

THE CRATERS IN OUR MOON: THE LEGAL LACUNA EXISTING IN MINING AND CONSULTATION IN OUTER SPACE

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Space has dependably been the last boondocks for human learning and creative energy. From connivances of outsider life to the conceivable production of feasible natural surroundings and settlements on Mars, the potential outcomes stay limitless. However, from a geopolitical viewpoint, Space is progressively turning into a basic methodology of State Power and Sovereignty. From the Space Race that started with the Cold War to the incorporation of digital systems and using space for the financial progression of individual country states today, there is a need to re-connect with our conventional epistemological comprehension of Outer Space. Though drafted with good intention, the treaty has lost its effect on issues regarding space mining and consultation among states. This paper throws some light on the above mentioned issues and how OST, despite some article being declared as customary international law fails to cover the same. The potential outcomes of space exploration are vast however there remains a need to develop and set up a steady and all around structured system that can help with struggle of de-heightening and emergency determination. Maybe fifty years after the commencement of treaty, the time has come to return to the bargain and equip it to deal with the remarkable difficulties postured by the interconnected postmodern globalized world we live in.

INTRODUCTION

Humanity is outgrowing the current body of space law. Commercial entities have steadily increased their presence in space and now they want in on a lucrative new field that is mining as there is a growing need for raw materials sourced outside of Earth's gravity. The rapid growth in the field of technology has helped us not only to explore but also to understand the enigmas of the space, making the activities like mining the celestial bodies and colonizing the Moon more plausible. Even though the space transportation is immensely expensive, celestial bodies are still being perceived as commercially attractive as there is a lot to gain from their exploitation. The minerals extracted from these bodies are very crucial and valuable due to their rarity on Earth. For the commercial extraction and exploration of mineral resources on celestial bodies, the states have to follow certain duties and enjoy rights in return. Thus, the provisions of the United Nations Space Treaties impose certain implications on the permissibility and confine the lawful activities in outer

space and on celestial bodies. Although the treaties and their provisions have direct effect only on the public or governmental space activities of States, Article VI of the Outer Space Treaty extends their application to private space activities by requiring States to authorize, continually supervise and adopt international responsibility for private space activities.¹

In particular, three important provisions of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and other Celestial Bodies (the “Outer Space Treaty”) imposes obligation that affects the legality of the ventures. They are:

- (1) Article I, which prescribes the requirement that space activities are to be conducted for the benefit and in the interest of all States, the freedoms of exploration and use of outer space, and the freedom of access to all areas of celestial bodies;
- (2) Article II, which embodies the principle of non-appropriation; and
- (3) Article IX, which outlines the duty to have due regard to corresponding interests of other States when conducting space activities and to avoid harmful contamination of celestial bodies.

COMMERCIAL USE VS. PUBLIC USE

Benefits and interests of all countries

Article I of the Outer Space Treaty provide for the freedom of exploration, access and use by all the states on an unbiased basis and that all the activities carried out by the States in the space should be for the benefit and in the interest of all the states. Specifically, Article I states:

The exploration and use of outer space, including the Moon and other celestial bodies, shall be carried out for the benefit and in the interest of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind. Outer space, including the Moon and other celestial bodies, shall be free for exploration and use by all States without discrimination of any kind, on a basis of equality and in accordance with international law, and there shall be free access to all areas of celestial bodies. There shall be freedom of scientific investigation in outer space, including the Moon and other celestial bodies, and States shall facilitate and encourage international cooperation in such investigation. Some commentators have suggested that these principles existed before the adoption of the Outer Space Treaty or that they had already become

¹ Lee R, *Law and Regulation of Commercial Mining Of Minerals in Outer Space* 153(1st edn, Springer 2012).

crystallized into customary law in any event.² As advocated by Cheng, this would have meant that the concept of ‘instant custom’ was being endorsed whereby States adopt principles of customary international law by simultaneous and uniform state practice or *opinio juris*.³ Regardless, it is prudent to consider that the terms and principles of the Outer Space Treaty are binding on all States either through ratification of the treaty or the crystallization of the terms into customary international law, since the inception of the Outer Space Treaty in 1967.

In the context of commercial space mining ventures, it is clear that the following two principles that are enshrined in Article I apply to such ventures:

- (1) “Exploration” and “use” of celestial bodies are to be carried out for the benefit and in the interest of all States; and
- (2) All States have the freedom to access, explore and use all areas of celestial bodies on a basis of equality and without discrimination of any kind.

