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Space mining and the legal framework of Outer Space

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Introduction

In recent years, technological advancements have increased the possibilities for Mankind to reach to Outer Space, making it an ever feasible and cheaper endeavor. Going to space and placing space objects in orbit is no longer the remit of just a few countries, like the United States or Russia, but an activity on which many countries rely for their activities here on Earth. An example of this is ISRO, India's Space Organisation, which for years has managed to send rockets to space at a fraction of the cost of what NASA's launches require. And this is not limited to public organizations, since even private actors have begun to launch objects into Outer Space using (mostly) their own resources. The most concrete example of this is the launching record of SpaceX, an American company which has developed the technology necessary for reusing booster rockets, thereby reducing the cost of escaping Earth's gravity by quite a margin. Recently, another American company, Blue Origin, has also achieved a similar feat. It is quite possible, and some might say even inevitable, that as this technology continues to evolve and even other entities (either private companies or government entities) develop similar or newer approaches to reaching Outer Space, the costs of space access will continue to fall, opening the heavens to all kinds of new activities. Indeed, companies already exist with bold ambitions for commercial activities, one of which is the extraction of natural resources from celestial bodies, or space mining, something that, other than the small mineral recollection done by the Apollo missions in the 1960s, has never been done before. This raises the question of how these new pursuits would be regulated, and what are the legal rights and obligations of States and/or private actors when carrying them out.

Human activity in Outer Space is currently regulated by what is known as the "five United Nations treaties on Outer Space", a series of legal texts signed between 1967 and 1984 the most important of which is the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (the Outer Space Treaty, or OST).¹ While these legal instruments certainly cover a broad range of subjects regarding human activity in space, there is a legal debate on how or even whether their regulations would cover an

¹ The rest of the agreements and conventions cover issues like the rescue of astronauts (the "Rescue Agreement"), liability for damage caused by space objects (the "Liability Convention"), the registration of objects launched into space (the "Registration Convention"), and the activities of States on the Moon and other Celestial Bodies (the "Moon Agreement"). Their texts are available at <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties.html>

activity such as space mining. This is particularly true of the OST, the treaty that establishes the general framework for regulating human activity in space.

As its name implies, the purpose of the OST is to establish the main principles that will govern human exploration and use of Outer Space. These include the freedom of exploration and use of Outer Space, the identification of the exploration and use of Outer Space as “the province of all mankind”, and the no appropriation principle. Taken together, these principles are understood to mean that while States, or entities for which States are responsible, may freely explore and even make use of Outer Space, no State may make sovereign claims on any part of it. Outer Space cannot be subject to principles of territorial sovereignty, a principle that would seem to clash with the idea of extracting natural resources from celestial bodies. Indeed, there is uncertainty regarding how the principles of the OST would apply to those types of activities, with the discussion ranging from those that read the OST with a focus on the idea of Outer Space as the “province of all mankind”, thereby excluding the possibility of private commercial activities taking place, to those that find in its articles no restriction to them. Within this camp, a limited number of countries, including the U.S., Luxembourg, the United Arab Emirates, and Japan have begun to establish rules and guidelines for carrying out space mining activities. In this context, the purpose of the dissertation is to try to discern the question of how the current legal regime would apply to those activities.

This paper proceeds as follows: First, in order to properly situate the magnitude of the discussion, it presents a brief overview of the activities that would fall within the “space mining” category, including the main components of what that type of missions would entail, as well as the possible economic dividends that would (tentatively) follow. Afterwards, it presents a discussion on the legal framework that would apply to these types of activities, as well as the legal issues raised by the prospect of space mining, with a particular focus on whether such activities could legally take place as a “use” of outer space. This is then followed by an analysis on the limits that said activities would face vis a vis the idea of the “province of all mankind”, as well as the matter of no-appropriation within the national legislation of States.

While the primary focus of the analysis would necessarily fall on the OST as the main legal source of obligations and principles that govern human activities in outer space, this work would try to take a more overarching view of the whole legal framework for Outer Space and try to extract its conclusions from this analysis. This is important because, while the OST enjoys a strong support within the international community, the law of outer space has continued to develop through other

means, such as other treaties, “soft law”, and even the practice of States. Thus, the Moon Agreement, the reports of the Legal Subcommittee of UNCOPUOS, as well as several UN General Assembly resolutions and national legislation on space mining, are also part of the discussion of this paper. Based on their joint reading, this paper proposes that commercial activities in Outer Space, in particular space mining, would be allowed in the context of the current legal framework, as long as the tenets of the “province of all mankind” and “no appropriation” principles are respected. This is based on a joint reading of the OST, the Moon Agreement and recent developments within the UN.

Economic Activities in Outer Space: Space Mining

As mentioned above, in recent years, technological advances have made possible achievements that once might have been considered as far-fetched possibilities, more suitable to Flash Gordon-esque pulp adventures than to reality. Then again, human ingenuity tends to constantly expand the limits of what is possible. Once only considered within the realm of science fiction, space mining seems to be one of the next frontiers in the advancement of human space flight. Beyond the idea of continuing the cause of human exploration, the following (non-exhaustive) factors can help explain the allure of space mining: Evolving knowledge of the composition of Earth's neighborhood, including that Near Earth Objects (NEOs); the advent of lower costs for the launching of space objects, and the prospects of diminishing planetary resources in the context of a continuously expanding global population in a world affected by climate change.

Regarding the first factor, NASA currently estimates that there are over a million asteroids in the Solar System, most of which is located within the Asteroid Belt between Mars and Jupiter.² Of these, over 26,000 thousand are considered to be NEOs, which are defined as “comets and asteroids that have been nudged by the gravitational attraction of nearby planets into orbits that allow them to enter the Earth's neighborhood”.³ This count of NEOs includes 114 Near-Earth comets, 888 Near-Earth asteroids over a kilometer long, and more than 9,000 Near-Earth asteroids bigger than 140 meters.⁴ The composition of a NEO can include clay and silicate rocks, silicate materials, metals like nickel and iron, and ice.⁵ Additionally, due to them being a result of the formation of the solar system, the presence of rare metals, like silver, gold and platinum, has been treated with a high degree of confidence. All these elements are materials that “could be used in developing the space structures and in generating the rocket fuel that will be required to explore and colonize our solar system in the twenty-first century”⁶, as well as to help sustain life during humanity's endeavors in outer space.

² “Asteroids in-depth”, NASA (2021), last accessed on 21 July, 2021. Available at <https://solarsystem.nasa.gov/asteroids-comets-and-meteors/asteroids/in-depth/>

³ “NEO Basics”, Center for Near Earth Object Studies (CNEOS), last accessed on 21 July, 2021. Available at <https://cneos.jpl.nasa.gov/about/basics.html>

⁴ Figures as of May 2021. “Discovery Statistics”, CNEOS, last accessed on 21 July, 2021. Available at <https://cneos.jpl.nasa.gov/stats/totals.html>

⁵ “Asteroids in-depth”, NASA Science (2021), last accessed on 21 July, 2021. Available at <https://solarsystem.nasa.gov/asteroids-comets-and-meteors/asteroids/in-depth/>

⁶ “NEO Basics (NEAs as Resources)”, CNEOS, last accessed on 21 July, 2021. Available at https://cneos.jpl.nasa.gov/about/nea_resource.html

Similarly, mining the resources available on the Moon would make sense in the long-term view of space exploration, since Earth's satellite could be used as the platform for launching deep space missions which would be prohibitively expensive to supply directly from Earth. Thus, *in-situ* resource utilization will be important to generate products with local materials that would make possible said activities⁷ and the composition of the Moon has been proven to include such materials. It is estimated that the crust or upper layer of the Moon contains oxygen, silicon, magnesium, iron, calcium, and aluminum, with small amounts of titanium, uranium, thorium, potassium, and hydrogen⁸, which through the appropriate processing could be used for the construction of human-supporting structures, like lunar bases. Additionally, water-ice has been confirmed to exist in the shadows of craters near the poles of the Moon, where the warmest temperatures never reach above -156°C⁹, and more recently in parts of the sunlit surface, which would indicate that its presence is more widespread than originally supposed.¹⁰ This is relevant because water could be used as radiation shielding for either human habitats or spaceships, but also because it can be separated into oxygen and hydrogen, with the oxygen used for life support, and hydrogen and oxygen being used for rocket propellant.¹¹ The ability to conduct this particular sort of operations *in situ* would represent a key achievement towards the development of further human presence in space, since this would eliminate one of its most important limiting factors: the launching of fuel, which usually represents more than 90% of the mass of a given launch.¹²

The second factor deals with how mankind reaches outer space, particularly the potential entailed in the lowering of costs for the launching of objects into it. The key for achieving reduced costs lies in the reusability of the equipment used for launches, which usually is discarded after just one use. A 2017 study posits that “if an entire launch vehicle could be reused 10 times with minimal maintenance between flights, it could in theory reduce the effective vehicle cost by roughly an

⁷ “Overview: In-Situ Resource Utilization”, NASA (2020), last accessed on 21 July, 2021. Available at <https://www.nasa.gov/isru/overview>

⁸ “Earth’s Moon”, NASA Science (2019), last accessed on 21 July, 2021. Available at https://solarsystem.nasa.gov/moons/earths-moon/in-depth/#otp_structure

⁹ “Ice Confirmed at the Moon’s Poles”, NASA Jet Propulsion Laboratory (2018), last accessed on 21 July, 2021. Available at <https://www.jpl.nasa.gov/news/ice-confirmed-at-the-moons-poles>

¹⁰ “NASA’s SOFIA Discovers Water on Sunlit Surface of Moon”, NASA (2020), last accessed on 21 July, 2021. Available at <https://www.nasa.gov/press-release/nasa-s-sofia-discovers-water-on-sunlit-surface-of-moon>

¹¹ David Kornuta, et al, “Commercial lunar propellant architecture: A collaborative study of lunar propellant production”. *REACH - Reviews in Human Space Exploration*, (2019), vol. 13, p. 3.

¹² “Lowering the Cost of Human Spaceflight”, *Air & Space Magazine*, (2016), last accessed on 21 July, 2021. Available at <https://www.airspacemag.com/daily-planet/lowering-cost-human-spaceflight-180960420/>

order of magnitude”¹³, a feat that would open the possibility of conducting more launches more frequently. If reusability is then combined with the use of a “heavy lift” vehicle to send more mass with each launch¹⁴, then prices could be lowered even further. As it was mentioned above, the technology for the reusability of rocket components has gained momentum recently with the success of private company SpaceX. However, that is not the only current effort; another American company, Blue Origin, has also developed the technology and has successfully launched reusable rockets. Outside the United States there are also efforts to develop this kind technology. For example, the European Space Agency has begun to develop the Themis program, which expects to carry out an in-flight demonstration of a prototype reusable rocket in 2023.¹⁵ For its part, ISRO has also announced efforts to develop its launch vehicles towards heavy lift capabilities, achieving partial and full reusability, within the next decade.¹⁶ Surely, more countries will follow on this trend and thus it would be expected that space access will continue to open up in the future.

