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Nicolai Dypvik Myklebust

The Road to Outer Space

Certain legal aspects on space resource activities

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Sjørettsfondet
University of Oslo
Scandinavian Institute of Maritime Law
P.O. Box 6706 St. Olavs plass 5
N-0130 Oslo
Norway

Phone: 22 85 96 00
E-mail: sjorett-adm@jus.uio.no
Internet: https://www.sjorettsfondet.no/

Editor: Professor dr. juris Trond Solvang –
e-mail: trond.solvang@jus.uio.no

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Preface

This master's thesis was written during my time as a research assistant at the Scandinavian Institute of Maritime Law. Apart from some linguistic and other minor adjustments, it is published as it was submitted at the University of Oslo on June 3, 2024.

Natural resources in outer space as a legal topic is among the more esoteric. A special thanks to my supervisor, Professor Alla Pozdnakova, is warranted. Your proficient and inspiring guidance has been invaluable. I would also like to express my gratitude for the opportunity to be a part of the intellectually stimulating and considerate environment of the institute. The encouragement and support I experienced when engaging in the unusual and complex field of space law has humbled me. I wish to thank my colleagues, and especially fellow research assistants, for a great year.

Thanks also to my brothers Aleksander and Henrik for your insights, feedback and help through this process. And lastly, thank you, my dear Idun, for your ever-caring support.

Oslo, October 9, 2024

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"THE FIRST INSTRUMENTS THAT MEN SENT INTO OUTER SPACE TRAVERSED THE AIRSPACE OF STATES AND CIRCLED ABOVE THEM IN OUTER SPACE, YET THE LAUNCHING STATES SOUGHT NO PERMISSION, NOR DID THE OTHER STATES PROTEST. THIS IS HOW THE FREEDOM OF MOVEMENT INTO OUTER SPACE, AND IN IT, CAME TO BE ESTABLISHED AND RECOGNISED AS LAW WITHIN A REMARKABLY SHORT PERIOD OF TIME."

Judge Manfred Lachs,
the North Sea Continental Shelf Cases, ICJ, 1969[1]

1 North Sea Continental Shelf, Judgment, I.C.J. Reports 1969, p. 3. Dissenting opinion of Judge Lachs.

Content

1 Introduction

1.1 Topic and purpose of the thesis

This thesis will examine certain legal aspects of space resource activities. First and foremost, it will analyze the legal status of natural resources in outer space within the current legal framework. The main topic is the prohibition on national appropriation in space – known as 'the non-appropriation principle', and how it impacts the legal status of natural resources of celestial bodies. This fundamental principle essentially prohibits claims to ownership in outer space.[2] However, the scope of the non-appropriation principle is unclear. It prohibits claims of ownership to celestial bodies, but does it cover natural resources contained within a celestial body? This is the initial question of the thesis.

Despite the lack of international agreement on the legal status of natural resources in outer space and within celestial bodies, both States and private companies are planning to extract and utilize such resources.[3] There exists no governing framework for such activities, however. How State responsibility and liability is regulated by the existing legal framework in the context of a future mining operation in space, is the second question of the thesis.

1.1.1 Setting the scene

There currently is no agreed-upon interpretation of the legal framework pertaining to space resource activities. When the current international space law regime was developed, the legal status of outer space resources was not given much consideration.[4] Now, as space resource activities are becoming a reality, the absence of clear and functional laws presents significant challenges that need to be addressed.

Over the course of history, the desire of the human spirit to explore new horizons has been a driving force behind some of our greatest accomplishments. From the maritime quests of the 15th century to the space race of the 20th, each exploration era has seen legal, ethical, and technological challenges. The acquisition and utilization of natural resources has consistently been essential for the evolution of human civilizations. However, history shows that unsynchronized access can lead to conflict, and unchecked development can change communities and environments for the worse. The notion of the 'tragedy of the commons', for example, illustrates the depletion of resources due to overconsumption.[5] Today, as humanity continue exploring the possibilities of the next great frontier – outer space – we find ourselves facing unprecedented legal quandaries. One of these quandaries concerns the potential exploitation of resources in outer space. The issue has sparked intense debates since the beginning of space activities and has recently been reignited once more.[6] In 2015 the United States authorized the recovery of space resources by private actors through the Commercial Space Launch

2 Stephan Hobe and Kuan-Wei Chen, "Legal status of outer space and celestial bodies". In *Routledge Handbook of Space Law,* ed. Ram Jakhu, Paul Stephen Dempsey (London: Routledge, 2016), 30.

3 Tanja Masson-Zwaan and Mark J. Sundahl, "National and International Norms Towards the Governance of Commercial Space Resource Activity". In *Routledge Handbook of Commercial Space Law,* ed. Lesley J Smith, Ingo Baumann, Susan-Gale Wintermuth (Abingdon: Routledge, 2023), 385.

4 Fabio Tronchetti, "Legal aspects of space resource utilization". In *Handbook of Space Law,* ed. Frans von der Dunk, Fabio Tronchetti (Northampton: Edward Elgar, 2015), 777.

5 Margaret E. Banyan, "tragedy of the commons", Encyclopedia Britannica. https://www.britannica.com/science/tragedy-of-the-commons . Last accessed June 2, 2024.

6 Tronchetti (2015), 777.

Competitiveness Act.[7] Additionally, the U.S.-led Artemis program, alongside the Chinese and Russian collaborative initiatives, are aiming to set up enduring lunar bases, which will depend on local lunar resources for functionality.[8]

There are vast amounts of resources in outer space. Celestial bodies contain enormous quantities of both primary elements and platinum-group metals.[9] Furthermore, the lunar surface is covered by lunar regolith, a material that may contain a revolutionary energy source for sustained fusion; namely the isotope Helium-3.[10] The occurrence of water ice is also a highly relevant topic at this stage of space exploration. Water can be used both for sustaining life, for rocket fuel[11], and substantial quantities may be located around the southern pole of the Moon, making it an attractive area for future exploration and settlement.[12] The interest in commercially exploiting these material, non-renewable resources located on, and inside, celestial bodies such as the Moon and various asteroids, is tinted by disagreement on the legality of such activities.

Extraterrestrial resource utilization will, not surprisingly, be both costly and difficult. Yet, its necessity for future space exploration is reflected in the plans of major space-faring States, where using lunar ice water and other resources is essential.[13] The foremost reason behind this lies in the immense energy required to launch objects from Earth, escaping its gravitational pull. Typically, about 90% of a launch's total mass is fuel, with the payload comprising just 1 to 5%.[14] This results in severely limited payload capacity, including essential supplies like water. Therefore, an optimal strategy involves minimizing the payload carried from Earth, which could be achieved by sourcing and utilizing materials found beyond Earth's atmosphere. Presently, the Moon appears as the most likely location for such resource extraction, but interest around the exploitation of asteroids continue to grow. In September 2023, the first sample of asteroid soil was brought back to Earth by NASA's probe OSIRIS-REx.[15] The following month, NASA launched another mission, designated to explore the contents of the very metal-dense asteroid' "Psyche" located somewhere between Mars and Jupiter.[16] It is the first object of its kind to be examined up close and may learn us more about the properties

7 U.S Commercial Space Launch Competiveness Act, Public Law 114-90–NOV. 25, 2015. Title IV of the Act, which is entitled 'Space Resource Exploration and Utilization', contains the key provisions; namely §§ 51301 through 51030. Available online: https://www.congress.gov/114/plaws/publ90/PLAW-114publ90.pdf . Last accessed May 20, 2024.

8 Masson-Zwaan and Sundahl (2023), 385. See also section 10 of the Artemis Accords. Available online: https://www.nasa.gov/wp-content/uploads/2022/11/Artemis-Accords-signed-13Oct2020.pdf?emrc=653a00 . Last accessed May 15, 2024.

9 Tronchetti, (2015), 771.

10 Ibid.

11 By separating hydrogen from oxygen and converting them into their liquid forms.

12 Anashe Bandari, "Study Reveals Map of Moon's Water Near Its South Pole", NASA, 15 March, 2023, https://www.nasa.gov/solar-system/study-reveals-map-of-moons-water-near-its-south-pole/ ; "Why is the Moon's south pole so important", World Economic Forum, August 23, 2023. https://www.weforum.org/agenda/2023/08/space-water-ice-moon-south-pole/ . Last accessed 22 May, 2024.

13 Masson-Zwaan and Sundahl (2023), 385.

14 Stephan Hobe, *Space Law* (Baden-Baden: Nomos Verlagsgesellschaft, 2019), 9.

15 "Origins, Spectral Interpretation, Resource Identification, Security-Regolith Explorer", NASA. https://science.nasa.gov/missions/osiris-rex/osirisrex-delivers-nasas-first-asteroid-sample-to-earth/ , last accessed March 14, 2024.

16 "Psyche: Mission to a Metal-Rich World", NASA. https://science.nasa.gov/mission/psyche/ , last accessed June 01, 2024.

of resources in outer space.[17] It is also a potential part of a wider foundation for future use of valuable resources from asteroids.[18]

The growing interest in lunar resources coincides with recent developments in the space industry, notably characterized by the rise of "NewSpace" – a sector largely driven by private companies born from the digital economy, such as SpaceX, Blue Origin and Virgin Galactic. These companies are not only demonstrating the desire but also providing the means to further human exploration into new frontiers.[19] However, several critical issues must be addressed before undertaking such ventures. Foremost among these is the ongoing debate regarding the legal status of natural resources on celestial bodies, including the Moon, Mars, asteroids, and meteorites. In response to this, the United Nations Committee on the Peaceful Uses of Outer Space has recently formed a working group dedicated to addressing these concerns.[20] Other issues relate to which rules apply when space resource activities commence. For instance, there is no existing framework pertaining to such activities. How responsibility for damage caused in space by a private mining company is allocated, or what the obligations of States are to ensure the sustainable use of outer space, are just a few questions that underline the reality of the matter.

The current legal framework governing space is first and foremost the Outer Space Treaty of 1967[21] – often dubbed the 'magna carta' or 'constitution' of outer space.[22] The Treaty has been a major success with its high number of ratifications and foundational principles.[23] Yet, it does not mention space resources at all. Another treaty does, however. The Moon Agreement, the fifth and last of the space treaties is the only one that explicitly mentions natural resources in outer space.[24] It has, however, only been ratified by 17 countries, compared to the 114 of the Outer Space Treaty.[25] Furthermore, the Moon Agreement's lack of international impact was amplified by Saudi Arabia's withdrawal on January 5, 2024.[26]

The lack of any mentioning of natural resources in the Outer Space Treaty does not mean that its implications on the legal status of natural resources in outer space has been ignored. On the contrary, debate on this has been ongoing for over 50 years. One of the major topics in this regard has been the impact of the fundamental non-appropriation principle of Article II, specifically whether it

17 Ashley Strickland, "Psyche mission launches as NASA's first trip to a metal world", *CNN,* October 13, 2023. https://edition.cnn.com/2023/10/13/world/psyche-metal-asteroid-nasa-launch-scn/index.html , last accessed June 01, 242024.

18 Emily Furfaro, "Is NASA Mining Asteroids? We asked a NASA Scientist", NASA, June 28. https://www.nasa.gov/general/is-nasa-mining-asteroids-we-asked-a-nasa-scientist-episode-41/ , last accessed June 1, 2024.

19 SpaceX will for example be providing the Starship lunar lander, a human landing system for transporting astronauts to and from the Moon, see "As Artemis Moves Forward, NASA Picks SpaceX to Land Next Americans on Moon, NASA, April 16, 2021. https://www.nasa.gov/news-release/as-artemis-moves-forward-nasa-picks-spacex-to-land-next-americans-on-moon/ , last accessed June 2, 2024.

20 The United Nations Committee on the Peaceful Uses of Outer Space [UNCOPOUS] Working Group on Legal Aspects of Space Resources. On its background, see paper submitted by the Chair and Vice-Chair of the Working Group February 6, 2023. A/AC.105/C.1/2023/CRP.16.

21 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, 610 UNTS 205, adopted January 27th1967, entered into force October 10, 1967.

22 Francis Lyall and Paul B. Larsen, *Space Law: A Treatise* (Milton Park, Oxon: Routledge 2018), 49.

23 Status of International Agreements relating to activities in outer space as at 1 January 2024 . A/AC.105/C.2/2024/CRP.3.

24 Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, 1363 UNTS 3, adopted December 5th1979, entered into force July 11th1984.

25 See Status of Treaties (n. 23).

26 Depositary Notification, C.N.4.2023.TREATIES-XXIV.2. Available online: https://treaties.un.org/doc/Publication/CN/2023/CN.4.2023-Eng.pdf . Last accessed May 22, 2024.

prohibits the extraction and use of natural resources in space. Advocates for both sides have made their arguments through the years, there has been written a fair amount of literature on the matter, but the issue has still not been settled.

The lack of agreement in the international community on the legal status of natural resources in outer space represent not only a legal issue, but it arguably serves as an implicit inhibitor of private initiatives. To both raise capital for future ventures, and mitigate the significant financial risks of space activities, commercial companies need clear legal rules.[27] Furthermore, the lack of a legal framework could lead to an unlawful state of affairs in the future, where whoever gets to the "gold" first, ends up owning it. This may again compound and result in even more powerful actors with access to proper technology being the only ones benefitting from what some describe as being humankind's 'global common'.[28] Some scholars have therefore advocated the need for a proactive approach to the seemingly inevitable exploitation of natural resources in outer space.[29]

Through a detailed examination and analysis of the international legal framework, this thesis mainly aims to

I Clarify the legal status of natural resources in outer space through an analysis and evaluation of the non-appropriation principle [Chapter 2]
II Analyze and assess how the existing legal framework regulates State responsibility and liability with regards to future space resource activities [Chapter 3]

1.2 History and background

In the 20th century two groundbreaking technologies rose forth: aviation and the modern use of rockets. The Wright-brothers achieved sustained and controlled flight in 1903, and started a new era of science, transportation, and warfare.[30] The early work on modern rocketry was inspired by visions of humankind flourishing outside terrestrial boundaries, often influenced by political and idealist motives with roots in philosophy. One such pioneer of modern rocket science was Konstantin Tsiolkovsky.[31] Tsiolkovsky, a Russian, often referred to as the father of human spaceflight[32], believed space to be a domain in which the human species could free itself from the limitations and injustices of a world where resources were very unevenly distributed. This broadcasted line of thinking was noticed by some: In 1917, the Bolsheviks seized power of the Russian Empire and started a new era of politics and way of living. Tsiolkovsky's values proved a good fit amongst the leaders of the newly forged Soviet Union. They viewed the novel rocket science as an important part of developing the union, and thus of spreading communism.[33]

In 1932 Czech jurist and university teacher Vladimir Mandl wrote his famous treatise "Space Law: A Problem of Space Flight". The work was heavily inspired by Dutch philosopher and legal scholar Hugo Grotius and his work *Mare Liberum*;

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27 Yannick Radi, "Space Mining in Practice: An International Law Perspective on Upcoming Challenges", *ESIL Reflections* Volume 13, Issue 8 (May 6, 2024): 2-3; https://esil-sedi.eu/wp-content/uploads/2024/05/Radi-Vol.13-Issue-8_final.pdf . Last accessed June 2, 2024.

28 See more on this in section 1.4,3, *infra.*

29 Ram S. Jakhu and Yaw Otu Mankata Nyampong, "Some Legal Aspects of Space Natural Resources", *European Journal of Law Reform* 18, no. 1 (2016): 87. DOI: 10.5553/EJLR/138723702016018001006.

30 Tom D. Crouch, "Wright flyer of 1903", Encyclopedia Britannica. https://www.britannica.com/topic/Wright-flyer-of-1903 . Last accessed May 13th2024.

31 Glenn H. Reynolds and Robert .P Merges , *Outer Space: Problems of Law and Policy* (Milton Park, Oxon: Routledge, 2019), 1.

32 "Konstantin Tsiolkovsky", Science & Exploration, European Space Agency. https://www.esa.int/Science_Exploration/Human_and_Robotic_Exploration/Exploration/Konstantin_Tsiolkovsky . Last accessed May 20, 2024.

33 Reynolds and Merges (2019), 2.

"Freedom of the High Seas.[34] Mandl, having a background in air law, rightfully pointed out the genesis of new issues as a result of the potential launch of rockets into outer space.[35]

Some 20 years after World War I, the world was thrown into a second war, this one more devastating than any previous or subsequent conflict. Here, the development of the V2-rocket, forerunner to modern rocketry, demonstrated the immense potential of rocket science. Although a terrifying weapon – built by the coerced labor of concentration camp prisoners; thousands of whom died during its construction – the V2-rocket was nonetheless a scientific breakthrough, and a large number of them were captured and used in the following space exploration programs of the Soviet Union and the United States.[36] The subsequent evolution of rocket technology would soon be intertwined with yet another monumental scientific achievement: the splitting of the atom. Despite on one side displaying a huge potential as an energy source, the sinister other side of the nuclear marvel revealed an unparalleled destructive potential. The age of the atom had dawned, and soon with it, an ever-more escalating nuclear arms race between the United States and the Soviet Union. In the aftermath of the foregoing brutal world war, a cold war between these major superpowers would push the boundaries of human ingenuity further than ever before; this time aiming for the stars.[37]

In the fall of 1957, the Soviet Union's successful launch of Sputnik I into Earth orbit marked the beginning of the space age. Yet again, the marvelous achievement of placing a man-made object into controlled orbit had a darker side: the potential of space becoming a new front in the nuclear arms race.[38] Realizing what this could lead to, the global community raised their voices, calling for the peaceful use of outer space. There were other issues as well, such as the ramifications in international law following the existence of satellite technology. For instance, following the launch of Sputnik I, there were major concerns addressed regarding violations of airspace sovereignty.[39] There were also concerns regarding the scope of reconnaissance potentially being conducted by such satellites, exemplified by the influence these debates had on U.S strategy at the time.[40]

In the late 1950's, a response to the various concerns and issues following the intersection of the newborn space age and developing cold war would eventually manifest itself through the forming of the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS).[41] Established to govern the exploration and use of space for the benefit of all humanity, the Committee faced the difficult task of navigating the line between cooperation and rivalry between the various factions engaged in the space realm. The aim was to create a framework that would keep space as a realm for peaceful exploration and scientific growth, free of the hazards of armed confrontation and nuclear war.[42] The early events of the space race

34 Hugo Grotius, *Mare liberum sive de iure quod Batavis competit ad Indicana commercia dissertatio*. Leiden: Elzevier, 1609; Hobe (2019), 40.

35 Peter Jankowitsch, "The background and history of space law". In *Handbook of Space Law,* ed. Frans von der Dunk, Fabio Tronchetti (Northampton: Edward Elgar, 2015), 1.

36 "V2 rocket", Encyclopedia Britannica. https://www.britannica.com/technology/V-2-rocket . Last accessed May 20, 2024.

37 Jankowitsch (2015), 3.

38 Ibid.

39 W. McDougall, "... the Heavens and the Earth: A Political History of the Space Age 185-189 (1985)". In Reynolds and Merges (2019), 4-5.

40 Ibid.

41 Established as an ad hoc committee in 1958 through Resolution 1348 (XIII) and made permanent in 1959 through Resolution 1472 (XIV), both available online: https://www.unoosa.org/pdf/gares/ARES_13_1348E.pdf and https://www.unoosa.org/pdf/gares/ARES_14_1472E.pdf . Last accessed March 10, 2024.

42 Jankowitsch (2015), 4.

thus worked as a catalyzer; highlighting the need for international agreements to prevent space from becoming another battleground.[43]

Subsequently, in the 1960's and 70's the COPUOS developed the *corpus juris spatialsis* – "the body of space law" – as we know it today, through three identified phases. The first phase consisted of a series of non-binding UN resolutions and declarations, laying the groundwork for the second phase.[44] The second phase is often referred to by the entry of the space treaties, notably the Outer Space Treaty of 1967, which built on the work of the previous phase and imposed binding obligations upon the Parties to them.[45] In the third phase, beginning shortly after the fifth and unsuccessful space treaty [the Moon Agreement of 1979], non-binding resolutions became once more the instrument of the COPUOS, and virtually continues to be so presently.[46] No space treaties has since been adopted.

In addition to non-binding instruments, the legal sphere of space activities has since the last UN treaty seen an increase in other instruments and agreements, specifically national legislation and multilateral agreements. Numerous countries now have legislation on space activities, four of them specifically regarding space resource activities.[47] Furthermore, multilateral agreements such as the U.S Artemis Accords are becoming a notable force in shaping the space industry. These unilateral and multilateral instruments constitute a shift from the consensus-based instruments of the COPOUOS and are arguably reflected by the political influence of the countries behind them. The interpretation of the existing legal framework with regards to ownership of natural resources is a central development. Some States are now stipulating such rights to ownership.[48] The view on the interpretation of the non-appropriation principle with regards to ownership of natural resources in space has been made clear by a number of States, possibly contributing to a shift in its legal implications.[49]

1.2.1 What constitutes a space resource?

There is no international consensus on what exactly defines a 'space resource'. There also exists no definition provided by international law. In the UN space treaties, the term 'natural resources' is explicitly addressed only in the Moon Agreement[50], but never defined.[51]

Most of the elements in the lunar surface consist of oxygen, silicon, aluminum, calcium, iron, magnesium and titanium.[52] There have also been proven highly valuable platinum-group metals such as platinum, palladium and iridium.[53] Asteroids may contain enormous quantities of these very scarce and precious metals,

43 Ibid. 2.

44 Frans von der Dunk, "International space law". In *Handbook of Space Law,* ed. Frans von der Dunk, Fabio Tronchetti (Northampton: Edward Elgar, 2015), 38.

45 Ibid. 39.

46 Ibid. 41-43.

47 Masson-Zwaan and Sundahl (2023), 389.

48 See e.g U.S Space Resource Act (n. 7), § 51303.

49 As shown in section 2.6.3 on Developments in the UN, *infra*.

50 Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, 1363 UNTS 3, adopted December 5th1979, entered into force July 11, 1984.

51 It is first mentioned in the preamble, and later in Article 11. See Article 11 in its entirety in section 2.6.1, *infra.*

52 Davide Sivolella, *Space Mining and Manufacturing: Off-World Resources and Revolutionary Engineering Techniques* (Cham: Springer Nature, 2019), 38, SpringerLink. DOI: 10.1007/978-3-030-30881-0.

53 Tronchetti (2015), 771.

which, *inter alia*, are used in high tech industry.[54] There have even been reported asteroids that may be made up of 60% metal.[55]

In 2015, the United States became the first country to legislatively address the commercialization and proprietary rights over outer space resources.[56] A space resource is here defined in general as "an abiotic resource in situ in outer space", including water and minerals.[57]

Luxembourg does not explicitly define 'space resource' in its legislation but the UN delegation state that they are "commonly defined [by the Luxembourg legislator] as abiotic resources that are in situ in outer space and can be extracted. This notion includes, for example, mineral resources and water, but not orbital positions or frequencies."[58] Japan defines space resources in its legislation as "[meaning] water, minerals and other natural resources that exist in outer space, including the Moon and other celestial bodies".[59]

In 2019, the Hague International Space Resources Governance Working Group adopted the Building Blocks for the Development of an International Framework on Space Resource Activities.[60] The group was established in 2016 to "assess the need for a governance framework on space resources and to lay the groundwork for such framework", and consist of a consortium of academic institutions; and members and observers such as industry, States, academia, NGOs and so forth.[61] They define a space resource as "an extractable and/or recoverable abiotic resource in situ in outer space" which by the elaboration in footnote 6 "includes mineral and volatile materials, including water".[62] They exclude satellite orbits, radio spectrum and solar energy.[63]

The recent sections indicate that the reason of interest for a definition of space resources go hand in hand with the interests in solid, material, and extractable resources that can be found on, or that constitute a part of, celestial bodies. Such resources are also the core subject of this thesis and will thus not address immaterial resources such as those already regulated by the International Telecommunications Union, including orbital slots, radio frequencies and so forth. It will also not address rapidly renewable and abundant resources such as solar energy.

1.2.2 Where does space begin?

Even though this thesis mainly addresses issues not directly affected by the indefinite Earth/space barrier; it is necessary to emphasize the challenges it may present

54 Sivolella (2019), 49.

55 "Asteroid Psyche", NASA. https://science.nasa.gov/solar-system/asteroids/16-psyche/ . Last accessed May 27, 2024.

