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Establishing a Legal Framework for Property Rights to Natural Resources in Outer Space

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ESTABLISHING A LEGAL FRAMEWORK FOR PROPERTY RIGHTS TO NATURAL RESOURCES IN OUTER SPACE*

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This Note addresses the need for a stable legal framework to form a workable system that encourages the responsible exploration and exploitation of resources from celestial bodies. Nations and private companies are eager to mine the moon because of its potential for commercial energy sources. However, without a stable legal framework, nations and companies are unlikely to fund such expensive mining operations. This Note analyzes proposals for a new system of rules to govern the mining and use of outer space resources, and concludes by proposing a new framework that encourages exploration and mining while benefiting mankind as a whole.

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INTRODUCTION

When the first space treaty entered into force in 1967, space exploration was in its infancy. Only ten years had passed since Russia launched the first satellite into space, and only six years had passed since the first human orbited the Earth. Man's first landing on the moon was still two years away. In the years since, there have been major developments in the exploration and use of space. Numerous countries have launched humans into space, nations have worked together to establish an international space station, and private companies have become important players in the field. Plans for the future are even more ambitious. Five nations have plans to go to the moon by 2020, and the United States plans to establish a permanently staffed base on the moon by 2024.[1] Many of these missions plan to exploit resources from space for use during the missions and for broader use back on Earth. Despite these developments, few new space treaties have emerged since the Outer Space Treaty of 1967,[2] and even fewer have been widely signed and ratified. Since the purpose of the Outer Space Treaty was to lay down only broad rules and principles, many specific issues in space law cannot be clearly resolved just by looking to that treaty.

One issue that has been widely debated, and for which there is no clear legal framework, is the mining of celestial bodies. The moon, Mars, and other celestial bodies contain resources that are scarce or non-existent on Earth and which could have immense value. One example is helium-3, a substance common on the moon but exceedingly scarce on Earth.[3] Helium-3 has better potential for providing clean, efficient energy than any other source currently known on Earth.[4] Nations and private companies are eager to mine this substance for use on Earth and in space. Without a stable legal framework in which legal rights and responsibilities are clearly outlined, however, these aspirations may not come to fruition. Nations and companies are unlikely to fund such expensive mining operations until they are assured that they will have a legal claim to what they extract.

This Note addresses the need for a stable legal framework to form a workable system that encourages the responsible exploration and exploitation of resources from celestial bodies while benefiting humanity as a whole. While this Note advocates that such a system should be applied to all celestial bodies, the examples in this Note focus on the moon—the only

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[1] Mark Williams, *Mining the Moon*, TECHNOLOGY REVIEW, Aug. 23, 2007, *available at* http://www.technologyreview.com/Energy/19296.

[2] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, *opened for* signature Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205 [hereinafter Outer Space Treaty].

[3] *See* HARRISON SCHMITT, RETURN TO THE MOON 44 (2006).

[4] *Id.* at 5, 44–47.

celestial body on which mining efforts are likely to commence in the near future. Part I addresses the potential uses of helium-3 and current plans to go to the moon. Part II discusses relevant space treaties currently in place, how the treaties address property rights in space, and what aspects of property rights are left unclear. Part III addresses international mining treaties governing the high seas and Antarctica and how they can provide guidance in forming a mining agreement for outer space. Part IV analyzes ideas and proposals for a new system of rules to govern the mining and use of outer space resources. Finally, Part V proposes a framework for governing the mining and use of resources derived from outer space that encourages exploration and mining while benefiting mankind as a whole.

I. LUNAR MINING

Space mining may seem like a distant prospect that presently does not require the creation of a special legal framework. Valuable resources found in outer space, however, have generated an intense interest in planning expeditions to exploit those resources. Though the cost of such an expedition would be high, the payoff in commercial quantities of natural resources nonetheless makes it an appealing prospect. For example, a metallic asteroid only a kilometer in size would provide one billion tons of iron, two hundred million tons of nickel, ten million tons of cobalt, and twenty-thousand tons of platinum, with a net market value of about one trillion U.S. dollars.[5] The first mining expeditions in outer space will likely not be for minerals such as these that are commonly available on Earth, however. Rather, the cost and risk of a space mining expedition will likely be justified initially by the prospect of obtaining an exciting new potential energy source that is exceedingly rare on Earth: helium-3.

A. Helium-3

It is well known that on Earth, the supply of fossil fuels is limited and their extraction and use harms the environment.[6] Researchers are looking elsewhere for clean, efficient new energy sources. One that shows great promise is isotope helium-3, which in fusion reaction can create an ultra-efficient, non-radioactive, clean source of energy.[7] Only trace amounts of helium-3 have been found on Earth, however—not nearly enough to generate commercial power.[8] Only the moon has the amounts necessary for

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[5] *See* Ricky J. Lee, *Creating an International Regime for Property Rights Under the Moon Agreement*, *in* PROC. 42ND COLLOQUIUM ON L. OUTER SPACE, 409, 409 (1999); *infra* text accompanying note 25.

[6] SCHMITT, *supra* note 3, at 31.

[7] *See* Williams, *supra* note 1.

[8] SCHMITT, *supra* note 3.

commercial use.[9] In fusion reaction, the moon's estimated helium-3 resources could produce ten times as much energy as is contained in the Earth's recoverable coal, oil, and gas combined.[10]

The mining operation could be a significant undertaking. Even though helium-3 is much more abundant on the moon than on Earth, it only found in quantities of about twenty-five parts per billion on the lunar surface.[11] While hundreds of millions of tons of lunar soil must be mined to extract one ton of helium-3, only a very small amount of helium-3 is needed to create a vast amount of power in fusion reaction, so much so that a single ounce of helium-3 is valued at $40,000.[12]

Some critics argue, though, that helium-3 is not a feasible option using standard reactors.[13] Currently there is only one helium-3 fusion reactor in the world.[14] It is a small scale, basketball-sized reactor located at the Fusion Technology Institute at University of Wisconsin—Madison, and not nearly large enough to produce commercial power.[15] The reactor currently consumes more power than it produces, but the institute's work has shown that helium-3 fusion reaction is possible.[16] For the past fifty years, fusion researchers have been trying to reach the break-even point at which a reactor produces more energy than it consumes, and it seems the break-even point is now in sight.[17] The eight billion dollar International Thermonuclear Experimental Reactor currently under construction in France is widely regarded as the last step before the design of commercial fusion reactors.[18] Scientist and Apollo 17 astronaut Harrison Schmitt, a champion of lunar mining for helium-3, estimates that it will take ten to fifteen years to develop commercial fusion plant technology.[19]

Helium-3's incredible potential as an energy source in an efficient reactor coupled with its value—1.4 million dollars per kilogram when compared to the value and energy potential of oil—have made it a source of

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9 *See* Williams, *supra* note 1.

10 Ezra J. Reinstein, *Owning Outer Space*, 20 NW. J. INT'L L. & BUS. 59, 61 (1999).

11 SCHMITT, *supra* note 3.

12 *See id.*

13 *See* Williams, *supra* note 1.

14 *See id.*

15 John Lasker, *Race to the Moon for Nuclear Fuel*, WIRED, Dec. 15, 2006, http://www.wired.com/science/space/news/2006/12/72276?currentPage=all.

16 *See* Williams, *supra* note 1.

17 *See* JOHN S. LEWIS, MINING THE SKY 136 (1997).

18 *Id.* Information on the International Thermonuclear Experimental Reactor's progress and a current timeline are available at http://www.iter.org/index.htm.

19 David Brown, *Lunar Land Rights*, AAPG EXPLORER, Aug. 2003, http://www.aapg.org/explorer/2003/08aug/moonexpl.cfm.

keen interest among nations and private companies alike.[20] Used in an efficient fusion reactor, helium-3's market value will be one thousand times its weight in gold or platinum, making it the most valuable known raw material in the solar system.[21] As a result, nations and private companies have an intense interest in going to the moon and extracting this valuable resource.

