IAC-10.E7.1.7

# YOU CAN LEAD AN ASTRONAUT TO WATER...: PROSPECTS FOR LEGAL USE AND WATER RIGHTS ON THE MOON AND OTHER CELESTIAL BODIES

**Mr. Joshua Easterson**
Alexandria, Virginia, USA, eastjo01@gmail.com

*Life, as we know it, is dependent on water. While several astrobiological theories have posited that water and carbon are not necessarily the universal basis for life forms, all known beings require water to function; even extremeophiles require limited water to exist. More importantly, human life can only be supported with sufficient water for drinking and agriculture. Water is essential to known life because it is an extremely versatile molecule; it has a high specific heat capacity, it is polar, it is a near-universal solvent, and its components readily conform to metabolic processes. Beyond basic life support, water can also be broken into oxygen and hydrogen, key components for the chemical rockets that comprise modern space travel. Whether providing drinking water, breathable oxygen or hydrogen fuel, the beneficial use of water in space could drastically reduce the payloads required in leaving Earth or living on a research base.*

*The use of water found in space has taken two giant strides away from the hypothetical in recent events: the discovery of significant lunar polar water-ice and NASA's decision to support commercial human spaceflight. The practical existence of water deposits on the nearest celestial body to Earth, and the need for ingenuity in for-profit ventures into space offer both opportunity and motive for beneficial water use on the Moon. Before the confluence of these circumstances culminates in unilateral action or an international disagreement, it is imperative to review our existing water law models, and the current space law regime, to come to an understanding of the present regulation for water use in space. Additionally, because there is no explicit international treaty language addressing the beneficial use of water deposits on celestial objects, it would appear necessary to synthesize a solution on how such water use is permitted, managed and adjudicated that is both pragmatic and in accordance with the spirit of extant international agreements on space.*

*This paper proposes that water in space is non-renewable and must be governed under the same rules as any other harvestable mineral resource. Finding language on resource extraction and use to be lacking in the treaties on outer space, this paper puts forth several analogies for legal exploitation of lunar resources. Ultimately the article advises that to ensure fair use without sacrificing practical advancement, new international agreements and a new regulatory body under the U.N. Office of Outer Space Affairs will be required.*

## I. INTRODUCTION

### I.I The Importance of Water and Fair Use in Space

Water is essential to supporting all known life. Scientists in search of extraterrestrial planets which could sustain life have made the search for water a key indicator of biological possibility. It has even been proposed that the presence of water is necessary for the formation of a number of significant organic compounds. More close to home, water can easily be converted into vital resources for manned space missions. Its usefulness in providing astronauts with breathable oxygen and necessary hydrogen for fuel offer new prospects for space exploration and diminish the often-prohibitive expense of the otherwise required payloads. The discovery of significant water ice on the Moon's southern pole by NASA's LCROSS probe in October 2009 and, more recently, the ISRO's Chandrayaan-I discovery of millions of tons of ice near the north pole of the Moon, sent ripples of excitement through the space community over the opportunities these findings offer.* With the new potential for lunar water use looming, we must look beyond the excitement of space exploration strategists and engineers and weigh the requirements for the use of such water under the existing space law regime. Additionally, much like the American Wild West, we may need to adopt new legal guidelines for the fair use of water as it becomes an issue in humanity's new frontier.

### I.II The Current Problem of Legal Extraterrestrial Water Rights

In February 2010, NASA announced that it was discontinuing the Constellation program and the related plans for manned missions to the Moon in favor of bolstering and utilizing commercial

* Paul Rincon, "Ice Deposits Found at Moon's Pole," *BBC News*, 2 March 2010. Available at: http://news.bbc.co.uk/2/hi/science/nature/8544635.stm

companies.* In light of an agency from such an actively spacefaring nation asserting a new commitment to encouraging commercial spaceflight resources, the legal implications and possibilities of extraterrestrial water use by non-governmental space-faring actors has become more that an academic thought-experiment.

While Article Six of the 1967 United Nations 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") implies permissive language regarding the space travel of non-state actors under the oversight of responsible state signatories, the globalization of the aerospace industry has resulted in a significant number of concerns regarding multinational corporations with space launch interests. With specific attention to the use of lunar water ice, this paper will examine the current national and international jurisdictional regimes that would govern the extraction and use of water in outer space. First, it will survey existing terrestrial water and resource law to examine ways in which states have used national laws to regulate the use of water by interested parties. It will then identify the relevant outer space treaty law and how the current and proposed international agreements on space allow for fair use of natural resources. Following this analysis, this article will look to propose solutions for the practical use of water deposits on celestial bodies and new international governance that incorporates the spirit of the existing space law regime. By considering existing water law, space law and the concerns to be addressed in regulating resources in space, this paper seeks to show the need for revision to the 1979 Agreement Governing the Activities of States on the Moon and Other Celestial Bodies ("Moon Treaty") to clarify the framework of the new international regime governing the exploitation of water and other resources in space as provided for in Article 11(5).

## II. RESOURCE USE

### II.1 Who Has the Right to Water?

It is of note that on July 28th of this year, the UN General Assembly voted that access to water is a universal human right.† This declaration was simply a recognition that most civilizations and systems of governance throughout history have acknowledged the importance of access to water to sustain life, to grow food and to support transportation. Modern codified water rights and the various systems of contemporary water laws were primarily established on ideas which came out of the British common law and Roman civil law traditions.

