> century when we begin to colonize the inner solar system, the metals and minerals found on asteroids will provide the raw materials for space structures and comets will become the watering holes and gas stations for interplanetary spacecraft.[16]

With the inevitable evolution of mankind into an interplanetary species quickly approaching, it only follows that entrepreneurial entities around the world would begin laying the foundation, both legally and technologically, for extraterrestrial resource mining.[17]

B. The 2015 CSLCA

However, despite the apparent practical and industrial potential of space-mining, there stands a decades old argument regarding the status of space resources that hinges on the nature of outer space itself. Are the mineral and water resources imbedded in celestial bodies available for exploitation by mankind, or does international law bar their commercial utilization under the principle of non-appropriation? At the center of this argument—at least, for United States citizens—is title IV of the 2015 U.S. Commercial Space Launch Competitiveness Act, also known as the Space Resource Exploration and Utilization Act of 2015. The CSLCA explicitly provides that

> A United States citizen engaged in commercial recovery of an asteroid resource or a space resource under this chapter shall be entitled to any asteroid resource or space resource obtained, including to possess, own, transport, use, and sell the asteroid resource or space resource obtained in accordance with applicable law, including the international obligations of the United States.[18]

Furthermore, it requires the President of the United States to

> (1) facilitate commercial exploration for and commercial recovery of space resources by Unite States citizens;

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[16] *Near-Earth Objects as Future Resources*, NASA, http://neo.jpl.nasa.gov/neo/resource.html (last visited Nov. 21, 2016).

[17] *Asteroid Mining: An unlimited future for all mankind*, DEEP SPACE INDUS., https://deepspaceindustries.com/mining/ (last visited Dec. 15, 2016).

[18] CSLCA, *supra* note 10.

> (2) discourage government barriers to the development in the United States of economically viable, safe, and stable industries for commercial exploration for and commercial recovery of space resources in manners consistent with the international obligations of the United States; and
>
> (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.[19]

Without question, this unprecedented Act is intended to officially jumpstart the long-awaited space-resource industry, fronted by and for the benefit of United States citizens. "The act has the unquestionable merit of placing extraterrestrial mining at the center of the legislative and diplomatic agenda of States and to, thus, "force" the international community to address the regulatory challenges associated with it."[20] Although it is undisputed that the United States has the sovereign authority to pass legislation allowing its citizens to utilize space resources, there is uncertainty as to whether said legislation complies with the U.S.'s international treaty obligations.[21] Seeing as this Act is the first of its kind, there exists a great deal of debate concerning whether the Act (Title IV specifically) is in compliance with some fundamental principles of the Outer Space Treaty.[22]

1. Arguments against the CSLCA

Article II of the Outer Space Treaty establishes that "[o]uter space, including the Moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use

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[19] *Id*. at § 51302.

[20] Fabio, Tronchetti, *Title IV – Space Resource Exploration and Utilization of the US Commercial Space Launch Competitiveness Act: A Legal and Political Assessment*, 41 AIR & SPACE L. 143, 154 (2016).

[21] *Id*.

[22] Gbenga Oduntan, *Who owns space? US asteroid-mining is dangerous and potentially illegal*, THE CONVERSATION (Nov. 25, 2015), http://theconversation.com/who-owns-space-us-asteroid-mining-act-is-dangerous-and-potentially-illegal-51073.

or occupation, or by any other means."[23] According to some scholars, this "principle of non-appropriation" is a "cardinal concept on which the entire system of space law is based"[24] and is generally accepted as a rule of international customary law.[25] According to the Vienna Convention on the Law of Treaties, "[a] treaty shall be interpreted in good faith in accordance with the ordinary meaning to be given to the terms of the treaty in their context and in the light of its object and purpose."[26] Therefore, what does "appropriation" mean and how should it be interpreted within the Treaty? According to the Merriam-Webster Dictionary, "appropriate" means, "to get or save (money) for a specific use or purpose," or "to take or use (something) especially in a way that is illegal, unfair, etc."[27]Although Article II of the Outer Space Treaty does not specifically refer to the resources contained on/in celestial bodies, there is a strong argument that "the prohibition against national appropriation should be understood as including not only sovereign but also property rights over extraterrestrial natural resources."[28] This is evidenced by the use of "appropriate" rather than a more narrow term such as, "annex."[29] Had the drafters intended Article II only to preclude colonial-style annexation of celestial bodies, could they not have used the narrower term?