B. Missions to the Moon

Currently, at least six nations and numerous private companies have plans to go to the moon in the near future. NASA's Vision for Space Exploration aims to send astronauts back to the moon in 2020 and to establish a permanently staffed base by 2024.[22] While NASA has not stated that the purpose of the mission is to mine helium-3, it has placed helium-3 mining advocates in influential positions.[23] Additionally, NASA's published Lunar Exploration Objectives include using lunar resources to establish alternative energy sources for Earth, including mining helium-3 from the lunar surface.[24] In this document, NASA describes the value of obtaining helium-3 by saying:

> Utilizing energy produced on the moon can reduce Earth's reliance on fossil fuels (including petroleum, coal, and natural gas) and the associated emission of greenhouse gasses and other pollutants on Earth. This can improve productivity (value per unit cost) associated with activities on the lunar surface; improve the economic sustainability of lunar activities, support permanent human presence and settlement on the moon, and reduce the cost of lunar activities. This activity may encourage investment in space infrastructures by private institutions and others to generate wealth on Earth and on the Moon.[25]

Other nations have similar goals. China plans to land an unmanned vehicle on the moon in 2011.[26] Luan Enjie, director of the China National Aerospace Administration, has said that developing and using lunar minerals and energy resources for the sustainable development of human society "is the most important driving force to return to the moon."[27] He singled out the potential use of the moon's helium-3 as a new energy source, stating

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[20] *See* SCHMITT, *supra* note 3.

[21] LEWIS, *supra* note 17, at 210.

[22] Williams, *supra* note 1.

[23] *Id.*

[24] *See NASA Lunar Exploration Objectives*, Dec. 2006, at 38, *available at* http://www.nasa.gov/mission_pages/exploration/mmb/why_moon_objectives.html.

[25] *Id.*

[26] Williams, *supra* note 1.

[27] Leonard David, *China Outlines its Lunar Ambitions*, SPACE.COM, Mar. 4 2003, http://www.space.com.missionlaunches/china_moon_030304.html.

that is a "clean, efficient, safe and cheap new-type nuclear fusion fuel for mankind's future long-term use, and it will help change the energy structure of human society."[28] Similarly, India wants to land a rover on the lunar surface in 2010 or 2011, and its president, A.P.J. Kalam, and prime minister, Manmohan Singh, made major speeches in 2007 announcing that India intends to mine helium-3 from the lunar surface.[29] Germany and Japan have also announced their interest in launching moon missions in a similar timeframe and in exploring the possibility of mining helium-3.[30]

Additionally, private ventures have stated their intention to go to the moon and mine helium-3. Energia, a Russian space corporation, in 2006, announced plans to build a permanent base on the moon by 2015 and to begin industrial-scale delivery of helium-3 by 2020.[31] Both public and private ventures will face significant risks in mining helium-3 from the moon. These include the financial risks of funding such an expensive operation and the safety risks associated with sending manned missions to the moon. Equally risky may be the uncertain legal framework that currently governs the resources of celestial bodies. The success of any approach to lunar mining requires supportive regulatory, treaty, and political environments.[32]

II. TREATIES

While both public and private ventures are racing to use the moon's resources, the laws governing those resources have remained vague and unchanged for many years. The United Nations created an Office for Outer Space Affairs (UNOOSA) in 1958.[33] UNOOSA represents the only international forum for the development of international space laws.[34] UNOOSA has concluded five major space treaties, all opening for signature between 1967 and 1979.[35] All of these treaties were concluded during the Cold War and reflect Cold War fears and ambitions, with significantly less emphasis on modern day concerns about space resources, commercialization, and production.[36] The fact that a generation has passed since the last major

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[28] *Id.*

[29] Williams, *supra* note 1.

[30] *Id.*

[31] *Russia Plans Mine on the Moon by 2020*, MOON DAILY, Jan. 25, 2006, http://www.moondaily.com/reports/Russia_Plans_Mine_On_The_Moon_By_2020.html.

[32] SCHMITT, *supra* note 3, at 275–76.

[33] United Nations Office for Outer Space Affairs, http://www.unoosa.org/oosa/en/OOSA/index.html (last visited Aug. 18, 2008).

[34] United Nations Treaties and Principles on Space Law, http://www.unoosa.org/oosa/en/SpaceLaw/treaties.html (last visited Aug. 18, 2008).

[35] *Id.*

[36] *See* Joanne Irene Gabrynowicz, *Space Law: Its Cold War Origins and Challenges in the Era of Globalization*, 37 SUFFOLK U. L. REV. 1041, 1043 (2004).

space treaty was concluded, even as science, technology, and space exploration have raced ahead, indicates that nations are in disagreement over how to resolve new issues that have arisen since Cold War fears dissipated and new ambitions became the focus of progress in space.

Two of the space treaties currently in place can be interpreted to encompass property rights to natural resources in space: the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (Outer Space Treaty or OST),[37] and the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (Moon Agreement or Moon Treaty).[38] In analyzing property rights to natural resources in space, the successes and failures of these treaties can provide insight into identifying unresolved issues, the priorities of the relevant parties, and possible compromises.

A. The Outer Space Treaty

The Outer Space Treaty provides the basic framework on international space law.[39] It declares that outer space is free for exploration and use by all states, that the moon and other celestial bodies shall be used exclusively for peaceful purposes, that outer space is not subject to national appropriation by claim of sovereignty, and that the exploration and use of outer space shall be carried of for the benefit and interest of all countries and shall be the province of all mankind.[40] These broad principles deny control of outer space to any single power.[41] This treaty thus addressed Cold War concerns about nations claiming space and celestial bodies as their own territory and using them to station weapons for use against other countries.[42] It does little, however, to address modern day concerns about obtaining and claiming resources from outer space and celestial bodies.

Article II of the OST forbids national appropriation of outer space, the moon, and other celestial bodies.[43] At the same time, however, the treaty promotes the "exploration and use" of outer space and celestial bodies. The term "use" seems to indicate that a public or private entity may own resources extracted from the territory as long as it does not claim sovereignty

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[37] Outer Space Treaty, *supra* note 2.

[38] Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, *opened for signature* Dec. 18, 1979, 1363 U.N.T.S 3 [hereinafter Moon Agreement].

[39] United Nations Office for Outer Space Affairs, Outer Space Treaty Overview, http://www.unoosa.org/oosa/en/SpaceLaw/outerspt.html (last visited Aug. 18, 2008).

[40] *Id.*

[41] Reinstein, *supra* note 10, at 66 (citation omitted).

[42] *See* Gabrynowicz, *supra* note 36.

[43] Outer Space Treaty, *supra* note 2, art. II.

over the land.[44] This idea is supported by the fact that the treaty explicitly states activities that are forbidden (such as using space for military purposes) and mining or owning natural resources is not one of the forbidden activities.[45] The six Apollo missions to the moon brought back a total of 842 pounds of lunar material, over which the United States has had exclusive dominion and control for over thirty years.[46] There has been no claim that removing those resources and declaring ownership of them constituted a breach of any international law.[47] The actions are apparently in compliance with the OST because the United States claims to own the rocks but not the lunar surface from which its astronauts removed them. At the least, this has set customary international law that resources removed from the moon may be owned.[48]

The provision of the OST that perhaps has generated the most debate is article I, which states, "[t]he 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."[49] The wording of this provision leaves much room for debate. Use "for the benefit . . . of all countries" can be seen as a non-binding guide to encourage the sharing of knowledge and resources, or it can be viewed as a binding legal mandate for the redistribution of wealth derived from space.[50]

Even if the provision does require sharing benefits, the OST does not stipulate how to do so, who makes decisons, and how much is to be shared. One approach is to view the OST is a non-self-executing treaty, so nations may interpret this obligation themselves and individually determine how much they believe their appropriate obligation to be.[51] Another approach is to say that after recouping expenses, profits and benefits should be split evenly among nations, with the nation who made the mission receiving no more than those who played no part in it.[52] Using lunar resources to create cleaner, more efficient energy on Earth, or to support exploration and settlement in space could arguably comply with the treaty's requirement

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44 *See* SCHMITT, *supra* note 3, at 282.

45 *See* Outer Space Treaty, *supra* note 2, art. IV.

46 *See* EDWARD L. HUDGINS, SPACE: THE FREE MARKET FRONTIER 228–29 (2002).

47 *See id.* at 229.