56 Masson-Zwaan and Sundahl (2023), 390.

57 U.S Space Resource Act (n. 7), *supra*, Title IV, § 51301 (2).

58 Contribution of the Grand Duchy of Luxembourg on the Mandate and Purpose of the Working Group on Legal Aspects of Space Resource Activities. A/AC.105/C.2/2023/CRP.16. https://www.unoosa.org/documents/pdf/copuos/lsc/space-resources/LSC2023/StatesResponses/Luxembourg_-_20221216_WG_SR_LU_Contribution.pdf . Last accessed May 15, 2024.

59 Act No. 83 of December 23, 2021 on the Promotion of Business Activities for the Exploration and Development of Space Resources. Article 2 (i). Translated version. Available online: https://www.japaneselawtranslation.go.jp/en/laws/view/4332/en . Last accessed May 15, 2024.

60 Building Blocks for the Development of an International Framework on Space Resource Activities The Hague International Space Resources Governance Working Group. https://www.universiteitleiden.nl/binaries/content/assets/rechtsgeleerdheid/instituut-voor-publiekrecht/lucht--en-ruimterecht/space-resources/revised-building-blocks-following-the-meeting-of-april-2019.pdf . Last accessed May 15, 2024.

61 "The Hague International Space Resources Governance Working Group", Universiteit Leiden. https://www.universiteitleiden.nl/en/law/institute-of-public-law/institute-of-air-space-law/the-hague-space-resources-governance-working-group . Last accessed May 15, 2024.

62 Bulding Blocks (n. 60), 2, point 2.1.

63 Ibid. See note nr. 3 in the Building Blocks-document.

with regards to space activity in general. The legal discussions on where space begins center around a key question: At what altitude does the sovereignty of a nation end and the expanse of outer space, begin? This boundary is not only a matter of scientific interest but also of significant legal and political implications, for instance in the event that aerospace vehicles are used both in airspace and outer space, increasing space traffic.[64]

There is no defined boundary between air space and outer space. The Earth's atmosphere becomes thinner with increasing altitude. Contrary to land and sea, there are no physical reference points for legal definition. There furthermore exists no defining agreement on this issue.[65] One of the most commonly referenced, although not universally accepted, boundaries, however, is the Kármán line, located at an altitude of between 80 to 100 kilometers above mean sea level.[66] This line is based on the calculation[s] of Hungarian-American engineer and physicist Theodore von Kármán, who determined that around this altitude, an aircraft would fail to maintain flight due to low air density.[67]

The UNCOPUOS is ongoingly discussing the issue, but consensus remains elusive.[68] Legal scholars frequently address this topic. Highlighting the absence of official definitions, Stephan Hobe provides a description for further consideration: "Outer space encompasses the terrestrial and the interplanetary space of the universe, whereby, the delimitation of the Earth space around the Earth to outer space starts at least 110 km above sea level."[69].

For this thesis, the ever-undecided question will have to make do with Hobe's description.

1.3 Elaboration on the thesis' research questions

1.3.1 What is the scope and impact of the non-appropriation principle in relation to natural resources in outer space?

In the Outer Space Treaty, the non-appropriation principle is incorporated in Article II.

It states that

> *"Outer space, including the moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means."* [70]

Does the non-appropriation principle extend to cover natural resources in outer space? This is considered unclear. The scope and content of the national appropriation-principle is one of the most heavily debated topics in the field of space law. It is even described by some as the greatest challenge for space resource activities.[71] Discussions on its scope already began in the immediate aftermath of the final

64 Hobe and Chen (2016), 30.

65 Hobe (2019), 13.

66 Anna Dubey, "Kármán line", Encyclopaedia Britannica. https://www.britannica.com/science/Karman-line . Last accessed May 20, 2024.

67 Ibid.

68 See for example the Working Group on the Definition and Delimitation of Outer Space of the Legal Subcommittee of COPUOS: https://www.unoosa.org/oosa/en/ourwork/copuos/lsc/ddos/index.html . Last accessed May 23, 2024.

69 Stephan Hobe "Article I" in *Cologne Commentary on Space Law, Vol.1,* ed. Hobe, Stephan, Schmidt-Tedd, Bernhard and Kai-Uwe Schrogl (Köln: Carl Heymanns Verlag, 2009), 32.

70 Outer Space Treaty (n. 21), Article II.

71 Melissa de Zwart, Stacey Henderson, and Michelle Neumann, "Space resource activities and the evolution of international space law" in *Acta Astronautica Volume 211,* October 2023, 155-162. https://doi.org/10.1016/j.actaastro.2023.06.009

treaty entering into force in October 1969. Recent advancements in technology and the upsurge of the private sector have significantly heightened interest and increased discussions regarding the legal status of space resources. This increasing interest is mirrored by the international community, notably through the 2021 [renamed in 2022] establishment of the COPUOS Working Group on Legal Aspects of Space Resource Activities, which has invited submissions to explore its five-year mandate and purpose further.[72]

There is still ongoing debate around the interpretation and application of the non-appropriation principle in the context of space resource activities. Some have argued that appropriation and exploitation of celestial body resources are intrinsically linked.[73] They point to the spirit of Outer Space Treaty, noting that while it permits limited scientific use under Article I, paragraph 3, it may not support large-scale commercial exploitation, particularly by private entities, as this could contradict the Treaty's original intent and principles.[74] Accordingly, the prohibition in Article II may extend to cover natural resources found in outer space.

There are opposing views to this. One perspective draws a parallel with the legal framework governing the high seas. Advocates of this view suggest that resources from celestial bodies might – like the capture of fish – be legitimately appropriated once removed from their original location and utilized for commercial purposes.[75] They argue that such activities align with Article I of the treaty, which allows State Parties to the treaty to freely explore and use outer space.[76] Another related viewpoint suggests that since the Treaty does not explicitly prohibit commercial resource exploitation, neither through wording nor interpretation, it can be inferred that such activities are, in principle, allowed.[77]

Numerous space-faring nations, as well as many non-space faring countries, have addressed the urgent need for greater legal clarity on a global scale, especially regarding activities related to space resources.[78] Furthermore, multinational organizations like the European Space Agency have addressed the need for a clarification and specification of the existing international legal framework, including the principles in the Outer Space Treaty in relation to space resource activities.[79]

1.3.2 How does the current legal framework regulate State responsibility and liability in the context of space resource exploitation?

If extraction, utilization, and exploitation of resources in outer space is allowed and initiated, several legal issues emerge. Resource activities are still embryotic and there is no specific framework governing space resource activities. Moreover, the existing legal framework that binds the major spacefaring nations is ambiguous and timeworn. This is problematic because imminent space resource activities

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72 Working Group on Legal Aspects of Space Resource Activities: https://www.unoosa.org/oosa/en/ourwork/copuos/lsc/space-resources/index.html . Last accessed May 23, 2024.

73 As demonstrated by F. Tronchetti and H. Liu when referring to articles in the 1970s by scholars S. Gorove and A.A Cocca; "The White House Executive Order on the Recovery and Use of Space Resources: Pushing the Boundaries of International Space Law" , note 7 in article; *Space Policy* vol. 57 (August 2021, 101448). https://doi.org/10.1016/j.spacepol.2021.101448 .

74 Ibid.

75 "NASA is looking for private companies to help mine the moon", *The Guardian*, September 11, 2020. https://www.theguardian.com/science/2020/sep/11/nasa-moon-mining-private-companies . Last accessed June 2, 2024.

76 See e.g Tronhetti (n. 288), *infra*.

77 Masson-Zwaan and Sundahl (2023), 402.

78 See paper submitted by the Chair and Vice-Chair of the Working Group (n. 20).

79 European Space Agency's Input to the Working Group on Legal Aspects of Space Resource Activities, paragraph 3. Available online: https://www.unoosa.org/documents/pdf/copuos/lsc/space-resources/LSC2023/PermObsResponses/ESAINP1.PDF . Last accessed June 2, 2024.

are expected to be ultra-hazardous, which again necessitates clear regulation on responsibility and liability.[80] As such regulation does not exist, the activities are ultimately regulated by the space treaties, with the Outer Space Treaty in front. Chapter 3 will therefore analyze and assess the international legal framework for State responsibility and liability with regards to the non-appropriation principle and space resource activities.

1.4 Sources and methodology

The forthcoming sections explain which legal sources are applied to address the research questions of this thesis, and how they are applied. The purpose of this thesis is first and foremost to provide an understanding of the law as it exists [*lex lata*] and thus applies the dogmatic method of legal research.

The laws of space constitute a part of international law.[81] The legal sources applied in addressing the research questions of this thesis, are those reflected in the Statutes of the International Court of Justice (ICJ), Article 38.[82] Although this article is formally intended for the judges of the ICJ, it is broadly recognized as providing an authoritative statement of legal sources applicable in international law.[83] International conventions, general principles of law, and customary law are primary means for determining the rules of law.[84] Judicial decisions and the teachings of the most highly qualified publicists are followingly subsidiary means.[85]

Treaties are often referred to as the most importance source of obligation in international law.[86] This is certainly true for space activities.[87] There are in total five UN space treaties that constitute the backbone of space law: the Outer Space Treaty of 1967[88], the Rescue and Return Agreement of 1968[89], the Liability Convention of 1972[90], the Registration Convention of 1975[91], and the Moon Agreement of 1979.[92] The most important agreement in this regard is the Outer Space Treaty of 1967 [OST].[93] As of January 1, 2024, the OST enjoys widespread support with 114 ratifications and 22 signatories, including all major spacefaring nations.[94] It is the main legal source applied in this thesis, as it codifies the fundamental principles

80 de Zwart, Henderson and Neumann (n. 71).

81 J. Crawford, *Browlie's Principles of Public International Law* (Oxford: Oxford University Press, 2019), 331, Oxford Scholarly Authorities on International Law.

82 Statute of the International Court of Justice, 33 UNTS 933, adopted June 26th1945, entered into force October 24th1945.

83 Cassandra Steer, "Sources and law-making processes relating to space activities" In *Routledge Handbook of Space Law,* ed. Ram Jakhu, Paul Stephen Dempsey (London: Routledge, 2016), 5.

84 Article 38 (n. 82), litras a, b, and c.

85 Ibid., litra d.

86 Crawford (2019), 28.

87 Lyall and Larsen (2018), 38; Steer (2016), 6.

88 (n. 21), *supra*.

89 Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, 672 UNTS 119, adopted 1967, entered into force December 1968.

90 Convention on International Liability for Damage Caused by Space Objects, 961 UNTS 187, adopted in the General Assembly in 1971, entered into force September 1972.

91 Convention on Registration of Objects Launched into Outer Space, 1023 UNTS 15, adopted 1974, entered into force September 15 1976.

92 Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, 1363 UNTS 3, adopted December 5th1979, entered into force July 111984.

93 Tronchetti (2015), 778; Hobe (2019), 59.

94 Status of International Agreements relating to activities in outer space as at 1 January 2024 , UN document A/AC.105/C.2/2024/CRP.3, available online: https://www.unoosa.org/res/oosadoc/data/documents/2024/aac_105c_22024crp/aac_105c_22024crp_3_0_html/AC105_C2_2024_CRP03E.pdf . Last accessed May 13th2024.

of non-appropriation, free use of outer space, and State responsibility – principles central to answering the research questions of this thesis.[95]

Another relevant treaty is the Moon Agreement of 1979 [MA].[96] It is the only space treaty that provides explicit provisions on natural resources in outer space. It also reiterates the non-appropriation principle of the OST Article II.[97] It is therefore of interest to examine. However, the MA lacks support from the majority of the States Parties to the OST, including all the major spacefaring nations.[98] Its provisions initially only apply to its 17 States Parties and its obligations are therefore limited to these.[99]

The third space treaty of relevance for this thesis is the Liability Convention of 1972.[100] It provides a specialized regulation of liability for damage caused by a space object in outer space. It enjoys close to the same support as the OST.[101] It is therefore central for analysis when assessing the State responsibility for damages caused in a future mining operation in outer space.

Certain non-binding instruments are of relevance when addressing the legal aspects of space resources. They are not traditional sources of international law as per the ICJ-Statutes, but they can transition into customary law when requisite state practice and *opinio juris* exist.[102] Resolutions adopted by the UN General Assembly such as the 1996 "Benefits Declaration" may be relevant, as it affirms that outer space should be used on an equitable basis.[103] The declaration essentially echoes Article I of the OST as it states that spacefaring States should give particular attention to "[t]he benefit for and the interest of developing countries and countries with incipient space programmes stemming from such international cooperation conducted with countries with more advanced space capabilities."[104]

Other instruments of importance when addressing the rules of responsibility and liability in space resource exploitation are the ones provided by the International Law Commission [ILC], codifying the rules of State responsibility and liability for damage in general international law. The most important is the Draft Articles on State Responsibility adopted by the UNGA in 2001.[105] There are two reasons for their relevance in this thesis. Firstly, they are considered to increasingly reflect customary law.[106] Secondly, their general applicability to all branches of international law also include space activities.[107] They therefore contribute as complimentary sources to the rules of the OST and the LC.[108] They express that the wrongful act of a State entails international responsibility of that State.[109] An

95 Section 1.3.1, *supra*.

96 (n. 24), *supra*.

97 Ibid. Article 11 (2).

98 See Status of Treaties (n. 23)

99 Ram Jakhu, "The International Legal Framework" in *Space Mining and its Regulation (*Cham: Springer Nature, 2017), 114-115.

100 (n. 90), *supra*.

101 With 100 ratifications, including all spacefaring countries, and 18 signatures (n. 23) .

102 Masson-Zwaan and Sundahl (2023), l, 388.

103 Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking into Particular Account the Needs of Developing Countries. UNGA Res. 51/122 of December 13, 1996. Available online: https://www.unoosa.org/oosa/en/ourwork/spacelaw/principles/space-benefits-declaration.html . Last accessed May 30, 2024.

104 See the Outer Space Treaty (n. 21) Article I.

105 Responsibility of States for Internationally Wrongful Acts, adopted by A/RES/56/83, 12 December 2001. Provided in Report of the ILC on the Work of its Fifty-third Session, Official Records of the UNGA, 56th session, Supp. No. 10. A/56/10 (2001).

106 Steer (2016), 14.

107 Ibid.

108 Ibid.

109 (n. 105) Article I.

act is wrongful when conduct is attributable to the State and constitutes a breach of an international obligation of the State.[110] Because the OST Article VI obligates States to assure conformity with the provisions of the OST and international law including non-governmental entities, and to authorize and continually supervise these entities, they are relevant in clarifying the legal framework of State responsibility in outer space. Moreover, the 2001 Draft principles on the allocation of loss in the case of transboundary harm arising out of hazardous activities may provide useful when examining the concept of due diligence in relation to what 'fault' as a prerequisite for liability in the LC entails.[111]

There are no judicial decisions directly relevant for the topic of this thesis, given that space activities are relatively novel, and space resource activities embryonic. Nonetheless, this thesis references to judicial decisions, primarily judgments of the ICJ, as they can help determine rules of international law.[112] They can also provide authoritative statements on treaty interpretation.[113]

The use of scholarly writings is a central element of this thesis. Because there is a lack of legal sources providing evidence of the law like judicial decisions, this makes the insights and opinions of eminent legal scholars in the field essential for clarifying and resolving legal questions. Scholarly contributions are considered subsidiary means of determining legal rules.[114] Given this context, it's important to approach the views found in literature with caution. Furthermore, although the Statutes stipulate the requirement of 'the most highly qualified publicist of the various nations', there is no clear line between a 'highly qualified' publicist and merely a "qualified" one. There exists a significant amount of literature in the field of space law, which in some cases is not of a satisfactory standard, and/or that provide unthorough analysis and reasoning.[115] This makes the selection and assessment of literature challenging, especially in the case where the qualification of the publicist is not completely obvious. However, elements such as the formative influence of a writer or authority in the field provide weight.[116] This thesis has been written with such considerations in mind and has mainly applied literature that adheres to the qualification of Article 38 (d).

1.4.1 A closer look at treaty interpretation

As emphasized earlier, treaties are the primary source applied in this thesis. The process of determining the meaning and obligations of these agreements between States has is an essential part of international law methodology. The work of the International Law Commission has provided a codification of the international law of treaties through the Vienna Convention on the Law of Treaties [VCLT].[117] It serves as a fundamental tool for treaty interpretation, ensuring that the interpretation process is grounded in internationally recognized standards, and establishes the true meaning of the treaty.[118] Articles 31 and 32 establish the means for interpretation, and are the primary tools utilized in this thesis.

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110 Ibid. Article 2 (a) and (b).

111 Article III, (n.457), *infra*.

112 Either as supplementary means or as elements of customary law, see Article 38 (n. 83).

113 See section 1.4.1.1 on ICJ-judgment as authoritative statements in treaty interpretation rules.

114 Article 38 (n. 83), d.

115 Lyall and Larsen (2018), 28.

116 Crawford, (2019), 40.

117 Vienna Convention on the Law of Treaties, adopted May 23rd1969, entered into force on January 27th1980, United Nations Treaty Series, vol. 1155.

118 Oliver Dörr, "Interpretation of Treaties: General rule of interpretation". In *Vienna Convention on the Law of Treaties: A Commentary* (Berlin, Heidelberg: Springer Berlin / Heidelberg, 2018), 560.

1.4.1.1 Articles 31 and 32 as customary law

The VCLT is a treaty, and therefore not a direct source of law, but a source of obligations.[119] This initially means that only Parties to it are bound by its provisions. Furthermore, the VCLT states in Article 4 that it does not apply retroactively to treaties concluded before its entry into force with respect to its States Parties, meaning the rules of the VCLT govern only treaties made after its entry into force 27 January 1980.[120] At first, this indicates that the VCLT does not apply to the Outer Space Treaty, as the latter entered into force in October 1967. However, Articles 31 and 32 are now widely recognized as reflecting pre-existing customary law.[121] The ICJ has consistently applied these articles to treaties concluded before the VCLT's enactment, thereby affirming their status as reflective of customary law, notably in cases such as Libyan Arab Jamahirya v. Chad (1994)[122], Qatar v. Bahrain (1995)[123], and Costa Rica v. Nicaragua (2009).[124] The Court's reliance on Articles 31 and 32 underscores the universal applicability of these interpretative principles. This is significant because it thus extends the applicability of these interpretative rules beyond the VCLT's Parties, making them relevant to all States irrespective of their ratification status of the VCLT.

1.4.1.2 The interpretation process

Article 31 provides the general rule of interpretation. It stipulates that

> "*A treaty shall be interpreted in good faith in accordance with the ordinary meaning to be given to the terms of the treaty in their context and in the light of its object and purpose."*[125]

"Ordinary meaning" often includes the use of dictionaries, and, additionally, considering elements such as the time the treaty came into force and the uniformity of terms across different [official] languages.[126] "Context" involves taking the treaty as a whole into consideration.[127] This includes taking into account a treaty's systematic structure, including sentence syntax and other provisions.[128] It also includes taking similar terms provided in other parts of the treaty text, or different terms dealing with the same issue, into consideration.[129] An example from section 2.4 can here be drawn from the interpretation of the OST Article II in light of other provisions of the Treaty. When determining the meaning of appropriation by 'use' in Article II, the preceding Article I can provide a means of interpretation, as it states that outer space shall be free for exploration and 'use'. This suggests that the lawful use of space cannot amount to appropriation.

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119 Crawford (2019), 29.

120 (n. 117).

121 Dörr (2018), 561.

122 *Territorial Dispute (Libyun Aruh Jamuhiriyu/Chad), Judgment, 1. C. J. Reports 1994*, p. 6. See paragraph 41, available online: https://www.icj-cij.org/sites/default/files/case-related/83/083-19940203-JUD-01-00-EN.pdf . Last accessed May 13, 2024.

123 *Maritime Delimitation and Territorial Questions between Qatar and Bahrain, Jurisdiction and Admissibility, Judgment, I.C. J. Reports 1995*, p. 6. See paragraph 33, available online: https://www.icj-cij.org/sites/default/files/case-related/87/087-19950215-JUD-01-00-EN.pdf . Last accessed May 13th2024.

124 *Dispute regarding Navigational and Related Rights (Costa Rica v. Nicaragua), Judgment, I.C.J. Reports 2009*, p. 213. See paragraph 47, available online: https://www.icj-cij.org/sites/default/files/case-related/133/133-20090713-JUD-01-00-EN.pdf . Last accessed May 13, 2024.

125 VCLT (n. 117) Article 31 (1).

126 Dörr (2018), 581.

127 VCLT Article 31 (2).

128 Dörr (2018), 581.

129 Ibid. 583.

This thesis interprets treaty text that is laconic and from an earlier age. It is therefore important to emphasize the time-aspect of the interpretation process. For example, the meaning of 'national appropriation' in Article II is discussed in later in section 2.3 Here, in determining the meaning of 'national', the intention of the States Parties to the OST at the time of its conclusion is taken into consideration. This is referred to as a "static approach" to establishing the meaning of a treaty provision and has often been applied by the ICJ.[130] Another example from section 2.4 is determining the meaning of 'by any other means' as means of appropriation. Here, the less common "dynamic approach" is reflected in the discussion. This approach refers to the interpretation of generic terms in a contemporary perspective when there are indications that the parties expected its content to change with time, thus reflecting their intention behind the wording.[131] In the later discussion of 'any other means', it appears that the term was included as a "safety net" with the intention of encompassing future developments – including the emergence of private entities in space.

Another notable means of interpretation that is addressed in thesis, is that of subsequent agreements and subsequent practice. They are characterized by being events following a certain amount of time after the conclusion of the treaty.[132] Moreover, they are essentially dynamic means of interpretation and thus not the same the "dynamic approach".[133]

Accordingly, the interpretational process shall take into account, together with the context:

> "*(a) any subsequent agreement between the parties regarding the interpretation of the treaty or the application of its provisions;*
>
> *(b) any subsequent practice in the application of the treaty which establishes the agreement of the parties regarding its interpretation[…]"* [134]

"Parties" in this regard refers to the parties to the agreement whose terms is interpreted. Later in this thesis, the question is raised on whether the MA qualifies as a subsequent agreement in the interpretation of the OST.[135] The MA is not formally of a lower rank than the OST, as it was adopted by the same organ and by consensus. As is emphasized later, there are those who think it may affect the interpretation of the OST Article II.[136] However, the low number of OST Parties to the MA, makes its interpretational value uncertain as there's a ratification difference of nearly 100 States.[137]

As for 'subsequent practice', it can be read from litra (b) that to have interpretational weight, the practice must be conducted by Parties in the application of the treaty. 'Practice' can in this sense be understood as several, ensuing acts. It includes a broad range of possible actions and inactions, and can range from official statements, to national legislation, to votes and submissions in the UN.[138] Followingly, the practice must be conducted 'in the application' of the treaty. This, according to Dörr, means that

130 Ibid. 572.

131 Ibid. 573.

132 Ibid. 593.

133 Ibid. 574.

134 VCLT (n. 117) Article 31 (3).

135 Section 2.6.1, *infra*.

136 Ibid.

137 See Status of Treaties (n. 23), *supra*.

138 Dörr (2018), 598.

> *"[j]ust as for the development of international customary law, a subjective link is required under lit b: the parties whose practice is under consideration must regard their conduct to fall within the scope of application of the treaty concerned and in principle to be required under that treaty."* [139]

Another element particularly interesting for this thesis, is that practice "establishing the agreement of the parties" does not require that all parties to have engaged, but on the contrary it is argued that it is possible that "only some parties participate in the practice".[140] Nonetheless, a key requirement in this regard is that inactive parties have accepted the practice, which means they have permitted it actively through endorsement or inactively through absence of disagreement.[141]

Section 2.6 addresses some possible practices that may have relevance for interpreting the OST Article II. It is particularly intriguing given the evolving unilateral and multilateral interpretations of the non-appropriation principle outlined in Article II of the OST. As States Parties increasingly adopt these interpretations, they could significantly influence how the treaty's provisions are ultimately understood.[142]

Applying the interpretational method outlined above has been challenging. The interpretation process is intricate, as it takes into account both static and dynamic elements. It can therefore be difficult to assess the interpretational value of some events. Yet, some, such as the mounting support for the Artemis Accords, may contribute to a shift in how the non-appropriation principle of Article II is understood.