Finally, it is important to acknowledge that Earth is not a planet that contains infinite resources, but that instead it is a finite system whose limits are only now being found out and studied.¹⁷ While it would seem that this is stepping into the realm of science fiction, it is not ridiculous to think that as the human population continues to grow and consume ever more of the planet’s natural resources, such as minerals and fossil fuels, outer space will emerge as an alternative for the sourcing of certain materials that are threatened by exhaustion due to their over-exploitation on Earth.¹⁸ One has to keep in mind that, while it is certain that mankind’s ingenuity to solve problems knows no boundaries, so it is certain that its urge for consumption is not going to stop.

¹³ K. Johnson & T. Roberts, “Implications of Ultra-Low -Cost Access to Space”, Center for Strategic and International Studies, (2017), p. 5. Available at <https://www.researchgate.net/publication/320911516>

¹⁴ Both the private company SpaceX and NASA have programs in place that aim to produce such kind of vehicles, although the one from NASA is not designed to be reusable.

¹⁵ “ESA plans demonstration of a reusable rocket stage”, European Space Agency, (2020), last accessed on 21 July, 2021. Available at https://www.esa.int/Enabling_Support/Space_Engineering_Technology/ESA_plans_demonstration_of_a_reusable_rocket_stage

¹⁶ “Laying a firm foundation for the next decade”, Department of Space, Indian Space Research Organisation (2021). last accessed on 21 July, 2021. Available at <https://www.isro.gov.in/update/01-jan-2021/secretary-dos-chairman-isro%E2%80%99s-new-year-message-2021-%E2%80%9Claying-firm-foundation-next>

¹⁷ An example of this is the concept of “planetary boundaries” developed by the Stockholm Resilience Center, which can be found here <https://www.stockholmresilience.org/research/planetary-boundaries/the-nine-planetary-boundaries.html>

¹⁸ F. Tronchetti, “Legal Aspects of Space Resource Utilization”, in F. von der Dunk and F. Tronchetti (eds.). *Handbook of Space Law*, (2015), UK, Edward Elgar Publishing, p. 776.

With this in mind, the following section turns to the discussion of the legal issues posed by space mining. Why would this be important? The peaceful and orderly development of these activities will rest on the coordination and cooperation of multiple actors, which in turn will require the certainty that only a proper legal framework can provide. Furthermore, the general issue of Outer Space, with its promises and perils for humanity as a whole, is not suitable, to use the words of Bruno Simma, of the bilateralism that characterized international law in its early stages, but perhaps instead of the idea of “community interest” understood “as a consensus according to which respect for certain fundamental values is not to be left to the free disposition of States individually or inter se but is recognized and sanctioned by international law as a matter of concern to all States”.¹⁹ The alternative would be a chaotic and first come-first served race for resources that would only benefit those entities, either public or private, with the available means to conduct said activities, further entrenching the already worrying inequality gap. Worse, it could lead to bringing into Outer Space the very conflicts that during the last 50 years the current legal framework has managed to avoid.

¹⁹ Bruno Simma, “From Bilateralism to Community Interest in International Law”, in *Collected Courses of the Hague Academy of International Law*, vol. 250, p. 234. Consulted online on 26 July 2021 http://dx.doi.org/10.1163/1875-8096_pplrdc_A9789041104199_02

Legal Issues

The point of departure for any discussion on whether space mining is legally allowed by the current applicable rules of international law of outer space must be the principles established in the Outer Space Treaty. Accordingly, through an analysis of its text, this section will first consider the general limitations that States face when carrying out activities in outer space. This will then allow for the consideration of the specificities posed by economic activities such as space mining, particularly regarding the status of outer space as part of the global commons, and to the issue of the appropriation of resources. While throughout the analysis the main focus is placed on the provisions of the OST, this is complemented by the provisions of other legal documents through which the law of outer space has also developed and through which we can understand its limitations, such as the Moon Agreement and UN General Assembly resolutions. It is also contrasted with recent State practice on the matter.

Activities in Outer Space: The Legal Framework

An understanding of what States are actually allowed to do in Outer Space as per the current legal framework is essential in order to be able to discuss the possibilities and limitations for economic activities. As such, an in-depth discussion of the provisions of the OST, and other relevant conventions, is necessary. This section will thus proceed with a brief overview of the background of the treaty and will then follow with an analysis of its main articles.

Background

The legal framework that regulates Outer Space is, to put it simply, a result of the political climate of the Cold War. Although the rocket technology that makes possible for man to reach for the stars actually debuted, and was shown for its possible deadly consequences in World War II, it wasn't until it appeared as a possibility that the confrontation between the United States and the USSR could extend to Outer Space that a legal regime was thought of in order to regulate State behavior beyond Earth. It was the Soviet launch of Sputnik I in October 1957, the first manmade satellite to circle the planet, that kickstarted the process, as "it became clear that a new area of competition between the two superpowers of the day had been opened, especially as the United States had been

caught quite unaware and were certain to react in one way or another.”²⁰ Thus, the process began, appropriately, within the United Nations. An Ad Hoc Committee was established first in 1958, and one year later a permanent Committee on the Peaceful Uses of Outer Space (UNCOPUOS) “became the essential step” for the development of space law.²¹ To this day, UNCOPUOS meets annually to discuss advances in the peaceful uses of Outer Space, as well as to consider best practices of a technical nature and the developments of the legal instruments.

The work of this Committee led to the approval of UN General Assembly resolution 1721 (XVI), titled “International co-operation in the peaceful uses of outer space” This resolution, the first that dealt with matters of Outer Space in the UN context, established some basic notions that later on would be developed as part of core principles of the UN treaties in the matter.²² This would be followed two years later by UN General Assembly resolution 1962 (XVIII), titled “Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space”, whose aim was, as reflected in its title, to establish the norms that would guide the behavior of States in outer space.²³ It further elaborated on the principles already stated in resolution 1721²⁴, including: the freedom of use and exploration of outer space and celestial bodies by all States; the

²⁰ P. Jankowitsch, “The background and history of space law”, in F. von der Dunk and F. Tronchetti (eds.), *Handbook of Space Law*, (2015), UK, Edward Elgar Publishing, p. 3.

²¹ V. Kopal, “Origins of space law and the role of the United Nations”, in C. Brunner & A. Soucek (eds.), *Outer Space in Society, Politics and Law*, (2012), Germany, Springer-Verlag/Wien, p. 224.

²² UN General Assembly resolution 1721, “International co-operation in the peaceful uses of outer space”, A/RES/1721(XVI)[C], (20 December, 1961), available from https://digitallibrary.un.org/record/665196/files/A_RES_1721%28XVI%29%5BC%5D-EN.pdf

²³ UN General Assembly resolution 1962, A/RES/1962(XVIII), “Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space”, (13 December, 1963), available from <https://digitallibrary.un.org/record/203965?ln=en>

²⁴ Both resolutions (1721 and 1962) are registered as “adopted without a vote”. This is a decision-making method used by the UN General Assembly to adopt decisions when there is no specific request for a vote and when there is no objection to the draft resolution (see Thomas Fitschen, “Ch. IV The General Assembly, Procedure, Article 21”, in Bruno Simma et al, *The Charter of the United Nations: A Commentary*, volume 1, 3rd edition, (2012), Oxford University Press, para 78, p. 710.). According to Higgins et al, “The concept of ‘adoption without a vote’ is very close to [that of] consensus, and the distinction between the two methods is often blurred.” (see Dame Rosalyn Higgins et al, *Oppenheim’s International Law: United Nations*, Oxford University Press, 2015, para. 10.16, p. 364.). Wolfrum notes that the difference lies in that resolutions adopted by consensus require consultations taking place before the voting. “In the case where a resolution is adopted under consensus, consultations take place and, assuming there are no objections, the chairman of the GA will declare that ‘it was so decided’. In contrast, in the without-a-vote procedure no negotiations take place and compared to decisions taken with unanimity the consensus does not require a positive cast vote of all delegates present and voting”. He also notes that “If a resolution contains a set of legal rules or principles, its adoption by consensus suggests a comparatively higher degree of general acceptability of its substance. Hence it can embody a consensus of opinion about what the law is so that, indirectly, it becomes evidence of international law” (see Rüdiger Wolfrum, “Ch. IV The General Assembly, Voting, Article 18”, in Bruno Simma et al, *The Charter of the United Nations: A Commentary*, volume 1, 3rd edition, (2012), Oxford University Press, para 32, p 633.).

no appropriation principle; the application of international law, as well as the UN Charter, to outer space and celestial bodies; the international responsibility of States for national activities in outer space, either from governmental or non-governmental entities; and the jurisdiction of State over the objects they launch into outer space. Most importantly, it declares that the exploration and use of outer space shall be carried on for the benefit and in the interests of all mankind, an important distinction that in effect separated Outer Space from the geopolitical tensions of the Cold War (or rather, the general political tensions of planet Earth). Resolution 1962 has been characterized as “the first and probably the most important early normative framework for space activities”, because it signified that “the international community was willing to subject the future uses of the uninhabited, unsettled and unknown universe to manmade legal rules, at least insofar as human activities were concerned.”²⁵ Its text would serve as a basis for the drafting of the Outer Space Treaty (OST), which is analyzed in the following section.

The Outer Space Treaty (OST, 1967)

The OST, which entered into force in 1967 and currently has 110 State parties, including all the spacefaring²⁶ States, plus 23 signatories²⁷, contains the core provisions that define the limits of State behavior in outer space.²⁸ Its entry into force marked the “creation of an entirely new branch of public international law, the law of outer space”²⁹, which is “meant to regulate relations between States, to determine their rights and duties resulting from all activities directed towards

²⁵ S. Hobe, “Historical Background”, in S. Hobe, B. Schmidt & K. Schrogl (eds.), *Cologne Commentary on Space Law*, vol. 1, (2017), Germany, BWV, p. 136.