48 *See id.*

49 Outer Space Treaty, *supra* note 2, art. I

50 *See* Reinstein, *supra* note 10, at 67.

51 *See* Edwin Paxson, Note, *Sharing the Benefits of Outer Space Exploration*, 14 MICH. J. INT'L L. 487, 492–93 (1993).

52 *See id.* at 495–96.

that lunar activities be carried out "for the benefit and in the interest of all countries" even though the benefit is indirect.[53]

> Given the different possible interpretations of the Outer Space Treaty, the OST appears too ambiguous to provide clear guidelines governing nations' and companys' rights and responsibilities in extracting helium-3 from the lunar surface or any other resource from any celestial body. Another international agreement must be made to clarify the legal status of these resources so that future missions may act within an accepted legal framework. Otherwise, the lack of a legal framework may deter nations and companies not willing to gamble on spending millions or billions of dollars on missions to collect resources that they may not legally own. Perhaps equally worrisome, there is the risk that missions undertaken without a clear legal framework will set bad precedent and form customary international law regarding exploitation of resources that the international community had no say in, yet which could be difficult to overturn.

B. The Moon Agreement

The Moon Agreement was an attempt to create a framework to govern property claims to resources in space. It was intended to reaffirm and elaborate on the Outer Space Treaty, clarify legal rights and responsibilities and establish an international regime for the exploitation of resources on the moon and other celestial bodies.[54] Though extensively debated, all space-faring nations and most of the rest of the international community rejected the Moon Agreement.[55] Although the Moon Agreement opened for signatures in 1979, it did not enter into force until 1984 when it was ratified by a fifth country.[56] It is currently binding only on the thirteen nations that have ratified it.[57] The Moon Agreement is, in effect, a failed treaty because no nation that has ever performed a manned space flight is bound by it.[58]

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[53] SCHMITT, *supra* note 3, at 282.

[54] *See* U.N. Office for Outer Space Affairs, *Moon Agreement Overview*, http://www.unoosa.org/oosa/en/SpaceLaw/moon.html (last visited Jan. 14, 2009).

[55] *See* Henry R. Hertzfeld & Frans G. von der Dunk, *Bringing Space Law Into the Commercial World: Property Rights Without Sovereignty*, 6 CHI. J. INT'L L. 81, 85 (2005).

[56] Moon Agreement Overview, *supra* note 54.

[57] U.N. Office for Outer Space Affairs, *United Nations Treaties and Principles on Outer Space and Other Related General Assembly Resolutions*, add. at 8–16, U.N. Doc. ST/SPACE/11/Rev.1/Add.1/Rev.1 (Jan. 1, 2007), *available at* http://www.unoosa.org/pdf/publications/ST_SPACE_11_Rev1_Add1_Rev1E.pdf (showing that the Moon Agreement has been ratified by Australia, Austria, Belgium, Chile, Kazakhstan, Lebanon, Mexico, Morocco, Netherlands, Pakistan, Peru, Philippines, and Uruguay while France, Guatamala, India, and Romania are signatories but have not yet ratified the treaty).

[58] *See* Elizabeth Svoboda, *Who Owns the Moon?*, SALON, Jan. 19, 2008, http://www.salon.com/news/feature/2008/01/19/moon_real_estate/

> Still, the Moon Agreement is important to consider because of the reasons that it failed. For any future agreement to be meaningful, it will need widespread acceptance and must be ratified by major space-faring nations. By analyzing the reasons for the space-faring nations' refusal to sign the Moon Agreement, we might determine what provisions they find essential to a workable treaty and find ways to balance their interests with the interests of other nations.

The major reason that space-faring nations rejected the Moon Agreement was that it prohibited property rights and declared celestial bodies and their resources "the common heritage of mankind."[59] The agreement called for an "international regime" to oversee space activities and determine how benefits and profits derived from space would be distributed among the nations of the world.[60] This was undesirable to nations with space programs because the international regime would include member nations without space programs, who might make unwise business decisions because they do not bear any risk.[61] For instance, those nations might decide to heavily tax space activities knowing that their countries would not have to pay the tax but would receive a cut of the proceeds from it. Smaller, non-space-faring nations would have a great incentive to use their position to gain monetary and technological advances at the expense of the nations actually going to space.[62]

No further treaties have been ratified since the Moon Agreement that have attempted to resolve the issue of private property in outer space resources.[63] As nations and companies make plans to go to the moon and mine helium-3, it becomes increasingly important for new proposals to be raised for an agreement that not only abides by the principles set out from the Outer Space Treaty, but also resolves the issues that led so many nations to refuse to sign the Moon Agreement.

III. ANALOGOUS SITUATIONS

In attempting to establish a system for lunar mining, it is helpful to look to analogous situations in international law to consider the issues de-

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[59] *See* Carol R. Buxton, *Property in Outer Space: The Common Heritage of Mankind Principle vs. the "First in Time, First in Right" Rule*, 69 J. AIR L. & COM. 689, 699 (2004).

[60] *See* Moon Agreement, *supra* note 38, art. 11.

[61] *See* 4 Frontiers, *Space Law*, http://www.4frontierscorp.com/areasoffocus/space_law.php (last visited Jan. 14, 2009).

[62] *See id.*

[63] The U.N. (through the Committee on the Peaceful Uses of Outer Space) is the only forum for the development of international space law, and the Moon Treaty was the last of the U.N. space treaties to be ratified. *See* United Nations Treaties and Principles on Space Law, http://www.unoosa.org/oosa/en/SpaceLaw/treaties.html (last visited Jan. 14, 2009).

bated and how they were resolved. While the moon may be the most remarkable subject of an international mining debate, international mining treaties have been concluded regarding the oceans and Antarctica. Although terrestrial, these areas have much in common with the moon. They can be harsh environments that are difficult to reach to extract minerals. They are also designated international areas in which no nation has a sovereign claim. Since the mining debate was resolved in dramatically different ways in the high seas and in Antarctica, these examples illustrate the drastically different arguments being presented and conclusions that may be reached in an international debate on lunar mining.

A. The Law of the Sea

The Third United Nations Convention on the Law of the Sea (UNCLOS III or Convention) establishes a comprehensive regime of law for the world's oceans and seas.[64] The Convention is the result of the participation of over 150 nations after more than fourteen years of work.[65] The wide participation and long debate indicate the importance that nations put on resolving the issues of international waters.

A major focus of this debate was the question of who should benefit from the oceans' resources, including mineral-rich nodules that had been discovered on the seabed. Technologically advanced, sea-faring nations felt that the resources should become the property of the nation that extracted them.[66] Smaller nations without the capabilities or funds to launch expeditions felt that the profits and benefits of the resources should be shared among all nations, since the high seas are international territory belonging equally to all nations.[67] This divide is strikingly similar to that between space-faring nations and non-space-faring nations in the debate over lunar resources.

UNCLOS III established that the international seabed is the common heritage of mankind, not subject to appropriation by any state, and stated that all rights to mineral resources shall be vested in mankind as a whole, with economic benefits from mining to be shared for the benefit of mankind.[68] Part XI of the Convention established an International Seabed Authority (ISA) to regulate and oversee the extraction of seabed resources

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[64] Law of the Sea Convention Overview, United Nations Division for Ocean Affairs and the Law of the Sea, http://www.un.org/Depts/los/convention_agreements/convention_overview_convention.htm (last visited Jan. 14, 2009).

[65] *Id.*

[66] *See* Rosanna Sattler, *Transporting a Legal System for Property Rights: From the Earth to the Stars*, 6 CHI. J. INT'L L. 23, 34–35 (2005).

[67] *See* Buxton, *supra* note 59, at 694.

