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THE MILITARIZATION OF OUTER SPACE: LEGAL LIMITS, GLOBAL GOVERNANCE AND HUMAN RIGHTS IMPLICATIONS

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Non è mai buio negli occhi di chi sogna.

Alla mia famiglia: Mamma, Papà, Federico (e il Gohan) per tutti i sacrifici fatti e per il costante, incondizionato supporto ed amore.
A chi mi è sempre stato vicino, quindi ai miei amici, agli zii, alle zie e ai cugini.
Ai nonni, che sebbene a volte manchino non hanno mai smesso di stare qui con me.

ABSTRACT

The present thesis research is a legal and policy analysis of the current governance of outer space, with a specific focus on the implications of the increasing militarization of space, the role of private actors and the development of dual-use technologies on the adequacy of the current international legal framework. It explores the extent to which the original principles of space law, developed in the Cold War era to ensure that outer space is used for peaceful purposes, continue to provide an effective framework to control strategic competition, manage new security challenges and safeguard the growing public interests that depend on space systems.

The main thesis argument follows two directions. Firstly, the assertion that the current framework is characterized by a void between normative ambitions and institutional capacities rather than an absence of law, where the Outer Space Treaty and the related UN bodies and instruments provide indispensable guiding principles but lack the clarity and effective enforcement to provide a sufficient legal and governance regime in the face of rapidly changing military strategies, commercial interests and new technologies. A counter-argument is also considered, suggesting that the flexibility of the existing framework, together with the incremental development of soft-law instruments and norms of responsible behaviour may offer a pragmatic response to current governance challenges, or rather risks establishing a fragmented, club-based order. Secondly, that space security can no longer be considered a primarily inter-State strategic matter, to be addressed through traditional arms control approaches alone. Rather, as dependence on space-based services grows, the governance of space security increasingly becomes a human-risk governance: space disruptions mean concrete risks on Earth, with unevenly distributed consequences across societies and, in particular, across States that lack independent space capabilities.

Methodologically, the research integrates a doctrinal study of treaty law and UN instruments with an institutional analysis of the debate, negotiation and often impasse of space security in multilateral settings. The thesis also benefits from first-hand experience with multilateralism, with the third chapter, in particular, reflecting the lessons learned from the author's time spent in New York at the Italian Representation to the United Nations, following the work of the First Committee on Disarmament and International Security. More broadly, the thesis benefited from research carried out as a visiting researcher at the International Institute of Air and Space Law of Leiden University, which offered an academic environment to critically approach both traditional space law and new governance initiatives.

The first chapter provides a systematic history of space law, with a focus on the COPUOS and UNOOSA role, the normative role of General Assembly resolutions and the systemic

limitations of the Outer Space Treaty and the Moon Agreement, including the void in the regulation of conventional and unconventional weapons and the institutional deficit relative to other regimes, such as the law of the sea.

The following chapter turns to the strategic context, analyzing strategies and capabilities of major and rising powers, including direct-ascent ASATs, counterspace strategies, the increasing nuclear risk component, and European and Italian strategic capabilities, but also exploring the emergence of private actors and the challenges of commercial militarization. The chapter concludes by considering emerging technological frontiers, including space drones, missile defence systems incorporating space elements, and orbital cyber operations which further complicate the distinction between civilian infrastructure and military advantage.

The third chapter investigates the United Nations architecture arguing that space security governance is shaped by a tension between institutional paralysis and incremental reform. It examines the current fragmentation of competencies between the First Committee, COPUOS, UNOOSA, and the Security Council, highlighting the constraints of consensus-building, enforcement, and competition in the UN's ability to produce binding decisions. In this context, the thesis will assess alternative paths of governance, such as the Artemis Accords as a form of plurilateral "club" governance, the development of new approaches to the interpretation of Article IV of the Outer Space Treaty, and multilateral or regional approaches to responsible behaviour and transparency. The thesis will also examine Italy's increasingly debris-focused approach as a pragmatic starting point for reconciling sustainability and security.

Finally, the last chapter develops a humanistic perspective, relating space governance to human rights, privacy, environmental protection, and distributive justice. It argues that satellite connectivity and Earth observation are increasingly becoming enabling infrastructures for the enjoyment of rights, while at the same time posing risks of surveillance and exclusion. The thesis concludes by suggesting some features of a more humanistic approach to space governance, with special focus on Space Traffic Management as a concrete site for accountability, transparency, and inclusive participation, and by returning to the Common Heritage of Mankind principle, drawn from the law of the sea, as a normative guide to identify equity deficits and guide reforms beyond the State-centric or club-based approach to space governance.

