LEGALITY OF UNILATERAL EXPLOITATION OF SPACE RESOURCES UNDER INTERNATIONAL LAW

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Abstract In recent years, there has been a surge of private investment in space resources and the enactment of domestic legislation aimed at protecting property rights over the resources to be extracted. This article argues that the unilateral exploitation of space resources is not prohibited by the principle of non-appropriation and is consistent with the freedom of use for common benefit and interests, with the caveat that it does not exclude others from exploitation or exacerbate inequality among States. It also argues that a laissez-faire approach would be detrimental to the orderly, sustainable and safe exploitation and use of space resources and calls for the establishment of an international regulatory regime consisting of rules concerning international coordination, benefits sharing and environmental protection.

Keywords: common benefits and interests, freedom of use, mineral resources, non-appropriation, outer space.

1. INTRODUCTION

The consumption of natural resources on the Earth has been accelerating with the increase in world population and the spread of industrialization around the globe. To meet growing demand, scientists are seeking to 'unlock' natural resources from outer space, with the idea of retrieving lunar and asteroidal materials dating back to the early 1970s.[1] Despite technical difficulties and high costs, extraterrestrial mining remains appealing to investors due to its significant potential value.[2] A glimmer of hope that this vision can become a reality has recently been seen with further development of science and technology. Private entities, such as Planetary Resources and Deep Space Industries (DSI), are pioneering efforts to bring extremely low-cost yet high-performance extraterrestrial resources to the market.[3]

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[1] GK O'Neill, 'The Colonization of Space' 27(9) *Physics Today* (1974) 32–40; GK O'Neill, 'Space Colonies and Energy Supply to the Earth' 190 (4218) *Science* (1975) 943–7.

[2] For instance, the raw value of the ore from an average-sized mineral-rich space object is estimated to be hundreds of billions of dollars. See R Ridderhof, 'Space Mining and (U.S.) Space Law' (18 December 2015) <http://www.peacepalacelibrary.nl/2015/12/space-mining-and-u-s-space-law/>.

[3] DSI, for instance, recently announced a plan to fly the world's first commercial interplanetary mining mission. Prospector-1 will fly to and rendezvous with a near-Earth asteroid and investigate the object to determine its value as a source of space resources. See Deep Space Industries,

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Anticipating a race for space resources, some States are taking the lead in seeking to enact legislation regulating future exploitation by their subjects. In 2015, the United States, in an attempt to create a pro-growth legal environment for space mining, passed the Space Resource Exploration and Utilization Act (or Space Resource Act), which forms Title IV of the Commercial Space Launch Competitiveness Act.[4] The Space Resource Act gives US citizens engaged in the commercial recovery of asteroid or space resources the right 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'.[5] Space resources are defined as abiotic resources *in situ* in outer space including, in particular, water and minerals.[6] The right to be recognized, in essence, is a property right, ie, the 'right to possess, use, and enjoy a determinate thing'.[7]

Predictably, more entities, public and private, are joining the race for space resources, and more States are seeking to enact domestic legislation protecting investors' interests. Luxembourg, which aims to position itself as a European hub in this new business, has announced its intention to develop a legal framework that ensures that private operators can be confident in their rights to the resources they extract. It is also committed to investing in relevant research and development projects and is considering direct capital investment in companies that are active in this field.[8] The government of Luxembourg announced that its comprehensive legal framework is expected to take effect in 2017 to spur investment in exploiting the resources of near-Earth objects.[9]

According to the Economy Ministry, like the US Space Resource Act, its legislation will guarantee the right to resources harvested in outer space in accordance with international law. However, it will apply not only to local companies but also to foreign corporations operating within its borders,[10] a feature that led DSI and Planetary Resources to establish legal entities in Luxembourg.[11] Its definition of space resources is similar to that in the US legislation.[12] It is worth mentioning that the United Arab Emirates (UAE) is also finalizing a space law covering both human space exploration and commercial activities, such as mining.[13]

Concerns have been raised about possible inconsistencies between domestic legislation, such as the above-mentioned laws, and international obligations incumbent upon the enacting State in the absence of an international regulatory regime similar to that governing deep seabed mining under the United Nations Convention on the Law of the Sea (UNCLOS). For instance, it is argued that the US Space Resource Act 'goes against a number of treaties and international customary

'Prospector-1: First Commercial Interplanetary Mining Mission' <http://deepspaceindustries.com/first-commercial-interplanetary-mission/>.

[4] U.S. Commercial Space Launch Competitiveness Act, H.R. 2262.

[5] ibid, section 51303.

[6] ibid, section 51301.

[7] BA Garner *et al.* (eds), *Black's Law Dictionary* (9th edn, West 2009) 1335.

[8] Luxembourg Ministry of the Economy, 'Luxembourg to Launch Framework to Support the Future Use of Space Resources' (2 February 2016) <www.gouvernement.lu/5653386>.

[9] 'Luxembourg Takes First Steps to "Asteroid Mining" Law' (3 June 2016) <http://phys.org/news/2016-06-luxembourg-asteroid-law.html>.

[10] ibid.

[11] ibid.

[12] Luxembourg Draft Law on the Exploration and Use of Space Resources, with Commentary (11 November 2016) <https://www.gouvernement.lu/6481974/Draft-law-space_press.pdf> 1.

[13] L Barnard, 'UAE to Finalise Space Laws Soon' *The National* (7 March 2016) <http://www.thenational.ae/business/aviation/uae-to-finalise-space-laws-soon>.

law which already apply to the entire universe'.[14] Others hold a different view, namely, that the Act does not, in its current form, conflict with international regulations.[15] The consistency of domestic legislation recognizing property rights over space resources extracted with international obligations under international law is closely related to the legality of unilateral exploitation of space resources.

The topic of property rights in outer space is not new. Sales of extraterrestrial real estate by private entities dates to the 1890s in the USA.[16] These speculative sales have prompted criticism within academia,[17] and they have been declared illegal in domestic courts.[18] The topic of property rights over natural resources in outer space is also addressed in a number of studies,[19] but this issue has become more tangible and pressing given recent developments in the realms of investment and domestic legislation. This article aims to provide an analysis of the legality of exploitation of space resources conducted unilaterally by States or private entities under current international law. Part II offers an assessment of legality under existing international treaties, especially the Outer Space Treaty. Part III assesses the possible existence of a rule of customary international law that permits or prohibits such unilateral exploitation. Part IV summarizes and argues for the establishment of an international regulatory regime for the purposes of international coordination, benefits sharing, and environmental protection.

