act because it requires any person using space resources to receive "written mission authorization from the minister or ministers."[124] The Luxembourg Law later states in Article 4 that "authorization for a mission shall only be granted" to "a public company limited by shares . . . a corporate partnership limited by shares . . . or a limited liability company of Luxembourg or a European Company . . . having its registered office in Luxembourg."[125] This article of the Luxembourg Law is quite similar to section 51303 of the Space Resource Commercial Exploration and Utilization Act, with the caveat that individual Luxembourg citizens are not allowed to commercially mine for space resources, unless they are acting as an entity.[126] It is also significant that Luxembourg has to give authorization to these entities for them to be able to commercially space mine, and it is significant that only entities have the capability of being approved for commercial space mining.[127] This is completely unlike the U.S. Space Resource Commercial Exploration and Utilization Act because that act has no authorization requirements aside from the definition of U.S. citizen.[128] In addition, Articles 7-14 of the Luxembourg Law lay out the authorization requirements and the process for how the governing body might grant authorization.[129]

Based on these articles, "authorization shall be subject to the production of evidence showing the existence in Luxembourg of the central administration and of the registered office" and "shall be refused if, taking into account the need to ensure a sound and prudent operation, the suitability of

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[121] Luxembourg Law, *supra* note 103.
[122] *See id.* at Art. 1-8.
[123] Luxembourg Law, *supra* note 103 at Art. 1-2.
[124] *See id.* at Art. 2; 51 U.S.C. § 51303, § 51301 (1)-(3).
[125] Luxembourg Law, *supra* note 103 at Art. 2.
[126] *See id.*; 51 U.S.C. § 51303, § 51301 (1)-(3), § 50902 (1)(A)-(C).
[127] *See* Luxembourg Law, *supra* note 103 at Art 2.
[128] *See* 51 U.S.C. § 51303, § 51301 (1)-(3), § 50902 (1)(A)-(C).
[129] Luxembourg Law, *supra* note 103 at Art. 7-14.

those shareholders or members [of an entity] is not satisfactory."[130] Essentially, the Luxembourg law requires the applying entities to be registered with Luxembourg under the business laws of the state, have shareholders that are in good standing, and have some kind of plan or "sufficient knowledge skills and experience to perform their duties."[131] In addition, "the application for the authorization must be accompanied by a risk assessment of the mission" and it must describe "the activities to be carried on within the territory of the Grand Duchy or from such territory; the limits that should be associated with the mission; the modalities for the supervision of the mission; [and] the conditions for ensuring compliance by the operator authorised with its obligations."

Essentially, entities must plan and prepare extensively before submitting their application to Luxembourg to commercially space mine.[132] In addition, based on the Luxembourg Law, there is no guarantee that a company that meets all of these requirements and provides the required plans and materials will be granted the right to commercially space mine.[133] This is significantly unlike the U.S. Space Resource Commercial Exploration and Utilization Act, because that act allows individuals and entities to engage in commercial space mining without any need whatsoever for the U.S.'s grant of authorization.[134] Due to this significant difference, the Luxembourg Law could serve as a better guide for new international space laws because it specifically provides for some space mining limitations.

3. Japan: Act on the Promotion of Business Activities for the Exploration and Development of Space Resources (Act No. 83 of 2021)

Japan's Act on the Promotion of Business Activities for the Exploration and Development of Space Resources was enacted to "promote business activities for the exploration and development of space resources by private business operators" and to specify "rules for acquisitions of ownership of space resources and other necessary matters concerning such activities."[135] Notably, it defines "space resources" as "water, minerals, and other natural resources that exist in outer space, including the Moon and other celestial bodies."[136] In addition, the Japan Law outlines a licensing process similar to the Luxembourg Law's authorisation process.[137] Under the Japan law, to obtain a license a person must provide a "business activity plan" which specifies "the purpose of the business activities for the exploration and development of space resources . . . the period of business activities . . . the place where the exploration and development of space resources . . . [and] the methods of exploration and development of space resources."[138] Further, the Japan Law, in prescribing requirements for the determination of licensing, refers back to the "basic principles of the Basic Space Act" which is a prior Japanese law.[139]

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[130] *Id.* at Art. 7-8.
[131] *See id.* at Art. 7-9.
[132] *See id.* at Art. 10 ¶ 1, Art. 12(a)-(d).
[133] *See id.* at Art. 1-18.
[134] *See id.*; 51 U.S.C. § 51303, § 51301 (1)-(3), § 50902 (1)(A)-(C).
[135] Japan Law, *supra* note 104 at Art. 1.
[136] *Id.* at Art. 2 (i).
[137] *See id.* at Art. 3; Luxembourg Law, *supra* note 103 at Art. 3-14.
[138] Japan Law, *supra* note 104 at Art. 3 ¶ 1 (i)-(iv).
[139] *Id.* at Art. 1, Art. 3 ¶ (i); Basic Space Law, Act No. 43 of 2008.