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LIST OF ABBREVIATIONS

ASAT – Anti-Satellite (Weapon)
CHM – Common Heritage of Mankind
CD – Conference on Disarmament
COPUOS – Committee on the Peaceful Uses of Outer Space
DA-ASAT – Direct-Ascent Anti-Satellite (Weapon)
EDF – European Defence Fund
EDIDP – European Defence Industrial Development Programme
ESA – European Space Agency
EU – European Union
EUSPA – European Union Agency for the Space Programme
GA – General Assembly
GNSS – Global Navigation Satellite System
GPS – Global Positioning System
IAI – Istituto Affari Internazionali
ICoC – International Code of Conduct for Outer Space Activities
IHL – International Humanitarian Law
ILRS – International Lunar Research Station
ISR – Intelligence, Surveillance and Reconnaissance
ISAC – Information Sharing and Analysis Centre
LEO – Low Earth Orbit
NATO – North Atlantic Treaty Organization
OEWG – Open-Ended Working Group
OST – Outer Space Treaty
PAROS – Prevention of an Arms Race in Outer Space
PNT – Positioning, Navigation and Timing
PPWT – Treaty on the Prevention of the Placement of Weapons in Outer Space and of the Threat or Use of Force Against Outer Space Objects
PTBT – Partial Test Ban Treaty
SATCOM – Satellite Communications
SDA – Space Domain Awareness
SG – Secretary-General
SSA – Space Situational Awareness
SST – Space Surveillance and Tracking
TCBMs – Transparency and Confidence-Building Measures
TEU – Treaty on European Union
UN – United Nations
UNCLOS – United Nations Convention on the Law of the Sea
UNOOSA – United Nations Office for Outer Space Affairs
UNSC – United Nations Security Council
US – United States
WMD – Weapons of Mass Destruction

INTRODUCTION

Outer space has evolved from a distant area of scientific research to an infrastructure crucial for contemporary international security, economic activity and the functioning of modern societies. Satellite-based systems are in fact today vital for communication, navigation, environmental observation, disaster response and military use, resulting in a new level of dependence from the stability and accessibility of the space environment. Furthermore, such transformation is occurring at a time when the strategic environment is undergoing a radical change characterized by a return to great power rivalry, advances in new technologies and the increasing role of private actors in activities that were traditionally exclusively of States.

In this context, the international legal framework that regulates outer space was established mostly during the Cold War era, hence in a totally different scenario and today these norms are increasingly under pressure in the current security framework with the development of conventional counterspace weapons, dual-use technologies, cyber-attacks, and debris-generating activities revealing significant voids in the regulation and enforcement of the existing structure.

Thus, this thesis analyses the development of space security governance with a dual focus on the law and institutions, informed by the author's experience at the Permanent Mission of Italy to the United Nations in New York, in particular following the activities of the First Committee on Disarmament and International Security, and the work carried out as a visiting researcher at the International Institute of Air and Space Law of Leiden University. The research argues that current deficiencies are not the result of a normative voidance but rather of the increasing gap between the ambitions of the legal principles and the institutional capacity to implement and enforce them effectively. Although the United Nations remains the core platform for norm-making and dialogue, its role in the production of binding decisions on space security is limited by its consensus-based decision making rules, geopolitical rivalries and the lack of a coherent institutional framework. As a consequence, States have turned increasingly to soft-law approaches, voluntary principles of responsible behaviour, and plurilateral initiatives, raising at the same time questions about the development of a fragmented or so called club-based governance structure.

Additionally, this thesis places space security in a human-centered lens. As the reliance on space-based services grows, any disturbance in outer space translates into real risks on Earth and with uneven consequences for different societies and States. Thus, by connecting space governance to human rights, environmental protection and distributive justice, it claims that the sustainability of the space environment is increasingly dependent on governance structures that are able to balance security needs with the collective interest of humanity.

CHAPTER I

THE LEGAL FRAMEWORK: SUCCESS AND FAILURES OF SPACE LAW

1.Multilateral Actors and Instruments in the Development of Space Law

1.1 Historical background to the Space governance

Initially, space was a domain of scientific imagination and speculative fiction, lacking any formal legal regulation, then, as law progressively extended from land to sea and air, the increasing technological capacity to access and utilize outer space required the formulation of an entirely new legal framework. In particular, it was only with the advent of rocket propulsion, mostly during the Second World War, that serious legal inquiry into outer space activities began to emerge, driven by the prospect of using outer space for military, strategic, and scientific purposes.[1] In this sense, the emergence of space law marks a paramount development in public international law, responding to the need for legal norms to govern state conduct beyond terrestrial domains.

One of the earliest and most visionary jurists in this area was Vladimir Mandl, who in 1932 anticipated that existing air law would be insufficient to regulate human activity beyond the atmosphere. In his monograph, published in Germany, Mandl argued that outer space would raise novel legal issues requiring the development of an entirely new legal *corpus*.[2] His pioneering insights laid the basis for subsequent scholars such as John Cobb Cooper,[3] Rolando Quadri,[4] Charles Chaumont,[5] Nicolas Matte,[6] and Eugene Pépin,[7] who, particularly around the time of the

[1] Frans von der Dunk and Fabio Tronchetti, eds., *Handbook of Space Law* (Cheltenham, UK: Edward Elgar Publishing, 2015).

[2] Vladimir Mandl, Das Weltraum-Recht: Ein Problem Der Raumfahrt [Outer Space Law: A Problem of Astronautics] (Leipzig, 1932).