[68] *Id.* at 695.

from international waters.[69] Developed nations such as the United States were concerned that the "common heritage of mankind" as applied in UNCLOS III seemed to indicate that nations that do not contribute financially or technologically to the extraction of resources would reap the benefit of such activity, reducing the incentive for capable nations to fund research and development.[70] The United States said that the common heritage principle and ISA would deter private mining companies from seeking licenses, impede the development of seabed mineral resources, deny national access, and create a monopoly by an international authority.[71] According to estimates from one U.S. consortium, it would take ten years and $1.5 billion to start up the seabed mining industry, time and money unlikely to be invested unless profits and a mining site are guaranteed.[72]

In response to these concerns, in 1994 the United Nations opened for signature the Agreement Relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea (Agreement), fundamentally changing the mining provisions of UNCLOS III to make it more acceptable to developed nations, particularly the United States.[73] The Agreement recognized previous U.S. claims to mining sites, guaranteed the U.S. a seat on the ISA Council, and ensured that a market-oriented approach would be used in managing seabed resources.[74] While the U.S. has signed the Agreement, the Senate has not yet ratified the convention.[75]

Important lessons can be learned from UNCLOS III that should be considered when approaching lunar mining. First, it shows that nations are willing to work together to establish order and regulation in the extraction of natural resources from international territory. Though nations differ in

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[69] United Nations Convention on the Law of the Sea, arts. 156, 157, *concluded* Dec. 10 1982, 1833 U.N.T.S. 396 [hereinafter Law of the Sea Convention].

[70] *See* Buxton, *supra* note 59, at 693.

[71] *See* Hamilton DeSaussure, *The Freedoms of Outer Space and their Maritime Antecedents*, *in* SPACE LAW, DEVELOPMENT AND SCOPE 11 (Nandasiri Jasentuliyana, ed. 1992).

[72] *See id.*

[73] *See* U.S. Department of State Bureau of Public Affairs, *Fact Sheet 96/03/19: U.S. Oceans Policy & Law of the Sea Convention*, http://dosfan.lib.uic.edu/ERC/environment/fact_sheets/960319.html (last visited Jan. 14, 2009).

[74] *Id.*

[75] The Senate Foreign Relations Committee overwhelmingly voted to approve the Law of the Sea Convention on October 17, 2007, but it is still waiting for ratification by a vote of the full Senate. Press Release, Richard G. Lugar, United States Senator, Law of the Sea Clears Committee, *available at* http://lugar.senate.gov/sfrc/sea.html (last visited Jan. 14, 2009). The following nations have not ratified UNCLOS III: Cambodia, Colombia, Congo, North Korea, Dominican Republic, Ecuador, Eritrea, Estonia, Iran, Israel, Latvia, Liberia, Libya, Morocco, Niue, Peru, Syria, Thailand, East Timor, Turkey, United States, Venezuela, and 21 landlocked states including Afghanistan, Ethiopia, and Niger. *See* Status of UNCLOS, July 16, 2008, http://www.un.org/Depts/los/reference_files/status2007.pdf (listing the status of UNCLOS for all countries).

their ultimate goals, there is a consensus among nations that international cooperation is needed and that no nation may act without regard to the other nations of the world. The Agreement shows that nations would rather compromise and act within the framework of international law than to disregard it entirely. The fourteen-year process of negotiating the treaty, however, should be a warning that an agreement will not be easy to reach and that the issue of lunar mining needs to be addressed immediately if there is to be an established legal framework by the time lunar mining begins.

B. Antarctic Treaty

International mining law regarding Antarctica also illustrates potential issues that may arise in building a legal framework for lunar mining. The Antarctic Treaty of 1959 established Antarctica as an area reserved for international scientific research and environmental preservation.[76] The Antarctica treaty, however, left many issues unsettled, and as a result Antarctica's legal framework has continued to evolve over time in a series of additional treaties and agreements.

Among the issues nations have addressed is mining in Antarctica. In the 1980s, although no mineral deposits of commercial interest had yet been discovered, nations wanted to create a framework to guide future decisions regarding whether and under what circumstance Antarctic minerals should be extracted.[77] There was concern that if a major mineral discovery was made before an international agreement was made, nations would exploit it without the benefit of regulation, which could result in harm to both the environment and the Arctic Treaty System.[78] As a result, the United States and other parties to the Antarctic Treaty launched negotiations to establish guidelines for mineral resource activities.[79]

In 1988, the parties signed the Convention on the Regulation of Antarctic Mineral Resource Activities (CRAMRA), which allowed for nationally sponsored mineral exploration and mining while protecting the environment.[80] It did not contain a detailed mining code but instead stated that mining activities would be regulated and fees would be collected and used

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[76] Buxton, *supra* note 59, at 696.

[77] *See* U.S. CONG. OFFICE OF TECH. ASSESSMENT, 101ST CONG., POLAR PROSPECTS: A MINERALS TREATY FOR ANTARCTICA 3 (1989).

[78] *See id.* The nineteen parties to CRAMRA were Argentina, Brazil, Chile, China, Czechoslovakia, Denmark, Finland, East Germany, Japan, New Zealand, Norway, Poland, Sweden, South Africa, South Korea, the USSR, United Kingdom, United States, and Uruguay. *See* New Zealand Ministry of Foreign Affairs, Convention on the Regulation of Antarctic Minerals, http://www.mfat.govt.nz/Treaties-and-International-Law/01-Treaties-for-which-NZ-is-Depositary/0-Antarctic-Mineral-Resource.php (last visited Jan. 14, 2009).

[79] U.S. CONG. OFFICE OF TECH. ASSESSMENT, *supra* note 77.

[80] *See* SCHMITT, *supra* note 3, at 279.

for Antarctic purposes.[81] This convention, however, was short-lived. Despite the CRAMRA's strict environmental protections, Australia and France declined to ratify the convention, stating that mining should not be permitted in Antarctica at all.[82] Only three years later, in October 1991, a separate protocol superceded the convention. The Protocol on Environmental Protection to the Antarctic Treaty (Protocol) designated Antarctica a natural reserve and prohibited mineral resource activity except for scientific research.[83] The Protocol bans exploitation of mineral resources indefinitely and the terms of the Protocol cannot be reviewed until 2048, fifty years from the year it entered into force (1998).[84]

Lessons learned from the Antarctic agreements should be considered in forming a future lunar mining agreement. CRAMRA took seven years to negotiate and was superceded three years later. This is an indication that forming the right mining regime would be a long process and that the goals may evolve over time. In the end, the parties to the Protocol agreed to ban Antarctic mining, and at present the ban has not been violated.[85] The Antarctic debate resulting in a prohibition on mining, however, does not indicate that the lunar mining debate should likewise be resolved with a ban.

Unlike Antarctica, important resources have been discovered on the moon in commercial quantities. These resources are not merely a potentially lucrative find but could present a new, clean, and efficient energy alternative for the world. If such a discovery had been made in Antarctica, it is likely that the mining prohibition never would have been ratified.[86] If such a find were discovered in Antarctica now, nations would have incentive to break the treaty and, with no regulatory regime binding the nations' mining activities, they might wreak havoc on the environment.[87] To prevent a similar prospect on the moon in the future, we must establish a set legal framework that allows regulated lunar mining before that mining begins.

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[81] *Id.*

[82] Antarctica New Zealand Information Sheet, *Mining Issues in Antarctica*, Aug. 2003, http://www.antarcticanz.govt.nz/downloads/information/infosheets/mining.pdf.

[83] *See* SCHMITT, *supra* note 3, at 279.

[84] *See* Protocol on Environmental Protection to the Antarctic Treaty, art. 25, *opened for signature* Oct. 4, 1991, S. TREATY DOC. No. 102-22, 30 I.L.M. 1455 (*entered into force* Jan. 14, 1998).

[85] *See* Australian Antarctic Division, http://www.aad.gov.au/default.asp?casid=6561 (last visited Jan. 27, 2009) (stating that the only drilling in Antarctica has been for scientific purposes).

[86] *See* SCHMITT, *supra* note 3, at 279–80.

[87] *See id.*

IV. PROPOSALS

A number of proposals for a new legal framework to govern resources from outer space have been set forth by commentators in the fields of law and space. These plans demonstrate how varied the possibilities in the field are and illustrate the types of compromises that will need to be made to resolve these differences. This section highlights the proposals that seem most capable of contributing to a workable framework for lunar mining, while noting each proposal's individual drawbacks and deficiencies. While in many cases it seems that the only thing the proponents agree on is that a new framework is needed, it may be possible to combine the best elements of each proposal in order to create a strong new legal framework without the drawbacks that the proposals create individually.