²⁶ The term “spacefaring” refers to the ability to engage in space travel, and thus is used to refer to those States that are capable of launching space objects into orbit. This list includes Brazil, China, the European Space Agency, China, India, Israel, Iran, Japan, New Zealand, North Korea, Russia, South Korea, the U.K., Ukraine, and the United States (While there is no official list, a rather complete one is available at *Launch Vehicles*, Gunter’s Space Page, <https://space.skyrocket.de/directories/launcher.htm>, last accessed on 4 august 2021). Of course, the list expands when the term is used to include those States that own a space object, such as a satellite or space telescope.

²⁷ UNOOSA, “Status of International Agreements relating to activities in outer space as of 1 January 2020”, last accessed on 21 July, 2021. Available at <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/status/index.html>. It must be noted that Iran, a spacefaring country, is only a signatory to the OST.

²⁸ The only notable declaration regarding the substantive parts of the Treaty was made by Brazil, regarding its interpretation of Article X. See: [Status list: Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and other Celestial Bodies](https://www.gov.uk/government/publications/treaty-on-principles-governing-the-activities-of-states-in-the-exploration-and-use-of-outer-space-including-the-moon-and-other-celestial-bodies-lond), available at: <https://www.gov.uk/government/publications/treaty-on-principles-governing-the-activities-of-states-in-the-exploration-and-use-of-outer-space-including-the-moon-and-other-celestial-bodies-lond>. Last accessed on 4 August 2021.

²⁹ P. Jankowitsch, “The background and history of space law”, p. 5.

outer space and within it—and to do so in the interest of mankind as a whole [...].³⁰ It's an unusual treaty in the sense that its drafting process began, within the umbrella of the Legal Subcommittee of UNCOPUOS, from the conciliation of the proposals for a legal text issued by the United States and the USSR³¹, and was concluded fairly quickly, in less than 12 months.

The OST makes it clear in its Preamble that it is built based on the principles established in UNGA resolution 1962. Accordingly, it recognizes the common interest of all mankind in the progress of the exploration and use of outer space for peaceful purposes, and states that the exploration and use of outer space should be carried on for the benefit of all peoples irrespective of the degree of their economic or scientific development. It then sets out to establish the basic rules for the behavior of States in outer space.

Article I refers to outer space activities in a general way and establishes legal boundaries that permeate throughout the rest of the Treaty.³² It has three specific elements. First, it cements the idea that the exploration and use of outer space, which includes the Moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, and shall be “the province of all mankind”. The second element compliments this by establishing that Outer Space “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”. Finally, the third element specifies that there shall be freedom of scientific investigation in outer space.

We can see here that outer space is being given a special status in which the jurisdiction of States is, in fact, limited. By making outer space free for exploration and use by all States without discrimination, Article I in effect confers to it the status of *res communis omnium*³³, which we may understand as an area which cannot be owned by anyone due to it being reserved for everyone. Furthermore, while being free to use and explore by all State parties to the treaty, they must do so taking into account the interests of all countries. In this sense, the concept of 'province of all

³⁰M. Lachs, “The International Law of Outer Space”, in *Collected Courses of the Hague Academy of International Law*, vol. 113, p. 33. Consulted online on 26 July 2021 http://dx.doi.org/10.1163/1875-8096_pplrhc_A9789028615021_01

³¹ S. Hobe & N. Hedman, “Preamble”, in S. Hobe, B. Schmidt & K. Schrogl (eds.), *Cologne Commentary on Space Law*, vol. 1, (2017), Germany, BWV, p. 155.

³² Article I, Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (hereinafter OST, 1967), available at <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspacetreaty.html>

³³ M. Shaw, *International Law*, (6th edition), (2008), Cambridge University Press, UK, p. 544.

mankind’ “serves as a limitation on the freedoms of outer space in the sense that neither exploration nor use of outer space shall be undertaken for the sole advantage of one country, but done only for the benefit of the international community.”³⁴

The freedom of exploration and use of outer space is then complemented by Article II, commonly referred as the “non-appropriation principle”, which establishes that “Outer space, including the moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means”.³⁵ This notoriously broad formulation emphatically bans States from making claims of territorial sovereignty in Outer Space and its importance cannot be overstated, since it has an effect over all of space law. Indeed, “the normative rationale of virtually every rule of international space law is ‘shaped’ by this fundamental rule as a principle systemic parameter”³⁶. It has been suggested that “the non-appropriative nature of space was the best possible guarantee for preserving peace for the creators of the space law regime”³⁷, particularly the US and the USSR, and its uncontroversial drafting history certainly suggests that early on it was understood as a fundamental concept.³⁸

One of the defining characteristics of Article II is how it reinforces, and indeed is the logical follow-up, of the premise of Article I: in an area designated as free for the exploration and use of States, where the interests of mankind as a whole have to be taken into account, it would follow that no part of said area could be claimed by any other entity, since that would deprive it from one of its essential characteristics, while at the same time it would limit the rights of other State parties. Thus, States are not only barred from exercising in outer space, including the Moon and celestial bodies, “all those exclusive rights the display of which amounts to what is called sovereignty. States are also barred from claiming some particular rights which are attributes of sovereignty”, with a

³⁴ S. Hobe, “Article I”, in S. Hobe, B. Schmidt & K. Schrogl (Eds.). *Cologne Commentary on Space Law*, vol. 1, (2017), Germany, BWV, p. 189.

³⁵ Article II, OST (1967), available at <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspacetreaty.html>

³⁶ Z. Paliouras, “The Non-Appropriation Principle: the Grundnorm of International Space Law”, *Leiden Journal of International Law*, (2014), 27, p. 38.

³⁷ Ganatra, D., & Modi, N., “Asteroid Mining and Its Legal Implications”, *Journal of Space Law*, (2015-2016), 40, p. 94.

³⁸ R. Jakhu & S. Freeland, “Article II”, in S. Hobe, B. Schmidt & K. Schrogl (Eds.). *Cologne Commentary on Space Law*, vol. 1, (2017), Germany, BWV, p. 228.

particular emphasis in use, occupation, or any other means.³⁹ Again, this applies “to outer space as a whole, and any part of it”.⁴⁰

Reading these two articles in conjunction, a clearer picture starts to emerge about the limits that States face in their activities in Outer Space. Indeed, they can be considered the base upon which the rest of the legal framework is built. Thus, all State parties have access to outer space for exploration and its use, “regardless of their level of technological development and without the need for any form of authorization, but cannot appropriate outer space and its celestial bodies.”⁴¹ Furthermore, considering the elements and scope involved in these two articles, the obligations that arise from them can be said to have the character *erga omnes*, since any one declaration of sovereignty in outer space would necessarily affect the rights and freedom of all other States.⁴²

Building on them, the rest of the OST continues to define how States should carry out their activities of use and exploration in Outer Space. In this regard, Article III is important insofar as it obliges States to carry them out “in accordance with international law, including the Charter of the United Nations, in the interest of maintaining international peace and security and promoting international co-operation and understanding”.⁴³ This binding obligation of States, dubbed as “one of the most essential articles in the OST”⁴⁴, brings the rest of international law and the UN Charter, as far as they would apply, to the realm of Outer Space. This could potentially include “not only long-established rules of customary international law, such as the principles of good faith and of *pacta sunt servanda*, but also basic and explicit tenets of international law that have found their way into the UN Charter” (e.g. the sovereign equality of States, non-intervention and non-aggression, the prohibition on the use of force, the right to self-defence, and the peaceful settlement of international disputes).⁴⁵ Referring particularly to the UN Charter, Lachs noted that “it seems clear that [its] application to outer space amounts in fact to applying to it principles of contemporary

³⁹ M. Lachs, “The International Law of Outer Space”, p. 48.

⁴⁰ Lachs mentions that this would include the physical elements the harnessing of which is possible, like solar radiation, cosmic and electromagnetic rays as sources of energy, or interstellar gases. *Ibid.*, p. 51.

⁴¹ F. Tronchetti, “Legal Aspects of Space Resource Utilization”, in F. von der Dunk and F. Tronchetti (eds.), *Handbook of Space Law*, (2015), UK, Edward Elgar Publishing, p. 779.

⁴² Art. 42, International Law Commission, Draft Articles on Responsibility of States for Internationally Wrongful Acts, November 2001, Supplement No. 10 (A/56/10), chp.IV.E.1, available at: <https://www.refworld.org/docid/3ddb8f804.html> [accessed 26 July 2021]

⁴³ Article III, OST (1967), available at <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspacetreaty.html>

⁴⁴ O. Ribbelink, “Article III”, in S. Hobe, B. Schmidt & K. Schrogl (Eds.). *Cologne Commentary on Space Law*, vol. 1, (2017), Germany, BWV, p. 272.

⁴⁵ *Ibid.*, p. 279

international law, as defined by it. States may therefore rely on them or invoke them, as embodied in the provisions of the Charter with regard to action taken in, carried out through, or in outer space.”⁴⁶ By the same token, it is also not inconceivable that, as the field develops and technological advances make possible a more robust human presence in Outer Space, other branches of international law could also find grounds for application in Outer Space. Indeed, this may already be the case. For example, on the matter of protection of the environment, given that the ICJ has recognized, in its Advisory Opinion on the Legality of the Threat or Use of Nuclear Weapons, “the existence of the general obligation of States to ensure that activities within their jurisdiction and control respect the environment of other States or of areas beyond national control is now part of the corpus of international law relating to the environment”⁴⁷, it would follow that, due to Article III, State parties to the OST would share this obligation in their activities in outer space. It would not seem inconceivable that something similar could eventually apply in other legal regimes such as international human rights law, humanitarian law, international economic law, and international criminal law.

Another limit of note contained in the OST is the one embodied in Article VI, which sets-up the framework regarding responsibility for space activities. It reads:

“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. The activities of non-governmental entities in outer space, including the moon and other celestial bodies, shall require authorization and continuing supervision by the appropriate State Party to the Treaty.”⁴⁸

The importance of this article for the overall legal framework of outer space activities cannot be overstated. By making the State party to the OST the bearer of responsibility for all space activities, whether these are carried out by governmental or non-governmental (e.g. private)

⁴⁶ Manfred Lachs, “The International Law of Outer Space”, p. 43.

