

Who Owns What in Outer Space? Dilemmas regarding the Common Heritage of Mankind

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Outer space is full of resources with great economic potential for Earth nations. Several issues arise when superpowers get involved in space activities, e.g. the status of celestial bodies and their resources, equality between states and potential conflicts on Earth. The lack of international regulation surrounding these issues could result in uncontrolled turmoil regarding space exploitation. This paper encompasses three goals. Firstly, to review the short history of mining in space and developing space law. Secondly, by analyzing the relevant legal instruments, it takes a look at what is possible today regarding exploitation rights on celestial bodies. The Outer Space Treaty and the Moon Agreement are crucial in this process. Thirdly, by analyzing the exploitation regimes on similar areas to the Moon and outer space, alternatives are illustrated for a future international exploitation regime. An analysis of the Common Heritage of Mankind principle will form the bridge between the mentioned goals. The Moon Agreement attempted to create an exploitation regime. However, it failed due to the Common Heritage of Mankind principle. Thus, an analysis of this principle should not be left out. The paper is an attempt to clarify the importance of property rights in the future of space exploitation and its complexity in the absence of a coherent international regime for the exploitation of space and the celestial bodies. It is necessary to stress why an international regime is necessary for the exploitation of space.

Keywords: Space Mining, Property Rights, CHM, Sovereignty, res communis omnium usus

“From behind a screen on earth, it is now possible to detect the substances of stars, planets and even galaxies, light years away.”¹

Philip Massey and Margaret Hanson

“The Earth is the cradle of mankind, but one cannot stay in the cradle forever.”²

Konstantin Tsiolkovsky

¹ Massey, P., Hanson, M., *Astronomical Spectroscopy*. In: T. Oswalt, H. Bond, eds., Springer Netherlands, 2013.

² Tsiolkovsky, Konstantin E., *Selected Works of Tsiolkovsky*, University Press of the Pacific, U.S. 2004.

1. Introduction

As there is a competition for resources between great powers,³ the Common Heritage of Mankind principle⁴ does or should control the activities of space mining;⁵ however, this issue remains controversial.⁶

Underdeveloped states⁷ often argue the fact that mineral reserves are being exploited in areas that needs protection, outer space being an example. It has also been argued that all minerals in space are considered as a common heritage of humanity.⁸ However territorial sovereignty⁹ has in part defined both

³ There is a social hierarchy in international relations, and *Great Powers* enjoy the highest status within that social hierarchy, states strive for higher status in the international social hierarchy and apply different status-seeking strategies in order to achieve that goal. Stolte, C., *Great Powers and the Drive for Status in International Relations*. In: *Brazil's Africa Strategy*, Palgrave Macmillan, New York, 2005 .

⁴ Common heritage of mankind also termed the common heritage of humanity, common heritage of humankind or common heritage principle is a principle of international law which holds that defined territorial areas and elements of humanity's common heritage cultural and natural should be held in trust for future generations and be protected from exploitation by individual nation states or corporations. The common heritage of mankind principle consists of four elements. 1 It prohibits states from proclaiming sovereignty over any part of the deep seabed. 2 Requires that states use it for peaceful purposes. 3 Sharing its management. 4 The benefits of its exploitation. See Harry, Martin, *The Deep Seabed: The Common Heritage of Mankind or Arena for Unilateral Exploitation?* 40 *Naval Law Review* 207, 226, 1992. Mahmoudi, Said, *The Law of Deep Sea-Bed Mining: A Study of the Progressive Development of International Law concerning the Management of the Polymetallic Nodules of the Deep Sea-Bed*, Stockholm, Sweden: Almqvist & Wiksell International, 130, 1987 . Molitor, Steven, *The Provisional Understanding Regarding Deep Seabed Matters: An Ill-Conceived Regime for US Deep Seabed Mining*, 20 *Cornell International Law Journal* 223, 228, 1987. On decision of the General Assembly see Resolution 2467A, GA Res 2467A XXIII , UN GAOR, 23rd sess, 1752nd plen mtg, UN Doc A/RES/2467 XXIII 1968 . The Seabed Committee drafted a number of resolutions, the most important being Resolution 2574D and Resolution 2749. Consequently GA Res 2574D XXIV , UN GAOR, 24th sess, 1833rd plen mtg, UN Doc A/RES/2574 XXIV 1969 *Moratorium Resolution* . GA Res 2749 XXV , UN GAOR, 25th sess, 1933rd plen mtg, UN Doc A/RES/2574 XXV 1970 *Declaration of Principles*.

⁵ Asteroid mining may seem like an idea out of an *Andy Weir* novel, however, with recent developments many are estimating that asteroid mining of near earth objects is only 10-20 years out of reach. Near Earth Object or NEO refers to an object that has been pulled into the "neighborhood" of earth either by earth's gravitational pull or that of a nearby planet. Minerals that can be found in asteroids are: iron, nickel, iridium, palladium, platinum, gold, and magnesium to name a few. Metal, however, is not the only thing that would be mined from asteroids. There is a certain interest in the mining of water. For further read see General Kinematics, *Mining in Space*. Available at <https://www.generalkinematics.com/blog/mining-in-space/>.

⁶ Guntrip, E., 'The Common Heritage of Mankind: An Adequate Regime for Managing the Deep Seabed?', 4 *Melbourne Journal of International Law* 376, 2003. To date, there is no clear-cut answer to whether private mining is legal or not. A personal statement by Professor Van Der Dunk. There is no 'loophole' that allows individuals to claim ownership of celestial bodies because Article II of Outer Space Treaty only addresses nations. On this regard see, e.g., Gorove, S., *Interpreting Article II of the Outer Space Treaty*, 37 *FORDHAM L. REV.* 349, 351 1969 . The Treaty also ensures that the use of equipment and facilities necessary for exploration and use shall not be prohibited, see Outer Space Treaty, Article I. and, shall proceed only on a non-interference basis, Outer Space Treaty, Article IX. Finally, the OST establishes the principle that states are responsible for objects they or their citizens launch into space, and retain jurisdiction over those objects once in space. Article VIII of Outer Space Treaty.

⁷ Eugene Staley defined an underdeveloped country as "A country characterized by i mass poverty which is chronic and not the result of temporary misfortune and ii obsolete methods of production and social organization, which means that the poverty is not due to poor natural resources and hence could presumably be lessened by methods already proved in other countries". Available at <http://www.economicdiscussion.net/underdeveloped-countries/underdeveloped-countries-meaning-and-classification-of-definitions/18975> .

⁸ The idea of the common heritage of mankind was launched in a memorable speech made at the United Nations General Assembly on 1 November 1967 by the representative of Malta, Mr. Arvid Pardo. The only precedent is a proposal made by the Argentine jurist José León Suárez. He was entrusted by the League of Nations Experts Committee for the Progressive Codification of International Law with the drafting of a report on the international rules relating to the exploitation of marine living resources. Société des Nations, *Comité d'experts pour la codification progressive du droit international, Rapport au Conseil de la Société des Nations*, Genève, p. 1232, 1927.

⁹ Territorial Sovereignty is the right of a State to exercise over its own territory, to the exclusion of any other states, the functions of a state. Shaw, M, *Title to Territory in Africa: International Legal Issues*, NY: Clarendon Press, p. 1. 1986.

international relations¹⁰ and international law¹¹ since the 1648 Treaty of Westphalia.¹² The primary exception to this principle is the international commons¹³ when dealing with outer space, in which theoretically all of humanity became sovereign and protectors of the international commons.¹⁴ The law of outer space is a branch of international law regulating activities in areas that fall either partially or totally outside national sovereignty. The law that governs these vast bodies includes state practice and *opinio juris* custom,¹⁵ treaties,¹⁶ general principles,¹⁷ and scholarly writing.¹⁸

The legal precedent set by the North Sea Continental Shelf Cases,¹⁹ requires “widespread and representative participation provided it include[s] that of [the] States whose interests [are] specially affected”²⁰ to create customary laws.²¹

The question is significant since airspace partly falls under national sovereignty in areas where it lies over national territories and territorial waters, while outer space never does.²²

¹⁰ Further read in this regard, see Goldsmith, Jack, Sovereignty, International Relations Theory, and International Law, *Stanford Law Review* 52, no. 4 2000. Osiander, Andreas, Sovereignty, International Relations, and the Westphalian Myth, *International Organization*, no. 2, 55, 2001. Cooley, Alexander, Hendrik Spruyt, Incomplete Sovereignty and International Relations. In: *Contracting States: Sovereign Transfers in International Relations*, 1-18, Princeton: Oxford: Princeton University Press, 2009. Lake, David A., The New Sovereignty in International Relations, *International Studies Review* 5, no. 3, 303-323, 2003.

¹¹ Territory and its normative translation, that is territorial sovereignty, is still the cornerstone of contemporary international legal order, as Article 2 1 of the United Nations Charter solemnly declares. Distefano, Giovanni, Theories on Territorial Sovereignty: A Reappraisal, *Journal of Sharia and Law*, Vol. 41, pp. 25-47, 2010.

¹² Herber, Bernard P. “The Common Heritage Principle: Antarctica and the Developing Nations.” *The American Journal of Economics and Sociology*, vol. 50, no. 4, pp. 391–406, 1991. The 1648 treaty resulted to a principle known as Westphalian sovereignty which simply means that each nation state has sovereign over its territory and domestic affairs, to the exclusion of all external powers. For further reading see Nexon, Daniel H., Westphalia Reframed. In: *The Struggle for Power in Early Modern Europe: Religious Conflict, Dynastic Empires, and International Change*, Princeton University Press, 265-288, 2009.

¹³ The term in this respect includes spaces beyond national jurisdictions, essential resources and concerns such as biodiversity conservation and climate change, are the focus of much international interest from a governance perspective. See further Morse, Edward, Managing International Commons, *Journal of International Affairs*, 31 1977. Vicary, Simon, The Voluntary Provision of a Public Good in an International Commons, *The Canadian Journal of Economics / Revue Canadienne D'Economique* 42, no. 3, 984-996, 2009.

¹⁴ Shackelford, Scott J., The Tragedy of the Common Heritage of Mankind, *Stanford Environmental Law Journal*, Vol. 27, pp. 101–120, 2008.

¹⁵ The ICJ in its jurisprudence, has relied on, and interpreted, Article 38 1 b to include two elements that assist the Court to determine the existence of an alleged customary international law — state practice and *opinio juris* also known as *opinio juris sive necessitates*. The ICJ explained *opinio juris*, in the *Nicaragua case*.

¹⁶ The *treaties* commonly referred to as the “five United Nations *treaties* on outer space”.

¹⁷ The Declaration of Legal Principles, The Broadcasting Principles, The Remote Sensing Principles, The Principles Relating to Remote Sensing of the Earth from Outer Space, The Nuclear Power Sources Principles and The Principles Relevant to the Use of Nuclear Power Sources in Outer Space.

¹⁸ D’Amato, Anthony, The Concept of Special Custom in International Law, 63 *American Journal of International Law*, 211-223, 1969.

¹⁹ *The jurisprudence of the North Sea Continental Shelf Cases sets out the dual requirement for the formation of customary international law: 1 State practice the objective element and 2 opinio juris the subjective element.*

²⁰ *North Sea Continental Shelf, Judgment, I.C.J. Reports 1969, p. 3.*

²¹ For further reading in this regard see Friedmann, Wolfgang, The North Sea Continental Shelf Cases—A Critique, *The American Journal of International Law* 64, no. 2, 229-2240 1970. Nelson, L. D. M., The North Sea Continental Shelf Cases and Law-Making Conventions, *The Modern Law Review* 35, no. 1, 52-56 1972. Uburn, F. M., The North Sea Continental Shelf Boundary Settlement, *Archiv Des Völkerrechts* 16, no. 1, 28-36 1973. Goldie, L. F. E., Sedentary Fisheries and the North Sea Continental Shelf Cases—A Paradox Revealed, *The American Journal of International Law* 63, no. 3, 536-543, 1969.