A. International Regime

One theory for how to best create a framework for rights to natural resources in space is to create a new international body to establish the laws governing outer space, oversee those laws, and enforce them. This proposal aligns with article 11(5) of the Moon Agreement, which requires that an international regime be created to govern the exploitation of natural resources on the moon when such exploitation is about to become feasible.[88] The Moon Agreement gave no further guidance on how this was to be done or what form it should take, leading many developed and space-faring nations to reject the proposal for fear that they would be bound to obey a body that would not act in their best interests.[89] Modern proposals seek to clarify the shape that such an international regime would take.

Professor Carl Christol, one of the foremost authorities in international space law, argues that an intergovernmental organization is necessary to manage and ensure the safe and orderly exploitation of lunar resources.[90] He believes that such an organization is the best and perhaps only way to maintain open channels of communication among public and private institutions that seek to use lunar resources.[91] He further believes that an intergovernmental organization could take into consideration both views when deciding equitable distribution of shares from the profits and other benefits derived from the exploitation of outer space resources.[92]

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[88] *See* Moon Agreement, *supra* note 38, art. 11(5).

[89] Space Law, *supra* note 61.

[90] Paxson, *supra* note 51, at 509; Carl Christol, *An International Regime for the Moon, Article 11, Paragraph 5 of the 1979 moon Treaty for the Moon*, PROC. 23RD COLLOQUIUM ON L. OUTER SPACE, 139, 146 (1980).

[91] *See* Christol, *supra* note 90.

[92] *Id.* Paxson, *supra* note 51, at 509.

In creating a legal framework to govern the exploitation of natural resources in space, it would be natural to look to international law currently governing mining in international territories on Earth, and to draw inspiration for an international space authority from other international administrative bodies already in place. The International Seabed Authority is one prototype that may be followed. Created under UNCLOS III, the ISA oversees the extraction of resources from international territory (in the ISA's case, mining in international waters).[93] UNCLOS designated international seabeds the "common heritage of mankind,"[94] similar to the OST's designation that space is to be explored and used for the benefit and in the interest of all mankind.[95]

The ISA administers rules and regulations for deep-sea mining, approves plans for exploration and exploitation of resources, oversees compliance with rules, and decides how mining revenues should be shared.[96] The ISA is divided into separate bodies with designated functions. Every party to UNCLOS is represented in the Assembly, which makes decisions about sharing mining revenues and considers problems of a general nature.[97] The Assembly appoints seats in the ISA's executive body, the Council, to ensure that both developing nations and those with a substantial interest in mining are represented.[98] Remaining seats are distributed to assure equitable geographic distribution.[99]

Nations or companies do not need the ISA's permission to prospect for resources but must obtain permission to have exclusive rights to the exploration and exploitation of discovered resources.[100] The ISA requires all mining applications submitted to it to encompass an area large enough to support two mining operations, so that a portion of that area may be reserved for the ISA's potential future use for the ISA's own mining expeditions.[101] If more than one proposal is submitted for the same area and authorizing multiple requests would exceed production limits, the ISA must select the application to authorize in a non-discriminatory manner, giving priority to the applicant who gives the better assurance of performance.[102]

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93 *See* Law of the Sea Convention, *supra* note 69.

94 *See id.* art. 136.

95 Outer Space Treaty, *supra* note 2, art. I.

96 *See* Law of the Sea Convention, *supra* note 69, arts. 160, 162.

97 *See id.* arts. 159–160.

98 *See id.* art. 161.

99 *Id.*

100 *Id.* Annex III, arts. 2–3.

101 *See id.* Annex III, art. 8.

102 *See id.* Annex III, art. 7.

Since the ISA was established in 1994, it has successfully established new regulations for marine mineral resource prospecting and exploration.[103] It has entered into fifteen-year exploration contracts with seven nations[104] to reserve areas to prospect exclusively.[105] So far, these nations have not begun to exploit deep-sea minerals.[106] Any disputes relating to ISA activities will be submitted to the Seabed Disputes Chamber,[107] which is a court within the International Tribunal of the Law of the Sea.[108] So far, only fifteen cases have been submitted to the Tribunal, and none of the cases have involved mining.[109]

A space authority that follows the ISA model may be divided into different bodies that carry out different functions. All nations would have a seat in the Assembly, regardless of their space-faring capabilities. Representation on boards and councils would depend on the nations' space-faring capacity and plans to send missions to space and exploit resources. If the ISA model is followed exactly, seats on the Council will be reserved so that developing countries have representation. It is likely, however, that powerful space-faring nations would only agree to this model if seats reserved to developing nations were very limited.[110] Some nations may argue that only those nations that will be performing the missions falling under the authority's jurisdiction should be guaranteed a role in approving and implementing the rules and regulations on the Council.[111] The ISA model would allow parties to search freely for resources but would require them to abide by the ISA's rules in claiming and extracting resources. The space authority could

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[103] *See* UNITED NATIONS & THE INTERNATIONAL SEABED AUTHORITY, MARINE MINERAL RESOURCES 9 (2004).

[104] The nations are India, France, Japan, Russia, China, Korea, and the Czech Republic. *Id.* at 9 n. 25.

[105] *See* Reserved Areas, International Seabed Authority, http://www.isa.org.jm/en/scientific/exploration/reserved (last visited Jan. 14, 2009).

[106] *See* Members, International Seabed Authority, http://www.isa.org.jm/en/about/members (last visited Aug. 27, 2008) ("The Convention also assigns several other powers to the Authority, which will come into play once deep-sea mineral exploitation gets under way.").

[107] *See* Proceedings and Judgments: Competence, International Tribunal for the Law of the Sea, http://www.itlos.org/start2_en.html (last visited Jan. 14, 2009).

[108] *See* Press Release, International Tribunal for the Law of the Sea, *The Tribunal Concludes its First Session & Organizes its Future Work* (Nov. 1, 1996), *available at* http://www.itlos.org/news/press_release/1996/press_release_4_en.doc.

[109] *See* International Tribunal for the Law of the Sea, http://www.itlos.org/start2_en.html (follow "Proceedings and Judgments" link; then follow "List of Cases" link) (last visited Jan. 14, 2009).

[110] The amount of control given to developing nations is a major reason the UNCLOS III and ISA were rejected by some nations, including the United States. *See* Sattler, *supra* note 66, at 34–35.

[111] *See id.*

levy a production royalty on the operations and might be free to impose fees as it felt necessary. Additionally, it could, as the ISA did, reserve a portion of every area approved for mining either by the space authority itself or to sell or rent to other interested parties to generate profits for itself or to distribute among non-space-faring nations.

There are drawbacks to forming a new international body to oversee the exploitation of space resources. An international authority would be very expensive to start and maintain. Most nations do not have the capacity to perform lunar missions, so they may not want to invest much money in the authority. This could effectively freeze them out of the decsionmaking process and put them at a disadvantage if they someday are able to participate in lunar missions.[112] There is also questionable value in creating a structure which is supposed to allocate profits and benefits to developing countries but which consumes funds that might have otherwise been put toward helping those nations directly.[113]

It may also be difficult for space-faring nations and developing nations to come to an agreement on how the international body should be set up and administered, even before they address the actual space law issues at hand in the international regime. They will need to decide whether the authority should be administered by the United Nations or exist as an independent entity and how to allocate power between developing nations and space-faring ones. Judging by the fourteen years it took to negotiate the ISA (with an additional twelve months before it came into force),[114] creation and implementation of a governing body could take many years, and thus the space authority may not be in place before missions are sent to the moon to begin assessing and mining resources.

B. Credit System

A credit trading system might avoid the problems associated with creating a new international body to govern space resources. In a 1993 University of Michigan Law Review Note, Edwin Paxson first proposed applying the credit trading system of the Montreal Protocol to space mining.[115] Since that time, the use of credit systems has greatly increased and been applied in areas as diverse as emissions trading under the Kyoto Protocol,[116]

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112 *See* Reinstein, *supra* note 10, at 64.

113 *See* Paxson, *supra* note 51, at 510.

114 *See* Law of the Sea Convention Overview, *supra* note 64.