1.4.2 The relationship between general international law and space law

The laws of space constitute a part of international law. This is undisputed. To what extent general international law can be applied, is not.[143] Space law is often referred to as a specialized domain within international law, functioning under the principle of *lex specialis*.[144] This concept signifies that, while space law operates in harmony with the broader framework of general international law, it assumes precedence in instances of conflict.[145] According to Hobe, this entails that general international law may fill the empty pockets of space law when clear regulation is not provided by the latter. The same premise applies to any recourse to general international law.[146]

The topic is repeatedly addressed in legal theory. Once concern is that there is a tendency to apply or put a heavy weight on terrestrial laws based on the stipulations of provisions such as the OST Article II.[147] Some argue that space, by its nature, is a unique and different dominion that should not be lumped together with terrestrial domains despite apparent similarities. This perspective is summarized by the metaphor, "Square pegs do not seamlessly fit into round

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139 Ibid.

140 Ibid. 599.

141 Ibid. 601-602.

142 See more on this in section 2.6.2, *infra*.

143 Olivier Ribbelink, "Article III". In *Cologne Commentary on Space Law, Vol.1,* ed. Hobe, Stephan, Schmidt-Tedd, Bernhard and Kai-Uwe Schrogl (Köln: Carl Heymanns Verlag, 2009), 67.

144 Hobe (2019), 55-56.

145 Ibid.

146 Ibid.

147 Steven Freeland, "The limits of law: challenges to the global governance of space activities" *in Journal & Proceedings of the Royal Society of New South* Wales, 2020-06, Vol. 153 (1) , 76-77.

holes", highlighting the mismatch between conventional legal frameworks and the distinct characteristics of space.[148]

These views indicate that using analogies from other legal fields, for example, should be approached with caution. Similarly, albeit to a lesser extent, they suggest that the application of general rules of international law also requires careful consideration.

1.4.3 International communal doctrines

When considering the impact of the rules of space on concepts such as the freedom to explore and use space, ownership rights and the potential wide or narrow prohibition thereof, it is important to recall that outer space is a realm beyond the jurisdiction of any State. This special legal domain is referred to differently, depending on whose glasses you look through. The most recurring view is that outer space constitutes a *res communis omnium*. The Latin phrase – stemming from Roman law – literally means "Thing of the [entire] community".[149] The term is typically used in relation to domains which fall outside national jurisdictions, but are not subject to any claims of sovereignty, and are free to access and use by everyone.[150] An example of such a domain is the high seas.[151] The *res communis* character of outer space can be seen reflected in the non-appropriation principle of the OST Article II, and the freedom to use space of Article I.[152] The term 'global common' is besides used interchangeably with *res communis*, and outer space is, in the same sense, often referred to as a global common.

Another communal concept also mentioned in the legal discussion of natural resources in outer space, is the 'common heritage of mankind' [CHM]. This term is *in verbatim* incorporated in the Moon Agreement[153], and also the United Nations Convention on the Law of the Sea (UNCLOS).[154] It implies that communal realms such as outer space, should not be exploited by sole entities, but benefit all of humankind. The CHM-concept of the Moon Agreement, however, must be read in light of the framework it is incorporated into, thereby differentiating it from the CHM-term of the UNCLOS because of the different realms they apply to.[155] As for space resource exploitation, the CHM-concept has been interpreted by some to suggest that all countries should benefit from the resources contained in outer space – a somewhat controversial notion.[156]

1.5 The following presentation

This thesis is composed of two main chapters. Chapter 2 analyses the current legal framework, starting with Article II of the OST. The main question is whether natural resources in space are covered by the non-appropriation principle, and if so, to what degree. Section 2.2 starts off with a clarification on what a celestial body is. Sections 2.3 and 2.4 analyses and assesses the meaning of 'national appropriation'

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148 Ibid.

149 Aaron Fellmeth and Maurice Horwitz, *Guide to Latin in International Law* (2. ed.). Oxford University Press, 2022. Available online: https://www.oxfordreference.com/display/10.1093/acref/9780197583104.001.0001/acref-9780197583104-e-1867?rskey=QwmsXc&result=6 . Last accessed May 13, 2024.

150 Crawford (2019), 191-192.

151 Ibid.

152 F. von der Dunk (2015), 56-57.

153 The Moon Agreement (n. 24), Article 11 (1).

154 United Nations Convention on the Law of the Sea, Article 136. Montego Bay, 10 December 1982. UNTS vol. 1833. Reg. nr. 31363. Available online: https://treaties.un.org/doc/Publication/UNTS/Volume%201833/volume-1833-A-31363-English.pdf . Last accessed May 20, 2024

155 Hobe and Chen (2016), 33.

156 Lyall and Larsen (2018), 180.

and the phrase describing appropriation 'by means of claims of sovereignty, by use or occupation or by any other means'. Section 2.5 examines and assesses the relationship between the inherent scope of the non-appropriation principle and space resource activities. Section 2.6 looks at international efforts to develop the legal regime of space resources and their significance for the non-appropriation principle.

Chapter 3 analyses and assesses the international legal framework of State responsibility and liability with regards to future space resource activities. Section 3.2 examines State obligations imposed by the OST Article VI. Section 3.3 addresses the consequences of States breaching their obligations.

The concluding Chapter 4 summarizes and presents the findings of this thesis. Moreover, reflections on the way forward, and suggestions on how to ensure that space resource activities are conducted in a responsible and sustainable way, are made.

2 The non-appropriation principle

2.1 Introduction

This chapter analyzes the scope of the non-appropriation principle and assesses its impact on the potential exploitation of natural resources in outer space. The non-appropriation principle is incorporated in Article II of the Outer Space Treaty [OST]. The provision codifies a fundamental principle regulating outer space. It stipulates:

> *"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."* [157]

As the OST is silent on the legal status of natural resources in outer space, questions arise regarding the scope and impact of Article II regarding natural resources in outer space: How does the non-appropriation principle, if at all, affect the potential exploitation of said resources? Leading scholars in the field have for a long time addressed the question, but their conclusions are of similar nature: Whether natural resources in outer space are covered by the non-appropriation principle is unclear.[158]

As we will see in the following sections, the non-appropriation principle entails that the acquiring or taking ownership of any part of outer space and celestial bodies by any means, is prohibited. In other words, the rule arguably prohibits exclusive ownership of any part of outer space. Yet, there is subsequent uncertainty surrounding the principle's reach. For example, what does the broad wording of 'appropriation by use' or 'appropriation by any means' entail? Is it so far reaching that it encompasses ownership of natural resources of celestial bodies? Is it possible to differentiate between the appropriation of celestial bodies themselves and the appropriation of natural resources derived from them? Furthermore, where exactly does the boundary lie between 'appropriation by use' or 'any other means', and a type of use that does not constitute appropriation as indicated in the treaty, but may in fact be a freedom guaranteed by the OST Article I?

Key questions in this chapter are:

- What is a 'celestial body'?
- What constitutes 'national appropriation' under the Outer Space Treaty?
- What is the meaning of appropriation 'by claim of sovereignty, by means of use or occupation, or by any other means'?
- What is the relationship between space activities the non-appropriation principle?
- Have there been subsequent developments in the interpretations of the non-appropriation principle that may impact space resource activities?

2.2 What is a 'celestial body'?

What constitutes a celestial body is not defined in the OST, nor any other international framework. At a glance, there are two interpretations: one broad, referring to any natural body in outer space, and another more restrictive, suggesting size or significance might play a role. The dictionary offers a wide definition, considering a celestial body as 'any unit of matter in the universe, like planets or stars,

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157 The OST (n. 21), *supra*.

158 See Masson-Zwaan and Sundahl (2023), 386; Hobe and Chen (2016), 29; Tronchetti (2015), 790.

for astronomical study'.[159] Although one might think of larger natural bodies in space such as a planet or moon when contemplating 'celestial bodies, the aforementioned description reflects that also this term is quite broad.

The ambiguity in terminology showcases the challenges inherent in legal analysis when confronted with unclear wording. The practical consequences of a narrower interpretation could, at least in theory, be that appropriation of whatever does *not* constitute a celestial body could be permissible. If such an object were to be an asteroid containing valuable resources, the incentive for such an interpretation could be substantial.

In the evolving field of space law, legal scholars have naturally provided their insights on the term 'celestial body', adding to the array of interpretations within the field. Ram Jakhu defines it as any natural body outside Earth's atmosphere, encompassing meteorites, planets, asteroids, etc., thus falling under the framework of existing space law.[160] This view aligns with the one of ICJ-judge and space law pioneer Manfred Lachs, who posited shortly after the OST's creation that an object's size does not determine its legal classification framework.[161] Lyall and Larsen notes that asteroids and comets clearly must be encompassed within this term.[162] Hobe differentiates between a celestial body as a 'naturally occurring entity' and a space object as something artificial, such as a satellite.[163]

Despite the lack of a universally accepted definition, the meaning provided by general interpretation and legal scholars suggests that 'celestial bodies' includes any natural space object, laying the groundwork for further analysis. This perspective is substantiated by the deliberate omission of a comprehensive list defining its jurisdiction, as evidenced by the phrasing of Article II: "Outer space, *including* the moon and *other* celestial bodies [...]" This lack of specificity in the treaty underscores the apparent acceptance of a wide range of objects under the umbrella of 'celestial bodies', encouraging a more inclusive approach to the term's legal interpretation.

2.3 What is the meaning of 'national appropriation'?

The act of appropriation is the core action prohibited under Article II. As mentioned earlier, the non-appropriation principle stems from a time where the focus on preventing both conflict and unwarranted expansions of national territory was highly prioritized in the international arena. These historical issues are reflected in the wording 'by claim of sovereignty (...) or occupation'; two explicit actions mentioned in the provision as means of national appropriation.[164] The terms 'national' and 'appropriation' together encapsulate the primary action forbidden by this principle. To understand the term 'appropriation,' we begin with its standard definition. Derived from 'appropriate,' it generally means to claim or take possession of something as one's own exclusive property.[165] This definition unveils two essential components for appropriation worth scrutinizing: i) possession and ii) property. Worth noting here is the apparent distinction between possession and

159 The Merriam-Webster dictionary describes a celestial body as "an aggregation of matter in the universe (such as a planet, star or nebula) that can be considered as a single unit (as for astronomical study)"; https://www.merriam-webster.com/dictionary/celestial%20body , last accessed January 16 2024.

160 Jakhu (2017), 117-118.

161 The views of Lachs was presented in *The Law of Outer Space: An Experience in Contemporary Law-Making.* Leiden: Martinus Nijhoff Publishers, 2010, originally published 1972, 44.

162 Lyall and Larsen (2018), 182.

163 Hobe (2009), 32.

164 See further elaboration in section 2.5, *infra.*

165 https://www.merriam-webster.com/dictionary/appropriate#dictionary-entry-2 . Last accessed May 20, 2024.

property. The latter often embodies an enduring right that exists regardless of whether the item is in use or possession. While using or possessing something may prevent others from using it simultaneously, a property right implies the authority to exclude others, even when the item is not actively used. This distinction is important to keep in mind,as it underpins further discussions on the relationship between the appropriation of space and its use.[166]

The appropriation-term is not used elsewhere in the OST but is, however, used in the Moon Agreement, where it reiterates the non-appropriation principle.[167]

To repeat; Article II of the OST explicitly prohibits national appropriation through 'claim of sovereignty, by means of use or occupation, or by any other means.' The scope is notably broad, not just in its reference to specific actions like 'use' or 'occupation,' or claims of sovereignty, but also so through its expansive phrase 'by any other means.' This inclusive language underscores that a comprehensive understanding of 'appropriation' requires an analysis of these actions and terms. And so, to grasp the full scope of the non-appropriation principle, it is essential to first analyze 'who' is encompassed by the term 'national,' and then explore 'how' these entities might attempt appropriation. Analyzing the meaning of 'national appropriation' thus begins with the defining 'national,' which sets the foundation for understanding the potential actions that could constitute 'appropriation' [examined in section 2.4].

2.3.1 Defining 'national' in Article II

What is the meaning of 'national' as it appears in OST Article II? Initially, the term's deliberate placement before 'appropriation" in the treaty text seems to target governmental entities, or States, suggesting a focused regulatory scope. If so, this specific usage of 'national' raises an important question with regards to, for example, private entities: Does its explicit mention – and the corresponding absence of any direct reference to non-governmental entities – imply their exclusion from this provision? The question is not insignificant given the growing presence of non-governmental entities in the space industry; particularly private enterprises operating on commercial models without direct government support.[168] Yet, Article II is notably silent on what defines 'national'. Consequently, interpreting 'national' within the context of Article II necessitates a thorough consideration of whether non-governmental actors such as private companies, organizations, or individuals are implicitly included under this term. This will be a central focus in the ongoing discussion.

Once more, we will commence by determining the ordinary meaning of 'national'. One dictionary characterizes the term as "relating to a nation," while another similarly describes it as "relating to countries or one particular country."[169] It seems reasonable, then, to consider 'nation' and 'country' as synonymous in this context. Therefore, based on its conventional definition, 'national' apparently implies some form of governing entity. At first glance, this indeed implies that 'national appropriation' primarily concerns actions undertaken by States. That is the ordinary meaning of the term, on its own. However, the ordinary meaning should be considered in light of other provisions in the OST.[170] Bearing this approach in mind, a closer look reveals that 'national' is mentioned in other parts of the treaty, notably in the aforementioned Article VI, which states the following:

166 Discussed in section 2.5, *infra*.

167 The Moon Agreement (n. 92). Article 11 (2). The Moon Agreement is addressed in section 2.6, *infra*.

168 The most prominent being the U.S-based company SpaceX. Non-Governmental Organizations would followingly also fall under the term non-governmental entity.

169 https://www.merriam-webster.com/dictionary/national ; https://dictionary.cambridge.org/dictionary/english/national last accessed January 17, 2024.

170 VCLT Article 31 (1).

> *"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. When activities are carried on in outer space, including the moon and other celestial bodies, by an international organization, responsibility for compliance with this Treaty shall be borne both by the international organization and by the States Parties to the Treaty participating in such organization."* [171]

The provision mandates that States Parties bear international responsibility for national activities in outer space. A crucial detail of this responsibility is that 'national' also explicitly covers the activities of non-governmental activities.[172] This is substantiated in the second sentence of the provision: "The activities of non-governmental activities in outer space [...] shall require authorization and continuing supervision by the appropriate State Party to the Treaty". Therefore, the use of 'national' in Article VI may shed light on its interpretation in Article II.

Nevertheless, it is sensible to approach the contextual interpretation of 'national' with caution due to the distinct purposes of Articles II and VI of the Outer Space Treaty. Article II is specifically concerned with prohibiting 'national appropriation' of space, while Article VI establishes a regime of responsibility. The different focus of these provisions begs the question: Should the interpretation of 'national' remain consistent throughout the treaty, or does contextual nuances demand different interpretations? Differentiating the term's meaning across the OST may at first seem unnecessary, but a simplistic harmonization could obscure the intentions of the treaty drafters, and subsequently lead to an incorrect interpretation. Such considerations of intention must be made, as reflected in previous judgments of the ICJ.[173] The Court has, in this sense, used treaty provisions of different purposes to implicate a certain meaning to the provision in question.[174] For instance, in *Dispute Regarding Navigational and Related Rights,* the Court utilized other treaty clauses to deduce a right to navigation that was not explicitly outlined in the contested provision.[175] The Court found it necessary to "draw certain necessary implications" from the provisions of the treaty as a whole – considering its objectives, purpose, and historical context – to faithfully reflect the intentions of its authors.[176] This suggests that 'national' in Article II may be affected by what can be read from Article VI.

The answer to what – or more specifically, who – is encompassed by the non-appropriation principle is therefore reliant on several contemplations on the purpose of the provision.[177] Firstly, the need for such a prohibition in outer space – to preserve it as a common realm for all humanity and to prevent conflicts –

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171 The OST (n. 21) Article VI.

172 Ibid. First sentence, second part.

173 *Case Concerning the land, island and Maritime Frontier Dispute (El Salvador/Honduras: Nicaragua intevening)* September 11 1992, General List No. 75., paragraphs 373-374: "The question must be why, if delimitation of the maritime spaces was intended, the Special Agreement used the wording "to delimit the boundary line (...) regarding the land frontier, while confining the task of the Chamber as it relates to the islands and maritime spaces to determine [their] legal situation..."(...)."

174 Dörr (2018), 583.

175 Ibid. Reference to *Dispute regarding Navigational and Related Rights (Costa Rica v. Nicaragua*), Judgment, I.C.J. Reports 2009, p. 213.

176 Ibid. Paragraphs 77-79.

177 VCLT Article 31 (1).

is clear.[178] After all, this understanding underpinned the codification of the non-appropriation principle through Article II.[179] Given the goal to protect space from national appropriation, one can consider whether the treaty's framers intended to include private or even personal forms of appropriation. Is 'private appropriation' of space comparable to 'national appropriation'? The distinction between a private entity and a State is significant, suggesting it might be reasonable to infer that private appropriation does not fall under the term 'national'. Supporting this view, the operations of private entities in space are likely on a much smaller scale than those of nations. Furthermore, the capability of a private entity to enforce any form of appropriation in space is considerably less than that of a nation, reflecting the potential consequences of space activities. When considering the implications of conflict and war, the impact of national entities differs significantly from that of private entities, reinforcing the idea that private entities were not intended to be included under a provision that solely mentions 'national' entities. Moreover, the absence of any mention of non-governmental entities in Article II – unlike in Article VI, where they are explicitly referenced – may suggest that Article II was specifically designed to address actions by States only.

The reason for the omission of any mention of private entities is discussed by scholars when contemplating the genesis of the OST. Some argue that there are historical reasons for why private entities are not mentioned in the wording of Article II. When the negotiations of the OST were ongoing, the only operators in space – both at the time and the foreseeable future – were States. Arguably, the drafters did not predict the need for addressing private entities when establishing the provision in Article II.[180] Furthermore, another reason for the omission of any mention of private entities is that Article II was the result of a compromise between those opposed to private enterprise in space [the Soviet Union] and those in favor [the U.S].[181] This compromise was allegedly the reason why Article VI – regulating non-governmental entities – was introduced.[182]

Hence, it may appear that the drafters of the OST never meant to intentionally exclude private entities from the scope of the provision, but rather that there was no imagined need for legal subjects other than States being addressed in the wording of the provision.[183] The official records of the OST-drafting history are shown to as support for this view. Key arguments build upon an assumption: Had there been a reality of private entities engaging in space activities, the wording of the draft[s] would have been broader.[184] This is arguably noticeable when examining the proposed draft language submitted by the UN representative of the U.S.[185]

This assumption has not gone unchallenged, however. A notable dissent stems from Stephen Gorove, an early space law pioneer, who contended that the lack of explicit prohibition against appropriation by entities other than national govern-

178 The consensus on this is made evident by e.g the binding force and number of ratifications of the OST.

179 As introduced earlier.

180 F. Tronchetti, "The Non-Appropriation Principle as a Structural Norm of International Law: A New Way of Interpreting Article II of the Outer Space Treaty". In *Air & Space Law, 2008-06, Vol.33 (3),* 282. HeinOnline Kluwer Law International Journal Library.

181 Ibid.

182 Ibid.

183 Abigail D. Pershing, "Interpreting the Outer Space Treaty's Non-Appropriation Principle: Customary International Law from 1967 to Today", in *Yale Journal of International Law, vol. 44, no. 1, Winter 2019* p. 155. HeinOnline. Downloaded 21st of December, 2023.

184 Ibid.

185 Ibid. Pershing references to a letter from the Permanent Representative of the United States of America addressed to the Chairman of the Committee on the Peaceful Uses of Outer Space, dated June 16th 1966. See it online: https://www.unoosa.org/pdf/limited/c2/AC105_C2_L012E.pdf .

ments suggests that private entities are not included in Article II's prohibition.[186] Gorove's argument seemingly hinges on the legal maxim "expressio unius est exclusio alterius," which means that the explicit mention of one is the exclusion of another.[187] This reasoning posits that if the law does not specifically forbid an action, it may, by implication, be considered permissible or at least not expressly illegal.[188] Space law scholar Wian Erlank presents a similar viewpoint to this perspective. He argues that the specific wording suggests the prohibition is strictly applicable to State actions and does not extend to private individuals or entities.[189] Erlank's argument also hinges on the absence of explicit mention of private entities within the treaty's language, interpreting this as an indication that "personal appropriation" fall outside the scope of the non-appropriation principle outlined in Article II.[190] This interpretation notably mirrors the rationale used by Gorove in the early days of space law, advocating for a literal understanding of 'national appropriation' that excludes private entities from its purview.[191]

However, this line of reasoning seemingly diverges from established principles of international law, which – even though caution is wise – advocate for interpreting terms within the broader context and objectives of the treaty.[192] Consequently, 'national' in Article II should indeed be understood in light of the *entire* OST, which includes its context, object, and purpose.[193] Acknowledging the requirements imposed by Article VI on States Parties to oversee their nationals' space activities, it poses a nuanced inquiry: If the Treaty prohibits States from appropriation in space, can the same States allow activities by private entities that constitute appropriation? Given the prohibition against States themselves engaging in appropriation, there is an implied expectation that they must similarly discourage such practices among private entities within their jurisdiction. After all, Article VI obligates States to assure that national activities are carried out in conformity with the OST.[194] Thus, the legal effect may be summarized like this: Given that States are prohibited from appropriation, they must logically extend this prohibition to private enterprises under their jurisdiction. This implies a straightforward duty: States Parties must actively assure that private entities do not engage in any form of appropriation, as to allow such activities would directly contradict the treaty's principles. Thus, assuring compliance with the OST not only requires States to abstain from appropriation but also to rigorously monitor and regulate the activities of their nationals to prevent any actions that might undermine the treaty's objectives.

Another important provision to recall is the OST Article III and its obligation upon States Parties to conduct their activities in accordance with international law.[195] States Parties are thus not only bound by the rules of space law, but could

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186 S. Gorove, "Interpreting Article II of the Outer Space Treaty" in *Fordham Law Review,* vol 37; Issue 3 (1969) , p. 351. Available online: https://ir.lawnet.fordham.edu/cgi/viewcontent.cgi?article=1966&context=flr , last accessed January 27, 2024.

187 Fellmeth and Horwitz, (2022). Available online: https://www.oxfordreference.com/display/10.1093/acref/9780197583104.001.0001/acref-9780197583104-e-757 . Last accessed May 20, 2024.

188 Ibid.

189 Wian Erlank, "Property and ownership in outer space". In *Outer Space Law: Legal Policy and Practice,* 2nd ed. Edited by Yanal Abul Failat and Anél Ferreira-Snyman Snyman (Surrey, UK: Globe Law and Business Ltd., 2022), 141.

190 Ibid.

191 And so, it seems that these scholars may appear very careful with contextual interpretation.

192 VCLT Article 31 (1).

193 Ibid.

194 First sentence (n. 171), *supra*.

195 Notice that Article III uses 'shall' to underscore the binding nature it imposes on the States Parties to the OST (n. 21).

also be bound by obligations in general international law.[196] For instance, the *res communis* status of outer space suggests that use cannot involve appropriation, either by States or private entities. As such, a State cannot allow private appropriation under its jurisdiction or obligated supervision regime because States have an obligation to assure that national activities are conducted in accordance with international law.[197]

Additionally, if a State is barred from certain actions under the OST, it cannot approve equivalent actions by private parties, because a treaty's purpose shall be upheld by the interpretation of the provisions in it.[198] This entails that any interpretation leading to actions that contradict the purpose of the treaty is in violation of international law.[199] For instance, the principle of effectiveness is a fundamental principle that seeks to guarantee a treaty reaching its purpose.[200] The principle exists to advance the aims of the treaty by protecting it from any interpretation diminishing its practical effects.[201] The phrase 'practical effects' is important because it is an argument against– or at least counterbalance to – a narrow interpretation based on the semantic meaning alone, or the lack of an explicit term. As highlighted earlier, the non-appropriation principle of the OST Article II exists because the protection of space against exclusive ownership and territorial claims was highly agreed upon by consensus. If the core aim of the treaty was to prohibit appropriation, it seems senseless that it should not apply to non-governmental entities. In the ever-developing human civilization, non-governmental entities may possibly grow to be capable of actions that might amount to appropriation either through occupation or excessive use.[202] If so, the practical effects of the provision would indeed be diminished.