²² Further read in this regard see Sand, Peter, Lyon, James, An Historical Survey of International Air Law Since 1944, 7 *McGill L.J.* 125 1961.

This represents a redefinition of the old doctrine of sovereignty that provided for the ownership of land and the airspace above it, rights *ad coelum*.²³ As technology progresses and space flights become as common as air travel, space law will likely react to allow some form of ownership.

However, governance of the international commons is not customary; it is laid out in treaties including the 1967 Outer Space Treaty,²⁴ the 1982 UNCLOS,²⁵ and to a lesser extent the 1969 Antarctica Treaty System ATS.²⁶ These regulations were created during the Cold War²⁷ at a time before technological progress had fully opened up these areas to economic activity.

2. A Brief Historical Analysis of Sovereignty in Space

The concept of sovereignty, once a relatively uncontested dilemma, has for a long time been a major question of rivalries within international law and international relations theory.²⁸

Rather than presupposing that the concept of sovereignty²⁹ has a timeless or universal meaning, more recent scholarship has focused on the changing meanings of this concept across a variety of historical and political contexts.³⁰

The issues encompassing sovereignty over outer space are to become ever more critical,³¹ as any heated issue in international relations, growing pressure on natural resources and the need for energy and national security are likely to become major issues in the twenty-first century.

Sovereignty in the sense of contemporary public international law denotes the basic international legal status of a state that is not subject, within its territorial jurisdiction, to the governmental, executive,

²³ The rule *ad coelum* means: “Whose is the soil, his it is up to the sky”, or in a more simple explanation “He who possesses the land possesses also that which is above it”. See *Dictionary*, 4th Ed. P. 453 1951 . And Broom, Herbert, *Legal Maxims*, 8th Ed. P. 395 1911 .

²⁴ The 1967 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205 entered into force Oct. 10, 1967 [hereinafter Outer Space Treaty]; The 1972 Convention on International Liability for Damage Caused by Space Objects, Mar. 29, 1972, 24 U.S.T. 2389, T.I.A.S. No. 7762, 10 I.L.M. 965.

²⁵ United Nations Convention on the Law of the Sea art. 1, para. 1, Dec. 10, 1982, 1833 U.N.T.S. 397 [hereinafter UNCLOS].

²⁶ The Antarctic Treaty System ATS consists of a number of separate international instruments and their associated measures including: the *Antarctic Treaty* 1961 ; the *Agreed Measures for the Conservation of Antarctic Fauna and Flora* 1964 ; the *Convention on the Conservation of Antarctic Seals* 1972 ; the *Convention for the Conservation of Antarctic Marine Living Resources* 1981 ; the *Protocol on Environmental Protection to the Antarctic Treaty* 1991 the *Madrid Protocol* ; and recommendations of Antarctic Treaty Consultative Meetings ATCMs and several Special Meetings in the form of decisions, measures and resolutions. Antarctic Law Interest Group, ‘Antarctic Treaty Papers’ 2005. Kriwoken, L.K., Keage, P.L., ‘Introduction: the Antarctic Treaty System’. In: J Handmer ed , *Antarctica: Policies and Policy Development*, Centre for Resource and Environmental Studies, Australian National University, Canberra, Australia, 1-6 1989 .

²⁷ According to Martineau, reactions to the realist critique ushered in a second period of confidence from 1960 to 1989, wherein international law was seen as evolving toward what Jenks termed the ‘common law of mankind’, capable of bridging a gap between sovereign autonomy and the international community. Anne-Charlotte, Martineau, *The Rhetoric of Fragmentation: Fear and Faith in International Law*, *Leiden J. of Int’l L.* 1, 1-2, 2009.

²⁸ Bartelson, Jens, *The Concept of Sovereignty Revisited*, *EJIL* 17, 463–474, 2006.

²⁹ The Montevideo Convention on Rights and Duties of States of 1933, Article 1 provides: “*The State as a person of international law should possess the following qualifications: a a permanent population; b a defined territory; c government; and d capacity to enter into relations with other States*”, *Montevideo Convention on the Rights and Duties of States*, Art. 1, Dec. 26, 1933, 165 LNTS 19.

³⁰ Spruyt, H., *The Sovereign State and Its Competitors: An Analysis of Systems Change*, N.J: Princeton University Press 1994 . Bartelson, Jens, *A Genealogy of Sovereignty*, Cambridge University Press, Cambridge, pp. i-vi. 1995 .

³¹ Siddharth, Badkul, *The Changing Concept of Sovereignty in Outer Space*, *Legal Bloc Journal*, Vol 1, Issue 2, p. 1, 2015.

legislative, or judicial jurisdiction of a foreign state or to foreign law other than public international law.³²

Sovereignty is the legal principle by which states exercise the exclusive control of a supreme authority over territory without any interference by foreign states.

Throughout history and for a variety of political, economic and social reasons, one of the primary activities that states and their historical precursors have engaged in has been fierce competition to acquire territory. Although sovereignty is merely a concept, it has been universally applied in order to protect and maintain a state's control within its boundaries.³³

Article 2 1 of the United Nations Charter also recognizes that all states are equal and sovereign because they are all politically independent.³⁴ However, the concept of sovereignty³⁵ in outer space is an issue that is growing among the super-powers of today's international community. Having said this, there is the principle of *res communis*,³⁶ which concerns the prohibition of national appropriation, freedom of exploration, and the province of all mankind.

“Outer space” is a new term in both a legal³⁷ and political sense,³⁸ and being comparatively novel, it has unfortunately not been explicitly defined since World War I.³⁹ Here, it is worth considering a major question which arises very often: at what point does air space stop and outer space begin?⁴⁰

According to the Chicago Convention, “The contracting States recognize that every state has complete and exclusive sovereignty over the airspace above its territory”.⁴¹

However, the concepts of jurisdiction *ratione instrumenti* and *ratione personae* on the other hand, apply to outer space and are recognized in the legal framework for the regulation of man's activity wherever it may take place in the universe.⁴² In addressing sovereignty, one must necessarily address the challenges arising in the event that property rights are granted.⁴³ These vary from environmental concerns and conflicts on Earth. Superseding both the 1928 Havana Convention,⁴⁴ and the Paris

³² Steinberger, H., *Encyclopedia for Public International Law*, Max Planck Institute for Comparative Public Law and International Law, 414 2013 .

³³ Sittenfeld, Linda R., The Evolution of a New and Viable Concept of Sovereignty for Outer Space, *4 Fordham International Law Journal*, 199-212, 1980 .

³⁴ Charter of the United Nations 26 June 1945, United Nations Conference on International Organization Documents, XV 1945 , art. 2 1 .

³⁵ According to art. 11 3 of the Moon Agreement, “neither the surface nor the sub-surface of the Moon nor any part thereof, or natural resources in place, shall become property of any State, or international, or intergovernmental or non-governmental organization, national organization or non-governmental entity or of any natural person”.

³⁶ *Res communis* is the common heritage of humankind. The Concept of *Res Nullius* is of Roman origin and states that a property does not belong to any person till a person claims ownership rights. Butler, Lind L., The Commons Concept: A Historical Concept with Modern Relevance, *23 Wm. & Mary L.Rev.* 835, 847, 1982. Unlike *res communist* he property is capable of being appropriated by a sovereign.

³⁷ However in reality all too often the terms used in legal discourse either have no universally agreed definitions or are defined very broadly and hence allow for different interpretations. Lyall, Francis, Larsen, Paul B., *Space Law: A Treatise*, UK: Ashgate Publishing, p. 2, 2009.

³⁸ Further read on the political sense of the term “outer space” see National Sovereignty of Outer Space, *74 6, Harvard Law Review*, 1154-1175 1961 . *Note*.

³⁹ Cooper, John C., The Rule of Law in Outer Space, *47 1 , American Bar Association Journal*, 23-27 1961 .

⁴⁰ Buck, Susan J., *The Global Commons: An Introduction*, 2nd ed., 1998 .

⁴¹ Chicago Convention on International Civil Aviation, art. 1, Dec. 7, 1944, 61 Stat. 1180, 15 U.N.T.S. 295.

⁴² Gbenga, Oduntan, The Never Ending Dispute: Legal Theories on the Spatial Demarcation Boundary Plane Between Airspace and Outer Space, *1 2 , Hertfordshire Law Journal*. 64-84, 2011 .

⁴³ Cherian, GJ., Abraham, J., Concept of Private Property in Space – An Analysis, *JICLT*, 211-220, 2007.

⁴⁴ Otherwise the Pan-American Convention on Air Navigation of 20 February 1928 *129 L.N.T.S.* 223 , superseded by the Chicago Convention on International Civil Aviation, signed at Chicago on 7 December 1944: *15 U.N.T.S.* 295.

Convention of 1919,⁴⁵ the Chicago Convention transcribed the first article on sovereignty from the Paris Convention almost as it was: “*The contracting States recognize that every State has complete and exclusive sovereignty over the airspace above its territory*”.⁴⁶

Kelsen considered that a sovereign state had jurisdiction over space. He thought not primarily of the physical connections but of the fact that the state had jurisdiction within something he called a “*Geltungsraum*”,⁴⁷ i.e. a “space of validity”.⁴⁸

Kelsen described this space as an area where not only the legal application of a territorial states but also the legal effect from a judicial act of that state, is three dimensional.⁴⁹

Historically, the concept of sovereignty was the defining principle of the state in the Peace of Westphalia: *Cuius regio*,⁵⁰ *eius religio*,⁵¹ the one who rules, selects the religion .

B. L. Manelis, a Soviet legal scholar, wrote: “[s]overeignty should be considered as a social phenomenon, which is closely connected with the state, its role in international relations and the regularities of its development.”⁵²

However, in the late 1940’s, individual scientists, in particular I. D. Levin expressed a later origin of sovereignty, linking it to the period of the collapse of feudalism and the establishment of capitalist production relations.⁵³

Levin also stated: “[i]nternational law and sovereignty are not only compatible, but are also a logically necessary correlation as they presuppose each other.”⁵⁴ As noted above, there is a considerable amount of literature that deals with the issue of “sovereignty”.⁵⁵ One eminent scholar has described the concept of sovereignty as “organized hypocrisy”.⁵⁶ Other authors have referred to it as being “of more value for purposes of oratory and persuasion than of science and law”.⁵⁷

⁴⁵ Convention Relating to the Regulation of Aerial Navigation Signed At Paris, October 13, 1919, League of Nation Treaty Series 1922 No. 297. *It is no longer in force.*

⁴⁶ Chicago Convention on International Civil Aviation, art. 1, Dec. 7, 1944, 61 Stat. 1180, 15 U.N.T.S. 295.

⁴⁷ Expanding a theory’s scope of validity.

⁴⁸ Engvers, A., *The Principle of Sovereignty in the Air*, Master Thesis, Lund University, Sweden, p. 33, 2001.

⁴⁹ *Ibid* at, 33.

⁵⁰ Latin: ‘In a [prince’s] country, the [prince’s] religion’. *The Oxford Dictionary of the Christian Church* 3 rev. ed. Ed. Cross, F. L., Livingstone, E. A., Oxford University Press 2005 .

⁵¹ Means “Whose realm, his *religion*”, meaning that the *religion* of the ruler was to dictate the *religion* of those ruled. von Friedeburg, R.C.F. 2011 . *Cuius regio, eius religio: The Ambivalent Meanings of State-building in Protestant Germany, 1555-1655*, Berghahn Books, 2011.