This is further reinforced by Article IX⁴, which states:

In the exploration and use of outer space, including the Moon and other celestial bodies, States Parties to the Treaty shall be guided by the principle of co-operation and mutual assistance and shall conduct all their activities in outer space, including the Moon and other celestial bodies, with due regard to the corresponding interests of all other States Parties to the Treaty. States Parties to the Treaty shall pursue studies of outer space, including the moon and other celestial bodies, and conduct exploration of them so as to avoid their harmful contamination and also adverse changes in the environment of the Earth resulting from the introduction of extraterrestrial matter and, where necessary, shall adopt appropriate measures for this purpose. If a State Party to the Treaty has reason to believe that an activity or experiment planned by it or its nationals in outer space, including the moon and other celestial bodies, would cause potentially harmful interference with activities of other States Parties in the peaceful exploration and use of outer space, including the moon and other celestial bodies, it shall undertake appropriate international consultations before proceeding with any such activity or experiment. A State Party to the Treaty which has reason to believe that an activity or experiment planned by another State Party in outer space, including the moon and other celestial bodies, would cause potentially harmful interference with activities in the peaceful exploration and use of outer space, including the moon and other celestial bodies, may request consultation concerning the

² See Bin Cheng, *United Nations Resolutions on Outer Space: “Instant” International Customary Law* (1965) 5 INDIAN J. INT’L. L. 23 and Daniel Goedhuis, *Reflections on the Evolution of Space Law* (1966) 13 NEDERLANDS TIJDSCHRIFT 109.

³ Cheng, *supra* note 2, at 36.

⁴ Outer Space Treaty, Article IX.

activity or experiment. As per Article I⁵, in the context of the “benefit and interest of all countries”, an obligation is imposed under Article IX that all the activities are to be conducted with “due regard to the corresponding interests of all other states.

Article I of the Outer Space Treaty: “For the Benefit and in the Interest of All Countries”

A critical determination that is to be made is whether there is a positive imposition from the phrase “for the benefit and in the interest of all countries” and a specific obligation from the phrase “regarding the sharing of the benefits of space exploration and use” or a mere expression of “desire that the activities should be beneficial in the general sense”.⁶ Gorove argued that the latter holds much significance and according to him, most commercial space activities, such as telecommunications, broadcasting, remote sensing and power generation, as being beneficial in a general sense and were sufficient to satisfy the requirement.⁷ The view of Gorove that Article I, instead of being a legal obligation in practice, is more of a moral obligation is even shared by other commentators. Cheng, for example, observed that:

Insofar as the preparatory work of the Treaty is concerned, the discussions which took place on several articles of the Treaty clearly showed that its draftsmen hardly intended this part of the Article I to be anything more than a declaration of principles from which no specific rights of a legal nature were to be derived, even though it may give rise to a moral obligation.⁸

There exist two *indicia* that suggests that the requirements in reality imposes a positive duty. Firstly, the requirement in Article I utilises the plural form “interests” instead of the singular, which may indicate that this involves more than “just the vague, general ‘interest’ of all countries” and, instead, represents specific and identifiable interests.⁹

Secondly, while Article I may be considered to be “an aspiration couched in very general terms which could not be specifically implemented without further elaboration and guidelines,” the Moon Agreement may constitute the elaboration and guidelines arguably further to give impact to the “interest and benefits of all the countries” requirements.¹⁰

⁵ Outer Space Treaty, Article I.

⁶ Stephen Gorove, *Implications of International Space Law for Private Enterprise* (1982) 7 ANN. AIR & SP. L. 319 at 321.

⁷ Stephen Gorove, *Freedom of Exploration and Use in the Outer Space Treaty* (1971) 1 DENVER J. INT’L. L. & POLY. 93.

⁸ Bin Cheng, *STUDIES IN INTERNATIONAL SPACE LAW* (1998) at 234–235.

⁹ *Ibid.*

¹⁰ Bin Cheng, *STUDIES IN INTERNATIONAL SPACE LAW* (1998) at 322.

Therefore, the effect of the common heritage of the mankind principle must be considered in the context of the Article I as well as other relevant provisions of the Outer Space Treaty.