Japan's Basic Space Act provides for the peaceful use of outer space and states that "Space Development and Use shall be carried out in accordance with treaties and other international agreements . . . including the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and other Celestial Bodies."[140] Given that the Japan Space Law references the Basic Space Law, which was written in accordance with the Outer Space Treaty, it can be assumed that Japan has also agreed to be bound by the Outer Space Treaty.[141] This is significant because it shows that countries that are parties to the Outer Space Treaty recognize the importance of being bound by it.[142] But because the Outer Space Treaty is ambiguous with regard to space mining,[143] these countries are essentially free to promulgate their own laws on space mining.[144] This is an issue because, as previously mentioned, some countries may choose to promulgate relatively lax space laws that do not provide limitations to commercial space mining.[145] New international space laws could effectively limit commercial space mining if big space leaders like the United States, Luxembourg and Japan were to be parties to an international treaty or agreement of this nature.

4. United Arab Emirates: Federal Law No. (12) of 2019

The UAE law, Federal Law No. (12) of 2019, was enacted before the Japan Law, and it "aims to establish a legislative framework regulating the Space Sector so as to create an appropriate regulatory environment . . . stimulating investment and encouraging private . . . sector participation in the Space Sector."[146] In addition, it regulates "Space Resources exploration or extraction activities" and "Activities for the exploitation and use of Space Resources for scientific, commercial, or other purposes."[147] The UAE law is a bit unlike the previous unilateral space laws because it also creates an agency to "carry out all actions and acts conductive to the achievement of its goals and objectives."[148] But this agency seems to function similarly to the regulating bodies outlined in Luxembourg and Japan's unilateral space mining laws.[149]

For example, the UAE agency may "grant permits for Space Activities and other Space Sector-related activities" and "suggest concluding bilateral or international agreements with the relevant entities in the Space Sector."[150] This is significant because in addition to the typical permit granting process outlined in other unilateral laws, the UAE Law also encourages international space law development.[151] The UAE Law, alone, could be instrumental in promoting new international space laws, but this may only be if international laws align with the UAE's values.[152] But it is unclear what kind of international space laws the UAE may be interested in supporting.

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[140] Basic Space Law, *supra* note 138 at Art. 2.
[141] *See id.*; Japan Law, *supra* note 104 at Art. 1, Art. 3 ¶ (i); Outer Space Treaty, *supra* note 4 at Art. I.
[142] *See* Japan Law, *supra* note 104 at Art. 1, Art. 3; Basic Space Law, *supra* note 139 at Art. 2; 51 U.S.C. § 403.
[143] Outer Space Treaty, *supra* note 4 at Art I-XII.
[144] *See* Japan Law, *supra* note 104; Basic Space Law, *supra* note 139 at Art. 2; 51 U.S.C. § 403.
[145] See 51 U.S.C. § 51303.
[146] UAE Law, *supra* note 105 at Art. 2.
[147] *Id.* at Art. 4 (i), (j).
[148] *Id.* at Ch. 2.
[149] *See id.*; Luxembourg Law, *supra* note 103 at Art. 3-17; Japan Law, *supra* note 103 at Art. 3.
[150] UAE Law, *supra* note 105 at Art. 7 ¶¶ 2, 7.
[151] *See id.*
[152] *See id.* at Art. 7 ¶ 7.

Given its recent actions, it might be more inclined to support the development of international space laws that legally allow some kind of space mining, since its space center recently joined NASA's Gateway Program, which will likely engage in space mining and space colonization.[153]

Notably, the UAE law states that "it is prohibited to own a Space Object, carry out or participate in Space Activities, or establish, use or possess related facilities or utilities without obtaining a Permit from the Agency."[154] This provides a limitation for parties that conduct space activities because it prohibits space activities without a permit.[155] This limitation is similar to the limitations in place in the Luxembourg Law and Japan Law because both of these laws set up a process where parties must be approved by governmental bodies before engaging in space activities like space mining.[156]

The UAE law further states that "the conditions and controls relating to Permits for exploration, exploitation and use of Space Resources, including their acquisition, purchase, sale, trade, transportation, storage and any Space Activities aimed at providing logistical services . . . shall be determined by a decision issued by the Council of Ministers." It is significant that space mining is set apart from the other space exploration activities and appears to require a higher level of approval. This may speak to the significance of the space mining as an activity and the UAE's understanding that space mining may be inherently different than activities like manned spaceflight activities.[157] Just as with the Luxembourg Law and Japan Law, the UAE Law can be used as a guide to base future international laws on. One important commonality between these unilateral laws, with the exception of the U.S. Law, is that they provide for some kind of permit, authorisation, or licensing process. A future international law or treaty might be effective by implementing a program similar to these aforementioned unilateral laws. In addition, a future international law or treaty could also have a council of member states approve space activities like space mining, similar to the aforementioned unilateral space laws.

