

ASTEROID MINING: INTERNATIONAL AND NATIONAL LEGAL ASPECTS

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1. INTRODUCTION; ASTEROID MINING AND THE LAW	83
2. THE INTERNATIONAL LEGAL CONTEXT FOR ASTEROID MINING – THE OUTER SPACE TREATY	85
3. THE INTERNATIONAL LEGAL CONTEXT FOR ASTEROID MINING—THE MOON AGREEMENT	88
4. BACK TO THE OUTER SPACE TREATY: INTERPRETING THE NON-APPROPRIATION PROHIBITION.....	91
5. UNILATERAL ACTION: TITLE IV, U.S. COMMERCIAL SPACE LAUNCH COMPETITIVENESS ACT.....	93
6. CONCLUDING REMARKS	99

1. INTRODUCTION; ASTEROID MINING AND THE LAW

Asteroid mining is one of the hot topics today not only within the space arena at large, but also in the more specific domain of space law, comprising “every legal or regulatory regime having a significant impact, even if implicitly or indirectly, on at least one type of space activity or major space application.”² The main reason for this lies in the well-developed plans of U.S. companies Planetary Resources³ and Deep Space Industries⁴ to launch missions within the next few years to first reconnoiter asteroids of potential interest from a commercial perspective

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4. Mike Wall, *Asteroid-Mining Project Aims for Deep-Space Colonies*, SPACE.COM (Jan. 22, 2013, 12:01 AM), <https://www.space.com/19368-asteroid-mining-deep-space-industries.html>; *Asteroid Mining*, DEEP SPACE INDUSTRIES, <https://deepspaceindustries.com/mining/> (last visited Sept. 20, 2017).

and then start harvesting valuable resources, ranging from water to such minerals as iron, nickel, and platinum, and selling them.⁵

From a legal perspective, these plans essentially raise questions of their compatibility with international space law, “a branch of general (public) international law, a subset of rules, rights[,] and obligations of states within the latter specifically related to outer space and activities in or with respect to that realm,”⁶ and in particular with respect to the 2015 U.S. Commercial Space Launch Competitiveness Act,⁷ Title IV of which addresses asteroid mining in a domestic United States context.⁸ This paper purports to provide an overview of exactly those questions, analyzing and evaluating the two main strands of interpretation currently visible in this respect, while also addressing the international ramifications of asteroid mining and their consequences in the legal context.

Following the launch of Sputnik I in 1957, the first discussions in the context of the United Nations, more specifically in the Legal Subcommittee of the Committee on the Peaceful Uses of Outer Space (UNCOPUOS), on space law arose and within some two decades gave rise to an embryonic yet almost all-encompassing legal regime for space activities.⁹ Even though the treaties drafted in that timeframe largely focused on the peaceful and safe use of outer space as well as scientific exploration,¹⁰ they still provide the legal framework within which such asteroid exploitation now should take place. Two treaties stand out from

5. See *supra* text accompanying notes 2–3.

6. Frans von der Dunk, *International Space Law*, in HANDBOOK OF SPACE LAW, *supra* note 1, at 29, 29.

7. See U.S. Commercial Space Launch Competitiveness Act, Pub. L. 114–90, 129 Stat. 704 (2015).

8. Title IV is entitled “Space Resource Exploration and Utilization.” *Id.* §§ 401–02 (codified at 51 U.S.C §§ 51301–03).

9. See, e.g., MANFRED LACHS, THE LAW OF OUTER SPACE 27–39 (2010); FRANCIS LYALL & PAUL B. LARSEN, SPACE LAW: A TREATISE 1–22 (2016); Stephan Hobe, *Historical Background*, in 1 COLOGNE COMMENTARY ON SPACE LAW 1, 2–12 (Stephan Hobe et al. eds., 2009).

10. See, e.g., Kai-Uwe Schrogl & Julia Neumann, *Article IV*, in 1 COLOGNE COMMENTARY ON SPACE LAW, *supra* note 8, at 70, 70–85; C.Q. CHRISTOL, THE MODERN INTERNATIONAL LAW OF OUTER SPACE 20–37 (1984); Stephan Hobe, *Article I*, in 1 COLOGNE COMMENTARY ON SPACE LAW 25, *supra* note 8, at 25, 34–6.

this perspective: the 1967 Outer Space Treaty,¹¹ ratified by over 100 states including all major spacefaring nations,¹² and the 1979 Moon Agreement,¹³ in spite of only counting 16 ratifications as of yet,¹⁴ none of which are major spacefaring nations.

2. THE INTERNATIONAL LEGAL CONTEXT FOR ASTEROID MINING – THE OUTER SPACE TREATY

As for the Outer Space Treaty, the states involved in its genesis in the late sixties did not seriously consider the possibilities for commercial exploitation of celestial bodies' resources, so that concept is essentially missing.¹⁵ Not even the term *commercial exploitation* can be found in the treaty, although most experts would agree that the reference to the freedom of use in Article I would include commercial exploitation.¹⁶ Beyond this very general clause, there are five clauses that have a bearing on the mining issue, even if not mentioning it explicitly.

11. Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205 (entered into force Oct. 10, 1967) [hereinafter Outer Space Treaty]; See, e.g., Bin Cheng, *The 1967 Space Treaty*, 95 J. DU DROIT INT'L 532 (1968), reprinted in BIN CHENG, *STUDIES IN INTERNATIONAL SPACE LAW* 215, 215–64 (1997); P.G. Dembling, *Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies*, in 1 *MANUAL ON SPACE LAW* 1, 1–51 (Nandasiri Jasentuliyana & Roy S.K. Lee eds., 1979).

12. See Comm. on the Peaceful Uses of Outer Space, Rep. of the Legal Subcomm. on Its Fifty-Fifth Session, U.N. Doc. A/AC.105/C.2/2016/CRP.3, at 10 (Apr. 4, 2016).

13. Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, Dec. 18, 1979, 1363 U.N.T.S. 3 (entered into force July 11, 1984) [hereafter Moon Agreement]. See, e.g., Stephan Hobe et al., *The 1979 Agreement Governing the Activities of States on the Moon and Other Celestial Bodies*, in 2 *COLOGNE COMMENTARY ON SPACE LAW* 325, 325–426 (Stephan Hobe et al. eds., 2013); Bin Cheng, *The Moon Treaty*, 33 *CURRENT LEGAL PROBS.* 213 (1980), reprinted in CHENG, *supra* note 10, at 357, 357–80.

14. Comm. On the Peaceful Uses of Outer Space, *supra* note 11, at 10.

15. See, e.g., Fabio Tronchetti, *Legal Aspects of Space Resource Utilization*, in *HANDBOOK OF SPACE LAW*, *supra* note 1, at 769, 777.

16. See Stephan Hobe, *Adequacy of the Current legal and Regulatory Framework Relating to the Extraction and Appropriation of Natural Resources*, 32 *ANNALS OF AIR AND SPACE L.* 115, 116–20 (2007).

Most importantly, Article II provides that national appropriation of celestial bodies, whether by sovereignty or by other means, is prohibited.¹⁷ This clause has generally been perceived to establish outer space as a “global commons,” an area not subject to any individual state’s legal authority and jurisdiction yet free for all states to access, as long as they are in compliance with any other applicable rules of international law.¹⁸ In other words, it refers to the prohibition of any colonization in the legal sense of the word—that is, exercising territorial sovereignty over a piece of land as if it were an outlying part of the motherland and exercising complete and exclusive jurisdiction over it.¹⁹ The main question here is what that means for the granting of mining rights: who is entitled to do so, and under what conditions?

Second, Article I requires exploration and use to be for the benefit of mankind.²⁰ Here, the question would be how the benefit of mankind would have to be interpreted in the context of possible mining

17. Outer Space Treaty, *supra* note 10, art. II (“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.”).

18. *See, e.g.*, von der Dunk, *supra* note 5, at 55–60; Bin Cheng, *The Legal Regime of Airspace and Outer Space*, 5 ANNALS OF AIR AND SPACE L. 323 (1980), reprinted in CHENG *supra* note 10, at 425, 434–44; Steven Freeland & Ram Jakhu, *Article II*, in 1 COLOGNE COMMENTARY ON SPACE LAW, *supra* note 8, at 44, 48–55.

19. *Cf.*, *e.g.*, Randall Lasaffer, *The Classic Law of Nations (1500–1800)*, in RESEARCH HANDBOOK ON THE THEORY AND HISTORY OF INTERNATIONAL LAW 408, 439–40 (Alexander Orakhelashvili ed., 2011).

20. Outer Space Treaty, *supra* note 10, art. I.

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.

Outer space, including the Moon and other celestial bodies, shall be free for exploration and use by all States without discrimination of any kind, on a basis of equality and in accordance with international law, and there shall be free access to all areas of celestial bodies.

There shall be freedom of scientific investigation in outer space, including the Moon and other celestial bodies, and States shall facilitate and encourage international cooperation in such investigation.

operations. Should everyone share in the proceeds? Should the mined resources be made available on the world market? Or does it merely mean that no other state should suffer harm from whatever mining activities would take place?

Third, Article VI provides for direct and full state responsibility with regard to private space activities, including asteroid mining, and requires them to be subject to “authorization and continuing supervision.”²¹ Usually, this clause is interpreted as requiring a national scheme for licensing private space operators and subjecting them to relevant obligations and procedures.²² A major issue is, however, what exactly constitutes the “national activities in outer space,” which Article VI makes reference to.²³ Fourth, concurrently with Article VI, Article VII of the Outer Space Treaty (as further elaborated by the 1972 Liability Convention)²⁴ provides that states are also liable for damage caused by space objects—including those used for space mining operations operated by private operators under their *aegis*.²⁵

21. *Id.* art. VI.