⁵² Manelis B.L., *Problems of Sovereignty*, Resume of Ph.D. Dissertation, Moscow, p. 9, 1966.

⁵³ Levin I.D, *On the Issue of Essence and Significance of Sovereignty*, “Soviet State and Law”, no. 6, p. 35, 1949.

⁵⁴ Levin, I. D., *The Idea of Sovereignty in Soviet and International Law*, p. 112 Moscow, 1974 .

⁵⁵ Jackson, John, Sovereignty - Modern: A New Approach to an Outdated Concept, *97 Am. J. Int’l L.* 782-802 2003.

⁵⁶ Krasner, Stephen, *Sovereignty: Organized Hypocrisy, State; Sovereignty, and National Governance* Gerald Kreijen et., al. eds., 2002; where he describes four ways that the term “sovereignty” has been used: domestic sovereignty, referring to the organization of public authority within a state and to the level of effective control exercised by those holding authority; interdependence sovereignty, referring to the ability of public authorities to control trans-border movements; national legal sovereignty, referring to the mutual recognition of states or other entities; and Westphalian sovereignty, referring to the exclusion of external actors from domestic authority configurations.

⁵⁷ See, e.g., Michael, Ross et al., *Law, Power, and the Sovereign State: The Evolution and Application of the Concept of Sovereignty*, Penn State University Press 1995 .

3. The Development of Space Law

The current space law is a relatively new branch of public international law,⁵⁸ and has been elaborated under the auspices of the United Nations since the 1960s.⁵⁹ Developed over the last few decades, the law consists of five international treaties⁶⁰ and principles,⁶¹ and is complemented by relevant UNGA resolutions.⁶² It is also developed through regional and bilateral treaties, practices of states and, for the most part, customary international laws.

As a *lex specialis* of international law,⁶³ space law has its own features, where the law regulates the interests of the international community at large. The law also contains obligations *erga omnes*,⁶⁴ however the Outer Space Treaty⁶⁵ is considered to be the main charter of space law in practice.

Outer space includes the Moon and other celestial bodies, which are considered both as global commons and yet a humankind heritage. Bruno Simma⁶⁶ wrote: “despite its traditional bilateralism structure, international law has entered a stage at which it does not exhaust itself in correlative rights and obligations running between states, but also incorporates common interests of the international community as a whole, including not only states but all human beings”.⁶⁷

In other words, treaties and international customary laws still serve space law and are its main legal groundings.⁶⁸ The rule of law⁶⁹ is also the governance of space law, although the freedom of using space is not absolute.

⁵⁸ See, e.g., Healy, Jason, Pitts, Hannan, *Applying International Environmental Legal Norms to Cyber Statecraft*, I/S J. 356, 359-62, 2012. See Kolossov, Y.M., On the Problem of Private Commercial Activities in Outer Space, 27 *Roc. COLLOQ. L. Outer Space*, 66 1984. Dann, Philip, *Future Role of Municipal Law in Regulating Space Related Activities*. In: *Space Law: Views for the Future*, 132 Zwaan& others ed. 1988. DeSaussure, H., The Unification and Development of Transnational Space Law, 31 *PROC. COLLOQ. L. Outer Space*, 253 1989.

⁵⁹ In 1958, just one year after Sputnik, the General Assembly of the United Nations expressed itself in a Resolution. See UNGA Resolution 1348 XIII of 13 December 1958. That same year, the U.N. Committee on the Peaceful Uses of Outer Space COPUOS was created. Its Legal Subcommittee drafted the legal instruments relating to space activities.

⁶⁰ The Outer Space Treaty, the Rescue Agreement, the Liability Convention, the Registration Convention, and the Moon Agreement.

⁶¹ The Declaration of Legal Principles, the Broadcasting Principles, the Remote Sensing Principle, Nuclear Power Sources Principles, and the Benefits Declaration.

⁶² Recent resolutions adopted by the General Assembly: A/RES/72/79 2017, A/RES/72/78 2017, A/RES/72/77 2017, A/RES/71/90 2016, A/RES/70/53 2015, A/RES/70/230 2015, A/RES/70/82 2015, A/RES/69/85 2014, A/RES/69/38 2014, A/RES/68/74 2013, A/RES/68/50 2013, and A/RES/68/75 2013.

⁶³ *lex specialis*, in legal theory and practice, is a doctrine relating to the interpretation of laws and can apply in both domestic and international law contexts. The doctrine states that if two laws govern the same factual situation, a law governing a specific subject matter *lex specialis* overrides a law governing only general matters *lex generalis*. Yun, Seira, *Breaking Imaginary Barriers: Obligations of Armed Non-State Actors under General Human Rights Law – The Case of the Optional Protocol to the Convention on the Rights of the Child*, *Journal of International Humanitarian Legal Studies*, 5 1–2, 213–257, 2014.

⁶⁴ In legal terminology, *erga omnes* rights or obligations are owed toward all.

⁶⁵ *The Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies*. United Nations, *Treaty Series*, vol. 610, No. 8843.

⁶⁶ Bruno Simma, a former Judge of the ICJ 2003-2012.

⁶⁷ Kingsbury, Benedict, Donaldson, Megan, *From Bilateralism to Publicness in International Law* 2010. *ESSAYS IN HONOUR OF BRUNO SIMMA*, p. 79, Ulrich Fastenrath, et. al., Oxford University Press, NYU School of Law, Public Law Research, no. 11-07, 2011.

⁶⁸ Xinmin, Ma, The Development of Space Law: Framework, Objectives and Orientations, Speech at United Nations/China/APSCO Workshop on Space Law, 2014.

⁶⁹ The rule of law between states must be extended to outer space. Otherwise the world will face chaos and disaster. Peace may be at stake. Cooper, J., The Rule of Law in Outer Space, *American Bar Association Journal*, 47 1, 23-27, 1961.

At present, there is no special international convention on space debris⁷⁰ and nuclear power sources.⁷¹ The regulation of the relevant international conventions on orbits and spectrum resources are obviously insufficient.⁷² In order to cope with the derogation of space's environment and to strengthen the regulation of orbits and spectrum resources, we need to improve the mechanisms on nuclear power sources,⁷³ space debris,⁷⁴ orbits,⁷⁵ spectrum resources,⁷⁶ and space mining⁷⁷ in the near future.

4. Mining Space and the New International Space Order

The governing treaties of space law share many similarities with UNCLOS⁷⁸ as protected international commons.⁷⁹ Technological progress rapidly changes this state of affairs, and many states⁸⁰ are reexamining the fundamental conceptions of sovereignty in space⁸¹ and its status as a protected international commons.⁸² The language used in the five principles space law treaties signed between

⁷⁰ Kopal, V., Present International Law Principles Applicable to Space Debris and the Need for Their Supplement, Second European Conference on Space Debris, Organized by ESA, held 17-19 March, 1997, ESOC, Darmstadt, Germany, ESA-SP 393., p. 739, 1997.

⁷¹ However, the Principles Relevant to the Use of Nuclear Power Sources in Outer Space, adopted in 1992 resolution 47/68, recognizes that nuclear power sources are essential for some missions, but that such systems should be designed so as to minimize public exposure to radiation in the case of an accident.

⁷² The Development of Space Law: Framework, Objectives and Orientations, Speech at United Nations/China/APSCO Workshop on Space Law by MA Xinmin, 2014.

⁷³ Russia has sent about 40 reactors into space and its TOPAZ-II reactor can produce 10 kilowatts. Zaitsev, Yury, "Nuclear Power in Space", *Space daily*, 2018.

⁷⁴ Initially, the term *space debris* referred to the natural debris found in the solar system: Asteroids and comets, and the fragments of those larger bodies, also known as meteoroids. Available at <https://orbitaldebris.jsc.nasa.gov/>

⁷⁵ An orbit is a regular, repeating path that one object in space takes around another one. An object in an orbit is called a satellite. A satellite can be natural, like Earth or the moon. Many planets have moons that orbit them. A satellite can also be man-made, like the International Space Station.

Available at <https://www.nasa.gov/audience/forstudents/5-8/features/nasa-knows/what-is-orbit-58.html>.

⁷⁶ The "orbit/spectrum resource" refers to the fact that satellites are assigned both a space on the geostationary orbit and a frequency on the radio spectrum. In addition to occupying a physical "slot," a satellite is also assigned a specific frequency in order to avoid interference between transmissions. The dual nature of the orbit/spectrum resource requires that both aspects be exploited simultaneously, and thus the current system to allocate orbits and frequencies necessarily encompasses both aspects. Thompson, Jannat C., Space for Rent: The International Telecommunications Union, Space Law, and Orbit/Spectrum Leasing, *62 J. Air L. & Com.* 279 1996.

⁷⁷ Space mining means the exploitation of raw materials from asteroids and other minor planets, including near-Earth objects. O'Leary, B., Mining the Apollo and Amor Asteroids, *Science*: 197, 363-366, 1977.

⁷⁸ The United Nations Convention on the Law of the Sea UNCLOS also called the Law of the Sea Convention or the Law of the Sea Treaty is the international agreement that resulted from the third United Nations Conference on the Law of the Sea UNCLOS III, which took place between 1973 and 1982.

⁷⁹ Global or national commons is a term typically used to describe international, supranational, and global resource domains in which common-pool resources are found. Global commons include the earth's shared natural resources, such as the high oceans, the atmosphere and outer space and the Antarctic in particular. Cyberspace may also meet the definition of a global commons. For further discussion see Strom, Elinor, *Governing the Commons: The Evolution of Institutions for Collective Action*, Cambridge, UK: Cambridge University Press, 1990. Neeson, Jeanette M., *Commoners: Common Right, Enclosure and Social Change in England, 1700-1820.*, Cambridge, UK: Cambridge University Press, 1996.

⁸⁰ For a list of current parties to all space treaties, see Office for Outer Space Affairs, Status of International Agreements Relating to Activities in Outer Space, last modified January 1, 2001. Available at http://www.oota.unvienna.org/Reports/treaty_status_2001E.pdf.

⁸¹ For more discussion on sovereignty in space see Bohumil, Doboš, Outer Space as a Physical Space, *Geopolitics of the Outer Space*, pp. 7-32, 2019. Bohumil, Doboš, Outer Space as a Military-Diplomatic Field, *Geopolitics of the Outer Space*, pp. 33-59, 2019. Morgan, Sterling et al., Can Space Mining Benefit all of Humanity? The resource fund and citizen's dividend model of Alaska, the 'last frontier', *Space Policy* 43, pp. 1-6, 2018. Bruhns, Sara, Haqq-Misra, Jacob, A Pragmatic Approach to Sovereignty on Mars, *Space Policy*, pp. 57-63, 2016. Leib, Karl, State Sovereignty in Space: Current Models and Possible Futures, *Astropolitics*, 13:1, 1-24, 2015.

⁸² Shackelford, Scott J., *The Tragedy of the Common Heritage of Mankind*, 27 *Stan. Envt L. J.* 101. 31 2008.

