School of Geoscience

Dissertation for the degree of

MSc in Energy Society and Sustainability

Valentina Wagner Gutiérrez

August 2019

Mining Helium-3 on the Moon:
An analysis of property rights in outer space

Valentina Wagner Gutiérrez

STATEMENT OF ORIGINALITY

" I hereby declare that this dissertation has been composed by me and is based on my own work."

Signed by: Valentina Wagner Gutierrez

ABSTRACT

More than 50 years have passed since the creation of the Outer Space Treaty. The debates in the 21st century have been shaped by challenges of this new era. These challenged include lunar mining, which until a few years ago seemed impossible. This dissertation will examine the possible benefits of lunar mining as a source of energy and the rapid interest from private companies and nations like the United States, Luxembourg, Russia, China and India. This dissertation will acknowledge the necessity to regulate lunar mining before the start of any mission and it will appreciate the economic benefits it might bring along with the different interpretations to the ownership of natural resources such as Helium-3. It will then further analyse the concept of *res communis* in outer space and the concept of Common Heritage of Humanity. It contemplates the global challenges brought by the current regulation and ultimately suggests a new legal and political framework that can be used in the distribution of natural resources exploited in outer space.

Key words: Lunar mining, Helium-3, Outer Space Treaty, Moon Treaty, Common Heritage of Humanity, Non-Appropriation, Outer Space.

Number of words: 21,399

ACKNOWLEDGEMENTS

First and foremost, I would like to thank my supervisor, Dr. Laura Watts for her invaluable guidance, feedback, and support while embarking my journey through this dissertation that definitely took a turn to outer space.

Second, I would like to thank Alfredo Rey for his assistance, amazing advice and great encouragement with my dissertation as he believes this is topic will ultimately be the next giant leap for humankind.

I would also like to thank Bernardo Rodriguez Ossa as his leadership and example have helped shape me into the lawyer I am today.

Finally, and most significantly, I would like to thank my family for their continued support and encouragement as I work, live, and study throughout the world.

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS

Antarctic Protocol	Protocol on Environmental Protection to the Antarctic Treaty
CHH	Common Heritage of Humanity
CRAMRA	Convention on the Regulation of Antarctic Mineral Resource Activities
COPUOS	Committee on the Peaceful Uses of Outer Space
DPDRC	Declaration on the principles of international law concerning friendly relations and cooperation among States
DRM	Documentary Research Method
He-3	Helium 3
IAE	International Energy Agency
ICJ	International Court of Justice
ILA	International Law Association
IPCC	Intergovernmental Panel on Climate Change
ISA	International Deep Seabed Authority
JAXA	Japan Aerospace Exploration Agency
LOS Convention	Agreement Relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea
Moon Treaty	the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies
NASA	National Aeronautics and Space Administration
NIEO	New International Economic Order
OS	Outer Space
OST	Treaty on Principle Governing the Activities of States in the Exploration and Use of Outer Space including the Moon and Other Celestial Bodies or Outer Space Treaty
UAE	United Arab Emirates
UN	United Nations
UNCLOSIII	Third United Nations Convention on the Law of the Sea
US	United States of America
USSR	Union of Soviet Socialist Republics
WWII	Second World War

INTRODUCTION

Background Information

Global warming, the environmental crisis and the progressive scarcity of natural resources are problems that will create future conflicts between nations. Due to their impact on the subsistence of humanity and of what we know today as planet Earth. Despite the fact that environmental degradation is increasingly evident and that its effects has involved changes in ecosystems, the increase in the level of the seas, the rise of temperatures and extinction of the species today there is no true way mitigate effects. As stated in the 2013 Technical Summary of the Intergovernmental Panel on Climate Change "it is highly likely that human influence has been the dominant cause of global warming observed since the mid-twentieth century" (IPCC 2013).

Where to find a solution? Since 1957 with the launching of the Sputnik 1 satellite, the interest of States was no longer only centred on Earth or the airspace but shifted to the mythical and unknown outer space. Outer space, the Moon and the other celestial bodies were contemplated as possible sources of energy useful for humanity. Therefore, it may be harbouring all those resources necessary for human subsistence on Earth.

The pace at which the modern world has grown is fast changing. With this growth and expansion, the demand for energy resources has been growing at par, if not even more rapidly (IAE 2018). Perhaps the most basic need to meet the rapid pace of development of these decades is the need for energy. This is established by the United States Energy Information Association (2018), which positions that the consumption of all forms of fuel will increase globally by the year 2040. A possible alternative that has been erected as a solution to the growing energy demand has been the extraction of the Helium 3 isotope, present in abundance on the surface of the Moon (Neal 2008). This as He-3 found on the Moon is supposedly a perfect fuel for thermonuclear fusion power reactors, which could serve as a virtually limitless source of harmless and pollution free source of energy (Bilder 2009). Becoming the optimal substitute for the development of the new forms of clean energy (Wittenberg 1986; Klinger 2017).

However, obtaining the aforementioned isotope is not simple. The chemical properties of the same avoid the accumulation in Earth due to its interactions in the high atmosphere of the planet. However, the Moon, not having a significant atmosphere, allows the mineral to be accumulated in the subsoil, generating important deposits (Bilder 2009).

The extraction of the isotope from the Moon is not a process, neither technical nor legal, similar to the extraction of natural resources on Earth. To begin with, the conditions in which the extractive event takes place are entirely different. Reduced gravity, lack of atmosphere as the one present on Earth, scarcity of water and different thermal situations are some of the operative differentiations between terrestrial and lunar mining. Additionally, lunar mining has a limited support from highly qualified trained professionals, and it has a very limited availability of humans prepared to participate in the extractive process (Hall & Green 2019). In the same way, the regulation of mineral resources of the Moon differs from the regulation of mineral resources available in sovereign territories, therefore the need for proper regulation is vital.

Research Aim

This research aims to show through a documentary analysis the space law regulations regarding natural resource extraction, the limitations, problems and creating possible solutions to conflicts and tensions that may arise in the future.

Therefore, the findings in this research will aim to answer the following questions:

- Does space law regulation allow the extraction of He-3 on the Moon?
- If so, who has the right of ownership of the extracted He-3? and
- Can this extracted He-3 become commercialized and privatized?

Research Approach

The research approach is based on a Documentary Research Method. This method refers to the examination of documents that holds material information about the subject that needs analysis,

in this case the legality of the extraction and ownership of He-3 (Bailey 1994). The Documentary Research Method is used in studying and classifying substantial sources, generally written documents, for this specific case ones in public domain (Ahmed 2010). Thus, the analysis was divided in the following stages:

1. General situation review: This stage was the collection of general information on the resources in outer space, space law and the possibility of extraction of natural resources in the Moon. It meant analysing legal regulations and doctrines regarding space law. Ultimately giving a general overview of the situation in outer space and the advantages and disadvantages of exploiting in the Moon.

2. Data Reduction: This next stage was the examination of information congregated from the literature review in order to illustrate the problems worth analysing (Selltiz, Wrightsman and Cook, 1981).

3. Data Collection: The data collection was carried out by both the analysis and interpretation set forth in the space law regulations and doctrine. It is worth mentioning that in addition to the guidance of my supervisor Dr. Laura Watts I have also obtained guidance from Colombian space law expert and Professor of Space Law in Universidad de los Andes, Colombia Dr. Alfredo Rey. With the aid of Dr. Alfredo Rey we discussed the basic guidelines and problems of space law. These lessons allowed a basic understanding of the current space law scenario and possible conflicts and problems that could be created in the near future.

   Additionally, the 62nd meeting for Committee on the Peaceful Uses of Outer Space (COPUOS) that was held in the United Nations Headquarters in Vienna, Austria from the 12th to the 21st of June 2019. Additionally, all recordings and journals of this Committee meeting have been officially uploaded to the COPOUS website[1]. This allowed the current understand of issues in space.

[1] Digital Recordings: http://www.unoosa.org/oosa/audio/v2/meetings.jsp?lng=en

Daily Journals: http://www.unoosa.org/oosa/en/ourwork/copuos/journals.html

4. Data Display: This process was the interpretation of the analysis gathered. This stage showed the response to the research aim and opened the doors to the creation of conclusions and policy proposals.

5. Drawing and verifying conclusions: This was the union of the past stages. The conclusions came to "combine and to present a comprehensive and robust explanation of the successes and challenge of implementing inclusion initiatives." (Marshall and Rossman 1995). This stage showed a clear presentation of the problems with space law today and create a call for a new space law treaty before extractive space missions occur.

Dissertation Structure

This dissertation will touch upon the necessity for legal regulation that encourages the responsible exploration and exploitation of resources from the Moon while benefiting humanity as a whole. Therefore, this research will have the following structure:

Part I of this dissertation will touch upon the potential uses of He-3.

Part II will discuss the relevant space treaties currently in place, how these treaties touch upon property rights in space and what aspects of these rights are left up to interpretation.

Part III will focus upon the international mining in the high seas and Antarctica and how these can be used to provide the framework and guidance for mining in outer space.

Part IV will then analyse ideas, problems and conflicts set forth above.

Finally, Part V will propose a new framework for governing mining activities in outer space while protecting and benefiting humanity as a whole.

PART I: HELIUM-3 IN THE MOON

When speaking about mining in the Moon it seems like a very distant context that would not require focus or regulation at the moment. Yet, during the past years, nations with space programs (i.e. United States, China, Russia, India among others) have expressed interest to establish base in the Moon and an exploratory goal to mine He-3 in the Moon (Mallick 2019) .

It is well known that Earth's reserves and supplies of fossil fuels are quite limited and create a harmful effect on the environment (Schmitt 2006). This led humanity to search for new renewable clean energy sources. He-3 is an isotope that is infrequently found naturally on Earth due to its magnetic field and atmosphere, but it is believed to be present in large amounts on lunar soil (Bilder 2009; David 2018). If placed within a fusion reaction it can create an ultra-effective and non-radioactive source of energy (Williams 2007). It is worth noting that currently nuclear power plants have *nuclear fission* reactors in which uranium nuclei are separated producing neutrons and very hard to contain. This means that energy is released, but also radioactivity and radioactive waste is created which has to be indefinitely safely stored. Whereas *nuclear fusion* essentially will use of the same energy source that fuels the Sun and other stars, and since that is clean energy it will not be radioactive and will not produce nuclear waste as current the *nuclear fission* power generation (Barnatt 2016). *Nuclear fusion* will ultimately produce protons that due to their positive charge can be easily contained (Open Mind 2019). Hence making, He-3 is ideally an ultimate fuel for *nuclear fusion* power reactors, which could serve as a practically limitless source of safe and clean energy. This allows the possibility to apprehend its energy to directly produce electricity, "without the need for a water heating process to move turbines, as in current nuclear fission plants" (Bilder 2009; Open Mind 2019).

Even though lunar He-3 is allegedly a source of energy which will fuel thermonuclear power reactors, determining the technological and economic feasibility of fusion power is yet to be seen (Bilder 2009).

As of today, there is only one large project working on the creation of the first functional nuclear power reactor. ITER (Latin for "The Way") is currently one of the most aspiring energy projects in the world. ITER will be the first fusion device to maintain nuclear fusion for long periods of time and will prove the necessities for the commercial production of fusion-based electricity. The idea was first created in 1985 and now counts with members such as China, the European Union, India, Japan, Korea, Russia and the United States. They are currently bound in a 35-year partnership to manufacture and operate the ITER experimental device and prove

that a nuclear fusion reactor can be designed. As signatories to the ITER Agreement, which concluded in 2006, the member States mentioned above have agreed to share of the cost of project creation, operation, neutralising, sharing the experimental results and sharing any intellectual property that is generated by the operational phase. It is expected to be tested by 2025 and to begin operation in 2035 (ITER 2019).

Countries working on the above help showcase the importance of the creation of production of clean energy derived from He-3. It is estimated that forty tons of liquefied He-3 brought from the Moon to the Earth (this quantity should properly be carried in the cargo compartments of two current United States space shuttles) would provide enough fuel for He-3 fusion reactors to meet one year's supply of the full electrical needs of the United States or $\frac{1}{4}$ of the electrical needs of the entire world (Bilder 2009).

He-3 is a component of *solar wind*. The Sun releases gas and other charged particles into the solar system forming *solar wind.* The Moon has been impacted by *solar wind* for more than four billion years causing particles to become imbedded in the Moon's regolith[2] (Kulcinski 1990; Bilder 2009). While He-3 constitutes only a small percentage of lunar regolith, it is projected that, there may be as much as one million metric tons of He-3 potentially recoverable from the Moon's surface (Slyuta 2007). This amount of He-3 is more or less equivalent to ten times the energy content of all of recoverable coal, oil, and natural gas on Earth (Coffrey 2009).

Space mining is something that has only recently been taken into account. Therefore, it is worth asking how would He-3 be exploited and transported to Earth?

It is necessary to note that the *solar wind* components that build up He-3 on the Moon are weakly tied to the lunar regolith (Kulcinski 1990). The first step necessary to begin exploitation would be to set up a lunar base. Once the lunar base is set up, lunar robotic mining vehicles with solar heat storage devices would then: (i) navigate the surface of the Moon in order to exhume the the lunar regolith and dividing it into tiny pieces. Since He-3 is thought to be contained in only a minor percentage of the lunar regolith, it vital to process a great sum of lunar regolith in order to obtain the quantities of He-3 necessary to maintain the He-3 power programs on Earth; (ii) the device would then use solar energy to process and heat the gathered

[2] Regolith is the loose and dusty upper layer of rocks and soil comprising much of the Moon's surface.

regolith in order to liberate, divide, and gather He-3 in its gaseous form, along with certain other solar-wind elements embedded in the regolith particles; (iii) consequently, the robot would then release the regolith back to the lunar surface; and (iv) finally the robot would return to the lunar base with the collected He-3 and other gases collected for liquification (Cameron 1990; Bilder 2009).

Liquification of He-3 could be done in the lunar cold and then transported in space shuttles back to Earth. It is vital to note that lunar mining in the search of He-3 could result in the collection of substantial amounts of elements such hydrogen, oxygen, nitrogen, carbon dioxide, and water. These elements are all potentially useful for the maintenance of a lunar base or further outer space activities (Bilder 2009).

Scholars such as Cameron and Kulcinski argue that lunar mining is not set to create harm or impact the lunar environment. No excavation will be necessary as the lunar regolith would be gathered and put back onto the Moon´s surface after it is processed (Cameron 1990; Kulcinski 1992; Bilder 2009). On the other hand, since this practice it not yet being performed there is no true way to prove the statements made my Cameron and Kulcinski. Planetary scientists such as Mazrouei have stated that since the extent of lunar mining is not clear this might have a harmful effect on sites such as craters. She argues that the protection of the craters should be held with the upmost importance as they are the time capsules of the Moon. This as the size of a lunar crater can be used to determine Earth's history and without them valuable scientific information would be lost (Mazrouei 2019).

Whether the production of He-3-based fusion power will be economically and commercially feasible is still a difficult and uncertain query. The viable realization of the He-3 development will evidently depend, among other things, on the growth and achievement of both "economically efficient He-3- fuelled fusion power reactors and a sustainable lunar mining initiative" (Bilder 2009). This initiative should be able to economically extract and return to Earth with a guaranteed amount of liquified He-3 to fuel the nuclear fusion power reactors (Bilder 2009).

This means that the economic sustainability of He-3-based fusion power will depend on its eventual production cost in proportion to other sources of energy such as fossil fuel or other Earthly renewable energy sources. The non-existence of lunar mining makes it difficult to

accurately predict the costs of production hence creating a high risk in developing such activity. Another risk, just as great, is the uncertain outer space legal regulation that are currently in force as it is said to be vague and ambiguous. In order to achieve a cost and risk efficient mission to the Moon it will require a functioning regulatory body and a stable political environment that will help secure a possible success of these operations.

It is necessary to understand the importance of He-3, before beginning to offer solutions to the central problem of delivering a viable regulatory framework, in the light of the existing treaties. As it will be the legal precision that will not only protect the resource and the Moon but will ultimately allow the exploitation of outer space.

PART II. SPACE TREATIES

Origin of Space Regulation

Space law emerges after the Second World War (1939-1945). The Earth and air space were filled with war and outer space emerges as a new field of power. Therefore, the United States and the Union of Soviet Socialist Republics (USSR), the two of the economic and political powers of the moment, begin with what is known as the *space race* through the development of space technology. Understanding the magnitude of a war in outer space shows the necessity of the creation of a common set rules to guarantee the peaceful use and benefits for all humanity (Seara 1961).