Article IX of the Outer Space Treaty: Due Regard to Corresponding Interests of Other States

Article IX of the Outer Space Treaty requires States to conduct their activities in outer space and on celestial bodies with “due regard to the *corresponding* interests of all other States”. The corresponding interest of other states must be equal or similar to the interest of the state which is undertaking the space activity so that the meaning of “corresponding” is not defeated. Furthermore, Article I imposes a negative duty on States in the conduct in outer space as well as on celestial bodies. This duty is to ensure that such activities do not interfere with the rights provided under the provisions of the Outer Space Treaty or cause any detriment to other States. It has been observed that the existing state practice already reflects this interpretation of the requirement under Article I.¹¹

Lawfulness of Commercial Use Generally

The commercial use of space pose legal problems mostly related to appropriation and that “sharing the common space resources, orbits and frequencies, establishing legal monopolies . . . through patent laws . . . may be in breach of space law”.¹² Since commercial activities are undertaken with a view to earn profit that is to be shared by the private concern, therefore they may face some hurdles to fall within the requirements of Article I. From existing state practice and *opinio juris*, it is doubtful that commercial space activities would *per se* be unlawful or that some element of “community service”, similar to those originally provided by INTELSAT and INMARSAT, would be required under international law.¹³ the reason behind this is that Article I prescribes a positive duty requirement to share the benefits that are derived from the activities undertaken in outer space. This is a view that was not widely accepted by either States or commentators when it was prescribed under Article 11 of the Moon Agreement in relation to mineral resource exploitation activities.¹⁴

¹¹ Roger K. Hoover, *Law and Security in Outer Space from the Viewpoint of Private Industry* (1983) 11 J. SP. L. 115 at 123.

¹² Arnel Kerrest, *Commercial Use of Space, Including Launching* (2004), in China Institute of Space Law, 2004 SPACE LAW CONFERENCE: PAPER ASSEMBLE 199 at 199.

¹³ Convention on the International Mobile Satellite Organisation and Agreement Relating to the International Telecommunications Satellite Organisation.

¹⁴ See, for example, Carl Q. Christol, *The American Bar Association and the 1979 Moon Treaty: The Search for a Position* (1981) 9 J. SP. L. 77 and Martin Menter, *Commercial Space Activities Under the Moon Treaty* (1979) 7 SYRACUSE J. INT'L. L. & COM. 213 at 220.

Even though no positive duty arises to share the benefits from the space activities, still the outcome of such activities should be available to all the potential customers without any discrimination.

FREEDOMS OF EXPLORATION AND USE AND THE PRINCIPLE OF NON-APPROPRIATION

Freedoms under Article I of the Outer Space Treaty

Three fundamental freedoms in space law are referred to in Article I of the Outer Space Treaty: the freedom of exploration, the freedom of use and the freedom of access to all areas of all celestial bodies, including the Moon. It is difficult to distinguish between “exploration” and “use” of outer space and celestial bodies, as it is very difficult in practice to determine their difference in applicability. In the context of Article I of the Outer Space Treaty, the distinction between the two is not of much consequence practically as in both the cases freedom for all the States is prescribed. Any activity that purports to exclude other States from a particular type of activity or access to a specific area on a celestial body would contravene the freedoms contained in Article I. Conversely, a lawful activity must not hinder other state to undertake any activity to access a specific area on a particular celestial body so that the freedoms are not contravened. The scope of such an obligation would be a question of degree. If the obligation is applied strictly, would infringe the freedoms of exploration and use as this would prevent another satellite from providing coverage to a particular area for a particular activity.¹⁵ Conversely, if the prohibitions are applied in a broad sense, then they may end up having very little legal effect. If Article I provides an unconditional right not to be excluded from accessing any area on a celestial body, then there is no reason why access to facilities on celestial bodies as per Article XII of the Outer Space Treaty would be needed.¹⁶ Unfortunately, there exists an overlapping effect between this issue and the non- appropriation principle enshrined in Article II of the Outer Space

¹⁵ The occupation of orbital slots on the geostationary orbit would not only occupy a particular orbital space to the exclusion of other satellites but also a particular radio frequency to be used for its transmissions: Yvon Henri, *Orbit/Spectrum Allocation Procedures Registration Mechanism*, paper presented at the ITU Biennial Seminar of the Radiocommunication Bureau, 15–19 November 2004, in Geneva, Switzerland. However, a persuasive argument may be made to support the view that the body of laws and regulations created by the ITU to regulate the use of the geostationary orbit and corresponding radio frequencies amount to a *lex specialis* to which Article I of the Outer Space Treaty has limited application.