The United Kingdom, many of its former colonies and the Eastern United States traditionally adjudicate water use according to riparian rights, or water rights based on adjoining or surrounding landownership. Water, even when it is flowing, is treated as static property subject to boundary lines. Each adjacent landowner has the right to do with his water as he will, as long as it does not severely impinge on any water use downstream from his property. Under this system, water rights are sold when the property abutting the body of water is sold. Generally in areas that rely on riparian rights, navigable waterways are considered public, with their own set of navigation and access laws. Water may be beneficially used by property owners on the banks as long as it does not significantly impact the flow of the large body of water.

In most of the rest of the world, including the American West, water is governed by use-based rights. These laws take a number of different incarnations, but all have a basis in the recognition of water scarcity and the right of parties sustaining themselves from a given water source to continue to do so. In both ancient Rome and modern Japan, all water was identified as belonging to the public, held in trust by the government, and individual and corporate rights to the water were usufructuary. In terms of Japan's current River Law, this means that disputes are arbitrated by a river administrator whose primary goal is to approve new use proposals to maximize utility from each waterway. No party will be denied historically approved water use, but all new proposals become increasingly competitive.‡ The Western United States favors prior-appropriation water rights: the first party to use the water for a beneficial use has a right to continue to use that quantity of water for that same purpose.§ In this system, any following parties may also use the water unless it interferes with the right of the preceding parties to continue to use the water as they had been using it. While water may not technically be property under use-based rights, established water

* Jonathan Amos, "Obama Cancels Moon Return Project," *BBC News*, 1 February 2010. Available at: http://news.bbc.co.uk/2/hi/science/nature/8489097.stm

† U.N. General Assembly, 64nd Session, "108th Meeting," 28 July 2010. Available at: http://www.un.org/News/Press/docs/2010/ga10967.doc.htm

‡ Ministry of Land, Infrastructure, Transport and Tourism, "River Administration in Japan." Available at: http://www.mlit.go.jp/river/basic_info/english/admin.html

§ *State of Wyoming v. State of Colorado et al*, 259 U.S. 419 (1922)

rights can be sold. In the prior-appropriation system, senior appropriators may sell or modify their priority level and share of the water as long as it does not interfere with recognized junior appropriators' water rights. Many states which regulate use according to appropriation have water administration agencies which can declare a water source fully appropriated to the extent that the local environment allows.

Riparian and prior-appropriation rights are primarily applied to flowing watercourses which run through and near multiple properties. Other regulatory systems do exist for stationary bodies of water, however they normally incorporate some form of purchased or use-based allocation of water. While not true in the EU, in parts of Scandinavia and several states in the U.S., small, nonnavigable, inland bodies of water can be purchased outright in connection with surrounding land.* In Finland, this has led to several fishing rights controversies, complex access ordinances and continued debate. In the U.S. the chief regulation concern of any such nonnavigable body is environmental protection of existing wetland ecosystems. As with rivers, navigable lakes in the U.S. are generally considered public and subject to rules regarding open-access for recreational and other purposes.

Underground water, be it a stream or a reservoir, is often governed differently than moving surface water because of the difficulties in determining and showing the flow of subterranean currents. In the majority of the United States, landowners may draw on groundwater resources with no limitations besides restrictions on malicious or wasteful use; which is difficult to prove by competing neighbors. Alternatively, in California where water law is often concerned with scarcity, subsurface water is to be used on an equal and correlative basis between all users of a shared aquifer.[t] In cases of dispute or draught, this water can be apportioned by a judge to comply with the guidelines for correlative use. Like standing bodies, subterranean water is still governed by ownership and use claims. In both instances ownership and access is easier to prove but the uncertainty of renewed supply makes fair use more difficult to assess.

As addressed above, water rights usually and practically fall under national or provincial adjudication. Internationally, water issues are generally arbitrated by bilateral or multilateral agreements between neighboring states and specific issue negotiations. One such treaty, the Indus Waters Treaty between India and Pakistan, requires notification and examination of any proposed projects which would significantly affect water flow between the states, and provides for mediation of disputes by a neutral party.[:t] Similarly, the International Joint Commission (the "IJC") between Canada and the U.S. was set up to prevent disputes relating to water quality and use over the border. The IJC investigates issues at the behest of both countries, holds biannual status meetings and coordinates open public forums to discuss water management and use impact.[§] Under the EU, water administration is governed by directive. In 2000, the EU Water Framework Directive required member states to organize and monitor water use by demarcated river basins.[<JI] Thus proposals for significant use projects would be presented in six-year River Basin Management Plans, for review and oversight by the European Union at large. Most interstate agreements do not directly quantify the flow or share of water each state may extract for beneficial use, but rather outline unacceptable impact and set up a framework for continued discussion on mutually acceptable water management.

On a broader scope, the International Law Association (the "ILA") and the U.N. have both notably weighed in on international water concerns. In an August 1966 meeting in Finland, the ILA adopted the Helsinki Rules on the Uses of the Waters of International Rivers ("Helsinki Rules") which offered the first globally applicable, albeit unenforceable, guidelines on the use of transnational waters. The Helsinki Rules declared that each state was entitled to a "reasonable and equitable" share of international freshwater.** This reasonable and

* Pekka Salmi and Riku Varjopuro, "Private Water Ownership and Fisheries Governance in Finland" available at: http://citeseerx.ist.psu.edu/viewdoc/download;jsessionid=0535633098A743C34AF72E5106A26615?