Consensus

"The contributions of space law to International Law must include consensus, born at the beginning of the codification task entrusted to the United Nations Committee on the Peaceful Uses of Outer Space" (Cocca 1991). Specifically, the word consensus denotes agreement and not a vote, a general opinion, on a thought shared by a plurality of the parties without opposition. It is characterized by its meaning as agreement, conciliation and harmony in human or international relations. Among the main benefits of consensus is the power to avoid unfounded votes or even a diplomatic negotiation among nations. Additionally, it can be seen as an effective instrument to achieve peace and cooperation at the international level.

Briefly, consensus means that nations approve the proposals, even if they do not fully agree with them. This is to say, it does not consist that all the nations agree with the decisions, it implies that no nation is opposed to them. This means that in order to reach consensus all nations have to agree. The difference between consensus and unanimous voting is in the process used to achieve the end result; consensus is achieved without voting but with an agreement of all parties whereas voting is required to keep a voting record. It is vital to say that all the treaties and resolutions that make up the normative body of space law have been adopted by consensus (Cocca 1991).

A highly relevant aspect of consensus and fundamental for the development of this dissertation, is the moral aspect of this form of decision making. From legal perspective, there is no difference between a decision taken unanimously, by majority or by consensus as no matter what method is used the decision will still be approved. However, the situation is different on the moral sphere. In consensus, the participation of each member is valued positively by their peers: personality and action are taken into account. Consensus supposes the expression of the will of a people that is represented in this case by State's representative in the decision-making process. Its legal sense from which "the legal conscience of the peoples emerges, which transmit it to their peers, resulting both sources of international law of our time" (Cocca 1991). To the extent that any attitude contrary to consensus places the State in a violation of the law. For these reasons, reservations and abstentions are not allowed, since consensus implies the exhaustion of the question addressed hence complete agreement. In thise sense "through the process of consensus, a group can become a true community and a force for effective social transformation" (Briggs 1997). Nations ultimately come together to agree and approve a certain topic.

Moreover, it generates confidence that all countries will comply with the agreements they will sign; thus, implying, good faith and responsibility in the actions of States. However, approving an agreement by consensus does not mean that a State is bound to sign it. It means that the body of the agreement is ready to be released for signatories.

Finally, consensus has allowed space law to be a right aimed at the achievement of a stable and lasting peace, the peaceful exploration and cooperation among all States. Through consensus the main principles of space law were created: (i) peaceful use of outer space; (ii) non-appropriation of outer space; and (iii) cooperation.

Treaties

More than 50 years have passed since the creation of the regulation that governs the extraction of He-3 in the Moon. It has remained ambiguous and unmodified. Science and technology have been growing and new ambitions in space have been created. In 2019 there are two space treaties regulate natural resources in outer space: (i) The Outer Space Treaty; and (ii) the Moon Treaty. Consequently, the following sections will analyse the above-mentioned treaties in regard to natural resources including He-3 in outer space. It will show their successes and failures that will showcase the unresolved issues and priorities that need to be taken into account when dealing with exploitation of He-3 in outer space.

The 1967 Outer Space Treaty

The Outer Space Treaty is the basic framework and *Magna Carta* produced to regulate activities in outer space while creating broad set of parameters for space exploration. It is a milestone in the creation and progressive development of international space law. It remains to serve as the base and often is the preamble to succeeding international treaties and agreements. The Outer Space Treaty was created to eradicate and forbid any rights and claims of sovereignty in outer space (Husby 1994). This Treaty was signed by more than 100 countries[3] therefore creating obligations to those signatory nations.

The Outer Space Treaty consecrates the three guiding principles that are the essence of the outer space law. These principles are (i) peaceful use of outer space; (ii) non-appropriation of outer space; and (iii) cooperation.

Principle of the peaceful use of outer space

In the first place, the *principle of the peaceful use of outer space* is reflected in the motivational part of the Outer Space Treaty. It recognizes that the general interest of humanity is the use of outer space for peaceful purposes, and prohibits the use outer space for war, military practices

[3] Please see Annex 1 for list of countries that signed the Outer Space Treaty.

and/or propaganda to incite war (OST 1967). The foregoing is confirmed by Article III[4] and IV[5]. Article III flatly excludes any activity that goes against the maintenance of peace therefore guaranteeing the *principle of peaceful use of outer space*. Additionally, Article IV deals with the peaceful use of outer space and prohibiting the total use of nuclear weapons in outer space.

It is worth noting that the pillars for space law are in the Charter of the United Nations, where international peace is guaranteed. Consequently, everything that is derived from the United Nations guarantees the following: peace and harmonious coexistence among nations. This means that even though outer space is free for exploration and use by all nations outer space should only be used for peaceful purposes. The above principle guarantees the protection of outer space forbidding the possibility of one nation gaining control and sovereignty of outer space(Coffrey 2009).

Principle of non- appropriation of outer space

Article II[6] exposes the *principle of non-appropriation* of outer space. The word appropriation means to "exercise of control over property" (Black Law 2009). Thus, it can be said that this Articles prevents the territorial claims made by States in outer space. Meaning that the

[4] ***Article III:*** *" States Parties to the Treaty shall carry on activities in the exploration and use of outer space, including the Moon and other celestial bodies, in accordance with international law, including the Charter of the United Nations, in the interest of maintaining international peace and security and promoting international cooperation and understanding." (OST 1967)*

5 ***Article IV:*** *" States Parties to the Treaty undertake not to place in orbit around the Earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons on celestial bodies, or station such weapons in outer space in any other manner. The Moon and other celestial bodies shall be used by all States Parties to the Treaty exclusively for peaceful purposes. The establishment of military bases, installations and fortifications, the testing of any type of weapons and the conduct of military manoeuvres on celestial bodies shall be forbidden. The use of military personnel for scientific research or for any other peaceful purposes shall not be prohibited. The use of any equipment or facility necessary for peaceful exploration of the Moon and other celestial bodies shall also not be prohibited."* (OST 1967).

[6] ***Article II:*** "*Outer space, including the Moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means*" (OST 1967).

possibility of appropriation of outer space, the Moon and other celestial bodies is eradicated. The treaty declares the promotion of the "exploration and use" of outer space. In this regard the term *use,* it can be interpreted as an indication that public and private parties may claim property over the resources extracted as long as they do not claim sovereignty over the land (Schmitt 2004). This can be valid to the extent that the treaty explicitly states the activities that are prohibited in space and mining natural resources is not explicitly stated (Su 2017). This theory is backed by the fact that the United States, in the six Apollo missions to the Moon, brought back to Earth a total of 842 pounds of lunar material. To this date, these activities have not said to breach international law as no action has been taken against the United Staes. Additionally, it can be stated that these actions are allegedly in compliance with the treaty as the United States claimed property over the rocks gathered but not over the lunar land, hence not breaching the Outer Space Treaty (Hudgins 2002).

Yet this is not the only interpretation. Another interpretation is that natural resources do not belong to anyone in particular but belongs to all, which generates an abstract space, of a legal nature that is open to exploration and will allow humanity to have common benefits (Coffrey 2008; Twibell 1997). This as it is explicitly stated that neither outer space nor the Moon and other celestial bodies can be claimed by any nation as their own, no matter what the right invoked is. This *principle of non-appropriation* is important from the moment which the Outer Space Treaty begins to be in force, to the extent that it prevents States from unleashing a war to declare sovereignty over outer space. It is worth mentioning that the existence of Article II can be interpreted with the prevention of a declaration of sovereignty in national legislations. Since non-appropriation presupposes the non-sovereignty of any State, it will then contradict the first interpretation of the Article (Tronchetti 2013; Peña n.d.).

Moreover, Article I[7] has created much debate. The wording for Article I explicitly says that outer space should be used "for the benefit […] of all countries". The above statement can form

[7] ***Article I:*** *"The exploration and use of outer space, including the Moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind.*

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

two interpretations: (i) it can be seen as a guide to procure the sharing knowledge and resources among different countries; or (ii) it can be seen as a mandatory stipulation that calls for the distribution of wealth and resources found in space (OST 1967; Reinstein 1999). Making these areas *res communis.* The concept of *res communis* is first created in Roman Law which means community possession. This concept was later introduced in the 1958 High Seas Convention which created precedent of a *res communis* area. In this sense a *res communis* area is one that is past and not subject to integration into any state territory or jurisdiction; thus, available for use and exploitation by all States. Therefore, making outer space as a *res communis*, that is, as a natural object that is common to all which allows the right to use and cannot be appropriated by States or individuals (Christol 1982).

As a consequence, outer apace cannot be appropriated by any other State or individual, however, the use, exploitation and exploration by all States is allowed based on cooperation and equality of access. Moreover, COPUOS formed the legal status of space law based on this theory. The foregoing is evidenced, for the first time, in Resolution 1721 (XVI) of December 20, 1961, by establishing that "outer space and celestial bodies may be freely explored and used by all States in accordance with international law and they cannot be the object of national appropriation" (Johnson 2010).

Additionally, the assumption that Space is “free for exploration and use” is set out in Article i of the Outer Space Treaty is the first time that property rights are expressed into this treaty. This Article grants all States the access to outer space “without discrimination,” thereby preventing exclusion from the same. This would be the first time that it is declared that Outer Space is of all humanity and therefore its exploration should create a benefit for all nations (OST 1967; Coffrey 2008; Bilder 2009).

Yet, Article I has different interpretations. Noting that the first interpretation to this language is seen as the creation of a right to equally contribute in space exploration, while the second interpretation assess the same provision as an obligation to equal distribution of resources irrespective of their participation or contribution to the space missions (Thomas 2006). Still,

---

There shall be freedom of scientific investigation in outer space, including the Moon and other celestial bodies, and States shall facilitate and encourage international cooperation in such investigation. ” (OST 1967).

the generally accepted interpretation agrees that Article I shape the right of nations to exploit the benefits of space (Christol 1982). Consequently, it can be seen the exploration and use of outer space is for the benefit of all humankind granting general access to outer space rather a strict prohibition (Thomas 2006). Until this day there is no specific definition to this article hence the interpretations given are speculative.

When analysed together, Articles I and II reject the right to claim territory because of the impact such claim would have on the right of access to outer space (Thomas 2006; Bilder 2009). This means that if a state claimed ownership over a section of outer space that claim would impede the equality of access described in Article 1 (Penner 1997).

The precise extent to these Articles is not clear. Author's like Christol interpret the Outer Space Treaty as a prohibition to exercise state sovereignty on the Moon but actors are free to claim property rights over the resources (Christol 1967). While Authors like Kolosov and Zhukov state that sovereignty and private property is strictly prohibited (Kolosov and Zhukov 1984; Reynolds 1992).

It needs to be said that even if there is the stipulation to share resources there is no specifications on how to do it, who is in charge of deciding where these resources should go to and how much be shared. Therefore, making this a problem for interpretation once resources are actually exploited making it vague and ambiguous stipulation.

If there is no direct stipulation as to how the resources should be distributed, scholars like Paxon has said that the Outer Space Treaty is a self-enforcing treaty. This means that States would free to interpret the obligations hence they individually determine how much is to be shared and the way it should be done. Additionally, this Article I of the Outer Space Treaty can also be interpreted in the sense that resources exploited, in this case He-3 obtained from the Moon, would be equally redistributed among nations. Therefore, after having the total amount of profits, benefits and expenses the mission State should split the latter in an even matter, and not gaining any more than other countries (Paxon 1992). A different interpretation to the ones said before, can come to play once He-3 production becomes real, since He-3 is a source of clean energy on Earth it could be arguably be seen indirect benefit to Earth's inhabitants therefore sharing of profits might not be necessary(Paxon 1992; Coffrey 2009).

These are all speculations and the Outer Space Treaty does not explicitly state the one true interpretation on the matter (Coffey 2009). Therefore, making no clear differentiation between the resources on the Moon and the lunar terrain.

Principle of cooperation in outer space

The third principle, the *principle of cooperation* arises from the *principle of peaceful use of outer space* and the *principle of non-appropriation of outer space*. This *principle of cooperation* is stated in Article I[8] of the Outer Space Treaty. This refers to the mutual assistance that States must provide for scientific development in the exploration and use of outer space, acknowledging that such activities are for benefit and interest of humanity. This means that cooperation between all is an international duty. This principle is materialized through various ways, such as the display of any technical or scientific discovery, of any progress or in the facilitation of projects and research (Nochin 2004; Coffrey 2008; Bilder 2009).

In brief, the Outer Space Treaty marks the creation of the three main principles of space law: (i) peaceful use of outer space; (ii) non-appropriation of outer space; and (iii) cooperation. Yet, it appears to be a very broad treaty as it does not provide a clear path as to what are the limits to the exploitation of He-3 on the Moon.

The efforts made in the creation of the Outer Space Treaty need to be acknowledged as it was made to prevent a nuclear war in a very quick manner (COPUOS 1966). Recognising this political environment gives us an irrefutable outcome: which is that the drafters did not mean to create a legal document that would govern space forever. On the other hand, the Outer Space Treaty showcases diplomatic unification and consensus in a fast approach before the first Moon landing to prevent an alternate Cold War (COPUOS 1966). Given this background it can be said that the drafters did not intent to regulate natural resource extraction in space. Hence another international agreement must be made to clarify the legality of these activities. This as if a mission is taken without a clear regulation, protection to resources and humanity it could create a precedent that will be tough to overturn. Therefore, the need for a new treaty is vital and must be done before any missions for space exploitation are on their way.

The 1979 Moon Treaty

[8] Please refer to footnote # 7.

The Moon Treaty was created due to Apollo 11 in 1969. Apollo 11 had the goal to expand the scientific exploration of the Moon, which involved the collection of samples found on the lunar surface (Piñeros 2014). Therefore, the COPUOS wanted this agreement to regulate the extraction and use of materials on the Moon to guarantee peace specially between the space powers. The Moon Treaty is founded on the basis that the Moon and its natural resources are Common Heritage of Humanity (CHH) and are not subject to national appropriation or sovereignty (Works 1980). Therefore, its main goal is to allow States to reach the Moon and other celestial bodies with the same possibilities of exploration and exploitation by clarifying legal rights and responsibilities.

Acceptance of The Treaty in the International Community

One of the main problems of the Moon Treaty is the low ratification in comparison with the Outer Space Treaty. Specifically, this Treaty has been ratified by only 18 States[9]. The main space powers, at the time, such as the United States, China or Russia have not ratified it, which questions its true usefulness, effectiveness, binding force and acceptance in the international community as no country has performed a space mission bound to this treaty (Svoboda 2008).

Is the Moon Treaty a failure because of its low acceptance and ratification? As mentioned above, this Treaty has been ratified by only 18 States. However, its little ratification does not transform the situation of Space Law. First, as will be discussed below, the guiding principles of all space activity (*peaceful use of outer space, non-appropriation of outer space* and *cooperation*) enshrined in the Outer Space Treaty are the same as those found in the Moon Treaty. Being the same principles, they are equally binding for those States that have not ratified the Moon Treaty (Paxon 1998; Coffrey 2008).

The reasons for the lack of acceptance of the Moon Treaty are diverse. It can be said that space activity was low, which is why there was no interest on the part of the States to design space programs. Hence it can be considered premature and unnecessary to provide a legal regime for an activity that, at the time, had little reception and little development. Secondly, conflicts were generated by enshrining in Article XI of the Moon Treaty the concept of *Common Heritage of*

[9] Please refer to Annex 2 for the list of states that signed and ratified the 1979 Moon Treaty.

Humanity. This expression, as it will be analysed, was controversial and generated all kinds of debates due to the political and economic repercussions (Coffrey 2008).

Hence, it can be stated that in 2019 there is no regulation that is clear and valid to all nations in order to protect and guarantee the safe administration of resources such as He-3 exploited in the Moon. A new regulation needs to be created that will allow all nations to explore the new boundaries that space brings while limiting the dangers that historically were seen in the era of colonization which led to extreme warfare over land and resources. That is the real risk, if exploitation of the Moon occurs without a clear regulation (O'Donnell 2007).

Guiding Principles

It is important to note that the Moon Treaty maintains, develops and refers to many of the provisions contained in the Outer Space Treaty. First, it assesses the *principle of peaceful use of outer space* in Article II[10] and III[11] by establishing that the activities carried out on the Moon must be carried out in accordance with the UN Charter based on peace. In addition, it categorically prohibits the use of force, hostile acts, the establishment of military fortifications and nuclear weapons or weapons of mass destruction on or around the Moon. Article III provides all States Parties shall use the Moon exclusively for peaceful purposes (Moon Treaty 1979).