Furthermore, an eventual claim of property in outer space by a private individual would require some form of granting of rights through national legislation.[203] The concept of ownership is, at least in legal terms, dependent on some kind of legal basis that, if granted, can be enforced by the State granting such ownership rights. In this sense, Lyall and Larsen highlight the limitations of individual claims to property rights, emphasizing that such rights cannot be established merely through self-declaration.[204] Only sovereign States hold the authority to confer property rights upon individuals.[205] In other words, a claim of ownership to something by any private entity is not enough to establish enduring rights. And since a State cannot grant a right it does not have itself, 'personal appropriation' cannot exist in a legal sense.[206]

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196 Ribbelink (2009), 67.

197 S. Freeland and R. Jakhu, "Article II". In Cologne Commentary on Space Law, Vol.1, ed. Hobe, Stephan, Schmidt-Tedd, Bernhard and Kai-Uwe Schrogl (Köln: Carl Heymanns Verlag, 2009), 52; P. De Man, "The exploitation of natural resources in outer space". In Outer Space Law: Legal Policy and Practice, 2nd ed. Edited by Yanal Abul Failat and Anél Ferreira-Snyman (Surrey, UK: Globe Law and Business Ltd., 2022), 204.

198 VCLT Art. 31, nr. 1.

199 This violation of international law would reach broadly, as the interpretation principles of VCLT Art. 31 and 32 is considered customary law, thus applicable to older treaties despite the rules of non-retroactivity, see more on this in section 1.4.1.1, *supra.*

200 As seen in practice by the ICJ: *Case Concerning the Territorial Dispute* (Libya/Chad), Judgment of February 3rd1994, General List No. 83, para. 51. Available online: https://www.icj-cij.org/sites/default/files/case-related/83/083-19940203-JUD-01-00-EN.pdf . Last accessed May 20, 2024.

201 Dörr (2018), 584.

202 This hypothetical scenario is elaborated on in later sections, see 2.5 and 2.6, *infra*.

203 As pointed out by De Man (2022), 204.

204 Lyall and Larsen (2018), 170.

205 Ibid.

206 De Man (2022), 208.

A real example circulating in literature is the case of *Nemitz v. United* States.[207] Gregory W. Nemitz, an American citizen and space enthusiast, had acquired an online certificate of ownership to the near-Earth asteroid 433 Eros.[208] When NASA conducted exploration of this asteroid, Nemitz sent parking ticket claims to NASA for the intrusion on his alleged property. Exchanging legal notices, NASA argued Nemitz' lack of basis for ownership rights, emphasizing the principle of non-appropriation as an obstruction of private claims.[209] The case was settled in the Nevada Federal District Court which ruled that Nemitz had no right to appropriation and ownership of the asteroid.[210] The court's decision had grounds in the same reasoning given by NASA's legal counsel; that legal basis for ownership does not exist and cannot exist on the basis of national legislation so long as the non-appropriation principle applies to States.[211] The rulings of a federal U.S court in Nevada may not be very relevant for interpreting the terms of the OST Article II. However, the example shows that actual attempts on ownership claims in outer space have been made, unsuccessfully. It thus reflects the functioning status of the non-appropriation principle.

As with many other issues of space law, there is not a lightning clear conclusion on what the meaning of 'national' in Article II entails. Nonetheless, it does seem more than reasonable to settle on an interpretation that includes non-governmental entities. Even if the ordinary meaning of terms by itself suggest it applies only to States, the context and purpose of the OST implies that an exclusion of e.g private entities would not make sense. Such an interpretation would go against the purpose of the provision because it could enable a circumventing of the non-appropriation principle by allowing appropriation by other entities than governmental ones. Moreover, even though non-governmental entities may not legally secure appropriation due to the lack of lawful property rights granted by a State, States must prevent any de facto appropriation by these entities, given their ultimate responsibility for regulating their activities.[212]

So far, this suggests that 'national' in the context of appropriation as it appears in Article II also extends to non-governmental entities, which includes private companies and individuals. This rather wide interpretation of 'national' is a reminder of the fact that to really understand the whole term 'national appropriation' we need to examine the actions deemed as attempts to claim it.

2.4 What is the meaning of appropriation by "claim of sovereignty, by means of use or occupation, or by any other means"?

In the preceding section, the word 'appropriation' was briefly examined. This section elaborates on its meaning through a detailed interpretation of the phrase "by claim of sovereignty, by means of use or occupation, or by any other means". Establishing the meaning of the non-appropriation principle in Article II requires a detailed analysis of the actions listed as means of appropriation.

2.4.1 "By claim of sovereignty"

As cited earlier the OST Article II prohibits national appropriation by 'claim of sovereignty'. What does 'claim of sovereignty' entail? By its ordinary meaning, 'sovereignty' involves holding supreme power, authority, or control over something,

207 Nemitz v. U.S., Not Reported in F.Supp.2d, 2004 WL 3167042

208 Lyall and Larsen (2018), 171. Elaborated in note 42 on the same page.

209 Ibid.

210 Freeland and Jakhu (2009), 55-56.

211 Ibid.

212 The OST Article VI (n. 181), first sentence, second part.

often relating to the power and authority of States.[213] States usually exercise sovereignty over their territory, i.e they exercise complete authority over that area. Holding specific sovereignty over something thus logically excludes others from obtaining the same specific sovereignty.

The reason for an explicit mentioning of the sovereignty claim stem from the geo-political history that was taken into consideration in the genesis of the OST.[214] Territorial conquest, colonization and conflicts were to be avoided. The objective of, and purpose for, Article II is reflected by the views made by State representatives to the UNCOPOUS briefly after the genesis of the OST. Accordingly it was "to prohibit a repetition of the acquisition of national sovereignty over overseas territories that developed in the sixteenth, seventeenth and eighteenth centuries".[215] The notion of space as a realm for all mankind, referred to as *res communis*, was already a contextual backbone and leading force in the process of making a binding international legal framework pertaining to space activities.[216] The term 'by claim of sovereignty' is therefore, by some, described as one of the more clear terms in the non-appropriation principle since it has not endured the same debates as other concepts found in Article II.[217]

To analyze the potential meaning of 'sovereignty' provided by terminology, differences and coherences in terms and distinctions provided by legal theory should be examined. With regards to territory, public international law scholar James Crawford list four types of 'spatial regimes' in international law: i) territorial sovereignty, ii) special status territories not subjected to sovereignty by any State, iii) *res nullius* and iv) *res communis*.[218] In international law, the 'sovereignty' of States usually relate to the power and authority – or 'legal competency'– they hold over their territory, although it is underscored that use of the terminology is inconsistent.[219] Furthermore, uses of 'sovereign' that does not pertain to the conventional 'territory-term' is pointed out, underscoring the somewhat confusing concept.[220] The confusion appear to stem from the various types of rights often also depicted as sovereign ones, e.g a coastal State's sovereign rights to natural resources in its continental shelf.[221] Crawford furthermore emphasizes that the 'owning' of rights essentially constituting some form of sovereignty are a different and broader concept than the conventional territorial sovereignty concept.[222]

Thus, it might appear that 'sovereignty' in international law indeed does most often refer to territorial concepts. However, Crawford's inclusion of other concepts of sovereignty indicate that the term can also be used with reference to various types of rights, not limited the strict sense of territory. Recalling the fresh observation just made on the potential broadness of 'sovereignty', the term may thus also refer to sovereign rights pertaining to natural resources. Yet, it is wise to yet again recall that applying concepts of general international law directly on the very different and unique legal realm of outer space should be approached with caution.[223]

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213 https://www.merriam-webster.com/dictionary/sovereignty , Last accessed May 20, 2024. https://dictionary.cambridge.org/dictionary/english/sovereignty . Last accessed May 20, 2024.

214 Jakhu (2017), 120-121, showing to statements made by U.S representative to the UNCOPOUS, July 1969, expressing the underlying rationale of the provision.

215 Ibid.

216 Ibid.

217 Freeland and Jakhu (2009), 53.

218 Crawford (2019), 191.

219 Ibid. 192.

220 Ibid. 194

221 UNCLOS Article 77 nr. 1: "The coastal State exercises over the continental shelf **sovereign** rights for the purpose of exploring and exploiting its natural resources."

222 Crawford (2019), 194.

223 As emphasized in section 1.4.2, *supra*.

Moreover, no 'claim' of sovereignty as the grounds for appropriation can be made in outer space. In the light of the discussion above, a claim of sovereignty involves some sort of assertion to spatial territory. This was the case when claims of sovereignty to Antarctica was made. Before the Antarctic Treaty of 1959[224],, historical claims to Antarctica's territories were formalized through decrees and legislative acts. For example, the United Kingdom was the first to claim sovereignty through Letters Patent.[225] Norway followed later through royal decrees.[226] Despite the suspension[227] of these assertions by the Antarctic treaty, they endure as historical claims of sovereignty, reflecting the geopolitical interests of the asserting nations during that period.[228] Nevertheless, history indeed shows that sovereignty claims have been made to other assets, specifically natural resources in the seabed. One example in this matter is the national claims of sovereignty to petroleum reserves on the continental shelves. A significant event in State Practice was marked by the 1945 Truman Proclamation, where the United States claimed jurisdictional and exclusive control over natural resources in the continental shelf off its coast.[229] A central characteristic of this claim was that they did not lay claim to territory, but to the resources themselves.[230] The Proclamation was followed by other States, thus substantiating the practice of sovereignty claims to resources in and under continental shelfs. Other States made later claims of sovereignty to the seabed and subsoil of the shelf, thus constituting a territorial claim.[231] The former, 'alternative' claims of sovereignty to resources made by the U.S and subsequent States – different from the mentioned more 'conventional' territorial claims –reveal that the 'claim of sovereignty'-term in Article II may in fact reach broader than sovereignty claims to territory or areas. Nevertheless, it is once again wise to recall that space is a unique realm, physically and legally. Adding weight on the historical terrestrial meaning of claims of sovereignty should be done with caution.[232]

Contemplating the concept of 'sovereignty', space law scholar Katrin N. Metcalf argues that the ideal way to use the sovereignty term should be limited to territorial sovereignty, i.e a description of the rights of States over territory.[233] She argues that 'territorial sovereignty' – the rights *to* territory – are not the only territorial rights States can have. Also, mere rights to use a territory for different purposes,

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224 The Antarctic Treaty, 402 UNTS 71, adopted December 1, 1959, entered into force June 6, 1961.

225 Government of the British Antarctic Territory, *History of the Territory: UK claim.* https://www.britishantarcticterritory.org.uk/heritage/history-of-the-territory/ . Last accessed May 20, 2024.

226 Norwegian Ministry of Foreign Affairs, *Meld. St. 32 (2014–2015) Report to the Storting: Norwegian Interests and Policy in the Antarctic*, p. 15. Available online: https://www.regjeringen.no/contentassets/cef2a67e958849689aa7e89341159f29/en-gb/pdfs/stm201420150032000engpdfs.pdf . Last accessed May 20, 2024.

227 Antarctic Treaty (n. 224), Article IV.

228 Crawford (2019), 238.

229 Ibid. p. 255, referencing to "Proclamation 2667 of September 28, 1945: Policy of the United States with respect to the Natural Resources of the Subsoil and Sea Bed of the Continental Shelf." Made available online through the U.S Department of Commerce (NOAA): https://www.gc.noaa.gov/documents/gcil_proc_2667.pdf . Last accessed May 20, 2024.

230 As can be read through the proclamation wording; note 243, *supra*: "[the] United States regards the natural resources of the subsoil and sea bed of the continental shelf beneath the high seas but contiguous to the coasts of the United States, subject to jurisdiction and control. In cases where the continental shelf extends to the shores of another State, or is shared with an adjacent State, the boundary shall be determined by the United States and the S[t]ate concerned in accordance with equitable principles. The character as high seas of the waters above the continental shelf and the right to their free and unimpeded navigation are in no way thus affected."

231 Crawford (2019), 255.

232 As emphasized in section 1.4.2 on the relationship between space law and general international law.

233 Katrin N. Metcalf (1999) *, Activities in space, appropriation or use?* (Vol. 75, p. 416). Iustus., p. 96.

can arguably exist. These 'lesser rights', according to her, include the rights to pass through territory or conduct certain activities on it.[234]

The sovereignty term as it appears in the legal framework governing space is difficult to get a grip on. Nevertheless, it – in the least – covers the more conventional sovereignty term pertaining to supreme control over territories. Whether or not the term can be interpreted as to applying to aforementioned 'lesser rights' such as to conduct activities, is not as clear. Yet, when contemplating the views of the treaty drafters, the prevalence of territorial references to the sovereignty term, and the fact that natural resources in space was not contemplated at the time, the intention behind the term's inclusion does not seem to include these 'lesser' sovereign rights. Even if claims of sovereignty to natural resources have been made in history, it seems farfetched to argue its heavy significance when discussing the meaning of provisions governing space and its *res communis*-nature. In other words, even though claim of sovereignty over natural resources has happened on Earth, this fact does not automatically exclude natural resources as part of what is prohibited from being appropriated by claims of sovereignty.

2.4.2 "By occupation"

Continuing our analysis of the terms in Article II, the next actions explicitly mentioned in the wording of the provision are 'use or occupation'.

Starting with the 'occupation' alternative, the terms 'sovereignty' and 'occupation' are at first glance related. They both represent actions pertaining to control or authority over something. Occupation is perceivably a more 'hands-on' term, in international context usually referring to taking possession or control of a place or area, including by force.[235] In international law the term is often used in relation to the acquisition of territory, usually being referred to as an 'original mode' of acquisition.[236] Yet, like the sovereignty term, 'occupation' is seemingly more multi-faceted than it first appears. Some argue that this is evident by the concept of 'effective occupation', a concept which is reflected in statements made by the ICJ; linking the sovereignty and occupation terms.[237] For example, in *Legal Status of Eastern Greenland*, the Permanent Court declared that sovereignty claims, not grounded in specific acts or titles like treaties but in ongoing demonstration of authority, must include both the i) intention and determination to govern as sovereign and ii) an actual display of governance or authority.[238] Furthermore, such effective and ongoing occupation is also mentioned as a prerequisite for claiming 'acquisitive prescription'.[239] Still, in practical terms the concepts of rights through prescription and occupation may be difficult to distinguish. The real question is often if rights can be established through i) ongoing display of authority and ii) that such exercise of authority is by jurisdiction or State functions, on a continuous and peaceful basis.[240]

And so, it once again seems that the meaning of 'occupation' as is appears in the OST Article II is broader than at first glance, as other modes of acquisition such as prescription apparently also should be covered by the term. Thus, the reason for

234 Ibid.

235 https://www.merriam-webster.com/dictionary/occupation . Last accessed March 12, 2024. https://dictionary.cambridge.org/dictionary/english/occupation . Last accessed March 12. 2024.

236 However, Crawford criticizes the 'labelling' of territorial acquisition such as the classification constituted by 'modes of acquisition', arguing that the complexity of any real-world case cannot be explained by a singular theoretical term, see Crawford (2019), 208-209.

237 Ibid., 210.

238 Ibid., showing to *Legal Status of Eastern Greenland*, Judgment of April 5th1933, General List No. 43, pp. 45-46. Available online: https://www.icj-cij.org/sites/default/files/permanent-court-of-international-justice/serie_AB/AB_53/01_Groenland_Oriental_Arret.pdf

239 Ibid., 210-211.

240 Ibid.

explicitly mentioning the actions of 'claim of sovereignty' and 'occupation' – even though they technically seem to be covered by the 'any other means'-provision – reflect the gravity of concern the drafters and States Parties to the OST had for space as a future realm for humankind. The term shares a historical background with the sovereignty-term. This is because the attempted acquiring of areas not subject to sovereign States was made by maintaining physical control over the area, whilst maintaining a peaceful demeanor.[241] This contextual description reasoned by Freeland and Jakhu is elaborated on by the authors when pointing to the difference between underlying terrestrial and spatial doctrines. The authors emphasize on the fact that terrestrial areas previously have been regarded as being *terra nullius,* in which anyone were free to occupy and subsequently establish exclusive rights to that area.[242] Additionally, the authors reference the (international) legally allowed concept of prescription further contrasting terrestrial matters from the *res communis*-doctrine that applies to the realm of outer space.[243] This yet again underscores the necessity of caution when applying terrestrial concepts to spatial ones.[244]

The above discussion emphasizes that outer space with all its components is indeed a *res communis.* A claim of sovereignty to territory in outer space and celestial bodies – arguably including resources located therein – is prohibited by the non-appropriation principle. Occupation and other modes of acquisition as a means to establish sovereign rights is also banned by the prohibition.

2.4.3 "By means of use"

Next is the meaning of 'by means of use'. What does appropriation by 'use' entail? Can you use a celestial body in a manner that amounts to appropriation? If so, it also indicates a line to be crossed, but drawing that line is difficult. The word 'use' is, on its own, far more general than the previously addressed words. However, we can find 'use' in other parts of the OST. Most notable is Article I.

It states:

> *"The exploration and **use** of outer space, including the moon and other celestial bodies, shall be carried out for the benefit and in the 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 co-operation in such investigation."*

In its first paragraph, it states that "The exploration and use of outer space […] shall be carried out for the benefit and in the interest of all mankind […] and shall be the province of all mankind". In its second paragraph, it is stated that outer space "shall be free for exploration and use […]". One can here distinguish a line between the free use of space in Article I and the prohibition of the non-appropriation principle in Article II. Whilst Article I articulate the freedom to use outer space, provided it is carried out in the interest and benefit of all mankind, Article II entails certain restrictions on this use. When Article I and II of the OST are

241 Freeland and Jakhu (2009), 54.

242 Ibid.

243 Ibid.

244 As briefly discussed in section 1.4.2.

interpreted in conjunction with one another, this seemingly entails a "provisional dynamic" that operates like this:

The binding rules of Article I allows the free use of outer space when it is carried out for the benefit and in the interest of all countries. This use must not, however, constitute an action of appropriation. States and their private nationals are thus free to use space in any equitable way[245] but this use cannot result in the taking of something as their own resulting in *de facto* possession constituting exclusive ownership rights, amounting to appropriation.

Given this premise, it is once more evident that the very general and broad wording of Article II provides uncertainty with regards to its potential scope. An example can be made based on the logical assumption that the exploitation of resources in outer space is 'use' as it appears in the OST. As the non-appropriation principle sets limits on space activities, but only when they constitute appropriation, it would appear that exploitation of resources – as one of many activities under the umbrella term 'use '– is not prohibited as long as it does not constitute said appropriation. Thus, the legality of the exploitation of space resources may depend on the way they are exploited.

So, how – or when – may use not be in accordance with the OST Article II? While acknowledging the hypothetical nature of the question, several new questions emerge. If the exploitation of resources in space initially is a use allowed by the OST Article I, when – if at all – does it qualify as an action of appropriation? The different nature between the ordinary meaning of 'use' on one side and 'claim of sovereignty' and 'occupation' on the other, seemingly point to 'use' as a less "orthodox" means of appropriation.[246] When contemplating 'use' as a basis for appropriation, it would appear – if actually realized – to constitute a more "discreet" means of appropriation than occupation or sovereignty claims. Instead of actively engaging in occupation or expressly claiming rights, use may exist under the "flag" of Article I, para 2, until it eventually infringes on the non-appropriation principle by excessive use. Yet, it is a challenge to simulate situations where such use would constitute, or border on, *de facto* appropriation. Prescription could be involved in the term; however, the occupation term covers such acquisition of ownership.[247]

In this matter, interesting scenarios that occasionally are addressed by legal scholars are indeed those connected to the extensive exploitation of celestial bodies to recover their resources. Space law scholar Ernst Fasan contemplates several examples of use that may or may not be in accordance with the space treaties. One of the examples is questioning the legality of the action of hollowing out an asteroid and using the material to build structures, including the covering of the asteroid with such structures.[248] The main issue addressed by Fasan concerns the definition of a 'celestial body' and not the meaning of 'use' in the OST. Still, his train of thought on questionable uses of celestial bodies catches the interest. Fasan notes that the destruction of an object is the ultimate form of appropriation.[249] Given such a premise, one can imagine scenarios where a small

245 As per the wording "(..) shall be carried out for the benefit and in the interest of all mankind".

246 In the light of the discussion on 'claim of sovereignty' and modes of acquisition such as occupation, *supra.*

247 See previous discussion on 'occupation'.

248 Fasan, Ernst, "Asteroids and Other Celestial Bodies – Some Legal Differences, in *Journal of Space Law,* Vol. 26, 1998, pp.39-40.

249 Ibid. p. 39. Fasan's article is also referenced to by both De Man and the European Space Agency on the question of resource exploitation versus appropriation, see De Man (2022), 205; "Property Rights and Commercialisation of Natural Resources", European Space Agency: European Centre for Space Law, https://www.esa.int/About_Us/ECSL_-_European_Centre_for_Space_Law/Property_Rights_and_Commercialisation_of_Natural_Resources , last accessed June 2, 2024.

asteroid – presumably still a 'celestial body' – is mined out of existence.[250] In such a scenario, given Fasan's premise, what is the *actual* difference between destruction of said celestial body and mining it out of existence? Furthermore, there are views arguing that appropriation 'by means of use' may involve the establishment of exclusive rights, such as "exclusionary rights of way or the monopolistic exploitation of cosmic resources".[251] A 'monopolistic' exploitation of resources suggests, in this regard, controlling the majority of available resources.

In relation to the related use of the Moon, equally a celestial body, it has been pointed out that activities relating to lunar mining may break the fundamentals of space law. A central issue pointed out, is the potential dividing of the lunar surface. This would often be necessary when conducting space activities such as resource extraction and the establishment of industrial safety zones. It is argued that such dividing may be prohibited by the non-appropriation-principle.[252] Though not emphasized, the argument seems to hinge on the purpose of Article II being breached if uses are of such magnitude that the principle of non-appropriation fails to be effective.[253] Hence, some reflections can be drawn:

Is there a scenario where the use of a celestial body is so largescale that the non-appropriation principle is effectively undermined? If not, how does appropriation, as it appears as a legal term in the OST, happen by 'means of use'? Does it also necessitate a formal declaration amounting to appropriation? Isn't that virtually the same as a claim of sovereignty? If it does not necessitate a formal declaration, and some scale of use is enough, why couldn't an excessive use of a celestial body infringe the non-appropriation principle?

The questions simulate a hypothetical scenario concerning largescale and excessive use of a celestial body. Conversely, given the same premise used above, a small-scale use of a celestial body hence entails a completely different scenario when discussing appropriation. This once more indicates that appropriation by means of use seem to depend on how the use is conducted.

The answer to the meaning of 'by means of use' lies, according to Freeland and Jakhu, in reading it in conjunction with Article I.[254] According to the authors, the relevant limits for such use is determined by the limitations in Article I, second paragraph, which stipulates that it must "be carried for the benefit and in the interest of all countries […]".[255] It seems therefore that the authors view the limits on the use of space as hinging on the way such use is conducted. If understood correctly, they view the use of resources in space as a freedom guaranteed by Article I and therefore consequently not prohibited by the non-appropriation principle. Hobe – while essentially sharing this view – is more laconic in his conclusion, building on the argument that Article II only prohibits the use of space in "terms of territorial appropriation", and that "appropriation of space resources is not regulated in the form of a strict prohibition but only indicated in Article 1 […]".[256] De Man views it differently, arguing that the notion of the non-appropriation

250 Example made by Freeland and Jakhu (2009), 53.

251 Jakhu (2017), 121, referencing to the views of legal scholar Manfred A. Dauses.

252 Nelson, Jack Wright, "The Artemis Accords and the Future of International Space Law", Insights; the American Society of International Law, Vol 24: Issue 31, December 10 th2020, available online: https://www.asil.org/insights/volume/24/issue/31/artemis-accords-and-future-international-space-law . Last accessed March 19, 2024. Reference found in article by Larsen, Paul B. "Is There a Legal Path to Commercial Mining on the Moon?." *University of Pittsburgh Law Review*, vol. 83, no. 1, Fall 2021, pp. 1-50. HeinOnline.

253 Both the VCLT and the principle of effectiveness serves to ensure that the aims of the treaty is advanced by its interpretation.