II. INTERNATIONAL TREATIES

The Outer Space Treaty is regarded as the *Magna Carta* of international outer space law and is the most widely accepted of the five space-related treaties negotiated under the auspices of the United Nations.[20] Member States, by enacting laws recognizing property rights over space resources, must consider whether such laws are consistent with their other treaty obligations. This issue is exceptionally important for the US, as a State party to the treaty and one of the two superpowers that championed its negotiation during the Cold War. At the 55th Session of the Legal Subcommittee of

[14] G Oduntan, 'Who Owns Space? US Asteroid-Mining Act Is Dangerous and Potentially Illegal' *NSNBC International* (25 November 2015) <http://nsnbc.me/2015/11/25/who-owns-space-us-asteroid-mining-act-is-dangerous-and-potentially-illegal/>.

[15] A Lintner, 'Extraterrestrial Extraction: The International Implications of the Space Resource Exploration and Utilization Act of 2015' (2016) 40 Fletcher Forum of World Affairs 139.

[16] V Pop, *Who Owns the Moon? Extraterrestrial Aspects of Land and Mineral Resources Ownership* (Springer 2009) 2.

[17] See eg Board of Directors of the International Institute of Space Law (IISL), 'Statement on Claims to Property Rights Regarding the Moon and Other Celestial Bodies, 2004' <www.iislweb.org/docs/IISL_Outer_Space_Treaty_Statement.pdf>.

[18] S Freeland and R Jakhu, 'Article II' in S Hobe *et al.* (eds), *Cologne Commentary on Space Law* (Heymanns 2009) vol 1, 44, 55–7.

[19] See generally RJ Lee, *Law and Regulation of Commercial Mining of Minerals in Outer Space* (Springer 2012); F Tronchetti, *The Exploitation of Natural Resources of the Moon and Other Celestial Bodies* (Martinus Nijhoff 2009).

[20] Treaty on Principles Governing the Space Resource Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (19 December 1966), opened for signature 27 January 1967, entered into force 10 October 1967, 18 UST 2410, TIAS 6347, 610 UNTS 205 [Outer Space Treaty]. The Outer Space Treaty has 105 State parties and 25 signatories as at 1 January 2017. UNCOPUOS, Legal Subcommittee, 'Status of International Agreements relating to Activities in Outer Space as at 1 January 2017', UN Doc A/AC.105/C.2/2017/CRP.7 (23 March 2017) <http://www.unoosa.org/documents/pdf/spacelaw/treatystatus/AC105_C2_2017_CRP07E.pdf>.

the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS), held in Vienna 4–15 April 2016, some delegations expressed the concern that the Space Resource Act 'may amount to either a claim of sovereignty or a national appropriation of those [celestial] bodies and thus could constitute a violation of the Outer Space Treaty'.[21] In response, the US delegation stated that the legislation 'played a crucial role in regulating the relationship between a State and its non-governmental entities in the exploration and use of outer space, and did not in and of itself constitute a violation of the Outer Space Treaty in the absence of an actual authorization granted to an entity to extract or utilize resources from the Moon or a celestial body'.[22]

Another treaty that should not be neglected in evaluating the legality of unilateral exploitation of space resources is the Moon Agreement[23] due to its unequivocal provisions on mineral exploitation in outer space. With 17 State parties and 4 signatories as of 1 January 2017,[24] mostly with limited space capability, the Moon Agreement has received much less support than the Outer Space Treaty. Nevertheless, it provides a starting point for the formulation of an international mechanism governing the exploitation of space resources. To this end, it is advocated that States should accede to and ratify the Moon Agreement.[25]

A. Possible Restrictive Rules

The Outer Space Treaty does not prohibit *expressis verbis* the extraction of space resources. However, there exists a possibility that the recognition of property rights by a State, which is a party to the Outer Space Treaty, over resources extracted in outer space may conflict with its international obligations under Article II of the treaty, which proscribes the national appropriation of outer space 'by claim of sovereignty, by means of use or occupation, or by any other means'.[26] The term 'appropriation' means '[t]he exercise of control over property; a taking of possession'.[27]

1. Subject of appropriation prohibited

The exploitation of space resources interests not only private entities but also States. Luxembourg is reported to have begun investments in research and development for such exploitation.[28] For instance, it has partnered with DSI to co-fund the development and launch of Prospector-X, the first DSI spacecraft, which will test

[21] UNCOPUOS, Legal Subcommittee, Draft Report of the 55th Session of the Legal Subcommittee of the COPUOS, Vienna, 4–15 April 2016, A/AC.105/C.2/L.298/Add.1, para 21.

[22] ibid, para 23.

[23] Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, opened for signature 18 December 1979, entered into force 11 July 1984, 1363 UNTS 3 [Moon Agreement].

[24] State parties are Australia, Austria, Belgium, Chile, Kazakhstan, Kuwait, Lebanon, Mexico, Morocco, Netherlands, Pakistan, Peru, Philippines, Saudi Arabia, Turkey, Uruguay and Venezuela (Bolivarian Republic of). Signatories are France, Guatemala, India and Romania. See 'Status of International Agreements relating to Activities in Outer Space as at 1 January 2017' (n 20).

[25] R Jakhu, JN Pelton, YOM Nyampong, *Space Mining and Its Regulations* (Springer 2017) 129.

[26] Outer Space Treaty, art II.

[27] Garner *et al.* (n 7) 117.

[28] L Hay Newman, 'Luxembourg Bets Big on Space Mining for Some Reason' (7 June 2016) *Future Tense* <http://www.slate.com/blogs/future_tense/2016/06/07/luxembourg_invests_in_space_mining_research.html>.

technologies necessary for future asteroid prospecting in low-Earth orbits.[29] NASA, an independent agency of the executive branch of the US federal government that is responsible for the civilian space programme, among others, has reportedly contracted with DSI and Planetary Resources to prepare for and ultimately execute missions to land on and mine asteroids for valuable resources.[30]

The prohibition of 'national appropriation' under Article II of the Outer Space Treaty is *prima facie* limited to appropriation by States.[31] Proponents of the freedom of appropriation by private entities, such as Dennis Hope, who founded the Lunar Embassy, an 'extraterrestrial estate agency', read Article II as not prohibiting commercial enterprises or private individuals from claiming, exploiting or appropriating celestial bodies for profit.[32] However, 'national appropriation' in its ordinary meaning does not seem limited to 'appropriation by States'. In this regard, it is noteworthy that in Article VI of the same treaty, 'national activities in outer space' include activities carried out by government agencies and by non-governmental entities.[33] The text of the treaty in Chinese, unlike those in the other four official languages of the United Nations when the Outer Space Treaty was adopted, namely English, French, Russian and Spanish, seems to limit prohibited appropriation to State parties. This is an inconsistency among the versions, which are all equally authentic.[34] This inconsistency, however, is very likely due to an inaccurate translation.