[10] ***Article II***: *"All activities on the Moon, including its exploration and use, shall be carried out in accordance with international law, in particular the Charter of the United Nations, and taking into account the Declaration on Principles of International Law concerning Friendly Relations and Cooperation among States in accordance with the Charter of the United Nations, adopted by the General Assembly on 24 October 1970, in the interest of maintaining international peace and security and promoting international cooperation and mutual understanding, and with due regard to the corresponding interests of all other States Parties" (Moon Treaty 1979).*

[11] ***Article III:*** *"States Parties to the Treaty shall carry on activities in the exploration and use of outer space, including the Moon and other celestial bodies, in accordance with international law, including the Charter of the United Nations, in the interest of maintaining international peace and security and promoting international cooperation and understanding" (Moon Treaty 1979).*

The *principle of cooperation* among States to ensure that exploration and use to another of the guiding principles introduced through the 1967 Outer Space Treaty, which is recaptured in this Treaty. As evidenced by the motivational and the articulated parts of the Moon Treaty, activities on the Moon and other celestial bodies should be based mainly on collaboration among States to obtain the benefits that can be derived from the exploitation of natural resources. Therefore, regardless of the degree of economic or scientific development of the States, the use of resources must be made in interest and the benefit humanity. As provided in Article VI[12] of the Moon Treaty reaffirms the cooperation that must exist to achieve scientific progress and the mutual benefit of States (Moon Treaty 1979).

On the other hand, Article XI[13] refers to the *principle of non-appropriation* of the Moon, stating that the Moon cannot be the "subject of national appropriation through claims of sovereignty,

---

[12] ***Article VI***: *" 1. There shall be freedom of scientific investigation on the Moon by all States Parties without discrimination of any kind, on the basis of equality and in accordance with international law.*
2. In carrying out scientific investigations and in furtherance of the provisions of this Agreement, the States Parties shall have the right to collect on and remove from the Moon samples of its mineral and other substances. Such samples shall remain at the disposal of those States Parties which caused them to be collected and may be used by them for scientific purposes. States Parties shall have regard to the desirability of making a portion of such samples available to other interested States Parties and the international scientific community for scientific investigation. States Parties may in the course of scientific investigations also use mineral and other substances of the Moon in quantities appropriate for the support of their missions.

3. States Parties agree on the desirability of exchanging scientific and other personnel on expeditions to or installations on the Moon to the greatest extent feasible and practicable." (Moon Treaty 1979).

[13] ***Article XI***: *"1. The Moon and its natural resources are the common heritage of mankind, which finds its expression in the provisions of this Agreement, in particular in paragraph 5 of 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.

through use or occupation, or by any means" (Moon Treaty 1979). Likewise, "neither the surface, nor the subsurface of the Moon, nor any of its parts or natural resources in place may be owned by any State, national organization or non-governmental entity or by any individual" (Moon Treaty 1979).

The debates on the non-appropriation have fallen exclusively on outer space, the Moon and the celestial bodies. However, the question arises whether the appropriation of the natural resources of the Moon and celestial bodies is allowed or, on the contrary, the *principle of non-appropriation* must be applied to them.

In the first place, Article II of the Outer Space Treaty (1967), establishes that outer space cannot be "subject to national appropriation by claim of sovereignty, use or occupation, or any other way". Although Article II makes no reference to the appropriation of natural resources, the Moon Treaty comes to compensate for this absence, considering that neither the natural resources in place, the surface or the subsurface of the Moon can be owned by States, international intergovernmental or non-governmental organization, national organization or non-governmental entity or any individual whatsoever (von der Dunk 2006; Coffrey 2008).

---

4. States Parties have the right to exploration and use of the Moon without discrimination of any kind, on the 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 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." (*Moon Treaty 1979)

On one hand there can be an interpretation of a denial the right of appropriation of all that is in outer space since Article II does not differentiate between outer space, celestial bodies and natural resources. However, it cannot be considered that all resources in outer space are not appropriable. That is, it should be understood that the prohibition only refers to the appropriation of the terrain or areas of space and celestial bodies, but it makes no mention to the resources that are not in place on the Moon (Coffrey 2008; Johnson 2010).

Common Heritage of Humanity

One of the most important elements introduced by this Treaty was the declaration that "the Moon and its natural resources are the Common Heritage of Mankind[14]" (Moon Treaty 1979). This term, related to the principle of non-appropriation, means that the resources of the Moon belong to all of humanity and that no State or individual can claim sovereignty or possession over them. On the contrary, there is equality to access, exploitation and use the resources found there.

In view of the above Article XI of the Moon Treaty declares that the Moon and the natural resources are *Common Heritage of Humanity*. Which forbids possession of the natural resources found on the surface and subsurface of the Moon and calling for an "international regime" to ensure their "safe development," "rational management," and "equitable use" (Moon Treaty 1979; Bilder 2009).

The concept of *Common Heritage of Humanity* must contain the following elements:

1. Non-appropriation: this means that the areas cannot be appropriated either privately or state owned. These are spaces that are legally owned by no one, but everyone is allowed to use it and enjoy it. It provides free access and use of the region (Heim 1990).
2. Common management: this means that the resources must be managed by all nations for common interest (Heim 1990).
3. Benefit Sharing: All nations much "share with each other the benefits acquired from exploitation of resources from the common heritage region" (Heim 1990; Walter 2011).
4. Peaceful use: this means that the region must be exclusively used for peaceful purposes.

[14] For reference of this dissertation the term that will be used will be Common Heritage of Humanity

5. Preservation for future generation: This means that the areas must be preserved for future generation therefore taking into account research conservation and environmental protection of the areas (Heim 1990).

Analysing the context of Article XI[15] with the general elements of the concept of *Common Heritage of Humanity* the following can be stated: That paragraph 2 and 3 of Article 11 states that this area cannot be appropriated. Paragraph 5 calls for the creation of an international body to administer the use of the area and its natural resources. Paragraph 7 declares that all benefits that come from the exploitation of the Moon should be equitable shared between all nations, even with those that do not have exploratory missions. Paragraph 4 expresses the right of the peaceful use of the Moon. To conclude paragraph 7 calls for a rational administration of the extraction of resources in the Moon as they belong to all of humanity. Hence, if literally interpreted the Moon Treaty it seems quite clear that there are no property rights in the Moon's surface and subsurface as they are *Common Heritage of Humanity*. (Vienna Convention 1969; Villiger 2009).

Even though this treaty seems to be clear, it has little impact to the current space regulations (Fountain 2003). While the Moon Treaty is in force it does not bind the nations that did not sign the treaty. As per international law this treaty cannot regulate the behaviour of the non-signing parties without their consent. Therefore, and as Fountain stated the concept of *Common Heritage of Humanity* will lead to the *tragedy of the commons* as more than 40 years have passed and there is still no efficient way to allocate resources, in this case He-3 that is to be exploited in the Moon.

It is worth clarifying that tragedy of the commons is an economic difficulty in "which every individual has an incentive to consume a resource at the expense of every other individual with no way to exclude anyone from consuming" (Chappelow 2019). The outcome will be "overconsumption, under investment, and ultimately depletion of the resource. As the demand for the resource overwhelms the supply, every individual who consumes an additional unit directly harms others who can no longer enjoy the benefits" (Chappelow 2019).

Even though the concept of *Common Heritage of Humanity* encourages the preservation of outer space for future generation Erin Clancy (1998) states that this doctrine will ultimately

[15] Please see footnote # 9

lead to the “overuse, profit hoarding, and fails to protect the commons as promised”. As humanity will eventually begin to exploit He-3 in the Moon it is vital to take into account the mistakes that have been made on earth that are currently causing humanity to search for energy sources outside of Earth’s atmosphere.

Different interpretations to the concept of *Common Heritage of Humanity* arise when authors such as Reynolds state that CHH is part of a larger goal to achieve the New International Economic Order (NIEO) . NIEO aims to modify the customs of international relations by reducing the gap of inequalities between nations. The concept of *Common Heritage of Humanity* is believed the road for the implementation of NIEO in the area of resource extraction from common regions (Reynolds & Mergers 1989). *Common Heritage of Humanity* can be seen as a prevention of the monopoly by nations in outer space, especially e by those that have the technology and financing to mine on the Moon. Secondly the concept of *Common Heritage of Humanity* will allow nations that do not have the technology of financing to participate in space a direct contribution in the administration of the resources that are extracted. Thirdly, NIEO is as a way to prevent colonization in space as it guarantees the use and benefits for humanity therefore assuring that all nations will gain benefits and distribution of resources from this extraction (Rana 1994).

The problem with the Moon Treaty is not the preservation and protection of space (Taylor 1998). The problem rises with the concept of *Common Heritage of Humanity* that calls for equitable share of economic and technological benefits. Therefore, an incentive for exploitation of natural resources must be given, this is a compromise all nations much reach. This as if there are no incentives for investment in exploitation then it might not be profitable for nations and private companies, therefore will extraction occur? (Frakes 2003).

In the current age space is no longer the sole domain of the US and the successor Sates of the USSR. A strong European space agency now exists, Japan has a rapidly growing program, and *Global South* front-runners like China and India have made a significand strive towards space programs. This means that when exploitation of resources in outer space begins many States will be part (Reynolds 1992; Coffrey 2008).

No further treaties that aim to solve the issue of private property in outer space have been ratified since the Moon Treaty. As nations and companies begin to create plans to mine, He-3 in the Moon it becomes vital to create a new proposal that not only follows the principles of

cooperation, peaceful use of outer space and *non-appropriation* stated in the Outer Space Treaty but creates a solution to the conflict that rose with the concept of *Common Heritage of Humanity* in the Moon Treaty that lead many nations to refuse to sign it.

2019: Who are the Key players in Space?

July 2019 marks the 50th anniversary of the first man on the Moon. 50 years later technology has changed and the 21th century *space race* is no longer only comprised of the US and Russia. As time has changed the situation in space and the players expanded beyond nation States and it is necessary to understand the current situation in space in order to prove that the topic of this dissertation should be held with the upmost importance. Examples of some of the current players that wish to reach the Moon in the next coming years will be shown below:

United States: 50 years have passed since the last space mission that allowed men on the Moon. However, the country has not stopped looking into space potentials. Under the Obama administration the US Commercial Space Launch Competitiveness Act (US Congress 2015) was created. First and foremost, the bill safeguards private spaceflight from regulatory oversight, giving the industry up to 8 years to improve technology before government (the Federal Aviation Authority) overseers step in if they deem necessary (Stockton 2015). But more interesting, the bill allows US exploiters the right to ownership, keeping, using, selling and distributing the resources of outer space as they deem fit. In order to obtain this, benefit the US require the company who exploits to have a permanent base and nationality in the country.

Along with this piece of legislation NASA had plans to begin lunar exploration by 2028. However, the Trump administration ordered NASA to change this date to 2024. By 2024 the United States is set to not only return to the Moon, send the first female astronaut but also begin lunar exploration for possible resources on the Moon. This statement was confirmed in the 62nd meeting of the Committee on the Peaceful Uses of Outer Space by the Executive Secretary of the United States Space Program Mr. Scott Pace. During his interventions in the committee he confirmed President Trump's statements and showcased partnerships with the Japanese space agency JAXA in order to ensure the creation of the Gateway Lunar Orbital Station (Gateway Foundation 2019). This Lunar Orbital Platform is a potential space station in lunar orbit

envisioned to serve as a solar-powered hub for communication science laboratory and short-term habitation module. This Orbital Platform is a partnership with the following nations: Canada, Japan, the Russian Federation, and eleven Member States of the European Space Agency (Belgium, Denmark, France, Germany, Italy, The Netherlands, Norway, Spain, Sweden, Switzerland and the United Kingdom) (Gateway Foundation 2019). Which shows that space participation has grown since 1969.

Russia: Russia and former predecessor have always been pioneers in space exploration ever since the first successful lunar mission in 1959. That interest in exploration has been maintained and currently the Russia's state space corporation, Roscosmos, has announced the plan to send astronauts to the Moon by 2030. The plan further talks about a "Federation" spacecraft[16] that will be built by 2022 and have the first test flight to the International Space Station (ISS) completed by 2023. Roscosmos will move ahead to conduct deep-space flights of the craft by mid-2020s, followed by collecting a lunar regolith sample to Earth in 2027. It plans to send manned flights to the lunar orbit by 2029. Man landing mission by 2030 and finally the construction of a lunar base for exploration of the Moon along with the potential resources by 2040 (Computing 2019). This information was acknowledged by the delegation of the Russian Federation in the 62nd meeting of the Committee on the Peaceful Uses of Outer Space. Additionally, there was a reference to the Gateway project, its advanced and ultimately the delegation calls for the creation of a legally binding instrument that protects the three principles of *cooperation, peaceful use of outer space* and *non-appropriation of outer space.*

China: In the first semester of 2019, the Chinese effectively landed the un-crewed Chang'e-4 on the Moon and have also placed astronauts aboard two temporary space stations, Tiangong-1 and Tiangong-2. “Their space agency also plans to put a larger, more permanent station into orbit in the coming years. The first parts of that permanent station will reach orbit aboard the country's new Long March 5B rocket in the first half of 2020. Chang'e-5, an un-crewed lunar lander originally scheduled for launch in 2017, will attempt to reach the Moon and return with samples in 2019” (Letzer 2019; WebIt 2019). This with the goal to extract He-3 from the Moon (Bhaskar 2017).

[16] The Federation Spacecraft is a project by the Russian Space Agency, Roscosmos to develop a new-generation, partially reusable piloted spacecraft.

Japan: Japan´s space exploration began in the University of Tokyo in the 1950´s. Recently, September 2018, the Japan Aerospace Exploration Agency (JAXA) placed a spacecraft Hayabusa2 in orbit around the asteroid Ryugu while placing two small rovers to the surface of the asteroid (Swiss Confederation 2019). Additionally, in July 2019, Toyota and the Japan Aerospace Exploration Agency just signed a three-year agreement to jointly "develop a pressurized lunar rover, which will incorporate fuel-cell electric-vehicle technologies" (Hopper 2018; Wall 2019)

If all goes according to plan, Toyota and JAXA will build a full-scale prototype by 2022, test the flight model around 2027, and ultimately launch would follow in 2029. As stated by representatives of JAXA and Toyota the rover will be used for missions to explore the Moon's polar regions, with the aim both of investigating the possibility of using the Moon's resources and analyse the necessary technology needed to exploit it (Wall 2019).

Additionally, Japan is working parallelly with NASA in order to advance on the Gateway Project that aims to create the first lunar orbital object.

India: India is also aiming for a great lunar success. India´s Chandrayaan-1 mission, failed as the spacecraft crashed as soon as arriving on the Moon yet it spotted evidence of resources. Chandrayaan-2, which launched July 22 will attempt to place the lunar spacecraft which model is the lander and rover down on the lunar surface to begin exploration of natural resources. It is worth noting that to date, only the USSR/Russia, the United States and China have achieved a soft-landing on the Moon so if this mission is successful it will be a great historical event (Wall 2019).

Additionally, the Indian Space Research Organisation is working towards the creation of Chandrayaan-3, a possible joint effort with Japan Aerospace Exploration Agency (JAXA) that may send a lunar spacecraft which model is the lander and a rover to a lunar pole in 2024. K. Sivan, Chairman of the India Space Research Organisation stated that the country will push towards Chandrayaan-3 while developing other projects for outer space (Bhaskar 2017;Wall 2019).

Luxemburg: In the 1980s Luxembourg became a leader in the satellite communications industry and is again looking to expand its horizon into outer space. In 2016 Luxembourg created the Space Resources initiative (2016) which guarantees a secure exploration of

resources in outer space while serving a peaceful purpose and protecting property rights. Additionally, it assigned USD $223 million of its national space budget to provide early-stage funding and grants to companies working toward space mining (Zaleski 2018).

In 2017 it became the first European country to pass a law which gives ownership of resources extracted from space to the extracting companies. This is similar to the US Commercial Space Launch Competitiveness Act explained above, the US law only applies to companies and individuals that are considered citizens of the country whereas the Luxembourg law applies to any company that legally has a registered address in the Kingdom (US Congress 2015; Government of Luxemburg 2017). This flexibility led countries like Japan, Portugal and the UAE to enter into five-year agreements with Luxemburg relating space mining (Space Resources 2017; Donoghue 2018; Ahmed 2019).