B. Several Countries and Companies Plan to Mine for Space Resources in the Very Near Future

It is easy to imagine that countries would not merely stop with the creation of unilateral space laws. Presumably, they would plan to eventually begin space mining if they have created laws to govern space mining. Accordingly, several countries and commercial companies are planning to mine for space resources in the very near future.[158] In addition, the U.S. and China are already active on the Moon and "have plans to undertake activities in the polar regions of the Moon where water is available."[159] Space technology advances throughout the space industry are driving these kind of prospects for space mining.[160] In addition, NASA's Gateway Program plans to establish a human presence on the Moon, which could potentially include space mining.[161] Further, NASA's

[153] *See NASA's Gateway Program*, *supra* note 11.
[154] UAE Law, *supra* note 105 at Art. 14, ¶ 1.
[155] *See id.*
[156] *See* Luxembourg Law, *supra* note 103 at Art. 3-17; Japan Law, *supra* note 104 at Art. 3.
[157] *See* UAE Law, *supra* note 105 at Art. 16, 18.
[158] Gilbert, *supra* note 98.
[159] Larsen, *supra* note 17 at 6.
[160] Gilbert, *supra* note 98.
[161] *NASA's Gateway Program*, *supra* note 11.

OSIRIS-REx has become the "first U.S. mission to collect a sample from an asteroid."[162] This is significant because it shows there are already space mining efforts in the works, even if they have not yet been commercialized.

Even for countries like the U.S. that have begun some kind of space mining, there are only signs that they will continue to engage in this kind of space mining.[163] For example, even though OSIRIS-REx returned with a sample from an asteroid, the spacecraft "continued on a new mission, OSIRIS-APEX, to explore asteroid Apophis."[164] In addition, "NASA and ESA are consulting with commercial satellite operators regarding commercial projects on the Moon" and the "Artemis Accords anticipate commercial mining activities on the Moon and the establishment of safety zones around mining sites."[165] Further, there is an asteroid mining startup that is set to launch a mission in early 2024 through the help of "Elon Musk's SpaceX rocket."[166] Overall, it is likely that these kinds of plans, programs, and activities will directly and indirectly inspire increased space regulation and space governance just as space activities inspired Cold War era international space laws like the Outer Space Treaty.[167]

C. NASA'S GATEWAY PROGRAM IS GAINING INTERNATIONAL PARTNERS THROUGH THE USE OF MOUS

As previously mentioned in Part II, E, there are several international partners that have signed MOUs with NASA to supply critical components to the Gateway Program.[168] For example, the Canadian Space Agency (CSA), European Space Agency (ESA), and Japan Aerospace Exploration Agency (JAXA) have signed MOUs with NASA.[169] In addition, in 2024, the "Mohammed Bin Rashid Space Centre (MBRSC) of the United Arab Emirates announced . . . the UAE will provide Gateway's Crew and Science Airlock module."[170] This is significant because it shows that several countries have allied with NASA to promote the broader goal of not only space exploration, but potentially space colonization and space mining.[171] Since the Gateway Program's establishment in 2019, it has only gained international support throughout the years, all the way into 2024.[172]

It is likely that once the Gateway Program launches in 2028, there will be increased motivation to develop international space laws to govern the actions of the new international space station that will orbit the Moon. This is because MOUs, as previously discussed in Part II, E, are an inadequate means of governing NASA and the other space agencies' space exploration activities. Instead, the MOUs that NASA and the other space agencies have used merely provide a basis upon which future international laws might build on. This is because MOUs are primarily concerned with two

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[162] NASA, *OSIRIS-REx* (last updated Feb 10, 2024), https://science.nasa.gov/mission/osiris-rex/ [https://perma.cc/FPY4-FMZC].
[163] *See id.*; Larsen, *supra* note 17 at 6; Gilbert, *supra* note 98.
[164] *OSIRIS-REx*, *supra* note 162.
[165] Larsen, *supra* note 17 at 7.
[166] *Asteroid Mining Startup to Launch Mission in Early 2024*, Mining.com, https://www.mining.com/asteroid-mining-startup-to-launch-mission-in-early-2024/ [https://perma.cc/DC4Z-TMPQ].
[167] *See* Outer Space Treaty, *supra* note 4.
[168] *NASA's Gateway Program*, *supra* note 11.
[169] *Id.*
[170] *Id.*
[171] *See id.*
[172] *Id.*

individual space agencies agreeing with one another to provide the critical components to build and run NASA's Gateway Program. Therefore, it is likely that countries will eventually work collaboratively with one another to create laws to govern their new space activities. It is not a far stretch to say they might work together in this manner if they are already working collaboratively to launch an international space station to orbit the moon.[173] Therefore, the increased international support and participation in NASA's Gateway Program will likely indirectly and directly lead to new international space laws to govern these kinds of activities.