⁴⁷ Paragraph 29, *Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion*, I.C.J. Reports 1996, p. 226, International Court of Justice (ICJ), 8 July 1996. Available at <https://www.icj-cij.org/en/case/95/advisory-opinions>

⁴⁸ Article VI, OST (1967), available at <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspacetreaty.html>

entities, this article in essence establishes a filter through which all those who wish to carry out activities in Outer Space must pass: that of the authorization and supervision of the State Party, which has to make sure that the proposed activities are in accordance with (all) its legal obligations under the provisions of the Treaty. Thus, State parties ‘bear responsibility to ensure that all national activities (those of governmental agencies as well as those of non-governmental entities) comply with the provisions of the Outer Space Treaty, in particular with the principles of Articles II–XII’.⁴⁹ To do this, the aforementioned State Party must enact its own legislation establishing the rules and procedures to comply with its international obligations. Thus, States “are essentially responsible for all activities of their nationals in space.”⁵⁰

It is telling that the drafting of this article was “a compromise formula which reconciled the then strongly opposed views of those, like the Soviet Union, wishing to reserve space activities to states only, and those, like the United States and other Western powers, advocating and allowing access to space and space activities to non-state actors as well.”⁵¹ In any case, the article makes clear that space is open not only to governments, and opens “the way for the private sector to conduct space activities side by side with states and international intergovernmental organisations.”⁵²

Two more articles must be mentioned in this discussion. First, Article VII deals with liability regarding the damage caused by objects launched into outer space. According to it, “each State Party to the Treaty that launches or procures the launching of an object into outer space, as well as each State Party from whose territory or facility an object is launched, is internationally liable for damage to another State Party to the Treaty or to its natural or juridical persons by such object or its component parts”⁵³ wherever this may happen, whether on the Earth, in air or in outer space. When read in conjunction with Article VI, this in effect adds an extra layer of responsibility to State parties to the OST related to the launching of space objects. Their combined effect “ensures that States are both responsible and liable in damages towards other State parties and their nationals

⁴⁹ Michel Gerhard, “Article VI”, in S. Hobe, B. Schmidt & K. Schrogl (Eds.). *Cologne Commentary on Space Law*, vol. 1, (2017), Germany, BWV, p. 412.

⁵⁰ Susan J. Trepczynski, “New Space Activities Expose a Potential Legal Vacuum”, *Journal of Space Law*, (2015-2016), 40, p. 25

⁵¹ Jankowitsch, “The background and history of space law”, p. 13

⁵² Vladimir Kopal, “Origins of space law and the role of the United Nations”, p. 226.

⁵³ Art. VII, OST, available at

<https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspacetreaty.html>

for their national space activities, specifically through the act of launching a space object”.⁵⁴ This is so because Article VII adds to the obligations States have regarding the applicable rules of international law, including customary international law, as established in Article III, by imposing “a strict treaty obligation on a launching State to compensate States and State party victims which have suffered launch damage.”⁵⁵ Thus, further to the responsibility of State Parties regarding space activities, they must also account for whatever damage their space objects cause.⁵⁶

As a complement to Articles VI and VII, Article VIII clarifies the issue of jurisdiction over the objects launched into Outer Space. Here, the OST makes clear that “a State Party to the Treaty on whose registry an object launched into outer space is carried shall retain jurisdiction and control over such object, and over any personnel thereof, while in outer space or on a celestial body”.⁵⁷ This is one of the avenues left to States to exercise their sovereignty in outer space in the usual sense; once again, however, States can only do so in a limited sense. It is important to note that, when read in conjunction with Article II, “the jurisdiction referred to in Article VIII with respect to certain persons and objects in outer space does neither imply nor entail jurisdiction over outer space as such, as the regulation of the status of outer space remains firmly within the prescriptive domain of the international community”.⁵⁸ Instead, the term “jurisdiction and control” entitles the State Registry to exercise its sovereignty over the registered space object⁵⁹, the legal consequence of which is “the applicability of the national law of the State of registry for the object launched into

⁵⁴ A. Kerrest and L. Smith, “Article VII”, in S. Hobe, B. Schmidt & K. Schrogl (eds.), *Cologne Commentary on Space Law*, vol. 1, (2017), Germany, BWV, p. 443.

⁵⁵ Ibid., p. 446.

⁵⁶ It bears noting that Article VII and the matter of liability in general is clarified and greatly expanded upon in the Liability Convention, which entered into force in 1972. Its Article II provides that “a launching State shall be absolutely liable to pay compensation for damage caused by its space objects on the surface of the Earth or to aircraft, and liable for damage due to its faults in space”. The Convention also establishes a claim mechanism for obtaining compensation because of damages. See UNOOSA, *The Liability Convention*, <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introliability-convention.html> (last accessed on 7th August, 2021). UNCLOS article 139 also establishes similar provisions on responsibility and liability for activities carried out in the Area by the State Parties, state enterprises or natural or juridical persons. It is included in Part XI, Section 2, which can be consulted in UNCLOS, Agreement relating to the implementation of Part XI of the Convention, available at https://www.un.org/depts/los/convention_agreements/texts/unclos/closindx.htm (last accessed on) August 2021).

⁵⁷ Art. VIII OST, available at

<https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspacetreaty.html>

⁵⁸ S. Hobe and P. de Man, “National Appropriation of Outer Space and State Jurisdiction to Regulate the Exploitation, Exploration and Utilization of Space Resources,” *Zeitschrift für Luft- und Weltraumrecht - German Journal of Air and Space Law*, (2017), 66, no. 3, p. 468.

⁵⁹ Bernhard Schmidt-Tedd and Stephan Mick, “Article VIII”, in S. Hobe, B. Schmidt & K. Schrogl (Eds.). *Cologne Commentary on Space Law*, vol. 1, (2017), Germany, BWV, p. 520.

outer space, including over any personnel thereof”.⁶⁰ Implicit in this Article is the obligation of State parties to create a national registry for space objects. In turn, the registration of space objects creates “a chain of attribution between the launching State, the space object, international responsibility for space activities and jurisdiction and control by the registering State”.⁶¹

A final note should be made regarding Article IX, the longest one of the OST. This article adds an extra dimension to the exploration and free use of outer space by State parties to the OST, which can be understood in two parts: cooperation in outer space, and environmental protection. Regarding the first one, Article IX establishes that States “shall be guided by the principle of cooperation and mutual assistance and [they] shall conduct all their activities in outer space, including the moon and other celestial bodies, with due regard to the corresponding interests of all other States Parties to the Treaty”.⁶² In other words, in their activities in outer space, States cannot act as isolated actors focusing only on their own self-interest. Instead, outer space “is to be explored and used with due diligence, as per the *res communes omnium* in Roman law, taking into account the interests and rights of other States”⁶³. This is a continuation of the premise of Article I.

The rest of Article IX then makes explicit the obligation that the study and exploration of outer space, including the Moon and celestial bodies, shall be conducted “so as to avoid their harmful contamination and also adverse changes in the environment of the Earth resulting from the introduction of extraterrestrial matter and, where necessary, shall adopt appropriate measures for this purpose.” Thus, whenever States, or even private actors for that matter, conduct activities in outer space, whatever their nature, they must consider their environmental repercussions and prevent them. This establishes a basic, yet quite formal, foundation for the environmental protection of outer space, and no doubt the reason Article IX has been referred as the “potential foundation of environmental space law”.⁶⁴ Furthermore, States might also be subject to further

⁶⁰ Ibid., p. 527.

⁶¹ Ibid., p. 495

⁶² Article IX, OST, available at

<https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspacetreaty.html>

⁶³ Sergio Marchisio, “Article IX”, in S. Hobe, B. Schmidt & K. Schrogl (Eds.). *Cologne Commentary on Space Law*, vol. 1, (2017), Germany, BWV, p. 568.

⁶⁴ T. Cheney, “There's No Rush: Developing a Legal Framework for Space Resource Activities”, *Journal of Space Law*, (2019), 43, no. 1, p. 132.

constraints regarding the environmental protection of outer space due to the applicability of customary environmental norms, in light of the provisions of Article III of the OST.⁶⁵

One final aspect to discuss regarding the Outer Space Treaty is whether it, either as a whole or just some of its principles, has achieved the status of customary international law, making their application an obligation not just of the signatories of the OST, but of all other countries as well. On this point, it bears reminding that the Statute of the International Court of Justice, in article 38.1, establishes “international custom, as evidence of a general practice accepted as law”, as one of the sources of international law and, through its jurisprudence, the ICJ has expanded on this definition. For example, in the North Sea Continental Shelf cases, the ICJ posits that “State practice, including that of States whose interests are specially affected, should have been both extensive and virtually uniform in the sense of the provision invoked; -- and should moreover have occurred in such a way as to show a general recognition that a rule of law or legal obligation is involved.”⁶⁶ Furthermore, actions by States “not only must amount to a settled practice, but they must also be such, or be carried out in such a way, as to be evidence of a belief that this practice is rendered obligatory by the existence of the rule of law requiring it. The need for such a belief, that is, the existence of a subjective element, is implicit in the very notion of the *opinio iuris sive necessitatis*. The States concerned must therefore feel that they are conforming to what amounts to a legal obligation”.⁶⁷ Thus, it is generally understood that two elements constitute a custom: general practice, which is equated with the actual behavior of States, and the belief that such behavior is required by law.⁶⁸

With this in mind, when discussing the OST, it is generally acknowledged that both the principles of freedom of exploration and use of outer space, as well as that of no-appropriation (articles I and II), have reached the status of customary international law. The argument in this case is based on the consistent practice of States, both at the time these principles were developed, as

⁶⁵ This might be the case of, for example, principles 21 of the Declaration of the United Nations Conference on the Human Environment of 16 June 1972, and Principle 2 of the 1992 Rio Declaration on Environment and Development, which establish that States have the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction. See Marchisio, “Article IX”, p. 575.

⁶⁶ Paragraph 74, *North Sea Continental Shelf Cases (Federal Republic of Germany v. Denmark; Federal Republic of Germany v. Netherlands)*, I.C.J. Reports 1969, p.3, International Court of Justice (ICJ), 20 February 1969. Available at <https://www.icj-cij.org/en/case/52/judgments>

⁶⁷ Ibid., para 77.

⁶⁸ M. Shaw, *International Law*, (2008), Cambridge University Press, UK, p. 74.

well as afterwards as they have been applied by States, and the aforementioned *opinio juris sive necessitates*.⁶⁹ Thus, both “were born in parallel to the very commencement of exploration of outer space, mirroring the practice of the major spacefaring nations, thus considered having a universal and obligatory character”.⁷⁰ Granted, initially this represented the practice of only the United States and the USSR, the only two space faring nations at the time of the signing of the OST. Yet, as more and more States have managed to reach outer space, either through launching space objects or owning them, it is telling that none of them have rejected these principles.⁷¹ Similarly, the implementation of Article VI, namely through the enactment of national space legislation in order to conform with the State’s obligations under the OST for matters of international responsibility, has been discussed as another possible principle with a status of customary law, particularly since no State has rejected such obligations⁷² (although as we will see below, Luxembourg and the UAE might have tried to do so).