115 *See* Paxson, *supra* note 51, at 513–14.

116 *See* Kyoto Protocol to the United Nations Framework Convention on Climate Change, Dec. 10, 1997, 37 ILM 22 [hereinafter Kyoto Protocol].

landfill allowance trading in the United Kingdom,[117] and fishing and water credits.[118] Given expanded use of the credit system over the past fifteen years, a credit system's possible application to lunar mining should be re-examined.

Under the emissions trading systems of the Montreal and Kyoto Protocols, the parties seek to reduce global emissions of substances that deplete the ozone layer and cause climate change by allowing each party a designated amount of emissions per time period.[119] The regimes allow parties to purchase emission allowances from other parties, so that if one nation wants to use more than its allotted shares, it may purchase them from a nation that did not use all of its shares.[120] Thus, emissions levels are kept stable by nations buying and selling the emissions credits among themselves, eliminating the need for an international body's consideration and approval for every proposed transaction.[121] Emissions trading programs have been very successful, leading dozens of countries to adopt programs to address global warming.[122]

While most famous credit trading schemes such as the Kyoto Protocol have focused on limiting emissions that are released into the air and water as pollution, a similar system can also be used for extracting and owning limited natural resources. Tradable credit systems have been applied to water resources, fisheries, and land control.[123] Tom Tietenberg, professor of economics at Colby College, explains how to apply this system to extraction rather than emission:

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[117] The U.K. government allocated to local authorities landfill allowances of tons of garbage that they may send to landfills each year. *See generally* Friends of the Earth, *U.K. Landfill Allowance Trading Scheme* Briefing, Sept. 2007, *available at* http://www.foe.co.uk/resource/briefings/lats.pdf (describing an overview of the U.K. Landfill Allowance Trading Scheme). Local authorities may trade their credits among themselves if they have more or fewer credits than they need. *Id.*

[118] *See* Tom Tietenberg, *The Tradable Permits Approach to Protecting the Commons: What Have We Learned?*, at 1, *presented at the* Conference of the International Association for the Study of Common Property, *Constituting the Commons: Crafting Sustainable Commons in the New Millennium*, 2000, *available at* http://dlc.dlib.indiana.edu/archive/00000366/00/tietenbergt040800.pdf.

[119] *See* Press Release, U.N. Framework Convention on Climate Change, The Montreal Protocol and Kyoto Protocol are Mutually Supportive (Sept. 17, 2007), *available at* http://unfccc.int/files/press/news_room/press_releases_and_advisories/application/pdf/070917_hcfc_pressrel.pdf.

[120] *See* The Montreal Protocol on Substances that Deplete the Ozone Layer, art 2.5, Jan. 1, 1989, 26 I.L.M. 1550 [hereinafter Montreal Protocol].

[121] Paxson, *supra* note 51, at 515.

[122] *See* David B. Sandalow, *Emissions Trading is Kyoto's Success Story*, INT'L HERALD TRIB., Feb. 17, 2005, at 8, *available at* http://www.iht.com/articles/2005/02/16/opinion/edsandalow.php.

[123] *See* Tietenberg, *supra* note 118.

> Tradable permits address the commons problem by rationing access to the resource and privatizing the resulting access rights. The first step involves setting a limit on user access to the resource . . . . For water supply it would involve the amount of water that could be extracted . . . . This limit defines the aggregate amount of access to the resource that is authorized. These access rights are then allocated . . . to potential individual users. . . . [R]ights may be transferable to other users and/or bankable for future use. Users who exceed limits imposed by the rights they hold face penalties up to and including the loss of the right to participate.[124]

By applying this model to lunar resources, all party nations, regardless of space-faring capacity, would be allocated a certain number of lunar mining credits. The credits would allow the holder to mine a certain tonnage of natural resources on the moon during a given period.[125] The tonnage limit assures that nations will make careful choices in where and what to mine, and assures that resources will be available to all nations that begin mining later.[126] Setting a date on which the credits expire prevents hoarding and controls the amount of mining activity happening at a given time. Nations could buy and sell their credits freely among nations that are parties to the credit agreement. This would create incentive for all nations to participate in the agreement regardless of their individual space-faring capacities. In addition, it would allow developing nations to benefit from space exploration and exploitation fairly, without giving them control over an international regime in which they might devise a system to distribute profits from resources that they played no part in obtaining and which they might skew unfairly in their own favor.[127] Little international organization would be needed to administer this system because countries could buy and sell the credits among themselves.[128]

This system is not without problems. First, a limited international authority would be needed to allocate the mining credits. The authority would need to decide how to allot credits: by population, by giving additional credits to developing countries to ensure they benefit, or by some other fashion. Since credits would be bought and sold among nations, it is unclear what role private actors such as corporations would play. It must be decided whether individuals may purchase credits directly from nations, or whether a citizen would have to obtain credits from his or her own nation.

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124 *Id.*

125 Paxson, *supra* note 51, at 514.

126 *See id.*

127 *See* KEMAL BASLAR, THE COMMON HERITAGE OF MANKIND IN INTERNATIONAL LAW 173 (1998) (demonstrating the concern of developing nations during negotiations for the Moon Agreement).

128 Paxson, *supra* note 51, at 515.

Some international oversight would be needed to ensure that nations adhere to the rules and do not exceed their allotted tonnage. This plan also does not resolve the fundamental questions of whether space resources may legally be claimed as personal property. While the plan assumes that they may, an international agreement would still be needed to firmly establish that celestial resources may legally belong to those who extract them.

C. Unlimited Ownership

Perhaps the clearest, most efficient solution to the space resources question would simply be to allow comprehensive property rights, including real estate ownership, in space. Supporters of this theory believe that property rights under the current Outer Space Treaty are unworkable. The OST seems to indicate that people may use real property in space to collect resources and claim those resources as their own property, but they may not own the real property itself.[129] Even those ownership rights, however, are constrained by other clauses of the treaty that say that the benefits belong to all mankind.[130] While the OST allows a constrained claim to space resources, it does not allow the right to exclude under article I's guarantee of free access to all areas of celestial bodies.[131] Thus, mining expeditions could not lawfully prevent others from entering their area of operation and extracting resources that the expedition worked to discover and expose.

The issue of real property ownership on celestial bodies has been litigated in federal court. Plaintiff George Nemitz claimed ownership over asteroid 433, known as "Eros," based on the registration of his claim on the Archimedes Institute[132] website and the use of the asteroid as collateral when he filed a Uniform Commercial Code security interest in California.[133] The National Aeronautics and Space Administration (NASA) landed a spacecraft on Eros on February 12, 2001.[134] Nemitz alleged that NASA's spacecraft on Eros infringed on his property rights, and claimed that he was

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129 *See* Outer Space Treaty, *supra* note 2, arts. I–II.

130 *Id.* art. 1

131 *Id.*

132 The Archimedes Institute is a space policy research group that keeps a Private Property Rights Registry where individuals can register private claims to solar system resources. Permanent, Archimedes Institute, http://www.permanent.com/ep-archi.htm (last visited Mar. 14, 2008). In its decision, the court found "[t]he Archimedes Institute registration on which [Nemitz] relies disclaims any authority to confer title or rights to property on its registrants. . . . There is absolutely no legal basis for asserting that such a registry creates a property interest in the asteroid." *Nemitz v. U.S.*, No. 030599, 2004 WL 3167042, at *1 (D. Nev., Apr. 26, 2004), *aff'd* No. 04-16223, 2005 WL 319010 (9th Cir. 2005). The Institute's website, http://www.permanent.com/archimedes, is apparently defunct.

133 *Nemitz v. U.S.,* No. 030599, 2004 WL 3167042, at *1 (D. Nev., Apr. 26, 2004).