[3] See e.g. J.C. Cooper, *The Boundary between Territorial Airspace and International Outer Space*, in *Explorations in Aerospace Law: Selected Essays by John Cobb Cooper, 1946–1966* (Ed. I.A. Vlasic) (1968), 298; J.C. Cooper, *Legal Problems of Spacecraft in Airspace*, in *ibid.*, 308.

[4] See e.g. R. Quadri, *Diritto Internazionale Pubblico* (5th edn., 1968), 685–7; R. Quadri, *Droit international cosmique*, in *98 Recueil des Cours* (1959), 505–98; further e.g. S. Marchisio, *Rolando Quadri (22.12.1907–2.4.1976)*, in *Pioneers of Space Law* (Ed. S. Hobe) (2013), 151 ff.

[5] See e.g. C. Chaumont, *Les problèmes du droit international de l'espace extra-atmosphérique*, in *Institut des Hautes Études Internationales de l'Université de Paris* (1958), 3 ff.; C. Chaumont, *Les perspectives que doit adopter le droit de l'espace*, in *7-2 Revue de Droit Contemporain* (1960), 5–12; C. Chaumont, *Die Brüsseler Entschließung des Institut de Droit International zum Weltraumrecht*, in *15 Zeitschrift für Luft- und Weltraumrecht* (1966), 20–35.

[6] See e.g. N.M. Matte, *Aerospace Law* (1969); also N.M. Matte, *The Law of the Sea and Outer Space: A Comparative Survey of Specific Issues*, in *3 Ocean Yearbook* (1982), 13–37; N.M. Matte, *Deux Frontières Invisibles: De la Mer Territoriale à l'Air Territorial* (1965), 157–240; N.M. Matte, *Aerospace Law: Telecommunications Satellites*, in *16 Recueil des Cours* (1980), 119–249.

[7] See e.g. E. Pépin, *Legal Problems Created by the Sputnik*, Lecture given on 6 November 1957 to the Canadian Bar Association (Quebec Maritime and Air Law Section), reprinted in *Legal Problems of Space Exploration, A Symposium* (1961), 187 ff.; E. Pépin, *Introduction to Space Law, A New York Law Forum* (1958), 258–61; E. Pépin, *The Legal Use of the Airspace in the Light of Progress in Science and in Astronautics*, in *3 McGill Law Journal* (1956), 70–7; E. Pépin, *Progrès dans la Juridiction de L'Espace*, *McGill Law Journal* (1959), 30–42; E. Pépin, *Further Aspects of Space*

International Geophysical Year (1957–1958)**,** emphasized the necessity of regulating outer space through international legal principles. Although these authors could not yet codify binding international law, they did help form an early doctrinal *consensus* on the normative content of what would become "space law".[8]

The real turning point came with the rapid development of rocket propulsion during the Second World War, which transformed outer space from a theoretical concept into a realistic domain of human activity. However, the most powerful drive in creating this new branch of international law was unquestionably the geopolitical context of the Cold War which provided the decisive push for legal codification, namely the opening of outer space as a new field of competition between the two main powers at the time: the USA and the USSR. In this context, crucial for both powers was the urge to find new areas or domains where military, political, or technological advantage over the adversary could be gained, and as land, air and sea were already themes of incessant arms race, the question was to what extent this competition would have reached new spheres.[9] Eventually, the answer to this question came in October 1957 when the Soviet Union launched Sputnik I, the first artificial satellite into outer space, indicating the potential militarization of space and inaugurating a new frontier of superpower rivalry between the United States and the USSR.[10] This development further raised alarm over the possible extension of State's arms race into orbit, threatening a catastrophic scenario for the global population. Instead, quite surprisingly, probably due to political considerations but arguably even more to powerful economic motivations such as the prohibitive costs, especially at the time, of moving and maintaining large military complexes into outer space, the two superpowers refrained from such an arms race and decided to engage in a diplomatic effort prompting initial bilateral efforts to regulate outer space, leading the two parts to reach in 1963 a bilateral political understanding to prohibit the stationing of nuclear and other weapons of mass destruction in space, namely the "Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water", [11] a commitment later endorsed by the UN General Assembly in Resolution 1884 (XVIII)**,**[12] unanimously adopted on 17 October 1963.

It is interesting to compare this rapid legal development to the evolution of air law, also a branch where technological factors had a large part to play similarly to space law, which saw a

Law, McGill Law Journal (1957), 66–72; reprinted e.g. A. Kerrest de Rozavel, *Eugène Pépin (27.06.1887–27.04.1988)*, in *Pioneers of Space Law* (Ed. S. Hobe) (2013), 11 ff.

[8]Frans von der Dunk and Fabio Tronchetti *op.cit.*p.9

[9] *Ibid.*

[10] *Ibid.*

[11] Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water (hereafter Partial Test Ban Treaty), Moscow, done 5 August 1963, entered into force 10 October 1963; 480 UNTS 43; TIAS No. 5433; 14 UST 1313; UKTS 1964 No. 3; ATS 1963 No. 26.