As we can see, the OST establishes important limits to the activities of a State in outer space. To recap, all States can freely explore and make use of outer space, but they cannot act only on their own self-interest, since they have to take into account the interests of the international community. Outer space, which includes the Moon and other celestial bodies, cannot be appropriated by States, or their nationals, by any means (thus, for example, no country can claim ownership of, or establish sovereignty over a moon, planet, or asteroid). Furthermore, States are responsible and liable for all space activities that launch from their territories, both governmental and private ones. Finally, in their activities, States must not only respect their obligations as contained in the OST, but those of other fields of international law as applicable to any given

⁶⁹ See Paliouras, “The Non-Appropriation Principle”, p. 44, and D. Zannoni, “The Dilemma Between the Freedom to Use and the Proscription against Appropriating Outer Space and Celestial Bodies”, *Chinese Journal of International Law*, (2020), 19 p. 4. Going further, Jakhu and Freeland argue that the no appropriation principle is not only a foundational legal principle of conventional international space law but has also become a significant norm of general international law and a jus cogens norm binding upon all States. See Jakhu and Freeland, “Article II”, *Cologne Commentary on Space Law*, p. 248.

⁷⁰ Valentina Vecchio, “Customary International Law in the Outer Space Treaty: Space Law as Laboratory for the Evolution of Public International Law,” *Zeitschrift für Luftund Weltraumrecht - German Journal of Air and Space Law*, (2017), 66, no. 3, p. 497.

⁷¹ Perhaps the only known situation that approximates something akin to this is the Bogota Declaration of 1976, in which a group of equatorial States claimed sovereignty over the geostationary orbits above their territories, under the premise that geostationary orbits were not part of outer space, but part of their natural resources. The Declaration was not, however, accepted by the rest of the international community.

⁷² R. Jakhu & S. Freeland, “The Relationship between the Outer Space Treaty and Customary International Law,” *Proceedings of the International Institute of Space Law*, (2016), 59, p. 194.

situation. This could include, for example, environmental and sustainable development matters, human rights issues, labor rights, questions on the use of force, and so on.

This paper now turns to the discussion of the legal issues that arise from the possibilities of carrying out mining activities in outer space. This includes not only an analysis that incorporates the provisions of the OST, but also of other legal instruments and documents which help to give meaning to the OST as of today. The first point to discuss is whether those type of activities are allowed by the current legal framework.

The legality of space mining activities.

When considering the legality of space mining activities, understood as the extraction of natural resources located in Outer Space, the provisions of the OST are the obligatory frame of reference. This is no simple task, being that within the space legal community there is no agreement on whether space mining activities actually conform to the OST. Broadly speaking, two positions can be summarized. The first one makes a reading of the provisions of the OST in a stringent sense, with a particular focus on the no-appropriation principle as applying to all parts of outer space, including the resources that would be available in the Moon and other celestial bodies. Under this interpretation, there would be no possibility for any sort of space activity that intends to extract natural resources and commercialize them, since that would go against the provisions of the OST. For example, for Jakhu, the logical conclusion of Article II is that “no amount of the use of outer space will ever suffice to justify, from a legal viewpoint, a claim of ownership rights over the whole, or any part of outer space. This includes exploitation of natural resources.”⁷³ Vladimir Kopal is of a similar mind, since for him the extraction of resources is something not covered by the provisions of the OST under exploration and use, and hence, Article II “must be interpreted on the basis of its exact wording, and in harmony with Article VI. Therefore, the prohibition of national appropriation relates to all national activities, be they conducted by states, their governmental agencies, or non-governmental entities of any kind of their nationality”.⁷⁴ Manfred Lachs further emphasizes that, without disregarding the effort made towards their utilization, resources located in celestial bodies should benefit mankind as a whole, and international arrangements should be made so that they can be used for the benefit of all States.⁷⁵

On the opposite end of these positions, another interpretation suggests that, while recognizing the no-appropriation and other principles of space law, the OST is not clear on the issue of space resource exploitation, leaving the issue both open for interpretation and generating uncertainty for future potential activities.⁷⁶ In this sense, Hobe argues that Article II “explicitly and implicitly prohibits only the acquisition of territorial property rights [...] No mentioning is made

⁷³ R. Jakhu, “Article II”, p. 244.

⁷⁴V. Kopal, “Comments on the issue of “Adequacy of the Current Legal and Regulatory Framework Relating to the Extraction and Appropriation of Natural Resources of the Moon”, pp. 228-229.

⁷⁵ M. Lachs, “The International Law of Outer Space”, p. 54.

⁷⁶ F. Tronchetti, “Legal Aspects of Space Resource Utilization”, in F. von der Dunk and F. Tronchetti (eds.), *Handbook of Space Law*, (2015), UK, Edward Elgar Publishing, pp. 769-770.

to the question of the extraction of natural resources which means that such use is allowed under the Outer Space Treaty”.⁷⁷ Similarly, Cheney posits that “since there is no prohibition on resource extraction per se in the Outer Space Treaty, therefore this principle combined with the plain, ordinary meaning of the term "use" means that it is reasonable to argue that resource extraction is permitted within the framework of the space law regime”.⁷⁸

Within this context, this paper will consider the following issues:

- a) Whether these types of activities could fall under the term “use of outer space”,
- b) Whether such activities would be considered within the concept of outer space as the province of all mankind; and,
- c) Whether they would constitute a form of appropriation that would go against article II of the OST.

This section will consider them in that order. The argument that I will develop will be that space mining is one of the possible uses of outer space that can be undertaken by a State under current space law. However, these types of activities have to be performed in accordance with the relevant provisions of the OST. States, or private actors for that matter, cannot make indiscriminate use of outer space in their pursue of profit. The interests of other parties, as well as the character of outer space as the province of mankind, must be respected and taken into account.

The use of outer space

On the first issue, the point of departure must be an analysis of what the word “use” means within the context of the OST, particularly Article I.⁷⁹ Use is one of the two broad activities that State parties to the OST can perform in space (the other being explore), and while the treaty contains no definitions of either term, it could be arguable that within its meaning the extraction of

⁷⁷ Hobe, “Adequacy of the Current Legal and Regulatory Framework Relating to the Extraction and Appropriation of Natural Resources of the Moon”, pp. 211.

⁷⁸ Cheney, “There's No Rush”, p. 141.

⁷⁹ This approach follows the provisions of Article 31 (1) of the Vienna Convention on the Law of Treaties, which reads: ‘A treaty shall be interpreted in good faith in accordance with the ordinary meaning to be given to the terms of the treaty in their context and in the light of its object and purpose.’

resources could be considered, particularly if one takes into account the ordinary meaning of the word.⁸⁰ The Oxford English Dictionary defines use as “the act of putting something to work, or employing or applying a thing, for any (esp. a beneficial or productive) purpose”.⁸¹ As we have seen from the above discussion of space mining activities, one could certainly make the case that a State, or a State supervised private entity, that uses its resources to establish a mining operation, or indeed any other economic activity, such as a tourist facility or an energy farm, could claim that their purpose is to obtain a particular benefit. And indeed, perhaps there is no other way to interpret this, since for what other reason would any entity go to the lengths required in terms of technological development and capital spending to set up these kinds of operations if not to obtain a profit.

This being clear, of course this is not the end of the story since such use would have to comply with the other provisions of the OST in order to conform with all legal obligations. Article I provides several of them, and while the link with “the province of all mankind” will be explored below, it bears reminding that any type of use of outer space must be “carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development”. Furthermore, any use would also be constrained by the provisions of Articles II, III, IV and IX, which impose strict limitations on State behavior. In this sense the OST does include some specific uses of outer space that are excluded from the rights of State parties (for example, activities that are incompatible with the UN Charter).

The implications of the concept of “the province of mankind” for these types of activities.

The second point is that related to the “province of all mankind” as established in Article I. This concept has been the subject of much debate regarding its meaning and implications for activities in Outer Space, and thus an understanding of it will benefit the discussion, since its meaning helps to elucidate the types of uses of outer space that are allowed by space law. Perhaps the first point to note is that the mention of “the province of all mankind” in Article I OST does

⁸⁰ Space law is not the only legal regime that deals with activities and obligations of States outside of their national jurisdictions, or the use of the resources available in said areas. The Law of the Sea, the legal regime for Antarctica and international environmental law also feature provisions that deal with these types of situations. See *infra* note 89.

⁸¹ “use, n.” *OED Online*, Oxford University Press, June 2021, www.oed.com/view/Entry/220635. Accessed 25 June 2021.

not refer to the area of Outer Space as such, but to the activities carried out within it, as is evident from a reading of the first sentence.

The exploration and use of outer space, including the moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind.

It is in this context that the phrase has to be understood. The “province of all mankind” is a qualification of how the exploration and use of outer space must be conducted, and “underlines the interest of all States and all generations (present and future) in the use and exploration of outer space and celestial bodies”.⁸² It is a limitation on the freedoms of outer space in the sense that “neither exploration nor use of outer space shall be undertaken for the sole advantage of one country, but done only for the benefit of the international community”.⁸³ The exploitation of natural resources, which as has been established is one of the activities that State parties to the OST can carry out in their use of outer space, would have to take place within this framework.

The interpretation of this provision, while debated in academic literature, has not been tested in any specific instance yet. However, there are some further legal developments that may help to interpret its meaning, and this work will focus on two of these: the Moon Agreement, and the so called “Space Benefits” UNGA resolution of 1996.

The Moon Agreement and the “common heritage of mankind”

With regards to the Moon Agreement, it is the last of the five UN Space Treaties to be negotiated and to enter into force (1984). In its Preamble it is possible to discern two broad objectives. The first was to emphasize the role that the Moon would have in the human exploration of outer space, thus establishing new obligations for its exploration and exploitation.⁸⁴ Second, and perhaps benefitting from the knowledge and experience that the international community gathered

⁸² S. Hobe and Kuan-Wei Chen, “Legal status of outer space and celestial bodies”, in Ram. S. Jakhu and Paul Dempsey *Routledge Handbook of Space Law*, 2017, Routledge, UK, p. 33.

⁸³ S. Hobe, “Article I”, p. 189.

⁸⁴ Paragraphs 3-6, Preamble of the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (Hereinafter Moon Agreement), available at <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/intromoon-agreement.html> .

since the negotiations that led to the OST, and thus having a more concrete idea of the possibilities that the future might hold, the Moon Agreement aimed to define and develop the provisions of the previous space treaties in relation to the Moon and other celestial bodies, having regard to further progress in the exploration and use of outer space. It is thus no coincidence that the Agreement specifically refers to the benefits which may be derived from the exploitation of the natural resources of the moon and other celestial bodies,⁸⁵ certainly a sign that natural resources in space can be “used”.