134 *Id.*

entitled to "parking" fees of twenty cents per year.[135] When Nemitz contacted NASA to collect this fee, NASA General Counsel Edward Frankle responded in a letter by saying:

> Your individual claim of appropriation of a celestial body (the asteroid 433 Eros) appears to have no foundation in law. Unlike an individual's claim for seabed minerals, which was considered and debated by the U.S. Congress that subsequently enacted a statute, The Deep Seabed Hard Mineral Resource Act, P.L. 96-283, 94 Stat. 533 (1980), expressly authorizing such claims. There is no similar statute related in outer space.[136]

The Nevada district court agreed with Frankle, granting NASA's motion to dismiss by finding that Nemitz had no property interest in the asteroid nor a cognizable cause of action against the defendants.[137]

Despite the current legal framework barring real property rights in space, proponents of full property rights argue that real estate ownership would have a number of advantages over other systems, and that new laws and treaties must be established to create real property rights on celestial bodies. One argument for this position is that allowing ownership of real property on celestial bodies would reduce wasteful use of the land. If expeditions were allowed to mine the moon or other celestial bodies without ownership rights to the land that they mine, there would be no incentive to use the land in a productive way.[138] Rather, the expeditions would work to extract only what they wanted and in the process potentially destroy other useful resources.[139] If the expeditions owned the land, however, they would have incentive to use it efficiently and carefully consider all of its possible uses to maximize the investment.[140] Even if the expedition did not extract all the possible resources, an owner of celestial property would have an incentive to preserve as much as possible to make it attractive to a future buyer when the expedition sells the land.[141]

Ownership rights would also provide incentives for expeditions to make the initial treks to the moon. The first expeditions to mine the moon are likely to be the costliest, with ventures prospecting sites, setting up bases, and generally learning from the initial successes and failures that come with being the first humans to work on another celestial body. Ventures that wait, however, will learn from the mistakes of earlier missions

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135 *Id.*

136 Wayne White, Nemitz vs. U.S.: *the First Real Property Case in United States Courts,* PROC. 47TH COLLOQUIUM ON L. OUTER SPACE, 339, 340 (2004).

137 *See Nemitz*, 2004 WL 3167042, at *2.

138 *See* Reinstein, *supra* note 10, at 75.

139 *See id.*

140 *See id.*

141 *See id.*

and benefit from the knowledge that they have acquired. Under the OST, later ventures would have access to the initial expeditions' equipment and resources under reciprocity, and the lack of the right to exclude under the OST means that the later ventures could mine the same sites that the earlier ventures found and started.[142]

Providing ownership rights to real estate on the moon would prevent these problems. Interested ventures would want to begin their expeditions as soon as possible in order to claim prime real estate and prevent its use by others. Absent an agreement with another expedition, they would need to establish their own base and provide their own resources, which means they gain no advantage by waiting for other ventures to be established. Another advantage is that ownership would allow a free market to develop in property rights.[143] Ventures could buy and sell their facilities in space, so ventures which were unsuccessful in their mining or other commercial goals would have residual value in facility and property rights, which they could sell to recoup expenses.[144]

Despite these advantages, full ownership of real estate in space poses some serious problems. Most importantly, full ownership violates article II's "no sovereignty" provision in the Outer Space Treaty.[145] While article II specifies that "nations" may not claim sovereignty on any celestial body, this is accepted to include private individuals as well, as nationals are considered a part of their country of citizenship and are required to work through and with their governments in planning and executing missions to space.[146] It would take an amendment to the OST itself to overturn this rule and, since it is the fundamental tenet of the treaty, it is almost unthinkable that that will happen, and certainly not before the expeditions to the moon begin.

The proposition of full ownership rights further violates the OST by disregarding the concerns of developing nations. If lunar real estate were put on the market, only the wealthy, developed nations and their citizens would be able to purchase it. If developing nations tried to purchase land later when they could afford it, they would be at a disadvantage because the prime locations are likely to be taken and the land's current owners could demand whatever price they wanted. This could perpetuate current disparities of wealth and resources on Earth to the Moon and outer space. Along the same lines, ownership of real estate could lead to ventures buying land

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142 *See* Outer Space Treaty, *supra* note 2, art. XII.

143 Wayne White, *Implications of a Proposal for Real Property Rights in Outer Space,* PROC. 42ND COLLOQUIUM ON L. OUTER SPACE, 366, 370 (1999).

144 *Id.* at 370–71.

145 *See* Outer Space Treaty, *supra* note 2, art. II.

146 *See id.* art. VI ("The activities of non-governmental entities in outer space, including the moon and other celestial bodies, shall require authorization and continuing supervision by the appropriate State Party to the Treaty.").

on the moon, not with the intent to use it, but to sell it for a large profit, thus skewing the value of the property so it seems to be more than it is actually worth.[147]

D. International Space Station Model

A big drawback to the models discussed above is that they likely could not be implemented before the anticipated missions to the moon are made. Establishing a new authoritative body on space property law, deciding on property rights, devising a credit system that nations will agree to, and attempting to amend a treaty to which ninety-eight countries have ratified are all propositions that would take a significant amount of time to implement. An alternative to these propositions is a solution modeled on the International Space Station (ISS).[148]

Rather than create a new body of law to govern the ISS, participating nations agreed to extend existing national terrestrial law to the station in outer space.[149] Each member registers its own components of the ISS and retains jurisdiction over them subject to provisions of overall station management.[150] Thus, Russian law governs in the sections Russia contributed to the space station, and American law governs in the modules that the United States supplied. Members may contract among themselves to use a portion of the craft belonging to another nation, but by doing so they agree to operate under foreign law when working in that area of the spacecraft.

The rights and responsibilities of the parties are set out in a hierarchy of instruments governing the ISS: intergovernmental agreements (IGAs), memoranda of understanding (MOUs), and implementing arrangements.[151] Participating nations first enter into a series of IGAs to define their participation and duties on the ISS.[152] The IGAs set out general principles for carrying out the cooperative effort, including those governing the parties' conduct in outer space.[153] NASA acts as the hub of the IGAs, and numerous other space agencies signed the agreement.[154] Under the IGAs,

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147 *See* Reinstein, *supra* note 10, at 81.

148 Sattler, *supra* note 66, at 37–38 (discussing the passage of the Commercial Space Act).

149 *See* Andre Farand, *Legal Environment for the Exploitation of the International Space Station (ISS)*, PROC. 42ND COLLOQUIUM ON L. OUTER SPACE, 8, 8 (1999).

150 HUDGINS, *supra* note 46, at 234.

151 John B. Gantt, *The Status of Multilateral Space Agreements in International and United States Law*, PROC. 45TH COLLOQUIUM ON L. OUTER SPACE, 84, 89 (2003).

152 HUDGINS, *supra* note 46, at 233.

153 Farand, *supra* note 149, at 9.

154 *See id.* Fifteen states are currently parties to the ISS. *Id.* They are the United States, Russia, Japan, Canada, and eleven member states of the European Space Agency. *Id.*

members contribute funds and technology, and each owns some portion of the space station.[155]

Under the IGAs in the hierarchy are individual MOUs between NASA and each foreign cooperating agency.[156] The MOUs contain detailed provision regarding the implementation of ISS cooperation as laid out in the IGAs.[157] Unlike the IGAs, which are conducted by the States, the MOUs are signed by the heads of the space agencies.[158] MOUs do not generate new rights or obligations, but rather concern details regarding the design, development, and operation of the ISS.[159] They detail the parties' roles and responsibilities, establish the management structure, and ensure effective planning and coordination of work between the parties.[160] At the bottom of the hierarchy of agreements governing the ISS are the implementing arrangements. These relate to how the parties' rights and obligations under the MOUs will be implemented.[161]

This flexible series of agreements between nations could be used as a model for agreements governing lunar mining. Nations could agree to work together, each contributing funds and placing technology on the moon through its own space agency, and retaining jurisdiction over its structures and equipment.[162] Once the nations made the initial IGA, there would be no need for continued official State involvement, and the individual space agencies could make further MOUs among themselves. Nations could establish bases on the moon and have an exclusive economic zone around their base through which other public and private expeditions may pass through so long as they do not disturb or remove resources.[163] The parties to the treaty could make agreements among themselves concerning mining locations and regulations without needing the approval of an international body.

There are a number of problems with this model that make it an undesirable starting point for establishing property rights in space. First, it allows a small number of nations to act together to set precedent for property rights in space instead of establishing formal international laws that the international community agrees upon. This means that when other nations

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155 Sattler, *supra* note 66, at 38.

156 *See* Gantt, *supra* note 151, at 89.

