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International Space Law: A Hindrance to Space Activities or a Resolute Action for Change

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Abstract: Space has changed immensely in both the 20th and 21st centuries, but the law has not. The law governing space activities, is the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies resolution 2222 (OST). The OST creates international legal clarity in which domestic law enhances the state's obligations and builds upon the OST. While the OST has undoubtedly laid the foundations for space activities and remains valid in the 21st century, it has left gaps in enforcement, legal advancement and the suitability of space governance. The creation of space governance and the proactive nature of such is a topical question which requires clarity in the 21st century. The activities and suitability of space governance for non-governmental organizations presents an international development gap in light of present-day activities. It may be argued that the OST was not prepared for the likes of commercial activities or the environmental impact of scientific missions. But the framework provided by the OST allows for a simple view of space. It is, therefore, left to the current governance structure to examine the productivity of these groups within the state or under article VI of the OST. Therefore, the hindrance of international law would fall upon current measures and whether space governance can produce a sustainable agreement that benefits the state and space under the OST. This article will consider the premise of the OST's ability to act within the 21st century and the suitability of space governance. Moreover, elements of non-governmental influences will be explored throughout to determine whether a hybrid approach could be formed by using the OST as a legal foundation for which space governance, through non-binding agreements, international agencies and domestic actors, can create a basis for the future of space. The developments from international law, state practice and space law will feature throughout. Ideas from private actors' philosophies and mandates awarded to international and regional agencies, will form a basis on space law which could be accepted in the international community.

Keywords: International Law, Soft Law, NASA, ESA, UNCOPUOS, COSPAR

1. Introduction

Space exploration received a lot of attention following the launch of Sputnik on October 4, 1957. As the first artificial satellite launched into elliptical orbit by the USSR, it became the preamble for human contact with space. This was followed by the development of ground-breaking technology by governments and private entities for space travel and exploration. [37] Satellite technology has not only informed and aided responses to natural disasters such as typhoons, tornados and hurricanes, it has also facilitated a deeper understanding of the cosmos. Through space exploration, space tourism is now imminent, with the possibility of residential space stations and settlements on the Moon and

other planets in the galaxy. Given the advances in space exploration by multiple governmental and private institutions, the development of space law has become necessary to facilitate peaceful interactions in these endeavors. [50] The law states that space exploration would be used for the benefit of all humankind as opposed to individual nations or private institutions. [42, 69] This law, the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies resolution 2222, or the Outer Space Treaty (OST), which was developed in 1967, makes it possible to regulate space exploration [41]. As a result, all states can use and explore outer space provided that they abide by the OST and the rules of international law. States

which are party to the treaty undertake not to place in the Earth's orbit any objects carrying nuclear weapons or any other kind of weapons of mass destruction, to install such weapons on celestial bodies, to place such weapons in outer space (Article IV), or to harmfully contaminate the Earth or any other celestial body, in addition to agreeing to mutual co-operation and assistance. Space exploration has significantly changed, but the law has not made a sufficient effort to regulate space activity in the 21st century.

Space law regulates activities in space and defines the obligations and liabilities for states involved in space exploration. The law addresses a number of issues or concerns, such as accidents and interference of space activities by other states or astronauts. These regulations control how humans interact with outer space while preventing damage or malicious activity by states or nationals. The international law of space is developed by the Committee on the Peaceful Uses of Outer Space (COPUOS) [50]. There is a total of five international treaties addressing different concerns and principles on space-related activities. Among the key issues are the non-appropriation of space by individual states, [44] arms control, damages liability, freedom of exploration and safety or rescue provisions [16, 15]. A brief background of the composition of space law is necessary in order to examine whether or not the OST sufficiently meets the demand for 21st century space activities.

The first part of this article will consider the fundamental aspects of international space governance and how the OST governs from a foundational point of view in relation to space activities in 2021. This chapter will discuss the Committee on the Peaceful Uses of Outer Space (COPUOS) and will begin to consider space governance through non-binding agreements and soft law. Next, the article will concentrate on current governance structures and the advantages and disadvantages of the current international structure. The article will further consider the developing issues of the OST, as well as peaceful and sustainable uses of space. To conclude this chapter, the possible evolution of space law and governance and what this may look like in the future will be discussed. Through this discussion, the article will begin to examine international space law and how international organizations, private actors and the commercialization of space works within the current international legal system. Such developments of none governmental organizations will also play a pivotal part in briefly considering non-binding agreements, soft law and state responsibility and how this could manifest beyond what is currently being acted upon. This view will be limited to what could be constrained within the commercial space doctrine and how space actors use it and act upon it. The consideration of legal theory and international implications will conclude the discussions herein, with a particular focus on recommendations for how space governance should shape the future of space. The author will consider what kind of hybrid approach may work for space and whether international space law can remain a foundational document

to build upon, or whether the deficiency of it is too much to bear in the 21st century.

2. At the Dawn of Space: Space Law

As many academics have pondered over the OST and the effects it has on modern space, this chapter will consider what foundational position the OST provides, the gaps it leaves and the ability or inability for international law to deal with space in the 21st century. While this discussion will not consider other space treaties, it will acknowledge them. By limiting the application to the OST, the author will attempt to demonstrate its foundational deficiencies. The author acknowledges that the other space treaties have great importance, but they all stem from the OST as a foundational treaty. Therefore, the OST will be the primary focus of the article, as well as what space law is, what it can be used for and how it can conform to 21st century life and commercial interests. The author believes it is important to consider the development of commercial space in a 21st century context, and the potential resulting strains that would need to be considered by international space law. The main aim of this section is to examine space law and governance and to discuss how the development of space activities in 2021 has developed and challenged the international governance legal regime.

2.1. *United Nations Committee on the Peaceful Uses of Outer Space (COPUOS)*

Within most articles on space law, COPUOS is the first to be addressed. But the development of space law and its geopolitical understanding of the treaties is just as important as its implementation. COPUOS was founded in the year 1959 [77] by the General Assembly as a means of governing the use and exploration of outer space [78] for such benefits as security, development and peace. The role of COPUOS was to review global co-operation to ensure peaceful utilization of outer space, to facilitate the study of space-related activities that were to be undertaken by the United Nations, to encourage research programs in outer space and to promote the study of legal issues that would arise due to the exploration of outer space [79]. The Committee facilitated the formation of five principles and treaties in regard to outer space. Global co-operation with respect to the exploration of outer space as well as the use of technology from space for exploration is annually discussed during committee meetings [79]. Because of the rapid development of space technology, the space agenda is constantly evolving, and the Committee therefore provides a unique 'ground' for discussing and monitoring these developments at an international level. The Committee comprises of scientific and technical subcommittees as well as a legal subcommittee, established in 1961 [80]. COPUOS answers to the fourth committee of the General Assembly that adopts a yearly resolution to ensure the peaceful utilization of outer space. The mandate for governing space activity lies with COPUOS. This UN body holds the responsibility for facilitating the co-

operation of parties in their conduct of space activities. [81] Ideally, space is an international resource that continues to attract several actors with a vested interest in its resources or information on the Earth's outer environment. Newlove-Eriksson et al assert these claims, stating that an increase has been seen in the number of intergovernmental actors involved in space politics. This has shifted the system of governance from the domain of a few superpowers to now also include independent private actors. [56, 67] The formation of COPUOS creates the first stage of governance which space law can draw upon. However, with the commercialization of space and rapid scientific and technological advancement in space exploration, COPUOS's development as a committee for space is being tested. Before considering the OST, which will alleviate some of these concerns, we must consider another international organisation which COPUOS could develop into, one which has the ability to recognise development and hear disputes. The likes of the World Trade Organisation is a similar governance body which the author will consider, along with the question of how the future development of COPUOS could only advance the peaceful use of space activities by governing through sustainable and proactive co-operation within the international community.