Private Companies: As previously mentioned space exploration is not only contained within the national space agencies. During the past years there has been a great increase of privately-owned companies searching to develop missions in outer space and specifically for the topic of lunar mining.

Technological innovations brought by individuals like Elon Musk[17] and Jeff Bezos[18] show the changing scenario of space exploration and exploitation. Start-ups such as Planetary Resources, Deep Space Industries, Ispace, and Kleos Space are aiming to create human and robotic missions to asteroids and the Moon. This is being done with alliances with NASA and Japan Aerospace Exploration Agency (JAXA) (David 2018; Corbyn 2018).

The company Planetary Resources is creating a mechanism to bring back to earth the energy sources found in space in order to fuel the decreasing energy sources on Earth (Klotz 2012; Mission 2016; Ahmed 2019).

---

[17] Is the founder, CEO, and lead designer of SpaceX, an American aerospace company focused on manufacturing and space transportation services and CEO of Tesla Motor.

[18] American technology entrepreneur and investor, founder and CEO of Amazon.com and owner of *The Washington Post*.

It is important to note the importance the impact that the Kingdom of Luxemburg is having on private owned corporation. As companies such as Deep Space Industries and Planetary Resources are already working in alliance with Luxembourg's government. CEO of Deep Space Industries reported that the government had contributed a large amount of research and development funding. Whereas Planetary Resources stated that in 2016 the government of Luxemburg investment a total of USD $28 million in investment that led to obtain the government to obtain an undisclosed equity stake[19] in the company (Zaleski 2018).

Plans to exploit outer space and specifically lunar mining are on the works and this is a situation that is shown in the examples above. However, the legal and regulatory aspects that encompass lunar mining are currently vague and there is no clear way to determine the ownership of the resources that are exploited.

The main issue lies within the *principle of non-appropriation of outer space*. This as not having a clear and direct rule as to the property and distribution of natural resources in this case He-3 has given the opportunity to many nations and companies to create their own interpretation. This is clear with the creation of the laws in the United States and Luxemburg states that all resources obtained from natural resources belong to those nationals that exploited them. This has led to private companies to move from one nation to the next in order to guarantee the protection of not only the resources, but the profits obtained.

Even though cost and scientific progress are considerable draw backs for lunar mining to become cost-effectively and scientifically feasible, the most pressing of them all is the legality of the actions. Understanding the issue and the extend of ownership of resources found on the Moon such as He-3 becomes pertinent when history has thought us the great extent which nations are willing to go to protect their own interest and those of their citizens. This is especially true when the possibility of earning high profits extend outside the Earth's boundaries.

[19] This means the percentage of the company's shares that a start-up is willing to sell to investors for a specific amount of money (Business Dictionary n.d.).

PART III. COMPARABLE SITUATIONS

The creation of a regime for exploration is necessary before actual exploration and exploitation of resources begins in outer space and for this case the Moon. Being this so, it is vital to understand the lessons that the high seas and Antarctica have thought humanity. Even though the high seas and Antarctica are terrestrial areas they have a lot in common with the Moon. The Moon, Antarctica and the high seas are environments with very harsh conditions that makes extraction of resources very difficult. Additionally, no claims of sovereignty over the Moon, the Antarctica or the high seas can be made, therefore validating the *principle of non-appropriation* of the areas. All three are areas with a vast variety of resources which calls into question the possibility of extraction and claims of property over the extracted resources. It is worth noting that in the high seas and Antarctica the debate over sovereignty, extraction and property of the resources were resolved in drastically different ways. Thus, these examples will show the arguments presented to create the current framework and the conclusions reached so they might be applied in order to propose a solution for the issues within lunar mining (Frakes 2003).

The Law of the Sea

The two modern treaties related to maritime issues that have relevance to the discussion of property rights of He-3 found on the Moon are the: (i) 1958 Geneva Convention on the High Seas; and (iii) the Third United Nations Convention on the Law of the Sea (UNCLOS III).

1958 Geneva Convention on the High Seas

The 1958 Geneva Convention of the High Seas was the first declaration of States on the rights of the high seas made right after World War II. This treaty voiced the rights of the water beyond those of the territorial seas and con contiguous zones. It codified the freedoms of navigation, fishing and overflight in areas beyond the territorial water (Geneva Convention on the High Seas 1958). With the codification of international waters, it was the first declaration that stated that the high seas are *res communis.*

Although this treaty did not enumerate the guidelines for mining as this was a concept that was not contemplated at the time it is the basis for international law of the sea. In view of that it can be said that much like the Outer Space Treaty the time in which this treaty was written did not

call for the creation of a natural resource mining regime. Yet the impact this treaty has on outer space is that it is the predecessor to the Outer Space Treaty which is the first time that outer space is set to be *res communis* therefore belongs to all and it is to be used the benefit of humanity.

Much like concept of regulating the exploitation of natural resources in the high seas did not seem like an issue at the time it was not an issue when the drafters of the Outer Space Treaty sat down to produce the document. When the issue became a reality, a new regulation was created hence the Third United Nations Convention on the Law of the Sea.

Third United Nations Convention on the Law of the Sea UNCLOS III

UNCLOS III of 1982 creates a legal regime for the oceans and seas of the world. It is the product of more than 14 years of work and 150 participatory nations. This great amount of countries working together shows the necessity of regulating the waters (UNCLOS III Overview 2009).

Mineral-rich nodules had been found on the seabed; an area located beyond the limits of national jurisdiction (Raclin 1986). Therefore, the biggest debate was who should benefit from these resources. One of the main creations of this UNCLOS III was the creation of the International Seabed Authority (ISA) which has the role to give licenses and regulate mineral exploration of the seabed. ISA is made up by the nation's signatories to UNCLOS III. It had decision making power and these were made one a one nation, one vote basis (Heim 1990).

UNCLOS III created its own intergovernmental company called the *Enterprise* which was set to compete with the private companies that were authorized to mine by the International Seabed Authority. This allowed the creation of a parallel system that provided incentives to those nations that would exploit and guarantee an equitable share of those resources obtained to developing countries[20]. In addition, UNCLOS III generated a system for regulation of the deep

[20] There is no definition under UNCLOS III as to what constitutes a developing country. Yet scholars such as Barbara Heim that states that in the time UNCLOS III was created it contemplated developing countries are those included in the *Group of 77.* The Group of 77 (G77) at the United Nations was created in 1963 as a coalition of

seabed. Yet there was never consensus on this topic because there was never an agreement between nations. This point of conflict was the portrayal of the concept that the seabed is to be considered as *Common Heritage of Humanity*.

Just like the Moon Treaty, UNCLOS III brings the concept that the seabed is *Common Heritage for Humanity* and therefore it is not subject to appropriation, it should have common administration and that all benefits should be assigned to humankind as a whole. Which means that the benefits should be shared for the profit of humanity (Buxton 2004).

Although there is no single definition of the concept of *Common Heritage for Humanity* most definitions contain the following elements. Therefore, the seabed is *Common Heritage for Humanity* because it includes.

i. *Non-Appropriation:* This means the nations cannot claim sovereignty to the deep seabed.
ii. *Common Administration*

In order to administer the deep seabed, UNCLOS III created the International Seabed the Authority. International Seabed Authority, functions through the United Nations , and has the authority to legalize and regulate the exploitation of minerals from the seabed. This power is limited to the deep seabed and its subsoil but does not include territorial waters (Rana 1994).

A system of "parallel access" was created in UNCLOS III. This means that public or private entities wishing to exploit natural resources from the deep seabed must undergo a process with ISA in order to comply with the CHH principle. Any action taken by the entity wishing to extract will be governed directly by the ISA, or by a private or public entity that authorized by ISA (Rana 1994; UNCLOS III 1982).

All disputes must go through a dispute resolution created by UNCLOS III to solve issues relating to application or interpretation of the treaty. Parties are able to choose different

77 countries to promote its members' collective economic interests and create an enhanced joint negotiating capacity in the United Nations. G77 currently has 134 member countries.

methods of dispute resolution, such as the International Court of Justice, the International Tribunal for the Law of the Sea or a general or specialized arbitral tribunal (Frakes 2003).

iii. Benefit Sharing and CHH principle

The concept of sharing benefits is the most debatable topic in UNCLOS III. The International Seabed Authority governs the process required in order to be authorized to mine in the seabed. In view of the above the entity that wishes to exploit resources must submit applications which shows two feasible mining sites and pay a fee of USD $500,000. It is then that International Seabed Authority grants the applicant use of one site, and reserves the other, already researched site, for a qualified non seafaring applicant or for itself. This means that the original applicant is sharing its preliminary research with a less capable nation. Once the area was granted the applicant must pay an annual fixed fee of not less than USD $1,000,000 (UNCLOS III 1982).

Once this is done the original applicant must share with ISA and other nations any specialized technology used in its project at reasonable rates. With this transfer of technology, the non-seafaring nations were ensured to have access to mining; yet this was to last only 10 years once the entity begins extraction of resources. Therefore, giving these nations enough time to build up their own enterprise and begin to mine the seabed (UNCLOS III 1982).

Debates on the CHH principle and the 1994 amendments

It is worth noting that nations such as the US were concerned with the treaty. This as UNCLOS III seemed to create a big economic and technological burden on the seafaring nation. They thought that non seafaring nations would not have an immense contribution on the exploitation process but would immediately benefit from the efforts of others. Thus, reducing the incentives of seafaring nations to mine on the seabed. They stated that International Seabed Authority discourages private companies from seeking licenses, denies access and creates a monopoly. They estimated that it would take have taken 10 years and an estimate of USD $1.5 billion to start the seabed mining industry and with the regulation it was not going to happen unless International Seabed Authority could have guaranteed profits and mining sites (DeSaussure 1992; Buxton 2004).

In view of the above the United States refused to sign UNCLOS III and created a tension between nations. In response to this situation, in 1994, the UN opened UNCLOS III for modifications in order to resolve these issues to encourage more nations to sign. This

convention which altered the decision-making process, financial requirements, and other points of contention from the original 1982 requirements (Epps 1998).

The United Nations searched for a free-market perspective, thereby attracting countries like the US. The structure of International Seabed Authority remains the same, but other decision-making instruments of UNCLOS III have been changed. Additionally, it lifted the production limits, changes the funding of the Enterprise and opens up for an open-market regime. It acknowledged the claims to the mining areas that the United Stated had made in the past and it guaranteed the US seat on ISA even though they did not sign the original UNCLOS III. The US signed the agreement and recognizes the agreement as customary law, yet it has not ratified it with congress (Coffrey 2008).

It is worth mentioning that the Moon Treaty resembles the experience of UNCLOS III with the concept of *Common Heritage of Humanity*. This caused nations to refuse to sign it. It uses language very similar to UNCLOS III stating that the natural resources of the Moon are *Common Heritage of Humanity* and calls for the creation of a regulatory authority to administer the resources. This is one of the biggest differences with UNCLOS III, the provision exists yet in case that He-3 is exploited in the Moon there is no way to administer these resources.

Similarities and differences with outer space

The regulations created for outer space and the high seas can be interrelated. Therefore, the following are some similarities and differences between them:

First no sovereignty claims can be made on both outer space and the high seas. This will mean that specifically the resources are not subject to be appropriated by anyone.

Secondly and perhaps the most controversial topic in both the high seas and outer space is the concept of the inclusion that resources obtained in the areas are *Common Heritage of Humanity*. It is worth noting that in 1958 with the Geneva Convention on the Law of the Sea and in 1967 with Outer Space Treaty both the high seas and outer space were considered *res communis.* This ultimately means that the areas are free to use as long as they do not impede the legal rights of others (Holmila 2005).

It was not until the Moon Treaty and UNCLOS III that the concept of *Common Heritage of Humanity* was portrayed. This caused a problem within nations and led to low signatories in both treaties. The main legal problem that is created here is the fact that the treaty alone cannot create obligations. In the specific case of the Moon Treaty it means that even though the concept of *Common Heritage of Humanity* is stated inside the treaty it does not bind non-signatories. This means that those States that are not parties to the treaty might object the regime and assert national sovereignty and private ownership of resources such as He-3. An example of this might be the international regulations currently in force in the United States and Luxemburg. It is vital to remember that these regulations state that all resources exploited in space are private property of their citizens. This would ultimately mean the rejection of the concept of *Common Heritage for Humanity.* Even if this concept of *Common Heritage for Humanity* only has an impact on the signing parties, the effect the current regulation is currently having will not only affect the signing parties but will ultimately have an effect con *humanity* (Holmila 2005).

Thirdly, a great difference in order to be able to share the benefits of the resources produced with the mining it is vital to separate the areas from the resources. In the high seas this means that both the high seas and the sea bed are legally separated from the resources that are contained within. They *must* be considered as different domains otherwise the legal tittle of the resources would not be able to be transferred to other and any prospect of exploitation of resources would be superseded. This concept has been taken into account in the high seas since 1958 with the first regulation of the law of the sea and it was then transferred with UNCLOS III. The drafters of the Outer Space Treaty failed to do this. It states that the Moon is not to be appropriated and all benefits derived from there are to be shared with humanity. Yet, there is no clear legal separation or distinction between the non-appropriation of resources obtained in the Moon and the actual lunar terrain. This issue was not clarified with the Moon Treaty. Hence making outer space regulation ambiguous and imprecise (Holmila 2005).

Seabed mining shows that in order to obtain regulation that benefits all nations long negotiations will have to be done. This was a 14-year process which showed the will of nations to cooperate in the creation of a regulation resource extraction in the seabed, but it is possible. Even though the perspective and goals of nations may vary there is one common goal which is a fair regulation. This proves that a new regulation for space exploration can happen. It has to be said that reaching an agreement for lunar mining will not be easy and therefore this issue

should be tackled as soon as possible and a new framework needs to be established before lunar mining begin.

The Antarctic Treaty

International law regarding mining in the Antarctica shows potential issues that may arise when the new framework for lunar mining is created. This area much like the Moon is an area with a harsh environment that makes mining much more difficult, it is an area that has a great protentional of resources and currently no sovereign claims can be made over it. However, this has not always been the case, as Argentina, Australia, Chile, France, New Zealand, Norway and the United Kingdom had made claims of sovereignty over the area (Epps 1998). Something that has never happened in outer space and specifically the Moon.

Therefore, in 1959 the Antarctic Treaty was created with the main purpose to clarify the sovereignty claims over the area. It is vital to note that the Antarctic Treaty was never meant to be the sole document governing Antarctica. Issues such as resource management and environmental protection are not addressed by it, but they are encompassed in various treaties compromising the Antarctic Treaty System. The Antarctic System includes the following agreements: (i) the Antarctic Treaty and its following Recommendations; (ii) the 1972 Convention for the Conservation of Antarctic Seals; (iii) the 1980 Convention on the Conservation of Antarctic Marine Living Resources; (iv) the 1988 Convention on the Regulation of Antarctic Mineral Resources Activities; and (v) the 1991 Protocol on Environmental Protection to the Antarctic Treaty (Rothwell 1996; Frakes 2003).

Sovereignty disputes in Antarctica

The creation of the 1959 Antarctic Treaty was done in order to prevent future claims of sovereignty over the area and resolve the issues with the past claims (Antarctic Treaty 1959).

Peaceful Purposes

As a predecessor to the Outer Space Treaty the Antarctic Treaty addresses the demilitarization of the Antarctica and states that it should only be used for peaceful purposes (Antarctic Treaty 1959). Therefore, acknowledging before the creation of the Outer Space Treaty the principle of peaceful use of the area.

Freedom for scientific research

The Antarctic Region guarantees a freedom of use for scientific investigation. Much like in Outer Space and specifically the Moon nations must cooperate to keep up the goal of open research.

Common Heritage of Humanity in Antarctica

In the Antarctic Treaty there is a reference to “the interest” of humankind. Yet there is no direct article that refers to resource exploitation (Joyner 1998). It refers to the interest of all humanity, but the parties to the treaty have reserved to themselves the right to govern Antarctic affairs, "in effect excluding nations that may have an interest in the region but lack the wherewithal to mount major expeditions." (Antarctic Treaty 1958). There has been a great amount of conflict over the status of the Antarctica region that prevent common state practice on resource extraction. This due to the fact that there is no concrete opinion over weather Antarctica is res nullius or *Common Heritage of Humanity* (Tronchetti 2015).

In view of the above scholars such as Frakes express that the Antarctic Treaty implements the concept of *Common Heritage of Humanity* without expressly stating it in the treaty. As was mentioned before the concept of *Common Heritage of Humanity* does not have a single definition but must meet five elements: (i) non-appropriation; (ii) peaceful use of the area; (iii) benefit sharing; (iv) common management; and (v) preservation for future generations (Frakes 2003).