1967 and 1981 demonstrates the growth of this new vocabulary. These were the first international treaties to employ the terms “mankind”⁸³ and “people”⁸⁴ rather than “states”,⁸⁵ “nations”,⁸⁶ and “international community”.⁸⁷

Space law is based on the principle that outer space, including celestial bodies, should remain freely accessible for exploration and use by all people.⁸⁸ Early space lawyers were divided on the occupation of celestial bodies.⁸⁹ This dispute was addressed by UNGA Resolution 1721 XVI⁹⁰ and resolved by the Outer Space Treaty, which proclaimed outer space to be the “province of all mankind”.⁹¹

Nevertheless, humankind realized the need for a formal legal framework to organize mining in space effectively and cautiously. Since mining space became a hope and opportunity for states, it was a critical point for COPUOS⁹² to determine this concern in order to legislate upon what is necessary to keep outer space peaceful.⁹³

The history of space mining, or so-called asteroid mining began with heightened interests in outer space and the launch of satellites in the late twentieth century. As many became concerned with the depletion of natural resources on Earth, they began to pay more attention to available resources in outer space. For example, a metallic asteroid can potentially provide a state with billions of tons of iron and millions of tons of cobalt, nickel and platinum.⁹⁴

It is clear that space mining will be a more challenging project for smaller developing countries since these projects are extremely costly even for rich developed countries. Another obstacle is technological development since recent technologies are not advanced enough to facilitate commercial outer space mining.⁹⁵

⁸³ Mankind means human race; human beings collectively without reference to sex; humankind.

⁸⁴ Human beings making up a group or assembly or linked by a common interest.

⁸⁵ A *state* is a compulsory political organization with a centralized government that maintains a monopoly on the legitimate use of force within a certain geographical territory. ... The term *state* is also applied to federated *states* that are members of a federal union, which is the sovereign *state*. Salmon, Trevor, Imber, Mark, *Issues in International Relations*, ed. 2, UK: Taylor & Francis, 2008.

⁸⁶ “Nation” refers to a cultural-political community of people.

⁸⁷ *Shackelford*, *supra* note 82, at 31.

⁸⁸ The Outer Space Treaty established a series of broad principles that have been elaborated upon and implemented in a series of subsequent international treaties and national laws. These principles include: Outer space and celestial bodies are free for exploration and use by all states.

⁸⁹ More discussion on this matter see Smirnoff, Michel, Legal Status of Celestial Bodies, 28 *J. Air L. & Com.* 385 1962 . Lasswell, Harold, *Anticipating Remote Contingencies: Encounters with Living Forms*, Paper presented to the IVth Colloquium on the Law of Outer Space, Washington, October 3, 1961. Meyer, Alex, *Exploration of Outer Space and Neutrality*, Paper presented to the IVth Colloquium on the Law of Outer Space, Washington, October 3, 1961. Korovine, *Neytralizacii i Demilitarizacii Kosmosa* On the Neutralization and Demilitarization of Outer Space , 5 *Mezhdunarodnaya Zhizn*, 109-110, Moscow, December 1959. Kopal, Milde, *The Legal Problems of Demilitarization and Neutralization in Outer Space*, Paper presented at the IVth Colloquium on the Law of Outer Space, Washington, October 3, 1961, De Nova, J., *War in Outer Space and Neutrality*, Paper presented to the Congress for Space Law in Taormina, Italy, November 2, 1960.

⁹⁰ International co-operation in the peaceful uses of outer space.

⁹¹ Outer Space Treaty, art. 1.

⁹² The *Committee on the Peaceful Uses of Outer Space* COPUOS was established by A/RES/1472 XIV of 12 December 1959 as an *ad hoc* committee.

⁹³ COPUOS, Mining in Space – Square space, Toronto, Canada. Namun, 2017 Available at https://static1.squarespace.com/static/.../t.../COPUOS_+Mining+in+Space.pdf

⁹⁴ Coffey, Sarah, Establishing A Legal Framework For Property Rights To Natural Resources In Outer Space, *Case. W. Res. J. Int'l L.* 41, 119-47 2009 .

⁹⁵ Davies, Rob, “Asteroid Mining Could Be Space’s New Frontier: The Problem Is Doing It Legally.” The Guardian , February 6, 2016. Available at <https://www.theguardian.com/business/2016/feb/06/asteroid-mining-spaceminerals-legal-issues>.

In short, outer space has become a more promising idea for many states as they anticipate that more resources can be found and exploited for the potentiality of a shortage of resources on Earth in the near future. It is not only states but also private mining companies⁹⁶ that are paying close attention to outer space mining at this time for its large potential profits and gains.

However, it is inevitable that they will breach U.N. treaties such as the Outer Space Treaty and the Moon Agreement, since these treaties ban the ownership of resources and planets of outer space for the sake of peacekeeping in outer space and to negate any potential threat to security on Earth between states.

All in all, the short history of outer space reveals that space mining is a promising future industry if states, of course, deal with the potential industry within the boundaries of the U.N. Charter.⁹⁷

Otherwise, and at the same time, it could be the root cause of further global conflicts and controversies.

The space mining race could lead to conflicts on Earth and will eventually cause considerable international turmoil, since there is no specific resolution or a measure that exclusively discusses the subject of space mining,⁹⁸ as it is yet to be fully explored and studied either in a legal and or a technological manner.

However, in the past few years, the U.N. has passed numerous resolutions regarding outer space activities.⁹⁹ For instance, it passed Resolution 68/74,¹⁰⁰ Recommendations on National Legislations Relevant to the Peaceful Exploration and Use of Outer Space, in 2013, and Resolution 68/74 specifically clarifies parts of the Registration Convention as it encourages the appropriate national authorities to be in charge of the registry of space objects and the proper authorization of space activities.¹⁰¹

⁹⁶ *i.e.*, Planetary Resources, Inc., formerly known as Arkyd Astronautics, is an American company that was formed on 1 January 2009, and reorganized and renamed in 2012. Its stated goal is to expand Earth's natural resource base by developing and deploying the technologies for asteroid mining. Mims, Christopher, *Are Ross Perot Jr. and Google's Founders Launching a New Asteroid Mining Operation?* *Technology Review* 2012. Available at <https://www.technologyreview.com/s/427624/are-ross-perot-jr-and-googles-founders-launching-a-new-asteroid-mining-operation/>.

⁹⁷ The treaties and principals regarding outer space should incorporate the *U.N. Charter by reference*, and requires states parties to ensure that activities are conducted in accordance with other forms of international law such as customary international law the custom and practice of states .

⁹⁸ Baseley-Walker, Ben, *Outer Space, Geneva and the Conference on Disarmament: Future Directions*, *Space Policy* 28, no. 1, pp. 45–49 2012 .

⁹⁹ COPUOS, *Mining in Space – Square space*, *supra* note 93.

¹⁰⁰ Resolution Adopted by the General Assembly on 11 December 2013. United Nations General Assembly 68, no. 74, 1–3 December 11, 2013.

¹⁰¹ Convention on Registration of Objects launched into Outer Space. The Convention was adopted by resolution 3235 XXIX of the General Assembly dated 12 November 1974, pursuant to resolution 3182 XXVIII dated 18 December 1973 and taking into account the report of the Committee on the Pacific Uses of Outer Space. The Convention was opened for signature on 14 January 1975.

As of now, the U.N. has conducted reports on a variety of issues such as space debris mitigation,¹⁰² near-earth object NEO management,¹⁰³ global satellite systems,¹⁰⁴ nuclear power use in outer space,¹⁰⁵ review of outer space treaties,¹⁰⁶ and capacity-building in space law.¹⁰⁷

As COPUOS noticed a rapid growth in the number of space expeditions and industries, it decided that it was essential for them to discuss a stronger enforcement of space laws and the idea of the rule of law. That being said, COPUOS also felt an urgency to align itself with new developments in space activities, such as mining outer space, so that it would be able to regulate outer space better in the near future.¹⁰⁸ In order to define space exploitation, defining exploitation itself is necessary first of all. Exploitation is ‘*the action of making use of and benefiting from resources*’.¹⁰⁹ Governments and companies are taking actions in order to prepare themselves to start mining the solar system; two major companies already specialize in mining asteroids and are doing tests and experiments.¹¹⁰ The Philae landing¹¹¹ is the first concrete proof that shows the tangibility of putting a robotic machine on a comet, and space-faring nations like Russia and China are preparing themselves to go back into space and look for the riches of the Moon.¹¹²

It is crucial to keep in mind the fact that during the drafting of the Outer Space Treaty, the commercialization of space resources was not an issue. Therefore, the lack of clear definitions concerning those activities is comprehensible.

With respect to extraterrestrial exploitation in the Outer Space Treaty, a closer look gives no clear-cut answer as to the regulation of exploitation rights. However, state practices and general opinions in the legal literature show three essential remarks:

¹⁰² See the Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space are the result of many years of work by the Committee and its Scientific and Technical Subcommittee. At its thirty-first session, in 1994, the Subcommittee considered for the first time, on a priority basis, matters associated with space debris under a new item of its agenda A/AC.105/571, paras. 63-74.

¹⁰³ The International Asteroid Warning Network IAWN and the Space Mission Planning Advisory Group SMPAG are two entities established in 2014 as a result of United Nations endorsed recommendations, and represent important mechanisms at the global level for strengthening coordination in the area of planetary defence. Available at <http://www.unoosa.org/oosa/en/ourwork/topics/neos/index.html>.

¹⁰⁴ The International Committee on Global Navigation Satellite Systems ICG, established in 2005 under the umbrella of the United Nations, promotes voluntary cooperation on matters of mutual interest related to civil satellite-based positioning, navigation, timing, and value-added services.

Available at <http://www.unoosa.org/oosa/en/ourwork/icg/icg.html>.

¹⁰⁵ The adoption of the Principles Relevant to the Use of Nuclear Power Sources in Outer Space NPS Principle by the General Assembly. A/RES/47/68 85th plenary meeting 14 December, 1992, 47/68.

¹⁰⁶ The review is done through the Outer Space Legal Subcommittee.

¹⁰⁷ Report of the Committee on the Peaceful Uses of Outer Space Fifty-Eighth Session, General Assembly Official Records 70, no. 58, 1–53 June 10-19, 2015.

¹⁰⁸ *Ibid.*

¹⁰⁹ Merriam-Webster dictionary “Exploitation”, 2015.

Available at <http://www.merriamwebster.com/dictionary/exploitation>.

¹¹⁰ Hartnett, K., “The comet landing as a prelude to asteroid mining”, *The Boston Globe* November 14, 2014. Available at <https://goo.gl/AjsDF4>.

¹¹¹ The Philae Lander, part of the Rosetta mission to investigate comet 67P/Churyumov-Gerasimenko, was delivered to the cometary surface in November 2014. See Biele, Jens *et al.*, The landing of Philae and inferences about comet surface mechanical properties, *Science*, 349 2015.

¹¹² Smith, J., “Russia makes plans to mine the moon”, *KSL* 2 December 2014. Available at <http://www.ksl.com/?nid=1012&sid=32515405>. Hewitt, J., “China is going to mine the moon for Helium-3 fusion fuel”, *Extreme Tech*, January 26, 2015. Available at <https://goo.gl/n8XSSo>.

1. The exploitation of extraterrestrial resources is allowed under the Outer Space Treaty.¹¹³ The freedom of use of outer space and its celestial bodies results in exploitation.
2. The non-appropriation clause in Article II of the Outer Space Treaty only applies to space and its celestial bodies and not to their natural resources.¹¹⁴ This means that those resources can be subjected to appropriation analogous to that of resources in the deep seabed.
3. Private commercial activities are allowed in space,¹¹⁵ but states are responsible for any private commercial activities, meaning that commercial entities are also subject to the provisions of the Outer Space Treaty.