It is argued that to interpret Article II as permitting private appropriation would defeat the purpose of the treaty.[35] This argument is tenable, as appropriation by States and appropriation by private entities have the same consequence of hindering free access to outer space. That the term of 'national appropriation' was intended to cover both public and private appropriation is confirmed by the drafting history of the Outer Space Treaty.[36] In any case, Article VI of the treaty provides that State parties shall bear international responsibility for national activities in outer space carried out by governmental agencies and non-governmental entities, as well as 'for ensuring that national activities are carried out in conformity with the provisions set forth in the present Treaty'.[37] It follows that both governmental and private commercial space mining ventures would be required to comply with principles of international space law.[38] The appropriation of outer space by private entities should thus be treated as appropriation by their States, which is prohibited.[39] Based on the above rationale, domestic courts have declared private claims over and sales of celestial bodies, in part or in whole, to be illegal.[40] These judgments are subsequent State practice in the application of Article II, which helps establish agreement among the parties regarding the above interpretation.[41]

[29] E Calandrelli, 'Deep Space Industries Partners with Luxembourg to Test Asteroid Mining Technologies' (5 May 2016) *TechCrunch* <https://techcrunch.com/2016/05/05/deep-space-industries-partners-with-luxembourg-to-test-asteroid-mining-technologies/>.

[30] Ridderhof (n 2).

[31] S Gorove, 'Interpreting Article II of the Outer Space Treaty' (1969) 37 FordhamLRev 349, 351; Lintner (n 15) 146.

[32] Pop (n 16) 12.

[33] Outer Space Treaty, art VI.

[34] Outer Space Treaty, art XVII.

[35] Jakhu, Pelton and Nyampong (n 25) 121.

[36] Freeland and Jakhu (n 18) 50.

[37] Outer Space Treaty, art VI.

[38] Lee (n 19) 153.

[39] ibid 167; Tronchetti (n 19) 199; Board of Directors of the International Institute of Space Law (IISL) (n 17).

[40] Freeland and Jakhu (n 18) 55–7.

[41] Vienna Convention on the Law of Treaties (23 May 1969) 1155 UNTS 331 [VCLT] art 31(3)(b).

Therefore, the essential question is not whether the non-appropriation rule applies to private entities but whether the unilateral exploitation of space resources *per se* amounts to appropriation.

2. *The object of appropriation prohibited*

As to the object of appropriation, one of the pertinent issues is whether celestial bodies, as territories, and the resources thereon, as materials, have the same legal status. Simply put, are resources on celestial bodies non-appropriable like the celestial bodies themselves? If so, then the exploitation of resources, which is apparently an 'exercise of control' over and a 'taking of possession' of them, would amount to partial appropriation of celestial bodies. Views on this issue differ. Whereas some argue that the non-appropriation principle in Article II applies to outer space as well as to the natural resources therein,[42] others hold that the principle is applicable to outer space but not to its natural resources.[43] Drawing on a basic principle of French property law, ie, the separable legal nature of mines and the surface of land, Luxembourg took the position that space resources can be appropriated.[44] Such a view is only implicit in the US Space Resource Act, which recognizes the non-appropriation of celestial bodies while providing for the freedom to engage in space mining.

The Outer Space Treaty was adopted in the 1960s, a time when space activities were conducted only by States for scientific, military and even national prestige purposes. The inclusion of a non-appropriation provision in the treaty stemmed from concerns that nations would claim space and celestial bodies as their own territory and use them to station weapons for use against other nations.[45] Thus, the provision aimed to prevent sovereignty claims over outer space in the territorial sense. As mentioned above, public interest in the retrieval of natural resources in outer space did not emerge until the 1970s. The exploitation of natural resources in outer space, which is appropriation in the material sense, was then a low-priority issue at best. Were the non-appropriability of natural resources envisaged, it could have been explicitly provided for. Such an inference can be drawn from the fact that the treaty explicitly states the activities that are forbidden, and mining or owning natural resources are not listed.[46] A lack of an *expressis verbis* prohibition, however, is not equivalent to lawfulness. The exploitation of space resources is simply a matter left for the further development of international law. As Johnson posited, the issue of the ownership of space resources is not adequately addressed under international law.[47]

[42] See eg S Gorove, 'Limitations on the Principle of Freedom of Exploration and Use of Outer Space: Benefits and Interests' (1973) Proceedings of the 13th Colloquium on the Law of Outer Space 74.

[43] See eg SM Williams, 'The Law of Outer Space and Natural Resources' (1987) 36 ICLQ 142, 147.

[44] Luxembourg Draft Law on the Exploration and Use of Space Resources, with Commentary (n 12) at 3, citing Law of 21 April 1810 concerning Mines, Mining and Quarries.

[45] JI Gabrynowicz, 'Space Law: Its Cold War Origins and Challenges in the Era of Globalization' (2004) 37 SuffolkULRev 1041, 1043.

[46] S Coffey, 'Establishing a Legal Framework for Property Rights to Natural Resources in Outer Space' (2009) 41 CaseWResJIntlL 119, 126.

[47] See eg D Johnson, 'Limits on the Giant Leap of Mankind: Legal Ambiguities of Extraterrestrial Resource Extraction' (2010–11) 26 AmUIntlLRev 1477, 1481.

Another issue pertaining to the object of appropriation is the scope of the term 'celestial bodies'. The US Space Resource Act defines an 'asteroid resource' as 'a space resource found on or within a single asteroid'.[48] A 'space resource' is further defined as 'an abiotic resource *in situ* in outer space', including 'water and minerals'.[49] The key questions that follow are whether any natural objects in outer space, which differ markedly in size and composition, are celestial bodies and, hence, non-appropriable and whether small asteroids are a material resource whose appropriation is not prohibited *expressis verbis*.

The Outer Space Treaty does not include a definition of celestial bodies, despite its repeated inclusion of 'the Moon and other celestial bodies'. The International Astronomical Union (IAU), in a resolution adopted in 2006, divides natural bodies in the Solar System into planets, dwarf planets, and small Solar System bodies, which include asteroids, most trans-Neptunian objects, comets, and other small bodies.[50] The definition, however, is not legally binding. It is argued that, in the absence of an internationally accepted legal definition, the ordinary meaning of celestial body should be used, namely, 'any natural body outside of the Earth's atmosphere',[51] which would include 'all planets, comets, stars, asteroids, and meteorites, irrespective of their sizes, forms and orbits'.[52] This approach has its merits, as it could be reasonably presumed that the capable drafters of the Outer Space Treaty were fully aware of the existence of small solar system bodies such as asteroids and comets. Ceres, the first and largest asteroid discovered, was observed early in 1801. It soon became obvious that a belt of asteroids existed between Mars and Jupiter.[53] Since 1891, the rate of detection dramatically increased due to the use of astrophotography.[54] Asteroids have been subject to increasing attention in astronomy since the late twentieth century when it was realized that those nearby might pose threats to the Earth but also that there were opportunities to exploit their resources. Based on the lack of exclusion of any celestial bodies, the treaty's scope shall be regarded as all-encompassing.