[t] U.S. Department of Interior Bureau of Land Management, "California: Water Rights Fact Sheet," *Western State Water Laws*, 15 Aug. 2001. Available at: http://www.blm.gov/nstc/WaterLaws/california.html

[:t] R.K. Arora, *The Indus Treaty Water Regime* (New Delhi: Mohit Publications, 2007), 5-13.

[§] International Joint Commission, "Who We Are." Available at: http://www.ijc.org/en/background/ijc_cmi_nature.htm

[<JI] European Council, *Directive 2000/60/EC,* 23 October 2000. Full text available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32000L0060:EN:HTML

** International Law Association, *Helsinki Rules on the Uses of the Waters of International Rivers,* 20 August, 1966. Full text available at: http://webworld.unesco.org/water/wwap/pccp/cd/pdf/educational_tools/course_modules/reference_documents/internationalregionconventions/

equitable use was to be determined by a number of factors including geography, climate, contribution of water to the source in question, historical use, need, alternative options and the ability of states to compensate one another to resolve water quarrels. The Helsinki Rules further advised that any states in dispute over the use of water should first seek negotiations, failing that they should set up a joint commission to study the issue and make recommendations, failing that a third party arbiter should be brought in, and failing all else the disagreement should be referred to a separate tribunal or the International Court of Justice.

The U.N. Convention on the Law of Non-Navigational Uses of International Watercourses was adopted in 1997 based on the pioneering guidelines of the Helsinki Rules, but also as a means for addressing several gaps in the ILA's document. The U.N. convention was approved by the General Assembly by an overwhelming majority. Even though it was not ratified unanimously, the adoption of the convention obliged member states to cooperate in a manner that is mindful of the equitable and reasonable use guidelines when managing water resources.* The U.N. convention offered no significantly new guidelines for adjudication of disputes, however it did extend the general protocols put forth in the Helsinki Rules beyond drainage basins to independent aquifers and it gave the Rules the weight of broader international agreement.:t While international law regarding shared water rights remains vague, the repeated themes of notification, cooperation, and the equitable benefit of mankind echo the language found in the Outer Space Treaty and other international agreements on the peaceful use of space.

II.II The Problems and Potential of Existing Water Rights Regimes as Applied in Space

In articulating new regulation it is often best to seek existing models of analogous and accepted legal governance and modify them to fit the situation at hand. In the survey of conventional solutions to terrestrial water use between private parties and between nations we have been offered several internationally accepted ideas on water management. While the listed water principles, or a combination thereof, are the basis for the exploitation of water as a resource on most of the globe, it is important to critically examine their utility as models for future water extraction and beneficial use in space. At first glance it is clear that both land-based water rights and use-based rights have their drawbacks, which would be exacerbated by the unique problems of space.

Riparian rights are derailed as a model for water use in space from the outset. The principle requires landownership of abutting or encompassing property to hold rights to the water in question. Article Two of the Outer Space Treaty explicitly prohibits, "national appropriation by claim of sovereignty..."§ No nation can be a riparian owner of extraterrestrial water, because no nation can claim property in outer space, on the Moon or on any other naturally occurring extraterrestrial object.

While it is clear that nations cannot stake claim to lunar real estate, this paper also seeks to investigate the legal use of water deposits in outer space by the imminent nongovernmental and private international corporations currently developing spacefaring capabilities. Would a non-state actor be able to claim riparian rights to the water-ice resources of space? The answer to that question is less overt. The Outer Space Treaty's Article Six declares that states bear international responsibility for national activities in outer space, in full accordance with all of the other treaty provisions, "...whether such activities are carried on by governmental agencies or by non-governmental entities."<JI[ The article goes on to state that when space activities are carried out by an international organization, both that organization and the participating states are responsible for ensuring the compliance with the treaty. Private ownership of the "province of all mankind" is not explicitly forbid, but national appropriation is prohibited. As state signatories are required by Article Six to authorize space activities of non-governmental entities, it is difficult to posit a scenario where a private actor could own lunar land without the express consent of a state. In such a situation the assenting state, be it the launching state or the state the company is registered

* The United Nations, *Convention on the Law of Non-Navigational Uses of International Watercourses*, 21 May 1997. Full text available at: http://www.internationalwaterlaw.org/documents/intldocs/watercourse_conv.html

:t It should be noted that the ILA adopted the Berlin Rules on Water Resources at its convention in 2004; however these rules only go beyond the Helsinki rules in adopting the U.N. convention's broadened scope and in requiring states to protect their water resources from environmental damage through local legislation. The Berlin Rules also set out prohibitions for how water is to be used in times of war—both of which are prohibited and at least not yet a concern in Space.

§ The United Nations, "Article 2," *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies* ("*OST*"), 10 October 1967.

<JI[ U.N., "Art. 6," *OST*.

in, would be violating the proscription against appropriation through asserting sovereignty in space.

As the preconditions for all riparian rights are expressly or implicitly forbid by the Outer Space Treaty, prior-appropriation rights would seem to become the only alternative for water rights on the Moon. Appropriation rights were developed out of other use-based ideas for the American frontier, where few citizens with recognized legal rights were present and water was scarce. Prior-appropriation was engineered to protect initial parties who were already invested in the territory, while allowing for the inevitable influx of additional arrivals. The idea of a manned lunar base operated by one or a group of users lends itself to this kind of first-come, first-served basis as long as later appropriators are allowed to use the lunar water resources as well. In such a scenario, the idea of appropriate beneficial use, which had been hotly contested in the Western United States, should be much clearer for any lunar mission. There is no wildlife or ecological balance to protect, all parties present on the Moon are well known due to international notification requirements, and their arrival and mission activities would be well documented because of the scientific data being collected and the safety procedures being observed. These conditions should make it very clear who is the senior appropriator to any water deposit and how much of the water they use in a given year.