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.

See also, e.g., Michael Gerhard, *Article VI*, in 1 COLOGNE COMMENTARY ON SPACE LAW, *supra* note 8, at 103, 111–22; FRANS G. VON DER DUNK, PRIVATE ENTERPRISE AND PUBLIC INTEREST IN THE EUROPEAN ‘SPACESCPE’ 17–22 (1998).

22. *Cf.* Irmgard Marboe, *National Space Law*, in HANDBOOK OF SPACE LAW, *supra* note 1, at 127, 131–35.

23. *See, e.g.,* von der Dunk, *supra* note 5, 53–54.

24. Convention on International Liability for Damage Caused by Space Objects, Mar. 29, 1972, 24 U.S.T. 2389, 961 U.N.T.S. 187 (entered into force Sept. 1, 1972) [hereafter Liability Convention].

25. Outer Space Treaty, *supra* note 10, Art. VII.

Each State Party to the Treaty that launches or procures the launching of an object into outer space, including the Moon and other celestial bodies, and 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

Finally, Article IX obliges states to ensure that space activities undertaken by them or their nationals shall not cause harmful interference with other legitimate space activities unless prior consultation with possibly affected states has taken place.²⁶ This clause has gradually come to be interpreted as disallowing the causation of serious harmful interference unless overriding reasons would require that activity to go ahead anyway.²⁷ This clause is about the most substantive requirement resting upon mining operations as far as the Outer Space Treaty itself is concerned.

3. THE INTERNATIONAL LEGAL CONTEXT FOR ASTEROID MINING—THE MOON AGREEMENT

As for the Moon Agreement, it was drafted with the intention partially to also address possible commercial exploitation, as this seemed to lie around the corner.²⁸ Noting that it was never ratified by the major

juridical persons by such object or its component parts on the Earth, in air space or in outer space, including the Moon and other celestial bodies.

See also, e.g., Armel Kerrest & Lesley Jane Smith, *Article VII, in 1 COLOGNE COMMENTARY ON SPACE LAW, supra* note 8, at 126, 129–145; VON DER DUNK, *supra* note 20, at 22–26.

26. Outer Space Treaty, *supra* note 10, Art. IX

If a State Party to the Treaty has reason to believe that an activity or experiment planned by it or its nationals in outer space, including the Moon and other celestial bodies, would cause potentially harmful interference with activities of other States Parties in the peaceful exploration and use of outer space, including the Moon and other celestial bodies, it shall undertake appropriate international consultations before proceeding with any such activity or experiment.

See also, e.g., Sergio Marchisio, *Article IX, in 1 COLOGNE COMMENTARY ON SPACE LAW, supra* note 8, at 169, 174–81; LOTTA VIKARI, *THE ENVIRONMENTAL ELEMENT IN SPACE LAW* 59–62 (2008); Howard A. Baker, *Protection of the Outer Space Environment: History and Analysis of Article IX of the Outer Space Treaty, in 12 ANNALS OF AIR & SPACE L.* 143, 166–67 (1987).

27. *Cf., e.g.,* VIKARI, *supra* note 25, at 59–60; Marchisio, *supra* note 25, at 176–77.

28. Moon Agreement, *supra* note 12, Preamble (“*Bearing in mind the benefits which may be derived from the exploitation of the natural resources of the Moon and other celestial bodies.*”); *id.* art. 11(5) (“*States Parties to this Agreement hereby undertake*

spacefaring nations, it is nevertheless worthwhile to briefly discuss it here since the original text was developed in agreement between major spacefaring nations, including the United States.²⁹

The Moon Agreement determined that the Moon, other celestial bodies, and their natural resources were the “common heritage of mankind” and called for an international regime to implement that concept in the context of interests in mining operations³⁰— without, however, specifying any details.³¹ When, in the contemporaneous discussions on the legal regime for the deep seabed resulting in the 1982 Convention on the Law of the Sea,³² the common heritage of mankind concept came to be specifically elaborated as requiring the transfer of relevant technology and the ultimate sharing of mining proceeds,³³ the

to establish an international régime, including appropriate procedures, to govern the exploitation of the natural resources of the moon *as such exploitation is about to become feasible.*”) (emphasis added).

29. Cf. Peter Jankowitsch, *The Background and History of Space Law*, in HANDBOOK OF SPACE LAW, *supra* note 1, at 1, 5–6.

30. See Moon Agreement, *supra* note 12, art. 11(1) (“The moon and its natural resources are the common heritage of mankind, which finds its expression in the provisions of this Agreement and in particular in paragraph 5 of this article.”); Moon Agreement, *supra* note 27, art. 11(5).