Like its international cousins, such as the World Trade Organisation (WTO) and the International Tribunal for the Law of the Sea (ITLOS), COPUOS does not have a legally binding arbitration or legal disputes mechanism. The author accepts that these bodies are not comparable within the international community, but they can learn from, and be utilized, by each other. A consideration of what such a mechanism may consider would be a future development that COPUOS could consider in its terms of reference. Although the WTO does not consider space activities that are applicable to trade, the remit of trade would be a factor within the future of space. The author therefore has chosen the WTO to envisage what COPUOS could develop or manifest into for the development and progressive mutual co-operation of matters relating to space. Again, this article will not examine the deficit of COPUOS or the WTO and ITLOS, but will simply point to the option to use transparent and open dialogue that compromises of legal remedies to solve an issue with the basis of the United Nations Charter in mind. The creation of space law was promoted as being implemented for the peaceful use of space but also for international co-operation, transfer of knowledge and the development of a framework that provides equality among states. Many will argue that COPUOS has a legal subcommittee, and again this point is not moot, but the legally binding nature is missing. Unless states agree to the adoption of a principle or declaration of COPUOS, the committee and organisation is left with a half in and half out scenario, and this is where the WTO and ITLOS have expanded the international community and solved issues without the need of sanctions and without the displacement of pro-logical friendships or underlying tensions. This will be further discussed in chapter two: the advantages and

disadvantages of space governance and what its evolution looks like will be considered.

2.2. *The Outer Space Treaty 1967 (OST)*

The OST became the central legal framework on which the General Assembly developed governance principles under the UN General Assembly Resolution 1962 (XVIII) with few additional provisions. Three depositor governments (the Soviet Union, the United Kingdom, and the United States) were the first signatories following the formulation of the OST in 1967 [50]. In addition, the treaty provided the framework for the development of space law. The declaration of space as the province of all humankind became one of the most important principles, ensuring that countries would not engage in territorial ownership of space and celestial bodies [58]. This principle would ensure that state and non-state actors engaged in activities that were in the best interest of all humanity with no malicious interactions between states. In addition, the treaty declared that all states could freely explore space without national appropriation by claim of sovereignty to the use of or residence on the Moon and other planets, and to allow free and unharbored exploration of space. According to the treaty, all exploration or space activities should be conducted peacefully [60]. Given that the law was developed shortly after the start of the Cold War, it was critical to ensure that powerful nations would not use their nuclear ability to lay claim to resources in space, hence inhibiting or controlling the activities of others. Under the treaty, nations are liable for all government and non-governmental entities based in their country.

The OST is the foundation on which space governance and mutual co-operation can be built. As discussed above, space law does not have any dispute mechanisms. By considering and acknowledging international environmental law and the likes of the Kyoto Protocol, Stockholm Declaration and Rio Declaration, the author argues that the lack of a dispute mechanism makes the OST weaker than other international legal areas which have a jurisdictional overview or dispute route. But what the OST does have is a mechanism built into the treaty to rationalize disputes as a form of absolute liability.

Article VI of the OST is perhaps the international community's best compatriot in reproducing a web of control and a safety mechanism under a dispute resolution. Article VI allows for the creation of absolute liability for the launching state, with the state theoretically responsible for the causation and remedy of any issues that may occur.

With absolute liability it stands to reason that on a theoretical legal question the answer is direct. If the launching state, which is typically the controlling jurisdiction, has an issue with any parties, then they are responsible for the launch, procedural authorization and legal development of the launch. If a satellite falls out of the sky and hits a car the state will be sued, and if a rocket explodes and causes massive environmental harm the state will be contacted, and so on. This allows a large scope for the state, but also affords a level of security to the international community and other

states. This article, among the other seventeen articles of the OST, provides a creative backstop for space activities. As will be discussed in later chapters, the commercialization of space and its governance will rely upon article VI in order to further develop and defend its lack of a legal authority or dispute mechanisms.

The foundation of space law through the OST is unquestionable. Throughout its international field a plethora of foundational legal doctrines exists for the benefit and uses of space. This chapter sets the scene for what is current during space activities and what space-goers can expect while using and exploring space. The key aspect from the OST remains in article VI, which awards the ultimate responsibility for space to the state. The enhancement of international space law through revisions of existing treaties and the implementation of a new treaties is not a topic that will be discussed within this article. However, if space can be considered in the same manner as the Earth's environment, agreements and treaties are not favored and are often replaced with principles and nonlegal doctrine.

2.3. Space Governance and Non-binding Agreements (Soft LAW)

The United Nations Office for Outer Space (UNOOSA) and the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) will be considered at the beginning of this chapter. The chapter will examine how COPUOS works within international space law, taking into account what authority they have and, more importantly, their ability to legally govern within their remit and terms under the OST and directions mandated by the UN. Moreover, international bodies such as the Committee on Space Research (COSPAR) and other regional space agencies such as the European Space Agency (ESA) will follow. By establishing the current international structure, pressures and regional and international involvement, this chapter will seek to understand the foundations, powers and influences often afforded to the international bodies and regional space agencies.

The increasing number of players in space use and exploration, and the growing suspicion with which states view the activities of one another, has led to the development of strategies, military tactics and techniques that would be necessary to prevail in a conflict that may extend into space. [6] Despite the insistence on the peaceful and non-territorial use and exploration of space, many actors continue to explore ideas around space weapons and the protection of expensive space crafts and stations. These are emerging issues that are not adequately addressed by the OST. [10] As a result, the use of non-binding agreements is one of the viable alternatives for space governance in the 21st century and beyond.

The process associated with the development of soft law provides a rapid and less complicated alternative for addressing shared problems and ambiguity in the statute, and for overcoming the political challenges which often hinder effective space governance. [10] Through the concept of soft

law, states are afforded flexibility which is instrumental in dealing with the constantly changing nature of space governance and associated issues. In *Thamotharem v. Canada* (2007), the court noted that administrative agencies' effective decision-making involved striking a balance between general rules and ad hoc discretion. [4] The result is an ability to access the benefits of certainty and consistency on one hand and flexibility and fact-specific solutions on the other, with the latter being particularly aided by the application of legislative instruments such as non-legally binding soft law and other guidelines. Space governance is characterized by complex interactions and a constantly changing practice environment, towards which the elements of hard law remain insufficient. [42] Therefore, incorporating soft law could facilitate the speedy and flexible resolution of emerging issues in space governance to foster peaceful use and exploration of space.