[12] UNGA Res 1884 (XVIII) (17 October 1963).

much more gradual evolution and development over decades following the Wright brothers' first powered flight in 1903, as reported by Isabella Diederiks- Verschoor in her "Introduction to Space Law".[13] By contrast, space law emerged with striking rapidity, as Bin Cheng observed in an essay published on the 30th anniversary of the Outer Space Treaty,[14] normative regulation of this field, especially referring to the above mentioned treaty, emerged and were adopted in less than a decade after the launch of the first artificial satellite, a swift development that illustrates how the urgent geopolitical stakes of the Cold War pushed the international community to achieve an unusually rapid legal *consensus*.[15] Space law, therefore, is both a product of the geopolitical climate of the mid-twentieth century and a forward-looking attempt to safeguard outer space for peaceful and cooperative purposes. It established a new branch of public international law, aimed at balancing state sovereignty with collective responsibility, scientific advancement with legal restraint, and military potential with normative ethics. The result is a legal framework that remains politically sensitive, technologically challenged, and normatively ambitious.

At this point, after the aforementioned bilateral agreement between USA and USSR, the path was cleared for multilateral legal negotiation, and in 1967 the signing and entry into force (shortly thereafter) of the "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies", commonly referred to as the Outer Space Treaty (OST), signed in London, Moscow, and Washington, marked the creation of this entirely new branch of public international law.[16] This treaty of paramount relevance institutionalized the foundational principles of space law, including the peaceful use of outer space, the non-appropriation of celestial bodies, and the principle that activities in space should benefit all humankind.[17] A deeper understanding of the Outer Space Treaty, conducted in the second paragraph of this chapter, requires however an examination of the legal and diplomatic developments that preceded it, notably the key UN resolutions and the UNOOSA and COPUOS work which laid the groundwork for its formulation.

[13] I.H.P. Diederiks-Verschoor & V. Kopal, Introduction to Space Law (3rd edn., 2008), 2.
[14] United Nations. *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies*. Opened for signature January 27, 1967. Entered into force October 10, 1967. 610 UNTS 205.
[15] B. Cheng, *Space Objects and Their Various Connecting Factors*, in *Outlook on Space Law over the Next 30 Years* (Eds. G. Lafferranderie & D. Crowther) (1997), 203.
[16] United Nations. *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies*. Opened for signature January 27, 1967. Entered into force October 10, 1967. 610 UNTS 205.
[17] *Ibid.*

1.2 Role of COPUOS and UNOOSA

Before analysing the two main treaties of international space law regulating the militarization of the outer space, namely the Outer Space Treaty and the Moon Agreement, it is of paramount importance to keep in mind that they are a product of the key role and work of what is considered to be the institutional foundation of international space governance: the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS).

Established in 1959 by the UN General Assembly through resolution 1472 (XIV) as a means of governing the use and exploration of outer space for such benefits as security, development and peace,[18] COPUOS first existed in the form of a temporary committee but became a standing body tasked with the codification of space law and the encouragement of peaceful international cooperation in outer space.[19] In other words, this UN body holds the responsibility for facilitating the cooperation of parties in their conduct of space activities.[20] Together with the two mentioned treaties, there are other 3 core space treaties (not specifically concerning the militarization of the outer space and therefore not treated in this work) whose preparation and facilitation represent the primary achievement of the Committee. These treaties are: the 1968 Rescue Agreement,[21] the 1972 Liability Convention,[22] and the 1975 Registration Convention.[23] These agreements form the body of the law of outer space and were all prepared under the auspices of COPUOS and ratified by the General Assembly. The Committee's *consensus* methods of operation have ensured that all countries, including developing countries with limited capacity in space, have a voice in the making of the law and norms of outer space.[24] 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. 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.

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[18] 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.
[19] United Nations General Assembly, *Resolution 1472 (XIV): International Cooperation in the Peaceful Uses of Outer Space*, 14th Sess., 12 December 1959, A/RES/1472(XIV)
[20] *ibid*
[21] United Nations, *Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space (Rescue Agreement)*, December 19, 1967, 672 UNTS 119, entered into force December 3, 1968,
[22] United Nations, *Convention on International Liability for Damage Caused by Space Objects (Liability Convention)*, November 29, 1971, 961 UNTS 187, entered into force September 1, 1972,
[23] United Nations, *Convention on Registration of Objects Launched into Outer Space (Registration Convention)*, January 14, 1975, 1023 UNTS 15, entered into force September 15, 1976,
[24] Francis Lyall and Paul B. Larsen, *Space Law: A Treatise* (Farnham, UK: Ashgate, 2009), 47.