31. *Id.* art. 11(7).

The main purposes of the international regime to be established shall include:

- (a) The orderly and safe development of the natural resources of the Moon;
- (b) The rational management of those resources;
- (c) The expansion of opportunities in the use of those resources;
- (d) An equitable sharing by all States Parties in the benefits derived from those resources, whereby the interests and needs of the developing countries, as well as the efforts of those countries which have contributed either directly or indirectly to the exploration of the moon, shall be given special consideration.

See also, e.g., CHRISTOL, *supra* note 9, at 342–63; FABIO TRONCHETTI, THE EXPLOITATION OF NATURAL RESOURCES OF THE MOON AND OTHER CELESTIAL BODIES 41–61 (F.G. von der Dunk, ed. 2009).

32. United Nations Convention on the Law of the Sea arts. 133–91, Dec. 10, 1982, 1833 U.N.T.S. 397.

33. See TRONCHETTI, *supra* note 30, at 45–61; LOTTA VIKARI, FROM MANGANESE NODULES TO LUNAR REGOLITH 52–54 (2002).

major spacefaring nations—including again the United States—refrained from signing and ratifying it.³⁴ The Moon Agreement, in spite of its relatively limited formal importance, offers a few interesting aspects for consideration with regards to the appropriate international legal approach to space mining.

First, Article 1(1) in principle allows for a special regime in deviation from the Moon Agreement, including for instance its application of the common heritage of mankind concept, to be developed.³⁵ If it would be considered helpful and feasible to develop an international regime specifically addressing the mining of asteroids, in a manner more conducive to stimulating private entrepreneurship than the original implementation of the common heritage of mankind concept in the context of the Law of the Sea, then this clause allows that, even as far as both the staunch adherents to that concept or parties to the Moon Agreement would be concerned.

Second, it is interesting to note that the Moon Agreement itself already excludes from its scope “extraterrestrial materials which reach the surface of the earth by natural means.”³⁶ While resources extracted by mining companies obviously do not reach the surface of the Earth by natural means, the distinction already made here between celestial bodies and extraterrestrial materials is noteworthy. The asteroids targeted by the space mining companies would likely be magnitudes smaller in size than the celestial bodies usually addressed under that heading, such as the Moon and planets. Landing on a celestial body would constitute a rather different mission than landing on an asteroid, which may come much closer to capturing extraterrestrial materials. The distinction made in the Moon Agreement may provide further justification for the argument that the prohibition to “appropriate” celestial bodies pursuant to Article II of the Outer Space Treaty does not extend to extraterrestrial materials, the

34. See VIIKARI, *supra* note 32, at 68–72.

35. Moon Agreement, *supra* note 12, art. 1(1) (“The provisions of this Agreement relating to the moon shall also apply to other celestial bodies within the solar system, other than the earth, except in so far as specific legal norms enter into force with respect to any of these celestial bodies.”).

36. *Id.* art 1(3). See, e.g., LYALL & LARSEN, *supra* note 8, at 175–77; Nicolas M. Matte, *Legal Principles Relating to the Moon*, in 1 MANUAL ON SPACE LAW, *supra* note 10, at 253, 258.

latter also referring to something magnitudes smaller than the classic celestial bodies.³⁷

Third, the common heritage of mankind principle may suggest some mandatory sharing of benefits and technology as per the elaboration in the context of the Law of the Sea, the Moon Agreement; it certainly does not simply provide or confirm this. In building upon the general prohibition of national appropriation in the Outer Space Treaty, namely, it provides: “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.”³⁸ The addition of “in place” suggests that once extracted, such resources could by contrast legitimately become the property of, for instance, private operators.

4. BACK TO THE OUTER SPACE TREATY: INTERPRETING THE NON-APPROPRIATION PROHIBITION

In sum, the clauses most pertinent to the question of the legal status, even legality, of space mining, are certainly those defining the legal status of outer space as a global commons, as addressed above pursuant to Articles I and II of the Outer Space Treaty. Without any helpful specific reference to space mining, however, that leaves the question what that status means, or how it should be interpreted, in that context.

Basically, there would be two approaches: One is to argue that, since outer space belongs to all of mankind, all natural resources available also belong to all of mankind. This means that a regime basically of an international character should determine who should be allowed access to those resources for the purpose of commercial exploitation. Additionally, for at least some, this also means that regime should principally drive for a form of benefit- and technology-sharing along the lines of the 1982 Convention on the Law of the Sea, as discussed above.³⁹

37. See Outer Space Treaty *supra* note 16 and accompanying text.

38. Moon Agreement, *supra* note 12, art. 11(3) (emphasis added). See, e.g., Cheng, *supra* note 12, at 368–69; LYALL & LARSEN, *supra* note 8, at 185.