Whether or not the new regime will be beneficial in adapting space law to the dynamics of the 21st century and beyond, depends on the view of the OST on the grounds of hard versus soft law and the idea of governance under the two concepts. According to Graziano and Halpern, focus on the interplay of policy instruments rather than the static examination of hard versus soft law establishes convergence of policy areas, inclusiveness and effectiveness in applying the law for space governance. Evaluation of the law under these measures facilitates a more expansive understanding of its relevance in space governance. The question lies not in whether the law is sufficient but rather on the governability of space activities by states and non-governmental entities. [24].

When examining the OST as a comprehensive legal document, its amendment or replacement is justified in light of current changes in the actors, technology and interests in space exploration. As a legal document, it means that the OST cannot provide the legal structure, standards and protections necessary for the use and exploration of space in the 21st century. The claims for the amendment of the OST have been based on the interpretation that the law lacks the capacity to facilitate the development of commercial space or to address emerging concerns on security and future exploration activities. [6] Therefore, the law cannot independently guarantee the effectiveness or inclusivity of varied interests in the future exploration of space. In comparison, the view of the OST as a set of guiding principles means that it can sufficiently guarantee space governance in the same way that states use constitutions as a guide and not static law. However, in the same way that the foundational principles of the United States do not satisfy the requirements for its governance, the OST as a set of guiding principles alone may be insufficient in providing comprehensive space governance. The bone of contention in the view of the OST, as a set of guidelines rather than comprehensive law, lies in the question of whether such principles can be legally binding. In response to these concerns, the case of *Baker v. Canada* (1999) is an important reference. The court cited that while

guiding principles may not be legally binding, they inform discretionary decisions. [3] The denial of Baker's application to remain in Canada on humanitarian grounds was unreasonable since it violated ministerial guiding principles. As a set of guiding principles, it would mean that the OST has not failed in providing effective space governance but rather has provided five decades of peaceful exploration and has prevented the launch of weapons of mass destruction. Article VI presents an interesting scenario and a means for testing as to whether the OST is acted upon. The function of weapons of mass destruction in space was a consideration of the OST. This primary issue managed to not only bring the East and West together but has also deflected the prospect of a war in space. In ASAT testing, missiles are fired by states at their own objects. Although this creates debris, this alone is not reason enough to consider the use of weapons of mass destruction in space a viable option. Is it the practicability, the costs, or the geopolitical pressure beyond the influence of the likes of Sputnik- or can the international community consider article VI to be a cheap bargaining tool for appeasing the international community at a time of uncertainty? Instead of a failed statute, the set of guiding principles that is the OST has stood the test of time. Nonetheless, the imminent issues and concerns of the 21st century are demanding and will become increasingly complex in the future. However, this demonstrates that guiding principles are equally effective in providing the flexibility necessary for 21st-century space governance and beyond.

An approach that uses non-binding agreements to address the inadequacies of the OST has been tested in space governance with considerable success. In his research, Beard observes that since the year 2005, the UN General Assembly has been involved in the creation and adoption of Outer Space Transparency and Confidence-Building measures (TCBMs). [6] Further, the UN General Assembly, recognizing the limitations of the current space law, formed a Governmental Group of Experts (GGE) in 2011 to conduct a study on the same, and a final report was delivered in 2013. In addition, the UN has been encouraging countries to voluntarily engage in the development of intercontinental ballistic missiles, which the organisation then reviews and monitors to ensure adherence to the fundamental standards and policies of space exploration. Engagements with individual states has allowed the UN access to information on the progression and individual interests of states and non-governmental entities towards future exploration activities. In addition to the ICBMs, the UN General Assembly is working on a new draft of the code which comprises of four components, namely core principles and objectives, general measures, co-operation mechanisms and organizational aspects. Under the new code, the objective is to enhance safety and sustainability in space exploration operations in the 21st century and beyond.

However, these developments, as the solution to emerging problems in an increasingly crowded space governance, are problematic at best and lack democratic legitimacy. [38] The

increase in private or independent actors participating in space exploration means that state-centric solutions such as the TCBMs, GGEs and the new code by the UN could still be inadequate in achieving inclusiveness in future space governance. [9] While states are responsible and liable for the actions of these actors, the commercial law for space is wildly underdefined. Given that article VI places the burden of the state on the regulatory and responsible body, commercial space, through state or international control, would limit the likes of normal governance elements within a corporate governance structure. The reason why SpaceX, Virgin, Blue Origin etc. have been so successful is that they are subsidized by the state and are under state control to a certain level. The development of commercialization in space may reach a point where state backing is not needed and therefore limited by liability and regulation. Relatedly, some authors recognise that commercial space actors' rise to prominence was not foreseen or was not a priority during the formulation of the OST. Still, this can no longer be ignored or suppressed in 21st century space governance. After all, the Cold War influenced many of the measures put in place by the OST, making the United States and the Soviet Union the two main actors in space exploration. [82] Both states were equally involved and could be considered the main actors when creating the OST. Today, about 85 state and non-state actors are conducting exploration activities in space, increasing the potential risk for lack of co-operation between the actors if they feel excluded or ignored. In addition, there is a need to expand the scope of regulations to protect assets and valuable orbits to guarantee the sustainability of space operations in the future. [16] While soft laws are not the ultimate solution to the problem of space governance, they provide numerous opportunities to respond to emerging issues with greater flexibility and speed.

This foundation chapter has considered space governance and space law relevant to this article and has touched upon non-binding agreements. The best alternative for space and its governance is yet to be determined. The author believes that governance will follow a modified environmental governance route, with an added value of international accepted treaties and principles to fall back on. Such a formation would consider the OST, Liability Convention, Rescue Agreement, The Moon Agreement and registration convention. The question of whether space governance is lacking because it fails to mandate a legal mechanism for dispute is a negative application towards the treaty. Article VI, COPUOS or the UN General assembly could manage a dispute, or similar states can manage negotiations, as was the case of Iridium 33 and Cosmos 2251. The development of the OST along with the UN Charter clearly mandates states to solve sovereign issues between themselves, uphold mutual co-operation and act in such a way that the international community develops rather than regresses. The next section will consider the peaceful and sustainable use of space and what the author sees as the current advantages and disadvantages of space governance, factoring in various issues.

3. Peaceful and Sustainable Use and Exploration of Space

Space governance occurs in a complex international domain which necessitates the promotion of peaceful and sustainable interactions. We will consider the complex nature of the peaceful and sustainable use of space in brief. Moreover, some of the advantages and disadvantages of space governance will be considered before moving on to the possible evolution of space governance and what could this look like. This will help once again to aid understanding of the nature of space and of why states undertake tasks as they do. The principles and provisions of the OST have not changed significantly since their formulation between the 1960s and 1980s. In contrast, space technology and exploration activities are advancing rapidly, giving rise to new possibilities as well as legal concerns. As a result, the future of space activities is highly reliant on constant and unimpeded access to space to facilitate activities such as space tourism. In the wake of modern-day space activity, the OST is no longer fit to regulate and facilitate peaceful space exploration in the 21st century. [21] An emerging legal issue not covered in the OST involves the likes of liability, harmful contamination, and the commercialization of space above the considerations of article VI. [45, 47] Chapter three will consider the commercial aspect of space and whether a legal doctrine exists. Space governance is critical in creating a new legal regime to govern activities in outer space to guarantee peaceful use and exploration of celestial bodies. [54].