While it is only natural that the increasing accessibility of asteroids generates a preference for a narrower scope of celestial bodies on the part of technology-ready States, any change to the scope of the definition must be made by an amendment to the Outer Space Treaty pursuant to its Article XV. A Working Group of the International Institute of Space Law (IISL) proposed that the definition of celestial bodies should be related to the human capability to remove them from their trajectory.[55] States may also consider setting a size threshold to demarcate celestial-body asteroids and non-celestial-body asteroids. Size appears relevant to determining the legal status of celestial bodies, as it seems that most people would not regard the possession of an

[48] U.S. Commercial Space Launch Competitiveness Act, section 51301.

[49] ibid. Luxembourg takes a similar view. See Luxembourg Draft Law on the Exploration and Use of Space Resources, with Commentary (n 12) 1.

[50] IAU Resolution B5, Definition of a Planet in the Solar System <http://www.iau.org/static/resolutions/Resolution_GA26-5-6.pdf> at fn 3.

[51] Jakhu, Pelton and Nyampong (n 25) 117, citing Jerry Coffey, 'Celestial Body' (27 December 2009) *Universe Today* <http://www.universetoday.com/48671/celestial-body/>.

[52] ibid, 118.

[53] ESA, 'Asteroids: The Discovery of Asteroids' <http://www.esa.int/About_Us/Welcome_to_ESA/ESA_history/Asteroids_The_discovery_of_asteroids>.

[54] For a discovery rate of near-Earth asteroids, see NASA, NEO Discovery Statistics <http://neo.jpl.nasa.gov/stats/>.

[55] M Smirnoff, 'Report from Working Group Three on the Law of Outer Space' (1964) 7 Proceedings of the Colloquium on the Law of Outer Space 352.

egg-sized asteroid as appropriation. Nor would they deny that a sovereignty claim over a Texas-sized asteroid is not appropriation.

3. *Means of appropriation prohibited*

A sovereignty claim is highlighted under Article II of the Outer Space Treaty as a typical means of appropriation. Sovereignty in relations between States, as Justice Huber opined in the 1928 *Island of Palmas* case, signifies independence which 'in relation to a portion of the globe is the right to exercise therein, to the exclusion of any other State, the function of a State'.[56] By analogy, this definition applies to outer space as well as to the Earth. Any claim of sovereignty over outer space, in whole or in part, is apparently appropriation, which is explicitly prohibited by Article II. It is unlikely that a State, even non-party to the Outer Space Treaty, would stake such a claim over outer space. The US Space Resource Act explicitly states that 'by the enactment of this Act, the United States does not thereby assert sovereignty or sovereign or exclusive rights or jurisdiction over, or the ownership of, any celestial body'.[57]

It is worth considering whether the protection of property rights over resources obtained from outer space amounts to a *de facto* sovereignty claim, even if no sovereignty claim is expressly made. In this context, it is argued that by conferring property rights over asteroid resources to its private companies, the US suspiciously considers the asteroid 'as part of its territory, thus violating the non-appropriation principle'.[58] The protection of property rights over material resources that private entities may recover from an area beyond national jurisdiction, as shown by international regulations governing fishing on the high seas, does not necessarily amount to a sovereignty claim over the territorial area. States recognize that fish harvested in the high seas and brought on board vessels to be the property of fishermen based on their jurisdiction over the vessels that fly their flags rather than their sovereignty over the high seas. One of the conditions is that flag States have the obligation to ensure that fishing is conducted in a manner consistent with international law.[59] As a means of guaranteeing compliance with relevant international laws, fishing activities must be licensed by States.[60] Hence, the question is essentially whether space resources are open for unilateral exploitation, as the nationals of all States have the right to engage in fishing on the high seas subject to certain conditions.[61]

A sovereignty claim is not the sole means of appropriation. Use or occupation may also amount to appropriation. The term 'any other means' indicates that the appropriation prohibition under Article II is all-encompassing. The test should therefore be based on the consequences of preventing others from engaging in

[56] Island of Palmas Case (or Miangas), United States v Netherlands, Award, (1928) II RIAA 829, 838.

[57] U.S. Commercial Space Launch Competitiveness Act, section 403.

[58] F Tronchetti, 'Private Property Rights on Asteroid Resources: Assessing the Legality of the ASTEROIDS Act' (2014) 30 Space Policy 193, 194.

[59] For instance, under the UNCLOS, States have the duty to take measures necessary for their nationals 'for the conservation of the living resources of the high seas'. See United Nations Convention on the Law of the Sea (10 December 1982) 1833 UNTS 3 [UNCLOS] art 117.

[60] Under Chinese law, for instance, licenses for fishing on the high seas shall be granted upon approval by the administrative department for fisheries under the State Council. Fisheries Law of the People's Republic of China, adopted and promulgated on 20 January 1986, art 23.

[61] UNCLOS, art 116.

exploitation. Occupying or using a portion of outer space in a manner that excludes others from exploitation, therefore, constitutes appropriation. The Space Resource Act recognizes property rights over 'asteroid resource or space resource obtained' without providing a clear definition of the term 'obtained'. Concerns have been raised that subjecting the unextracted, *in situ* asteroid resources to US federal law is a form of national appropriation by 'other means'.[62] In this respect, whether the US Space Resource Act is consistent with the non-appropriation principle would depend largely on the manner in which it is to be implemented when space resources are extracted and whether this excludes others from extractive activities.

Unlike the Outer Space Treaty, the Moon Agreement is unequivocal in prohibiting the appropriation of outer space, particularly with regard to the scope of subjects and objects for which appropriation is prohibited. It explicitly recognizes that '[t]he moon and its *natural resources* are the common heritage of mankind'[63] and that '[n]either 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*'.[64] The Agreement leaves the door open for future mineral exploitation in space. State parties must establish an international regime, including appropriate procedures to govern the exploitation of the natural resources of the Moon, when such exploitation is about to become feasible.[65]

At the 55th session of the Legal Subcommittee of the UNCOPUOS, some delegations expressed the view that the unilaterally enacted legislation of the US represented a reversal of the position it took during the negotiation of the Moon Agreement in the Committee and its adoption by the General Assembly.[66] The US delegation, on the other hand, denied that its obligations under the Outer Space Treaty precluded the right to use natural resources in outer space.[67] The US has not signed or ratified the Moon Agreement; thus, it is not obliged to refrain from defeating its objects and purposes.[68] Nor is it obligated to comply with its provisions, regardless of whether it took a position against unilateral exploitation during negotiations. Therefore, as a point of departure, States not party to the Moon Agreement are not bound by it. Nevertheless, Article 11 of the Moon Agreement provides a valuable framework for the development of an international coordination and benefits-sharing mechanism for the exploitation of space resources.