39. See discussion *supra* Section 3.

As for the latter, it should be noted that the 1994 New York Agreement⁴⁰ de facto amended the 1982 Convention so as to do away with the aspects considered most anti-private-enterprise even while formally maintaining the qualification of the deep seabed as being part of the common heritage of mankind.⁴¹ While technically speaking a license from an international organization—the “International Seabed Authority” established by the 1982 Convention⁴²—would still be required, the likelihood that it would not be granted in a manner the licensee would appreciate is reduced considerably.

As for the former, nothing is said about the specificity or level of detail of what an *international regime* refers to, in line with the relatively open-ended phrasing of Articles 11(5) and (7) of the Moon Agreement. Thus, the closest analogy might well be the international regime currently regulating up to a certain level the access to satellite orbits, orbital slots, and frequencies within the framework of the International Telecommunication Union (ITU).⁴³ While this regime unequivocally endorses commercial exploitation of the relevant natural resources of outer space (satellite orbits, orbital slots, and radio frequencies), it is fundamentally built on the law of nature that two contemporary users of the same frequency in the same area will both suffer interference and thus would be keen to ensure that access to such frequencies is regulated at an international level.⁴⁴ This has certainly played a major role in making states willing to accept the system of coordination of the use of orbits, orbital slots, and frequencies developed within the ITU as binding

40. Agreement Relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982, July 28, 1996, 1836 U.N.T.S. 42 [hereinafter New York Agreement].

41. See VIHKARI, *supra* note 32, 73–78; TRONCHETTI, *supra* note 30, 116–18.

42. See United Nations Convention on the Law of the Sea, *supra* note 31, arts. 156–69.

43. The current legal foundations of the ITU are comprised by the ITU Constitution and Convention, as well as the ITU Radio Regulations, the most recent of which concerns the 2016 one. Constitution of the International Telecommunication Union, Dec. 22, 1992, 1825 U.N.T.S. 330; Convention of the International Telecommunication Union, Dec. 22, 1992, 1825 U.N.T.S. 390; *Radio Regulations 2016*, ITU, <http://www.itu.int/pub/R-REG-RR-2016> (last visited Sept. 20, 2017).

44. See, e.g., LYALL & LARSEN, *supra* note 8, at 199–244; Frans von der Dunk, *Legal Aspects of Satellite Communications*, in HANDBOOK OF SPACE LAW, *supra* note 1, at 456, 458–84.

law.⁴⁵ It remains to be seen, of course, whether similar parameters apply with respect to space mining and whether they would result in a similar willingness.

The other approach would argue that since outer space has been qualified as a global commons, all states are *ipso facto* entitled to use resources for their own benefit, which would include unilaterally allowing their private operators to exploit them, as long as this is done in compliance with applicable international law.⁴⁶ The analogy closest to such an approach would be fishing on the high seas. The high seas are considered global commons as much as outer space, meaning that appropriation of part of the high seas as exclusively national territory is not allowed.⁴⁷ At the same time, the freedom of fishing, one of the fundamental freedoms of the high seas,⁴⁸ means that in spite of such non-appropriation of the high seas themselves, the fish caught there would legitimately belong to whoever caught it—provided they would comply with international law regarding, for instance, overfishing or pollution.⁴⁹ Consequently, individual states would be entitled to unilaterally license fishing companies to fish on the high seas, as long as the companies remain within the above legal parameters.

5. UNILATERAL ACTION: TITLE IV, U.S. COMMERCIAL SPACE LAUNCH COMPETITIVENESS ACT

The proper authoritative interpretation, as between the two general approaches outlined above, has not yet been determined. This leaves the

45. See Francis Lyall, *'Harmful Interference' and the ITU*, in HARMFUL INTERFERENCE IN REGULATORY PERSPECTIVE 19, 20 (Mahulena Hofmann ed., 2015).

46. Cf., e.g., JAMES CRAWFORD, BROWNLIE'S PRINCIPLES OF PUBLIC INTERNATIONAL LAW 333–51 (8th ed. 2012) (discussing cooperation in the use of national resources in various contexts); Jankowitsch, *supra* note 28, at 12–14.

47. See United Nations Convention on the Law of the Sea, *supra* note 31, art. 89.

48. See *id.* art. 87(1)(e).

49. See *id.* art. 87(2); Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, Aug. 4, 1995, 2167 U.N.T.S. 88; International Convention for the Prevention of Pollution from Ships, Nov. 2, 1973, 1340 U.N.T.S. 184 *amended by* Protocol of 1978 Relating to the International Convention for the Prevention of Pollution from Ships, Feb. 17, 1978, 1340 U.N.T.S. 61.

question of whether an international regime would be a mandatory prerequisite before space mining would become legal and before national authorities could start licensing relevant companies unilaterally. So far, this question is without a definitive and generally acknowledged answer.