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[23] 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 [hereinafter Outer Space Treaty].

[24] Fabio Tronchetti, *Non-Appropriation Principle as a Structural Norm of International Law: A New Way of Interpreting Article II of the Outer Space Treaty*, 33 AIR & SPACE L. 277, 279 (2008).

[25] FRANCIS LYALL & PAUL B. LARSEN, SPACE LAW – A TREATISE 54, 180 (2009). Articles I-IV of the Outer Space Treaty are all generally considered to have attained the status of customary international law.

[26] Vienna Convention on the Law of Treaties, Art. 31, May 23, 1969, 1155 U.N.T.S. 331 [hereinafter Vienna Convention]. Although the Vienna Convention was drafted and ratified after the Outer Space Treaty and does not apply retroactively, its principles of treaty interpretation are generally accepted as customary international law.

[27] *Simple Definition of APPROPRIATE*, MERRIAM-WEBSTER, http://www.merriam-webster.com/dictionary/appropriating (last visited Nov. 22, 2016).

[28] Tronchetti, *supra* note 21, at 146.

[29] *Annex*, CAMBRIDGE DICTIONARY, http://dictionary.cambridge.org/us/dictionary/english/annex. "to take possession of an area of land or a country and add it to a larger area, usually by force."

This argument is further strengthened by the lack of any significant international agreement, treaty, or consensus on the legality of exploiting space resources for commercial purposes.[30] Although Article 11 of the Moon Agreement does address space-resource utilization, this Agreement is neither binding on the United States, nor considered customary international law.[31] Furthermore, there are those who argue that the very nature of commercial space-resource mining is inconsistent with Article I of the Outer Space Treaty, which states that, "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."[32] Although it would hardly be reasonable to interpret this Article as requiring the equal distribution of space-resource related benefits evenly across the entire planet, "it, at the least, calls for utilization of outer space that may be, in a way or in another, beneficial to the largest number of States/people."[33]

However, the exact meaning of "carried out for the benefit and in the interest of all countries" or "province of all mankind" is ambiguous at best. Nonetheless, this language is often equated (often times by government authorities) with other terms like *res communis*, *res nullius*, "global commons," *res extra commercium*, and "common pool resources;" however, none of these words or phrases actually exist in the U.N. space treaties.[34] In fact, the word "common" is only used twice in the space treaty regime: 1) "common interest" in the Outer Space Treaty's preamble,[35] and 2) "common

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[30] *Id*. at 151.

[31] Agreement Governing the Activities of States on the Moon and other Celestial Bodies, Art. 11, Dec. 5, 1979, 1363 U.N.T.S. 3, 18 I.L.M. 1434 [hereinafter Moon Agreement]. Only 17 States have actually ratified the Moon Agreement and none of the world's major space-faring nations are among them; *see Agreement governing the Activities of States on the Moon and Other Celestial Bodies*, UNITED NATIONS, https://treaties.un.org/Pages/showDetails.aspx?objid=080000028003b946.

[32] Outer Space Treaty, art. I.

[33] Tronchetti, *supra* note 21, at 152.

[34] Henry R. Hertzfeld, Brian Weeden, Christopher D. Johnson, *How Simple Terms Mislead Us: The Pitfalls of Thinking about Outer Space as a Commons*, 2015 PROC. INT'L INST. SPACE L. 533, 536 (2015).