Despite the apparent practicality and historical analogies supporting a prior-appropriation doctrine for water use on the Moon, obvious international objections and treaty stipulations leave many doubts about its applicability. A primary concern in reviewing use-based rights is consideration for developing nations who do not yet posses launch capabilities. The first provision in the Outer Space Treaty advises that space is to be used "in the interests of all countries, irrespective of their degree of economic or scientific development..."[*] While first claimants rights would be easy to adjudicate in space, it would seem that the nations with existing space capabilities have distinct advantage over the rest of the world, expressly counter to the international cooperation encouraged in modern space law.

Beyond general fairness, the legality of use-based entitlements seems to run counter to the Outer Space Treaty. Article Two not only prohibits national appropriation by sovereignty claims, but also forbids ownership "by means of use or occupation, or by any other means."[†] Prior-appropriation rights rely on claims staked by use. If no part of the Moon or other natural objects in the solar system can be allocated by ownership or use claims, than neither riparian rights nor the prior-appropriation model can be made to suit the existing legal framework. The Outer Space Treaty essentially disallows any ownership in space, except for manmade objects.

While water deposits cannot be made the property of any nation or entity, it should be remembered that under most use-based rights, water itself is not owned; only the right to beneficial use is owned. In such systems water is often a public good, accessed by users under limitations placed by government regulations. The Outer Space Treaty prohibits any one nation jurisdiction over water allocation and therefore use-based rights would need to be adjudicated and apportioned at an international level.

Both riparian and prior-appropriation rights, as they are practiced terrestrially, are invalid models under the Outer Space Treaty. There can be no property on the Moon, owned by a country or by any private entity authorized to act in space by a nation, which is not explicitly sent there from Earth; but use is not itself prohibited. The specific circumstances of existing and accepted space law prohibit traditional water rights, but lunar water use is still viable and practical. Just as both the U.N. and ILA's international frameworks prohibit harmful water projects and facilitate discussion rather than bestow privileges, water in space cannot be looked at in terms of traditional rights.

II.III Where Water is Not a Right

The legal hurdles of existing space law are not the only thing preventing water-ice deposits on the Moon and other extraterrestrial bodies from being regulated by existing terrestrial water rights models. The practical difficulties and differences of using water on the moon also indicate that new models must be sought. It should be abundantly clear that water on the Moon is not a renewable resource as it is on Earth. There is no water cycle on known celestial bodies, even for repurposed waste water. Water in space will be used, not as part of the seasonal cycle that defines terrestrial water rights, but as a mineral resource. Like oil on Earth, water on the Moon and asteroids will be mined from deposits to be used up as fuel or to generate power. Even as a supplement to life support systems, extraterrestrial water cannot be a requirement for sustaining life in space because conscientious safety precautions require enough oxygen and water to be maintained in a space vehicle's payload for a return to Earth. Rather, water will be a convenience extending the reach and

[*] U.N., "Art. 1," *OST.*
[†] U.N., "Art. 2," *OST.*

staying power of spacecraft. Water in space will also be a commodity requiring significant processing and special storage. Much like terrestrial gasoline, water extracted from celestial bodies will have to be dispensed for use by multiple parties, or each party will have to harvest and refine it themselves to make the water usable.

Water rights on Earth are distinct from mineral rights because the water cycle approximately replenishes the resource being used each year, and because clean drinking water is a basic necessity of life. In space, water-ice deposits will be harvested, with no promise of remainder for subsequent access. Furthermore, as identified previously, lunar water being non-renewable cannot conscionably be relied upon to sustain the life of any space mission, only to supplement it. Reasonable safety procedures necessitate any spacefaring party to carry sufficient water, air and fuel supplies for emergency returns. As extraterrestrial water cannot be considered an essential element for survival, and as it will not be a renewable resource, it is most fitting to consider it a mineral for the purpose of use.

Historically, mineral interests are usually severed from landownership. In this way mineral estate avoids the initial problems of riparian water rights. Mineral extraction rights are also historically compatible with prior appropriation principles. In the 1849 gold rush in the United States, mines and panning streams were open to prospectors on a first-in-time, first-in-rights basis.* Despite the fact that no lunar real estate is required to purchase mineral rights, and that mineral rights can also be successfully administered on a use claim basis, property declared under national appropriation is still not permitted under international space law. While more pragmatically correct, thinking of water in space as a mineral does not resolve the existing prohibitions on ownership and appropriation.

The benefit of recognizing that water in space is indistinct from other minerals, in conditions for use, is that it condenses the scope of the fix that is needed in space law, while also broadening the analogies that can be drawn on as a basis for new regulation. Standard national water and mineral resource regulation models cannot be made to fit in existing space law. In looking for practical legal solutions, one must turn to the existing treaty parameters to identify the spirit of the accords and corresponding resource regulation regimes that bar property rights but allow beneficial use.

## III. SPACE LAW

### III.I The Sky is Not the Limit, the Law is

It has clearly been identified that standard terrestrial water and mineral rights are proscribed by the provisions of the Outer Space Treaty. As states and their nationals cannot claim sole oversight of specific water deposits, it is necessary to examine the possibilities for use, without ownership, allowed for in the body of existing space law.