For one thing, national appropriation appears to violate international law¹¹⁶ and the Outer Space Treaty, which states that space “is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means.”¹¹⁷ The 1979 Moon Agreement¹¹⁸ went further, declaring

¹¹³ See e.g., Johnson, D, Limits on the Giant Leap of Mankind: Legal Ambiguities of Extraterrestrial Resource Extraction, 26*AmUnlLRev*1477, 1481 2010–11. Jensen, M, *Asteroidal Nature: What It Takes to Capture an Asteroid*, 45*Southwestern Law Review*757, 776 2016. Jakhu, R, Legal Issues Relating to the Global Public Interest in Outer Space, 32*Journal of Space Law* 31,37–39 2006 . Also, Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space, G.A. Res. 1962 XVII of 13 December 1963, para 2, U.N. Doc A/RES/1962 XVIII 1 January 1964 . International Cooperation in the Peaceful Uses of Outer Space, G.A. Res. 1721, U.N. Doc A/4987, 20 December 1961 .

¹¹⁴ In this regard see Baca, Kurt, Property Rights in Outer Space, 59*J. Air L & Com.* 1041 1993 . Reynolds, Glenn, International Space Law: Into the Twenty-First Century, 25*Vand. J. Transnat'l L.* 225 1992 . Dasch, Smith, Conference on Space Property Rights: Next Steps. In: PROCEEDINGS OF THE 42th COLLOQUIUM ON THE LAW OF OUTER SPACE, 174 2000. Smith, M., *Matching Space-Related Intellectual Rights to Industrial Needs*, ISU International Symposium, Retrospective of the 1996 Symposium November 7, 1996 .

¹¹⁵ For further read in this matter see Dula, Arthur M., Regulation of Private Commercial Space Activities, *Jurimetrics*, vol. 23, no. 2, pp. 156–189, 1983. Dempsey, Paul, National Laws Governing Commercial Space Activities: Legislation, Regulation, & Enforcement, 36*Nw. J. Int'l L. & Bus.* 1 2016 . Hoffstadt, Brian M., Comment, Moving the Heavens: Lunar Mining and the “Common Heritage of Mankind” in the Moon Treaty, 42*UCLA L. REV.* 575, 580–81 1994 . Dempsey, Paul, Foreword to SPACE SAFETY REGULATIONS AND STANDARDS, at xxi Joseph Pelton & Ram S. Jakhu eds., 2010. See, e.g., Gerhard, Michael, National Space Legislation—Perspectives for Regulating Private Space Activities, in 2*ESSENTIAL AIR AND SPACE LAW* 75–76 Marietta Benkő& Kai-Uwe Schrogl eds., 2005 . Ronald L. Spencer, Jr., State Supervision of Space Activity, 63*A.F. L. REV.* 75, 78 2009 . See Taghdiri, Adrian, Flags of Convenience and the Commercial Space Flight Industry: The Inadequacy of Current International Law to Address the Opportune Registration of Space Vehicles in Flag States, 19*B.U. J. SCI. & TECH. L.* 405, 514 2013 . Frans von der Dunk, As Space Law Comes to Nebraska, Space Comes Down to Earth, 87*NEB. L. REV.* 498, 507 2008 . Fitzgerald, Paul, notes, “While it is true that domestic law is probably sufficient to cover ‘up and down’ SATV [suborbital aerospace transportation vehicle] flights, international carriage by SATV will require legal infrastructure, and such a requirement will likely be necessary within the next decade. Unless States begin to consider this issue, it is not inconceivable that such a lack of action could become an impediment to intercontinental flights by SATVs.” Fitzgerald, Paul, Inner Space: ICAO’s New Frontier, 79*J. AIR L. & COM.* 3, 5 2014. See e.g., Dempsey, Paul, Mineiro, Michael, *The ICAO’s Legal Authority to Regulate Aerospace Vehicles*, in SPACE SAFETY REGULATIONS AND STANDARDS 251 Joseph Pelton & Ram S. Jakhu eds., 2010 . See generally Dempsey, Paul, Mineiro, Michael, *Space Traffic Management: A Vacuum in Need of Law*. In: OUTER SPACE: WARFARE AND WEAPONS P. Kumar, ed. 2010; THE NEED FOR AN INTEGRATED REGULATORY REGIME FOR AVIATION AND SPACE: ICAO FOR SPACE? Ram S. Jakhu, Tommaso Sgobba& Paul Stephen Dempsey eds., Springer 2011 .

¹¹⁶ For years before the advent of the Space Treaty some authors expressed grave doubts about the applicability of public international law to the realm of outer space. See, e.g., Schick, H., Problems of a Space Law in the United Nations, 13*INT’L & COMP. L.Q.* 977 1944 . Mankiewicz, René, Some Thoughts on Law and Public Order in Space, 2*CAN. Y. B. of INT’L L.* 260 1964 . Cepelka, Cestmir, The Application of General International Law in Outer Space, 36*J. Air L. & Com.* 30 1970 .

¹¹⁷ Article II of the Outer Space Treaty.

¹¹⁸ The “Moon Agreement” of 1979. Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, opened for signature December 18, 1979, 18 I.L.M. 1434, 1363 U.N.T.S. 3 entered into force July 11, 1984 . See also Hermida, Julian, Legal Basis for National Space Legislation 30 Springer 2004 . Article VI provides: “States Parties to the Treaty shall bear international responsibility for national activities in outer space, including the Moon and other celestial bodies, whether such activities are carried on by governmental agencies or by non-governmental entities, and for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty.” Outer Space Treaty, art. VI.

outer space to be the “common heritage of mankind” and explicitly forbidding any state from annexing non-Earth natural resources in the solar system.¹¹⁹

Ultimately, it remains clear that land or areas of outer space cannot be owned by anyone, state or non-state. But are space resources subject to the same regulations as land resources? Recent discussions¹²⁰ at U.N. COPUOS show that this might not be the case.¹²¹

The exploitation of a celestial body to the point that it ceases to exist by means of over mining would not constitute, from a legal standpoint, an appropriation in the sense of Article II of the Outer Space Treaty. As noted before, the notion of appropriation is linked to the idea of claiming ownership over a celestial body which would require an intent to appropriate the celestial body.¹²² But in the case at hand, it is not the small asteroid *per se* that the mining entity claims but the resources it contains.¹²³

The appropriation of a celestial body, in the sense that no one else will be able to use it, is a consequence resulting from over mining. Therefore, it would be a *de facto* appropriation¹²⁴ of the celestial body rather than a *de lege* appropriation.¹²⁵ Now, as discussed earlier, Article II of the Outer Space Treaty only aims at avoiding *de lege lata*¹²⁶ claims by ensuring *inter alia* that no amount of use or occupation gives rights to titles in outer space. Consequently, neither can the extreme use of a celestial body by means of resource extraction.

Without a clear understanding of where space mining activities stand with regards to international space law, the only legal boundary for space mining actors is the one imposed by Article VI of the Outer Space Treaty,¹²⁷ namely the obligation for private entities to obtain the authorization of the state before conducting activities in space.

From the state’s viewpoint, this minimal requirement can be understood in two significantly different ways. One possibility is to consider that there is currently no restriction on space mining and that

¹¹⁹ Mining in Space Could Lead to Conflicts on Earth. Available at <http://nautil.us/blog/mining-in-space-could-lead-to-conflicts-on-earth>

¹²⁰ In contrast to the law of the sea regime, the Moon Agreement does not provide for a specific institutional structure to govern the Moon’s exploitation. It only outlines the main purpose of such a regime, including orderly and safe development, rational management of lunar resources and equitable sharing of the benefits. Schrijver, Nico, Managing the Global Commons: Common Good or Common Sink? *Third World Quarterly*, 37: 7, 1252-1267 2016.

¹²¹ Masson-Zwaan, T., Palkovitz, N., Regulation of Space Resource Rights: Meeting the needs of States and Private Parties, *Questions of International Law* 35: 18, 2017. UN COPUOS, para. 231 2017 .

¹²² Cherian, Jijo George, Abraham, Job, Concept of Private Property in Space – An Analysis, *Journal of International Commercial Law and Technology*, Vol. 2, Issue 4 2007 .

¹²³ Leterre, Gabrielle, Providing a Legal Framework for Sustainable Space Mining Activities. Available at <https://www.fr.uni.lu/.../Gabrielle%20Leterre%20Providing%20a%20Legal%20Frame>

¹²⁴ *De facto* taking refers to the *appropriation* of private property by an entity by means other than a formal *appropriation*. Szatkowski, Thomas S., De Facto Takings and the Pursuit of Just Compensation, 48 *Fordham L. Rev.* 334 1979 .

¹²⁵ *De lege* means being on the basis of new law.

¹²⁶ *De lege lata* means the existing law.

¹²⁷ [States Parties to the Treaty shall bear international responsibility for national activities in outer space, including the Moon and other celestial bodies, whether such activities are carried on by governmental agencies or by non-governmental entities, and for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty...]. For further reading see von der Dunk, Frans G., The Origins of Authorisation: Article VI of the Outer Space Treaty and International Space Law, *Space, Cyber, and Telecommunications Law Program Faculty Publications*, no. 69 2011.

authorizations can largely be granted until the establishment of another treaty.¹²⁸ The other possibility is to consider that any utilization of space resources has to comply with a national legal framework.¹²⁹

Therefore, the future international regime in space mining should recognize the possibility for states and their nationals to appropriate space resources and that general measures should be laid down by –the house of nations, the U.N.,– particularly with relation to the control of any conflict that might arise on Earth regarding outer space mining.

In this framework, the authorization and supervision of space mining missions and their development are left to states under the supervision of the U.N.

5. Property Rights in International Law

Scholars have for a long period of time considered property rights¹³⁰ to be of a national level; however, in the years following the establishment of space law, the development led scholars to consider property rights as a global issue.

In recent years, technology has permitted humans to exploit resources in the global commons areas¹³¹ which are outside of the territory of any nation,¹³² such as the Earth’s atmosphere, outer space, and the high seas.¹³³

Because these resources transcend national borders, international regulation is both desirable and inevitable.¹³⁴

In certain situations, the common good of all nations requires the adoption of international constraints on property rights¹³⁵ that expressly preempt national law to some extent.¹³⁶

¹²⁸ In this matter, I share the opinion of Masson-Zwaan and Palkovitz that “waiting until states reach an international agreement relating to space resource mining would mean giving a hand to an unregulated space industry”.

¹²⁹ Masson-Zwaan T., Palkovitz, N., Regulation of Space Resource Rights: Meeting the Needs of States and Private Parties, *Questions of International Law*, 35: 18, 2017.

¹³⁰ A property right is the exclusive authority to determine how a resource is used, whether that resource is owned by government or by individuals. Alchian, Armen, Some Economics of Property Rights, *Il Politico* 30, no. 4, 816-829 1965.

¹³¹ “Areas outside the jurisdiction of any nation or group of nations.” Wilson, Phillip E., Barking Up the Right Tree: Proposals For Enhancing the Effectiveness of the International Tropical Timber Agreement, *10 TEMP.INT’L & CoMp. L.J.* 229, 244, 1996. citing Jeffrey L. Dunoff, Reconciling International Trade with Preservation of the Global Commons: Can We Prosper and Protect? *49 WASH. & LEE L. REV.* 1407, 1408 1992 . Also see Clancy, Erin A. The Tragedy of the Global Commons, *Indiana Journal of Global Legal Studies* 5, no. 2, 601-19, 1998.

¹³² However there are spaces on the Earth that have one of more global common properties, these include: ocean water and sea-bed, air inner atmosphere and outer space, celestial bodies and Antarctica. Further read see Wijkman, Magnus, Managing the Global Commons, *International Organization* 36, no. 3, 511-536, 1982. Shii, Naoko, Safeguarding Our Global Commons. In: *From Summits to Solutions: Innovations in Implementing the Sustainable Development Goals*, edited by Desai Raj M., Kato Hiroshi, Kharas Homi, and McArthur John W., Washington, D.C.: Brookings Institution Press, 318-333, 2018.