The way COPUOS operates is under the Scientific and Technical Subcommittee (STSC) and the Legal Subcommittee (LSC), established in 1961. While the former addresses the technical and scientific aspects of satellite data exchange and space weather, the other is responsible for formulating the legal norms and treaties of the framework.[25] Despite the existence of the Legal Subcommittee, the legally binding authority of COPUOS 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.[26] What the two committees do is they work together to create a unique multilateral forum where countries can set the rules for space activities, despite and regardless of their range of ability in terms of technology. Nevertheless, committee's role and activity in space governance is further reinforced by its ability to take up and transmit GA's resolutions, again, not legally binding but with strong political and normative guidance to the world in general. Resolution 1721 and Res. 1962, as described in the following paragraph, are of particular relevance in this regard.[27]

In its foundation, COPUOS was tasked with reviewing international cooperation to ensure the peaceful use of space, facilitating the study of space-related activities that the UN was to undertake, encouraging space research programs, and advancing the study of legal issues that would arise from space exploration.[28] Every year, at committee meetings, the topic of global cooperation in space exploration and the application of space technology for exploration is considered. 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.[29]

COPUOS recently revised their 2030 space agenda draft. This agenda demonstrated how the General Assembly's resolution 1348 (XIII) of December 13, 1958, which acknowledged the significance of using space for peaceful purposes and the necessity of fostering international cooperation in the conduct of space activities, gave rise to their mandate of Peaceful Uses of Outer Space. They added a few additional ideas and tenets to their strategic vision. In addition to providing Earth with numerous special and essential advantages, space science and technology are now an integral part of our everyday life.[30] The recognition of a multidisciplinary approach also

[25] Kai-Uwe Schrogl, 'The New Debate on the Working Methods of the UNCOPUOS Legal Subcommittee' (2014) Acta Astronautica 105, no. 1: 101-108.
[26] Scott Michael Steele. International Space Law: A Hindrance to Space Activities or a Resolute Action for Change. American Journal of Aerospace Engineering. Vol. 9, No. 1, 2022, pp. 1-13. doi: 10.11648/j.ajae.20220901.11
[27] *See*. p.22
[28] United Nations Office for Outer Space Affairs, 'COPUOS' (Unoosa.org, 2020)
[29] Scott Michael Steele. *op.cit*
[30] 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).

enables COPUOS to consider and utilize other existing domains while affecting their mandate of 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 nongovernmental 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 cooperation in the peaceful uses of outer space".[31]

The flexibility of space governance beyond the Outer Space Treaty and other space regulations establishes a reciprocal system. COPUOS delineates a four-step strategy aimed at enhancing space-derived economic advantages, fortifying the space sector's role as a catalyst for sustainable development, utilizing space to address quotidian challenges, leveraging space-related innovations to elevate quality of life, fostering partnerships and bolstering international cooperation in the peaceful utilization of outer space and global governance of space activities, improving access to space for all, and ensuring that all nations can reap socioeconomic benefits from space science and technology applications, as well as space-based data, information, and products, thereby facilitating the attainment of the Sustainable Development Goals. Space governance has evolved from the principles established by the OST, while endeavouring to enhance them. COPUOS is fostering international cooperation by collaborating with States, United Nations entities, intergovernmental and non-governmental organizations, as well as industry and private sector entities, in accordance with the UN Charter, to enhance their capacity for proactive space governance, emphasizing innovation, adaptability, and future-oriented strategies in space exploration. The establishment of COPUOS and its impact on the worldwide space community exemplify their reciprocal relationship in the 21st century.[32] The rapid implementation of soft law via non-binding agreements may serve as a means for the advancement of space governance beyond the principles and basic treaties of international law, as authors like Jakhu et al. asserted, that the operational framework of agreements, intricate relationships, and advancements in space are all aimed at develop a viable scenario for the formal evolution of space law and governance, ensuring

[31] *ivi. P.13*
[32] Scott Michael Steele. *Op.cit.*p.13

adaptability for commercialization and the progression of space activities.[33] Complementing COPUOS in this institutional landscape is the United Nations Office for Outer Space Affairs (UNOOSA), a specialized office within the UN Secretariat that works with COPUOS to carry out its decisions and policies. UNOOSA serves as the Committee's secretariat and provides expert legal, technical, and policy support. Its main task is to keep the Register of Objects Launched into Outer Space up to date, help developing countries to build their capacity, and promote the UN Space Applications Programme.[34]

Headquartered in Vienna, the Office is structured around two principal divisions: The Committee on Policy and Legal Affairs (CPLA), which assists COPUOS and oversees legal frameworks, treaties, and inter-agency collaboration; and the Space Applications Section (SAS) specialised in field outreach, practical technological applications, and education via initiatives such as UN-SPIDER (disaster management), HSTI (human space technology), and the Basic Space technological Initiative.[35]

Over time, UNOOSA has gradually taken on a more prominent role in the evolving areas of outer space governance, including the regulation of small satellites (CubeSats), the long-term sustainability of space activities, and the management of space traffic. It has also significantly contributed to the adoption and promotion of the "Guidelines for the Long-Term Sustainability of Outer Space Activities," which were developed through the Scientific and Technical Subcommittee and adopted by COPUOS in 2019.[36] The purpose of these guidelines is to tackle the increasing concerns surrounding space debris, radio-frequency interference, and the necessity for coordination in orbital traffic, particularly as the number of space launches and private entities continues to rise rapidly.[37] Within the framework of the UN's Space2030 Agenda, UNOOSA operates as a comprehensive hub for the coordination of space-based data and services to facilitate the Sustainable Development Goals (SDGs). The Global Space Partnership for the SDGs illustrates UNOOSA’s dedication to connecting space activities with developmental goals, including climate