The Outer Space Treaty is the primary guide and foundation for all legal space operations. Having been signed and ratified by a majority of the U.N. members, as well as by all major spacefaring nations, this treaty sets up the framework for peaceful uses of outer space and must be the first source in examining the current permissibility of the use of water on the Moon.

The treaty at its outset recognizes the common interest of mankind in the peaceful use of space and asserts that it is to be used for the benefit of all people.[†] In terms of resource use, this is the spirit of the treaty which should govern all non-explicit conditions for exploitation of celestial bodies. The first article of the treaty reminds all signatory states that free access shall not be restricted in space and asserts the need to encourage overall cooperation, echoed in many other articles. As previously elucidated, Article Two prohibits all national appropriation, and Article Six extends state responsibility to all non-governmental national parties. The treaty obligates signatory states to require private entities to seek state authorization for space activities and states must subsequently monitor the proposed actions.[‡] The treaty goes on to clarify, in Article Eight, that personnel and objects launched into space are subject to the jurisdiction of the state on whose launch registry they are listed. Any craft or facility constructed in space remains under the jurisdictional rules of State that launched the constructing elements, but Article Twelve makes any equipment subject to visit by other signatory parties to the treaty. The treaty also requires that states report any planned activity in outer space, directly to another state if it might harmfully interfere with that country's operations, or otherwise to the Secretary-General of the United Nations and international scientific community. These reports should, if feasible detail "the nature, conduct, locations and

* Douglas R. Littlefield, "Water Rights During the California Gold Rush: Conflicts over Economic Points of View," *The Western Historical Quarterly.* Vol. 14, No. 4 (Oct., 1983), 415-434

† U.N., "Preamble," *OST.*

‡ U.N., "Art. 6," *OST.*

results of such activities."[*] Numerous articles in the treaty speak to how space operations and use should be conducted, and in so doing lay out a vision of how practical resource exploitation should be carried out.

The Outer Space Treaty makes private and state launch vehicles and astronauts subject to the national laws of their launching state. Any such entities looking to use the natural resources on the Moon or other celestial bodies must be authorized to do so by their launching state, and that state is obligated by the treaty to notify the other signatory states and the Secretary General of the U.N. In extracting resources, they cannot block other national entities from free access to the site and all the equipment and facilities involved are subject to visitation by representatives from other parties to the treaty. The water resources being mined, and the land that facilities are being built on would not belong to the state or parties using them. These are the only binding and widely accepted specific limitations in place for resource use in space. With state authorization, U.N. notification, possible subsequent consultations, and open access to all interested parties, the extraction of water-ice deposits on the Moon and beyond can easily be a legal reality.

While the Outer Space Treaty implicitly allows resource use within set boundaries, the Moon Treaty sought to address issues relating to activities on or around celestial bodies more directly. This article has not significantly referenced this agreement in its earlier discussions because no country with launch capabilities has yet ratified the Moon Treaty. Its status as international law exists only in the framework it proposes, and only inasmuch as countries are willing to honor it. Many of the major launch-capable countries rejected the Treaty because of the constraints it put forward on resource use in space.

Like the Outer Space Treaty, the primary purpose of the Moon Treaty was to avoid international conflict in space, but the latter also was conceived clearly bearing in mind the "benefits which may be derived from the exploitation of the natural resources of the Moon..."[t] Despite this distinction, many of the provisions of the earlier treaty are echoed in the Moon agreement. Like the Outer Space Treaty, Article Five of the Moon Treaty requires notification of the U.N. Secretary-General and the scientific community at large of any proposed activities in space. Similarly, Article Nine reasserts free access to all lunar areas and Article Fifteen affirms the right of states to visit any equipment or installation on the Moon. Article Fourteen simply reiterates that states must ensure that non-governmental parties act in accordance with the treaties and international law, and Article Twelve restates that the jurisdiction of national laws applies to launched vehicles and constructed bases.

The agreement starts to expand on the previous treaty in that it that it asserts space activities should only be undertaken with due regard for future generations and in the interest of all countries.[:t] Explicitly in regarding use, the Moon Treaty states that scientific investigations, "shall have the right to collect on and remove from the moon samples of its mineral and other substances," and those resources will remain at the disposal of the removing state. Furthermore, the treaty also agrees that states may, "in the course of scientific investigations also use mineral and other substances of the moon in quantities appropriate for the support of their missions."[§] Under the treaty's expanded guidelines for resource use, to support scientific missions, acting parties are to take measures to protect the "existing balance of [the Moon's] environment."[<J[] In protecting the Moon's environment, the agreement allows states to propose preserves on the moon for areas of special scientific interest.[**] However, the most significant update regarding the use of water, minerals or any other celestial resource is the Moon Treaty's proposal of a new governing body.

Article Eleven of the Moon Treaty seeks to set up an international committee to review and authorize the use of space resources. This agency would ensure: 1) the orderly and safe development of resources, 2) rational management thereof, 3) the expansion of use opportunities, and, 4) the equitable sharing of resource benefits.[tt] The fourth charge of this new regime requires the equitable sharing of resources while both remembering the needs of the developing countries and the efforts of countries which contributed to the exploration of the moon. It was apparently decided by the drafters of the treaty that resource use was too complex an issue for the treaty to outline or for signatory nations to agree to directly. In order to allow this organization to be the gatekeeper of resource use, all parties to the treaty are obliged to notify the U.N. Secretary-General and the public of any natural resources they may discover on

[*] U.N., "Art. 9 & 11," *OST.*

[t] The United Nations, "Preamble," *Agreement Governing the Activities of States on the Moon and Other Celestial Bodies* ("*MT*"), 5 December 1979.