With regards to the concept of the “province of mankind”, it is expressed in two provisions of the Agreement. First, in a similar way as it is expressed in the OST, Article 4 applies it to the exploration and use of the Moon and other celestial bodies⁸⁶, which “shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development.”⁸⁷ Second, and perhaps more importantly, Article 11 of the Moon Agreement expands on the concept with the idea of the “common heritage of mankind”. This principle refers in general to “the establishment of an international administration for areas open to the use of all States (international commons)”⁸⁸, and was first developed as part of the negotiations of the UN Convention of the Law of the Sea, where a rather complete system for the exploitation and extraction of resources in areas beyond the jurisdiction of all States has been established.⁸⁹In the

⁸⁵ Paragraph 8, Preamble of the Moon Agreement.

⁸⁶ While the treaty is titled Moon Agreement, article 1 makes it clear that the provisions of it that relate to the Moon shall also apply to other celestial bodies within the solar system.

⁸⁷ Article 4, Paragraph 1, Moon Agreement.

⁸⁸ Paragraph 1, in R. Wolfrum, *Common Heritage of Mankind*, Max Planck Encyclopedias of International Law, Oxford Public International Law, 2009.

⁸⁹ The principle is included in Part XI, Section 2, Article 136, in which the Area (meaning, the seabed and ocean floor and subsoil thereof located beyond the limits of national jurisdiction as established in the Convention) and its resources (meaning all solid, liquid or gaseous mineral resources in situ in the Area at or beneath the seabed, including polymetallic nodules) are declared the common heritage of mankind. Article 137 further provides that:

1. No State shall claim or exercise sovereignty or sovereign rights over any part of the Area or its resources, nor shall any State or natural or juridical person appropriate any part thereof. 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. These resources are not subject to alienation. The minerals recovered from the Area, however, may only be alienated in accordance with this Part and the rules, regulations and procedures of the Authority.
3. No State or natural or juridical person shall claim, acquire or exercise rights with respect to the minerals recovered from the Area except in accordance with this Part. Otherwise, no such claim, acquisition or exercise of such rights shall be recognized.

Furthermore, UNCLOS (Part XI) envisages the creation of a really complex administration regime headed by the International Seabed Authority, through which State Parties organize and control activities in the Area, including

case of Outer Space, it was first discussed during the negotiations of the OST in the context of the status of that area as a global commons, although the term “province of all mankind” was preferred in that particular negotiation.⁹⁰ In general, there seems to be an opinion within the academic literature that both terms share the same meaning, e.g. understanding Outer Space and celestial bodies as common spaces that are not under the jurisdiction of specific States.⁹¹ Its expression in the Moon Agreement aims to operationalize the idea and apply it to the Moon and its natural resources, first by expanding the no appropriation principle by clarifying that “neither the surface nor the subsurface of the moon, nor any part thereof or natural resources in place, shall become property of any State, international intergovernmental or non-governmental organization, national organization or non-governmental entity or of any natural person”.⁹² Second, by setting up the contours of an international regime that would govern the exploitation of natural resources of the Moon, with an emphasis on orderly and safe development, rational management, and equitable sharing of them.⁹³ Said regime, however, does not exist (yet), since the Agreement only demands its creation once the exploitation of resources becomes feasible, and no effort has been made to establish it.

Article 11 is remarkable because of its ambition regarding human activities in outer space, and its implications for their future. Yet, it was precisely this article, and notwithstanding the broad support that the Moon Agreement received during its negotiation phase, which led to the low adoption of the Agreement, since it’s the space treaty with the least number of State Parties (18, plus 4 signatories), none of which are the major space powers.⁹⁴ This has led the academic literature

the establishment of a “system of exploration and exploitation”. See UNCLOS, Agreement relating to the implementation of Part XI of the Convention, available at https://www.un.org/depts/los/convention_agreements/texts/unclos/closindx.htm (last accessed on) August 2021).

Wolfrum also mentions that, besides UNCLOS and Outer Space, the common heritage principle is also present to some extent in the legal regime for Antarctica, particularly for the issue of the mineral resources of that region, and in international environmental law, where a version of it (common concern of mankind) is used relating to the possible exhaustion of non-renewable resources. See Wolfrum, *Common Heritage...*, paras. 9-10.

⁹⁰ Ibid., para. 5.

⁹¹ Hobe, “Article I”, p. 201.

⁹² Article 11, Paragraph 3, Moon Agreement.

⁹³ Ibid., para. 7.

⁹⁴ The complete list of State parties is: Armenia, Australia, Austria, Belgium, Chile, Kazakhstan, Kuwait, Lebanon, Mexico, Morocco, Netherlands, Pakistan, Peru, Philippines, Saudi Arabia, Turkey, Uruguay, and Venezuela. France, Guatemala, India and Romania are signatories. List available in “Status of International Agreements relating to activities in outer space as at 1 January 2021”, A/AC.105/C.2/2021/CRP.10, Legal Subcommittee of UNCOPUOS, 31 May, 2021. Available at <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/status/index.html>

to qualify it as a failure⁹⁵, yet it is still a treaty in force between its parties, one which has even continued to gather new signatories (albeit at a slow pace). Furthermore, it is the subject of continued discussions within the UN, particularly in the Legal Subcommittee of UNCOPUOS, where every year the item “Status and application of the five United Nations treaties on outer space” features on the agenda. It is also notable that the State parties to the Agreement have been active in promoting it among the international community, with perhaps the best example being the Joint Statement on the benefits of the Moon Agreement that they authored in 2008.⁹⁶ It would not be surprising that, as access to outer space continues to develop, more States will realize that acceding to the Moon Agreement might be an option worth exploring in order to avoid losing out on the space economy (or as an attempt to guide or limit its development). In any case, since they are built on the provisions of the OST, the provisions of the Moon Agreement, particularly Article 11 and the “common heritage of mankind”, do set up a possible solution to the issue of exploitation of resources in outer space. At the very least the fact that such a document was negotiated is a sign that the principles and obligations of the OST allow for the possibility of exploiting the resources in outer space, and it might be argued that it could be used as a means of interpretation of the provisions of the OST, as per the Art. 31 (3) of the Vienna Convention on the Law of Treaties.⁹⁷

The “Space Benefits” UNGA resolution (1996).

Another document which helps to define and understand the notion of use of outer space as the province of mankind is the 1996 Declaration on International Cooperation in the Exploration

⁹⁵ This failure supposedly reflects the fact that, although approved by consensus, including that of the so-called “Space powers”, the Moon Agreement was later disavowed by those same countries. Jankowitsch argues that a possible explanation for this change of position lies in the liberalization and deregulation of national and international markets, as well as the reduction of the influence of states and governments in economic and social matters. P. Jankowitsch, “The background and history of space law”, p. 13.

⁹⁶ “Joint Statement on the benefits of adherence to the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies of 1979 by States Parties to that Agreement”, by Austria, Belgium, Chile, Mexico, The Netherlands, Pakistan, and Philippines, Forty Seventh Session of the Legal Subcommittee of UNCOPUOS, 31 March-11 April 2008. UN Classification A/AC.105/C.2/2008/CRP.11. Document available at https://www.unoosa.org/pdf/limited/c2/AC105_C2_2008_CRP11E.pdf

⁹⁷ Art. 31 (3) of the Vienna Convention on the Law of Treaties reads on the matter of interpretation of treaties: There shall be taken into account, together with the context: a) any subsequent agreement between the parties regarding the interpretation of the treaty or the application of its provisions; (b) any subsequent practice in the application of the treaty which establishes the agreement of the parties regarding its interpretation; (c) any relevant rules of international law applicable in the relations between the parties.

and Use of Outer Space for the Benefit and in the Interest of All States, Taking into Particular Account the Needs of Developing Countries, commonly known as the “Space Benefits” declaration of the UN General Assembly.⁹⁸ This document is a result of a compromise between, on the one hand the desire of developing countries for incorporating the benefits of outer space into their development paths, which initially would have “forced cooperation and an automated transfer of financial and technological resources from North to South”, and of the industrialized countries’ opposition to such ideas.⁹⁹ Thus, the end result reiterates on the one part that international cooperation on the use and exploration of outer space shall “be carried out for the benefit and in the interest of all States, irrespective of their degree of economic, social or scientific and technological development, and shall be the province of all mankind. Particular account should be taken of the needs of developing countries”.¹⁰⁰ On the other, “States are free to determine all aspects of their participation in international cooperation in the exploration and use of outer space on an equitable and mutually acceptable basis”.¹⁰¹ The declaration makes clear, however, that States with relevant space capabilities and with programs for the exploration and use of outer space, when fostering international cooperation on this basis, should give particular attention to the benefit for and the interests of developing countries and countries with incipient space programs.¹⁰²

With its wording, we can see that the declaration tries to give something to both sides of the debate, since on the one hand it “cements the freedom of the exploration and utilization of outer space but at the same time reminds the space powers - in a productive and mutually fruitful manner - to fulfill their obligation to conduct their activities for the benefit of all countries”.¹⁰³ In this sense, its added value could be that it reflects an interpretation of the provisions of Article 1 of the OST, via acknowledging the existence of space power, as well as and the interests of developing countries in reaching outer space and clarifying the way in which cooperation should take place.

⁹⁸ Adopted without a vote. See Resolutions adopted by the General Assembly at its 51st session, UN Digital Library, <https://research.un.org/en/docs/ga/quick/regular/51> (last accessed on 7th August, 2021).

⁹⁹ M. Benko & K.-U. Schrogl, “History and Impact of the 1998 UN Declaration on ‘Space Benefits’”, *Space Policy*, (1997), 13, 2, p. 140

¹⁰⁰ Paragraph 1, “Space Benefits Declaration” (The Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking into Particular Account the Needs of Developing Countries), General Assembly resolution 51/122 of 13 December 1996, available at <https://www.unoosa.org/oosa/en/ourwork/spacelaw/principles/space-benefits-declaration.html>

¹⁰¹ *Ibid.*, para. 2.

¹⁰² *Ibid.*, para. 3.

¹⁰³ M. Benko & K.-U. Schrogl, “History and Impact of the 1998 UN Declaration on ‘Space Benefits’”, p. 143.