¹⁶ Gorove made the same observation and suggested that this is an indication that the drafters of the Outer Space Treaty had not intended to fully abolish the extension of sovereignty of States into its facilities and installations on celestial bodies. See Stephen Gorove, *Sovereignty and the Law of Outer Space Re-examined* (1977) 2 ANN. AIR & SP. L. 311 at 316.

Treaty. Consequently, it is important to consider the implications of Article II in conjunction with the freedom of access to celestial bodies.

Article II of the Outer Space Treaty

It was clear from the beginning of space activities that the classical rules of international law on sovereignty, territory and delimitation cannot apply to outer space and celestial bodies. Article II of the Outer Space Treaty contains one of the most fundamental and universally acknowledged principles of space law, namely the principle of non-appropriation as stated in explicit terms: Outer space, including the Moon and other celestial bodies, is not subject to *national* appropriation by claim of sovereignty, by means of use or occupation, or *by any other means*.

National Appropriation

Article II does not refer explicitly to private entities even though the extension of the non-appropriation doctrine to private entities is “firmly established in space law”.¹⁷ As Article VI requires the appropriate State to authorise and continually supervise the space activities of private entities, any act of national appropriation by private entities would be subject to the direction or influence of the State, thus contravening Article II of the Outer Space Treaty. Article II does not purportedly prohibit all forms of appropriation but merely “national” appropriation. This must be considered as an issue of *scope* as distinct to the issue of whether Article II would have *application* to private and non-governmental entities, otherwise it may be possible for States to circumvent the prohibitions contained in the Outer Space Treaty simply by “privatising” the contravening activity.¹⁸ Indeed, the Vienna Convention on the Law of Treaties mandates that subsequent treaties that interpret or apply the provisions of an earlier treaty are to be taken into account when interpreting the terms of the earlier treaty.¹⁹ Accordingly, Article II does not prescribe any rights or duties concerning the assertion of title by private nationals.²⁰

“By Any Other Means”

¹⁷ Leslie I. Tennen, *Second Commentary on Emerging System of Property Rights in Outer Space* (2003) United Nations, PROCEEDINGS OF THE UNITED NATIONS/REPUBLIC OF KOREA WORKSHOP ON SPACE LAW 342 at 343.

¹⁸ See discussion in Tennen, *supra* note 37, at 344 and Patricia M. Sterns and Leslie I. Tennen, *Privateering and Profiteering on the Moon and Other Celestial Bodies: Debunking the Myth of Property Rights in Space* (2003) 31 ADV. SPACE RES. 2433.

¹⁹ Vienna Convention on the Law of Treaties, Article 31(3).

²⁰ See, for example, Stephen D. Krasner, *Think Again: Sovereignty* (2001) 122 FOREIGN POLICY 20.

In any event, having reached such a conclusion, Lachs noted the phrase “by any other means” and asked: “What other means are there?”²¹ Some commentators suggested that the phrase “by any other means” was not meant to refer to specific means but that it includes “whatever residue of international law applies to national appropriation, and has no limitation”.²² If this interpretation is accepted, then “by any other means” would include the exercise of sovereign rights by States through private use, private occupation and assertions of private exclusive rights. This interpretation, though creative, is nevertheless consistent with the idea that Article II relates only to the exercise of state sovereignty or “national appropriation” and, in that context, refers only to State exercising sovereign rights through private use or occupation of celestial bodies.

Content and Effect of Article II of the Outer Space Treaty on Commercial Space Activities

There remains a significant degree of disagreement among commentators even on the effect of Article II on exclusive claims of title asserted by non-governmental entities, such as private individuals or companies. This position has found support among some commentators, especially in the context of the allocation and use of the geostationary orbit by private entities.²³ In the context of private and commercial entities, States and private entities would not have the legal authority to assert any exclusivity over any area of space. Accordingly, it may be prudent to suggest that Article II of the Outer Space Treaty is in fact silent on the issue of exclusive property rights but does have the effect of prohibiting the exercise of sovereign rights, which is prohibited whether by claim, use or occupation by the State or its nationals.