Just like in Outer Space and specifically the Moon, under the Antarctic Treaty the region of Antarctica meets the elements of non-appropriation and peaceful use of the area as they are expressly stated. Moreover, the research sharing requirements can present a form of shared benefits. Finally, as for the benefit of future generations, the treaty delivers environmental conservation measures. So, the concept of *Common Heritage of Humanity* already influences governance of the Antarctic, even though it is not expressly stated.

During the 1980s concerns about Antarctic Treaty were created because countries like France opposed it; they felt that there was no adequate protection of the Antarctic environment. Even

though the Antarctic Treaty promoted research conserving a minimum amount of environmental damage it did not address the issue of mining. Therefore, the needed creation of the Convention of the Regulation of Antarctic Mineral Resource Activities (CRAMRA) in 1988 (Heim 1990). This treaty allowed resource mining while protecting the environment. It did not contain a code but regulated activities and created fees that would be used for the maintenance of the Antarctic.

Convention of the Regulation of Antarctic Mineral Resource Activities was modified three years later by the Antarctic Protocol. This due to the fact that even though it had strict environmental protections Australia and France refused to ratify the treaty because they believed that no mining should be done at all. With the modification and creation of the Antarctic Protocol it gave Antarctica a status of natural reserve and only allowed resource mining for scientific research. It bans mining for commercial purposes, and this cannot be reviewed until 2048 (Frakes 2003; Coffrey 2008).

The situation that occurred with the Antarctic should be taken into account when analysing lunar mining. The Convention of the Regulation of Antarctic Mineral Resource Activities took seven years to be finalized and then it was ineffective only three years later. This means that creating the correct mining regulation on the Moon will take a very long time and an adaptation to the lunar mining goals that will progress with time requiring changes when necessary.

It is important to note that just as Antarctica the Moon possesses a fragile environment that even if very different requires the upmost environmental protection. Therefore, when creating the framework for lunar mining it is key to always keep in mind that the stability of the environment of the Moon must come before the extraction of resources. This is an important lesson that must be taken from the Antarctic Treaty.

Even though it is prohibited to mine in the Antarctic it does not mean that it should be stopped in the Moon. A great commercial quantity of renewable resources has been found in the Moon. These resources are said to be very valuable and will help with the creation of new clean energy sources on Earth. Yet commercial exploitation should not be the only focus of the new legal framework for the Moon. Being this so, before the start of lunar mining missions a framework needs to be created taking into account the protection of the environment just as set by regulations of Antarctica.

PART IV. ANALYSIS

"*One small step for man, one giant leap for mankind*" the words spoken by astronaut Neil Armstrong still mark humanity today. Only 50 years have passed since humanity began to leave a footprint on the Moon allowing it to have a common share in exploration in space and the space law instruments stated above support this statement.

With further technological advances growing every day the possibility for mining He-3 on the Moon seems to be fast approaching. Nonetheless, the current space regulation is generally ambiguous, imprecise with little state practice which has led to great controversy in matters like the obligation to share fruits of ventures in space and the legal tittle to the extracted resources (Smith 1988).

Humanity has always reached beyond the territorial limits to find and ultimately use resources. Regulations for matters like the high seas and Antarctica are an example that consensus can be reached even if there is not a complete agreement on the subject. The high seas and Antarctica, even though not perfect, shows a prototype for the solutions of the lunar problems. It shows a possible solution for the obligation to share the fruits of ventures in space and the legal tittle from extracted resources. In view of the above the following section will focus on (i) the solutions given by the Law of the Sea and the Antarctic Treaty to the problems of *Common Heritage of Humanity* and legal title of the resources. Then it will be analyse how these elements can be used for the creation of the framework for lunar mining; (ii) Following the above it will analyse international customary law; and (iii) finally, the section will then move on to show the analysis of property rights of natural resources found on the Moon specifically He-3 and closing remarks on the matter.

Lessons from the High Seas and Antarctica

When analysing the high seas, Antarctica and outer space it is vital to understand that these are areas designated to be used for the benefit of humanity. In this sense the designating the areas as *res communis* and then , transformed by posterior treaties, *Common Heritage of Humanity* was a way the drafters protected the areas from national sovereignty. The concept of *Common Heritage of Humanity* is one that as seen in both the Moon Treaty and UNCLOS III caused a great problem between nations creating very low approval and implementation rates.

This analysis will then seek to establish the elements that make up *Common Heritage of Humanity* and complement the regulation in Outer Space while acknowledging the successes in the high seas and Antarctica.

Res Communis

First and foremost, it is vital to understand the concept of *res communis* that was firstly implemented in the 1958 Geneva Convention on the Law of the Sea and the Outer Space Treaty. Firstly, high seas were *res communis*, which meant common possession. Common possession should not be understood as ownership. It means that States as well as individuals have the right to use *res communis* freely as long as it does not obstruct the same rights of others (Holmila 2005). This part was then translated to the Outer Space Treaty which made the outer space, the Moon and other celestial bodies a common possession of humanity. The difference between outer space and the high seas in relation to *res communis* is that the 1958 Geneva Convention on the Law of the Sea shows how limited property rights may coexist with liberties in a *res communis* area. Article 2[21] gives the right to fish in international waters, therefore allowing the fisherman property over their catch. The above recognizes that there is a right to fish the high seas which indicates two types of property: (i) a limited right in the uncaught fish; and (ii) a property over the fish once caught. The above shows that there is a separation between the appropriation of the area and that resources located in *res communis* areas. This means that a nation could not appropriate the high sea but could use the resources found within (Eckert 1979).

[21] ***Article 2:*** *"The high seas being open to all nations, no State may validly purport to subject any part of them to its sovereignty. Freedom of the high seas is exercised under the conditions laid down by these articles and by the other rules of international law. It comprises, inter alia, both for coastal and non-coastal States:*

(1) Freedom of navigation;

(2) Freedom of fishing;

(3) Freedom to lay submarine cables and pipelines;

(4) Freedom to fly over the high seas.

These freedoms, and others which are recognized by the general principles of international law, shall be exercised by all States with reasonable regard to the interests of other States in their exercise of the freedom of the high seas." (LOS Convention 1958).

Looking in detail at the Outer Space Treaty, Article I created controversy in the manner of how benefits from space exploration would be distributed among nations (COUPUS 1966). Nations like former USSR felt that benefits should be limited to information or results of scientific investigation. Whereas nations like the former United Arab Republic stated that all the useful benefits of space should be equitably distributed, even with those nations that did not hold a participatory role in the exploratory process. Ultimately this was a discussion of weather States should be treated as equals or just have the same equal opportunity access to space. Hence, drafters decided to establish the principle of freedom of use (COUPUS 1966). It ultimately guaranteed exploitation granting right to use outer space, but it is worth noting that this happened 50 years ago, and the discussion focused potential benefits derived from satellites rather than the issue of natural resource extraction (Johnson 2006).

In this era the focus of Article II had shifted into a restriction on the right to use space and non-appropriation of the same. Delegations such as the one from Belgium claimed that Article II had the purpose of not only prohibiting sovereignty on outer space but prohibited any claim of private property under private law (COUPUS 1966). Not all delegations agreed with the above, the delegation of France stated that definition of non-appropriation failed to noticeably ascertain which activities would fall under the term *use* and that the provision should be open to further textual improvements. This delegate also stated that it was impossible to predict how technology would advance in reference to extraction of lunar resources and warned that it was too premature to create regulation for such activity. Therefore, the delegations should avoid attempting to regulate future technologies in the since they did not have the understanding of the concept of the technological advance (COPUOS 1966).

The Soviet representative stated that international law should focus on realities rather than possibilities in a very distant future (COPUOS 1966). He was correct at that time, since only a few years before the 1958 High Seas convention did not aim to regulate oil rigs because they were not that advanced. It was not until 1982 that the technology advanced and regulation was necessary (Johnson 2006; Eckert 1974). Gangale (2013) states that “anticipatory law-making” is unsuitable in areas involving complex technologies because the drafters must rely on assumptions about the future rather than actual precedent in the field, which may lead to the elaboration of legal norms that lack practical effect. Following this idea, it is worth noting that this Outer Space Treaty only regulates the realities of that time but did not aim to regulate the possibility of what was then a distant future.

Being this so, even if the Outer Space Treaty only aimed to regulate the reality the distinction between the *res communis* area and resources within could have been made. The 1958 Convention comes to show that in 1967 when the Outer Space Treaty was created international law allowed the distinction (Johnson 2010). Therefore, it seems that the drafters of the Outer Space Treaty could have considered the differences between a *res communis* land and its movable natural resources, yet this exact distinction is not in place. However, in order to make legal sense of the provisions stated in Article I and II, one has to make said distinction. Just as the high seas and the seabed are separated from its resources, that it to say, that they are considered as different domains the same has to be done in Moon. This lack of clarity in the Outer Space Treaty is one of the reasons a new framework is necessary. More than 50 years have passed and there is no regulation as to the property of resources such as He-3 in the Moon.

Common Heritage for Humanity

The concept of *res communis* shifted to the concept of *Common Heritage for Humanity* with the 1979 Moon Treaty and the 1982 UNCLOS III. These new treaties focused on the extraction of natural resources in their respective areas, the Moon and other celestial bodies and the high seas specifically the sea bed.

As previously mentioned there is not one single definition of the concept of *Common Heritage for Humanity.* However, there is an acceptance in international community that it means "ownership by all and non-appropriation by any" (Ballah 1982). It is also worth noting that just like there is no universal definition the application of this concept must be applied differently depending on the case. Baring these things in mind, it would not be useful to come up with one single definition of the concept (Holmila 2005). Even though a single definition is not possible it is vital to understand what the Moon Treaty, UNCLOS III and the Antarctic Treaty have in common. Thus, the following will consider the elements of the concept of *Common Heritage of Humanity* that were accepted and should be considered when creating a new regulation for exploitation of natural resources on the Moon.

As presented before the elements that should be considered when analysing the concept of *Common Heritage of Humanity* are*:* (i) non-appropriation; (ii) peaceful use of the area; (iii) benefit sharing; (iv) common management; and (v) preservation for future generations (Frakes 2003).

For this analysis the focus will be on the elements of: *:* (i) non-appropriation; (ii) peaceful use of the area; (iii) benefit sharing; and (iv) common management.

Non appropriation:

The *principle of non-appropriation* is perhaps one of the key elements in the regulations of the sea, outer space and Antarctica. The first thing that should be analysed in this element is the inadmissibility and unrecognizability of sovereign claims made in these areas. This is especially true in the sea bed and the Moon. Its importance lies in the fact that the position of the concept of the *Common Heritage of Humanity* would not be maintained if this were not true.

It is important to note that there is an exception to this rule and that is the case of Antarctica. The 1959 Antarctic Treaty does not annul existing claims but freezes them (Holmila 2005). However, it established that it will not allow claims of sovereignty and jurisdiction in the future.

The *principle of non-appropriation* does not prohibit exploitation to the area. In UNCLOS III this principle is the differentiation from the 1958 Geneva convention on the Law of the Seas. This as UNCLOS III grants states the right to exploit natural resources in the sea bed. The *principle of non-appropriation* refers to the facilitation of exploration of the seabed and property of the resources as they are subject to international control by the International Seabed Authority. Additionally, this exploration has to be in accordance with the rest of the treaty.

This differentiation is not made in the Moon Treaty. The Moon Treaty states that neither the Moon's surface, subsurface and resources are subject to appropriation. However, it can be seen from UNCLOS III that the separation between the sea bed and the resources is vital. Because just as it is acknowledged by Professor Taylor non-appropriation of the sea bed does not mean that the resources cannot be owned. As one does not exclude the other it means that the sea bed can be used without appropriation. Therefore, when creating the new regulation for extraction of natural resources in the Moon the separation made in UNCLOS III should be taken as a prototype.

Common Management:

In order to understand the element of common management one must take into account its direct connection to the *principle of cooperation.* The *principle of cooperation* is not only the basis for space law but also a principle of great importance in the high seas and the purpose of the United Nations (Charter of the United Nations 1948). This obligation to cooperate is behind the regulations of Outer Space, the Sea and Antarctica. It is consecrated in the preambles of both the Outer Space Treaty, the Moon Treaty, UNCLOS III 1982 and the Antarctic Treaty.

The above comes to show that international cooperation is crucial in the common management of areas that are subject to *Common Heritage of Humanity*. The common management system in outer space is mentioned but non-existent. The concept of common management was introduced in the Moon Treaty of 1979 under Article 11 (b) where it calls for a creation of an international regime that must include "(b) The rational management of those resources". It later on refers to Article 18[22] which sets a timeline of 10 years so the international community may come together to form the international regime that will regulate the extraction of natural resources in outer space. It is 30 years after the time the international community should have come together. There is still no regime to regulate resources and specifically no mention as to how the resources should be managed in the rest of the Moon Treaty or the Outer Space Treaty.

In view of the above it is vital to take into account the development of the regime that regulates the seabed. First and foremost, it is important to recognize the creation of the International Seabed Authority which has the role to "organize and control activities in the Area[23], particularly with a view to administering the resources of the Area" (UNCLOS III 1982). The International Seabed Authority is automatically composed of all member countries of UNCLOS III. This authority consists of a plenary body, an executive body, an administrative

[22] ***Article 18****: "Ten years after the entry into force of this Agreement, the question of the review of the Agreement shall be included in the provisional agenda of the General Assembly of the United Nations in order to consider, in the light of past application of the Agreement, whether it requires revision. However, at any time after the Agreement has been in force for five years, the Secretary-General of the United Nations, as depositary, shall, at the request of one third of the States Parties to the Agreement and with the concurrence of the majority of the States Parties, convene a conference of the States Parties to review this Agreement. A review conference shall also consider the question of the implementation of the provisions of article 11, paragraph 5, on the basis of the principle referred to in paragraph 1 of that article and taking into account in particular any relevant technological developments" (Moon Treaty 1969.*

[23] The word "Area" makes reference to the deep sea bed.

body and the Enterprise. As mentioned before the Enterprise is a commercial entity part of the International Sea Bed Authority which was meant to enter into mining activities in the seabed in the name of humanity (UNCLOS III 1982).

The second point that is important to mention is that the powers of the International Seabed Authority have been accepted and set out in the treaty. It is an organization with legal personality meaning it can act on its own. It is this authority who after careful consideration can decide who can conduct mining activities. Hence making the common management element of the concept of *Common Heritage of Humanity* very powerful and effective.

It is worth noting that the International Seabed Authority is not perfect and had to adapt to the different political situations that were presented. An example is the fact that the United States refused to sign the 1982 UNCLOS III which led to further negotiations and in 1994 agreed to the amendment[24]. This shows that the organization needs to be flexible to the upcoming challenges it may face and willing to work in cooperation with nations to make the mining activities possible.

UNCLOS III is a clear example that the common management element can be created in the Moon. It is possible to create a common system that not only benefits the interest of States and private parties but also humanity. A common management initiative needs to be created if He-3 is to be shared with all of humanity and this issue that should be treated carefully. In 1979 the drafters of the Moon Treaty understood this and left it open to future generations to provide a solution. The law of the sea proves that the creation of an authority it possible and that the parties need to be flexible to the upcoming challenges it may face in order to adapt to not only protect the resources but the interest of humanity. The system created in the seabed can be used

[24] The main disagreements the United States had with the role of the International Seabed Authority were: (i) The Assembly which is composed of all signatories of UNCLOS III were in charge of creating policies related to mining in the sea bed and it was created on a one member one vote basis. This was changed in 1994 and modified so that the policy created had to be done in collaboration with the Council. (ii) the Assembly decided who could be part of the executive body therefore no country had a secured seat in it. This was modified in 1994 when the United States was guaranteed a seat in the council. The Authority stated that the country with the largest GDP would be guaranteed a seat in the council. This country was the United States (UNCLOS III 1994).

as a basic *guide* for the creation of an organization to manage the resources exploited in outer space.

Peaceful purposes:

It is important to note that regimes where the concept of *Common Heritage of Humanity* applies have been limited to areas of peaceful use. This is the case the seabed, the Moon and celestial bodies and the Antarctic (Antarctic Treaty 1959; Moon Treaty 1979; UNCLOS III 1982). Therefore, making the peaceful use of the area an essential part of those areas known to be *Common Heritage of Humanity.*

Benefit sharing:

Since there is no universal definition of the concept of Common Heritage of Humanity there is no specific way as to how the benefits obtained from the extraction of natural resources should be shared. Yet, as per UNCLOS III and the Moon Treaty there should be an equitable distribution of benefits. Nevertheless, the way this should be done varies depending on the regime.