[:t] U.N., "Art. 4," *MT.*

[§] U.N., "Art. 6," *MT.*

[<J[] U.N., "Art. 7," *MT.*

[**] Ibid.

[tt] U.N., "Art. 11," *MT.*

the moon. As the whole Moon is potentially a resource, including the orbits around it, it is conceivable that parties would only report resources they intend to use; however in reporting resources the intend to use, states and their non-governmental actors are inviting the committee to decide that the resource may be exploited, but the product must be distributed and shared.

Beyond concerns about a new committee's ideas of equitable sharing, a major sticking point against signing the Moon Treaty for current spacefaring nations was Article Eleven's declaration that the Moon and its natural resources are "the common heritage of mankind." Both applicable treaties identify outer space and the celestial bodies as the "province of all mankind."[*] Indeed, they are the province of all nations, in that all states party to the Outer Space Treaty have agreed that space is to be governed by all nations and is subject to no national claims of sovereignty. In fact this was a major impetus behind the Outer Space Treaty and the term was originally included in the 1966 Soviet draft of the treaty.[†] In agreeing that space was a province of all states, all major spacefaring nations agreed that space was not *res nullius* to be annexed by the first claimant to court or the first to occupy. The concern in signing the Moon Treaty lies in the leap between *res comunis* and the common heritage principle. While some may not see much of a jump between common property and "common heritage," the implications are striking. In accepting space as *res comunis*, the international community agrees that access to it cannot be blocked and that no one state or entity can make claims to property in space. Much like public domain creative works, or more aptly the common grazing areas of many 17th century villages, celestial bodies are open to all use, but not to be restricted by any. The idea of common heritage, as presented in the Moon Treaty, identifies the Moon and its resources as a birthright for all people and for future generations. As many of the natural resources on celestial objects are non-renewable, declaring them a common heritage of posterity is tantamount to barring the use of resources on the Moon. The Moon Treaty goes beyond explicitly prohibiting property ownership, and declares that no natural resources can be owned by the parties who extract them.[‡] While the distinction between the "province of all mankind" and the "common heritage of mankind" is unarticulated in international law, the prevailing interpretations identify the Moon agreement's phrase as a disincentive for private or commercial operations in space and a significant constraint on state exploration.

The Outer Space Treaty puts significant boundaries on the use and right to natural resources in space, including water, without directly addressing consumption by states or private parties under national oversight. The Moon Treaty was proposed as a means for addressing the vagaries and gaps of the earlier agreement, in large part regarding the exploitation of resources, but in so doing it deters any party from making the expenditure to pursue space water deposits and discourages further exploration to that end. With open questions as to how international law would claim and allocate the products of any mission's labor, few states which could actually use lunar resources in the coming century are willing to subject their nationals to the restraints of the Moon Treaty, but none are willing to reject it outright. In failing to adopt clear rules of resource use, but also failing to offer alternative regimes, the Moon Treaty's provisions have a tenuous status as de facto law. That is, the treaty is implicitly accepted until someone actually begins operations to utilize lunar resources.

III.II Analogies and Interpretations

As the Outer Space Treaty and Moon Treaty were conceived in an effort to prevent space and space resources form becoming the stage or impetus for conflict, it would seem important to offer practical solutions for regulation before the issue is decided in dispute. Many of the provisions of both treaties have terrestrial or existing analogies that offer ideas for practical implementation or legal work-arounds.

The standard and most discussed comparison to the Moon Treaty is the UN Convention on the Law of the Seas ("Law of the Seas"). In designating another "common heritage of mankind," the Law of the Seas sets out similar environmental considerations, equal access provisions and a regime to control the use of resources.[§] The actual practice of the clauses concerning natural resource use in the treaty has manifested as the International Seabed Authority

[*] U.N., "Art. 1," *OST* and "Art. 4," *MT*.

[†] J.I. Gabrynowicz, "The 'Province' and 'Heritage' of Mankind Reconsidered: A New Beginning," *The Second Conference on Lunar Bases and Space Activities of the 21st Century (Proceedings from a conference in Houston, TX, April 5-7, 1988)*, ed. W.W. Mendell. (Houston: NASA Conference Publication 3166, 1992), 691.

[‡] U.N., "Art. 11(3) (5)," *MT*.

[§] The United Nations, "Section 2, Article 136 & Section 6," *Convention on the Law of the Sea* ("*UNCLOS*"), 16 November 1994.

("ISA"), a two-organ body composed of a general assembly of all signatory states and an elected 36 member council which is designed to represent competing interests.* Together, these organs set policies on seabed use, and authorize specific requests to prospect for mineral resources in international waters.

Procedurally, the ISA contracts private and public entities to explore seabed areas of interest for exploitable natural resources. These contractors are given geographic regions in which to exclusively conduct their exploration. The contractors are required to submit annual resource and environmental reports and samples, in preparation for transitioning from an exploration contract to an exploitation contract. Applying contractors are required to submit $250,000(USD) in application fees and their prospecting must be approved by Council and its advisory committees. The contractors are required to remit portions of their explored area to the Authority on a designated schedule, totaling half of their contract area after eight years.† While the ISA is recognized and the Law of the Seas has been ratified by all major spacefaring nations, except the United States, it remains a cautionary model for the bureaucracy proposed under the Moon Treaty. The ISA has, under its oversight, authorized numerous entities to investigate resources in a designated "common heritage" area; however none the operations have been permitted or submitted formal requests to move into the exploitation stage. Under the ISA's Mining Code, contractors who conduct exploration are to be given preference in designating exploitation contracts, however no such contract has been made, and exploration appears lackluster.:t It can easily be argued that the numerous restrictions on use and the uncertain claim to the return on investment have dissuaded commercial exploration and the use of the seabed for the benefit of mankind. While the ILA has effectively delayed any mining operations in international waters, it has effectively preserved the common heritage of mankind charged to them for future generations.