Both the concept of the “common heritage of mankind” in the Moon Agreement and the Space Benefits declaration, notwithstanding the fact of the low approval of the former and the status as a UN General Assembly resolution of the latter, give us a glimpse of the sensibilities that are part of the debate on the use of outer space. One could argue that, at the very least, they make a serious case for the idea that human activities beyond the Earth cannot be undertaken for the benefit of a few, and that should any entity manage to successfully carry out any sort of space mining operation, it would have to comply with the notion of the use of outer space as the province of all mankind, with all its implications. They also give us a glimpse of the boundaries of the debate, with a proposal for making operation the idea of the use of outer space as the province of mankind and protecting the status of outer space as global common.

The Appropriation of resources

The final issue under consideration is whether space mining activities would constitute a form of appropriation that would go against the provisions of the OST, particularly Article II. As explained above, in carrying out these activities a State, or a State-licensed private company, would set up an operation that would extract the natural resources of a celestial body, presumably for their use in setting up further activities and/or for their commercialization. Given that Article II establishes that “Outer space, including the moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means”, at first glance it would seem difficult to equate the extraction of natural resources with the principle that no State may proclaim its sovereignty in Outer Space. Yet, it should be pointed out that Article II is phrased in such wide-ranging terms that it only refers to outer space, including the Moon and celestial bodies, as not being subject to appropriation. There is no mention, indeed in the whole of the OST, on the issue of natural resources, and whether they could be used in some way by State parties. Indeed, as we have seen, within the academic literature there is considerable debate on whether the OST promotes or restricts these kinds of activities.

As explained above, the exploitation of natural resources could be considered as one of the uses of outer space as long as it is carried out under certain conditions. This is also something that the Moon Agreement points to (but, as mentioned above, it does so within the framework of the no-appropriation principle). The problem then, seems to be the manner in which these should be

conducted, so that they comply with the provisions of the OST, including that of the no-appropriation principle. To recall, when States explore and use outer space, they have to take into account the interests of all other State parties to the OST, and indeed those of the international community. Furthermore, States are responsible and liable for all space activities that launch from their territories, both governmental and private ones. Finally, in their activities, States must not only respect their obligations as contained in the OST, but those of other fields of international law as applicable to any given situation.

Given that so far no actual space mining activities have taken place (besides those carried out for scientific purposes), this discussion will remain, for the moment, an academic one. However, it is possible to approach this issue by discussing the legal framework that some countries have established to regulate any possible space mining activity that would take place under their supervision. Currently only four countries have so far established national legislation that purports to regulate the commercial resource extraction in outer space of their nationals: the United States, Luxembourg, the United Arab Emirates and, just recently, Japan. This paper will now turn to their discussion in the context of the no appropriation principle.

National Legislation

For the United States, the most important legislative initiative is that of the U.S. Commercial Space Launch Competitiveness Act of 2015¹⁰⁴, notable for being the first piece of national legislation that tried to tackle the issue of space resource extraction, as well as being the first to try to actually define the notion of “space resources” (defined as “an abiotic resource in situ in outer space”, which can include water and minerals). The Act also makes a distinction with “asteroid resource”, which are “space resources found on or within a single asteroid”.¹⁰⁵ On the matter of commercial exploration and recovery of resources, Section 51302 of the Act allows the Government of the U.S. to¹⁰⁶:

¹⁰⁴ "Text - H.R.2262 - 114th Congress (2015-2016): U.S. Commercial Space Launch Competitiveness Act." November 25, 2015. Available at <https://www.congress.gov/bill/114th-congress/house-bill/2262/text>.

¹⁰⁵ Ibid., Chapter 513 – Space Resource Commercial Exploration and Utilization, Sec. 51301, Definitions.

¹⁰⁶ Ibid., Chapter 513 – Space Resource Commercial Exploration and Utilization, Sec. 51302, Commercial exploration and commercial recovery.

- (1) facilitate commercial exploration for and commercial recovery of space resources by United States citizens;
- (2) discourage government barriers to the development in the United States of economically viable, safe, and stable industries for commercial exploration for and commercial recovery of space resources in manners consistent with the international obligations of the United States; and
- (3) promote the right of United States citizens to engage in commercial exploration for and commercial recovery of space resources free from harmful interference, in accordance with the international obligations of the United States and subject to authorization and continuing supervision by the Federal Government.

Finally, in perhaps its most contentious provision, the Act establishes a position on the matter of space resources' commercialization. Section 51303 establishes that "a United States citizen engaged in commercial recovery of an asteroid resource or a space resource under this chapter shall be entitled to any asteroid resource or space resource obtained, including to possess, own, transport, use, and sell the asteroid resource or space resource obtained in accordance with applicable law, including the international obligations of the United States".¹⁰⁷

The bill tries to walk a tight rope between actually promoting the commercialization of outer space by US citizens and doing so in a manner consistent with the international obligations of the country, which on this matter would be those of the OST and the other three space treaties to which the US is party to.¹⁰⁸ It is not clear, however, whether it actually does that. Here it bears reminding that the freedom of exploration and use of outer space is limited by the obligations established in that instrument. This is particularly true of Section 51303, since it would be difficult to equate the legal obligation of non-appropriation with the possibility for any US citizen to be able to possess or even sell whatever space resource they manage to obtain. Furthermore, since any space operation by any of its citizens would have to be supervised and approved by the US

¹⁰⁷ Ibid., Chapter 513 – Space Resource Commercial Exploration and Utilization, Sec. 51303, Asteroid resource and space resource rights.

¹⁰⁸ The Astronaut Rescue Agreement, the Liability Convention and the Space Object Registration Convention. See UNCOPUOS, *Status of International Agreements relating to Activities in Outer Space*, available at <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/status/index.html> (last accessed on 15 August, 2021).

Government, as per Article VI OST, the authorization of these types of activities could constitute a breach of the international obligations of the US government as per the OST. In this sense, this legislation “could be seen as the US granting itself the right to grant property rights over space resources to US companies”¹⁰⁹, and, ultimately, an attempt to exercise some sort of jurisdiction of celestial bodies. Thus, it is not surprising to say that the Space Launch Competitiveness Act has been controversial since it became law.¹¹⁰

In a manner similar to that of the US, Luxembourg has also established its own national legislation on the matter of space resources utilization, via the *Loi du 20 juillet 2017 sur l’exploration et l’utilisation des ressources de l’espace*.¹¹¹ According to the Luxembourg Space Agency, this space resources law aims to provide to future explorers and investors the certainty they will need regarding their rights to extract, consume and commercialize the materials they discover in any space mining operation.¹¹² Thus, and in contrast with the US legislation, this bill has a heavy focus on the administrative processes that a prospective company would have to fulfill in order to obtain a permit from the Government of Luxembourg that would enable it to carry out a mission of exploration and use of space resources for commercial purposes, including their financial, technical and statutory procedures, organizational structure, and whether it can ensure a sound and prudent operation. However, on the issue of compliance with the general principles of space law, three of its articles stand out and merit some comment.

First, Article 1 establishes in no uncertain terms that “space resources are capable of being owned”¹¹³, without making any differentiation on the purpose of the extraction or their origin. This would mean that a space operation authorized by Luxembourg could be susceptible of appropriating all resources that it manages to obtain, whether they come from the Moon, other

¹⁰⁹ Cheney, “There's No Rush”, p. 118.

¹¹⁰ See for example Stephan Hobe; Philip de Man, “National Appropriation of Outer Space and State Jurisdiction to Regulate the Exploitation, Exploration and Utilization of Space Resources,” *Zeitschrift für Luft- und Weltraumrecht - German Journal of Air and Space Law*, (2017): 66, no. 3 460-475. The discussions in the Legal Subcommittee of UNCOPUOS are also indicative of this. In 2018, for example, one can note a clear push from certain countries that favor a multilateral approach for the development of a regulatory regime for outer space resources. See UNCOP Committee on the Peaceful Uses of Outer Space, Report of the Legal Subcommittee on its 57th session, Vienna, 9 to 20 April, 2018, UN doc. A/A.C.105/117, pp 29-33.

¹¹¹ Ministry of Economy of Luxembourg, “Loi du 20 juillet 2017 sur l’exploration et l’utilisation des ressources de l’espace”, published on 28 July, 2017. Available at <https://legilux.public.lu/eli/etat/leg/loi/2017/07/20/a674/jo/en>

¹¹² “Law on Space Resources”, Luxembourg Space Agency, last accessed on 24 July 2021, available at <https://space-agency.public.lu/en/agency/legal-framework.html>

¹¹³ Article 1, “Loi du 20 juillet 2017 sur l’exploration et l’utilisation des ressources de l’espace”.

planets, or comets/asteroids. Notably, the legislation also does not define what is to be understood as a “space resource”. If we follow the analysis explained above regarding the provisions of the OST, the language of this article and the possibilities that it creates for space activities authorized by Luxembourg, would seem to be in violation of several of its tenets, the most notable one being the no-appropriation principle. The lack of definitions also poses questions on issues such as how to draw a line between a space resource and a celestial body, for example, which in turn raises questions on whether/how this could infringe in the freedom of exploration and use of outer space that other States can enjoy.

Second, Article 16 establishes that “the operator that is granted an authorisation for a mission is fully responsible for any damage caused at the occasion of the mission, including at the occasion of all preparatory works and duties”¹¹⁴, which would seem to contravene both Article VI on the international responsibility of State Parties for national activities in outer space, as well as Article VII on the matter of liability, both of which, as was discussed above, place responsibility/liability for space activities on State parties of the OST, even if those activities are carried out by private actors. This is all the more odd given that Article 2, paragraph 3, of the same legislation establishes that authorized operators may only carry out the proposed space activities “in accordance with the conditions of the authorisation and the international obligations of Luxembourg”.

Most recently, and in a similar vein to that of the US and Luxembourg, both the United Arab Emirates and Japan also adopted their own national legislation on the matter of space resources. The UAE legislation is parts of the efforts of that country to “establish a legislative framework regulating the Space Sector so as to create an appropriate regulatory environment to achieve the objectives of the State's national space policy”¹¹⁵ and to try to promote the country as a future space hub. It establishes a National Space Agency and sets up procedures for the authorization of space activities, which may include the extraction, exploitation and utilization of space resources. This is dealt with in article 18, which establishes that space resources (defined as any non-living resources present in outer space, including minerals and water) can be owned,

¹¹⁴ *Ibid.*, Article 16.