B. Possible Permissible Rules

1. Freedom of use of outer space

Proponents of the right to unilateral exploitation of space resources argue that it is an exercise of the freedom of use of outer space, which is explicitly protected by the

[62] See eg a letter from Professor Joanne Gabrynowicz commenting on H.R. 1508 as a citizen expert, dated May 12, 2015, in Congressional Recording on Spurring Private Aerospace Competitiveness and Entrepreneurship Act of 2015 (21 May 2015) H3513.

[63] Moon Agreement, art 11(1) (emphasis added). It is noteworthy that the provisions of the Moon Agreement relating to the Moon also apply to celestial bodies within the solar system other than the Earth. Moon Agreement, art 1(1).

[64] Moon Agreement, art 11(3) (emphasis added).

[65] Moon Agreement, art 11(5).

[66] Draft Report of the 55th Session of the Legal Subcommittee of the COPUOS (n 21) para 22.

[67] ibid, para 23.

[68] VCLT, art 18.

Outer Space Treaty.[69] The term 'use' in its ordinary meaning refers to the 'application or employment of something'.[70] It is interpreted by some as 'non-economic and economic use', including the 'exploitation of outer space and of celestial bodies'.[71] The Board of Directors of the IISL holds that 'there is no international agreement' on whether the right of free use extends to the right to take and consume non-renewable natural resources, including minerals and water on celestial bodies.[72]

A treaty should be interpreted in good faith in accordance with the ordinary meaning to be given to its terms in their context and in the light of its object and purpose.[73] It should be observed that the purpose of the Outer Space Treaty 'is not to restrict the use of outer space, but rather to promote the free exploration and use of outer space', and 'where activities are not expressly prohibited, ambiguities should be construed in a permissive rather than restrictive way in order to avoid unnecessarily impeding the development of the uses of outer space'.[74] This observation with respect to the object and purpose of the Outer Space Treaty is probably accurate in view of the recognition by State parties of 'the common interest of all mankind in the progress of the exploration and use of outer space for peaceful purposes' in the preamble.[75] The questions that follow concern whether entities engaged in the exploitation of resources in space are entitled to property rights over the resources exploited and what limitations are imposed on them apart from the requirement of non-appropriation.

One may wonder whether there is any legal presumption of ownership of mineral resources. Under the laws of various jurisdictions, wild animals are *res nullius*, or ownerless property, and can be considered private property when reduced to possession by being killed or captured.[76] By contrast, mineral resources are generally owned by States or private entities and are not subject to the 'first come, first served' rule.[77] In some areas beyond national jurisdiction, similar rules have been established. Under the UNCLOS, for instance, fisheries in the high seas are free to harvest subject to conservation measures;[78] mineral resources deep within the seabed, on the other hand, cannot be freely extracted.[79] However, the above norms, domestic or international, cannot be extrapolated to outer space in order to prohibit the unilateral exploitation of its natural resources therein since the above domestic legislation and international treaties prohibiting unilateral exploitation of minerals are based on agreements between citizens or between States. The agreement that States achieved

[69] Letter from HR Hertzfeld, M Schaefer, JC Bennett, and MJ Sundahl commenting on Professor Joanne Gabrynowicz's letter, dated 15 May 2015, in Congressional Recording on Spurring Private Aerospace Competitiveness and Entrepreneurship Act of 2015 (21 May 2015) H3518–9; H Schmitt, *Return to the Moon* (Copernicus 2006) 282; Tronchetti (n 19) 222–3.

[70] Garner *et al.* (n 7) 1681.

[71] S Hobe, 'Article I' in S Hobe *et al.* (eds), *Cologne Commentary on Space Law* (Heymanns 2009) vol 1, 25 at 35, para 36; F von der Dunk, 'The US Space Launch Competitiveness Act of 2015' *JURIST: Academic Commentary* (3 December 2015) <http://jurist.org/forum/2015/11/frans-vonderdunk-space-launch.php>.

[72] Board of Directors of the International Institute of Space Law (IISL), 'Position Paper on Space Resource Mining, 20 December 2015' <http://iislweb.org/html/20151220_news.html> at 2.

[73] VCLT, art 31. [74] Lintner (n 15) 147. [75] Outer Space Treaty, Preamble, 2nd para.

[76] See eg *Pierson v Post*, 3 Cai. R. 175, 2 Am. Dec. 264. F Laurent, *Principes de droit civil français*, vol 6 (3rd edn, Bruylant-Christophe & Cie 1878) at 10.

[77] See eg *Mineral Resources Law of the People's Republic of China*, art 3, which provides that '[m]ineral resources belong to the State'.

[78] UNCLOS, art 116 and Part VII, section 2 in general. [79] UNCLOS, Part XI.

under the Outer Space Treaty regarding the non-appropriation of outer space, as mentioned above, only extends to celestial bodies in the territorial sense. The assimilation of asteroids to *ferae naturae*[80] and the application of the municipal category of movables to asteroids and comets[81] are likewise untenable due to the lack of such an agreement among States.

Natural resources in outer space are not designated as the 'common heritage of mankind', as are resources in the deep seabed under the UNCLOS.[82] As outer space is not subject to national sovereignty, space resources are essentially in a 'state of nature'. According to John Locke, whose writings were influential in the development of modern property rights, God gave the Earth to mankind in common.[83] The question of whether outer space was also gifted by God may be translated into secular terms as whether we ought to be considered an interplanetary species. The question is more philosophical than legal, but an affirmative answer can be inferred from the pro-exploration approach of the Outer Space Treaty mentioned above. Locke further argued that in the state of nature, resources and land may be appropriated and converted to private property by adding to them 'the labour of his body, and the work of his hands' rather than by an express compact among all the commoners.[84] The exploitation of space resources obviously requires labour and work. The recognition of property rights over resources unilaterally exploited in outer space thus conforms to Locke's theories, even without the achievement of an international agreement.