254 Freeland and Jakhu (2009), 53-54.

255 Ibid.

256 Hobe (2019), 96.

principle only applying to territories is arbitrary.[257] Such a denial of the relevance of Article II on the use of natural resources, would according to De Man, allow circumvention of the non-appropriation principle by reclassifying parts of territories as natural resources.[258] Essentially De Man argues that a "workable application of the non-appropriation principle thus natural resources as such remain covered, in a very literal way, by the non-appropriation principle, though not necessarily with the implication that they are non-exploitable."[259]

What does appropriation by 'use' entail? The answer is not obvious. However, when interpreted in light of Article I, it implies that any free use of space can constitute, or amount to, appropriation. Moreover, comparing the term with 'claim of sovereignty' suggests that 'appropriation' as it appears in Article II does not require a proclamation or assertion, nor any intentional occupation, but can occur as a consequence of lawful space activities. Perhaps it may even amount to appropriation regardless of the intention of those conducting space activities.

2.4.4 "By any other means"

Lastly, the broadest reaching term is provided by Article II as it prohibits appropriation by 'any other means'. The inclusion of such a profound term initially appears as a reflection of the intended broad scope of the non-appropriation principle. The meaning and intended implications of the term, however, remain somewhat unclear. Being the last term in the wake of the other more 'traditional' actions [e.g sovereignty, occupation], the scope of the term is soundly far more dynamic than the traditional terms. Subsequently, all actions stipulated in Article II would technically be covered by the term. Showing similarity to the generality of 'use', the wording of 'any other means' broadens the potential scope of means to appropriate in outer space. Thus, it is sometimes argued that – if perceived on the basis of its very definition – the provision covers any form of ownership, hindering any national claim to any matter outside the Earth's atmosphere.[260]

The concept of 'constructive ambiguity' comes to mind when contemplating the provision. The intentional use of ambiguous terms when negotiating an agreement can likely serve a dual purpose. Firstly, by easing the negotiation process whilst, secondly, providing flexibility to accommodate unforeseen future advancements.[261] As emphasized earlier, the dynamic properties of a law-making treaty such as the OST may thus adapt with time and subsequent events, particularly considering treaty interpretation.[262]

Legal scholar and space law pioneer Carl Christol expressed his view already in 1984 on its contents. Contemplating the historical negotiation background leading to the OST, Christol acknowledged that the negotiators' primary focus was the regulation of State activity in space.[263] However, he also highlighted views arguing that the 'by any means' term extend to international intergovernmental

257 P. De Man, Exclusive Use in an Inclusive Environment: The Meaning of the Non-Appropriation Principle for Space Resource Exploitation. Springer E-Books (2016), 205.

258 Ibid.

259 Ibid., 205-206.

260 Zach Miller, "Space Settlement and the Celestial Subjectivity Model: Shifting Our Legal Perspective of the Universe. In *A Fresh View on the Outer Space Treaty,* ed. Anette Froelich (Springer Charm: 2018), 62. https://doi.org/10.1007/978-3-319-70434-0 .

261 Michael Byers, 2020. "Still Agreeing to Disagree: International Security and Constructive Ambiguity." Journal on the Use of Force and International Law 8 (1): 91–114. https://doi.org/10.1080/20531702.2020.1761656 .

262 See 1.4.1 *supra*. This is also addressed in section 2.6 *infra* when the significance of subsequent agreements and practice regarding the interpretation of the non-appropriation principle of Article II are discussed.

263 C. Christol, *Article 2 of the 1967 Principles Treaty Revisited, 9 Annals of Air and Space Law 217 (1984)*. In Reynolds & Merges (2019), 81.

organizations.[264] This highlighting relates to questions asked during the drafting of the OST on the scope of Article II and whether it extended to other entities than governmental states. When the negotiation and drafting of the OST was ongoing, there was a view expressing that the provision acted as a sort of "safety net", ensuring that future non-governmental claims was intercepted.[265] Consequently, with this last and broad reaching term the drafters of the OST cut off any potential "loopholes" that could be argued as grounds for actions not constituting national appropriation, effectively acting as a "catch all phrase".[266] The phrase is therefore intrinsically linked to the meaning of 'national' previously examined in this thesis. An example of this could be if a claim to ownership rights was made in combination with the notion that the non-appropriation principle only applies to the actions of States.[267]

Some emphasize that a States' recognition of private property rights to even already extracted resources might constitute appropriation by 'any means'.[268] The reason for this, according to Tronchetti, is the questionable scenario of States authorizing licenses for private mining operators to conduct commercial exploitation activities [akin to mining in the high seas]. The author, describing outer space as a 'global commons', argues that a State cannot use its national laws to ensure these interests of both private and public businesses.[269] This view is interesting considering the recent actions of States guaranteeing ownership rights to resources in space.[270]

2.4.5 Summary

The recent analysis of the terms of Article II reveals that the scope of the non-appropriation principle is broader than what it seems *in verbatim*. Firstly, non-governmental entities are included as legal subjects under its scope. Secondly, appropriation can take many forms, including appropriation through the actions of non-governmental entities. An important element of the perceived broadness of the non-appropriation principle is that appropriation can happen gradually depending on how close to constituting appropriation the space activity essentially is. This implies that initially lawful space activities may, theoretically, constitute *de facto* appropriation if such activities become excessive, exclusive, and so forth.

The recent discussions transition from general space activities to a more focused examination of how the non-appropriation principle interacts with space resource activities. Specifically, the pressing issue is to determine when resource activities potentially violate – or come close to violating – the non-appropriation principle.

2.5 What is the relationship between the non-appropriation principle and space resource activities?

The preceding section concluded that space activities must not constitute appropriation under the law. After exploring Article II's terms and the initial scope of the non-appropriation principle, we now turn to how these concepts apply specifically to the extraction and utilization of space resources. This section builds on previous analyses of what actions constitute appropriation, narrowing in on space

264 Ibid.

265 Ibid.

266 Freeland and Jakhu (2009), 54.

267 Ibid.

268 Tronchetti (2015), 791-792.

269 Ibid. p. 791.

270 Stipulated in the national legislation of e.g the U.S (n. 7).

resource activities. A critical question addressed here is under what circumstances do space resource activities cross into the realm of appropriation?

Firstly, a few things should be recalled: As space is effectively a *res communis,* all use should be conducted in accordance with this doctrine.[271] The OST Article III furthermore explicitly obligates States Parties to carry on activities in accordance with international law, meaning space as a legal domain is not closed off from the application of general international law.[272] Additionally, the concept of the free use of outer space, and its limits, provided in the OST Article I, is central. To understand the relationship between space activities and the non-appropriation principle, it is essential to analyze and put an emphasis on the provisions of Article I and the interaction between Article I and Article II.[273]

2.5.1 Does the freedom to use space include the use of natural resources?

The guaranteed freedom to use space and its celestial bodies in the least seems to involve *some* freedom to use its natural resources. This may be ascertained from the OST Article I, paragraph 3. The provision emphasizes the freedom of scientific investigation, a principle of significant practical relevance given that space exploration is predominantly scientific in nature:

> *"There shall be freedom of scientific investigation in outer space, including the moon and other celestial bodies, and States shall facilitate and encourage international co-operation in such investigation."*

In order to conduct scientific investigation, it is reasonable to assume that the need for natural resources is key. For example, an enduring research station on the Moon would likely require access to resources for research and to sustain a presence without ongoing [and resource-demanding] supply. This may include the extraction and removal of precious metals for study, or frozen water-ice for life support and rocket fuel.[274] The treaty's intent to nurture scientific progress implies that using space resources on a small scale for scientific research should be generally uncontroversial.[275] In fact, extraction of materials from the Moon and asteroids has been conducted several times without protest.[276] Moreover, the allowed use of resources for scientific purposes is widely supported in scholarly discussions on the legal status of space resources.[277] Some argue that previous extraction of materials constitute State practice, as the collection of lunar material by the U.S and USSR was done for scientific purposes without objection of other States.[278] Some even argue that this collection was in fact 'space resource appropriation' and that it constituted the beginning of State practice contributing to a

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271 See section 1.4.3.

272 The OST (n. 21), and also by its inclusion of the Charter of the U.N in the preamble.

273 Tronchetti (2015), 779.

274 As introduced in section 1.1.1 (n. 12).

275 The Preamble of the OST (n. 21) proclaims that "[The States Parties to this Treaty] *Desiring*to contribute to broad international co-operation in the scientific as well as the legal aspects of the exploration and use of outer space for peaceful purposes".

276 See for example section 2.6.4, *infra,* on the Apollo-missions who brought plenty of lunar samples back to Earth. Additionally, China recently opened up access for U.S scientist to their lunar soil samples. The event marks a shift in the cold relationship between the two states, see Leonard David, "China's Chang'e 5 moon samples, beyond NASA's reach for years, are finally available to US scientists", *Space.com,* December 1, 2023. https://www.space.com/china-moon-samples-change-5-nasa-researchers . Last accessed March 22, 2024.

277 Tronchetti (2015), 788.

278 Fabio Tronchetti, *The Exploitation of Natural Resources of the Moon and Other Celestial Bodies: A Proposal for a Legal Regime*. (Boston: Martinus Nijhoff Publishers, 2009), 224.

change in customary law regarding the impact of the non-appropriation principle in this regard.[279]

Any scientific use would of course need to be in compliance with other provisions of the OST such as the benefit-clause, as well as with general international law. Nevertheless, the initial contemplation on scientific use of resources provides a premise for further discussion on space resource activities:

The use of natural resources is arguably allowed for scientific purposes.

But what then about commercial purposes?

2.5.2 For commercial purposes?

Scientific use of natural resources on celestial bodies often involves the permanent removal of materials. If this does not constitute appropriation, the criteria for appropriation likely depend on the methods employed in these activities. If the scientific use of resources is permitted under Article I, paragraph 3 of the OST, and other types of use are not explicitly prohibited, it can reasonably be assumed that non-scientific activities, including commercial ones, may proceed under the free use provisions of paragraph 2, subject to the constraints of paragraph 1 and the rest of the OST. Thus, commercial extraction and utilization – essentially 'exploitation' – of space resources does not inherently seem to be prohibited. The OST guarantees freedom to use space within certain limits while prohibiting appropriation. These principles interact dynamically to regulate all space activities. It is therefore more logical to assume that activities are permitted by the freedom granted in Article I rather than restricted by the non-appropriation clause of Article II.

Is there any point then, discussing the principle of non-appropriation in relation to space resource activities when they seem to be allowed by OST Article I? The answer is yes, particularly because the scale of these activities repeatedly appears as a critical factor in this regard. Consider yet another hypothetical scenario: a mining operation on the Moon begins on a small scale but gradually expands, covering vast areas and restricting access to these regions. Over time, if this operation becomes extensive and long-term, it effectively places the area under the ongoing control of the operator, preventing others from using it simultaneously. Such large-scale activities could potentially shift from mere use to something akin to appropriation. The critical consideration here is when exclusivity in use extends beyond merely physical possession. For example, if a mining operator indefinitely seals off a large area rich in potential mining materials but does not fully exploit these resources, it might effectively exclude other operators from the "idle" materials located within this area. This activity might entail exclusion based not on mere possession, but on something starting to resemble property rights, even though not formally so. This could potentially be the case if the operating party limits access to the area as a safety measure – not unthinkable in mining activities. In such a case, another fundamental principle, the free access to space, could also be breached.[280]

Early contemplations on when use of resources might turn into appropriation can be traced back to the late sixties and early seventies. Some viewed the magnitude of permitted use of resources as crucial, referencing to the freedom of use in the OST Article I. Scholars noted that even while the OST should permit the use of such resources, it draws a clear line against national appropriation.[281] This distinction arguably hinges on the extent and nature of the resource usage. For instance, it was argued that if a nation derives significant benefit from the extensive use of a tangible resource, or monopolizes a scarce resource, this behavior was interpreted as appropriation. Furthermore, it was argued that the limits of Article I suggested

279 Pershing (2019), 158.

280 OST (n. 21) Article 1, paragraph 2.

281 De Man (2016), 196, referencing the views of E. Brooks and M.G Markoff.

that surpassing a certain level of usage could shift an action from lawful use to unlawful appropriation.[282] These views seemingly entailed that breaching Article I could contribute to acts of appropriation, thus establishing a clear link between Article I and Article II.

Lyall and Larsen highlights the difference between exploration of a celestial body such as the moon and exploitation of it. A key feature, they argue, is the nature of the activity. Exploration does arguably "not entail permanent appropriation of materials *in situ"*, but they mention that "exploitation may be thought necessarily to do so".[283] If understood correctly, the possibility of legal infringement upon the non-appropriation principle, according to them, may start with the notion of exploitation leading to ownership rights to said materials.

Metcalf underscores the intricate task of determining when space activities become appropriation. The author emphasizes that the 'benefit clause' in Article I (2) may impact when use becomes appropriation, effectively making a borderline appropriation act less "appropriative" when significantly beneficial for mankind.[284] The author seems in other words to argue that the freedom to use space in Article I (1) may 'raise the bar' of what constitutes appropriation in Article II, but only when substantially beneficial to mankind. Yet, argues Metcalf, the only activities clearly qualifying as appropriation, thus never allowed, are taking complete possession or substantial possession of a celestial body for a long period of time.[285]

Jakhu underscores how the "three key legal principles" in the OST – common interest, freedom of use, and principle of non-appropriation – form the fundamental pillar of space law.[286] Any infringement upon these principles would weaken the existing order of law the interaction between them provides. A significant exploitation of natural resources in space such as on a commercial scale, would thus amount to appropriation, according to Jakhu, if they were not conducted in compliance with not only Article I of the OST but also other provisions.[287]

Tronchetti emphasizes that commercial exploitation of resources is a type of space activity included in the term 'use' in the OST, specifically with reference to the right to use space in Article I, paragraph 1.[288] One of the contextual arguments for this according to Tronchetti, is that in today's world, the use of outer space is no longer only scientific, but also commercial. Subsequently, 'use' may include or involve 'exploitation'.[289] Additionally, practical realities can be considered. Tronchetti underscores that the use of outer space logically involves the use of its natural resources. He argues that the only sensible use of space is the one where the possibility of utilizing its natural resources is considered.[290]

De Man also ask the question: When does exploitation become appropriation? Building upon the notion that the OST Article I stipulates the right to exploitation of natural resources, he argues it only can be considered to be appropriation when based on exclusive rights, such as ownership rights. These rights are based on the authority of ownership to exclude others from the resource, regardless of one's own use or not. De Man emphasizes that exploitation of resources does not require property rights to exist, but that such activities can be safeguarded on the basis of its factual use. Exemplified by the conducting of any space activity, De Man points out that as no one can interfere with an entity exercising the free use of space, they

282 Ibid.

283 Lyall and Larsen (2018), 172.

284 Metcalf (1999), 169.

285 Ibid. 169-170.

286 Jakhu (2017), 125.

287 Ibid., 126.

288 Tronchetti (2009), 223.

289 Ibid.

290 Ibid., 224.

similarly cannot interfere with the exploitation of natural resources in space.[291] An interesting point made by the author pertains to the telecommunications industry. This industry has, for quite some time, conducted activities pertaining to the use of immaterial orbit slots and radio frequencies. Earlier assertions of exclusive rights to such resources have been refuted by the international community.[292] De Man argues that even though these resources are renewable, thus different from non-renewable, material ones, their usage hinges on the freedom to use space and not property rights. In other words, when a satellite operator uses an orbital slot, no one else can use the exact same slot. Thus, according to De Man, the freedom of use requires some form of exclusivity to function, but as a consequence of factual use and not exclusive property rights.[293]

Christol argues that the exploitation of natural resources in outer space initially is allowed on the basis of the *res communis*-principle codified in the OST Article II, which according to the author, prohibits exclusive rights to private property in non-sovereign areas.[294] Christol shares similar views with De Man, as a key point in his argumentation is that the exploitation of resources do not require property rights to be conducted. Drawing upon analogy from the law of the sea, the author sees no reason for differentiating the high seas from the similar legal sphere of outer space: "The law of the sea rule, relying on the *res communis* principle, which prevents a nation from exercising sovereignty on the high seas, but which accords to its fishermen, who are subject to its jurisdiction, proprietary rights in the fish which they may catch, applies to natural resources of the space environment."[295]

2.5.3 Summary

What is the relationship between the non-appropriation principle and space resource activities? The recent discussion suggests that while the OST permits resource exploitation, extensive or exclusive activities could potentially breach the non-appropriation principle of Article II if not conducted within the stipulated legal boundaries. Thus, while small-scale scientific use appears uncontroversial, the scalability of resource exploitation demands careful consideration to ensure it is conducted in accordance with international law. A notable point in the recent discussion is that the lawfulness of any resource exploitation seems to depend on *how* it is conducted, either being scientific or commercial in nature, as opposed to either lawful or not.

2.6 International efforts to develop the legal regime of space resources and their significance for the non-appropriation principle

In the further attempt to clarify the impact of the non-appropriation principle of the OST Article II on space resources and activities thereof, any "subsequent agreement between the parties regarding the interpretation of the treaty or the application of its provisions between Parties" or subsequent practice should be taken into account in the interpretation process.[296] In the recent years, States have adopted unilateral legislation on space resources, which guarantees the ownership

291 De Man (2022), 204.

292 E.g the Bogotá declaration, where several equatorial States claimed sovereignty over parts of the geostationary orbit slots of outer space directly above their respective territories. The claim violated the non-appropriation principle; see De Man (2016), 223-224.

293 Ibid. 207.

294 C. Christol, "The 1979 Moon Agreement: Where is it today?". In *Journal of Space Law, vol 27. No. 1,* 1999. Found in in *Space Law* (Aldershot: Ashgate, 2007), ed. Larsen, B. Paul and F. Lyall, 276.

295 Ibid.

296 VCLT Article 31, nr. 3 (a) and (b).

of extracted resources in outer space. Multilateral agreements such as the Artemis Accords provide their own interpretation of the non-appropriation principle, and the Parties to the Accords are already becoming a force to be reckoned with. The following sections examine and discuss the international efforts to develop the legal regime of space resources, and their significance for the non-appropriation principle.

2.6.1 The Moon Agreement

One potential subsequent agreement of interest is the fifth and last of the UN space treaties, the Moon Agreement of 1979 [MA], was an attempt to regulate activities on the Moon. It reiterates the non-appropriation principle and introduces provisions regarding the exploitation of natural resources.[297] The MA is a recurring topic addressed by legal scholars when discussing the legal status of natural resources in outer space. A central question is: Does it affect the interpretation of provisions in the OST at all? Some believe it may be relevant when interpreting Article II of the OST, because it reiterates the non-appropriation principle almost word by word.[298] Others subtly acknowledge its close link to the OST.[299] In this regard, the MA may possibly contribute to a clarification of the provisions of the OST. Some commentators also acknowledge its potential as a future legal framework.[300]

The Moon Agreement, Article 11 introduces the first and last treaty-based framework on natural resources in space:

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 or this article.*
2) *The moon is not subject to national appropriation by any claim of sovereignty, by means of use or occupation, or by any other means.*
3) *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. The placement of personnel, space vehicles, equipment, facilities, stations and installations on or below the surface of the moon, including structures connected with its surface or subsurface, shall not create a right of ownership over the surface or the subsurface of the moon or any areas thereof. The foregoing provisions are without prejudice to the international regime referred to in paragraph 5 of this article.*
4) *States Parties have the right to exploration and use of the moon without discrimination of any kind, on a basis of equality and in accordance with international law and the terms of this Agreement.*
5) *States Parties to this Agreement hereby undertake to establish an international regime, including appropriate procedures, to govern the exploitation of the natural resources of the moon as such exploitation is about to become feasible. This provision shall be implemented in accordance with article 18 of this Agreement.*
6) *In order to facilitate the establishment of the international regime referred to in paragraph 5 of this article, States Parties shall inform the Secretary-*

297 The Moon Agreement (n. 24), Article 11.

298 De Man (2016), 135.

299 Lyall and Larsen (2018), 169.

300 Tronchetti, (2015), 782.

General of the United Nations as well as the public and the international scientific community, to the greatest extent feasible and practicable, of any natural resources they may discover on the moon.

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.*

8) *All the activities with respect to the natural resources of the moon shall be carried out in a manner compatible with the purposes specified in paragraph 7 of this article and the provisions of article 6, paragraph 2, of this Agreement."*

As we can see, Article 11 provide a set of rules explicitly pertaining to natural resources on the Moon. Paragraph 2 reiterates the non-appropriation principle of the OST virtually *in verbatim.* It is necessary to underline that the provisions of the MA also extend to other celestial bodies, as stipulated in the MA Article 1.[301]

Paragraph 3 establishes explicit rules on property and ownership. It states that none of the moon's natural resources located "in place" shall become the property of anyone.[302] Furthermore it states, *inter alia*, that no stationary constructions can create a right of ownership over the surface or subsurface of the Moon or 'any areas thereof'.[303]

Accordingly, no ownership of natural resources "in place" on the Moon is allowed. Additionally, no activities on the Moon can establish ownership rights by their, e.g, stationary nature. By implication, this applies to stationary constructions of varied size over a long period of time. This effectively appears as an elaboration of the non-appropriation principle. The meaning of 'in place' is not clear. Some argue that the MA establishes a *de facto* moratorium – a suspension of activity – on the exploitation of the natural resources of celestial bodies.[304] If so, the question is whether resources are capable of being owned once *not* 'in place'.

Several arguments have been made on the meaning of 'in place'. One hinges on the very fact that as the wording 'in place' suggests that resources are capable of being owned if they are extracted, i.e 'out of place'.[305] This view is not unfounded, but not necessarily because of the wording itself and sentence structure. Any natural resource 'in place' on the surface or subsurface of the Moon is, more or less, a part of the Moon. If ownership to a resource 'in place 'is to exist, it cannot exist on the basis of use but on some kind of assertion or claim, because the resource cannot be in physical possession while still part of the Moon's surface. This brings us back to earlier discussions on the meaning of appropriation. Exclusive use

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301 Article 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."

302 First sentence.

303 Second sentence.

304 Hobe (2019), 98.

305 Pershing (n. 185), 159, refers to a statement of the U.S delegate in the negotiations of the Moon Agreement, in which it was argued that "in place" suggests that extracted materials can become property..

is not prohibited, but appropriation of celestial bodies is. For anyone to own a resource 'in place' in the surface or subsurface of the Moon, they would effectively have to claim ownership to them, and, by implication, part of the celestial body. This would infringe on the non-appropriation principle.

Another provision of interest is established in paragraph 1, which states that the Moon and its natural resources are the 'common heritage of mankind' (CHM). This way of thinking stems from the now acquainted *res communis*-concept and is considered to be an evolution of that principle.[306] Different than the right to free use provided in the *res communis*-principle, the concept sets limits on certain activities if they exploit what can be considered the common heritage of all humankind – effectively a broad mass of legal subjects. The collective management of natural resources is often a central theme when discussing the CHM, although discussions show the concept is not crystal clear.[307]

The authority of the MA in the interpretation of the non-appropriation principle, however, is weak due to the lack of support, with only 17 ratifications compared to the 114 of the OST.[308] Its obligations are only binding for those party to it. Thus, it is hard to argue that it is an "agreement between the parties regarding the interpretation of the [Outer Space] treaty or the application of its provisions".[309]. Even if on the border of being such an agreement, the shift from no mention in the OST of natural resources at all, to possibly part of the 'common heritage of mankind', would make it hard to justify such a drastic interpretation of the OST in favor of the rules of the MA. Some even view the postponement of negotiations [Article 5] on a regulatory regime until resource exploitation becomes feasible, as more an absence of a subsequent agreement than a possible one, thus rendering the MA of little help when interpreting the OST.[310] Consequently, the legal basis is too weak, and the results too drastic, to consider the MA as significant when interpreting the OST. Since the MA does not apply to major space-faring nations, the OST remains the primary framework relevant for the use of space resources.[311] However, since it lacks specific provisions, this arguably prompts countries to develop national legislation to address these legal gaps.[312]

2.6.2 The Artemis Accords

A recent development that should be addressed is the impact of the Artemis Accords. This U.S-founded multilateral agreement is described as the legal foundation for the Artemis Program, which plans to send humans to the Moon and beyond. The Accords establish a set of principles and guidelines that intends to "increase the safety of operations, reduce uncertainty and promote the sustainable and beneficial use of space for all humankind".[313] Signing the Accords is required to join the Program.[314] Furthermore, the Accords declares that the use of space resources is beneficial for space operations, that any such use should be in accordance with the OST, and that the extraction of space resources does not "inherently" constitute national appropriation under Article II.[315] The placement

306 Tronchetti (2015), 783.

307 As touched upon in section 1.4.3.

308 See Status of Treaties (n. 23).

309 Cf. VCLT Article 31, nr. 3 (a).

310 Michael Byers and Aaron Boley, "Space Mining" in Who Owns Outer Space. Cambridge University Press, (2023), 145.

311 Tronchetti and Liu, 2019 (n. 73).

312 Ibid.

313 The Artemis Accords, Section 1 (1). Available online: https://www.nasa.gov/wp-content/uploads/2022/11/Artemis-Accords-signed-13Oct2020.pdf . Last accessed May 13th2024.