¹³³ Sands, Philippe, *Principles of International Environmental Law*, Cambridge University Press, 14 2d Ed. 2003 .

¹³⁴ See, e.g., Posner, Eric A., Sykes, Eric, O., Economic Foundations of the Law of the Sea, *104 AM. J. INT’L L.* 569, 595 2010. discussing the need for international regulation of ocean resources “to protect against overexploitation, excessive investment in search, and related externality problems” .

¹³⁵ Art. 1 of the First Additional Protocol to ECHR has adopted broad concepts of ‘possessions’ and ‘property’.

¹³⁶ Sprankling, John G., The Emergence of International Property Law, *90 N.C. L. Rev.* 461 2012 .

Property law stems from four principal sources: regulation of the global commons;¹³⁷ coordination of transboundary property rights;¹³⁸ adoption of global policies to protect against specific harms;¹³⁹ and protection of human rights.¹⁴⁰

The question is, then, to what extent is property rights protection essential for development to proceed in the global commons? In its most basic form, a property right is an entitlement to exclude someone from doing something.¹⁴¹

The Outer Space Treaty indirectly suggests that commercial space companies do not own the rights to any resources, minerals or natural materials¹⁴² they find in outer space. The treaty states that no “celestial body”¹⁴³ is subject to “national appropriation by claim of sovereignty, by means of use or occupation, or by any other means.”¹⁴⁴

The Outer Space Treaty established all of outer space as international commons by describing it as the “province of all mankind” and forbidding all nations from claiming territorial sovereignty.

The international Moon Treaty – finalized in 1979, and although just five countries had ratified it by 1984,¹⁴⁵ five was sufficient for it to be considered officially “in force” – went further and forbade private ownership of extraterrestrial real estate.¹⁴⁶

Although Article II bans appropriation, the provisions of the Outer Space Treaty lend support to property rights. For example, the treaty states that the use and exploration of outer space shall be free and without discrimination of any kind, and that there shall be free access to all parts of space.¹⁴⁷ It also allows the use of equipment and facilities necessary for peaceful activities and allows individuals and nations to retain the private property rights of anything launched into, or built in, space.¹⁴⁸ The Outer Space Treaty supports the proposition that international law¹⁴⁹ is applicable in outer space.¹⁵⁰ As has been described

¹³⁷ It is achieved through giving the international agreement more effect.

¹³⁸ Sprankling, *supra* note 136, at 461.

¹³⁹ Helpman argues that tighter IPRs reduce technology flows from developed countries to developing ones if imitation is the channel of international production transfer. Helpman, E., Innovation, Imitation and Intellectual Property Rights, *Econometrics*, 61 6 , 1247-1280 1993 .

¹⁴⁰ Sprankling, *supra* note 136, at 472.

¹⁴¹ Dinkin, Sam, Property Rights and Space Commercialization, *SPACE REV.*, May 10, 2004. Available at <http://www.thespacereview.com/article/141/1>

¹⁴² In this respect see Lee, Ricky J., *Creating an International Regime for Property Rights Under the Moon Agreement*. In: PROC. 42ND COLLOQUIUM ON L. OUTER SPACE, 409, 409 1999 . Herzfeld, Henry R., Frans G. von der Dunk, Bringing Space Law into the Commercial World: Property Rights without Sovereignty, 6 *CHI. J. INT'L L.* 81, 85 2005 . Buxton, Carol R., Property in Outer Space: The Common Heritage of Mankind Principle vs. the “First in Time, First in Right” Rule, 69 *J. AIR L. & COM.* 689, 699 2004 . Coffey, Sarah, Establishing a Legal Framework for Property Rights to Natural Resources in Outer Space, 41 *Case W. Res. J. Int'l L.* 119 2009 .

¹⁴³ Pop, Virgiliu, A Celestial Body is a Celestial Body is a Celestial Body ...” 44 *Proc. Coil. L. Outer Sp.* 100, 2001.

¹⁴⁴ Gorove, Stephen, Interpreting Article II of the Outer Space Treaty, 37 *Fordham L. Rev.* 1969. White, W.N., Real Property Rights in Outer Space, 40 *Proc. Coli. L. Outer Sp.* 370, 1997. Also see, for example, Krasner, Stephen, Think Again: Sovereignty, 122 *Foreign Policy* 20, 2001.

¹⁴⁵ Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, this treaty was adopted on 5 December 1979 1363 *U.N.T.S.* 3 .

¹⁴⁶ Virgiliu G. Pop, *Who Owns the Moon?: Extraterrestrial Aspects of Land and Mineral Resources Ownership*, Springer Publishing, pp. 2–3, 2009.

¹⁴⁷ Outer Space Treaty Art. I.

¹⁴⁸ Outer Space Treaty Art. IV.

¹⁴⁹ Wherever international law is applied successfully, relative anarchy turns into relative peace and security. See generally Cassese, Antonio, *International Law* 117-126 2001 .

¹⁵⁰ Cepelka, Cestmir, Gilmour, Jamie H., The Application of General International Law in Outer Space, 36 *J. AIR L. & CoM.* 30, 30 1970 . “[General international law, which governs the conduct of states in their mutual relations, is not confined to the

¹⁵¹ property has two fundamental aspects. The first is possession,¹⁵² which can be defined as control over a resource. The second is title,¹⁵³ which is the expectation that others will recognize one's rights to control¹⁵⁴ a resource.¹⁵⁵ The expectation of profit from improving one's stock of capital rests on this control through private property rights.¹⁵⁶ The belief is that these rights encourage property holders to develop, generate wealth, improve standards of living, and efficiently allocate resources through a capitalist market system.¹⁵⁷

6. Property Rights in Outer Space

Considering the above, the United Nations Committee on the Peaceful Uses of the Outer Space UNCOPUOS introduced several treaties like the Outer Space Treaty, the Moon Treaty, the Rescue Treaty, the Liability Treaty and the Registration Treaty, declaring outer space to be *res communis*, where all entities have common access to the resources that are contained within it and are precluded from making any claims of ownership thereto. The approach of *res nullis*¹⁵⁸ was rejected, as it would have proclaimed outer space to be available for conquest. However, these treaties encourage the exploration of outer space for peaceful purposes. While national appropriation is expressly not allowed, there is no mention about private ownership of celestial bodies.

However, it is not just human nature to explore and use resources, it is economically beneficial for human beings to explore and exploit property beyond Earth. Simply put, outer space cannot be appropriated by any state; the objects launched by any state are considered to be the property of that state.

Hence, for example, the satellites launched by the U.S. are considered to be the national property of the U.S. However, outer space follows the concept of *res communis*,¹⁵⁹ not *res nullis*.¹⁶⁰

Outer space is for everyone's enjoyment and exploitation and no one person can claim it as their own.¹⁶¹ The resources of the high seas, *i.e.*, the deep seabed¹⁶², similar to the resources detected in celestial

ill-defined upper limit of national airspace, but is applicable to activities of states in the vast realm of outer space. Thus the Space Treaty incorporates rule of general international law, apart from norms of *legis Specialis* derogating there from].”

¹⁵¹ In *The Common Law* Oliver Wendell Holmes describes property.

¹⁵² The right of possession leads to: the right of control, the right of exclusion, the right of enjoyment and the right of disposition.

¹⁵³ The property is owned by whoever holds the title.

¹⁵⁴ Within the laws, the owner controls the use of the property.

¹⁵⁵ Holmes, Oliver, *The Common Law*, 243 2004 . See generally White, G. Edward, *The Rise and Fall of Justice Holmes*, 39 *U. CHI. L. REV.* 51 1971 .

¹⁵⁶ This view is according to Adam Smith.

¹⁵⁷ De Soto, Hernando, *The Mystery of Capital: Why Capitalism Triumphs in the West and Fails Everywhere Else*, New York: Basic Books, 39-67 2000 .

¹⁵⁸ *Res nullius* is ownerless property and it can be owned by any person. The person who takes first possession of the *res nullius* is the owner of that property. *Res nullius* includes wild animals and abandoned property. *Res nullius* also refers to the principle by which a nation may assert control of an unclaimed territory. Available at <https://definitions.uslegal.com/r/res-nullius/>

¹⁵⁹ “Thing of the entire community.” The common heritage of all humankind, not subject to the appropriation by or sovereignty. Available at <https://goo.gl/8LkkUq>

¹⁶⁰ Listner, Michael, *The Ownership and Exploitation of Outer Space: A look at Foundational Law and Future Legal Challenges to Current Claims*, 1 *Regent J. Int'l L.* 75, 2003.

¹⁶¹ *Ibid*, at 75.

¹⁶² In this area of the Law of the Sea, see Burton, Steven J., *Freedom of the Seas: International Law Applicable to Deep Seabed Mining Claims*, *Stanford Law Review* 29, no. 6, 1135-1180 1977 . Johnston, Cheryl Hein, *Deep Seabed Mineral Resources Act*, *Natural Resources Journal* 20, no. 1, 163-168 1980 .

bodies, enjoy a specific nature that excludes them from the general characterizations attributed to celestial bodies and outer space as a whole; both areas have been characterized as areas *res communis omnium*,¹⁶³ since both legal regimes that govern them require them to be beyond state sovereignty and at the same time to be commonly used by humankind.¹⁶⁴

7. Regulating the Space in the Age of Mining

“The rule of law ... affects our business, our property and our families. It provides for and protects our liberties. The rule of law guarantees freedom for men and diversity of ideas as expressed by free people. The alternative to the rule of law – a rule of force whenever by one man or a group of men – means the oppression of men and the suppression of ideas”.¹⁶⁵

Humans live in parallel in both framework of international legal orders¹⁶⁶ and in a diverse fabric in the international community. However, nationals of any given nation cannot act on their own and require legal entities – states – to represent their legal interests and to protect their rights.

States,¹⁶⁷ as subjects of public international law, are the main actors in the international arena. It is best seen, on this particular level of international coexistence, that respect for the law and international commons in general bring greater freedom and peace while a lack respect for such rules and commons will diminish the freedom and peace which we all enjoy by sharing our global heritage.

Ever since the very first human interactions, between one human and another on one side of the coin and between humans and things on the other side, international law has been evolving throughout human civilizations. When the oceans became a subject of interest for mankind,¹⁶⁸

–law of the sea– emerged.¹⁶⁹ The same goes for the dawn of the outer space era the scope of international law had to move beyond Earth, which coupled with the great inventions in technology, has led to the emergence of a new body of international space regulations.

¹⁶³ See *supra* note 158.

¹⁶⁴ Evidential is Art. 11, para. 8 of the Moon Agreement that requires equal sharing of the natural resources exploited in outer space: “An equitable sharing by all States Parties in the benefits derived from those resource [...]”; see also, Cocca, Aldo, The Principle of the Common Heritage of Mankind as Applied to Natural Resources from Outer Space and Celestial Bodies”, *Proceedings of XVIth colloquium on the law of outer space*, 174 IISL, 1973 . Barbara, Ellen, Exploring the Last Frontiers for Mineral Resources: A Comparison of International Law Regarding the Deep Seabed, Outer Space, and Antarctica, 23 *Vand. J. Transnat'l L.* 819, at 822, 1990-1991 . For the respective nature of the natural resources of the sea see Art. 137 of the UNCLOS which states: “1. No State shall claim or exercise sovereignty or sovereign rights over any part of the Area or its resources, [...]. No such claim or exercise of sovereignty or sovereign rights nor such appropriation shall be recognized. 2. All rights in the resources of the Area are vested in mankind as a whole, on whose behalf the Authority shall act. [...]”