D. The U.S.'s Status as a Space Leader Could Help Inspire New International Space Laws

Significantly, it is the U.S.'s space agency, NASA, that established the Gateway Program.[174] NASA is not only leading the Gateway Program, but as mentioned in Part III, C, NASA is gaining international support through its international space agency partners and is in charge of the plans for space mining and space colonization.[175] Given this, and given that the U.S. has mined for space resources on an asteroid by using OSIRIS-REx[176] and enacted a unilateral space mining law,[177] the U.S. is clearly a leader in the international space realm. In addition, the U.S., through its activities and status as a space leader, is continuing to support space technology, space exploration and space mining activities.[178] The U.S. could use its status as a space leader to propose international treaties and laws to regulate international space activities like NASA's Gateway Program and space mining.

Even if the U.S. chooses not to use its status as space leader to spur international space law development, its status and role will still likely continue to spur the new space race, which will in turn likely lead to new international space laws.[179] Given the international space laws from the Cold War period and the first space race, the changing circumstances and the new space race will likely inspire new international laws in the same way. It may be necessary for countries and companies to engage in unregulated activities before international space laws can catch up and determine what is off limits, as the law is often made and refined by these kinds of changing circumstances.

IV. Conclusion

The international realm is at a point in time where space exploration activities and space technology are at an all-time high. Various countries and companies have plans to either mine space for space resources or contribute critical parts to the new international space station (NASA's Gateway Program) that will orbit the Moon and is set to launch in 2028.[180] Despite these critical developments, there is still a serious lack of international space laws to govern space activities of

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[173] *Id.*
[174] *NASA's Gateway Program*, *supra* note 11.
[175] *Id.*
[176] *OSIRIS-REx*, *supra* note 162.
[177] 51 U.S.C. §§ 51301–51303.
[178] *NASA's Gateway Program*, *supra* note 11.
[179] *See The New Space Race*, *supra* note 13.
[180] *See NASA's Gateway Program, supra* note 11; *Asteroid Mining Startup to Launch Mission in Early 2024*, *supra* note 166.

this magnitude. Arguably, there has not been a significant international space law since the Outer Space Law entered into force over 50 years ago.[181]

Even though international space law has not caught up with countries and companies' plans to mine space resources and launch full-scale programs like NASA's Gateway Program, this will likely be addressed by countries and companies engaging in these kinds of currently unregulated activities. For example, as mentioned in Part III, there are several critical developments that will indirectly and directly contribute to new international space laws.

First, several countries, including the United States, Luxembourg, Japan, and the United Arab Emirates have enacted unilateral laws for space resource mining;[182] second, several countries, including the U.S., plan to mine space resources in the very near future;[183] third, several countries have entered into MOUs with NASA to implement the Gateway Program and have publicly pledged their cooperation, and NASA is continuing to expand NASA's Gateway Program by adding more international partners as the program nears its official launch;[184] and lastly, the U.S.'s recent developments in space laws, and its status as a space leader will likely lead to another race to space, which will in turn inspire new international space laws in a similar way as the first space race spurred international space law development. All of these recent developments will likely indirectly and directly spur international space development.

Additionally, it is possible that companies, like SpaceX, could have a hand in international space development by aiding other companies in space mining and engaging in largely unregulated space activities.[185]

Overall, international space law is currently behind space development and technology, but it will likely catch up once countries and companies engage in the very unregulated activities that international space laws need to govern. Additionally, countries and companies could attempt to come together to agree on sufficient international space laws to govern space activities, because many of the currently existing unilateral space laws are similar in substance, to the exclusion of the U.S. Commercial Space Act. Perhaps countries and companies could come together to draft an international law with some kind of licensing or permitting process like the Luxembourg Law, Japan Law, and UAE offer.[186] As of now, however, it is unclear what new international space laws will look like.

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[181] *See* Outer Space Treaty, *supra* note 4.
[182] Osburg & Lee, *supra* note 99.
[183] Gilbert, *supra* note 98.
[184] *NASA's Gateway Program*, *supra* note 11.
[185] *See Asteroid Mining Startup to Launch Mission in Early 2024*, *supra* note 165.
[186] *See* Luxembourg Law, *supra* note 103 at Art. 3-17; Japan Law, *supra* note 104 at Art. 1, 3; UAE Law, *supra* note 105 at Art. 14.