157 *See* Farand, *supra* note 149, at 10.

158 *See id.*

159 *See id.*

160 Gantt, *supra* note 151, at 92.

161 Farand, *supra* note 149, at 10 (discussing the heads of ths space agencies signing MOUs containing detailed provisions for implementation of ISS cooperation).

162 *See* Sattler, *supra* note 66, at 39.

163 *Id.* at 43.

eventually do participate in such activities, they likely will be bound by customary law that they did not play a role in shaping and that is disadvantageous to them. Second, it disregards the "common heritage" provision of the OST, with developing nations fully excluded and receiving no benefit from resources derived from space unless they eventually gain the capacity to travel to the moon themselves. Finally, it seems unwise to allow one country's space agency to act as the hub to accessing and participating in activities in space when space is supposed to belong to the world as a whole. Having individual nations dictate the agreements presents the risk that a country may be excluded from participation for any reason: diplomatic problems between the nations, unwillingness to share equipment and resources, or pressure from other members.

IV. A NEW PROPOSAL

Drawing on the strengths of the proposals discussed above, this Note suggests a new proposal for governing property rights to outer space resources. This proposal falls within the bounds set by the Outer Space Treaty and avoids many of the problems that prevented the Moon Treaty from being widely ratified. Both developed and developing nations will benefit from the proposal. In addition, it encourages the exploration and exploitation of resources from space.

First, an international agreement should be made that clarifies property rights on celestial bodies and establishes a limited international body to oversee its execution and implementation. The agreement should clearly state the rule that the Outer Space Treaty is widely understood to have indirectly stated that: nations, companies, and individuals may not own real estate on celestial bodies, but may have property rights to resources they derive from the moon or other celestial bodies. Stating this outright in a new treaty will prevent the types of ongoing debates that arise from the imprecise or ambiguous language of agreements such as the Outer Space Treaty and the Moon Agreement. Since the OST is widely understood to have this meaning anyway, nations are likely to assent to this portion of the treaty. It solidifies the rights of expeditions to legally claim the resources they extract from the moon, and the knowledge that they are acting within a stable legal framework should encourage nations to send expeditions without fear that the resources will be confiscated or deemed illegal.

The agreement should establish an authoritative body to be formed under the already existing U.N. Office of Outer Space Affairs. The body would serve limited functions, so it would not be overly difficult, time-consuming, or costly to initiate and maintain. It would have a council on which every space-faring nation or nations otherwise involved with a space would be guaranteed a seat, with limited seats reserved for developing nations. The body would serve limited functions in that it would oversee the general execution of the agreement and be the contact point for participating

nations, but under normal circumstances it would not make everyday decisions regarding which country may use what areas and resources. Instead, the credit system would be used. Each nation would be allocated a certain number of credits representing tonnage of resources to be extracted from the lunar surface for a given period of time. The credits would be allocated to all member countries with additional credits given to developing nations.[164] The credits would be freely transferable, so nations without space-faring capabilities could benefit by selling their credits, leasing them while retaining ownership, or creating novel agreements that benefit the nation.[165] Nations may sell their credits to their own citizens, or if all the nation's credits are already in use, facilitate in purchasing them from other nations. Individuals and corporations must still go through the appropriate channels in their nation, per the OST, because it is the nation that is ultimately responsible for their safety and actions.[166]

The members of the new space property treaty will need to determine what exactly the credits represent. For example, particular plots of land on the moon could be permanently tied to a particular nation's credits, or the credits may represent tonnage that has no fixed location until a nation extracts it on a first come basis. The former would provide some features of real property rights and discourage wasteful use the land.[167] The latter, however, seems to better comport with the idea that the moon is the "common heritage of mankind" and no section is owned by a nation or person. This allows expeditions to prospect freely, as they do under the International Seabed Authority,[168] and use their credits only when they decide on a location to begin extraction. When a nation exercises its credits on land, that land will become the exclusive economic zone of that nation, with other parties free to pass through as long as they do not disturb it or take resources from it. Like the ISS model, nations may collaborate and form agreements

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[164] The authority would need to decide how to allocate the credits: equally among member countries, adjusted based on population, or in some other fashion. Developing countries should receive more than their proportional share of credits so they might significantly benefit from the system even without directly participating in lunar activities. This complies with the "benefit and interest of all countries" provision of the OST. *See* Outer Space Treaty, *supra* note 2, art. I ("The exploration and use of outer space, including the moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind.").

[165] Given the immense value of the helium-3 that nations will extract, the cost of credits will likely not make the activity cost-prohibitive. *See supra* Part I (assessing the value of helium-3).

[166] *See* Outer Space Treaty, *supra* note 2, art. VI.

[167] *See supra* Part IV.C (arguing that ownership rights discourage wasteful use of land).

[168] *See supra* Part IV.A (discussing the International Seabed Authority's prospecting and exploration procedures).

among themselves regarding particular issues without needing to go through the authoritative body so long as the agreements do not violate the overarching agreement on property rights.

The natural resources extracted could be taxed by the ton to encourage nations not to take more than they need and to fund the operations of the authority governing the new agreement. There may even be a time or tonnage limit for staying on a piece of land so that particularly rich areas of resources will not be monopolized by any one country without giving other nations the opportunity to compete. Additionally, the authority may establish environmental rules to ensure that the mining does not harm the environment and that the mining and its effects would not be visible from earth.

Any conflicts arising from lunar activities would be governed by article XIII of the Outer Space Treaty, which calls for issues regarding outer space to be resolved between State parties to the treaty or between a party and the international organization that oversees the activities.[169] Applying that provision to this legal framework, if member parties have a dispute they must first try to resolve the issues through independent negotiation or by working with the authoritative body. Further, article III of the OST states that parties shall comply with international law, including the U.N. charter.[170] The implication is that disputes arising in space law should be resolved in the same way as disputes in other areas of international law.[171] Chapter IV of the U.N. charter states that parties shall "seek a solution by negotiation, enquiry, mediation, conciliation, arbitration, judicial settlement, resort to regional agencies or arrangements, or other peaceful means of their own choice."[172] If such action is successful, chapter XIV of the U.N. Charter provides that nations may bring their disputes to the International Court of Justice or make agreements to bring their issues to another tribunal.[173]

Therefore, in the event of a dispute under this legal framework the parties must first negotiate between themselves to resolve it. For the foreseeable future, there will likely not be enough space activity to necessitate a special space law tribunal, and if parties are unable to successfully resolve their dispute through diplomatic channels they may bring their dispute to the International Court of Justice. If at some future time there is enough space activity and disputes that an international space tribunal is necessary, one may be created at that time.

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169 *See* Outer Space Treaty, *supra* note 2, art. XIII.

170 *Id.* art. III.

171 H. L. VAN Traa-Engelman, Commercial Utilization of Outer Space: Law and Practice 343 (1993).

172 U.N. Charter art. 33, para. 1.

173 *See* U.N. Charter arts. 92, 95.

This legal framework should ensure that all of mankind benefits from the natural resources of outer space while operating under an efficient system that encourages exploration and use of resources without the system itself becoming burdensome.

CONCLUSION

The plans of five nations to go to the moon within the next ten years and extract helium-3—a substance that could change the way the world gets its energy—illustrates the urgent need to form a clear, stable legal framework to govern property rights regarding natural resources in space. A stable legal framework will encourage progress by assuring expeditions that they will legally own the resources they extract. It will also prevent ventures from setting bad precedent by performing expeditions outside of firmly established international law. The proper framework may even help nations that will not directly be participating in missions to the moon, in compliance with the Outer Space Treaty's provision that the operations benefit all of mankind.

Under this proposal, an authoritative body would oversee the space property laws, act as a point of contact between nations, and act as a forum for proposing and discussing space property law. The credit system would depend on individual contracting between nations, so the body would not generally be involved in everyday affairs of reviewing and approving proposals. Nations must merely alert the council before exercising their credits to ensure that that area is not already being used by another nation. Short of enforcing environmental rules, the council would otherwise only be directly involved in operations when resolving disputes. In short, the plan should appeal to all nations and benefit all of mankind while encouraging mankind's next giant leap.