However, the acquisition of property rights over resources in the state of nature is not unlimited. It should not be forgotten that Locke, while advocating for private property rights over resources recovered from the state of nature, also held that one cannot accumulate as much as one wills. Indeed, one limitation on private property is to 'make use of to any advantage of life before it spoils'; whatever is beyond this amount belongs to others.[85] He turned to 'exhaustiveness' for the assessment of this limitation, arguing that one 'ought not to meddle with what was already improved by another's labour', as far as he 'had as good left for his improvement, as was already taken up'.[86] In the seventeenth century, Locke lived in an early age of industrialization when the resources of the Earth seemed inexhaustible. With industrialization and surging populations, the resources of the Earth can no longer be appropriated without prejudice to the interests of others. By contrast, human use of natural resources in outer space is primitive at best. A large quantity of asteroids linger in the asteroid belt between Mars and Jupiter, and those that come close to the Earth, called near-Earth asteroids, are capable of exploitation. Given the abundance of these resources, it could be concluded that the appropriation of mineral resources in outer space is not prohibited, with the caveat that due regard should be paid to others' opportunities to engage in exploitation. This conclusion is compatible with the current requirement of the Outer Space Treaty that its State parties conduct all their activities in outer space 'with due regard to the corresponding interests of all other States Parties'.[87]

[80] M Jensen, '*Asteroidae Naturae*: What It Takes to Capture an Asteroid' (2016) 45 Southwestern Law Review 757, 776. [81] Pop (n 16) 50–1. [82] UNCLOS, art 136.
[83] John Locke, *Second Treatise of Government* (Hackett Publishing Company 1980) 18.
[84] ibid, 19, 21. [85] ibid, 19–20. [86] ibid, 22. [87] Outer Space Treaty, art IX.

2. The common benefits and interests principle

It is noteworthy that the freedom of use of outer space is, in addition to the prohibition of appropriation, subject to the limitation that they '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'.[88] This provision 'initiated the principle of global public interest in outer space, thereby establishing that the interests, both present and future, of all States must be taken into consideration in the exploration and use of outer space'.[89] The inclusion of this limitation in an operative paragraph and the use of the word 'shall' indicates that it was intended to entail legally binding obligations. During negotiations, the Italian and French representatives suggested that this item should be transferred to the preamble, while the Brazilian representative expressed an opposing view and proposed the addition of 'irrespective of the state of their scientific development'. In view of the drafting history, this principle should be treated as a binding legal obligation.[90]

Generally speaking, the use of natural resources in space would benefit and be in the interests of all countries by relieving the scarcity of resources on the Earth and promoting the advancement of technologies. For instance, it is argued that using lunar resources to create cleaner, more efficient energy on Earth or to support exploration and settlement in space is consistent with the above requirement, 'even though the benefit is indirect'.[91] What is considered beneficial by some States, however, may not be deemed so by others. For instance, the exploitation of space resources would be detrimental to the interests of countries exporting such resources by lowering the price. However, it should be noted that benefits and interests common to 'all countries' are not equivalent to common benefits and interests for 'each country'. It is conceivable that in today's world, with countries at varied stages of development, they must have divergent benefits and interests that shape policies differently. It is often difficult to fulfil the benefits and interests of each and every State. However, as Bentham said, we should seek 'the greatest good for the greatest number'.[92] Whether certain activities support the interests of all countries shall be tested by this formula. In fact, it is quite practical to compensate the small number of countries that would be adversely affected in order to act in the global public interest. During the UNCLOS negotiations, similar concerns were raised with respect to the possibility that some developing countries might suffer serious damage to their export earnings or economies from reductions in the prices or increases in the volume of affected minerals. The Convention provides for compensation and other measures of economic assistance for affected countries.[93]

There are questions that are secondary to the general conclusion that the exploitation of space resources would benefit all countries. Whether exploitation should be carried out by a collective body on behalf of all countries or by capable entities on a free-market basis is a matter of the production mode; whether the benefits derived from the exploitation of

[88] Outer Space Treaty, Preamble, 3rd para; art I.

[89] R Jakhu, 'Legal Issues Relating to the Global Public Interest in Outer Space' (2006) 32 Journal of Space Law 31, 37–9.

[90] B Cheng, *Studies in International Space Law* (Oxford University Press 1997) 234.

[91] Coffey (n 46) 127.

[92] JE Crimmins, 'Jeremy Bentham' *Stanford Encyclopedia of Philosophy* (17 March 2015) <https://plato.stanford.edu/entries/bentham/>.

[93] UNCLOS, art 151(10).

space resources should be divided evenly among States or following market principles, on the other hand, is a matter of distributive justice. Whilst there is no lack of argument that all States should be entitled to an equal share of the benefits,[94] it is also argued that even if there is a specific duty to share the benefits among all States, such a requirement must be considered to be subject to some extent to commercial interests.[95]

Commercial interests are a vital incentive for investment in the exploitation of space resources. Dividing the benefits evenly among all States is ultimately contrary to their common interests by discouraging exploitation. As Aristotle said, 'treat like cases as like',[96] ie, treat equals equally and unequals unequally. It is validly argued that most commercial space activities, such as telecommunications, broadcasting, remote sensing and power generation, are beneficial in a general sense and that this is sufficient to satisfy the requirement of the common interest.[97] The fate of Part XI of the UNCLOS, which concerns deep seabed mining, suggests that equalitarianism is unlikely to endure in the regulation of resource exploitation in common areas. It was due to their scepticism concerning Part XI that many industrial countries did not join the Convention until the adoption of the 1994 Implementation Agreement. The 1994 Agreement, which prevails over Part XI of the UNCLOS in the event of any inconsistency,[98] introduced many free market elements and significantly watered down the idea of the common heritage of mankind. For instance, transfer of technology is no longer mandatory and unconditional but follows a market approach,[99] more specific rules are established for providing economic assistance to affected developing countries,[100] and financial requirements are significantly reduced and made more flexible.[101]

However, it must be borne in mind that the commercial approach to mineral exploitation in outer space runs the risk of inequality. Therefore, questions regarding the mode of production and distributive justice, albeit secondary to the question of the right of unilateral exploitation, may result in a backlash against the validity of the general conclusion reached above. In an extreme case, the acquisition of resources in outer space could be used by a group of countries to suppress the interests of others—imagine if that the exploitation of large quantities of plutonium, a highly strategic material, were monopolized by a few States or even private entities. Even if the use serves all, the resulting inequality might be so grave that the additional material benefits enjoyed by the disadvantaged group would be negligible in comparison with the heightened inequality between them and the advantaged group.

III. CUSTOMARY INTERNATIONAL LAW

The rules of customary international law are binding on all States, with the possible exception of those that have persistently objected to the development of the particular

[94] See eg E Paxson, 'Sharing the Benefits of Outer Space Exploration' (1993) 14 MichJIntlL 487, 495–6.

[95] Lee (n 19) 156.

[96] Aristotle, *Nicomachean Ethics*, V.3. 1131a10–b15; *Politics*, III.9.1280 a8–15, III.12. 1282b18–23.

[97] See eg S Gorove, 'Implications of International Space Law for Private Enterprise' (1982) 7 Annals of Air & Space Law 319, 321.

[98] Agreement relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982, 1836 UNTS 3 [Agreement Relating to the Implementation of Part XI of the Convention] art 2(1).