¹⁶⁵ As the honorable William Pierce Rogers, attorney general of the United States in the years 1957 - 1961, stated in his official address on the occasion of the 1st U.S. Law Day on May 1, 1958.

¹⁶⁶ Further read regarding international legal order see generally Cogan, Jacob Katz, The Idea of Fragmentation, *Proceedings of the Annual Meeting American Society of International Law* , vol. 105, pp. 123–125, 2011. Slaughter, Anne-Marie, Burke-White, William, The Future of International Law is Domestic or, The European Way of Law , 47 *Harv. Int'l L.J.* 327, 329 2006 . Owada, Hisashi, Problems of Interaction between the International and Domestic Legal Orders, 5 *Asian J. Int'l L.* 2, 247 2014 .

¹⁶⁷ As Antonio Cassese puts it, “most activities performed by the primary subjects of the world community, States, take place within a geographical area. Cassese, Antonio, *International Law*, 2nd ed., Oxford University Press, 2005.

¹⁶⁸ For discussion of the interactions see Brunner, A.D., El Niño and World Primary Commodity Prices: Warm Water or Hot Air? *The Review of Economics and Statistics* 84 1 , 176-183 2002 . Waite, R., et al., *Coastal Capital: Ecosystem Valuation for Decision Making in the Caribbean*, World Resources Institute Washington, DC. 2014. Available at <https://www.wri.org/publication/coastal-capital-ecosystem-valuation-decision-making-caribbean>

¹⁶⁹ Today, the principal legal instrument is the 1982 United Nations Convention on the Law of the Sea. For further developments in the law of the sea see Simmonds, Kenneth R., The Law of the Sea, *The International Lawyer* 24, no. 4, 931-

Throughout the centuries, humans have lived by the motto “*dominus soli est dominus coeli*”,¹⁷⁰ meaning “the master of the land is also the master of the skies”. Furthermore, Hugo Grotius, in his opus *The Free Sea Mare Liberum*,¹⁷¹ formulated a new principle the sea was international territory and all nations were free to use it for seafaring trade.¹⁷²

According to Grotius, “the sea was free to all, and nobody had the right to deny others any access to it”. Seas were seen by Grotius as “similar in nature to air and, unlike land, were deemed the *common property of all*”.¹⁷³

Recently, the sky is no longer the limit of state sovereignty; however, there are certain kinds of territories that are recognized in international law as falling outside the territory of a given state. These include the high seas; the international seabed, its soil and its subsoil; Antarctica and outer space.

Contemporary states are supposed to ensure that any exploitation of these particular areas is solely for peaceful purposes and for the benefit of all mankind.

Turning to the *res communis*, the concept consists of five main elements:

- a) The absence of the right of appropriation;¹⁷⁴
- b) The duty to exploit resources in the interests of mankind in such a way as to benefit everyone,¹⁷⁵ including developing countries;
- c) The obligation to explore and exploit¹⁷⁶ for peaceful purposes only;
- d) The duty to pay due regard to scientific research;¹⁷⁷
- e) The duty to protect the environment.¹⁷⁸

956 1990 . Oxman, Bernard, The Territorial Temptation: A Siren Song at Sea, *The American Journal of International Law* 100, no. 4, 830-851 2006 .

¹⁷⁰ *Cuius est solum, eius est usque ad coelum et ad inferos*, Latin for whoever’s is the soil; it is theirs all the way to Heaven and all the way to Hell . *Jackson Mun, Airport Auth. v. Evans*, 191 So. 2d 126, 128 Miss. 1966. transcribing doctrine as “ad inferos” . Hepburn, Samantha J., Ownership Models for Geological Sequestration: A Comparison of the Emergent Regulatory Models in Australia & the United States, 44 *ENVTL. L. REP. NEWS & ANALYSIS*, 310-313, 2014 . translating phrase as “whoever owns [the] soil, [it] is theirs all the way [up] to Heaven and [down] to Hell” .

¹⁷¹ *Mare liberum* Leiden: Elzevier, 1609 . Reprinted and translated many times since. The translation and edition by Ralph van Deman Magoffin Oxford: Oxford University Press, 1916, contains a facsimile of the 1633 edition. See also the recently published *The Free Sea; trans. by Richard Hakluyt with William Welwod’s critique and Grotius’s reply*, edited and with an introduction by David Armitage Indianapolis: Liberty Fund, 2004 . Grotius, Hugo, *Mare Liberum, The Free Sea* 1609 ; Martinus Nijhoff, Bilingual edition 2009 .

¹⁷² *Mare Liberum*, Peace Palace Library. Available at <https://www.peacepalacelibrary.nl/imagecollection/mare-liberum/>

¹⁷³ Grotius, H., The ‘*Freedom of the Seas*,’ Tran’s. Scott, J.B., *Latin and English version, Magoffin trans.* 1608 .

¹⁷⁴ For further read in the right of appropriation see Virgiliu, Pop, Appropriation in Outer Space: the Relationship between Land Ownership and Sovereignty on the Celestial Bodies, *Space Policy, Vol. 16, Issue 4*, PP. 275-282 2000 .

¹⁷⁵ Tennen, Leslie, Outer Space: A Preserve for All Humankind, 2 *Hous. J. Int’l L.* 145 1979-1980 .

¹⁷⁶ Further analyses see generally Trimble, James, International Law of Outer Space and its Effect on Commercial Space Activity, 11 *Pepp. L. Rev.* 3 1984 .

¹⁷⁷ NASA was created by the National Aeronautics and Space Act of 1958 NAS Act , 42 U.S.C. §§ 2451-2484 1976 & Supp. V 1981 . Space efforts dealing with weapons systems, military operations, or defense are reserved to the Department of Defense, subject to the direction of the President. 42 U.S.C. § 2451 b 1976 .

¹⁷⁸ Private enterprise has always been expected to participate in the use and exploitation of outer space. See Christol, C., *Modern International Law of Outer Space*, Xi 1982 . Menter, Martin, *Legal Regime of International Space Flight*. In: *Space Shuffle and the Law*, 61 S. Gorove ed. 1980. “It is thus apparent that the 1967 Treaty envisions activities in space by private enterprise” . For a discussion of the Soviet Union’s attempt to exclude private enterprise from outer space, and the United States’ response, see Dula, Arthur, *Management of Interparty and Third-Party Liability for Routine Space Shuttle Operations*. In: *SPACE SURVEILLANCE AND THE LAW* 93, 95 S. Gorove ed. 1980 . Dula, Arthur, Regulation of Private Commercial Space Activities, 23 *JURIMETRICS J.* 156, 172 1982 . See also Jaksetic, E., The Peaceful Uses of Outer Space: Soviet Views, 28 *Am. U.L. REV.* 483 1979 . a discussion of the Soviet Union’s views on space law in general . Trimble, *supra* note 176, at. 3.

Turning to the international agreements more closely, the Moscow Treaty,¹⁷⁹ or the Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water, was signed and ratified by the governments of the Soviet Union, United Kingdom and the United States in 1963. As a consequence, states have agreed to apply the international law principles of *res communis* to ensure the preclusion of the national appropriation of outer space and any of the celestial objects by claim of sovereignty.

The United Nations General Assembly, in its efforts to promote international cooperation in the field of outer space, adopted a number of resolutions regarding this matter, among them: Resolution 1472 XIV of 1959 establishing the Committee on the Peaceful Uses of Outer Space COPUOS ;¹⁸⁰ Resolution 1721 XVI of 1961 International Co-operation in the Peaceful Uses of Outer Space;¹⁸¹ Resolution 1962 XVIII , the Declaration of Legal Principles Governing the Activities of States in the Exploration and Uses of Outer Space of 13 December 1963;¹⁸² Resolution 37/92 regarding Principles Governing the Use by States of Artificial Earth Satellites for International Direct Television Broadcasting of 10 December 1982;¹⁸³ Resolution 41/65 regarding the Principles Relating to Remote Sensing of the Earth from Outer Space of 3 December 1986;¹⁸⁴ Resolution 47/68 regarding the Principles Relevant to the Use of Nuclear Power Sources in Outer Space of 14 December 1992;¹⁸⁵ and Resolution 51/122 regarding the Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States of 13 December 1996.¹⁸⁶

As an outcome of U.N. efforts aimed at regulating the conduct of states that undertake space exploration, the following international treaties have been negotiated and drafted under the auspices of UNCOPUOS: the 1967 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies known as “Outer Space Treaty” ;¹⁸⁷ the 1968 Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space the Rescue Agreement ;¹⁸⁸ the 1972 Convention on International Liability for Damage Caused by Space Objects the Liability Convention ;¹⁸⁹ the 1975 Convention on the Registration of

¹⁷⁹ Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water, Moscow, August 5, 1963, *The American Journal of International Law* 57, no. 4 1963 .

¹⁸⁰ Further read and analysis see Zahoor, Saadia, Maintaining International Peace and Security by Regulating Military Use of Outer Space, *Policy Perspectives*, vol. 14, no. 2, pp. 113–135, 2017.

¹⁸¹ Resolutions adopted by The United Nations General Assembly: 1721 XVI . International Co-operation in the Peaceful Uses of Outer Space, *Bulletin of the American Meteorological Society* 43, no. 4 1962 .

¹⁸² Aerospace Law: Progress in the UN. In: *Explorations in Aerospace Law: Selected Essays, 1946-1966*, edited by Vlasic Ivan A., and Cooper John Cobb, 327-38, Montreal: McGill-Queen’s University Press, 1968.

¹⁸³ Resolution adopted by the General Assembly: 37/92. Principles Governing the Use by States of Artificial Earth Satellites for International Direct Television Broadcasting, *The American Journal of International Law* 77, no. 3, 733-36. 1983 .

¹⁸⁴ Nirmal, B.C., Legal Regulation of Remote Sensing: Some Critical Issues, *Journal of the Indian Law Institute* 54, no. 4, 451-79 2012 . Hanley, Colleen, Regulating Commercial Remote Sensing Satellites over Israel: A Black Hole in the Open Skies Doctrine? *Administrative Law Review* 52, no. 1, 423-442 2000 . Szawłowski, Richard rev , *Remote Sensing of the Earth from Outer Space in the Light of International Law*, *The American Journal of International Law*, vol. 84, no. 2, pp. 626–627, 1990.

¹⁸⁵ Christol, C., United Nations: General Assembly Resolution and Principles Relevant To The Use Of Nuclear Power Sources. In: Outer Space, *International Legal Materials* 32, no. 3, 917-926 1993 . Nirmal, B.C. Legal Regulation of Remote Sensing: Some Critical Issues, *Journal of the Indian Law Institute* 54, no. 4, 451-79 2012 .

¹⁸⁶ Resolution 51/122 of 13 December 1996. Many scholarly written articles on the resolution, i.e., see Dean, Jonathan, *Future Security in Space: Commercial, Military, and Arms Control Trade-Offs*. [Report] Edited by Moltz James Clay, James Martin Center for Nonproliferation Studies CNS , pp. 3-7, 2002. Khan, Saeed, Space Law for Peace: A Critical Review, *Pakistan Horizon* 59, no. 2, pp. 83-106 2006 .

¹⁸⁷ Further analysis of the treaty; see Annette Froehlich, et al., *A Fresh View on the Outer Space Treaty*, Springer, Vienna 2018.

¹⁸⁸ For further discussion on the agreement see Gorove, Stephen, The Recovery and Return of Objects Launched into Outer Space: A Legal Analysis and Interpretation, *The International Lawyer* 4, no. 4, 682-694, 1970.

¹⁸⁹ Convention on International Liability for Damage Caused by Space Objects opened for signature 29 March 1972. Entered into force 1 September 1972: 10 ILM 965 1971 : 24 UST 2389: TIAS 7762: 961 UNTS 187.