[33] Jakhu, R. S. and Pelton J. N. (eds) Global Space Governance: an international study (Springer International Publishing 2017).
[34] United Nations Office for Outer Space Affairs (UNOOSA), "About UNOOSA," https://www.unoosa.org/oosa/en/aboutus/index.html.
[35] United Nations Office for Outer Space Affairs (UNOOSA), *History*, accessed August 2025, “History” section, UNOOSA website, United Nations Office for Outer Space Affairs, detailing its establishment as a small expert unit in 1958, transformation into a Division in 1968, and relocation to Vienna in 1993, https://www.unoosa.org/oosa/sk/aboutus/history/index.html.
[36] COPUOS, "Guidelines for the Long-term Sustainability of Outer Space Activities of the Committee on the Peaceful Uses of Outer Space," A/74/20, 2019.
[37] *Ibid.*

monitoring, disaster response, and global health.[38] UNOOSA is further responsible for overseeing the implementation of international registration obligations as outlined in the 1976 Registration Convention, which requires States to furnish information regarding space objects launched under their authority. Ultimately, the Office promotes transparency in space operations, a principle grounded in Article XI of the OST, by keeping the UN Register accessible to the public online.

In conclusion, COPUOS and UNOOSA serve as the institutional framework that enables the international community to articulate, develop, and implement norms for the peaceful exploration and utilization of outer space. Their approach, which is driven by *consensus*, inclusive, and rooted in technical expertise, has provided legitimacy and stability to space governance since the beginning of the Space Age. While this section has outlined the foundational mandate and historical role of COPUOS and UNOOSA within the architecture of international space governance, a different and more critical analysis of these bodies, focused on their contemporary relevance, structural limitations, and interaction with space security dynamics, will be developed in Chapter III.[39]

1.3 General Assembly Resolutions and PAROS

The concept of the "Prevention of an Arms Race in Outer Space" (PAROS) originated in 1978 during the tenth special session of the General Assembly, which was the inaugural session focused on disarmament. Since that time, it has been the principal aim of multilateral dialogues on space security within the United Nations, consistently appearing in resolutions and the directives of working groups. Nonetheless, despite considerable effort, minimal tangible advancement towards an arms control deal has been realized due to both political and technical impediments. Fundamental challenges include apprehensions regarding prospective space-based strike weapons in contrast to terrestrial anti-satellite systems, divergent preferences for legally binding versus voluntary agreements, and variances in emphasis on the definition of space 'weapons' versus behavioural regulations. The divergent perspectives have culminated in a block that has exacerbated geopolitical disparities.[40] In response, certain specialists in space security have increasingly advocated for more stringent behavioural guidelines in outer space.[41] Some within the diplomatic

[38] United Nations, *United Nations Office for Outer Space Affairs (UNOOSA): UNSystem SDG Implementation*, SDG Knowledge Platform, accessed August 2025, https://sdgs.un.org/un-systemsdgimplementation/unitednationsofficeouterspaceaffairsunoosa24523.

[39] See Chapter 3 para.1.2 and 1.3

[40] Jessica West e Almudena Azcárate Ortega, *Space Dossier 7 – Norms for Outer Space: A Small Step or a Giant Leap for Policymaking?* (Ginevra: UNIDIR, marzo 2022), UNIDIR Space Dossier 7, 39 pp

[41] Brian Weeden & Victoria Samson, India's ASAT Test is Wake-Up Call for Norms of Behavior in Space, Space News (8 April 2019), available online at https://spacenews.com/op-ed-indias-asat-test-is-wake-up-call-for-norms-of-behavior-in-space. Phillip Swarts, 'Standards and Norms' Needed in Space, Pentagon Experts Say, Space News (18 November 2016), available online at https://spacenews.com/standards-and-norms-needed-in-space-pentagon-experts-say. Bruce McClintock, Space Safety Coordination: A Norm for All Nations, RAND (16 April 2019).

world have also suggested that a focus on rules could be a useful tool for ending the current impasse and lowering the geopolitical tensions, misunderstandings, and rivalry that exist in space.[42]

The General Assembly adopted the first two resolutions related to PAROS in 1981.[43] Nonetheless, these conflicting resolutions, one aimed at prohibiting all forms of space weapons (including those capable of targeting terrestrial objectives)[44] and the other focused on anti-satellite weapons (ASATs),[45] have presented divergent strategies and priorities that have obstructed political discourse on the Prevention of an Arms Race in Outer Space (PAROS) and hindered tangible advancements on this matter for the past four decades.