In the Law of the Sea the way the benefits should be shared are set out in Article 140 of UNCLOS III. It declares that "The activities in the Area[25] shall … be carried out for the benefit of mankind as a whole, irrespective of the geographical location of States, whether coastal or land-locked, and taking into particular consideration the interests and needs of the developing States and peoples who have not attained full independence or other self-governing status recognized by the United Nations" (emphasis added) (UNCLOS III 1982).

This means that the benefits should be carried out in favour of humanity therefore of common interest. Further to the above, Article 140 (2) of UNCLOS III " The Authority[26] shall provide for equitable sharing official and other economic benefits derived from the activities in the Area" (emphasis added) (UNCLOS III 1982). Specifically, for seabed mining the equitable

[25] As per UNCLOS III, when the word Area is mentioned is makes reference to the seabed.

[26] As per UNCLOS III, when the word Authority is mentioned is makes reference to the International Seabed Organization.

sharing of benefits constitutes *Common Heritage for Humanity*. In view of that it can be said that the core is the Authority is deciding how the division of economic benefits should be done (Holmila 2005).

As mentioned above the Moon Treaty also makes reference to "equitable sharing" yet the concept used is radically different to the one in UNCLOS III. Even though the Moon Treaty calls for the creation of the international body to govern mining in the Moon and other celestial bodies it also warrants the "equitable sharing by all State 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 exploitation of the Moon, shall be given special consideration" (emphasis added) (Moon Treaty 1979).

Hence creating two interpretations. It can mean that the benefits would be shared among the parties of the treaty. In this specific case if He-3 were to be gathered on a mission using the Moon Treaty then the benefits would be shared only among the signatory States. On the other hand, it can be interpreted that it can extend the benefits to the rest of States, not necessarily part of the treaty. In any case it is very specific whereas UNCLOS III adopts a much wider view on the matter. This as UNCLOS III guarantees protections to those States that do not have the economic capacity to mine in the seabed.

Moon and the seabed are perhaps the only areas of *Common Heritage of Humanity* where mining activities can take place, this as mining activities in Antarctica are currently banned. In the case of lunar mining under the Moon Treaty the benefits are to be shared by only a limited number of countries. Whereas UNCLOS III has 164 ratifications which would cover most of the globe (UNCLOS III).

Since there is no single definition of the concept of *Common Heritage of Humanity* it cannot be said that the application of the concept goes beyond the obligation to share benefits beyond States part of the treaty (Holmila 2005). Yet when creating the new framework for lunar mining it is worth noting that the basis of space law, the Outer Space Treaty, establishes that benefits obtained from activities in space should be shared with humanity. It takes the broad approach taken by UNCLOS III. Therefore, it up the drafters to decide if the examples taken in the

successful treaties of UNCLOS III and Outer Space Treaty should be followed for the future of lunar mining.

Dangers of International Custom

Until today there has not been a mission to mine He-3 on the Moon with either the Outer Space Treaty or the Moon Treaty. The technology for lunar mining is not yet created, therefore there are no current attempts to harvest He-3 in the Moon. There is an immense technological wall to space mining due to the lack of a system for processing rocks into valuable resources like liquid He-3 and a guaranteed method to bring He-3 back to Earth. Even if this is true, multiple States (i.e. Russia, the United States, Japan, China, India among others) have shown initiatives and set dates for multiple exploratory missions in the search of He-3. In the case a nation mines and collects He-3 with the current vague and ambiguous regulation it can create a precedent that will be hard to overturn.

This precedent will be hard to overturn as signing and ratifying an international treaty is not the only way in which binding international law may be created. International custom is the creation of a set of rules formed by the repetitive conduct of nations that act with the belief that the law requires them to act in that sense (Rosenne 1984). This means that customary international law is encompassed with two elements: " (1) consistent and general international practice by States, and (2) a subjective acceptance of the practice as law by the international community (opinio juris)" (Kindred 200).

Taking into account the above, it is vital to refer back to the hypothetical situation that there is mining in the Moon and the collection and production of He-3 as a source of energy is feasible. If there are number of States mining on the Moon it could create a reiterative practice that builds up the first element of customary international law. The second element is the subjective acceptance by the international community. To analyse this point, one must remember the biggest problem in the ambiguity of the space treaties: no clear understanding on the use and appropriation of resources and no clear representation as to how the benefits will be shared.

Being this said there are currently approved and accepted national legislations that clarify these topics (United States and Luxemburg). The goal of these legislations are to clarify those ambiguities, benefiting their States and nationals, stating that the resources mined in this specific scenario He-3, belong to the citizens (in the case of the United States and Luxemburg

) and those who possess a permanent office in the country (in the specific case of Luxemburg) (US Congress 2015; Government of Luxemburg 2017). This precedent is starting to be created first by the acceptance and implementation these laws into the national legal system of both the United States and Luxemburg. It is worth noting that more international States are beginning to acknowledge this topic as alliances under the Luxemburg law have been created between said government and nations such as Japan, India and the United Arab Emirates (Space Resources 2017; Donoghue 2018; Ahmed 2019). The actions between the mentioned nations can lead to an interpretation that the elements of said laws are correct hence creating a subjective acceptance of the law beyond the national jurisdiction of Luxemburg.

Cases of international customary international law have been seen throughout history. An example is the use and exploration of the high seas before the 1958. The practices done in the high seas before the codification were understood by States as a mandatory law. It not until 1958 that the codification of these reiterative practices was done. It is vital to say that the 1958 Geneva Convention on the Law of the Seas is the collection of practices in the high seas into a legal binding document (Holmila 2005).

The above shows an example that reiterative practices and subjective acceptance can create a binding precedent and further be converted into a treaty. In view of that it is crucial to say that if mining occurs without a proper framework designed to regulate mining of natural resources in the Moon there is a possibility that creating the framework will be hard. Once mining begins there is the possibility that actions taken without regulation might become reiterative and accepted, hence creating an international binding law. All this to say that if mining occurs without regulation then it will be even harder to regulate and discredit the reiterative practices.

Conclusions

The comparison of the regulations of outer space with the regulations of the high seas, the sea bed and Antarctica showcases the elements that space law is lacking for the extraction of natural resources. These treaties can be linked in the fact that natural resources are beyond a territorial control of nations, in order to reach them a specific technology is needed, and the explorations need to be done while always protecting the environment (Heim 1990).

In view of the analysis it can be concluded that there is no clear differentiation between the natural resources and the lunar terrain and that there is no clear mechanism to control or share

the benefits extracted. Therefore, it is tempting to ask if a lunar mission were to be sent in the search of He-3 who would have ownership of said resources?

As it was shown before, even though the Moon Treaty attempts to answer questions of property and natural resources in outer space, it had little acceptance therefore rendering it not useful. Hence, to this date the analysis of property of He-3 should be done in accordance with the Outer Space Treaty.

As we have seen there is no clear way to interpret the extent of the *principle of non-appropriation* stated in the Outer Space Treaty. An interpretation would strictly mean that the He-3 exploited is for the benefit of humanity and hence ultimately would lead to a slower development of commercial activities in space (O'Donnell 2007).

The Outer Space Treaty contains the stipulation that the benefits of extraction of natural resources should be shared with humanity (OST 1967). It it worth to restate that as per the Outer Space Treaty the Moon is *res communis,* which allows the community to use it. It specifically means that the Moon is not legally subject to ownership. Therefore, it must remain free to be used for the benefit of humanity (Van-Bogaert 1986).

The *principle of non-appropriation* stated in the Outer Space Treaty would mean that the area is not subject to national appropriation, it must be used for peaceful purposes, allows scientific research with the condition that the results must be shared, it allows exploitation of resources as long as they must be done in public interest and in line with the UN charter and international law (Joyner 1998). Therefore, if applied to the Moon there is no right to national appropriation nor private ownership of resources such as He-3. Yet this would mean that the community could appropriate the resources or authorize appropriation for collective distribution (Christol 1967; Lynn 2003). Even if this interpretation were to be deemed correct there is no way to guarantee how this common distribution will be done, who will be in charge of doing it or how would it be supervised. Hence creating a real danger to the ill distribution of resources obtained in space.

After having analysed the complementary methods of interpretation of a treaty there is no concrete answer as to what the activities are allowed in the Outer Space Treaty. However, the drafters at the time of the Outer Space Treaty had a goal to protect space because of the Cold War threats that were happening. Nonetheless it not well-defined that the right to use outer

space extends to the right to extract natural resources. Even if this were interpreted that there the right to use outer space extends to resources , there is no concrete way of knowing who will have ownership of the extracted resources like He-3. The context surrounding the Outer Space Treaty does not sufficiently clarify the prohibitions of how space can be used or clarify the ownership of the resources (Christol 1982). 50 years have passed and there is still no clear interpretation as to what the legal status of those resources is, who can obtain property of the same and what extracting parties must do in order to ultimately benefit humanity.

What would create consensus is not yet to be seen yet a series of negotiations need to begin sooner than later. Plans to explore space and the potential resources in outer space is constantly growing. The statements made delegations in the 62nd meeting of the Committee on the Peaceful Use of Outer Space show this. This meeting showed the true union of States with the common goal to use space for the benefit of humanity. The delegation on the United States, Japan, Russia, India and China confirmed the interest and plans to reach the Moon in the upcoming years. The representatives of the ITER Organization[27] showcased the plans to begin operations with the fusion reactor to create energy from renewable resources found in outer space by 2035. Most importantly multiple delegations such as China, Russia, United States, Japan, Malta, United Kingdom, France, Australia, Cuba, Canada, Iran, Israel, Nigeria, European Union, Italy, Austria and Iran came together to say that nations should expand into outer space as space technology can be used for the development of countries. While the Russian delegation called for a legally binding document to regulate space activity bearing in mind the prevention of conflict in outer space.

This shows that mining in outer space is something that is expected, and it is being held with the most important interest as a source of development of nations. Even though need for resources such as H-3 found in space has not yet been created, the need to solve the ambiguities in the use, property, and benefit sharing of resources is now growing with every development that puts humanity one step closer to be back on the Moon.

Outer space needs to be seen as a mechanism of open possibilities to new actors and a regulation correcting the vagueness of the past will help towards this. Just as was mentioned by the Director of the United Nations Office for Outer Space Affairs (UNOOSA) in the 62nd

[27] A collaborative international project to develop fusion energy for peaceful purposes composed of China, the European Union, India, Japan, Korea, Russia and the United States

meeting of the Committee on the Peaceful Use of Outer Space "the legacy of the Apollo era is a testament that an agreement can be reached. Therefore, it is the time to look to the near future and achieve the next giant leap for humankind" and ultimately use space exploration for benefit of all humanity.

PART V: PROPOSALS

After noting the necessity to modify the current legal framework that governs mining activities in outer space this sector will highlight a proposal that could be used to create a workable framework for lunar mining. It is worth noting that to facilitate the framework that will be given below discussions as to the legal problems that might come with the rise of the new technologies are necessary before the draft of the new treaty is in place.

A new framework needs to be created specifically for the rights to natural resources in space. Therefore, clarifying and separating the lunar terrain from the resources found within. It must be said that the creation of the principles of *non-appropriation of outer space, peaceful use of outer space and cooperation* created in 1967 with the Outer Space Treaty should be kept. Being this so understanding that the use of space should be shared with humanity it is necessary to create an international body that will create the regulations that will govern outer space, oversee that nations and individuals are obeying them and finally enforce said laws.

This proposal is in line with Article 11(5) of the Moon Treaty. This as it calls for the creation of an international body that will govern the exploitation of natural resources in the Moon and other celestial bodies. Since the Moon Treaty does not display any formal guidance as to how to create the international body or what model they should follow it would be natural to look into the system that governs the seabed. Just as it was mentioned below outer space and the seabed share similar characteristics such as they are both are environments with very harsh conditions that makes extraction of resources very difficult, no claims of sovereignty over the Moon, the Antarctica or the high seas can be made, therefore validating the *principle of non-appropriation* of the areas and due to the variety of resources which calls into question the possibility of extraction and claims of property over the extracted resources.

Using the International Seabed Authority as a model for the body that would govern space will be helpful. This Seabed Authority, created under UNCLOS III, oversees the extraction of natural resources in the seabed.

The International Seabed Authority (ISA) administers rules and regulations for mining in the seabed, approves plans for exploration and exploitation, oversees compliance with the regulations and decides how the profits from the seabed should be distributed. It has the following subdivisions : (i)the assembly which makes decisions about sharing of revenues and problems of general nature. (ii) the council which is the executive body. This executive body is represented by members appointed by the assembly. The role of the council is to ensure the representation of developing nations and those who will extract. (iii) the enterprise which is the company of the International Seabed Authority that mines in the name of humanity (UNCLOS III 1984).

Nations need ISA's permission to obtain exclusivity for exploration and exploitation of an area, yet, do not need permission to explore for prospective resources in the seabed. When asked for exclusivity ISA mandates that the request must contain two areas with prospects of mining. In this sense one mining site will be assigned to the country that requested and the other one will be kept by the enterprise to develop mining activities in the name of ISA.

It is worth noting that this is a successful example. Since the establishment in 1994 y has created functioning marine mineral prospects and exploration regulations (ISA 2004). It entered into fifteen-year exploration contracts with India, France, Japan, China, South Korea and the Czech Republic. No exploration has begun.

In case of disputes regarding mining ISA has a Seabed Dispute Chamber, a court within the Tribunal of the Law of the Sea. Since the creation in 1994 only 15 cases have been filed and none of them have involved mining issues (International Tribunal on the Law of the Sea 2019).

If the space authority were to follow the model used by ISA it would have to be divided in different subdivisions in order to carry out functions. In view of the above the assembly would be formed of every country part of the Outer Space Treaty and the modification that forms the space authority. Every nation would have a seat in the assembly meaning equal representation regardless the capability in space exploration. The council would be composed of a balance of

nations who are not able to exploit natural resources and those who can. It is vital to always remember the UNCLOS III example, especially in the creation of the council. This as nations refused to sign the original UNCLOS III until they were guaranteed a seat in the council. (Sattler 2005) Therefore it might be useful to guarantee a seat to those countries who have high potential to exploit natural resources. Just like the ISA model the space authority would only require a request for exclusivity for exploitation and exploration of a specific area. This means that any nation is free to search for the resources without needed permission.

It would be worth considering the possibility of the space authority creating royalties on operations for and free to impose fees where necessary. Just like ISA the space authority would be in charge for sharing the benefits made with the exploration of natural resources. Additionally, it might be a possibility for the space authority to reserve a portion of the approved mining area to exploit, rent or assign to different parties. This allowing a generation of profits that could be reinvested into the space authority or could be distributed between those nations that at the moment do not have the capacity to exploit space.

Since outer space does not have a special tribunal like the sea does, disputes would be then resolved by the International Court of Justice.

Just like ISA this proposal is not perfect. This means that the creation of this new space authority would be something that would require a big investment from all nations. This as the creation and maintenance of the authority are probably hard to keep. There is a limited number of nations have the capacity of exploit space hence it is vital that their interests are represented so they will be willing to contribute in the creation of the authority (Reinstein 1999).

This will be a difficult process, but the International Seabed Authority is proof that it is possible. Negotiations need to occur in order to obtain consensus on how the international body should be set up and administered before any mission to space are sent. Through negotiations it is important to decide if this organization will be a body of the United Nations or it will have legal personality and how this international body will guarantee representation between the countries that have the capacity to exploit space and those who don’t. It will be a long process, ISA took 14 years to negotiate and another year to enter into force, but this proposal is possible.

Plans of nations to go back to the Moon within the next 10 years hoping to explore new resources such as He-3 could mean a new way in which planet Earth obtains a clean source of energy. This means that it is urgent to create a clear and stable legal framework that will regulate property rights regarding resources in outer space. A stable framework would allow and encourage the development of the exploration and exploitation in specifically the Moon.

To summarize, under this proposal the space authority would oversee space property law, act as a mediator between nations, propose and discuss regulations for property in outer space. The council will decide how to share benefits, who they go to and who and where can exploit the Moon and other celestial bodies. Just like this was possible in the seabed this proposal, with the proper negotiation, should appeal to nations and create benefits for humanity while as said by delegations during the meeting on the Committee on the Peaceful Use of Outer Space look for the development of Earth while encouraging the next giant leap for humanity.