ENVIRONMENTAL PROTECTION OF CELESTIAL BODIES

Article IX of the Outer Space Treaty

Article IX of the outer space treaty, requires the state to take appropriate action in order to avoid the harmful contamination of outer space. The article states that, states are under the obligation to take necessary steps to avoid harmful contamination of outer space and celestial bodies. Also, they are obliged to take precautions to avoid the adverse changes that may damage the environment of Earth through the introduction of extraterrestrial matter. There is no definition as to what would constitute “harmful contamination” of outer space

²¹ Manfred Lachs, *THE LAW OF OUTER SPACE: AN EXPERIENCE IN CONTEMPORARY LAW MAKING* (1972), at 43.

²² S. Bhatt, *Legal Control of the Exploration and Use of the Moon and Celestial Bodies* (1968) 8 INDIAN J. INT'L. L. 38 and E. Brooks, *Control and Use of Planetary Resources* (1969) 11 PROC. COLL. L. OUTER SP. 342.

²³ See, for example, Clyde E. Rankin III, *Utilization of the Geostationary Orbit – A Need for Orbital Allocation* (1974) 13 COLUM. J. TRANS. L. 101.

and celestial bodies, though it would appear to be quite specific and narrow in scope.²⁴ For instance, the avoidance of harmful contamination is an obligation restricted to the “study” and “exploration” of outer space and not to the “use” of outer space.²⁵ The unforeseen fact is that the “use” of outer space and celestial bodies would not be subject to the requirement to avoid harmful contamination of the space environment and celestial bodies. Though the term “harmful contamination” is not defined anywhere, *prima facie* it is interpreted as a any activity or residue thereof that may be deemed harmful in any way, it is difficult to see how this can be sustained as all activities conducted in outer space would have an impact in some way on the environment, however minor, regardless of the nature of the activities involved²⁶. Further, States are required to engage in appropriate international consultations if it has a reasonable belief that its planned space activity, or that of another State, could cause potential “harmful interference” with the peaceful exploration and use of outer space.²⁷ This requirement has severe limitations, the first of which is that this provision is not retrospective in nature and relates only to activities proposed and not to activities already completed.²⁸ The second is that there is no definition of “harmful interference” and, if the similar provision relating to the use of radio frequencies in space in the Constitution of the ITU is any guide, harmful interference would mean an impairment or total restriction to the ability of the other State to conduct its space activities.²⁹ The third is that, regardless of the possibility that such a proposed movement brings about unsafe obstruction with the exercises of different States, the commitment of the State proposing the movement is constrained to leading discussions with the influenced States, with no commitment to adjust its proposed action, subject to its commitment to have due respect to the comparing interests of those States under Article IX of the Outer Space Treaty. It is prudent also to note that Article IX of the Outer Space Treaty requires States to avoid “adverse changes in the environment of the Earth resulting from the introduction of extraterrestrial matter”, such as materials extracted from celestial bodies, and are to “adopt appropriate measures for this purpose”.³⁰ Therefore, it will be important to receive worldwide controls for the isolate of extraterrestrial materials and for the States to embrace

²⁴ Delbert D. Smith, *The Technical, Legal and Business Risks of Orbital Debris* (1997) 6 N. Y. U. ENVTL. L. J. 50 at 56.

²⁵ Outer Space Treaty, Article IX.

²⁶ See, for example, M. Miklody, *Some Remarks to the Legal Status of Celestial Bodies and Protection of the Outer Space Environment* (1983) 25 PROC. COLL. L. OUTER SP. 13.

²⁷ Outer Space Treaty, Article IX.

²⁸ Smith, *supra* note 1, at 57.

²⁹ Constitution and Convention of the International Telecommunication Union, opened for signature on 22 December 1992, 1825 U.N.T.S. 3; 28 U.S.T. 7645 (entered into force on 1 July 1994), Article 45.

³⁰ See Philip McGarrigle, *Hazardous Biological Activities in Outer Space* (1984) 18 AKRON L. REV. 103 and George S. Robinson III, *Earth Exposure to Martian Matter: Back Contamination Procedures and International Quarantine Regulations* (1976) 15 COLUM. J. TRANSNAT'L. L. 17.