¹¹⁵ Article 2 – Objectives of the Law, Federal Law No. 12 On the Regulation of the Space Sector, United Arab Emirates, issued on 19 December, 2019. Available online at https://space.gov.ae/Documents/PublicationPDFFiles/SpaceSectorFederalLaw_EN.pdf

purchased and traded.¹¹⁶ Any activity of this nature must be authorized by the Board of Directors of the Agency. Intriguingly, there is no mention of the principle of no-appropriation, although one of the purposes of the legislation is to “support [...] the commitment of the State to implement the provisions of international conventions and treaties related to Outer Space and to which the State is a party”.¹¹⁷ For its part, the most recent Japanese legislation on space resources, adopted only in June of 2021, seems to follow the same pattern: it allows for the possibility that Japanese companies prospect for, extract and use various space resources, for which they must obtain permission from the Japanese government.¹¹⁸

After a joint reading of all four pieces of legislation, the following basic pattern emerges: these States all believe that one of the uses of outer space is the extraction and exploitation of space resources, which seem to be differentiated from celestial bodies in general, and that these actions can be performed by entities which manage to obtain an authorization from the corresponding regulatory authority in-country (thus fulfilling some of the supervision requirements that stem out of Article VI of the OST). Furthermore, they all seem to suggest that these actions can be carried out in accordance with the international obligations of their country, which presumably are those of the OST and any other space treaty that the country has ratified, as well as the applicable rules of international law. Of course, at this point in time this all conjecture, since no space mining operations have been initiated in any of these countries. In this regard it is important to note that the establishment of this type of legislation has generated a vigorous debate within the Legal Subcommittee of UNCOPUOS¹¹⁹, where a “General exchange of views on potential legal models for activities in the exploration, exploitation and utilization of space resources” has been conducted in recent years and in which delegations have expressed a plethora of views on the matter, ranging from support for the current framework to the need to further define the legal terms under which the utilization of resources could take place, including the view that “unilateral domestic initiatives aimed at regulating commercial activities in outer space could lead to the development of multiple

¹¹⁶ Ibid., Article 18.

¹¹⁷ The UAE is part of all UN space treaties, except the Moon Agreement and the Rescue Agreement.

¹¹⁸ News of the Japanese legislation surfaced only recently, and so far, only news reports have detailed its contents. The most detailed report is available at: “Japan passes space resources law”, *Space News*, 17 June, 2021, last accessed on 24 July, 2021. Available at <https://spacenews.com/japan-passes-space-resources-law/>

¹¹⁹ The reports from the Legal Subcommittee of UNCOPUOS can be found on <https://www.unoosa.org/oosa/en/ourwork/copuos/past-sessions.html>

incompatible national frameworks, which would pose a risk of conflicts among States and potentially impact the sustainability of outer space”¹²⁰. .

Perhaps one final element to take into account in this analysis is the fact that all four countries are part of the Artemis Accords, which are a set of principles proposed by the United States in the second half of 2020, described by NASA as “a shared vision for principles, grounded in the Outer Space Treaty of 1967, to create a safe and transparent environment which facilitates exploration, science, and commercial activities for all of humanity to enjoy”.¹²¹ They are part of the broader Artemis Plan of space exploration and currently have 12 signatories.¹²² Though recent, these Accords provide further insights into the way these countries are thinking about the emerging economic opportunities of outer space, the development of which they are certainly trying to influence. In a way, the document crystallizes their reading of the available space of maneuver that a country could have when developing economic activities in outer space, within the framework of the OST. Because of this, the Accords could prove to be pivotal in the development of space law. For the purpose of this paper, the following lines will focus on what the Accords establish on the issue of space resources, although it should be mentioned that a general trend that runs through them is a particular emphasis on cooperation between the signatories in order to achieve a sustainable presence in the Moon and, eventually, Mars.

In their preamble, the Accords make it clear which international obligations constitute the framework of the proposed activities, since the document affirms the importance of compliance with all UN space treaties, except the Moon Agreement; as well as the benefits of coordination via multilateral forums, such as COPUOS, to further efforts toward a global consensus on critical issues regarding space exploration and use. They also make clear their desire to implement “the provisions of the Outer Space Treaty and other relevant international instruments and thereby establish a political understanding regarding mutually beneficial practices for the future exploration and use of outer space”.¹²³ This is the approach that is taken when dealing with the possibility for

¹²⁰ Para. 233, Committee on the Peaceful Uses of Outer Space, *Report of the Legal Subcommittee on its fifty sixth session*, held in Vienna from 27 March to 7 April 2017, (UN document A/AC.105/1122), p. 31.

¹²¹ “The Artemis Accords”, NASA, published on 13 October, 2020, last accessed on 24 July, 2021, available at <https://www.nasa.gov/specials/artemis-accords/index.html>

¹²² The signatories are Australia, Brazil, Canada, Italy, Japan, South Korea, Luxembourg, New Zealand, Ukraine, United Arab Emirates, United Kingdom and the United States.

¹²³ Artemis Accords, Preamble, p. 1. Available online at <https://www.nasa.gov/specials/artemis-accords/img/Artemis-Accords-signed-13Oct2020.pdf>

extracting and using space resources, since these activities, “including any recovery from the surface or subsurface of the Moon, Mars, comets, or asteroids, should be executed in a manner that complies with the Outer Space Treaty and in support of safe and sustainable space activities”.¹²⁴ More importantly, the Accords also establish a noticeably clear position regarding the issue of appropriation, since they “affirm that the extraction of space resources does not inherently constitute national appropriation under Article II of the Outer Space Treaty, and that contracts and other legal instruments relating to space resources that any of the signatories should formalize should be consistent with that Treaty”.¹²⁵

This is the most concrete position on the matter and its repercussions, given the weight and space capabilities of the countries involved in the statement, could be far reaching in how the OST and space law in general are interpreted going forward. Indeed, even if they do not have the status of an international treaty, they could be used as a stepping-stone from which general practice could develop, in the long-term guiding the development of the general principles of space law according to this interpretation of the OST. Not surprisingly, the Artemis Accords have elicited strong reactions, particularly from countries, such as China and Russia¹²⁶, which have been at odds with the United States in recent years.

It is still too early to pass judgement on the Accords, or even on some of the most recent examples of national legislation on the matter of space resources. Perhaps at this point it just suffices to say that these documents all seem to take as a given a particular interpretation of the OST and of the applicable international obligations that suits their particular purposes. Going back to the premise of this paper, in the sense that the extraction and commercialization of space resources can be considered a use of outer space as established in the OST, the crux of the question seems to be how such activities should be carried out in order to comply with all the other requirements of space law. We should not forget that these are activities that would take place in a very particular domain which cannot be appropriated and in which State sovereignty is very limited. Furthermore, the use of such domain must be to the benefit of mankind. In this regard, whether these pieces of legislation actually manage to do so is still at best an open question. At this

¹²⁴ Ibid., Section 10 – Space Resources, p. 4.

¹²⁵ Idem.

¹²⁶ E. Taichman, “Why Biden must pursue space diplomacy with Russia and China”, POLITICO, 29 January, 2021. Last accessed on 24 July 2021. Available at:

<https://www.politico.com/news/2021/01/29/biden-space-diplomacy-russia-china-455963>

point they are just efforts that could aim either to bring about an advantage in the establishment of space resources efforts in their countries while their international obligations are clarified, or an actual effort to try and guide the practice of States, with the hope that this interpretation of the OST will be established as its actual implementation.

Conclusion

The definition of the issue of space resources utilization and their commercialization will be one of the most important legal and political debates of the next decades. It is not a matter of if but of when the first operation for extracting mineral resources from a celestial body, either an asteroid or more probably the Moon, will take place. Thus, the regulation of these types of activities is of utmost importance for their successful and safe completion. And as we have seen, a regulatory framework does exist. The Outer Space Treaty codifies and establishes a set of principles that guide State behavior in outer space and which are accepted by the international community as a whole, with credible arguments for some of them being part of customary international law. However, it is a framework that leaves many doors open to interpretation, particularly on the issue at hand, since the international community has not been able to come together for any further negotiations on space law since the negotiations for the Moon Agreement over 40 years ago. There have been, of course, further developments via “soft law”, such as UN General Assembly resolutions like the Space Benefits declaration, but as we have seen their impact is rather limited. Where the international community goes from here will be one of the key factors of interstate relationships in the 21st century.

What becomes clear from the issues explored in this paper is that any solution to this issue must by necessity conform with the principles established in the OST, particularly the freedom of exploration of outer space, as well as the no-appropriation principle. That is the base from which any further legislation, either national or international, must be enacted. As we have seen, perhaps the “void” could be filled by the practice of some States, who through their carrying out actual operations in outer space could set the trends and practices that eventually all others would have to follow. The pieces of national legislation explored in this paper, as well as the Artemis Accords, seem to be going in this direction. It is encouraging that the latter takes into account the OST and

indeed aims for the activities developed within its umbrella to comply with its principles. Whether it will do so is another matter altogether, for one thing is to proclaim the acceptance of any set of principles and the other is actually complying with them. And here again is the crux of the matter: How will the extraction of natural resources located in celestial bodies in outer space comply with the idea of outer space as an area for all of humanity in which States have to respect the no-appropriation rule? How will the idea that the use of outer space should be for the benefit of mankind be interpreted? The consequences of getting the answer wrong are enormous. The resources available in outer space could represent incredible possibilities for the future of mankind, both for the sustainability of planet Earth and for the development of human efforts of space colonization. It is not something that should be taken lightly, or that should be decided by just a few countries.

Clearly, this is an issue in which further international cooperation and regulation is needed. As the practice of State develops in this area, there are a few legal paths through which this matter might advance. It would still be possible, for example, to think of the Moon Agreement as an alternative to which more States could subscribe, especially if they perceive that the current actions of some would not be in the interests of mankind. It is important to remember that the MA is still a treaty in force, and one which was negotiated with the support of the membership of the UN at the time. It already contains the seed of a solution in the form of an international regime for the management of space resources. Should clarification be needed on what are the implications of certain legal concepts within space law, there is always the possibility of the UN General Assembly requesting an Advisory Opinion from the ICJ. In this regard, perhaps the experience in other areas of international law related to the management of global commons, such as the regime for the exploitation and extraction of resources in the Area as is provided in UNCLOS, or that of Antarctica, could perhaps prove to be useful as an example for countries to rely on.

The Legal Subcommittee of UNCOPUOS could also become another avenue through which a compromise might be found. Indeed, just this year discussions begun within it on the matter of space resources. One could hope that States will find it a useful forum, just as it happened 70 years ago, in which to negotiate an issue which will have important repercussions for the international global order. In any case, we should not lose sight of all the legal obligations that States already face in outer space. The scope of the OST is quite grand in that sense, having regard

of the interests of mankind as a whole, and it is through its framework that any solution to this issue would have to be developed from.

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