REFERENCES

Ahmed, J.U., 2010. Documentary research method: New dimensions. Indus Journal of Management & Social Sciences, 4(1).

Anderson, F. & Cayton, A., 2005. The Dominion of War: Empire and Liberty in North America, 1500-2000,Viking .

Anderson, K., 1993. Property Rights in Outer Space, 58J. AIRL.&COM. 1041, 1069.

Anderson,S., Christensen, K., & LaManna, J., 2018. The development of natural resources in outer space, Journal of Energy & Natural Resources Law, DOI: 10.1080/02646811.2018.1507343.

Atermis Project, 2017. Lunar Helium-3 as an Energy Source, in a nutshell, Accessed 27 July 2019 online from: http://www.asi.org/adb/02/09/he3-intro.html.

Bailey, K.D, 1994. Methods of Social Research. New York: The Free Press.

Ballah, L., n.d.. "The Universality of the 1982 UN Convention on the Law of the Sea: Common Heritage or Common Burden?" - Al Nauimi & Meese (eds), International Legal Issues.

Barnatt, C., n.d.. Helium-3 Power Generation, Accessed 27 July 2019 online from: https://www.explainingthefuture.com/helium3.html.

Bennet, J., 2017. MIT Achieves Breakthrough in Nuclear Fusion, Accessed 27 July 2019 online from: https://www.popularmechanics.com/science/energy/a27961/mit-nuclear-fusion-experiment-increases-efficiency/.

Bergstein, B., 2019. Finally, Fusion Power Is About to Become a Reality, Accessed 27 July 2019 online from: https://wattsupwiththat.com/2019/01/09/finally-fusion-power-is-about-to-become-a-reality/.

Berry,A. 2016. How China is sending man back to the Moon to mine safe nuclear power and become the world's energy giant, Accessed 10 July 2019 online from: https://www.telegraph.co.uk/news/science/space/nightsky/12178122/night- sky-march-2016-china-space-mission.html.

Bilder, R.B., 2009. A legal regime for the mining of helium-3 on the Moon: US policy options. Fordham Int'l LJ, 33, p.243.

Bhaskar, U., 2017. "Isro plans to mine energy from Moon by 2030 to help meet India needs," Accessed 10 July 2019 online from: https://www.livemint.com/Science/W5WjJCdqqxXYpHvrB2TTHP/Isro-plans-to-mine-energy-from-Moon-by- 2030-to-help-meet-Ind.html; Helium-3 mining on the Lunar surface, ESA, https://www.esa.int/Our_Activities/Preparing_for_the_Future/Space_for_Earth/Energy/Helium-3_mining_on_the_lunar_surface, Bloomberg, 26 June 2018, https://www.bloomberg.com/news/articles/2018-06-26/the-quest-to- find-a-trillion-dollar-nuclear-fuel-on-the-Moon.

Breccia, P., 2016. Article III of Outer Space Treaty and its Relevance in the International Space Legal Framework. In Proceedings.

Briggs, B. 1997. Introducción al proceso de consenso. México: Instituto Nacional de Facilitación y Consenso.

Booth, J. & Walker, T., 1989. Understanding Central America ,Westview Press, Inc.

Boothby, B., 2017. Space Weapons and the Law, 93 Int'l L. Stud. Ser. US Naval War Col.

Boyle, P., 1993. American-Soviet Relations: from the Russian Revolution to the Fall of Communism 54-70.

Bula, R., 1988. Potential of Derived Lunar Volatiles for Life Support, in The Second Conference on Lunar Bases and Space Activities of the 21st Century.

Burk, D., 1989. Application of United States Patent Law to Commercial Activity in Outer Space.

Buxton, C., 2004. Property in Outer Space: The Common Heritage of Mankind Principle vs. the "First in Time, First in Right" Rule, 69 J. Air L. & Com.

Cameron, M., 1990. Net Environmental Aspects of Helium-3 Mining, Phase 1: Effect on the Moon.

Chappelow, J., 2019. Tragedy of the Commons, Accessed 27 July 2019 online from: https://www.investopedia.com/terms/t/tragedy-of-the-commons.asp.

Christol, C.Q., 1980. International Space Law and the Use of Natural Resources: Solar Energy. Rev. BDI.

Christol, C.Q., 1982. The Modern International Law of Outer Space.

Clancy, E., 1998. The Tragedy of the Global Commons, 5 IND. J. GLOBAL LEGAL SD.

Cocca, A., 1991. Contribución del consenso al desarrollo progresivo del derecho internacional en las Naciones Unidas. En: Desarrollo progresivo del derecho internacional. Aportaciones de organizaciones, tribunales y parlamentos internacionales. Buenos Aires: Consejo de Estudios Internacionales Avanzados.

Coffey, S., 2008. Establishing a legal framework for property rights to natural resources in outer space. Case W. Res. J. Int'l L.

Computing, 2019. Russia plans to land cosmonauts on the Moon by 2030: Computing. Accessed 10 July 2019 online from: https://www.computing.co.uk/ctg/news/3076447/russia-Moon-cosmonauts-2030

Corbyn, Z., 2018. “The asteroid rush sending 21st-century prospectors into space,” The Guardian, Accessed 10 July 2019 online from: https://www.theguardian.com/science/2018/jun/09/asteroid-mining-space- prospectors-precious-resources-fuelling-future-among-stars.

Crapart, L., Achilléas, P., Farand, A., Marescaux, E. and Summerer, L., 2004. Legal aspects of solar power satellites. In Proceedings International Astronautical Congress IAC’03.

David, L., 2018. Mining Moon Ice: Prospects to take Shape, Accessed 15 April 2019 online from: https://www.space.com/41164-mining-Moon-water-plans-take-shape.html

David, L., 2018. “The US Geological Survey Is Getting Serious About Space Resources and Mining,” Accessed 10 July 2019 online from: www.space.com https://www.space.com/41707- space-mining-usgs-resource-survey.html.

Delascio, V. 1961. Space Explorations and Space Law, 28 J. Air L. & Com. 364.

De Man, P., n.d. Exclusive Use in an Inclusive Environment.

De Man, P., 2010. The exploitation of outer space and celestial bodies- A functional solution to the natural resource challenge. Leuven Centre For Global Governance Studies.

DeScaussure, H., 1992. The Freedoms of Outer Space and Their Maritime Antecedents, in Space Law, Development and Scope.

Eckert,R., 1979. The Enclosure of Ocean Resources: Economics and The Law of The Sea.

Ehrett, J. S. 2014. To Boldly Go: International Space Law and the Expansion of Res Communis Doctrine. Grove City College Journal of Law and Public Policy, 5, 65-94.

Epps, V., 1998. International Law for Undergraduates.

Everett, D. & Kinder, A., 1993. Gentler Moon Treaty: A Critical Review of the Current Moon Treaty and a Proposed Alternative, 8 J. NAT. RESOURCES & ENVTL. L. 293.

Ferrer, E., 1991. Las resoluciones de la asamblea general de las Naciones Unidas como fuente del derecho internacional. En: Desarrollo progresivo del derecho internacional. Aportaciones de organizaciones, tribunales y parlamentos internacionales. Buenos Aires: Consejo de Estudios Internacionales Avanzados.

Franco, I., 2014. Consenso, confianza y cooperación en el derecho del Espacio ultraterrestre. Bogotá: Universidad de los Andes.

Frakes, J., 2003. The Common Heritage of Mankind Principle and Deep Seabed, Outer Space, and Antarctica: Will Developed and Developing Nations Reach a Compromise. Wis. Int'l LJ, 21, p.409.

Fountain, L., 2003. Creating Momentum in Space: Ending the Paralysis Produced by the "Common Heritage of Mankind" Doctrine, 35 CONN. L. REV. 1753, 1753 n.3.

Foust, J. (2019, May 29). U.S. and Japan to cooperate on return to the Moon. Accessed 27 July 2019 online from: https://spacenews.com/u-s-and-japan-to-cooperate-on-return-to-the-Moon/.

Galloway, E., 1979. Consensus decision making by the united nations committee on the peaceful uses of outer space. Journal of Space Law, 7(1), 3-14.

Gangale,T., 2009. The Development of Outer Space: Sovereignty and Property Rights in International Space Law.

Goldman, N., 1996. American Space Law: International & Domestic.

Gorove, S., 1976. Solar Energy and Space Law. In Int'l L. (Vol. 10, p. 531).

Gradoni, L., 2018. What on Earth is Happening to Space Law? Accessed 15 April 2019 online from: https://www.ejiltalk.org/what-on-earth-is-happening-to-space-law-a-new-space-law-for-a-new-space-race/

Hall, R. & Green P., 2019. Transfer of Terrestrial Technology for Lunar Mining, Accessed 27 July 2019 online from: https://cedb.asce.org/CEDBsearch/record.jsp?dockey=0076689.

Heath, T., 2017. “Space-mining may be only a decade away. Really.”, Accessed 10 July 2019 online from: https://www.washingtonpost.com/ business/space-mining-may-be-only-a-decade-away-really/2017/04/28/ df33b31a-29ee-11e7-a616-d7c8a68c1a66_story.html?noredirect=on& utm_term=.6a3693902deb.

Henckaerts, J., 2005. Study on Customary International Humanitarian Law: A Contribution to the Understanding and Respect for the Rule of Law in Armed Conflict, 87 INT’L REV. RED CROSS 175.

Heim, B.E., 1990. Exploring the last frontiers for mineral resources: A comparison of international law regarding the deep seabed, outer space, and Antarctica. Vand. J. Transnat'l L., 23,.

Hertzfeld, H.R. and Von der Dunk, F.G., 2005. Bringing space law into the commercial world: Property rights without sovereignty. Chi. J. Int'l L., 6,.

Hoisington, M., 2014. International Law and Ungoverned Space, 1 Indon. J. Int'l & Comp. L. 423.

Hoffstadt, B. M., 1994. Moving the heavens: Lunar mining and the common heritage of mankind in the Moon treaty. UCLA Law Review 42(2).

Holmila, E., 2005. Common Heritage of Mankind in the Law of the Sea. Acta Societatis Martensis, 1, 187-205.

Hooper, R., 2018. 2018 in science in Japan: Climate change, space exploration and water bears. Accessed 27 July 2019 online from: https://www.japantimes.co.jp/news/2018/12/24/national/science-health/2018-climate-change-space-exploration-water-bears/#.XT1ut5NKjVo

Hudgins, L., 2002. Space: the Free Market Frontier.

Husby, E., 1994. Comment, Sovereignty and Property Rights in Outer Space, 3 J. INT'L L. & PRAC.

ITER, 2019. What is ITER?, Accessed 27 July 2019 online from: https://www.iter.org/proj/inafewlines.

Interntaional Seabed Authority Accessed 28 July 2019 online from: https://www.isa.org.jm/authority.

Jakhu, R., & Mankata Nyampong, Y., 2016. Some Legal Aspects of Space Natural Resources, 18 Eur. J.L. Reform 86.

Jamasmie, C., 2017. Luxembourg, Japan team up to explore and mine space resources, Accessed 10 July 2019 online from: http://www.mining.com/luxembourg-japan-team-explore-mine-space- resources/.

Johnson, D., 2010. Limits on the Giant Leap for Mankind: Legal Ambiguities of Extraterrestrial Resource Extraction. Am. U. Int'l L. Rev., 26.

Joyner, C., 1998. Governing the Frozen Commons: The Antarctic Regime And Environmental Protection.

Keefe, H., 1995. Making the Final Frontier Feasible: A Critical Look at the Current Body of Outer Space Law.

Kindred, H., 2000. International Law, Chiefly as Interpreted and Applied in Canada, 6th ed. Toronto: Emond Montgomery.

Klotz, I., 2012. Tech billionaires bankroll gold rush to mine asteroids, Accessed 10 July 2019 online from: https://www.reuters.com/article/us-space-asteroid-mining/tech-billionaires-bankroll-gold-rush-to-mine-asteroids-idUSBRE83N06U20120424.

Kulcinski, G., 1990. Mining Helium-3 From the Moon-A Solution To Earth's Energy Needs In The 21st Century.

Landis, G.A., 2004. Reinventing the solar power satellite.

Leach, M., 2014. Property rights in outer space, Accessed 15 April 2019 online from: http://www.abanet.org/abastore/index.cfm?section=magazines&fm=Product.AddToCart&pid=5458000 .

Lee, R., 2009. Creating a Practical Legal Framework for the Commercial Exploitation of Mineral Resources in Outer Space (Doctoral dissertation, Murdoch University).

Letzter, R., 2019. China Plans to Build a Moon Base Near the Lunar South Pole. Accessed 28 July 2019 online from:https://www.space.com/china-Moon-base-10-years.html

Lewis, C., 2017. Meet the Japanese company that intends to mine the Moon. Accessed 28 July 2019 online from: https://www.miningglobal.com/mining-sites/meet-japanese-company-intends-mine-Moon

Malanczuk, P., 1997. A Kehurst's Modern Introduction To International Law 208 (7th ed).

Mallick,S. & Rajagopalan, R., 2019. If Space is 'the Province of Mankind', Who Owns its Resources? The Potential of Space Mining and its Legal Implications", ORF Occasional Paper No. 182, Observer Research Foundation.

Marshall, C. & Rossman, G.B., 1995. Designing Qualitative Research. Newbury Park, CA: Sage.

Mate,J., 2010. Space Waste and Environmental Space Law, 2010 Jura: A Pecsi Tudomanyegyetem Allam- es Jogtudomanyi Karanak tudomanyos lapja.

Mazrouei, S., 2019. What the Moon's craters reveal about the Earth's history, Accessed 27 July 2019 online from: http://theconversation.com/what-the-Moons-craters-reveal-about-the-earths-history-109692.

Meyer, Z., n.d., Private Commercialization of Space in an International Regime: A Proposal for a Space District, 30 NW. J. INT'L L. & BUS. 241, 249-50.

Michigan Institute of Technology, 2016. Mission 2016: The Future of Strategic Natural Resources, MIT, Accessed 10 July 2019 online from: http://web.mit.edu/ 12.000/www/m2016/finalwebsite/solutions/asteroids.html.

Nelson, L.D.M., 1995. The new deep sea-bed mining regime. Int'l J. Marine & Coastal L., 10,.

Nicholson, G., 2002. The Common Heritage of Mankind and Mining: An Analysis of the Law as to the High Seas, Outer Space, the Antarctic and World Heritage. NZJ Envtl. L., 6,.

Noichim, C., 2005. International Cooperation for sustainable space development. Journal of space law, 31(2).

Noyes, J.E., 2011. The common heritage of mankind: past, present, and future. Denv. J. Int'l L. & Pol'y, 40,.

O'Donnell, R., 2007. Staking a Claim in the Twenty-First Century: Real Property Rights on Extraterrestrial Bodies, 32 U. DAYTON L. REV. 461, 468-69.

O'Donoghue, R., 2018. Space mining a step closer as Japan successfully lands rovers on ASTEROID , Accessed 10 July 2019 online from: https://www.dailystar.co.uk/news/weird-news/731536/japan-asteroid- rovers-space-mining-asteroids-spaceship.

Oduntan, G., 2015. Who owns space? US asteroid-mining act is dangerous and potentially illegal.

Open Mind, 2019. Helium-3: Lunar Gold Fever, Accessed 27 July 2019 online from: https://www.bbvaopenmind.com/en/science/physics/helium-3-lunar-gold-fever/.

Oxman, B.H., 1978. The Third United Nation's Conference on the Law of the Sea: The 1977 New York Session. American Journal of International Law, 72(1), pp.57-83.

Paxson III, E.W., 1992. Sharing the Benefits of Outer Space Exploration: Space Law and Economic Development. Mich. J. Int'l L., 14, p.487.

Penner, J., 1997. The Idea Of Property In Law 2-3.

Perek, L., 1990. Interaction between Space Technology and Space Law, 18 J. Space L. 19

Piñeros, A., 2014. De la extracción y explotación de recursos naturales en el Espacio ultraterrestre, la Luna y los cuerpos celestes. Una regulación jurídica. Universidad de los Andes, Bogotá, Colombia.

Rana, H., 1994. The "Common Heritage of Mankind" & the Final Frontier: A Revaluation of Values Constituting the International Legal Regime for Outer Space Activities, 26 RUTGERS L. J..

Raclin, 1986. From Ice to Ether: The Adoption of a Regime to Govern Resource Exploitation in Outer Space, 7 Nw. J. INT'L L. & Bus. 727, 740.