[99] Agreement Relating to the Implementation of Part XI of the Convention, Annex, section 5.

[100] ibid, Annex, section 7.

[101] ibid, Annex, section 8.

rule in question.[102] That outer space is not subject to appropriation, for example, became part of customary international law soon after the commencement of the space activities. This was included in General Assembly Resolutions 1721 and 1962[103] and codified in the Outer Space Treaty. With respect to space mining, it is contended that '[a] customary international law of the right to claim ownership over extracted natural resources has emerged due to the collections of moon rocks by the United States and the subsequent gifting of these rocks to foreign nationals without any objections from any states'.[104] On the contrary, it is maintained that the Moon Agreement of 1979, which has, in effect, forbidden State parties from engaging in commercial mining on planets and asteroids until there is an international regime to govern such exploitation, is binding on non-party States as customary international law.[105]

In examining the possible existence of a customary rule, a number of factors need to be taken into consideration concerning the nature of a particular practice by States, including its duration, consistency, repetition and generality.[106] So far, State practice pertaining to the collection of extraterrestrial rocks is simply too scarce to meet these criteria. It should also be noted that a lack of objection from States is not necessarily equal to acquiescence. In the *Lotus* case, the Permanent Court of International Justice held, 'only if such abstention were based on their being conscious of having a duty to abstain would it be possible to speak of an international custom'.[107] The collection and gifting of moon rocks has not always been publicly known, and even if it were, the quantities involved have been so small that their removal has not been regarded as so serious impediment to the interests of States as to be deserving of protest. However, the international community should pay close attention to the efforts of some private entities to bring back rocks from the Moon with the intention to establish property rights over them. The Moon Express, for instance, aims to return lunar rocks and dust before 2020 in order to establish and codify commercial precedent.[108] Such high-profile programmes with the express intention of affecting State practice would carry more weight in the development of customary international law given the publicity and the possible application of domestic law to these actions.

Furthermore, a distinction should be made, in terms of purpose and quantity, between the past practice of sample collection in outer space and envisaged resource exploitation. With respect to the purpose, 'the right of States to scientific exploration of outer space and its celestial bodies' is commonly differentiated from

[102] J Crawford, *Brownlie's Principles of Public International Law* (8th edn, Oxford University Press 2012) 28.

[103] Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space, G.A. Res. 1962 (XVII) of 13 December 1963, para 2, U.N. Doc A/RES/1962 (XVIII) (1 January 1964); International Cooperation in the Peaceful Uses of Outer Space, G.A. Res. 1721, U.N. Doc A/4987, (20 December 1961).

[104] Letter from Hertzfeld *et al.* (n 69) H3518. See also JE Dunstan, 'Toward a Unified Theory of Space Property Rights: Sometimes the Best Way to Predict the Weather Is to Look Outside' in EL Hudgins (ed), *Space: The Free Market Frontier* (Cato Institute 2002), 223 at 229. Coffey (n 46) 126.

[105] Oduntan (n 14).

[106] MN Shaw, *International Law* (6th edn, Cambridge University Press 2008) 74.

[107] *Case of the S.S. "Lotus" (France v Turkey)*, 1927 P.C.I.J. (Ser A) No.10, at 28.

[108] B Richards, 'The View from the Private Sector', Speech at the Seminar on 'Space Mining between the Space Treaties and the US Commercial Space Launch Competitiveness Act', European Space Policy Institute, Vienna (13 April 2016).

'the prevention of unilateral and unbridled commercial exploitation of outer-space resources'.[109] Whereas the freedom to engage in the scientific exploration of outer space has clearly become part of customary international law, commercial exploitation has yet to commence let alone give rise to the establishment of relevant customary rules. Quantity is another point of distinction between sample collection for scientific purposes and mineral exploitation. The six Apollo missions to the Moon, for instance, were recorded to have brought back a total of 842 pounds of lunar material.[110] This figure is small compared to the normal scale of mineral exploitation. The former Soviet Union also collected samples from the Moon during its three lunar programs,[111] and Japan once collected samples from Itokawa, an Apollo asteroid.[112] The amounts brought back from these unmanned missions are presumably significantly smaller than those obtained from the Apollo missions.

The distinction between large-scale exploitation of space resources and the collection of extraterrestrial samples is an idea rooted in the minds of the drafters of international law and domestic law. While suspending the exploitation of natural resources from the Moon, Article 6 of the Moon Agreement explicitly provides that 'States Parties shall have the right to collect on and remove from the Moon samples of its mineral and other substances' in carrying out scientific investigations, and 'States Parties may in the course of scientific investigations also use mineral and other substances of the moon in quantities appropriate for the support of their missions'.[113] Luxembourg also makes a distinction between commercial mineral exploitation and scientific research. The subject matter of its draft law only extends to missions of exploration and use of space resources for commercial purposes.[114]

The distinction between commercial activities and scientific research activities based on quantity was made in the *Whaling in the Antarctic* case before the International Court of Justice. Australia considered the quantity of whale meat generated in the course of a Japanese programme, and the sale of that meat, casts doubt on whether the killing, taking and treating of whales was for the purposes of scientific research; Japan argued in response that the sale of meat as a means to fund research is allowed by the International Whaling Convention and is commonplace in fisheries research.[115] The Court found that although Japan may fund its research through the sale of whale meat, a programme for purposes of scientific research may not use lethal methods on a larger scale than is reasonable in relation to achieving its stated objectives of funding that research.[116] Likewise, large-scale extraction of space resources is apparently beyond the reasonable need of scientific research. Freedom to engage in the scientific exploration of outer space, therefore, does not justify large-scale exploitation of extraterrestrial resources.

[109] Oduntan (n 14). Tronchetti also held that the extraction and use of extraterrestrial resources for scientific reasons is usually regarded as fully consistent with the terms of space treaties, whereas that for non-scientific purposes is not. See Tronchetti (n 19) 196.

[110] Dunstan (n 104) 228–9.

[111] NASA, Soviet Lunar Missions, <http://nssdc.gsfc.nasa.gov/planetary/lunar/lunarussr.html>.

[112] NASA, Hayabusa Asteroid Itokawa Samples, <https://curator.jsc.nasa.gov/hayabusa/>.

[113] Moon Agreement, art 6.

[114] Luxembourg Draft Law on the Exploration and Use of Space Resources, with Commentary (n 12) art 3.

[115] *Whaling in the Antarctic (Australia v Japan; New Zealand intervening)*, Judgment, ICJ Rep 2014, at 226, paras 91–92.

[116] ibid, paras 94 and 142.