3.1. Advantages of Space Governance

The growing number of states and non-state actors in the use and exploration of space has ultimately resulted in complex interactions, raising issues and concerns about space governance. According to Jakhu, the conception of governance with regard to space pays little attention to the institution of government and focuses more on the interactions between governments and social organizations. [35] Therefore, governance refers to the engagement of stakeholders in processes involving social, economic, political, administrative and legal domains, with the government playing the role of a facilitator. Jayaraman posits that the complexity of observing the process means that understanding governance is largely based on its systems and frameworks, including the procedures, conventions, agreements and policies that inform the distribution of power or control of space exploration. [38] The rise of private authority in space governance in the 21st century has contributed significantly to the complexity of the domain. According to Gallagher, international systems in the 21st century permeate the degradation of multilateral governance and facilitate the progression of unilateral norm-shaping and bilateral governance processes between state actors in space, which can be advantageous or disadvantageous for the governability of space. [23] An example of such interactions is the divergence between the United States, China and the

Russian Federation as key state actors in outer space, causing conflict around the use of materials obtained from outer space, legal principles, militarization and norm-shaping, which have had an obstructive effect on effective space governance.

Additionally, the creation of unilateral and bilateral systems of governance at the expense of multilateral ones can be seen through the UN General Assembly's efforts to establish accountability of individual state actors through TCBMs and GGEs that the organisation reviews and monitors based on the interests of different states in space exploration. Nonetheless, the fact that space governance is highly state-centric remains problematic to space exploration activities in the 21st century and beyond. In the midst of the complex interaction between state and non-state actors in space exploration, there are many advantages and disadvantages of the current space governance system. COPUOS provides a platform where states, experts and international organizations can openly discuss issues and plans. Recently, COPUOS revised their draft for a space 2030 agenda. This agenda showed that their mandate of Peaceful Uses of Outer Space came into being as a result of recognition from the General Assembly in its resolution 1348 (XIII) of 13 December 1958, which stated the importance of using outer space for peaceful purposes and of the need to promote international co-operation in the conduct of space activities; in its resolution 1472 A (XIV) of 1959, the Assembly permanently established the committee remains the priority for the group doesn't quite make sense. I think a word might be missing but I'm not sure what it is. It's not clear what remains the main priority for the group.

In their strategic vision however, some new concepts and principles were added. Space science and technology are now intrinsic to our daily lives and bring an abundance of unique and fundamental benefits to Earth [83]. The acknowledgement of a multidisciplinary approach allows the advancement of COPUOS and allows them to consider and make use of other established areas while influencing their mandate of the peaceful use of space. Point 13 of Space2030" Agenda report states:

We commit to addressing changes in the undertaking of outer space activities at a time when new technologies have emerged and when an increasing number of participants, representing both governmental agencies and non-governmental entities, including industry and the private sector, are becoming involved in ventures to explore and use space and carry out space activities. In that regard, we commit to ensuring that the Committee, and its subcommittees, supported by the Office for Outer Space Affairs, continue, as appropriate, to respond to such changes, in their role as unique platforms for international co-operation in the peaceful uses of outer space [83].

The adaptability of space governance beyond the OST and other space laws creates a two-way system. COPUOS further lays out a four-step plan for the future which has a number of aims: to enhance space-derived economic benefits, to strengthen the role of the space sector as a major driver of

sustainable development, to harness the potential of space to solve everyday challenges, to leverage space-related innovation to improve quality of life, to build partnerships and strengthen international co-operation in the peaceful uses of outer space and in the global governance of outer space activities, to improve access to space for all, and to ensure that all countries can benefit socioeconomically from space science and technology applications and space-based data, information and products, thereby supporting the achievement of the Sustainable Development Goals. It is clear that space governance has moved on from the foundations of the OST, while seeking to build on them.

By working with states, United Nations entities, intergovernmental and non-governmental organizations, industry and private sector entities, COPUOS is extending their hand through the UN Charter and encouraging international cooperation to develop their ability to govern space proactively, with a focus on being innovative, adaptable and looking to the future of space.

In this chapter, the author has attempted to understand the remit of space governance and the law. The creation of COPUOS and its influence on the international space community demonstrates their mutually beneficial relationship in the 21st century. The early introduction of soft law through non-binding agreements is perhaps one way in which space governance can develop above the rationale and foundational treaties of international law. According to authors such as Jakhu et al., the working regime of agreements, complex relationships and space developments are all seeking to foster a potential workable scenario within which space law and governance can develop at a formal level and be somewhat futureproof in terms of commercialization and developing space activities.

3.2. Disadvantages of Space Governance

The degradation of multilateral governance in the contemporary international systems in space exploration activities, presents the degradation of the international legal system and treaty law as an atypical concept. The creation of unilateral and bilateral governance processes between actors in space has been attributed to the development of escalating strategic geopolitical narratives which obstruct effective governance of space activities. [27] Processes of space governance continue to uphold the standards and requirements set out under the OST, which remain uncontested and have been reaffirmed by unilateral action and multilateral mechanisms. However, the OST and subsequent agreements regarding space exploration limit and obstruct effective multilateral governance. For instance, the OST fails to provide sufficient guidance for operations such as space mining on celestial bodies, a factor that opens up the creation of unilateral and bilateral systems between powerful actors such as China and the United States. [8] The Moon agreement, created in 1979, was meant to set out the foundation for developing a legal regime on the use of space resources. However, it did not include the legal framework to facilitate the governance of space activities.

Moreover, the Moon agreement was only adopted by 11 states, thus failing to garner widespread international support for multilateral space governance. The Moon Agreement stated that in addition to space being the province of humanity, it would be considered a common heritage for all humanity. Reasonably, powerful actors in space explorations were put off the idea of space being a shared heritage, causing stagnation in the development of multilaterally led space law. [12] This obstacle has not yet been overcome despite rapid growth in the number of private actors in space exploration. [7, 69] The development of voluntary TCBMs through bilateral co-operation is a clear indicator that the stagnation of multilateralism could continue in years to come, making it harder to regulate the use of space resources.

The Artemis Accords refer to a set of common principles developed by the United States as a form of bilateral co-operation. Under the Artemis Accords, the United States included standards for scientific and commercial exploration of space aimed at creating an ecosystem that facilitates the creation of products and services that would guarantee a sustainable presence on the Moon. Acceptance of the accord by other nations is guaranteed to establish bilateral agreements between the US and any willing partners, who must abide by American principles and in return participate in US-led space activities. [17].