Reinstein, E.J., 1999. Owning outer space. Nw. J. Int'l L. & Bus., 20.

Resnick, B., 2019. Trump's hasty plan to get Americans back on the Moon by 2024, explained. Accessed 28 July 2019 online from:https://www.vox.com/science-and-health/2019/5/22/18623177/nasa-artemis-Moon-2024-trump-bridenstine-explained

Reynolds, G. & Merges,R., 1989. Outer Space Problems Of Law And Policy.

Reynolds, G., 1992. International Space Law: Into the Twenty First Century. 25 VAND. J. TRANSNAT'L L. 225, 230.

Rosenne,S., 1984. Practice and Methods of International Law.

Rosenfield, S., 1981. Solar Energy from Outer Space, 43 U. Pitt. L. Rev. 49.

Rothwell, D., 1996. The Polar Regions And The Development Of International Law 51.

Rua, M., 2019. Competencia de egos en la conquista del espacio Accessed 8 July 2019 online from: https://m.eltiempo.com/amp/vida/ciencia/los-multimillonarios-que-le-apuestan-a-la-exploracion-espacial-382622

Sandalow, D., 2005. Emissions Trading is Kyoto's Success Story.

Sattler, R., 2005. Transporting a Legal System for Property Rights: From Earth to the Stars, 6 CHI, J. Int'L L.

Schick, F.B., 1961. Space Law and Space Politics, 10 Int'l & Comp. L.Q. 681.

Schmitt,H., 2006. Return to the Moon.

Seara, M., 1961. Introducción al derecho internacional cósmico. México: Universidad Nacional Autónoma de México.

Sattler, R., 2005) Transporting a Legal Sustem for Property Rights: From the Earth to the Stars, 6 CHI.K INT'L23.

Selltiz, C.S., Wrightsman, L.S. & Cook, S. W., 1981. Research Methods in Social Relations. New York: Holt, Rinehart & Winston.

Shtivelman, A., 2012. Solar Power Satellites: The Right to a Spot in the World's Highest Parking Lot. BUJ Sci. & Tech. L., 18, p.435.

Slyuta, A. Abdrakhimov M & Galimov, E., 2007. The Estimation of Helium-3 ProbableReserves in Lunar Regolith, 38 LUNAR & PLANETARY SC. 2175, 2176.

Smith, M., 1988. The Commercial Exploitation of Mineral Resources in Outer Space, In Space Law: Views of The Future 50-53.

Smith, B., 2019. Who protects the Apollo sites when space law says no-one owns the Moon?, Accessed 27 July 2019 online from: https://www.abc.net.au/news/science/2019-07-19/apollo-11-Moon-landing-heritage-preservation-outer-space-treaty/11055458.

Smithsonian National Air & Space Museum, n.d.. Apollo Moon Rocks Accessed 15 April 2019 online from: http://www.nasm.si.edu/exhibitions/cchoice/Moon rocks/Moonrocks1.htm.

Sonter, J., 1998. The Technical and Economic Feasibility of Mining the Near-Earth Asteroids (paper presented at 45th IAF Congress), available at http://www.spacefuture.com/archive/the_technical_and _economic_ feasibility_of_mining_the_near_earth_asteriods.shtml.

Space Law, 1964. 51 Int'l L. Ass'n Rep. Conf. 622.

Space Daily, 1999. The Challenge of Space Mining, Accessed 15 April 2019 online from: , http://www.spacedaily.com/news/asteroid-99i.html.

Space Resources, 2017. Luxembourg and the United Arab Emirates Sign MOU on Space Resources. Accessed 10 July 2019 online from: https://spaceresources.public.lu/ en/actualites/2017/MoU-UAE.html.

Stocton, N., 2015. Congress Says Yes to Space Mining, No to Rocket Regulations. Accessed 10 July 2019 online from: https://www.wired.com/2015/11/congress-says-yes-to-space-mining-no-to-rocket-regulations/.

Su, J., 2017. Legality of unilateral exploitation of space resources under international law. International & Comparative Law Quarterly, 66(4), pp.991-1008.

Svoboda, E., 2008. Who owns the Moon?

Swiss Confederation, 2019. 2018 in Science in Japan: Climate Change, Space Exploration and Water Bears. Accessed 10 July 2019 online from: https://www.stofficetokyo.ch/news/general-interest/2018-in-science-in-japan-climate-change-space-exploration-and-water-bears.

Taylor, P., 1997. An Ecological Approach to International Law 268.

The Government of the Grand Duchy of Luxembourg, 2017. Press Release - Luxembourg and Japan agree to cooperate on exploration and commercial utilization of space resources, 2. Accessed 10 July 2019 online from: https://spaceresources.public.lu/ dam- assets/press-release/2017/2017-11-29-press-release-mou-japan-space.pdf.

The Moscow Times, 2018. Russia Announces Plans to Establish Moon Colony by 2040. Accessed 28 July 2019 online from: https://www.themoscowtimes.com/2018/11/29/russia-announces-plans-to-establish-Moon-colony-by-2040-a63557

Thomas, J., 2006. Spatialis Liberum, 7 FLA. COASTAL L. REV. 579, 589-90.

Tronchetti, F., 2009. The exploitation of natural resources of the Moon and other celestial bodies. A proposal for a legal regime. Boston: University of Nebraska.

Tronchetti, F., 2013. Fundamentals of space law and policy (Vol. 26). Springer.

Tronchetti, F., 2015. The Space Resource Exploration and Utilization Act: A move forward or a step back?. Space Policy, 34, pp.6-10.

Twibell, T., 1997. Space Law: Legal Restraints on Commercialization and Development of Outer Space, 65 UMKC L. Rev. 589.

Van Bogaert, E.R.C., 1986. Aspects of Space Law 32,Kluwer L. & Taxn. Publishers.

Villiger, M., 2009. Commentary on the 1969 Vienna Convention on The Law Of Treaties (Martinus Nijhoff Publishers).

Wallach, M.I., 2010. Legal issues for space based solar power. Online Journal of Space Communication, 1, p.18.

Wall, M., 2019. 50 Years After Apollo 11, A New Moon Rush Is Coming. Accessed 28 July 2019 online from: https://www.space.com/Moon-exploration-plans-nasa-india-china-and-more.html.

Walter, E., 2011."Hot" Issues and Their Handling. In: Brünner C., Soucek A. (eds) Outer Space in Society, Politics and Law. Studies in Space Policy, vol 8. Springer, Vienna.

WebIt, 2019. China Plans to Build a Base near the Moon's South Pole. Accessed 28 July 2019 online from: https://webitdeutchland.de/english/china-plans-to-build-a-base-near-the-Moons-south-pole/.

Williams, M., 2006. Mining the Moon. Technology Review.

Wittenberg, L.J., 1968. Lunar Source of He-3 for Commercial Fusion Power, 10 Fusion Tech.

Works, J., 1980. The Moon Treaty. Denver Journal of International Law of Policy. 9(1), 281-285.

Zaleski, A., 2018. Luxembourg leads the trillion-dollar race to become the Silicon Valley of asteroid mining. Accessed 28 July 2019 online from: https://www.cnbc.com/2018/04/16/luxembourg-vies-to-become-the-silicon-valley-of-asteroid-mining.html

Zell, J.L., 2006. Putting a Mine on the Moon: Creating an International Authority to Regulate Mining Rights in Outer Space. Minn. J. Int'l L., 15, p.489.

Zhukov, G.P., Kolosov, I.M. and Zhukov, G.P., 1984. International space law. New York: Praeger.

Zullo, K.M., 2001. The need to clarify the status of property rights in International Space Law. Geo. LJ, 90, p.2413.

TREATIES, DECLARATIONS AND LAWS:

General Assembly of the United Nations, 1967. Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies.

General Assembly of the United Nations, 1945. Charter of the United Nations.

General Assembly of the United Nations, 1979. Agreement Governing the Activities of States on the Moon and Other Celestial Bodies.

General Assembly of the United Nations, 1966. Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies.

General Assembly of the United Nations, 1970. Declaration on Principles of International Law concerning Friendly Relations and Cooperation among States in accordance with the Charter of the United Nations.

General Assembly of the United Nations, 1963. Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space.

General Assembly of the United Nations, 1982. Third United Nations Convention on the Law of the Sea.

General Assembly of the United Nations, 1982. Third United Nations Convention on the Law of the Sea: Overview .

General Assembly of the United Nations, 1969. The Vienna Convention on the Law of Treaties.

General Assembly of the United Nations, 1958. The Antarctic Treaty.

One Hundred Fourteenth Congress of the United States of America, 2015-2016. U.S. Commercial Space Launch Competitiveness Act.

The Government of the Grand Duchy of Luxembourg, 2016. The Space Resource Initiative.

The Government of the Grand Duchy of Luxembourg, 2017. Draft Law on The Exploration and Use of Space Resources.

United Nations & the International Sea Bed Authority, 2004. Marine Mineral Resources 9.

Resolutions

Committee on the Peaceful Uses of Outer Space “COPUOS”, 1966. U.N. GAOR, COPUOS, Legal Subcomm., Interim Report by the Chairman, annex 2 at 6, U.N. Doc. A/AC.105/C.2/L.16.

Committee on the Peaceful Uses of Outer Space, 1966. U.N. GAOR, COPUOS, Legal Subcomm., 5th Sess., 71st mtg. at 4, U.N. Doc. A/AC.105/C.2/SR.65.

General Assembly of the United Nations, 1958. G.A. Res. 1348 (XIII), pmbl., U.N. Doc. A/RES/1348, XIII.

Committee on the Peaceful Uses of Outer Space, 1966. U.N. GAOR, COPUOS, Legal Subcomm., 5th Sess., 72d mtg. at 3, U.N. Doc. A/AC.105/C.2/SR.72.

Committee on the Peaceful Uses of Outer Space, 1973. U.N. GAOR, COPUOS, Legal Subcomm., 12th Sess., 192d mtg. at 11- 12, U.N. Doc. A/AC.105/C.2/SR.192.

Dictionaries

BLACK'S LAW DICTIONARY, 2009.

Business Distortionary, 2019.

ANNEX I: SIGNATORIES OF THE 1967 OUTER SPACE TREATY

Participant	Action
Afghanistan	Signature
Afghanistan	Ratification
Antigua and Barbuda	Succession
Antigua and Barbuda	Succession
Argentina	Signature
Argentina	Ratification
Australia	Ratification
Austria	Ratification
Austria	Ratification
Austria	Signature
Austria	Ratification
Bahamas	Succession
Bangladesh	Accession
Barbados	Accession
Belgium	Ratification
Belgium	Signature
Benin	Accession
Bolivia	Signature
Brazil	Signature
Brazil	Ratification
Brazil	Ratification
Bulgaria	Ratification
Burma	Ratification
Burma	Signature
Burma	Ratification
Burundi	Signature
Byelorussian Soviet Socialist Republic	Signature
Cameroon	Signature
Canada	Ratification
Central African Republic	Signature
Ceylon	Signature
Chile	Signature

China	Signature
China	Accession
Colombia	Signature
Cyprus	Signature
Cyprus	Ratification
Cyprus	Ratification
Czech Republic	Succession
Czech Republic	Succession
Czechoslovakia	Ratification
Democratic Republic of the Congo	Signature
Denmark	Ratification
Dominican Republic	Signature
Dominican Republic	Ratification
Ecuador	Signature
Ecuador	Ratification
El Salvador	Signature
El Salvador	Ratification
Equatorial Guinea	Accession
Ethiopia	Signature
Federal Republic of Germany	Signature
Federal Republic of Germany	Ratification
Federal Republic of Germany	Ratification
Federation of Malaya	Signature
Fiji	Succession
Fiji	Succession
Finland	Ratification
France	Signature
France	Ratification
France	Ratification
Gambia	Signature
German Democratic Republic	Ratification
Ghana	Signature
Greece	Ratification
Greece	Signature
Guyana	Signature

Haiti	Signature
Honduras	Signature
Hungary	Ratification
Iceland	Ratification
Iceland	Signature
Iceland	Ratification
Iceland	Ratification
India	Signature
India	Ratification
Indonesia	Signature
Indonesia	Ratification
Iran	Signature
Iraq	Signature
Iraq	Ratification
Ireland	Signature
Ireland	Ratification
Ireland	Ratification
Israel	Signature
Israel	Ratification
Italy	Signature
Italy	Ratification
Italy	Ratification
Jamaica	Ratification
Jamaica	Signature
Jamaica	Ratification
Japan	Ratification
Jordan	Signature
Kazakhstan	Accession
Kenya	Accession
Kuwait	Accession
Laos	Signature
Laos	Ratification
Lebanon	Ratification
Lebanon	Ratification
Lebanon	Signature

Lesotho	Signature
Libya	Accession
Luxembourg	Signature
Luxembourg	Ratification
Madagascar	Accession
Mauritius	Succession
Mauritius	Succession
Mexico	Ratification
Mexico	Ratification
Mexico	Ratification
Mexico	Signature
Mongolia	Ratification
Morocco	Accession
Morocco	Accession
Morocco	Accession
Nepal	Ratification
Nepal	Ratification
Netherlands	Signature
Netherlands	Ratification
Netherlands	Ratification
Netherlands	Territorial application
New Zealand	Ratification
New Zealand	Ratification
New Zealand	Signature
Nicaragua	Signature
Niger	Ratification
Nigeria	Accession
Norway	Ratification
Norway	Signature
Norway	Ratification
Pakistan	Signature
Pakistan	Ratification
Pakistan	Ratification
Pakistan	Ratification
Panama	Signature

Papua New Guinea	Succession
Peru	Signature
Peru	Ratification
Philippines	Signature
Poland	Signature
Poland	Ratification
Poland	Ratification
Poland	Ratification
Portugal	Accession
Republic of China	Ratification
Republic of Korea	Declaration
Republic of Korea	Ratification
Republic of Viet-Nam	Signature
Romania	Ratification
Romania	Ratification
Romania	Signature
Romania	Ratification
Rwanda	Signature
San Marino	Ratification
San Marino	Ratification
San Marino	Signature
Seychelles	Accession
Sierra Leone	Ratification
Singapore	Accession
Slovakia	Succession
Slovakia	Succession
Somalia	Signature
South Africa	Signature
South Africa	Ratification
South Africa	Ratification
Spain	Accession
Spain	Accession
Sri Lanka	Ratification
St. Vincent and the Grenadines	Succession
Sweden	Ratification

Switzerland	Ratification
Switzerland	Ratification
Switzerland	Signature
Thailand	Ratification
Thailand	Signature
Thailand	Ratification
Togo	Signature
Tonga	Succession
Tonga	Succession
Trinidad and Tobago	Signature
Tunisia	Ratification
Tunisia	Ratification
Tunisia	Ratification
Tunisia	Signature
Turkey	Signature
Turkey	Ratification
Turkey	Ratification
Turkey	Ratification
Uganda	Accession
Ukrainian Soviet Socialist Republic	Ratification
Union of Soviet Socialist Republics	Ratification
United Arab Republic	Ratification
United Arab Republic	Ratification
United Kingdom of Great Britain and Northern Ireland	Ratification
United States of America	Ratification
Upper Volta	Ratification
Upper Volta	Signature
Uruguay	Signature
Uruguay	Ratification
Vatican City State	Signature
Venezuela	Ratification
Venezuela	Signature
Yugoslavia (Socialist Federal Republic of)	Signature
Zambia	Accession

ANNEX II: SIGNATORIES OF THE 1979 MOON TREATY

Participant	Signature	Ratification, Accession
Armenia		19 Jan 2018 a
Australia		7 Jul 1986 a
Austria	21 May 1980	11 Jun 1984
Belgium		29 Jun 2004 a
Chile	3 Jan 1980	12 Nov 1981
France	29 Jan 1980	
Guatemala	20 Nov 1980	
India	18 Jan 1982	
Kazakhstan		11 Jan 2001 a
Kuwait		28 Apr 2014 a
Lebanon		12 Apr 2006 a
Mexico		11 Oct 1991 a
Morocco	25 Jul 1980	21 Jan 1993
Netherlands	27 Jan 1981	17 Feb 1983
Pakistan		27 Feb 1986 a
Peru	23 Jun 1981	23 Nov 2005
Philippines	23 Apr 1980	26 May 1981

Romania	17 Apr 1980	
Saudi Arabia		18 Jul 2012 a
Turkey		29 Feb 2012 a
Uruguay	1 Jun 1981	9 Nov 1981
Venezuela (Bolivarian Republic of)		3 Nov 2016 a