As, however, Planetary Resources and Deep Space Industries were pushing forward,⁵⁰ the United States was pressed into taking some action in the absence of any definitive and generally acknowledged regime. The one serious effort to establish such a regime, the Moon Agreement, had essentially fallen short by failing to carry the agreement of the spacefaring countries, and nothing of substance had yet taken its place.⁵¹

The result of this pressure was, after an initial bill had addressed the mining issue only,⁵² the inclusion of Title IV on Space Resource Exploration and Utilization in the 2015 U.S. Commercial Space Launch Competitiveness Act.⁵³ It provided a first level of legally-framed support and guarantees to the incipient asteroid mining sector by adding Chapter 513 to Title 51 of the United States Code, consisting of three Sections.⁵⁴ These additions achieved three results.

First, it recognizes the property rights of U.S. citizens and companies over space resources once extracted on a first come, first served basis for disputes playing out within U.S. jurisdiction and in stated compliance “with the international obligations of the United States.”⁵⁵ In other words, potential claims—in particular from outside the United States—that such extracted space resources would constitute the spoils of illegal activities or would have to be somehow shared internationally under a

50. *See supra* text accompanying notes 2–4.

51. *See supra* text accompanying note 28.

52. American Space Technology for Exploring Resource Opportunities In Deep Space Act, H.R.5063, 113th Cong. (2014).

53. U.S. Commercial Space Launch Competitiveness Act, ch. 513, § 402, Pub. L. No. 114–90, 129 Stat. 704, 720–22 (codified at 51 U.S.C. §§ 51301–51303 (2015)).

54. *Id.*

55. *Id.* § 51303 now provides:

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.

possible interpretation of the common heritage of mankind principle would not be recognized by any U.S. court. Second, it calls for future regulation to authorize and supervise in further detail any operator interested in engaging in asteroid mining and thus potentially benefitting from the legitimacy of ownership rights, in conformity notably with the requirement resting upon the United States under Article VI of the Outer Space Treaty to authorize and continuously supervise such activities.⁵⁶

Third, it calls upon the U.S. President to promote the interests of U.S. industry in the global context.⁵⁷ Effectively, this means by way of some sort of international regime sympathetic to the interests of the United States and its companies. The market for space resources would by all accounts be global in nature; recognition of legitimate ownership rights of companies over celestial resources in the United States would not necessarily be accepted in other countries where an interest in such

56. *Id.* § 51302(b) now provides:

Not later than 180 days after the date of enactment of this section, the President shall submit to Congress a report on commercial exploration for and commercial recovery of space resources by United States citizens that specifies—

(1) the authorities necessary to meet the international obligations of the United States, including authorization and continuing supervision by the Federal Government; and (2) recommendations for the allocation of responsibilities among Federal agencies for the activities described in paragraph (1).

57. *Id.* § 51302(a) now provides:

The President, acting through appropriate Federal agencies, shall—

(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.

resources might otherwise exist. On the other hand, Article I of the General Agreement on Tariffs and Trade may present an argument that if, for instance, platinum mined on a celestial body would be brought back to earth pursuant to the U.S. legal regime, other states could not contest the legality of its enjoyment of free trade benefits as a “like product.”⁵⁸

The discussion at the international level on this issue has essentially just taken off. So far, two countries have clearly shown to be sympathetic to the U.S. approach. Luxembourg, a small country, but serving as a gateway to the European Union as a whole,⁵⁹ has already announced the establishment of a national law authorizing and supervising space mining activities generally along the lines of the U.S. approach.⁶⁰ The United Arab Emirates have equally planned to develop a regulatory regime conducive to such activities, provided that those activities are duly authorized and supervised.⁶¹

58. General Agreement on Tariffs and Trade art. I(1), Oct. 30, 1947, 61 Stat. A-11, 55 U.N.T.S. 194.

With respect to customs duties and charges of any kind imposed on or in connection with importation or exportation or imposed on the international transfer of payments for imports or exports, and with respect to the method of levying such duties and charges, and with respect to all rules and formalities in connection with importation and exportation, and with respect to all matters referred to in paragraphs 2 and 4 of Article III,* any advantage, favour, privilege or immunity granted by any contracting party to any product originating in or destined for any other country shall be accorded immediately and unconditionally to the like product originating in or destined for the territories of all other contracting parties.

59. Consolidated Version of the Treaty on the Functioning of the European Union art. 28(2), Oct. 26, 2012, 2012 O.J. (C 326) 47 (providing that once a product is legitimately brought “in free circulation” in one EU member state, it should be allowed to be freely traded across all member states).

60. See SPACE RESOURCES.LU, <http://www.spaceresources.public.lu/en.html> (last visited Feb. 11, 2017); Loi 674 du 20 juillet 2017 sur l’exploration et l’utilisation des ressources de l’espace [Law 674 of July 20, 2017 on the Exploration and Use of Space Resources], JOURNAL OFFICIEL DU GRAND-DUCHÉ DE LUXEMBOURG [J.O.] [OFFICIAL JOURNAL OF THE GRAND DUCHY OF LUXEMBOURG], July 28, 2017, <http://legilux.public.lu/eli/etat/leg/loi/2017/07/20/a674/jo>.