PAROS has traditionally been discussed within the Conference on Disarmament (CD): the primary body of the United Nations that serves as a multilateral disarmament negotiating forum of the international community. Through its PAROS Committee, the CD has debated arms control in outer space since 1985. Although constrained by diplomatic disagreements, the CD considered several proposals, including the 2008 Russian-Chinese draft treaty on preventing space weaponization (further discussed later in the next paragraph); however, a lack of *consensus* among States on space and other issues has made it difficult to conduct substantive discussions. This dynamic is particularly true with referring to the United State who resolutely opposed in giving the committee a negotiating mandate, preferring bilateral talks with the Soviet Union.[46] The committee convened each year through 1994 and no further committee meeting occurred due to objections made by the United States. In 1990 the United States stated that it "has not identified any practical outer space arms control measures that can be dealt within a multilateral environment." With its large missile defence program and technical advantages in potential space weaponry, the United States has consistently refused to negotiate PAROS in the CD.[47] Matters concerning PAROS

[42] Comm. on the Peaceful Uses of Outer Space, Operating in Space: Towards Developing Protocols on the Norms of Behaviour, U.N. Doc A/AC.105/2019/CRP.12 (June 13, 2019)
[43] Jessica West e Almudena Azcárate Ortega *op.cit.p.16*
[44] GA Res. 36/99, 36th Sess., on Conclusion of a treaty on the prohibition of the stationing of weapons of any kind in outer space (9 December 1981), available online at https://digitallibrary.un.org/ record/27062?ln=en. This resolution was sponsored by Angola, Bulgaria, Byelorussian SSR, Cuba, Czechoslovakia, German Democratic Republic, Hungary, Lao People's Democratic Republic, Mongolia, Poland, Ukrainian SSR, USSR, and Viet Nam, and sought to encourage the international community "by concluding an appropriate international treaty, to prevent the spread of the arms race to outer space", as its sponsoring States considered that the OST was insufficient
[45] GA Res. 36/97 C, 36th Sess., on Prevention of an arms race in outer space 3–4 (9 December 1981), available online at https://undocs.org/en/A/RES/36/97. This resolution was sponsored by Australia, Barbados, Belgium, Canada, Denmark, Federal Republic of Germany, France, Greece, Italy, Japan, Netherlands, New Zealand, Niger, Norway, Spain, United Kingdom, and Uruguay, and aimed to prompt the negotiation at the Committee on Disarmament of "effective and verifiable agreements aimed at preventing an arms race in outer space, taking into account all existing and future proposals designed to meet this objective", in particular the negotiation of an "effective and verifiable agreement to prohibit anti-satellite systems".
[46] Nuclear Threat Initiative (NTI), *Proposed Prevention of an Arms Race in Space (PAROS) Treaty*, NTI Education Center, accessed August 2025, https://www.nti.org/education-center/treaties-and-regimes/proposed-prevention-arms-race-space-paros-treaty/.
[47] *Ivi p. 17*

remain therefore under discussion in the First Committee of the General Assembly. Following the rules-based approach paved from some specialists, the UN General Assembly adopted in December 2020 resolution 75/36, titled "Reducing space threats through norms, rules and principles of responsible behaviours," with 164 votes in favour, 12 opposed, and 6 abstentions.[48] Subsequently, a First Committee resolution was passed in November 2021, that the General Assembly adopted with 150 votes in favour, 8 against, and 7 abstentions. This resolution aimed to establish a body tasked with "making recommendations on potential norms, rules, and principles of responsible behaviour concerning threats posed by States to space systems, including, as appropriate, how these recommendations would facilitate the negotiation of legally binding instruments, particularly regarding the prevention of an arms race in outer space." [49]

Furthermore, in 2021 the General Assembly ratified five resolutions on this subject that predominantly mirror increasingly entrenched stances regarding space security: "Prevention of an arms race in outer space,"[50] "No first placement of weapons in outer space",[51] "Further practical measures for the prevention of an arms race in outer space",[52] "Transparency and confidence-building measures in outer space activities",[53] and "Reducing space threats through norms, rules and principles of responsible behaviours".[54]Although resolutions passed by the General Assembly are not legally enforceable, it is important, as stated previously, to keep in mind that their influence lies in guiding international conduct, building consensus, and laying the groundwork for treaty-making.[55]

Hence, General Assembly resolutions have maintained key political and normative momentum, highlighting the peaceful aspirations of space, reinforcing transparency and cooperation, and repeatedly calling for legally binding measures to prevent weaponization. PAROS remains a central focus, though no binding treaty has yet materialized. This continuous UN architecture underscores both the progress and limitations of relying on soft law in regulating complex and evolving challenges of space security.

Most recent developments and trajectories in GA's resolutions and work on PAROS will be discussed later in this work in chapter 3.

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[48] GA Res. 75/36, 75th Sess., on Reducing space threats through norms, rules and principles of responsible behaviours (16 December 2020) [hereinafter "Res. 75/36"],
[49] GA Res. 76/231, 76th Sess. 5 c) (30 December 2021) [hereinafter"Res.76/231"]
[50] GA Res. 76/22, 76th Sess., on Prevention of an Arms Race in Outer Space, (6 December 2021)
[51] GA Res. 76/23, 76th Sess., on No First Placement of Weapons in Outer Space, (6 December 2021) [hereinafter "Res. 76/23"]
[52] GA Res. 76/230, 76th Sess., on Further Practical Measures for the Prevention of an Arms Race in Outer Space, (30 December 2021)
[53] GA Res. 76/55, 76th Sess., on Transparency and Confidence-building Measures in Outer Space Activities, (13 December 2021),
[54] GA Res. 76/231, 76th Sess. 5 c) (30 December 2021) [hereinafter"Res.76/231"]
[55] Jessica West e Almudena Azcárate Ortega *op.cit.p.17*