314 Masson-Zwaan and Sundahl (2023), 396.

315 Artemis Accords (n. 313), Section 10, paragraphs 1 and 2.

of "inherently" is peculiar, as it makes the statement less conclusive. It seems to suggest that extraction of space resources on the one hand, and national appropriation on the other, are not 'inseparable', or, that extraction does not 'necessarily' constitute national appropriation.[316] Acknowledging the play of words, this may nonetheless indicate – yet again – a view expressing that the non-appropriation principle can be infringed on by resource activity in certain situations. Others see the wording merely as a result of constructive ambiguity, thereby reducing the weight of the Accords as means of interpretation or contributing to form customary law.[317]

One of the more controversial concepts introduced by the Accords, is the establishment of 'Safety Zones'. Their purpose is to avoid harmful interference when conducting hazardous activities by informing the public of these activities, and by notifying and coordinating with other Signatories.[318] The result is an area which is maintained as a safety zone until the operation ceases.[319] This is by some considered controversial, pointing out that such activity may infringe on the non-appropriation principle.[320] Contemplating the time aspect of resource exploitation, some furthermore argue that a *de facto* occupation may occur when a safety zone remains in place for a long period of time.[321] Others contradict such concerns, arguing that the introduction of safety zones in the Accords does not impose any exclusion but merely emphasizes the importance of communication through notice and coordination.[322] This can supposedly be perceived by the Accord's emphasis on respecting the principle of free access to all areas of celestial bodies and all other provisions in the OST.[323]

This brief discussion on safety zones and their possible infringement on the non-appropriation principle seems to underscore, yet again, a recurring element in this discussion: Whether a space resource activity constitutes appropriation depends on factors such as timeline and scale of operation. Especially for safety zones, the time aspect is recurringly emphasized.

Furthermore, the discussion is highly political in nature. For instance, China and Russia are not parts to the Accords, and they seem highly unlikely to join. Their reaction to the development of safety zones may involve a similar counteract of their own. Followingly, there is, for example, a chance that non-parties to the Accords establish their own equivalent of safety zone principles.

39 States have now signed the Accords.[324] 36 of these are Parties to the OST, and an additional two are signatories.[325] Additionally, 15 of the world's top 20 largest economies have signed the Accords.[326] All 39 Signatories to the Accords, affirm that "[the] extraction of space resources does not inherently constitute national appropriation under Article II of the Outer Space Treaty. […]."[327] More States can

316 https://www.merriam-webster.com/dictionary/inherent . Last accessed May 15, 2024.

317 Byers and Boley (2023), 160.

318 The Artemis Accords (n. 313), section 11, paragraphs 6 through 10.

319 Ibid. Section 7.

320 Alexander Gilbert, "Implementing safety zones for lunar activities under the Artemis Accords" in *Journal of Space Safety Engineering 10 (2023)* 103-111. https://doi.org/10.1016/j.jsse.2022.12.007.

321 Byers and Boley (2023), 175.

322 Masson-Zwaan and Sundahl, (2023), 397-398.

323 Ibid., 398. The Artemis Accords Section 11, paragraph 11.

324 https://www.state.gov/artemis-accords/ . Last accessed May 15, 2024.

325 See Status of treaties (n. 23).

326 "Gross domestic product 2022", World Development Indicators database, World Bank, 1 July 2023. https://databankfiles.worldbank.org/public/ddpext_download/GDP.pdf . Last accessed May 15, 2024.

327 Artemis Accords, Section 10, second paragraph, second sentence. See note 305, *supra*.

be expected to join the Accords.[328] Thus, how the subsequent interpretation of non-appropriation principle may develop in the future, is uncertain.

2.6.3 Developments in the UN

The legal subcommittee of the UN Committee on the Peaceful Uses of Outer Space (COPUOS) established in 2022, known as the Working Group on Legal Aspects of Space Resource Activities (Working Group), have a mandate to provide a set of recommended principles for space resource activities within a five year working plan.[329] This includes studying the legal framework for such activities, ensuring that the provided principles are in accordance with international law, thus implying an effort to clarify the meaning of provisions, in particular the OST.[330] Furthermore, the Working Group shall take the submissions of State members of the Committee into account, and as appropriate, from other stakeholders.[331] The recommended principles provided by the Working Group may constitute a significant means of determining the meaning of the non-appropriation principle.

The discussions in the COPOUS have changed from a focus on the legality of using or establishing property rights to space resources, to focusing on their governance and sustainable use.[332] Yet, the view of States on the impact of the non-appropriation principle differs notably. This can be read from the submissions of States members in response to the invitation of the Working Group on with regards to its mandate and purpose. The U.S Delegation declares that the U.S position is that the non-appropriation principle only applies to natural resources of celestial bodies that remain "in place", making ownership of extracted resources permitted.[333] The Russian Delegation contradicts this view, arguing that resources of celestial bodies are "organically associated with a certain physical volume (space) of the celestial body itself". Moreover, extraction or other methods of transformation "does not give rise to ownership of these resources".[334] The Chinese delegation is not as clear, stating they believe that exploitation of resources should

328 Notably, Norway has not signed the Accords at the time of writing.

329 UNOOOSA – website of the Working Group on Legal Aspects of Space Resource Activities, under Mandate, terms of reference, and workplan and methods of work of the Working Group. Available online: https://www.unoosa.org/oosa/en/ourwork/copuos/lsc/space-resources/index.html . Last accessed May 14, 2024.

330 Ibid.

331 Ibid. Under "B. Terms of reference", litra (e).

332 Masson-Zwaan and Sundahl (2023), 395.

333 Initial Submission by the Delegation of the United States of America to the United Nations Committee on the Peaceful Uses of Outer Space Legal Subcommittee Working Group on the Legal Aspects of Space Resource Activities, March 20, 2023. A/AC.105/C.2/2023/CRP.37. Available online: https://www.unoosa.org/documents/pdf/copuos/lsc/space-resources/LSC2023/States-Responses/20230320_US_initial_submission_UNCOPUOS_LSC_SRU_WG_1.pdf . Last accessed May 14, 2024.

334 Submission on the Mandate and Purpose of the Working Group on Legal Aspects of Space Resource Activities, p. 5. A/AC.105/C.2/2023/CRP.20. Available online: https://www.unoosa.org/documents/pdf/copuos/lsc/space-resources/LSC2023/States-Responses/RUSSIA1.PDF . Last accessed May 14, 2024.

be done in conformity with the principle of non-appropriation.[335] France[336] and Germany[337] do not comment on the non-appropriation principle with regards to resource exploitation, but view the use of space resources for scientific purposes as in accordance with the legal framework and the OST. They are, however, more restrictive when addressing activities of a larger, non-scientific scale.[338] The U.K follows the same line of emphasis on scientific purposes, asserting "[that] Space Resource Utilisation is not expressly prohibited under the Outer Space Treaty for the purposes of scientific investigation".[339] The delegation, however, views commercial arrangements for scientific purposes as compatible with Article I.[340] Japan views the use of resources as included in the freedom to use space provided by the OST Article I.[341] When taking their recent national legislation on space resources into account, their view presumably also includes ownership as a result of commercial activity.[342] Canada underscores the freedom to use space as "[a] broad right subject to only certain limitations", and only briefly mentions the non-appropriation principle as one of these.[343] The delegation furthermore shares Canada's plans for resource activities, and also highlight their being part to the Artemis Accords.[344] This implicitly means that they also do not view space resource extraction as infringing on the non-appropriation principle.[345]

335 They elaborate: "[and] the Working Group should formulate initial recommended principles to reaffirm the applicability of this fundamental principle, and to operationalize its application to the various contexts of space resource activities. See page 9 in Submission by China to the Working Group on Legal Aspects of Space Resource Activities under the Legal Subcommittee of the Committee on the Peaceful Uses of Outer Space, in original format. A/AC.105/C.2/2024/CRP.5. Available online: https://www.unoosa.org/documents/pdf/copuos/lsc/space-resources/LSC2024/English_Chinas_submission_to_the_working_group_on_space_resources.pdf . Last accessed May 14, 2024.

336 Submission by France in original format: Proposal for a French Contribution to the work of the Working Group on the Legal Aspects of Space Resource Activities, pp. 5-6. A/AC.105/C.2/2023/CRP.12. Available online: https://www.unoosa.org/documents/pdf/copuos/lsc/space-resources/LSC2023/StatesResponses/France_-_En_-_23-0221-221222_contribution_France.pdf . Last accessed May 14, 2024.

337 Submission by Germany in original format: Working Group on Legal Aspects of Space Resource Activities at COPUOS Legal Subcommittee, p. 3. A/AC.105/C.2/2023/CRP.13. Available online: https://www.unoosa.org/documents/pdf/copuos/lsc/space-resources/LSC2023/StatesResponses/Germany_Annex_-_WG_on_SR.pdf . Last accessed May 14, 2024.

338 See the French submission (n. 348), p. 6, and the German submission (n. 349), p. 3.

339 Submission by the United Kingdom of Great Britain and Northern Ireland to UN COPUOS Legal Sub Committee on Space Resource Utilisation Regarding: Possible Areas for Member State Input/Contributions To the Working Group on Legal Aspects of Space Resource Activities. A/AC.105/C.2/2023/CRP.21. Available online: https://www.unoosa.org/documents/pdf/copuos/lsc/space-resources/LSC2023/StatesResponses/United_Kingdom_-_UNCOPUS_LSC_-_UK_Submission_on_SR.pdf . Last accessed May 15, 2024.

340 Ibid.

341 Japan: Information on the mandate and purpose of the Working Group on Legal Aspects of Space Resource Activities under the Legal Subcommittee of the Committee on the Peaceful Uses of Outer Space, p. 2. A/AC.105/C.2/2023/CRP.33. Available online: https://www.unoosa.org/documents/pdf/copuos/lsc/space-resources/LSC2023/StatesResponses/Japan_Information_to_Space_Resource_WG.pdf . Last accessed May 15, 2024.

342 Ibid.

343 Canada's Submission to the Working Group on Legal Aspects of Space Resources Activities of the Legal Subcommittee of UN COPUOS, p. 2. A/AC.105/C.2/2023/CRP.11. Available online: https://www.unoosa.org/documents/pdf/copuos/lsc/space-resources/LSC2023/StatesResponses/Canadas_Submission_to_the_SRU_WG_at_LSC62_Jan2023.pdf . Last accessed May 15, 2024.

344 Ibid.

345 Artemis Accords (n. 313), Section 10 (2).

2.6.4 Unilateral practice

The extraction and transportation of lunar soil from the Moon to back to Earth has happened in the past, and through a sequence of acts.[346] Whether this practice "establishes the agreement of the parties" is the key question.[347] Essential to this assessment is that even if a few Parties has conducted said practice, evidence of the endorsement of inactive Parties must exist.[348] Yet, such endorsement seems to be able exist even by absence of any disagreement.[349] There is no record of protests by the States Parties to the OST on the collection and return of lunar soil samples, nor any other later extraction of such materials. This may therefore constitute another argument supporting that natural resources are not covered by the non-appropriation principle, at least not for scientific purposes or small-scale operations.[350] When it comes to larger, commercial activities, however, the case is more uncertain. Nevertheless, in 2020 NASA selected commercial companies to collect lunar resources for the Artemis program, and transfer ownership of them to the agency.[351] One of these companies, ispace inc., has already received an interim payment from NASA on September 22, 2022.[352] When the planned future transfer of ownership is completed – given a successful mission – it will be the first commercial transaction of lunar regolith ever made, and the first transaction of space resources in history to take place off-world.[353] It may therefore constitute subsequent practice if, or more likely when, it becomes frequent among State Parties – including their private entities – and absence of disagreement on this practice remains.[354]

National legislation may also constitute subsequent practice.[355] Four States have enacted such legislation, pertaining to space resource activities.[356] As previously mentioned, the U.S have codified the right for their citizens to own extracted resources through the Commercial Space Launch Competitiveness Act.[357]. In 2020, the U.S President proclaimed in an executive order that "Americans should have the right to engage in commercial exploration, recovery, and use of resources in outer space, consistent with applicable law."[358] This substantiates the U.S position established by the Act of 2015.

346 "Practice" suggests that several acts must be committed, which it has by e.g the Apollo missions, the Russian lunar missions, and recently the Chinese Chang'e 5.

347 Cf. VCLT Article 31, nr. 3 (b).

348 This is a stricter requirement than e.g the conduct of organs of international organizations, which requires a counteraction in the form of an act or "representations of the parties to the treaty in question, see Dörr (2018), 601-602.

349 Ibid.

350 The extraction of lunar soil samples amounted to 382 kilograms through six Apollo-missions. See "Lunar Rocks and Soils from Apollo Missions, NASA. https://curator.jsc.nasa.gov/lunar/ . Last accessed May 14th2024.

351 "NASA Selects Companies to Collect Lunar Resources for Artemis Demonstrations, NASA, December 03, 2020. https://www.nasa.gov/news-release/nasa-selects-companies-to-collect-lunar-resources-for-artemis-demonstrations/ . Last accessed May 15, 2024.

352 "ispace Receives Interim Payment on Lunar Regolith Transfer Contract from NASA, ispace, inc., September 22, 2022. https://ispace-inc.com/news-en/?p=3696 . Last accessed May 15, 2024.

353 Ibid.

354 Dörr (2018), 599.

355 Ibid.

356 The United States (2015), Luxembourg (2017), the United Arab Emirates (2019), and Japan (2021).

357 51 USC, Title IV of the Act, which is entitled 'Space Resource Exploration and Utilization', contains the key provisions; namely §§ 51301 through 51303. Available online: https://www.congress.gov/114/plaws/publ90/PLAW-114publ90.pdf . Last accessed May 13, 2024.

358 Executive Order 13914 of April 6, 2020. Available online: https://www.govinfo.gov/content/pkg/FR-2020-04-10/pdf/2020-07800.pdf . Last accessed May 15, 2024.

In the Luxembourgian legislation, it says that space resources are capable of "l'appropriation" – translated to "owned" in the unofficial version.[359] The UAE implicitly does the same through the regulation of "[the] acquisition, purchase, sale, trade, transportation (...)" of space resources.[360] Japan also guarantees the ownership of extracted resources for the receiver of a permit to conduct space resource activities.[361] The guarantee of ownership by these States is, however, controversial, and has been criticized by States and scholars alike.[362] Adding to the fact the ratio of only 4 State legislations to a 114 States Parties, it is therefore not enough to establish the agreement of the State Parties on the interpretation of the OST.[363]

2.7 Chapter 2: Summary

This chapter began addressing whether, and to what effect, the non-appropriation principle applies to natural resources in space. Both States and private entities are planning significant activities that not only rely on the use of these resources for further exploration of the solar system, but that also aim to exploit these resources commercially. The assessment of the existing legal framework, especially the OST Article II, Article I and Article VI shows that the non-appropriation principle of Article II may not prohibit the extraction and use of natural resources. Such activities are presumably lawful when they are conducted for scientific purposes and in reasonable scales. The uncertainty in this regard pertains to large-scale resource activities that non-scientific, i.e commercial. Such activities may infringe on the non-appropriation principle by their scale and excessiveness, and by their exclusionary nature. For instance, if powerful actors restrict access to areas containing natural resources over time – either due to security concerns, or their large scale – they essentially exclude others from an area, resembling property rights.

Indeed, the use of natural resources in space is a necessity for expansion and scientific development. Commercial activities in space are arguably, just as on Earth, also a necessity for development, because it incentivises non-governmental activity, which after all, is a dominant force in the free market economies of the world. However, it is imperative that the international community closely monitor and regulate such development. If States and private companies commence resource exploitation, there is a need for a clear legal framework regulating matters such as State responsibility and liability for damage. This is the topic of the next chapter.

359 Loi du 20 juillet 2017 sur l'exploration et l'utilisation des ressources de l'espace, Art. 1. Available online: https://legilux.public.lu/eli/etat/leg/loi/2017/07/20/a674/jo . Last accessed May 13, 2024.

360 Federal Law No. (12) of 2019, Article 18. Available online: https://www.moj.gov.ae/assets/2020/Federal%20Law%20No%2012%20of%202019%20on%20THE%20REGULATION%20OF%20THE%20SPACE%20SECTOR.pdf.aspx . Last accessed May 13, 2024.

361 Masson-Zwaan and Sundahl (2023), 394.

362 Byers and Boley (2023), 153.

363 Ibid.

3 International obligations of States in the exploitation of natural resources in outer space

3.1 Introduction

The previous chapter examined whether the extraction, utilization, and exploitation of natural resources in outer space are permitted under the international legal framework governing space activities, with a particular focus on the implications of the non-appropriation principle and the freedom to use space. It was found that the exploitation of natural resources, including for commercial purposes, does not *as such* breach the non-appropriation principle, but may violate the principle if conducted in certain ways.

If exploitation of natural resources in outer space and on celestial bodies commence, one fact has to be recalled: A governing framework for the mining of natural resources in space does not presently exist.[364] Instead, these activities fall under the broader umbrella of the space treaties and general international law. This is an issue, because space resource activities – and frankly also other upcoming space activities – necessitate a clear regulation, which international law does not provide at this time. Recent views have in this regard been expressed in the UNCOPOUS, revealing a concern for the lack of such regulation, thus substantiating the reality of this issue.[365]

Activities in space are at the mercy of the extreme environment they are conducted in. They are ultra-hazardous. The breach of an obligation may impose responsibility on that State, which can include reparations for damages.

Additionally, States are also liable for damages caused by lawful activities. The Liability Convention of 1972 [LC] provides special rules in this regard.[366] For damages caused to the surface of the Earth and in the atmosphere, States are absolutely liable.[367] For damages caused in outer space, liability is assigned only if fault is proven to be the cause of damage.[368] The involvement of non-governmental entities further complicates the legal landscape, raising intricate issues about the extent of State responsibility for private companies under their jurisdiction.

State obligations are often categorized into 'primary' and 'secondary' rules, a distinction introduced by ICJ Judge Roberto Ago in his work with the International Law Commission (ILC).[369] Primary rules establish specific obligations of States, while secondary rules address the consequences of breaching or neglecting these obligations.[370] Some refer to this categorization as a somewhat artificial but useful tool when analyzing a legal framework.[371]

The research questions for this chapter are:

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364 And just to recall: The drafters of the Moon Agreement (n. 24) saw the necessity of governing the exploitation of natural resources when it was about to become feasible, cf. Article 5.

365 Draft report: IV. Status and application of the five United Nations treaties on outer space, and ways and means, including capacity-building, to promote their implementation, paragraph 17. A/AC.105/C.2/L.329/Add.3. Available online: https://www.unoosa.org/oosa/oosadoc/data/documents/2024/aac.105c.2l/aac.105c.2l.329add.3_0.html . Last accessed May 14, 2024.

366 Convention on International Liability for Damage Caused by Space Objects, 961 UNTS 187, adopted in the General Assembly in 1971, entered into force September 1972.

367 Ibid. Article II.

368 Ibid. Article III.

369 Crawford (2019), 524.

370 Ibid.

371 Scarlett O'Donnell , *International responsibility for activities in outer space in the modern space age : article VI of the Outer Space Treaty in the context of international space law and public international law*. Lund University, Faculty of Law; 2023, p. 106.

1) What key obligations does the Outer Space Treaty [OST] establish for States regarding the exploitation of natural resources in outer space?
2) What are the consequences of breaching these State obligations?

3.2 What obligations does the OST Article VI impose on States?

The OST Article VI establishes a fundamental responsibility for the activities of States Parties as well as the activity of non-governmental entities.[372] It includes the obligation to assure that national activities, including non-governmental entities, are in conformity with the Treaty.[373] It further stipulates that the activities of non-governmental entities shall require authorization and continuing supervision.[374] Mining activities conducted by a private company would therefore require an authorization, likely involving a licensing regime.[375] What these obligations on the State party would entail in practice, however, is not clear. Space mining is still in an embryonic stage and the international framework does not elaborate on how these obligations should be implemented.

3.2.1 Obligation to assure compliance with international law

To reiterate the exact wording of the OST Article 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*** *. When activities are carried on in outer space, including the moon and other celestial bodies, by an international organization, responsibility for compliance with this Treaty shall be borne both by the international organization and by the States Parties to the Treaty participating in such organization."* [376]

The first part of the first sentence emphasizes the general responsibility of States for national activities, the second part elaborates that 'national activities' applies to both governmental agencies and non-governmental entities. 'National activities' may by itself suggest that only governmental agencies, citizens, or national companies of the respective State is encompassed by the term. This interpretation was for instance made by the UK in the 80s.[377] However, most argue that the term is to be understood in conjunction with which State effectively holds jurisdiction over the activity in question.[378] The third part allocates the responsibility upon States Parties to 'assure' that national activities are conducted in compliance with the provisions of the OST, and thus, in accordance with international law.[379] The

372 Lyall and Larsen (2018), 77.

373 The OST (n. 21) Article VI, first sentence, second part.

374 Ibid., second sentence.

375 Hobe (2019), 128.

376 The OST (n. 21).

377 Bin Cheng, "International Responsibility and Liability for Launch Activities" in *Air and Space Law, vol 20* (1995), p. 302. https://doi.org/10.54648/aila1995041 .

378 Ibid. 303.

379 As the OST Article III obligates States to carry out space activities in accordance with international law.

central question is: What does the duty to 'assure' that national activities are in compliance with the OST entail?

The word 'assure' implies that States must make *certain* national activities comply with international law.[380] This suggests that States must implement measures to regulate these activities, implying a duty of conduct and the obligation of due diligence.[381] Recalling the discussion in Chapter 2, this means States must carefully assess their space resource activities, considering the scale and timeline of operations, the interests of other States, and the purpose of resource exploitation in order to comply with the non-appropriation principle. Subsequently, they must also consider other provisions, such as conducting activities with due regard to other States, which can be read from both the OST Article I (2), and Article IX.[382]

Although the OST does not specify how States should ensure compliance, it suggests that adequate measures must be taken, likely involving regulation through governmental instruments or national legislation. A comparable obligation is found in maritime law. In the UNCLOS it is, *inter alia,* stipulated that "States Parties shall have the responsibility to ensure that activities in the Area, whether carried out by States Parties, or state enterprises or natural or juridical persons which possess the nationality of States Parties or are effectively controlled by them or their nationals, shall be carried out in conformity with this Part."[383] Arguably, this "[may] be characterized as an obligation "of conduct" and not "of result", and as an obligation of "due diligence".[384] In this regard, the standard of due diligence may – taking into account the rulings of the ICJ – entail not only regulation, but also a vigilant enforcement of said regulation, and exercise of administrative control and supervision over operators.[385]

The obligation of due diligence to assure compliance in the first sentence of the OST is clearly connected to obligation of authorization and supervision in the second sentence, which is examined in the upcoming section. It is also connected to State liability because breach of these obligations may, under general international law, constitute a wrongful act if damage is caused by the breach. Additionally, space treaty rules may entail liability based on fault.[386]

3.2.2 What does authorization and supervision by the appropriate State Party entail?

The second sentence of Article VI stipulates that the activities of non-governmental entities shall require authorization and continuing supervision by the appropriate State Party to the Treaty. It is specific and instructional, as it demands that States Parties authorize and continually supervise the activities of entities such as private companies. As such, it can be considered a primary rule – similar to the preceding obligation to assure compliance – setting forth specific obligations for State conduct. Consequently, if a State fails to adequately authorize and supervise a non-governmental entity, secondary rules of State responsibility may be invoked.

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380 https://www.merriam-webster.com/dictionary/assure . Last accessed May 21, 2024.

381 Timo Koivurova and Krittika Singh, «Due Diligence" in *Max Planck Encyclopedias of International Law* (last updated 2022), provided online by Oxford Public International Law: https://opil.ouplaw.com/display/10.1093/law:epil/9780199231690/law-9780199231690-e1034?prd=MPIL . Last accessed May 22, 2024.