[35] Outer Space Treaty, at Preamble.

heritage of mankind" in article 11 of the Moon Agreement.[36] Neither of these examples refer to the sharing of resources or a prohibition against the utilization of space resources. In fact, the use of "common heritage of mankind" in Article I immediately precedes paragraph 2 of the Article, which states that, "outer space, including the Moon and other celestial bodies, shall be free for exploration and use by all States . . ."[37] Regarding the notion of a "commons" as it relates to Article I of the Outer Space Treaty, a group of scholars write,

> [I]n the world of the law of outer space, fortunately, we have in the Outer Space Treaty Art. I, which guarantees the "freedom of any nation to access, explore and indeed use outer space." (art. I) Furthermore, there is a logical contradiction in this discussion about outer space being treated as a commons. If a commons needs a sovereign government to grant the open territory to the use of all people, it is that government that has to oversee, regulate, and enforce that charter. Art. II of the OST prohibits national sovereignty in outer space Thus, it is an area without government. Even if all nations regard outer space as a "commons," it is a very different concept from any commons that has been established in the past. There is no real legal precedent, no true means of oversight or enforcement, and therefore should not be confused with any of the many ways that concept has been applied to the territory or oceans of the Earth.[38]

Although arguments against the legality of commercial space-resource utilization are often well-founded and rooted in sound interpretations of the Outer Space Treaty, there exists a legitimate alternative interpretation of the Treaty language, steadily moving the international community towards accepting the legality of limited property rights in outer space.[39] Unsurprisingly, the very language employed by the CSLCA's dissenters is also the foundation for legal arguments by its proponents.

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[36] Moon Agreement, art. 11.

[37] Outer Space Treaty, art. I.

[38] Hertzfeld, Weeden, Johnson, *supra* note 35, at 547.

[39] *Position Paper on Space Resource Mining*, INT'L INST. OF SPACE L. 1-3 (2015), *available at* http://www.iislweb.org/docs/SpaceResourceMining.pdf [hereinafter IISL Position Paper].

2. Arguments for the 2015 Space Act.

As previously discussed, the non-appropriation principle is derived primarily from Articles I and II of the Outer Space Treaty.[40] However, the language of these two Articles is also the starting point for advocates of space-resource utilization. This alternate interpretation of the Treaty language (currently championed by the United States and Luxembourg) emphasizes that Article II does not expressly prohibit the appropriation of space resources, nor does Article I expressly exclude the utilization of space resources from a State's right to freely explore and use the Moon and celestial bodies.[41] In fact, many scholars claim the "province of all mankind" is not the physical realm of outer space but the act itself of exploring and utilizing it; "this subtlety seems all too often lost on those whom believe that space (both void space and celestial bodies) somehow belongs to humanity. Rather, the exploration and use of space (both void space and celestial bodies) is free to be explored and used by states parties to the treaty."[42]

Advocates of this approach often compare their ideology to the Law of the Sea, which allows States/individuals to fish in international waters, keep the fruit of their labor, and use it for commercial benefit without having "appropriated" the high seas.[43] This school of thought finds a manifestation in the CSLCA, which was drafted with a firm belief that, though outer space is not subject to the sovereignty of any State and is not available for appropriation, "States are entitled to use its resources so long as their activities do not involve any claim over outer space areas and until such activities do not prevent others to do the same[.]"[44] The CSLCA attempts to clarify the United States' intent to remain wholly consistent with the Outer Space Treaty by stating, "'[i]t is the sense of Congress that by the enactment of this Act, the United States does not

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[40] Tronchetti, *supra*, notes 21, 27.

[41] Guoyu Wang & Yangzi Tao, *Who Owns the Natural Resources on Asteroids?,* 2015 PROC. INT'L INST. SPACE L. 549, 554 (2015).

[42] Hertzfeld, Weeden, Johnson, *supra* note 35, at 537.

[43] FRANS VON DER. DUNK & FABIO TRONCHETTI, HANDBOOK OF SPACE LAW 789 (2015).