61. See *UAE to Finalise Space Laws Soon*, THE NAT’L (Mar. 7, 2016, 4:00 AM),

On the other end, at least two countries have so far voiced their general opposition to the U.S. legislative initiative in the context of UNCOPUOS. First, the Russian representative in the Scientific and Legal Sub-Committee (*not* the Legal Sub-Committee!) has claimed that the U.S. legislation:

- shows disrespect for international law by allowing the U.S. private sector to appropriate and sell space resources as per Title IV;
- presents a new interpretation of the concept of non-appropriation of outer space;
- shows disregard for the discussions in the context of the Moon Agreement, which would call for an international regime to regulate any exploitation;
- constitutes an element of the U.S. policy of domination of outer space; and
- presents a concept of ‘freedom to use outer space’ which is not law but merely a theory of experts and specialized fora.⁶²

The problem with the first claim is that essentially, as analyzed above, there is no international law of any relevant specificity addressing the issues of asteroid mining and ownership rights over extracted resources. This includes the concept of non-appropriation, which is clearly addressing only celestial bodies as such but is silent on natural resources contained in them. Considering that unilateral licensing of exploitation of the latter is allowable would constitute a new interpretation only because there has, so far, not been *any* interpretation which has been widely accepted as authoritative. From that same vantage point, the interpretation that such unilaterally condoned exploitation would not be permitted is equally new.

<http://www.thenational.ae/business/aviation/uae-to-finalise-space-laws-soon>.

62. Comm. on the Peaceful Uses of Outer Space, *Reviewing Opportunities for Achieving the Vienna Consensus on Space Security Encompassing Several Regulatory Domains: Working Paper Submitted by the Russian Federation*, ¶¶ 5–7, U.N. Doc. A/AC.105/C.1/2016/CRP.15 (Feb. 16, 2016).

The claim of showing disregard for the discussions leading to the Moon Agreement suggests that, because the United States initially agreed to the text thereof, including the phrasing of the common heritage of mankind concept, it would be somehow bound to recognize that unequivocally. First, this fails to recognize that in international law concepts such as signature and ratification have been developed to confirm a measure of willingness to be bound by the text⁶³ (as opposed to an acceptance of the text before such events), both of which the United States choose to abstain from. Second, it fails to recognize that the Soviet Union at the time, later Russia, also did not sign or ratify the Moon Agreement, so as to clearly express its agreement to it as a legally binding document. Legally speaking, this makes it rather difficult for Russia to base any claim of non-compliance on the basis thereof against the United States. Third, as discussed above, even the Moon Agreement itself as per its Article 11(3) accepted that the non-appropriation principle would not apply to resources once extracted.⁶⁴

The reference to U.S. policy on space domination is political and rather reminiscent of Cold War rhetoric, as the activities addressed are purely commercially oriented and have nothing to do with any specific U.S. policy of ensuring that no potential adversary could gain the military or strategic upper hand in outer space. Whereas, finally, the freedom of use of outer space is not a theoretical hypothesis of some academics, but is enshrined in Article I of the Outer Space Treaty, as briefly addressed before.⁶⁵

The other country which apparently raised objections to the U.S. legislation at an early stage is Brazil, which has claimed:

- inconsistency between national law allowing economic exploitation of celestial bodies and the principles of the U.N. space treaties;

63. See Vienna Convention on the Law of Treaties, May 23, 1969, 1155 U.N.T.S. 331. This treaty is generally considered to reflect customary international law on the law of treaties, it provides: "The consent of a State to be bound by a treaty may be expressed by signature, exchange of instruments constituting a treaty, ratification, acceptance, approval or accession, or by any other means if so agreed." *Id.* art. 11.

64. See sources cited *supra* note 35 and accompanying text.

65. See Outer Space Treaty, *supra* note 19 and accompanying text.

- that multilateral interests should take precedence over unilateral ones; and
- that domestic legislation is a poor substitute for a multilateral instrument.⁶⁶

While the first claim is, again, a matter of interpretation—the relevant principles are not specific enough to either validate or deny the claim of inconsistency—the two other points are correct. In an area such as the global commons of outer space, multilateral interests should prevail, which would point toward an international legal instrument as the preferred option. Even the United States would not seem to disagree with this in principle, as that is precisely why the U.S. President is charged to enter into international discussions to make that happen⁶⁷—of course in the hope that such a multilateral approach would be very much along the lines of the U.S. one.