382 The OST (n. 21), *supra.*

383 UNCLOS (n. 154 Article 139, paragraph 1.

384 Responsibilities and obligations of States with respect to activities in the Area, Advisory Opinion, 1 February 2011, ITLOS Reports 2011, p. 41. Available online: https://www.itlos.org/fileadmin/itlos/documents/cases/case_no_17/17_adv_op_010211_en.pdf . Last accessed May 22, 2024.

385 Ibid. p. 42, paragraph 115. The Advisory Opinion show to the *Pulp Mills on the River Urugay (Argentica v. Urugay)*-judgment of April 20, 2010.

386 This is discussed in section 3.3, *infra*.

The obligation to authorize and supervise non-governmental entities is to be carried out by the 'appropriate' State Party. Which State is the 'appropriate' one, however, is not defined or elaborated on in the Treaty. Its ordinary meaning suggests that the appropriate State is the one suitable or fitting for the particular situation.[387] Nevertheless, the concept of the 'appropriate State' differentiates itself from the responsibility for 'national activities' mentioned in the first sentence. States are responsible for national activities, including private activities, but this provision does not dictate what the 'appropriate' State Party per the second sentence means. Some seem to quickly conclude that the authorization by the appropriate State is by in large a specific elaboration of the obligations arising from the overall responsibility of States in the first sentence.[388]

There is a possibility of several appropriate States where both must authorize and supervise non-governmental entities, but one is not responsible because the entities are under another State's jurisdiction.[389] This concept of multiple 'appropriate' States might initially seem problematic. However, States can arrange for one appropriate State to carry out the obligation, similar to the process of registration.[390] Typically, the most logical scenario is that the appropriate State is the one with jurisdiction over the entities' activities, ensuring minimal risk of negative repercussions for the State. Thus, the 'appropriate' State is often described as the State responsible for the activity based on jurisdiction.[391]

As such, the 'appropriate' State will likely be the State that holds jurisdiction over the non-governmental entities applying for e.g a license to mine in outer space. But what exactly does authorization and supervision entail, and how are these to be applied in accordance with international law?

The OST does not specify rigid requirements for how authorization should be implemented by the responsible State, though it is often interpreted as a licensing requirement.[392] It is assumed that authorization or license conditions can be implemented in several ways. National legislation is likely the most impactful, as it often addresses a broad range of elements, such as registration, liability for damages, and supervision.[393] A considerable amount of existing national space legislation implements the requirements of Article VI concerning authorization and supervision, while also including provisions on registration and indemnification.[394]

Whilst national legislation pertaining to space activities is growing, there are alternatives to the formal legislative approach. Examples include formal agreements between States and their private entities or State investments in private endeavors, both scenarios formally involving the State in the activity and ensuring compliance with the OST.[395] Nevertheless, many consider national legislation the safest and most effective way to ensure compliance.[396] Therefore, a brief examination of existing practice on space resource legislation in some States may provide insight into current developments.

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387 Camridge Dictionary, see definitions online: https://dictionary.cambridge.org/dictionary/learner-english/appropriate , last accessed 03.05.2024.

388 See the different views of Marboe, Gerhard and Cheng in section 3.3.2 on consequences of breach, *infra*.

389 O'Donnell (2023), 231-232.

390 Cheng (1995), 304.

391 Michael Gerhard, "Article VI", in Cologne Commentary of Space Law vol. 1, ed. Hobe, Stephan, Schmidt-Tedd, Bernhard and Kai-Uwe Schrogl (Köln: Carl Heymanns Verlag, 2009), 117.

392 Hobe (2019), 128.

393 Gerhard (2009), 119.

394 Irmgard Marboe, «National space law". In Handbook of Space Law, ed. Frans von der Dunk, Fabio Tronchetti (Northampton: Edward Elgar, 2015), 183.

395 Ibid.

396 Lyall and Larsen (2018), 416.

3.2.3 How are the obligations of Article VI implemented in national legislation on space resources?

In 2015, the U.S famously enacted the first ever national legislation on space resources.[397] Title IV of the Act sets forth general provisions reflecting obligations of the OST Article VI when it in § 51 302 states that "The President, acting through appropriate Federal agencies, shall– (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". However, the Act does not say how authorization is to be granted or by which government entity. The U.S Congress has not approved delegation of authority to authorize space resource activity to any Federal agency yet. The likely authority to issue such licenses – at least in the absence of a specified one – is assumed to be the Federal Aviation Administration Office of Commercial Space Transportation ("AST").[398] The AST already licenses a range of space activities such as launches and re-entry, and space traffic management. Yet, as the Federal Aviation Administration ("FAA") agency is ultimately a part of the Department of Transportation, some view its "stand-in role" as not fit to regulate mining operations.[399] Time will tell what agency, and which terms the U.S select for space resource activities.

Luxembourg has through its space resource act set forth provisions pertaining to the authorization and supervision of the operator conducting space activity.[400] There are several conditions that must be fulfilled to be granted authorization.

According to central requirements, the operator to be authorized must:

1) Have a **robust scheme of financial, technical and statutory procedures** when planning and executing space resource missions,[401]
2) Have a **robust internal governance** scheme, including a clear organizational structure with well-defined lines of responsibility, proper risk management, and adequate control mechanisms on administrative, financial, and technical aspects,[402]
3) Have a management with sufficiently good repute and **sufficient skills, knowledge, and experience,**[403]

The UAE Space Agency provides similar provisions in a recent regulation on space resources.[404] The conditions for authorization are not as elaborated upon as the Luxembourg legislation, but impose several obligations in Article 6 that also reflect principles and obligations in the OST:

"The Agency shall take into consideration the following, before granting an Authorization:

397 Space Resource Exploration and Utilization Act (the "Act") in Commercial Space Launch Competiveness Act, 51 USC, Title IV, Chapter 513. Available online: https://www.congress.gov/114/plaws/publ90/PLAW-114publ90.pdf , last accessed May 7, 2024.

398 Masson-Zwaan and Sundahl, (2023), 391.

399 Ibid., 392.

400 Law of July 20th 2017 on the Exploration and Use of Space Resources, English unofficial version. Available online: https://space-agency.public.lu/en/agency/legal-framework/law_space_resources_english_translation.html . Accessed April 13, 2024.

401 Ibid. Article 7 (2), first sentence.

402 Ibid. second sentence

403 Luxembourg Act (n. 400), Article 9 (1).

404 United Arab Emirates The *Ministry of Cabinet Affairs Resolution No (19) of 2023 Regarding the Space Resources.* Available online under "Space resources Exploration and Use Activities": https://space.gov.ae/en/policy-and-regulations . Last accessed May 21, 2024.

1) The international legal obligations of the State and any other international requirements agreed upon by the state.
2) Any potential adverse impacts on the Earth's **environment or harmful contamination** in Identified Area, including celestial bodies, bearing in mind any international guidelines, policies or other instruments relating to planetary protection.
3) **The rights of other relevant States** to access to all stations, installations, equipment, and space objects on the surface of the moon and other celestial bodies, in accordance with States' international obligations, taking into account the safety of operations and avoidance of interference in operations, and the protection of intellectual property rights, and commercial sensitive data.
4) The obligation of the State to **consult with any affected state when it has reasons to believe that the Space Resources Activities may result in interference with another state's activities** in the Identified Area, including that state's activities which may fall within the meaning of Space Resources Activities.
5) **Sharing of scientific information** resulting from Space Resources Activities with the international scientific community, to the greatest extent feasible and practicable, on a good-faith basis, and in accordance with the applicable national laws.
6) Any other considerations which the Agency deems appropriate and relevant, including the extent to which there are any priority rights over the Space Resources."

The UAE Space Agency may request additional information or assessments, including financial and technical information.[405] Furthermore, the Council of Ministers and the Agency can issue applicable regulations that may include liability coverage.[406]

The responsible State shall furthermore continually supervise the activities of non-governmental entities.[407] Like with authorization, the OST does not elaborate on how such supervision is to be conducted. However, the Treaty text stipulates that the supervision is to be 'continuing'. This implies that State supervision of activities must be ongoing even after authorization has been granted. 'Supervision' thus suggests, similar to the previously discussed obligation to assure compliance with the provisions of the OST, that the 'appropriate' State[s] must oversee that non-governmental entities comply with not only the requirements set by the authorization-State, but that they also comply with provisions of the OST, such as the non-appropriation principle.[408] This involves facilitating for the receival of information on activities and enforcing sanctions upon operators who do not comply with the governing rules.[409]

Both Luxembourg and the UAE provide regulations on this:

Article 15 of the Luxembourg space resource act allocates the authority to specific administrative positions "The ministers are in charge of the continuous supervision of the missions for which an authorization has been granted."[410] Furthermore, an authorization may include details on how the following supervision is to be conducted, as per Article 12: "The authorisation shall describe the manner in which the operator to be authorised fulfils the conditions of articles 6 to 11, paragraph 1. It may in addition include provisions on [...] c) the modalities for the supervision of the mission". By Article 14 (1), an authorization may be withdrawn: "The authorisation shall be withdrawn if the conditions for the granting thereof are no longer met." This reflects a continuing supervision by the State, as activities may be stopped even after authorization has been granted.

The UAE regulation, Article 4, nr. 2 states that: "Upon the receipt of an Authorization and commenced its Space Resources Activities, the Operator shall keep the Agency up-to-date on a regular basis about the progress of the Space Resources Activities and comply with all instructions issued by the Agency in the event of

405 Ibid. Article (4), nr. 3.

406 Ibid. nr. 4.

407 The OST, Article VI, second sentence.

408 Gerhard (2009), 119.

409 Ibid.

410 Luxembourg Act (n. 400)..

emergencies or the likelihood of material risks arising out of the Space Resources Activities." Article 8 furthermore provides a list of reporting obligations, ranging from immediate (significant mission changes, damage, harmful conducts etc.) to routine-based and annual notifications and reports.[411]

In summary, the obligation of Article VI to authorize and supervise non-governmental entities, is not clearly defined. However, based on the recent discussion, some key points can be highlighted. Firstly, the provision appears as a primary rule, as it establishes a specific obligation upon States Parties to ensure that the activity of non-governmental entities conform with international law. Breach of the specific obligations may impose secondary rules of responsibility.

Secondly, the legal framework does not dictate how States Parties should act to comply with these obligations. Still, it seems that enacting national legislation is the most effective way to ensure conformity with international law, as it provides a clear and predictable premise for the activities of governmental and private entities alike. Examples from existing national legislation highlight important elements when considering an authorization for space resource activities: non-governmental entities should have robust governance, qualified management, and comprehensive planning schemes. Additionally, considering environmental aspects and the rights of other States is crucial.

3.3 Consequences of breach

Under the rules of general international law, a State is responsible for any breach of its obligations, primarily dealing with the repercussions and reparations for unlawful acts.[412] It also occasionally allows for compensation for actions not prohibited by international law.[413] Within the unique legal realm of space, two significant modifications arise:

I States are explicitly responsible for non-governmental entities.
II Liability for damages caused by lawful acts is specifically codified in space treaties, notably the OST Article VII and particularly the Liability Convention.[414]

An important reason why State liability is placed under this section is that fault must be proven to assign liability for damage caused in space. This *lex specialis*-rule therefore shares many of the same considerations as State responsibility for wrongful acts because fault essentially also implies the breach of an obligation.

3.3.1 International responsibility for wrongful acts

To gain a comprehensive understanding of the legal dynamics of State responsibility in space – and later, the fault standard of State liability – it is necessary to also examine how general international law regulates breach of State obligations. After all, these "background" rules also apply to space activities.[415] A key document in this context is the 2001 ILC Draft Articles on Responsibility of States for Internationally Wrongful Acts [ARSIWA], increasingly regarded as a reflection of customary international law.[416] These Articles elucidate secondary rules of State

411 Article 8: Reporting Obligations.

412 Crawford (2019), 254.

413 Ibid.

414 The Outer Space Treaty (n. 21) and the Liability Convention (n. 90).

415 Because space law is a part of international law, c.f the OST Article III (n. 143 and 144) as discussed in section 1.4.2.

416 Steer (n. 106); Responsibility of States for Internationally Wrongful Acts, adopted by A/RES/56/83, 12 December 2001. Provided in Report of the ILC on the Work of its Fifty-third Session, Official Records of the UNGA, 56th session, Supp. No. 10. A/56/10 (2001).

responsibility, described in the ARSIWA commentary as "general conditions under international law for the State to be considered responsible for wrongful actions or omissions, and the legal consequences which flow therefrom".[417]

Article 1 states:
"Every internationally wrongful act of a State entails the international responsibility of that State."

Article 2 outlines:
"There is an internationally wrongful act of a State when conduct consisting of an action or omission:

a) is attributable to the State under international law; and
b) constitutes a breach of an international obligation of the State"

Accordingly, both an action and an omission can constitute an internationally wrongful act if such conduct is a) attributable to the State under international law and b) constitutes a breach of an international obligation of the State. Furthermore, the act is wrongful if it is not subject to circumstances precluding wrongfulness.[418] Chapter II of the draft Articles addresses what is attributable to the State under international law. The conduct attributed to a State includes actions by its organs, individuals, or entities exercising elements of governmental authority, regardless of their formal status or level within the state. This also extends to organs acting under the control of another state, those exceeding their authority, persons under the direction or control of a State, persons acting exercising governmental elements in default of official authorities, and even insurrectional movements that achieve governmental status, and otherwise conduct acknowledged and adopted by a State as its own.[419] Hence, a State is responsible for acts attributed through a direct or indirect link to it.[420] The reach is therefore quite broad.

The ARSIWA, however, does not attribute acts of nationals to a State unconditionally. A prerequisite for attribution is that the State exercises some sort of influence or control over the situation. Thus, Article 8 states that acts of 'private persons' may be attributable to the State when under the direction or control of the State. Accordingly, there is no 'automatic' imputability for the State to its nationals. Scholars confirm this view, arguing that, in international law, States are usually not unconditionally responsible for the activities of their nationals.[421] Whether the activities of private entities are attributed arguably depends on the specific obligations involved.[422]

Furthermore, for it to be a wrongful act, the conduct must b) also constitute a breach of an international obligation of the State.

Article 12 defines what constitutes a breach of an international obligation (b). It states that:

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417 Draft articles on Responsibility of States for Internationally Wrongful Acts with commentaries, p. 31, para. graph 1. Available online: https://legal.un.org/ilc/texts/instruments/english/commentaries/9_6_2001.pdf . Last accessed May 22, 2024.

418 Ibid. Chapter V.

419 Ibid. Articles 4 through 11.

420 Lyall and Larsen (2018), 60.

421 Ibid.

422 Crawford (2019), 527.

> *"There is a breach of an international obligation by a State when an act of that State is not in conformity with what is required of it by that obligation, regard-less of its origin or character."*

A breach of an international obligation is determined by the contents of the primary rule establishing the obligation.[423] For example, the primary rule of the OST Article VI, second sentence, establishes an international obligation to authorize and continually supervise non-governmental entities.

As discussed earlier, the duty of conduct that States must maintain, is not defined, but there are certain standards of diligence that indicate how a State should act to ensure conformity with the obligation.[424] In space resource activities, this implies that not only must States themselves adhere to the non-appropriation principle, but they must make certain that private entities do as well. If the State fails to ensure conformity, it may breach the obligation. Subsequently, if the act is also attributable to the State, it is considered a wrongful act and the secondary rules of responsibility for the breach enters.

3.3.2 Lex specialis: State responsibility for space activities

In space law, the criteria of State responsibility are formulated in unique terms. The OST, particularly Article VI, clearly mandates that States Parties shall bear international responsibility for national activities conducted in space, including those by non-governmental entities. The result is arguably a "[…] much more far reaching […]" responsibility for private entities involved in space activities, than what is found in general international law.[425] Consequently, in space activities, the conduct of private entities is arguably already attributed to the State, often through jurisdictional ties, simplifying the attribution issues encountered in other domains of international law.[426]

There are different views on what the State the responsibility for non-governmental entities stipulated in the OST entails. Marboe argues that the responsibility regime assigned to States Parties through Article VI does not attribute every national space activity to the State, but that the obligation, as per the second sentence, rather pertains to ensuring that all national activities are conducted in accordance with the obligations of the OST.[427] Thus, State responsibility for non-governmental entities per Article VI, according to Marboe, is not directly attributed to the State for all activities of its nationals. If understood correctly, Marboe argues that attribution of acts by non-governmental entities to the State depends on the conduct of the State and whether it has adequately acted to ensure that these entities conduct their activities in accordance with the OST.

Gerhard poses a slightly different view. Focusing on the meaning of jurisdictional authority over non-governmental entities, he emphasizes the importance of considering aspects of general international law when defining State responsibility.[428] In other words, jurisdiction is allegedly an important element when ascertaining the duties of States and how this relates to e.g private entities. The author argues that there is no indication in the OST or its *travaux préparatoires* of wanting to deviate from general international law, where States, according to Gerhard, hold jurisdiction over any activity carried on by its nationals, thus entailing that

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423 2001 Draft articles on Responsibility of States for Internationally Wrongful Acts with commentaries, p. 54. Available online: https://legal.un.org/ilc/texts/instruments/english/commentaries/9_6_2001.pdf . Last accessed May 22, 2024.

424 See section 3.1.1.

425 As put by Hobe (2019), 128.

426 The OST Article VI, first sentence.

427 Marboe (2015), 131-132.

428 Gerhard (2009), 112.

non-governmental activities are attributable to the State. According to Gerhard, neither the first nor second sentence of Article VI suggest a departure from this, and the *travaux préparatoires* in fact suggests that the impact of State responsibility is answered by a referral to the general concept of jurisdiction.[429] I.e, if a private company operates under the jurisdiction of a State Party, that State Party will be responsible for the company's activities because it authorized or permitted those activities.[430] Furthermore, the author argues that the OST intended to allocate "all" activities of non-governmental entities to the States Parties, essentially making a deviation from the general premise of international law needless.[431] If understood correctly, Gerhard thus argues that the State Party is effectively identified with the actions of the entity it is responsible for on the basis of jurisdictional authority over that entity.

Cheng argues that the OST Article VI first sentence and second sentence does not exhaust the scope of State responsibility in space.[432] He argues that both a narrow and a wide interpretation of the first sentence suggest that States are in fact directly responsible for national activities conducted by non-governmental entities.[433] This includes, according to Cheng, not only national non-governmental entities wherever they are, but also entities that are not national but which operate within a State's territory and jurisdiction. This furthermore includes persons onboard a vessel of the State's nationality, and subsequently also a space object, wherever it may be.[434] It thus seems that Gerhard and Cheng are of a similar view, namely that a State's jurisdiction is a decisive element when attributing responsibility for the conduct of non-governmental entities.

3.3.3 Liability for damage caused in space

Liability for damage is described as a breach of an obligation if damage to another is caused.[435] Liability for damage caused by space objects differs from the general responsibility of States for wrongful acts, because liability for damage in the space treaties concern lawful acts. In the context of space mining activities, this essentially means that States can be liable for damage on the basis of general international law, and on the basis of space law.

Liability for damage caused by space activities is regulated by the Liability Convention of 1972.[436] This is contrary to the more comprehensible 'strict' liability regime pertaining to damage caused in the atmosphere and on the surface of earth, which does not take fault into consideration.[437] This difference in liability regimes as the arena changes from earth to outer space is a major game changer because damage disputes on the basis of fault requires proof of a causal link between intentional or negligent behavior and the damage. A fault-based incident is therefore, presumably, far harder to settle than one on the basis of absolute

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429 Ibid., 113

430 Ibid., 113-114. Gerhard also references to a U.S proposal for principle 5 in the UNGA Res. 1962 (XVIII) to support his view. The U.S proposal emphasized, *inter alia,* that a State's *permission* to launch a space vehicle would entail the international responsibility, para 6 of document. Available online: https://www.unoosa.org/pdf/garecords/A_C1_881E.pdf , accessed 11.04.2024.

431 Ibid. p. 114.

432 Cheng (1995), 302.

433 Ibid.

434 Ibid., 303. Cheng emphasizes that "[Since] Article VIII of the Space Treaty speaks of the State of registry 'retaining' its jurisdiction and control over such objects and their personnel, 'while in outer space or on a celestial body', it implies that such jurisdiction exists before such objects and their personnel enter outer space, and is not restricted to the period when they are in it. Consequently, its responsibility covers their activities wherever carried on."

435 Ibid., 300.

436 Convention on International Liability for Damage Caused by Space Objects, 961 UNTS 187, adopted in the General Assembly in 1971, entered into force September 1972.

437 Ibid. Article II.

liability. The overlap with responsibility for wrongful acts is notable, because negligence of conduct is a prerequisite for inducing a responsibility to e.g compensate for damage. Such a breach of diligent conduct is therefore implied in a fault-based regime as well. The primary issue, however, is that what constitutes fault in space is not defined in the legal framework or by any authoritative legal source. Fault liability in space is therefore one of the more obscure concepts in space law, as even supplementary legal sources on its function are scarce.

Damage in space as a result of human activity is likely to occur. The extreme environment of space logically makes any space activity prone to serious damage risk. This is one of the reasons the *corpus juris spatialis* contains explicit regulation on liability allocation.[438] The OST Article VII establishes liability upon a State for damages to anything or anyone on the Earth, in the air and in outer space, including the moon and other celestial bodies:

> *"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 juridical persons by such object or its component parts on the Earth, in air or in outer space, including the moon and other celestial bodies."* [439]

The Liability Convention ("LC") elaborates on the content of this regime. In the LC Article II, a launching State shall be "absolutely liable to pay compensation for damage caused by its space object on the surface of the earth or to aircraft in flight". A 'launching State' is defined as i) "A State which launches or procures the launching of a space object, and ii) "A State from whose territory or facility a space object is launched".[440] A 'space object' includes component parts, the launch vehicle, and its parts thereof.[441] Additionally, the ordinary meaning of space object in this sense likely entails any object and parts of it made to operate in space that is not natural [anymore] by human design. This includes non-functioning space objects and small pieces of debris.[442]

When it comes to damage caused in space, the LC Article III establishes a different liability concept in which fault is a prerequisite cause of damage:

> *"In the event of damage being caused elsewhere than on the surface of the earth to a space object of one launching State or to persons or property on board such a space object by a space object of another launching State, the latter shall be liable only if the damage is due to its fault or the fault of persons for whom it is responsible."* [443]

The provision deviates from both the strict liability regime in the LC Article II, and the more general rule of the OST Article VII, which merely articulates that a State Party – effectively a launching State[444] – is liable for damage on Earth, in the air and in outer space. It does not provide for how, or in what situations, liability

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438 Armel Kerrest and Lesley. J. Smith, "Article VII". In Cologne Commentary on Space Law, Vol. 1, ed. Hobe, Stephan, Schmidt-Tedd, Bernhard and Kai-Uwe Schrogl (Köln: Carl Heymanns Verlag, 2009), 129.

439 (n. 21), *supra*.

440 Article I (c).

441 Article I (d).

442 Kerrest and Smith (2009) define it as "any object which humans launch, attempt to launch or have launched into outer space, including the Moon and other celestial bodies", and the authors also include space debris and other smaller remnants of space objects, see p. 140 (n. 438).

443 The Liability Convention (n. 438), Article III.

444 Per the OST Article VII, liability for damage is attributed to State Parties that launches , procures the launch, from whose territory the launch happens, and from whose facility the launch happens. The same premise is established in the LC Article I c, defined a 'launching State'.

shall be attributed. Article III of the LC thus limits the liability of the launching State for damages caused in space, making it liable for damages only when such damages are caused by the States own fault or the fault of the entities for whom it is responsible. Furthermore, as the wording states, the damage concerned is that which is inflicted upon a space object or to 'persons or property on board'. Property in this case can logically be interpreted as whatever does not constitute a 'space object', as the two are separated in the wording. The meaning of 'on board' is unclear. Does this mean that Article III excludes e.g persons conducting extravehicular activity (EVA), i.e astronauts outside the space object they pertain to? Some argue that this is the case, seemingly based on the *verbatim* wording of the provision.[445] If so, the damage to property or personnel outside the space object would have to seek recovery on other grounds, possibly by recourse to the OST Article VII or even Article VI.[446] A mining operation would in theory suffer the same legal fate in terms of personnel conducting EVA and property which does not constitute a space object.