[44] Tronchetti, *supra* note 25, at 281, *citing* Outer Space Treaty, art. IX. This article demands that "States Parties to the Treaty shall be guided by the principle of cooperation and mutual assistance and shall conduct all their activities in outer space, in including the Moon and other celestial bodies, with due regard to the corresponding interests of all other States Parties to the Treaty."

thereby assert sovereignty or sovereign or exclusive rights or jurisdiction over, or the ownership of, any celestial body."[45] As previously described, the stated purpose of the Act is to facilitate the commercial exploration of outer space, discourage government barriers to these activities, and promote the execution of these activities in accordance with international obligations.[46]

Although there are those who criticize the United States' unilateral action granting its citizens a right to commercially utilize space resources,[47] much of the current dialogue amongst scholars praises the Act as progressive in encouraging space exploration for all States,

> [f]rom the perspective of the economics of law, a rule is to be judged from whether it grants positive incentives. Apparently, in the time of early human exploration and use of outer space, the right incentives should be to encourage countries to actively explore and use outer space and to promise the development of human cognition. However, if inappropriate emphasis is added on "for the benefit and in the interests of all countries" or "use on the basis of equality" and even using them as prerequisite for the freedom to explore and use outer space, it would reduce the enthusiasm of states greatly.[48]

Incredibly important to this conversation is the recent position paper by the International Institute of Space Law validating the 2015 Space Act. The paper first recognized that, "it is uncontested under international law that any appropriation of "territory" even in outer space (e.g. orbital slots) or on celestial bodies is prohibited," yet it also recognized that "it is less clear whether this Article also prohibits the taking of resources."[49] Seeing as the act "pays respect to the international legal obligations of the United States," the IISL concludes that, "in view of the absence of a clear prohibition of the taking of resources in the Outer Space Treaty one can conclude that

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[45] CSLCA, 51 U.S.C. § 51303 (as amended).

[46] *Id*. at § 51302.

[47] Tronchetti, *supra* note 21, at 144.

[48] Wang & Tao, *supra* note 42, at 556.

[49] IISL Position Paper, supra note 40, at 2. The IISL is made up of highly qualified publicists from over forty countries, whose objectives include cooperating "with appropriate international organizations and national institutions in the field of space law and carrying out of tasks for fostering the development of space law"; *see Overview*, IISL, http://www.iislweb.org/about.html (last visited Dec. 13, 2016).

the use of space resources is permitted. Viewed from this perspective, the new United States Act is a possible interpretation of the Outer Space Treaty."[50]

Although the CSLCA is still in its infancy—and likely years away from practical application—its bold objectives and initial positive reception by international scholars will likely have a longstanding domino effect on the space industry (e.g. Luxembourg's new space legislation);[51]

Through the recognition of private property rights over space resources and the commitment of the US government to support the rights and interests of the space mining industry, the CSLCA aims at creating a legal environment supportive of space mining ventures and, thus, also capable of attracting the required technological and financial investments.[52]

Because of the United States' position as a leading space authority, the CSLCA is destined to have transformative effects on the future of space exploration and utilization. The act has thus far been passed by Congress, signed by the President, and defended by experts, scholars, and international legal organizations. The legal climate surrounding space-resource utilization is undeniably changing, paving the way for a surge in funding, technological development, and novel business models for private space-mining activities. Assuming the act's sound legal foundation, one must now direct attention to the aforementioned inevitable surge in space activities, and whether the Act is sufficient to ensure the United States' compliance with *all* of its international treaty obligations, specifically those outlined in Article IX of the Outer Space Treaty.

III. HARMFUL CONTAMINATION AVOIDANCE AND PLANETARY PROTECTION

Although article IX of the Outer Space Treaty is perhaps most famous for establishing the notion of "due regard," it also requires States to ensure their space activities protect both the space environment and the Earth,

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[50] *Id*. at 3.

[51] *Supra*, note 4.