Countries such as India, one of the largest upcoming economies and a potential ally in the Artemis Accord, have been under pressure to abandon the Moon Agreement. [39] In essence, bilateral and unilateral co-operation is likely to bring an end to the multilateral system of governance in favor of commercial exploration of space. The state-centric nature of governance in a system comprising several non-state actors, is a major barrier to commercial development, and could compromise the foundation of international co-operation in space exploration.

The procedure of space governance is particularly interesting and continues to be a work in progress. The simple and direct answer is that there is space governance. As demonstrated above, the system is splintered and reliant upon states. Unlike established areas of human rights or international criminal law, space relies upon influence from states, NGOs and many activists as well as international co-operation. Equally Weighted, the advantages and disadvantages of the current international treaty law seem to work in the 21st century to a certain extent. What they fail to factor in is the future. The impracticality of 21st century space is limited by technology with consideration to the goals of NGOs. Therefore, laws and regulations around space mining, colonization and other areas cannot be considered to be above the principles of the OST. With plans such as tourism, colonization and others from SpaceX, Blue Origin, space law and governance are restricted by technology, regulation and the era in which it finds itself. Only in developing an early proactive system that works with states, receives continued support within the UN, and is involved with international organizations, private actors and regional bodies, can space governance produce a potential regime

which the international community can foster, and therefore cater for the future.

Part B of the working paper submitted by the Bureau of the Working Group on the Space2030 agenda, sets out ideas of partnerships, tools and resources in a progress review. The partnership level is open to all. We must remember that under article VI of the OST, only states are considered ultimately responsible for activities within space. So, all parties are invited to the table, but unless a state authorizes a procedure or element within domestic law, other providers are simply restricted. Thinking optimistically, the author would like to think that the benefit of humanity and international co-operation comes above state interest, but this is not the case as directed by international environmental law.

Member States are invited to actively undertake bilateral, multilateral, regional and broader international space co-operation in various forms, including capacity-building, the sharing of information and infrastructure and the development of joint projects and, as appropriate, to integrate space co-operation with economic and development co-operation in order to promote the fulfilment of the Space2030 agenda and its implementation plan. [83] Although this is a positive aspect and one could argue that the current workings of cooperation and space activities is an advantage, there is a negative element. States and private entities are already carrying out developing and exploration tasks with the legal requirement to do so. Communications from the Committee on Space Research (COSPAR), the European Space Agency (ESA) and others are all working together in a private capacity and within multiple states for economic and development benefits. Therefore, the need for COPUOS is called into question. If all parties are working towards developing space without the need of a committee, why would another body be required?

Is it practicable that agencies exist to monitor and advise? Or if the space community shows a willingness to communicate and develop on their own accord, the level of international space governance seems somewhat diluted and fails to address what is currently happening under the likes of the WTO as previously discussed. If COPUOS was to develop their mandate to become the backstop for space, then space governance may be monitored, encouraged and progressed at international level. This would inevitably be passed down to states and actors to develop procedures and to create the ability to advance their methods. However, the author is minded that the development of COPUOS would have to be agreed by the General Assembly, which would allow for additional space-related governance to be given to COPUOS and for more sovereign and international co-operation to be afforded to the United Nations. This section has demonstrated the inability of COPUOS to act within a legal international region. To monitor, advise and issue declarations is only worthwhile if states acknowledge COPUOS and work in agreement with it. In such a scenario, space governance could develop with multilateral state interest, achieving a position in which the state listens to international organizations and other actors. The next chapter

will consider the evolution of space governance and how it can benefit space, in light of what has previously been discussed in this article.

3.3. Evolution of Space Laws and Governance

With the current technological advances in many spheres, the world has become “smaller” and “internationalized”. [21] Improved technology, as discussed in the previous sections of this article, has led to increased space exploration, including placing satellites in space and landing astronauts and scientists on the Moon and on other planets such as Mars. NASA has documented the planet Mars through several images with many discoveries made, leading to speculation about the existence of life on other planets [84]. These speculations follow the discovery of water on the surface of both the Moon and Mars [85]. With many countries launching explorations in space, it is imperative to explore the legal frameworks and governance which aim to ensure law and order in space. International treaties have been signed and national laws implemented. Currently, space laws and governance are an international concern, for instance, holding discussions about climate change, international criminal justice, global commons and world poverty, at the same time maintaining a grounded perception with respect to significant relevance in practical contemporaries [21]. Space exploration and activities in space affect ongoing evolution on Earth as it results in multiple changes in the manner in which people, cities, communities and nations exist and operate [86]. This has a similar effect in terms of implementing policy and regulatory frameworks or governance for activities in space.

The change in pace and widening scope of space activities is necessary to monitor the scope and content of space laws and governance, while at the same time recognizing strict legal perspectives to keep up with changes in space exploration [21]. A legal framework is required, for instance, for the interaction between space activities and space technology. This area is relevant to future international or global regulation relating to, for example, cybersecurity and cyber laws. It is imperative to highlight significant issues that arise due to continued advances in cyber technology, and that further emphasize the importance of regulating activities in outer space [87], given that there has been a rush to attain ‘digitization’ of activities in outer space. Given lessons that have been learned about space activities with respect to a legal regime for air space, it is important to consider the development of laws and regulations that will govern future space activities, taking into consideration the associated technical, jurisdictional, cultural, security and societal complexities [21]. There are consequences for continued use that requires regulations.

There exists a clear parallel distinction between the regimes with respect to cyberspace and outer space [88]. This not only impacts on law-making, but also, due to endless technological development as a result of space activities of the two regimes, is becoming more independent through private sector and critical development of technologies. In

multiple respects, the two regimes act in unison in the same ecosystem, with each regime relying on the other to ensure efficient functioning [89], current operational viability, development and significant concerns with national security. Indeed, it is becoming necessary to draft space infrastructure associated with clear reference to elements of cybersecurity that would dictate the utilization, implementation and application of the subject infrastructure [21]. In retrospect, it is fortunate that various space-exploring governments have devoted resources to establishing systems to safeguard cyber operations and capabilities of the subject country, cognizant of developing the same protective system for space assets.

A major development in space governance is the rise of private authority outside the domain of corporations and non-governmental organizations, giving rise to private actors increasingly influencing policies, practices, rules and norms in space politics. The growth of private authority in the governance of space activities is advantageous. It detaches public organizations from accountability and responsibility, facilitating the formation of governmental systems characterized by tenacity and adaptability. These developments highlight the complex networks of public and private actors that constitute space governance. Therefore, the legal and governance frameworks developed in the Cold War era are largely inadequate for sufficiently providing certainty, standards and protections for the use and exploration of space. Critical analysis of international space law, as a hindrance to space activities, provides a legal foundation for future legal frameworks of space law by considering non-binding agreements, international agencies and domestic actors.