Space exploration and the development of space resources are recognized as benefits for all mankind, so it is essential to seek effective international regulation which does not conserve by impeding progress. The other example often cited as analogous to the existing international space law is the Antarctic Treaty and its protocols. Unfortunately for our purposes, the original treaty does not discuss mineral resource use or identify the southern continent as the common heritage of mankind, in an effort to tread lightly around pre-existing territorial claims.§ While a 1988 protocol sought to set up an ISA style regulatory body on mining it was rejected by most parties and a later protocol to the treaty imposed an outright moratorium on resource exploitation until binding regulations could be agreed upon.<JI As such, our second most similar international law offers no solutions as to how water can be beneficially used on the Moon, as a mineral resource, in accordance with international law and multinational interests.

As common analogies to space law offer only models where resource use is unnecessarily bogged by unwieldy committee bureaucracy or banned outright until a better solution can be found, it is necessary to look for less conventional guidance. The Moon treaty as it stands allows for the removal and use of minerals "in carrying out scientific investigations".** Furthermore, state parties are allowed to retain their collected minerals as long as some quantity is made available to the scientific community. State parties may even use the minerals and other substances to support scientific missions. The Outer Space Treaty and the Moon agreement are not the only international treaties that allow otherwise prohibited activities in the furtherance of scientific research. While not an ideal model for practical resource use when seeking to avoid provocation and diplomatic conflict, the whaling expeditions of Japan and Iceland conducted under scientific permits take advantage of provisions similar to the Moon Treaty in allowing the harvesting of resources for scientific purposes. In 1982 the International Whaling Commission voted to halt commercial whaling beginning in 1986, subject to review at prescribed time periods.tt Despite this moratorium, several

---

* International Seabed Authority, "About Us." Available at: http://www.isa.org.jm/en/about

† International Seabed Authority, "Regulations for Prospecting and Exploration of Polymetallic Nodules," *Mining Code*. Full text available at: http://www.isa.org.jm/files/documents/EN/Regs/MiningCode.pdf

:t ISA, "Regulation 24(2) of the Regulations for Prospecting and Exploration of Polymetallic Nodules," *Mining Code*.

§ *The Antarctic Treaty*, 23 June 1961. Full text available at: http://www.nsf.gov/od/opp/antarct/anttrty.jsp

<JI *Convention on the Regulation of Antarctic Mineral Resource Activities*, 1988 (never in force) and "Article 7 and Article 25(5)," *Protocol on Environmental Protection to the Antarctic Treaty*, 14 January 1998.

** U.N., "Art. 6(2)," *MT*.

tt International Whaling Commission, "Paragraph 10(e)," *International Convention for the Regulation of Whaling*, 2 December 1946 (here amended 23 July 1982. Full text available at: http://iwcoffice.org/commission/schedule.htm

nations continued to conduct whaling operations under the Convention's provisions for scientific research.* The primary requirement in the Convention for issuing scientific whaling permits is notification of the International Whaling Commission of the details and possible effect of the operation, allowing enough time for comment by advisory committees and interested state parties. Similar notification provisions are required by the Moon Treaty in Articles 5(1), 9(1) and 11(6).

While the notification provisions involved in scientific whaling seem too weak to offer successful regulation, many international treaties effectively govern by simply requiring the presentation of detailed proposals and opportunities for consultation. As discussed earlier in this article, the U.N. Convention on the Law of the Non-navigational Uses of International Watercourses urges nations to work in a spirit of general cooperation as facilitated through mutual notification of planned projects. Notable multinational accords regarding specific water resources have been drafted under these same principles and interested nations have cordially conducted themselves accordingly. Given the opportunity to not simply object, but to consult on workable solutions after reviewing proposals, states find they can better plan their own strategic interests.

The most apt model for resource use in space is the only existing regulation of a specific natural resource in space: geostationary Earth orbits. Many countries and committees have urged recognition that geosynchronous orbits are a limited and natural resource. To avoid possible collision and signal interference orbit allocation and radio frequency must be governed judiciously; with both an eye towards present capabilities and future needs. The International Telecommunications Union, specifically the Radiotelecommunication Sector (ITU-R) is responsible for encouraging growth, maintaining technological momentum and planning for equitable access by developing nations, but more importantly ITU-R is a space resource regulatory body that works. While the very real concern posed by space junk and overcrowding often overshadow the broader workings of the ITU-R, the agency is one of few examples where international agreement has led to both pragmatic use and ethical consideration of future needs.

ITU-R confronts its space resources with a two pronged approach, designated to ensure both efficient utilization and equal access. Equitable allotment of resources is achieved by *a priori* planning and allocation of both broadcasting and fixed satellite service frequencies designated for each state for a predetermined orbital arc.† Countries can then apply to take up there reserved allocations and use them when it is within their capabilities. In an effort to encourage widespread communications networks and improved technology, ITU-R also coordinates with launching parties prepared for actual pending usage. Parties planning to launch a satellite must publish general details and the likely effect the system will have on other existing or planned satellites.‡ If the satellite to be launched is intended for geosynchronous earth orbit (or other designated special orbits), the launching party must request coordination of frequency from ITU-R. If the planned orbit is not a designated coordination orbit, than due notification for recording in the ITU-r register is sufficient.§ While these are simplified descriptions of the complex space resource management that ITU undertakes, the guiding principles of maintaining incentive for technical development and safeguarding resources for all nations are germane to the issue of legal water use in space.