[52] Tronchetti, *supra* note 21, at 148.

> States Parties to the Treaty shall pursue studies of outer space, including the Moon and other celestial bodies, and conduct exploration of them so as to avoid their harmful contamination and also adverse changes in the environment of the Earth resulting from the introduction of extraterrestrial matter and, where necessary, shall adopt appropriate measures for this purpose.[53]

Therefore, the United States is obligated to ensure that the space activities of its nationals do not harmfully contaminate either outer space or the Earth's fragile environment. Seeing as the United States is solely responsibility under article VI of the Outer Space Treaty to authorize and oversee the space activities of its nationals, the need for clear and thorough legislation becomes paramount. As briefly described earlier in this article, the CSLCA is lacking necessary elements to satisfy its article IX obligations and requires additional amendments and/or clarification. COSPAR has already developed thorough guidelines for the purpose of avoiding harmful contamination of the space/Earth environment. In fact, these guidelines have already been implemented and expanded by NASA, and are mandatory for all NASA missions. In order to ensure the United States' compliance with its treaty obligations—including the protection of Earth's environment—NASA's planetary protection policies should become mandatory for all activities conducted under the 2015 Space Act.

A. The 2015 Space Act's Insufficiencies Regarding Planetary Protection

As previously mentioned, the CSLCA is lacking virtually any direct reference to planetary protection or harmful contamination avoidance. According to one NASA report, "contamination" is "the act of depositing chemical, biological or physical material" onto artifacts or sites in such a way that it "reduces its historical, engineering, or scientific value."[54] Although the act itself does not directly address the issue of contamination avoidance, it does provide for

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[53] Outer Space Treaty, art. IX.

[54] *NASA's Recommendations to Space-Faring Entities: How to Protect and Preserve the Historic and Scientific Value of U.S. Government Lunar Artifacts*, NASA 8 (2011), https://www.nasa.gov/sites/default/files/617743main_NASA-USG_LUNAR_HISTORIC_SITES_RevA-508.pdf.

the submission of a previously mentioned presidential report.[55] This report was issued by the Executive Office of the President's Office of Science and Technology Policy on April 4, 2016, proposing amendments to the 2015 Space Act and a very basic framework for the process of overseeing future commercial endeavors (including resource utilization).[56] Like the CSLCA, the Presidential Report's language is extremely vague and lacks any direct reference to contamination avoidance or planetary defense. However, to its credit, the Presidential Report recognizes the United States' obligation to "serve a range of public policy interests, including public safety, safety of property, national security, and foreign policy."[57] Furthermore, the Presidential Report admits that, "[w]hile existing licensing frameworks provide clear means to address certain aspects of these activities, they do not, by themselves, provide the United States Government with a straightforward means to fulfill its treaty obligation to ensure the conformity of these activities with the provisions of the Outer Space Treaty."[58] Nevertheless, the actual provisions recommended by the Presidential Report in order to fulfill its treaty obligations fall short due to ambiguity;

> [T]he Administration does not seek to establish a comprehensive regulatory framework for the type of outer space activities described . . . Instead, the proposed legislation is intended to establish a process no more burdensome than is necessary to enable the United States Government to authorize these pioneering space activities in conformity with its treaty obligations, and to safeguard core public interests, such as national security.[59]

The actual amendment to the CSLCA—as proposed by the Presidential Report—introduces the term "Mission," and defines it as, "the operation of a space object, with or without human occu-

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[55] CSLCA, *Supra*, note 10.

[56] John P. Holdren, Office of Science and Technology Policy, *Letter submitted in fulfillment of a reporting requirement contained in the U.S Commercial Space Launch Competitiveness Act (Public Law 114-90, herein referred to as "the Act"), signed into law November, 25th, 2015* 1 (2016) [hereinafter the Presidential Report].

[57] *Id*. at 1-2.

[58] *Id*. at 3.