In comparison to its international cousins such as the World Trade Organisation (WTO) and the International Tribunal for the Law of the Sea (ITLOS), COPUOS creates a legally binding arbitration or legal disputes aspect in its field. The author accepts that these bodies are not comparable within the international community, but maintains that they can learn from, and be used by, each other. A consideration could be considered on celestial trade and the manufacturing of space resources. Although this is not a factor considered by the WTO, the remit of trade would be a factor within the future of space. Therefore, the author has chosen the WTO as a basis for considering what COPUOS could manifest into as an organisation for the development and progressive mutual co-operation of space governance. Again, this article will not examine the deficit of COPUOS, or the WTO and ITLOS, but will simply point to the possibility of using transparent and open dialogue comprising of legal remedies to solve an issue with the basis of the United Nations Charter in mind. The creation of space law was promoted as being not only for the peaceful use of space, but also for international co-operation, transfer of knowledge and the development of a framework that would provide equality among states. Many argue that COPUOS has a legal subcommittee, and again this point is not moot, but the legally binding nature is missing. Unless states agree to the adoption of a principle or the deceleration of COPUOS, the committee and the organisation

is left with a half-in and half-out scenario. This is where the WTO and ITLOS has expanded the international community and solved issues without the need of sanctions or the displacement of pro-logical friendships or underlying tensions. This will be further discussed in chapter two when considering the advantages and disadvantages of space governance and what its evolution looks like.

It's difficult to begin to evolve space governance without clear intentions. The OST and other treaties provide a foundation, and COPUOS continues to bring to the table space activities and to motivate co-operation within space by opening the table and inviting all parties to it. A critical question is whether this is enough. How can space governance evolve beyond what is current to reach the next level of complete governance? Hirschmann [90] and Zurn [91] factor in various levels of global governance and by definition, the author believes that the acquisition of general overall governance can factor into and develop space governance. The space community must understand that space is just another international area where crossovers of governance, legal, financial, technological and other areas merge to allow the area to function. It is therefore proposed that by factoring in global governance and other areas of international law, the probability of an evolution of space governance would be reasonable and would allow true enhancement. The next chapter will consider commercial space and how private actors adapt and develop space governance through their commercial endeavors.

4. Conclusion

This article has sought to demonstrate where current space law and governance feature within the international community, the advantages and disadvantages of space law and what the future looks like with the evolution of space governance. To reach this position, the international community must develop space law and governance to correspond with such developing ideas and concepts of space mechanism throughout space activates. Private actors are hindered by financial resources without state aid, as demonstrated recently by OneWeb who were heavily invested in satellite communications, and SpaceX who received subsidies from the USA and NASA. Satellites are well managed, yet debris and inactive satellites are not considered in legally binding documents. New developments and commercialization are actively evolving and are rapidly changing the way space activities are undertaken and the way humanity views space. A flaw in previous space treaties failed to consider the commercialization process of space activities, and thus, the need for revised international space treaties. The author accepts that the development of soft law is a credible and legal consideration in space, as pressed by the International Courts of Justice article 38. However, the provision of soft law has developed so that continuous practice and development must be carried out and accepted by the state. If an established amount of time and casual acceptance can be shown, the state may still not accept such a

soft law mechanism. If this was to be challenged, the national or international community would still develop the issues of a formal and adequate dispute mechanism.

A comprehensive international treaty will also prevent space explorers from establishing a bad precedent by engaging in space activities outside the scope of established international space laws. A proper framework shall also assist countries that will not participate directly in moon missions, complying with the provisions of the OST that space operations are for the benefit of humanity. Under a hybrid approach, the likes of COPUOS could develop a larger role within international governance. The likes of the World Health Organisation, World Trade Organisation (WTO), and other international bodies would afford space a unique specialization which states could rely upon. If we put aside current international tensions and work on the basis that space is, and always will be, for the benefit of humanity, peaceful use and for the advancement of technology and scientific endeavors, a hybrid position of COPUOS would only advance space governance, acceptance and state co-operation. The likes of the WTO offer a dispute settlement arrangement, transparency and a specialized perspective within the area of trade. With the likes of specialized organizations such as COSPAR, regional representation and expertise, the workings of such a governance approach could be carried out under the mandate of space, in addition to being fair and transparent. This therefore builds on the routes of global governance and the theory behind such legal constructs. If the main consideration is dispute mechanisms, an overseeing body and mutual co-operation, then the WTO model or even a hybrid approach could be developed for space.

If this was considered, the international community would build upon the international space treaties already in place which would allow the development of a rolling governance approach that grows and matures with all areas and concepts of space. The formation of agreements, international practices and soft law develops as a natural process through time and agreement. However, the caveat of the space industry over governance would lend itself to the likes of international environmental law and the governance of non-binding agreements as the preferable option in the current international environment. If such a governance structure is considered, then states may not readily buy into these concepts, and therefore the current governance system would remain. The nature of international treaty law being as it is, it would remain unlikely that the OST would be replaced, and therefore international law would continue to be vulnerable and left to rely upon precedents, soft law and political influence to command any sort of influence over space. In general, treaties are not typically popular in particular areas if dispute mechanisms and articles are featured that can hold a state to account. Therefore, we are left with non-binding agreements or a new view of space governance in line with a reformed international governance system.

The pessimism and concern over space do not take away from the excitement and affluence it offers. The author will

forever remain skeptical without black letter treaty law but understands that as with the mysteries of international law, this is normal. The author has hope that international organizations, regional agencies and private actors within the community can rally behind space for economic value and, equally, for scientific prosperity. Space holds some intrinsic value and must remain the province of all humanity so that we can understand its environment and what amazing and exciting possibilities it offers. The enthusiasm surrounding discussions on space are firmly on the agenda and can only develop as humanity increasingly uses and operates in space.

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References

- [1] *United States v. Causby*, 328 U.S. 256, 66 S. Ct. 1062, 90 L. Ed. 1206 (1946).
- [2] *United States v. Mead Corp.*, 533 U.S. 218, 121 S. Ct. 2164, 150 L. Ed. 2d 292 (2001).
- [3] *Baker v. Canada (Minister of Citizenship and Immigration)*, 1999 S.C.R. 2 817 (1999).
- [4] *Thamotharem v. Canada (Minister of Citizenship and Immigration)*, 2007 F.C.A. 198, 2008 F.C.R. 1 385 (2007).
- [5] Ball, P. 'Time to Rethink the Outer Space Treaty' (2007) *Nature*.
- [6] Beard, J. M. 'Soft Law's Failure on the Horizon: The International Code of Conduct for Outer Space Activities' (2016) *U. Pa. J. Int'l L.*; 38: 335.
- [7] Benkő, M., Schrogl, K-U., Digrell, D., and Jolley, E. (eds) *Space Law: current problems and perspectives for future regulation* (Eleven International Publishing 2005).
- [8] Boley, A. and Byers, M. 'US policy puts the safe development of space at risk' (2020) *Science*; 370 (6513): 174-5.
- [9] Bragg, B. 'Governing in a Crowded Space: The OST and Development of the Legal Regime for Space: A Virtual Think Tank (ViTTa) (registered trademark)' Report. Joint Staff J39, Strategic Multilayer Assessment Washington, DC United States; (2018).
- [10] Cannizzaro, E. and Rebasti, E. 'Soft Law in the EU Legal Order' (2012) *Das soft law der europäischen Organisationen - The Soft Law of European Organisations - La soft law des organisations européennes* 208.
- [11] Chiu, S. W. 'Promoting international co-operation in the age of global space governance—A study on on-orbit servicing operations' (2019) *Acta Astronautica*; 161: 375-81.
- [12] Coffey, S. 'Establishing a legal framework for property rights to natural resources in outer space' (2009) *Case W. Res. J. Int'l L.* 41: 119.