the proceeding with domestic supervision of private performing actors in the usage of such directions. Apart from outer space treaty, Article 7(1) of the moon agreement also discusses about the harmful contamination of celestial bodies, but it is not of much relevance, as it barely assists in the interpretation of Article IX of OST. Though the one distinction which is worth mentioning is, that while Article 7 of the Moon Agreement prohibits the disruption of the existing balance of celestial bodies whereas Article IX of the Outer Space Treaty prohibits the harmful contamination of outer space and celestial bodies³¹. Further, Article 7 of the Moon Agreement applies not only to “exploration”, as is the case for Article IX of the Outer Space Treaty, but also to “use” and “scientific investigation” as provided for under the Moon Agreement. It could be concluded that Article 7 of Moon Treaty creates new and additional obligations rather than extending or interpreting OST. Accordingly, it is probable that Article 7 would only have force and effect on States that have ratified the Moon Agreement but not to States that have merely signed it or third States, as provided for in the customary norms applicable to the law of treaties.³²

LEGAL IMPLICATIONS FOR A REGULATORY REGIME FOR EXPLORATION OF MINERAL RESOURCES ON CELESTIAL BODIES

To simplify the complex activities involved in exploration segment, they are divided into two categories: “prospecting” and “regulations”. These two terms are defined in the Wellington Convention on the Regulation of Antarctic Mineral Resource Activities as:

- “prospecting” means all activities directly or indirectly associated with the aim of identifying areas of mineral resource potential for possible exploration and extraction, including geological, geochemical and geophysical investigations and field observations, the use of remote sensing techniques and the collection of surface samples and small scale subsurface samples with drilling to depths not exceeding 25 m; and
- “exploration” means all activities directly or indirectly connected with the aim of identifying and evaluating specific mineral resource deposits or occurrences, including exploratory drilling and other surface or subsurface excavations required to determine the nature and size of mineral resource deposits and the feasibility of their development³³

For any future international regulatory regime, the legal and general issues arising from the abovementioned activities would be sine-qua-non. Under Article VI of OST, the states are

³¹ Lee R, *Law And Regulation Of Commercial Mining Of Minerals In Outer Space* (1st edn, Springer 2012).

³² For the principles relating to the effect of a treaty on States that have signed but not ratified it, see the Vienna Convention on the Law of Treaties, Article 18; for the principles relating to the effect of a treaty on third States, see the Vienna Convention on the Law of Treaties, Article 34.

³³ *Supra* note 8, at 195.

required to authorize and supervise the activities of private entities. It is a mandate for the private entities to abide by all the obligations imposed on them under the OST, Moon Agreement and other relevant international instruments. Further, it would be necessary for the State or a private “explorer” to consider the following general obligations under the Outer Space Treaty when undertaking prospecting or exploration on celestial bodies:

- the need not to interfere with the rights provided to other States under the Outer Space Treaty³⁴
- the need to have due regard to the corresponding interests of other States in the conduct of space activities³⁵
- the obligation to avoid harmful interference with the activities of other States in outer space³⁶
- the avoidance of harmful contamination of the space environment in the exploration of outer space and celestial bodies³⁷
- for States that are party to the Moon Agreement, there is an additional duty to avoid conducting activities that disrupt the existing balance on celestial bodies in their exploration and use.³⁸

LEGAL IMPLICATIONS FOR A REGULATORY REGIME FOR EXTRACTION OF MINERAL RESOURCES ON CELESTIAL BODIES

It is observed that inherent novelty of national appropriation as a concept in international space law has sparked numerous discussions, often compounded by muddled accounts mixing private property with national sovereignty. As an international legal concept, property is dealt with only in the context of very specific fields of law, such as intellectual rights³⁹ and cultural heritage,⁴⁰ or as a basic human right against expropriation.⁴¹ Other than that, private international law largely underscores the irreconcilable differences between various conceptions of property rights as notion of purely national origin, whose

³⁴ Outer Space Treaty, Articles I and IX.

³⁵ *Ibid.*, Article IX.

³⁶ *Ibid.*

³⁷ *Ibid.*

³⁸ Moon Agreement, Article 7(1).

³⁹ See the Berne Convention for the protection of literary and artistic works of 9 September 1886, entered into force 4 December 1887, 1161 *U.N.T.S.* 3 and the instruments developed by the United International Bureaux for the Protection of Intellectual Property and the World Intellectual Property Organization.

⁴⁰ See the Convention concerning the protection of the world cultural and natural heritage of 16 November 1972, entered into force 17 December 1975, 1037 *U.N.T.S.* 151 and other treaties.