This use of lunar resources should not be overburdened by bureaucracy, halted in anticipation of future solutions or conducted through a legal loophole in the treaties. Scientific advancement, exploration, commercial interests and equal access should be harmonized in international law which requires notification, offers discussion and ensures that progress and fairness are both protected from one another.

## IV. PROPOSALS

### IV.I The New Moon Agreement

The Moon Treaty disincentivizes lunar exploration through ambiguity and encourages would-be beneficial users of resources to sidestep regulation by justifying their operations as scientific investigation. As this is the case, a new Moon agreement must be drafted. The existing Moon

* IWC, "Paragraph 30," *International Convention for the Regulation of Whaling*, 1946 (amended 1982).

† Ed. B.G. Evans, *Satellite Communication Systems, 3rd Ed.* (London: Institution of Engineering and Technology, 2008), 73.

‡ "Spectrum-orbit Coordination Procedures," presented at International Telecommunications Union Radiocommunication Regional Seminar in Abu Dhabi (22 - 26 April 2007). Full text available at: http://www.ituarabic.org/2007/Radiocommunication-UAE/DOCS/04_Spectrum%20Orbit%20Coordination_MS.pdf

§ International Telecommunications Union, "Article 9(1)(2)," *Radio Regulations*, 2008.

Treaty should be aborted because it has not and will not be accepted by spacefaring nations with the current language in place. Yet space law scholars continue to debate the merits of the Moon Treaty and incorporate its principles into their legal reckonings. The treaty doubly fails in regulating the peaceful use of celestial bodies because it is not pragmatic international law but, because it remains a focal point for discussion, no new agreement has been put forward. Without such a new agreement, or a significant amending of the existing treaty, space resource law will be made by the precedent of some interested party's practice and not by the legal considerations necessary to prevent conflict and promote cooperative regulation.

A new Moon agreement should avoid the diplomatic hazard of referring to our natural satellite and activities conducted on it as anything besides the "province of all mankind." This language is already accepted and ratified in international law by all major players in space. By reasserting that all nations have province over the exploration and use of the Moon, the new agreement should set up an international body to govern resource use, rather than recommend that one be implemented at a later date.

Such an agency could be put under the oversight of a larger body to build on existing space regulations and give legitimacy regulation framework and decisions. Just as the ITU-R is connected to broader industry issues by its parent organization, so a space resource branch would be a fitting expansion of the U.N. Office of Outer Space Affairs ("OOSA").

### IV.II The Office for the Peaceful Use of Outer Space

The Committee on the Peaceful Use of Outer Space's ("COPUOS") serves an advisory role to the U.N. General Assembly by collecting information and deliberating over the technical and legal aspects of operating in space. In turn, OOSA is charged with implementing resolutions and overseeing initiatives proposed by COPUOS. The launch registry, legally maintained by COPUOS, is housed in the Secretariat at Outer Space Affairs. By adding a Section for the Peaceful Use of Outer Space Resources, the new regulatory body would benefit from the annual council of both the legal and technical subcommittees on emerging capabilities and parameters.

The new resource regime, as set up by a new Moon agreement, would be an operational office concerned with receiving notifications and disseminating them to state parties to the new treaty for review. Resources on the Moon and asteroids would have to be identified and managed in such a way that some resources would be preserved in trust for all nations, and others would be used to encourage the profitability of increased space transportation capabilities and scientific exploration.

## V. CONCLUSION

While water remains an important substance with unique molecular properties, traditional terrestrial water rights cannot apply in outer space. Water rights on earth are based on property ownership and historical claims, predicated on the idea that water is a replenishable resource necessary for the preservation of life. Water-ice deposits on the Moon and all known extraterrestrial bodies are non-renewable and have not been discovered in a form that would readily support life without processing. In space, water rights lose their distinction from mineral estate. Furthermore, as outer space is not subject to national appropriation by treaty law, neither property-based nor usage claims support ownership rights to water deposits.

Current space law neither expressly nor implicitly bars the use of water-ice found in space, as long as equitable access is preserved and the U.N. and interested parties are given due notification. While unsigned by all states with launch capabilities, the Moon Treaty more directly permits the use lunar mineral resources in the furtherance of scientific missions. The Moon agreement both expressly permits the utilization of valuable deposits and subjects the utilization of those resources to a legal limbo where their beneficial use may be redistributed to all signatory states in the name of equal access.

Analogous examples of international law show that suitable management of resource use faces many pitfalls and threats of irrelevance. The impetus to develop new technologies and the general pursuit of resources can be dampened by bureaucracy, deferred in perpetuity by legal considerations, or a driving force to circumvent international agreements. Successful international regulation of resources makes equitable considerations for parties who cannot yet utilize resources that should be open to all, while not unduly impeding the progress of those who would use them to advance human capabilities. Overall, peaceful resource use should be facilitated by notification, communication and coordination between interested parties.

With these principles in mind, this article suggests that the failed Moon Treaty be amended or usurped by a new agreement outlining the practicable use of lunar resources, including water deposits, with equitable reservations for countries to utilize after developing spacefaring capabilities. The use of the Moon should serve as an example and an incentive to go to the celestial bodies beyond.