- [13] Cooper, D. *Governing out of order: Space, law, and the politics of belonging* (Rivers Oram, London and New York University Press 1998).
- [14] Cornec, C. The post-Cold War issues of the space conquest: Thoughts on the future of an increasingly attractive space (2019).
- [15] Crane, L. The arms race in space (2018). 1.
- [16] De Man, P. *Space Law, Scope and Status. In Exclusive Use in an Inclusive Environment* (Springer, Cham 2016).
- [17] Deplano, R. 'The Artemis Accords: Evolution or Revolution in International Space Law?' *International & Comparative Law Quarterly* (2021).
- [18] Double SpaceX Rocket Launch (2017) 235 *New Scientist* 7.
- [19] Dunn, M. 'Blue Origin Successfully Tests In-Flight Escape System' (2016) *Physics Today*.
- [20] Ehrenfreund, P. and others, 'Toward a global space exploration program: A stepping stone approach' (2012) *Advances in Space Research.*; 49 (1): 2-48.
- [21] Freeland, S. 'The limits of law: challenges to the global governance of space activities' (2020) *Journal and Proceedings of the Royal Society of New South Wales* (Vol. 153, No. 477/478, pp. 70-82).
- [22] Gabrynowicz, J. I. 'Space Law: Its Cold War Origins and Challenges in the Era of Globalisation' (2004) *Suffolk UL Rev.*; 37: 1041.
- [23] Gallagher, N. 'Space Governance and International Cooperation' (2010) *Astropolitics.*; 8 (2-3): 256-79.
- [24] Graziano, P. R. and Halpern, C. 'EU governance in times of crisis: Inclusiveness and effectiveness beyond the 'hard' and 'soft' law divide' (2016) *Comparative European Politics.*; 14 (1): 1-9.
- [25] Hampson, J. 'The future of space commercialisation' (2017) *Niskanen Center Research Paper.*; 25.
- [26] Handberg, R. 'Is space war imminent? Exploring the possibility. Comparative strategy. (2017); 36 (5): 413-25.
- [27] Hertzfeld, H. R., Weeden, B., and Johnson, C. D. 'Outer space: Ungoverned or lacking effective governance?: New approaches to managing human activities in space' (2016) *SAIS Review of International Affairs.*; 36 (2): 15-28.
- [28] Hertzfeld, H. R. and von der Dunk, F. 'Bringing Space Law into the Commercial World: Property Rights without Sovereignty' (2005) *Space, Cyber, and Telecommunications Law Program Faculty Publications.* 15.
- [29] *Highlights in Space 2002: Progress in Space Science, Technology and Applications, International Co-operation and Space Law* (United Nations 2003).
- [30] Hobe, S. The Impact of New Developments on International Space Law (New Actors, Commercialisation, Privatisation, Increase in the Number of Space-Faring Nations). *Univ. L. Rev.* 2010; 15: 869.
- [31] Hobe, S. 'Historical Background' in Hobe, Schmidt-Tedd and Schrogl (n 33) 14, para 44.
- [32] Hunt, K. 'Mission to Clean up Space Junk with Magnets Set for Launch' (*CNN*, 1 April 2021) <<https://www.cnn.com/2021/03/19/business/space-junk-mission-astro-scale-scen/index.html>> accessed 2 July 2021.
- [33] Iacomino, C. *Commercial Space Exploration: Potential Contributions of Private Actors to Space Exploration Programmes* (Springer 2019).
- [34] In addition, the Outer Space Treaty has been signed by 23 States (January 1 2020); data available at <[TreatiesStatus-2020E.pdf](https://www.unoosa.org/pdf/2020E.pdf) (unoosa.org)>.
- [35] Jakhu, R. S. and Pelton, J. N. 'National Space Policies and Laws and Global Space Governance' (2017) *Space and Society Global Space Governance: An International Study* 87.
- [36] Jakhu, R. S. and Pelton J. N. (eds) *Global Space Governance: an international study* (Springer International Publishing 2017).
- [37] Jasentuliyana, N. *International space law and the United Nations*. (Brill Nijhoff 1999).
- [38] Jayaraman, V. 'Space Technology Inputs for Good Governance' (2015).
- [39] Kaul, S. 'Need for Space Governance for India and Global Space Governance' (2017) *Journal of space safety engineering*; 4 (1): 52.
- [40] Keefe, H. 'Making the final frontier feasible: A critical look at the current body of outer space law' (1995) *Santa Clara High Technology Law Journal*; 11 (2): 345.
- [41] Kopal, V. Treaty on principles governing the activities of states in the exploration and use of outer space, including the Moon and other celestial bodies. United Nations Audiovisual Library of International Law. (2008). 1.
- [42] Kostenko, I. 'Current Problems and Challenges in International Space Law: Legal Aspects' (2020) *Advanced Space Law.*; 5: 48-57.
- [43] Kudryavster, K. 'Blue Origin protests NASA choice of SpaceX to land astronauts on Moon' (*AFP*, 27 April 2021) <<https://www.msn.com/en-us/news/technology/blue-origin-protests-nasa-choice-of-spacex-to-land-astronauts-on-moon/ar-BB1g59YB>> accessed 2 July 2021.
- [44] Lai, A. K. *The Cold War, the Space Race, and the Law of Outer Space: Space for Peace* (Routledge 2021).
- [45] Latimer Martinez, K. 'Lost in Space: An Exploration of the Current Gaps in Space Law' (2021) *Seattle Journal of Technology, Environmental & Innovation Law.*; 11 (2): 4.
- [46] Lee, R. J. 'Reconciling International Space Law with the Commercial Realities of the Twenty-First Century' (2000) *Sing. J. Int'l & Comp. L.*; 4: 194.
- [47] Liu, H. and Tronchetti, F. 'United Nations Resolution 69/32 on the 'No first placement of weapons in space: A step forward in the prevention of an arms race in outer space?' (2016) *Space Policy.*; 38: 64-7.
- [48] López, L. D. 'Predicting an arms race in space: problematic assumptions for space arms control' (2012) *Astropolitics.*; 49-67.
- [49] Lopez-Claros, A., Dahl, A. L., and Groff, M. *Global governance, and the emergence of global institutions for the 21st century* (Cambridge University Press 2020).