The liability of the launching State hinges on whether fault is the cause of damage. What constitutes fault, however, is not defined in the space treaties. In ordinary terms, 'fault' implies a negligent conduct leading to a particular negative outcome in which responsibility is attributed for that outcome.[447] When addressing the legal meaning of fault-based liability in space, factors such as intentional acts, omission of acts and gross-negligence are therefore of importance when determining fault.[448]

Moreover, the LC's connection to general international law is evident in various sections. For instance, the LC Article VI specifies that exoneration from absolute liability is not applicable if damages arise from activities that violate international law, specifically mentioning the UN Charter and the Outer Space Treaty.[449] Additionally, the preamble of the LC highlights the objective of "[*Recognizing*] elaborate effective international rules and procedures concerning liability for damage caused by space objects [...]".[450] These clauses underscore the necessity of adhering to and further refining international law. This could involve contemplating how fault is viewed in other areas governed by international law. Yet, as repeatedly said, applying analogous concepts must be done with caution. There is a factual difference between, for example, hazardous terrestrial mining activities on the seabed and ultra-hazardous activities of resource mining. Consequently, there would thus exist a *legal* difference as to what qualifies as negligent conduct, logically because the activities – even though somewhat related – are unlike. To further this discussion, general international law should be examined for clarification of the meaning of 'fault'.

445 Lotta Viikari argues that under the conditions of Article III, persons or property must be inside ("on board") the space object in order to recover damages, see the author's comments on the Liability Convention in the section on "Environmental aspects of space activities" in *Handbook of Space Law,* ed. Frans von der Dunk, Fabio Tronchetti (Northampton: Edward Elgar, 2015) , 732.

446 F. von der Dunk (2015) 51-52. The author argues that many 'oversee' the possibility of the OST Article VI as grounds for liability claims.

447 See also the dictionary's definition[s] of the term, e.g "deserving blame for something bad: responsible", https://www.britannica.com/dictionary/fault , last accessed April 14th2024.

448 Heather H. Dinniss, "Cyber operations in outer space". In Outer Space Law: Legal Policy and Practice, 2nd ed. Edited by Yanal Abul Failat and Anél Ferreira-Snyman (Surrey, UK: Globe Law and Business Ltd., 2022), 472.

449 The LC, Article VI, second paragraph.

450 Ibid., in the Annex of the LC.

3.3.4 Fault liability in general international law

State liability for damage caused to another State has previously been subject to the rulings of the International Court of Justice.[451] Thus, even though not supported by authoritative sources like treaties, State liability for damage certainly exists in the sphere of international law. This includes an obligation to make reparations when a State is liable for said damages as well.[452] Especially of interest in our case is State liability for lawful acts. The concept is perceivably different than State responsibility for wrongful acts.[453] Nevertheless, an alleged overlap exists between the two concepts: State conduct may result in a lawful act causing damage, which, in turn, may have stemmed from the State's own wrongful acts or omissions.[454] However, the concept of State liability for lawful acts in general international law is not very substantiated by legal sources and it is therefore unclear to what extent it can be applied. Ironically, the only example of a binding international legal instrument unanimously agreed upon to establish liability for lawful acts is the Liability Convention.[455]

The ILC has addressed State liability, including the relation to State responsibility, in its Draft principles on the allocation of loss in the case of transboundary harm arising out of hazardous activities.[456] Commentators perceive the work of the ILC to be a gradually more authoritative source of law.[457] Principle 4 of the draft, paragraph 1 and 2, contains suggested rules on compensation and liability. Paragraph 1 suggests an obligation upon States to enact measures to "ensure that prompt and adequate compensation is available for victims of transboundary damage caused by hazardous activities located within its territory or otherwise under its jurisdiction and control". Paragraph 2 elaborates that these measures should include the "imposition of liability on the operator or, where appropriate, other person or entity". The ILC draft principles thus acknowledges the attribution of liability as a necessary measure pertaining to hazardous activities. The relationship between State responsibility and liability for damages marks its presence: In the draft principles, the State is responsible for imposing liability for damage upon the appropriate entity, ultimately to ensure prompt and adequate compensation. Furthermore, paragraph 2 states that "such liability should not require proof of fault".[458] This last statement is interesting, as it indeed suggests that fault liability as an international legal concept is undesirable when relating to hazardous activities. This is evidenced in the commentary to the draft principles. The reason for the explicit statement of fault liability not being used, arguably lies in the nature of hazardous and ultra-hazardous activities.[459] Such activities involve complex and potentially harmful operations. Consequently, it would arguably be unjust to impose a burden of proof of fault in an industry proof is difficult to assess due to both complex technological operations [which in some cases are guarded

451 Lyall and Larsen (2018), 95. The authors refer to the Corfu Channel Case (UK v. Albania) of 1949 and the Chorzow Factory Case (Germany v. Poland) of 1929.

452 Ibid.

453 State responsibility – a 'secondary rule' – as discussed in section 3.2, *supra*.

454 Joel. A. Dennerley, "State Liability for Space Object Collisions: The Proper Interpretation of 'Fault' for the Purposes of International Space Law" in *The European Journal of International Law Vol. 29 no. 1*, 2018, p. 292.

455 Crawford (2019), 544.

456 Draft principles on the allocation of loss in the case of transboundary harm arising out of hazardous activities with commentaries, 2006, in Report of the ILC, fifthy-eight session. GA Official Records, supplement No. 10 (A/61/10) 2006. Available online: https://legal.un.org/ilc/texts/instruments/english/commentaries/9_10_2006.pdf . Last accessed May 22, 2024.

457 Lyall and Larsen (2018), 95.

458 (n. 456), p. 76.

459 Ibid. p 78.

as a secret].[460] The scarcity of clarifying sources in this matter of determining the meaning of 'fault' is – at this point – not mitigated by the work of the ILC. The draft principles, or the commentaries, only argue why fault-based liability should *not* be a part of the liability regime in general international law.

Crawford examines the topic of liability for lawful acts and underscores the prevalence of the obligation of due diligence in several examples he provides. Referring to both an arbitration case as well as the works of the ILC, the author highlights that a recurring duty is a reasonable exercise of care, ensuring the rights of others and preventing harm.[461] The duty of due diligence may therefore, ultimately, be the most impactful concept for clarification on what fault-based liability in space entails. However, due diligence is an indefinite concept in international law that traditionally evolves around holding a State accountable for the actions of private actors that it can't directly control.[462] The idea is that while a state doesn't have to prevent all harmful private actions, it must take reasonable steps to try to prevent them. This is, as previously examined, considered an obligation of conduct.[463]

An indication of an underlying due diligence standard can be seen in the work of the International Court of Justice (ICJ). The most noted example is the *Corfu Channel case.* The judgment revolved around a dispute between the United Kingdom and Albania, where the Court found Albania liable for not warning about mines in its waters, which damaged British warships.[464] The Court used the concept of due diligence – although not using the term in *verbatim* – to underscore Albania's obligation not to allow its territory to be used for acts contrary to the rights of other States.[465] Furthermore, the statements of the ICJ has served as a precedent in later cases, where due diligence was associated with the obligation to prevent harm ("no-harm rule"), shaping the principle as part of customary international law, especially in the environmental and human rights fields.[466] Yet, 'due diligence' as a concept still lacks sufficient definition in practice. Crawford argues that this standard will differ with what context it is applied in.[467] This is also the view of Ollino, adding to the discussion that due diligence is attached to 'primary rules', i.e the concrete rules of international obligations.[468]

If the obligation of due diligence is an important element when clarifying what fault-based liability in space implies, another question emerges. What standard of 'reasonable exercise of care or conduct' apply to space activities? One commentator highlights the concepts of 'constructive knowledge' and 'actual awareness' when discussing fault standards. Constructive knowledge, allegedly established in the *Corfu Channel Case,* implies that a State should have known about the acts going on inside its own jurisdiction leading to interference with the rights of

460 Ibid. See paragraph (13) of the commentary on Principle 4 on Prompt and adequate compensation.

461 Crawford refers to the *Trail Smelter* case where Canada had conducted lawful activities on their own territory that ultimately caused cross-border air pollution in the U.S. The tribunal held Canada responsible for damage on the basis of the magnitude of consequences and the clear evidence linking injuries to Canadian activity. See Crawford (2019), 544.

462 Timo Koivurova and Krittika Singh, «Due Diligence" in *Max Planck Encyclopedias of International Law* (last updated 2022), provided online by Oxford Public International Law: https://opil.ouplaw.com/display/10.1093/law:epil/9780199231690/law-9780199231690-e1034?prd=MPIL .

463 Ibid.

464 *Corfu Channel case*, Judgment of April 9th, 1949: I.C.J Reports 1949, p. 4. General List No. I. Available online: https://www.icj-cij.org/sites/default/files/case-related/1/001-19490409-JUD-01-00-EN.pdf .

465 Alice Ollino. Section 1.3.2: "Due Diligence as a General Principle of Law?" In *Due Diligence Obligations in International Law*. Cambridge: Cambridge University Press, 2022.

466 Ibid.

467 Crawford (2019), 536.

468 Ollino (2022), section 1.3.2.

other States.[469] A key point is that the State *should* have had knowledge about activities under its jurisdiction and control leading to contrary acts of States. In this regard, Von der Dunk notes that as space objects are under close control and observation when active, the operator – in cases of e.g orbital deviation or irregular activity – could often be rightfully held liable on the basis of fault.[470] The other standard, actual awareness, establishes fault based on what the State *actually* knew when the incident occurred. Fault would exist only if it is proved that the State had knowledge of circumstances that led to damage and chose to not act or acted negligible.[471] 'Actual awareness' is argued as a more reasonable standard if taking into consideration the potential and volatile dangers of space, such as space debris, which is very hard to predict and where even the tiniest material can cause harmful situations.[472]

The discussion above underscore two key aspects. Firstly, the fault standard seems to be linked to the obligation of due diligence of States. If a State has caused damage because of poor judgment or management, this may invoke responsibility upon that State.[473] This means that liability for damage caused in space depends on the conduct of the State. Is there reason to argue that the operator had, or should have had, knowledge prior to the incident? Or were the circumstances of such a nature that any expectation of preventable measures would be unreasonable?

The absence of a definition on 'fault' in the laws pertaining to space activities is indeed an issue. There are no clear and legally binding standards which helps delineate the meaning of 'fault' in the LC.[474] A future damage-causing incident caused by e.g operators extracting resources on the Moon may thus involve tough challenges if attempting to settle disputes on the basis of the LC Article III. Nonetheless, the recent discussion seems reveal some important contours that may be applied if [or when] this scenario is realized.

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469 Dennerley (n. 454), 295-296.

470 Ibid., 296. The author references to Frans von der Dunk's discussion on the satellite collision of 2009: 'Too-Close Encounters of the Third Party Kind: Will the Liability Convention Stand the Test of the Cosmos 2251-Iridium 33 Collision?", see reference in note 474 under.

471 Ibid. p. 298.

472 Ibid.

473 Crawford (2019), 544.

474 Frans von der Dunk, "Too-Close Encounters of the Third Party Kind: Will the Liability Convention Stand the Test of the Cosmos 2251-Iridium 33 Collision?" (2010). Space, Cyber, and Telecommunications Law Program Faculty Publications. 28., p. 206. Published in the Proceedings of the International Institute of Space Law (2009), 199-209.

4 Summary and concluding remarks

4.1 Intro to this last chapter

The increased interest in the extraction and use of natural resources in outer space raises several legal issues. This thesis has addressed some of them in two parts.

The first part of the thesis addressed the legal status of natural resources in outer space, and particularly those located on and within celestial bodies. Focus was applied on clarifying the scope and impact of the non-appropriation principle, and whether it extends to cover natural resources.

The second part addressed how the existing legal framework regulates States responsibility and liability in the context of future mining operations on celestial bodies.

In this last and concluding chapter, I will first provide a summary of the conclusions and findings of this thesis. Thereafter, I will provide some suggestions on how to ensure that space resource activities are conducted in a responsible and sustainable way.

Lastly, I will make some final reflections.

4.2 Summary of conclusions and findings

4.2.1 Part I

The first part of this thesis addressed the legal status of natural resources in outer space, and particularly those located on and within celestial bodies. It started off with emphasizing that there exists no agreement on the interpretation of the legal framework pertaining to space resource activities. The main topic was whether, or to what extent, the non-appropriation principle provided in Article II of the OST covers the natural resources of outer space.

In 2.2, the term ‘celestial bodies’ was analysed. The ordinary meaning of the term in conjunction with the contributions of legal scholars, provided a broad understanding of this term, encompassing all natural bodies in space, which aligns with the inclusive language used in the treaty itself.

Section 2.3 analyzed and assessed the meaning of ‘national appropriation’. First, a brief look at the term ‘appropriation’ implied exclusive rights to something, including property rights. ‘National’ was concluded to include also private entities. This interpretation was especially made in conjunction with the OST Article VI, which includes non-governmental entities under its State responsibility for national activities and for assuring that non-governmental entities comply with the provisions of the OST. The contextual approach which included the purpose and object of the terms provided several reasons for the inclusion of private entities. Firstly, States cannot allow private entities to do something that they themselves are prohibited from doing. This would undermine the effect of the non-appropriation principle. Secondly, any ‘private appropriation’ cannot exist without State appropriation. Such rights are effectively not realized until granted by a State, yet States cannot grant rights they do not have themselves. Thirdly the purpose of Article II suggests that private entities are included since the core aim of the provision was to prohibit appropriation by any means. An interpretation where private entities are not subjects to its regulation would arguably violate the effectiveness of the intended meaning, because private entities in theory may be capable of State-like conduct in the future. Treaty negotiations reveal that private activities in space were not a priority at the time of drafting, and therefore explains that there was no reason for an explicit mention of them in Article II. This substantiates the conclusion of an inclusive interpretation of ‘national’.

Section 2.4 analyzed the meaning and implications of the phrase "by claim of sovereignty, by means of use or occupation, or by any other means". It aimed

to clarify how these terms contribute to the meaning ‘appropriation’, in light of the conclusion on ‘national’. The term "claim of sovereignty" was understood to involve assertions of supreme authority or control, typically associated with State power over territory. The term ‘use’ was examined in detail in the context of ‘use’ in OST Article I, which guarantees the free exploration and use of outer space. The nexus between ‘use’ in Articles I and II suggests that space activities are ‘use’ per Article I that can amount to appropriation by ‘use’ per Article II. This creates a delicate balance between permissible activities and those that could amount to appropriation. The phrase ‘by any other means’ was identified as a “safety net-provision” designed to cover any forms of appropriation not explicitly mentioned. Section 2.4 established that the non-appropriation principle of Article II is broad and inclusive, covering both explicit and implicit forms of appropriation. The findings from this section laid the groundwork for the subsequent analysis of the relationship between the non-appropriation principle and space activities, particularly concerning the exploitation of space resources and how such activities must be conducted within the legal framework to avoid appropriation.

Section 2.5 discussed the relationship between the non-appropriation principle and space activities, particularly resource exploitation, building on the previous discussion of ‘use’ in section 2.5 It was first concluded that the OST Article I (3) allows the use of space, including resources, for scientific purposes. This agreed interpretation underscores that resources are included in 'use', and by implication extends to commercial use as well. The key issue highlighted was when use becomes appropriation, which is determined by the interplay between OST Articles I and II. Article I allows the use of outer space when conducted in the benefit of all countries. Thus, while commercial exploitation of space resources may be permitted, it must be conducted in a way that avoids excessive or monopolistic use and considers the interests of all countries.

Section 2.6 explored how subsequent agreements and practices may have influenced the interpretation of the non-appropriation principle. It considered the Moon Agreement, which reiterates the non-appropriation principle and regulates natural resources but, due to its limited support has limited impact on others than those party to it. It also reviewed whether practices like previous extraction and collection of lunar and asteroid material, national legislations, and particularly the Artemis Accords have affected interpretation. It was found that especially the growing support for the Artemis Accords may play a significant role in shaping contemporary views on space resource activities, as it emphasizes that resource extraction does not ‘inherently’ constitute appropriation.

4.2.2 Part II

The second part of this thesis addressed the obligations of States the context of future resource activities.

Section 3.2 examined the obligations imposed by Article VI of the OST on States.

An important premise for further discussion was established: States are responsible for ensuring that both governmental and non-governmental space activities are conducted in compliance with the treaty's provisions and international law.

The obligation to authorize and supervise non-governmental entities was emphasized, high- lighting the necessity of ongoing oversight even after initial authorization is granted. This means that States are obligated to adhere to the non-appropriation principle when both them- selves, or non-governmental entities under their jurisdiction, are conducting space resource activities. This entails making certain such activities are not so excessive and long-term that they violate Article II.

In Section 3.3, the focus shifted to the consequences of States breaching their obligations un- der international law, particularly regarding space activities. It was noted that the breach of obligations could lead to international responsibility and

necessitate reparations for damages caused. The interplay between the OST Article VI and the LC Article III was discussed, underscoring the necessity of proving fault when assigning liability for damages caused in space. This analysis highlighted the significant role of the fault standard, which is inherently tied to the due diligence expected of States in regulating space activities.

4.3 The way forward: Ensuring responsible and sustainable space resource activities

Space technology has already contributed to innovation in many fields. Water-purifying technology, heart monitor implants, and the camera in your smartphone are just a few examples of benefits from space exploration.[475] If we wish to continue space exploration in a beneficial way, we should be proactive in our approach towards regulation. In the discussion earlier, we hinted that the exploitation of resources will happen sooner or later, and there are few boundaries in space. Yet, outer space is ultra-hazardous, and mistakes are just statistically bound to happen sometime. Space resource activities on the Moon and beyond proportionately necessitates minimizing the risks involved with such activities. There are, in fact, a number of measures we can consider.

In 2019 the COPOUS adopted Guidelines for the Long-term Sustainability of Outer Space Activities of the Committee on the Peaceful Uses of Outer Space.[476] The long-term sustainability of outer space is here defined as:

> *"[t]he ability to maintain the conduct of space activities indefinitely into the future in a manner that realizes the objectives of equitable access to the benefits of the exploration and use of outer space for peaceful purposes, in order to meet the needs of the present generations while preserving the outer space environment for future generations."* [477]

In the guidelines, the call for national regulation is notable.[478] This measure is recurringly emphasized as crucial by scholars as well.[479] Through national legislation, damage caused by misconduct can be prevented through responsible State direction. Dangerous space debris in Earth or lunar orbit from mining operations may be avoided through implementing obligations and guidelines. When the Working Group on natural resources provide their recommendations and principles in 2027, this may also contribute to a more uniform expression of law in various national legislations.

Moreover, the exclusive and excessive exploitation of celestial bodies can remain a hypothetical scenario through not only implementation of the obligation to adhere to the non-appropriation principle into national legislation. Another important consideration is the need for an international governing framework pertaining to resource activities and exploitation. There are several views on how a regulatory regime to govern space mining activities can be developed. One feasi-

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475 International Space Exploration Cordination Group; "Benefits Stemming from Space Exploration". Available online: https://www.nasa.gov/wp-content/uploads/2015/01/benefits-stemming-from-space-exploration-2013-tagged.pdf?emrc=ca90d1 . Last accessed 01.06.2024.

476 Guidelines for the Long-term Sustainability of Outer Space Activities of the Committee on the Peaceful Uses of Outer Space (2021), ST/SPACE/79. Available online: https://www.unoosa.org/res/oosadoc/data/documents/2021/stspace/stspace79_0_html/st_space79E.pdf , last accessed May 6, 2024.

477 Ibid. 2.

478 Ibid. 9.

479 Ingo Baumann and Erik Pellander, "Ensuring space sustainability through national legislation". In Routledge Handbook of Commercial Space Law, ed. Lesley J Smith, Ingo Baumann, Susan-Gale Wintermuth (Abingdon: Routledge, 2023), 533.

ble option is a protocol annexed to the OST, essentially a governing instrument based on the already successful treaty.[480]

4.4 The road to outer space: A highway for space cowboys or on the verge of an orderly expansion?

> *"All extraterrestrial activity today is governed by a 50-year-old, Cold War-era treaty. Will governments agree on an update before the final frontier becomes the Wild West?"*
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> Adam Mann, The Wall Street Journal, 2017 A. Mann, "Who's in Charge of Outer Space", Wall Street Journal, 19 May 2017, last accessed 2 June 2024 from: https://www.wsj.com/articles/whos-in-charge-of-outer-space-1495195097

In the autumn of 2025, four sets of eyes may again gaze through a window at a barren surface hidden from everyone else in the world. 57 years will have passed since astronauts Borman, Lovell and Anders become the first humans to see the far side of the moon and experience the earth rising, as part of the Apollo 8 crew. NASA's planned Artemis II mission is at the time of writing set for September 2025.

And in September of 2026, a boot print may once more leave traces of the explorative human nature on a celestial body other than the one we stem from, as NASA plans to send a manned crew to the surface of the moon for the first time since 1972 – Artemis III.

Our journeys to the moon, both of its sides, represent a pinnacle of human ambition and technological advancement. However, as we enter the second half of the 2020s, our eyes are again directed at what lies beyond our familiar neighbor.

What form will it take? Government programs continue to be at the center. The United States' NASA is still the leading agency and drives the US efforts, however with a strongly increasing cooperation and dependency on private companies. SpaceX, established as late as 2002, has become a core player with its Falcon lifters and Dragon and Starship spacecraft. Europe's ESA, Russia's Roscosmos, China's CNSA and India's ISRO also have advanced space programs with considerable ambitions.

Exploration, with manned flights to the Moon and Mars as the most yearned for, is likely to cause the most excitement from the public at large. Yet *exploitation* may well become more important in terms of economic output and as a source of economic growth. In the spring of 2017, Goldman Sachs published a widely quoted report or investment note. The investment bank was of the view that while still some time away, mining on asteroids was within the foreseeable:

> *"While the psychological barrier to mining asteroids is high, the actual financial and technological barriers are far lower. (..) Given the capex of mining operations on Earth, we think that financing a space mission is not outside the realm of possibility."* [481]

This potential for private actors with commercial motivations to enter the arena of resource exploitation in space, accentuates the need for a strengthened regulation. Throughout this thesis, we have navigated the intricate existing legal landscape governing space resource activities. The relevance of the existing handful of space treaties is clear, but they do not appear to suffice on their own as governing frameworks for what is to come. The expected increased volume of space activities,

480 Tronchetti (2015), 812.

481 Business Insider, *Goldman Sachs: space-mining for platinum is 'more realistic than perceived',* 6 April 2017, last retrieved on 2 June 2024 from: https://www.businessinsider.com/goldman-sachs-space-mining-asteroid-platinum-2017-4

including major private actors, call for enhanced and well-considered regulation. The need for clear and specific regulation to govern the activities were considered by the members of the COPOUS already in the 70s, when adopting the Moon Agreement. Presently, the future seems to hold only increased interest in the natural resources of celestial bodies.

In the introduction, the tragedy of the commons was drawn upon when contemplating what can happen if a race to obtain these resources develops, likely benefitting most the already powerful actors on the scene. Yet, this is not the worst-case scenario. Unregulated activity may potentially even lead to conflict, in all its facets.

While private companies or state agencies may not seek or wish to behave like space cowboys, chaos could become the result in a scenario where economic incentives become sufficiently strong, and the regulation is immature, unclear, or outright lacking. The uncertainty surrounding the non-appropriation principle as described particularly in Chapter 2 of this thesis is a case in point: At which point does resource exploitation – take space mining as an example - cross the line and result in a breach of the non-appropriation principle of the OST Article II? Space law as it is today has no clear answer to this question. And while we wait for the states of the world to agree new legal instruments, the materialization of substantial economic activities in outer space is drawing nearer day by day.

There has already been speculation as to whether the first dollar trillionaire could emerge from space mining.[482] I view this prospect as exciting and bearing with it enormous possibilities that could benefit all of mankind if done wisely. Adding to our common toolbox the ability to find, develop, use, and enjoy the literally endless resources of outer space would entail an enormous expansion of humankind's reach and potential. Calling for our half-a-century old set of treaties to be supplemented or updated may in this light seem rather mundane. Nonetheless I believe it could prove a necessary and central milestone for the success of this new chapter of human and technological development.

482 NBC News, *Neil deGrasse Tyson Says Space Ventures Will Spawn First Trillionaire,* 3 May 2015, last retrieved on 2 June 2024 from: https://www.nbcnews.com/science/space/neil-degrasse-tyson-says-space-ventures-will-spawn-first-trillionaire-n352271

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