[59] *Id*. at 4.

pants, in outer space, including on the Moon and other celestial bodies." Next, it provides the framework for "Mission Authorization," a vague and lengthy vetting process by which an array of government agencies review proposed commercial space missions in order to determine whether they would comply with the United States' interests;[60]

> The Secretary of Transportation, in coordination with the Secretary of Defense, the Secretary of State, the Secretary of Commerce, the NASA Administrator, the Director of National Intelligence, and such other appropriate United States Government departments and agencies as the Secretary deems appropriate, is authorized to grant authorizations for missions in outer space. The Secretary shall grant such authorizations to the extent consistent with the international obligations, foreign policy and national security interests of the United States, and United States Government uses of outer space, with such conditions as the Secretary, in coordination with Secretary of Defense, the Secretary of State, the Secretary of Commerce, the NASA Administrator, the Director of National Intelligence, and other appropriate departments and agencies, deems necessary for compliance with United States international obligations, preservation of the foreign policy interests and national security of the United States, and protection of United States Government uses of outer space.[61]

The above litany of government agencies (seemingly in no particular order) is as ambiguous as it is disjointed. Granted, the Presidential Report does expressly state that agencies (like NASA) shall only grant mission authorizations consistent with treaty obligations and national security interests; however, what exactly are these interests and how are these agencies to go about protecting them? The Report makes no specifications, discloses no methods or processes, and creates more uncertainties than answers.

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[60] *Id.* at 6.
[61] *Id.*

B. COSPAR's Planetary Protection Guidelines

The Committee on Space Research was first established in 1958 by the International Council for Science "as an interdisciplinary scientific body concerned with the progress on an international scale of all kinds of scientific investigations carried out with space vehicles, rockets and balloons."[62] It is comprised of forty-one national scientific institutions (including the vast majority of space-faring nations) and thirteen international scientific unions.[63] COSPAR first established a set of planetary protection guidelines in 1967—as a direct response to the obligations established by Article IX of the Outer Space Treaty—and have reviewed/updated them on a yearly basis in order to remain current with contemporary science and exploration.[64] These guidelines are then integrated, expanded, and implemented by space agencies around the world, including NASA, ESA, JAXA, and Roscosmos.[65] COSPAR summarizes its policy objective as follows:

> Although the presence of life elsewhere in the solar system may be unlikely, the conduct of scientific investigations of possible extraterrestrial life forms, precursors, and remnants must not be jeopardized. In addition, the Earth must be protected from the potential hazard posed by extraterrestrial matter carried by a spacecraft returning from an interplanetary mission. Therefore, for certain space mission/target planet combinations, controls on contamination shall be imposed in accordance with issuances implementing this policy.[66]

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[62] *Space Research (COSPAR)*, ICSU, http://www.icsu.org/what-we-do/interdisciplinary-bodies/cospar/ (last visited Nov. 29, 2016).

[63] *Members*, COSPAR, https://cosparhq.cnes.fr/about/members (last visited Nov. 15, 2015). For the purposes of this article, "space-faring nation" includes any nation that regularly has access to/conducts activities in outer space, whether manned or unmanned.

[64] ANDREA BELZ & PAT BEAUCHAMP, STRATEGIC MISSIONS AND ADVANCED CONCEPTS OFFICE, JPL-D-72365, ASSESSMENT OF PLANETARY PROTECTION AND CONTAMINATION CONTROL TECHNOLOGIES FOR FUTURE PLANETARY SCIENCE MISSIONS 6 (2011), *available at* http://solarsystem.nasa.gov/docs/PPCCTECHREPORT3.pdf [hereinafter JPL Report].

[65] *Id*. at 6-7.

[66] *COSPAR Planetary Protection Policy*, COSPAR 1 (2005), http://w.astro.berkeley.edu/~kalas/ethics/documents/environment/COSPAR%20Planetary%20Protection%20Policy.pdf (last visited Nov. 10, 2016) [hereinafter the COSPAR Guidelines].