- [50] Lyall, F. and Paul, B. L., *Space Law: A Treatise* (Routledge 2017). 14.
- [51] Mack, E. 'Elon Musk: SpaceX Is Sending Starship and Its Super Heavy Rocket to Space Soon' (*CNET*, 1 July 2021) <<https://www.cnet.com/news/elon-musk-spacex-is-sending-starship-and-its-super-heavy-rocket-to-space-soon/>> accessed 2 July 2021.
- [52] Martinez, P., Jankowitsch, P., Schrogl K-U., Di Pippo, S. and Okumura, Y. 'Reflections on the 50th anniversary of the outer space treaty, UNISPACE+ 50, and prospects for the future of global space governance' (2019) *Space Policy*.; 47: 28-33.
- [53] Meyer, Z. 'Private commercialisation of space in an international regime: A proposal for a space district' (2010) *Nw. J. Int'l L. & Bus.*; 30: 241.
- [54] Mohammed, A. 'Redefining the Frontiers of Global Governance: Non-Governmental Organisations in the Global Public Space' (2010) *SSRN Electronic Journal*.
- [55] Neilson, S. 'SpaceX's next astronaut mission for NASA has been pushed to November following an issue with its rocket engines' (*Business Insider*, 12 October 2020) <<https://www.msn.com/en-us/news/technology/spacex-s-next-astronaut-mission-for-nasa-has-been-pushed-to-november-following-an-issue-with-its-rocket-engines/ar-BB19XhUa>> accessed 2 July 2021.
- [56] Newlove-Eriksson, L. and Eriksson, J. 'Governance beyond the global: who controls the extraterrestrial?' (2013) *Globalizations*.; 10 (2): 277-92.
- [57] Nucera, G. G. 'International Geopolitics and Space Regulation' *Oxford Research Encyclopedia of Planetary Science* (2019).
- [58] Paliouras, Z. A. 'The Non-Appropriation Principle: The Grundnorm of International Space Law' (2014) *Leiden Journal of International Law*; 27 (1): 37-54.
- [59] Pultarova, T., 'Commercial Space Clean-up Service Could Be Ready in 2024' (*Space.com* 26 May 2021) <<https://www.space.com/commercial-space-debris-removal-2024-astrocale>> accessed 2 July 2021.
- [60] Quinn, A. G. 'The New Age of Space Law: The Outer Space Treaty and the Weaponisation of Space' (2008) *Minn. J. Int'l L.*; 17: 475.
- [61] Rainbow, J. 'Astroscale Breaking New Ground for on-Orbit Servicing Demonstration' (*SpaceNews*, 29 June 2021) <<https://spacenews.com/astrocale-breaking-new-ground-for-on-orbit-servicing-demonstration/>> accessed 2 July 2021).
- [62] Remus, N. L. *Theorising institutional change: the impact of the European integration process on the development of space activities in Europe* (Springer 2018).
- [63] Reynolds, G. H. 'Space law in the 21st century: Some thoughts in response to the Bush administration's space initiative' (2004) *J. Air L. & Com.*; 69: 413.
- [64] Robertson, S. and Schlager, N. *International Directory of Company Histories* (St James Press 2021).
- [65] Robinson, G. S. and O'Donnell, D. *Space Governance: A Blueprint for Future Activities* (Wiley 1997).
- [66] Robinson, J. 'The Role of Transparency and Confidence-Building Measures in Advancing Space Security' *ESPI Report* (2010); 28.
- [67] Tepper, E. 'Polycentric Governance in Global Affairs: The Case of Space Governance' (2019) *SSRN Electronic Journal*.
- [68] Tronchetti, F. IV-'Space Resource Exploration and Utilisation of the US Commercial Space Launch Competitiveness Act: A Legal and Political Assessment' (2016) *Air and Space Law*.; 41 (2), 143-156.
- [69] Twibell, T. S. 'Space Law: Legal Restraints on Commercialization and Development of Outer Space' (1996) *UMKC L. Rev.*; 65: 589.
- [70] UN Office for Outer Space Affairs, *Highlights in Space 2002: Progress in Space Science, Technology and Applications, International Co-operation and Space Law* (United Nations 2003).
- [71] Vacuum, P. 'Blue Origin Successfully Launches Suborbital Rocket and Returns It to Launch Site' (2015) *Physics Today*.
- [72] Vernile, A. *The Rise of Private Actors in the Space Sector* (Springer 2018).
- [73] Viikari, L. *The environmental element in space law: assessing the present and charting the future* (BRILL 2008).
- [74] Von der Dunk, F. 'International Space Law' In *Handbook of Space Law* (Edward Elgar Publishing 2015).
- [75] Williamson, M. *Space: The Fragile Frontier* (American Institute of Aeronautics and Astronautics 2006).
- [76] Zamanifard, H., Alizadeh, T. and Bosman, C. 'Towards a framework of public space governance' (2018) *Cities*.; 78: 155-65.
- [77] Sergio Marchisio, 'The Evolutionary Stages of the Legal Subcommittee of the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS)' (2005) *J. Space L.* 31: 219.
- [78] S. Neil Hosenball, 'The United Nations Committee on the Peaceful Uses of Outer Space: Past Accomplishments and Future Challenges' (1979) *J. Space L.* 7: 95.
- [79] United Nations Office for Outer Space Affairs, 'COPUOS' (Unoosa.org, 2020) <<https://www.unoosa.org/oosa/en/ourwork/copuos/index.html>> accessed 19 May 2021.
- [80] Kai-Uwe Schrogl, 'The New Debate on the Working Methods of the UNCOPUOS Legal Subcommittee' (2014) *Acta Astronautica* 105, no. 1: 101-108.
- [81] United Nations Treaties and Principles on Outer Space, related General Assembly resolutions and other documents, Office of Outer Space Affairs, ST/SPACE/61/Rev.1.
- [82] Célia Bragg, 'The post-Cold War issues of the space conquest: Thoughts on the future of an increasingly attractive space' (2019).
- [83] Working paper submitted by the Bureau of the Working Group on the "Space2030" Agenda, A/AC.105/C.2/L.316, AC105_C2_L316E.pdf (unoosa.org).
- [84] Kenneth H. Williford and others, 'The NASA Mars 2020 rover mission and the search for extraterrestrial life.' in Nathalie A. Cabrol and Edmond A. Grin (eds) *From Habitability to Life on Mars*, (Elsevier 2018) pp. 275-308.

- [85] Rik Volger and others, 'Mining moon & mars with microbes: Biological approaches to extract iron from Lunar and Martian regolith' (2020) *Planetary and Space Science* 184: 104850.
- [86] Madhu Thangavelu, 'Outer Space Activities and City Evolution' (2020) *ASCEND* 2020, p. 4059.
- [87] Dmytro Dzvinchuk and Oleksandra Kachmar, 'A Look into the Future: Cyber-aggression as the Problem of Interaction in Space Exploration' (2018) *Philosophy and Cosmology* 21: 54-60.
- [88] Jesper Tække, 'Cyberspace as a Space parallel to geographical space.' in Lars Qvortrup and others (eds) *Virtual Space*, (Springer 2002) pp. 25-46.
- [89] Metcalf, Katrin Nyman. 'A Legal View on Outer Space and Cyberspace: Similarities and Differences' (2018) Tallinn Paper 10: 1-11.
- [90] Gisela Hirschmann, *Accountability in Global Governance*, (Oxford University Press 2020).
- [91] Michael Zurn, *A Theory of Global Governance: Authority, Legitimacy, and Contestation*, (Oxford University Press 2018).