⁴¹ See Art. 17 of UNGA, Universal declaration of human rights, UN Doc. A/RES/217 A (III) of 10 December 1948; Art. 1 First additional protocol to the European Convention on Human Rights and Fundamental Freedoms of 20 March 1952, entered into force 18 May 1954, No. 009 *E.T.S.*

interactions inevitably result in conflicts that need to be resolved through an overarching set of international rules of mediation⁴². The first question that requires consideration is whether state sovereignty can exist over mineral resources as distinct to state sovereignty over territory. The reason why this issue is significant is that, if sovereignty can exist over mineral resources, then the extraction of resources from celestial bodies may constitute a “national appropriation” for the purposes of Article II of the Outer Space Treaty. This would effectively prohibit any extraction of mineral resources of celestial bodies. Even though there is some uncertainty in the legality of extracting mineral resources from celestial bodies, it is clear that the express terms of the Outer Space Treaty and the other United Nations space treaties do not embody a specific legal prohibition⁴³. Article 11 of the Moon Agreement appears to attempt to put the issue beyond doubt. Article 11(2) reaffirms that national appropriation of celestial bodies, whether by any claim of sovereignty, means of use or occupation or by any other means, is prohibited. Article 11(3) goes further by declaring that neither the surface or the subsurface of the celestial bodies “nor any part thereof or natural resources in place, shall become property of any State, . . . national organizations or non-governmental entity or of any natural person”. Article 11(1) also declares natural resources on celestial bodies to be the “common heritage of mankind”. Assuming that the extraction of mineral resources from celestial bodies is not unlawful per se, it is then appropriate to consider the lawfulness of the methods that may be used to extract such mineral resources. There are at least four possible means of extracting ores from a celestial body such as a Near Earth Asteroid. In each of these scenarios, different provisions of the Outer Space Treaty and the Moon Agreement have varying effects on the ability of a State or its private entity to extract mineral resources from a celestial body. Consequently, it is necessary to consider each scenario separately.

CONCLUSIONS

The legal and policy issues along with the general issues of space law that are applicable to all space activities are to be considered during the mineralogical exploration of celestial bodies and the consequential physical extraction of mineral resources from their surface and/or subsurface. The legal and policy issues as enumerated below, demand to be considered and discussed by an international regulatory framework for exploration and extraction activities on celestial bodies.

⁴² See in general C.B. M ACPHERSON , ‘The meaning of property’, in C.B. M ACPHERSON (ed.), *Property: mainstream and critical positions* , Toronto: University of Toronto Press, 1978, p. 1–14. Waldron notes that there are “as many ambiguities in the term «ownership» as there are legal systems [...] leaving the concept of ownership without any essential content at all”: J. W ALDRON , *The right to private property* , Oxford: Clarendon, 1988, p. 29. See further J. W ALDRON , ‘What is private property?’, 5 *Oxford J. Legal Stud.* 1985, p. 313–316.

⁴³ *Supra* note 8 at 197.

- the lawfulness of commercial prospecting, exploration and extraction activities in the context of the need to be conducted for the benefit and in the interest of all countries under Article I of the Outer Space Treaty;
- the granting of exclusive property rights on celestial bodies for exploration and extraction activities;
- the lawfulness of physically removing materials from celestial bodies for the purpose of commercial exploration and extraction of mineral resources;
- what obligations, if any, are placed on the dissemination of the prospecting and exploration data and the materials extracted from celestial bodies;
- the appropriate limits, if any, on the physical extraction of materials that may substantially deplete the mass of the celestial body;
- the appropriate limits, if any, on the size or mass of a celestial body that may be the subject of commercial mining activities;
- the legality of changes to the orbital parameters of a celestial body or the removal of a celestial body from its natural orbit; and
- the measures that may be prescribed or adopted to avoid adverse effects on the Earth through contamination by the introduction of extraterrestrial materials to the environment of the Earth.

It is evident that the existing body of space law poses challenges regarding the issues identified in this paper on the exploration and extraction segments of a commercial space mining venture that such activities pose significant challenges for the. Before considering the appropriate international regulatory framework for such activities, it is prudent, if not necessary, to analyze the legal and policy issues arising from the exploitation segment of a commercial space mining venture. In particular, this will entail a discussion of the declaration in the Moon Agreement that celestial bodies are the “common heritage of mankind”, generally considered to be the most controversial concept in the existing body of space law. It is in resolving this controversy that the key to creating an appropriate international regulatory framework may be found.