The claim that there exists a customary rule prohibiting States from conducting commercial mining on planets and asteroids until there is an international regime for such exploitation is equally inconceivable. No State has exploited natural resources in space or has permitted their private entities to exploit them prior to the US legislation, not because they take it as a legal obligation to refrain from doing so but because of its being infeasible. Moreover, one of the possible explanations for the disparity in numbers of State parties to the Moon Agreement compared to the Outer Space Treaty is its unequivocal provisions relating to mineral exploitation in outer space.[117] And it is unclear 'whether the nature and scope of the future regime governing activities on the Moon will be based exclusively on the current Moon Agreement or on a new agreement'.[118] It would thus be contrary to predominant State practice, particularly that of space powers, to claim that the obligation not to exploit minerals on the Moon unilaterally has gained customary status.[119]

Listner predicted that '[t]he true test of the Moon Treaty both as treaty and customary law will not come until the exploitation of extraterritorial resources becomes technically and economically feasible'.[120] This test seems to have arrived earlier than anticipated. The recent resurgence in public and private interest in the exploitation of the Moon makes it urgent to establish clear rules on the exploitation of space resources. Practices like the legislation of the US and Luxembourg seem to point in the direction of freedom to engage in unilateral exploitation. Whether this practice will become predominant remains unclear and would depend on other States' responses to such legislation.

IV. CONCLUSIONS

To sum up, there is no prohibitive or permissive rule in customary international law regarding the legality of unilateral exploitation of space resources, as there has been no such practice to date. Recent domestic legislation in this area indicates a tendency towards freedom to engage in unilateral exploitation, but it remains unclear whether this will become predominant. Although the issue is not addressed *expressis verbis* in the Outer Space Treaty, the general principles enshrined therein are applicable to future exploitation activities, barring any *lex specialis*.

The principle of non-appropriation of outer space was not intended to prohibit resource exploitation in outer space, even that carried out unilaterally, but conducting exploitation in a manner that limits others' access to the same resource would also amount to appropriation. The consumption of a celestial body in its entirety, regardless its size, would also amount to appropriation. In order to make full use of small natural bodies, a narrower definition of celestial body may become necessary, which should be done by an amendment to the Outer Space Treaty.

[117] TG Nelson, 'The Moon Agreement and Private Enterprise: Lessons from Investment Law' (2011) 17 ILSAJIntl&CompL 393, 396; CR Buxton, 'Property in Outer Space: The Common Heritage of Mankind Principle vs. the "First in Time, First in Right" Rule' (2004) 69 Journal of Air Law & Commerce 689, 699.

[118] Jakhu (n 89) 105–6.

[119] RB Bilder, 'A Legal Regime for the Mining of Helium-3 on the Moon: U.S. Policy Options' (2010) 33 FordhamIntlLJ 243, 269.

[120] M Listner, 'The Moon Treaty: Failed International Law or Waiting in the Shadows?' *The Space Review* (24 October 2011) <http://www.thespacereview.com/article/1954/1>.

The exploitation of space resources arguably falls within the ambit of the freedom of use of outer space and is hence permitted. However, the principle of common benefits and interests, which constrain this freedom, requires that the benefits derived from the exploitation be shared in a manner that is non-detrimental to international peace and stability and beneficial to the promotion of equality among States. Thus, whether the US Space Resource Act and similar pieces of domestic legislation are consistent with international law depends on the manner in which they are to be implemented.

That unilateral exploitation of space resources is generally legal under existing international law does not mean that the exploitation will be carried out in an orderly and sustainable fashion without an international regime. The recognition of property rights over space resources under domestic laws is likely to lead to a laissez-faire approach to exploitation on the international plane. A number of issues can be anticipated if exploitation is regulated solely by domestic laws, which usually only apply to the extent of national jurisdiction.[121]

First, national legislation, which is likely to follow a 'first come, first served' approach to resource exploitation in outer space, is insufficient for coordinating competition for the same space resources between entities from multiple States, which might escalate into serious violations of existing legal rules governing outer space. The Outer Space Treaty requires its State parties to conduct all their activities in outer space 'with due regard to the corresponding interests of all other States Parties'.[122] While providing a general principle for coordination, it provides no specific coordinating rules. It cannot be ruled out that, with the risk of conflicts, private entities may choose to arm themselves to safeguard their own interest, and their States may also step in to protect them if necessary. In extreme cases, violations of Article IV of the Outer Space Treaty, which prohibits military use of celestial bodies and weapons of mass destruction in outer space, may occur.

Second, domestic legislation does not address the question of intra-generational equality. Given that the exploitation of natural resources in outer space is ultimately a hi-tech and costly enterprise, only a small number of private entities or States will have the capability to do so. States not directly involved in the exploitation may ask for a share of the benefits derived, as well as for technology transfers so that they can carry out exploitation themselves in the future. Benefits sharing, including technology transfer, was one of the important issues addressed in the negotiations on other common areas such as the deep seabed and Antarctica. Similar ideas have emerged at the UNCOPUOS, where multiple States expressed the view that a multilateral approach to addressing issues of resource extraction from the Moon and other celestial bodies was necessary to ensure that States adhered to the principles of equality of access to space and that the benefits of the exploration and use of other space was to be enjoyed by all humanity.[123]

Third, the lack of an international regime also increases the risk of causing significant derogation to the space environment and interplanetary contamination, including 'harmful contamination' of celestial bodies and 'adverse changes' in the environment of the Earth, as cautioned by Article IX of the Outer Space Treaty. Private entities

[121] For instance, the U.S. Space Resource Act applies to citizens of the legislating State. U.S. Commercial Space Launch Competitiveness Act, sections 51301, 51303.

[122] Outer Space Treaty, art IX.

[123] Draft Report of the 55th Session of the Legal Subcommittee of the COPUOS (n 21) para 25.

may choose to incorporate themselves in a State with lower standards of regulation, potentially causing problems resembling the 'flag of convenience' in shipping, a disincentive which may, in turn, make States 'race to the bottom'.

An international regulatory regime is thus called for to coordinate international competition for space resources, to promote intra-generational equity by redistributing benefits derived from the exploitation, and to protect and preserve the environment on Earth and in space. There are good reasons to be optimistic that we are moving in the direction of multilateralism rather than unilateralism regarding the regulation of mineral exploitation in outer space. Luxembourg stressed that its legal framework will be worked out in full consideration of international law, and that it is eager to engage with other countries on this matter within a multilateral framework.[124] The US delegate also expressed the view that '[its] national legislation on resource extraction and use did not preclude a multilateral approach or mechanism being developed in the future', although the delegate also cautioned, 'at present such a multilateral approach would be premature because resource extraction and utilization was not yet technologically viable'.[125]

[124] Luxembourg Ministry of the Economy (n 8).
[125] Draft Report of the 55th Session of the Legal Subcommittee of the COPUOS (n 21) para 27.