The point is further that, in the absence so far of any more or less acceptable and accepted international instrument—the Moon Agreement having failed to achieve this purpose, with no serious initiative ever since trying to replace it with something more acceptable—the United States had to take some action to address the interests of Planetary Resources and Deep Space Industries and at the same time to properly comply with its international obligations by initiating a process towards authorization and continuing supervision in line with Article VI of the Outer Space Treaty.⁶⁸

6. CONCLUDING REMARKS

Currently, the international legal uncertainty regarding the proper and generally accepted regime applicable to asteroid mining remains unresolved. The United States has taken a first, rather embryonic step to address the issue by allowing asteroid mining entrepreneurs a first degree

66. E-mail from Fabio Tronchetti, Assoc. Professor at the Sch. of Law of the Harbin Inst. of Tech., to Frans von der Dunk, Professor of Law, Neb. Coll. of Law (Mar. 11, 2016) (on file with author) (discussing statement of the Brazilian representative to the Scientific and Technical Sub-Committee).

67. See 51 U.S.C. § 51302(a) (2015).

68. See *id.* § 51302(b).

of legal certainty regarding their ownership rights at least under U.S. law, while indicating that before any actual mining operation would be condoned, a more detailed approach to licensing such activities is to be developed. This approach prominently includes compliance with the international obligations of the United States, which refers *inter alia* to such key requirements under the Outer Space Treaty as to authorize and continuously supervise them in accordance with Article VI, to accept state liability for any damage resulting from such activities in line with Article VII and the ensuing Liability Convention, and to ensure that harmful interference with other legitimate space activities remains at a minimum, on the basis of Article IX.⁶⁹ With a view to the current status of international law on the issue, that approach cannot be qualified as illegal, although it remains important to monitor whether the licensing regime to be ultimately developed in the United States will indeed diligently comply with obligations resting upon the United States under international law.

Various scenarios as to how the international situation will develop can be discerned. The worst-case scenario is a continuing fragmentation of the legal situation with certain countries going in one direction and others going in another. This will effectively amount to the continued absence of a proper legal regime at the international level, which will give rise to international strife and likely be a recipe for commercial uncertainty, *mala fide* entrepreneurs going ahead regardless, or politically motivated land-grabs.

Whilst the, perhaps, optimum scenario of arriving top-down at an overarching treaty-like regime is not realistic for the moment, considering on the one hand the failure of the Moon Agreement from this perspective and on the other hand the general unwillingness to accept treaty obligations in the field of space activities, the third scenario might be the most likely to arise. This is effectively a bottom-up approach, whereby other countries start to more or less follow the U.S. approach, enunciate their own national laws on the issue while ensuring compliance with the Outer Space Treaty and other relevant elements of international space law, and thus gradually coming to a common understanding of what should be considered legitimate or legally allowed.

69. See *id.* §§ 51302, 51303.

For such a scenario, there is a very interesting precedent: when U.S. President Harry Truman in 1945 declared that the continental shelf stretching outwards from the territorial waters of the United States for reasons of geology should be considered an extension of the U.S. landmass, and at least the economic exploitation thereof hence subject to U.S. coastal state jurisdiction, this strictly speaking was against customary international law as it stood at the time.⁷⁰ That law allowed coastal states jurisdiction over territorial waters at most a few miles offshore; beyond that the freedom of the high seas ruled, allowing every state to exploit any natural resources, unless other specific rules of international law conditioned or prohibited such exploitation.⁷¹ However, rather than protesting this unilateral extension of U.S. coastal state jurisdiction, most states acknowledged the validity of the geological-continuation argument, and started to assert similar claims with respect to their respective continental shelves.⁷² Within a little more than a decade, the concept of the continental shelf then was transformed into treaty law by the enunciation of the 1958 Convention on the Continental Shelf.⁷³

Note that while this scenario developed from what could be classified as an illegal claim with respect to an existing international rule, the assumption is that for the space mining context what is at issue is less controversial as merely comprising a particular interpretation of an existing but vague international legal principle. This should make it feasible to arrive at a widely agreed approach amongst spacefaring nations to allow national licensing of mining operations as long as the relevant overriding public interests in the safety, security, and general international legality of space activities would be guaranteed to be protected thereby.

70. Proclamation No. 2667, 59 Stat. 884 (1945). See also Peter-Tobias Stoll, *Continental Shelf*, in 2 MAX PLANK ENCYCLOPEDIA OF PUBLIC INTERNATIONAL LAW 720 (2012); Malcolm D. Evans, *The Law of the Sea*, in INTERNATIONAL LAW 651, 670–71 (4th ed. 2014).

71. See, e.g., CRAWFORD, *supra* note 45, at 255–57.

72. See Frans G. von der Dunk, *Effective Exercise of 'In-Space Jurisdiction': The US Approach and the Problems It Is Facing*, 40 J. OF SPACE L. 147, 160 (2015).

73. Convention on the Continental Shelf, Apr. 29, 1958, 499 U.N.T.S. 312.