Objects Launched into Outer Space the Registration Convention ,¹⁹⁰ and the 1979 Agreement Governing the Activities of States on the Moon and Other Celestial Bodies the Moon Treaty .¹⁹¹

We now turn to the question of how space mining should be regulated. The Outer Space Treaty is geared toward nations, but in *theory* it might not apply to private companies.¹⁹²

At the same time, the treaty also specifies that states are responsible for ensuring that private individuals and corporations within their borders abide by all the terms of the treaty. This means that the states would be forced not to allow private companies,¹⁹³ for instance, to exert any claims of ownership or exploitation.

On the same level, there is another provision in the Outer Space Treaty, which states that “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.”¹⁹⁴ Now, does *mining* fall under *use*?¹⁹⁵ The answer might be yes to some,¹⁹⁶ and the argument here is that any material extracted from celestial bodies belongs to the entity that performed the extraction.

States may undertake space mining operations on their own, allow private companies to carry out such activities or participate in the space mining operations of international organizations.

However, in the latter case, the responsibility for the adoption of and compliance with safety standards would be borne both by the international organizations and by the states participating in such organizations.¹⁹⁷

Similarly, if two or more states jointly undertake space mining activities,¹⁹⁸ each state will be expected to adopt and impose space mining safety standards¹⁹⁹ and procedures.

One of the many phases required in the regulation of space is to address a uniform international regulatory system for space mining, and that could be the ratification of the Moon Agreement in order that states can abide by what I suggest is called an “outer space governance”.

¹⁹⁰ In the historical context of the treaty see von der Dunk, Frans G., *The Registration Convention: Background and Historical Context*, *Space, Cyber, and Telecommunications Law Program Faculty Publications*, 32, 2003.

¹⁹¹ Agreement Governing the Activities of States on the Moon and Other Celestial Bodies Moon Agreement , New York, done 18 December 1979, entered into force 11 July 1984; *1363 UNTS* 3; *ATS 1986 No. 14*; *18 ILM* 1434 1979 .

¹⁹² In private companies and exploring the space see Simberg, Rand, Property Rights in Space, *The New Atlantis*, no. 37, pp. 20-31 2012 .

¹⁹³ Blount, P.J., Renovating Space: The Future of International Space Law, *Denv J Intl L & Pol'y* 515-532, 2011. Marks, P., Who Owns Asteroids or the Moon? 2 *New Scientist* 28-29, 2012 . Mincke, W., Objects of Property Rights. In: Van Maanen GE and Van der Walt AJ eds . *Property Law on the Threshold of the 21st Century*, MAKLU Uitgevers Antwerpen, 651-668, 1996. Reynolds, GH. Merges, R.P., *Outer Space: Problems of Law and Policy*, 2nd ed Westview Press Boulder 1998. Wasser, A., Jobes, D., Space Settlements, Property Rights, and International Law: Could a Lunar Settlement Claim the Lunar Real Estate It Needs to Survive, *J Air L & Com* 37-78, 2008.

¹⁹⁴ Article 1 of the Outer Space Treaty.

¹⁹⁵ For a detailed discussion on this subject, see Jakhu, Ram S., Pelton, Joseph N., *Space Mining and its Regulation*, New York, Springer Press 2016 .

¹⁹⁶ The case of NASA which claimed ownership of 842 pounds of lunar rock collected during the Apollo missions.

¹⁹⁷ Outer Space Treaty, article VI.

¹⁹⁸ It is recently reported that the “Luxembourg Government will work with Deep Space Industries [from the U.S.]... to develop the technology needed to mine asteroids and build a supply chain of valuable resources in space.” See “Prospector-X™: An International Mission to Test Technologies for Asteroid Mining,” online Deep Space Industries. Available at <https://goo.gl/s3Th74>.

¹⁹⁹ *i.e.*, the U.S. Commercial Space Launch Competitiveness Act CSLCA . The bill does not allow ownership of an asteroid, or a swath of the moon, or any other section of extraterrestrial real estate — just the resources extracted from such a body.

However, the success of outer space mining will depend upon the appropriate and timely determination of solutions to the following issues:

- (a) What are the potentially positive global benefits to space mining that might be derived and equitably shared through future regulation?
- (b) What are the major safety risks in space mining, and how should safety standards and procedures be formulated and implemented and by whom?
- (c) What would be the legal consequences for non-compliance with such standards and procedures?

For the time being these questions are largely theoretical; however, it is difficult to discuss outer space resources, minerals and even debris without some understanding of the central role played by international law.²⁰⁰ It is not practical in this paper, however, to attempt to survey all of the international rules, institutions, arrangements, and procedures bearing on natural resource policies and issues in outer space.

The adoption of national laws, like the U.S. SREU Act of 2015,²⁰¹ are the first important steps for initiating a governance system as they provide a national regulatory basis for the licensing process and continuous supervision of, and the imposition of safety standards and procedures upon, the space mining activities of private companies.

At best, the challenge will be to implement these laws in such a way that would not breach the international obligations of the concerned states.

Since space mining operations will take place in the international environment of outer space or on celestial bodies including asteroids, it would seem logical that safety standards and procedures are international, national and comprehensive in their nature and scope so that all interests of states space faring and non-space faring remain protected. It would also be prudent for these standards and procedures to use common metrics and interfaces so that rescue or repair operations could be more easily achieved.²⁰²

Following on from the discussion in the preceding part, it is clear that innovation and space mining is exorbitant and if a state invests in this enterprise, it will need protection.²⁰³ This is where property law comes in. In referring to Bentham²⁰⁴ and Locke,²⁰⁵ Rose²⁰⁶ underlines the essential argument for the protection of property interests. “[P]eople will not work much without some inducement, and if there is no such inducement to labor, resources lie undeveloped and total wealth remains low. What induces people to labor? Property does. Let people have secure property, and they will learn to invest their labor

²⁰⁰ Bilder, Richard, *International Law and Natural Resources Policies*, 20 *Nat. Resources J.*, 451, 1980 .

²⁰¹ Space Resource Exploration and Utilization Act of 2015, 51 *U.S.C.A.* 513 §51303. Further reading on the Act, see generally National Space Policy of the United States of America 2010 . Available at <https://goo.gl/qiWcZA> HR 1508 - Space Resource Exploration and Utilization Act of 2015 Purpose and summary – need for legislation .

²⁰² Jakhu, Ram S., Pelton, Joseph N., Regulation of Safety of Space Mining and its Implications for Space Safety, *Journal of Space Safety Engineering*, Vol. 3 No. 2, pp. 67-72 2016 .

²⁰³ Here there is the need to rethinking *terra nullius* and property law in space. The terra nullius literally a ‘land belonging to nobody’. For further reading in this matter see Banner, Stuart, Why Terra Nullius? Anthropology and Property Law in Early Australia, *Law and History Review*23, no. 1, 95-131 2005 .

²⁰⁴ Bentham, J., “Principles of the Civil Code”. In: Bowring, J., ed *The Works of Jeremy Bentham, Vol I.*, William Tait Edinburgh, pp. 297-364 1864 .

²⁰⁵ Locke, J., Laslett, P., *Two Treatises of Government* Cambridge Texts in the History of Political Thought , 3rd Edition, Cambridge University Press Cambridge 1988 .

²⁰⁶ Rose, Carol, Property as the Keystone Right? 71 *Notre Dame L Rev* 329-369 1996 .

on the things that they own, because they themselves will take the rewards. Once able to trade, they will invest even more in socially useful activities, because the whole world becomes the market for their efforts.”²⁰⁷

However, ownership is considered to be the right that gives one the most comprehensive set of rights.²⁰⁸

So, dealing with property in outer space, as mentioned and referenced above with regard to the common heritage of mankind principle, relates to the international management of resources *within* a territory, rather than the territory itself²⁰⁹

Looking at the big picture, the “freedom of scientific investigation ... [allows states to] collect on and remove from the moon samples of its mineral and other substances,”²¹⁰ “on or below [the moon’s] surface.”²¹¹ The Outer Space Treaty further states that “[s]uch samples shall remain at the disposal of those States Parties which caused them to be collected and may be used by them for scientific purposes.”²¹²

8. Conclusion

Having considered the issues relating to the development of and needs for space-focused regulations in the area of space mining, it is clear that outer space is considered a common heritage of mankind and there is no state that can declare ownership thereof; rather, other than any use for peaceful purposes, space itself is protected.

Life on Earth shows that physical evolution results when a *need* arises. However, man’s broad acceptance of a common heritage approach to land and its resources demands a *psychological* evolution rather than a physical change mandated by his environment.²¹³ As a solution, the international community could agree to abstain from exploitation for a period of time, as in the Antarctic Treaty.²¹⁴

Evidently, the problem of legal regulations still remains, as there needs to be a safe and clear legal progression for the private enterprise of different nations to thrive and settle disputes. Also, even setting aside the common heritage of mankind principle and following the factual provisions of the Outer Space Treaty, one must bear in mind the safety reasons behind regulations and avoid excess expense on space activities.

²⁰⁷ Erlank, W., *Property Rights in Space: Moving the Goal Posts so the Players don't Notice*, Potchefstroom Electronic Law Journal, Vol 19, p. 17 2016 .

²⁰⁸ These rights are sometimes referred to as “competencies” that relate to an object.

²⁰⁹ Joyner, Christopher C., *The Concept of the Common Heritage of Mankind in International Law*, 13 *Emory INT'L L. Rev.* 615, 620 1999 .

²¹⁰ The Moon Treaty, art. 6. Allows promotion.

²¹¹ *Ibid.*, art. 6, 8. Allows exploitation.

²¹² *Ibid.*, art. 6.

²¹³ Buxton, Carol R., *Property in Outer Space: The Common Heritage of Mankind Principle vs. the First in Time, First in Right, Rule of Property*, 69 *J. Air L. & Com.* 689, 2004 .

²¹⁴ See *Naval Treaty Implementation, Antarctic Treaty*. stating that representatives of twelve nations signed the Antarctic Treaty on December 1, 1959, and the treaty became effective in 1961 . Those original signatories were: Argentina, Australia, Belgium, Chile, France, Japan, New Zealand, Norway, South Africa, United Kingdom, United States and the USSR. The Antarctic Treaty applies to the area south of 60° South latitude. Through this agreement, the countries active in Antarctica consult on the uses of the whole continent, with a commitment that it should not become the scene or object of international discord. *Available at* www.nawcwpns.navy.mil/treaty/Ant.html.

First of all, with regard to the safety of mining operations or other space activities, the question is, will its regulation be easy? One may say yes, and I would regard this answer as relating to the progress of technology and to the progress of international law above all. It is unquestionably true that today's technology is not yet as advanced as it hopefully will be in the field of mining equipment, as such equipment must not create space debris.

Russia on the other hand, has its own regulations on establishing safety zones around space installations and objects. That is to say, it does not constitute appropriation "by other means", as its purpose is the safety of any third party equipment, personnel or the facility/vehicle itself. One would not like unauthorized personnel to go near the mining site due to the risk of injury, damage, or death.²¹⁵

In conclusion, I must emphasize that there is a need for a broader discussion on ways in which all entities can participate in deep space endeavors, and coming to terms on this may require an agreement similar to the one established with the International Space Station Inter-governmental Agreement of 1998. Humanity already carries the burden of space exploration, and every new approach is a new frontier, that will benefit all humanity.²¹⁶

²¹⁵ Muzyka, Kamil, The common burden of "spacemankind", 2017. Available at <http://www.thespacereview.com/article/3279/1>

²¹⁶ *Ibid.*