1.4 The Russia-China PPWT Proposal: A Failed Attempt at Hard Law

Among the many aspects on space governance that cannot seem to find *consensus* between States, there is also disagreement on the means of achieving PAROS. Certain States, led by the Russian Federation, China, and several Eastern European nations, claim that current legal frameworks, including the Outer Space Treaty and the United Nations Charter, are inadequate, thereby instigating a movement to formulate a supplementary treaty explicitly prohibiting weapons in outer space. The latest proposal in this context is the draft treaty for the Prevention of the Placement of Weapons in Outer Space and the Threat or Use of Force against Outer Space Objects (PPWT). Initially introduced by the Russian Federation and China to the Conference on Disarmament in February 2008 and amended in 2014, the PPWT would mandate that States refrain from "placing in orbit around the Earth any objects equipped with any types of weapon" and "resorting to the threat or use of force against outer space objects."[56]

Thus, under the draft treaty submitted to the CD by Russia in 2008, State Parties would commit to refrain from placing objects carrying any type of weapon into orbit, installing weapons on celestial bodies, and threatening to use force against objects in outer space. State Parties would also agree to practice agreed confidence-building measures.[57] A PAROS treaty like the PPWT would complement and reaffirm the importance of the 1967 Outer Space Treaty, which aims to preserve space for peaceful uses by prohibiting the use of space weapons, the development of space-weapon technology, and technology related to “missile defence.” The treaty would prevent any nation from gaining a military advantage in outer space.[58] But where did the proposal come from?

The sense of urgency in preventing an arms race in space became a reality when Beijing launched a test of a direct-ascent anti-satellite (ASAT)[59] on January 11, 2007, when it launched an SC-19 missile that impacted and destroyed its defunct Fengyun-1C weather satellite. The impact, which was at about 534 miles above Earth, generated more than 35,000 pieces of orbital debris, the largest debris-generating event ever and a danger to both manned and unmanned space flights, both on and around the International Space Station. This test underscored two crucial realities: satellites’ susceptibility to hostile use, and the absence of binding international norms regulating the

[56] Article II of the 2008 draft of the PPWT, submitted by China and the Russian Federation, https://www.reachingcriticalwill.org/images/documents/Disarmament-fora/cd/2008/documents/Draft%20PPWT.pdf. See also CD/1839 (29 February 2008).
[57] Nuclear Threat Initiative (NTI), *Proposed Prevention of an Arms Race in Space (PAROS) Treaty*, NTI Education Center, accessed August 2025, https://www.nti.org/education-center/treaties-and-regimes/proposed-prevention-arms-race-space-paros-treaty/.
[58] *Ibid.*
[59] The ASAT system will be specifically analysed on par. 1.1 of the Chapter 2 of this research

placement or employment of ASAT weaponry. As a response against such dynamic threat environment, Russia and China put forward a joint draft of a Treaty on the Prevention of the Placement of Weapons in Outer Space and of the Threat or Use of Force Against Outer Space Objects (PPWT) at the Conference on Disarmament in 2008, which tried to expand upon the Outer Space Treaty's underlying framework by banning outright all forms of weaponry, not simply those of mass destruction, from orbit."[60]

While the original 2008 PPWT offered a pioneering attempt at comprehensive space arms control, it was widely criticized for definitional vagueness, lack of verification mechanisms, and an unrealistic approach to dual-use technology. These issues were only partially addressed in the revised 2014 version of the PPWT, which clarified certain definitions such as "space weapons" and reiterated the commitment to preventing the "use or threat of force" against space objects. However, it continued to omit any reference to ground-based ASAT systems, such as the one used in the 2007 Chinese test, which represented a significant loophole.[61] Furthermore, the 2014 draft inadequately addressed cyber, electronic, or directed-energy threats, which have surfaced as significant counter-space instruments owing to their plausible deniability and challenges in attribution.[62]

A primary weakness of both PPWT versions is their inadequate definition of a "weapon." The 2014 draft characterized a weapon as "any object in outer space or its component designed or modified to eliminate, damage, or disrupt the normal operation of objects in outer space. This definition, although striving for inclusivity, is ambiguous and inadequately comprehensive, neglecting to include non-kinetic capabilities such as jamming, dazzling, or spoofing—technologies with valid civilian applications that can be readily repurposed for hostile purposes. The dual-use nature of space technology presents a significant challenge to any arms control framework, including the PPWT.[63]

In addition to definitional concerns, the PPWT lacks verification and compliance methods, rendering the treaty unenforceable. Monitoring space objects, particularly co-orbital systems, and non-kinetic processes such as cyberattacks, presents significant technological and political challenges. Attribution poses significant challenges; for instance, a failing satellite may be indistinguishable from one subjected to a high-powered laser unless equipped with excellent sensor

[60] Conference on Disarmament, CD/1839 (2008), Draft Treaty on Prevention of the Placement of Weapons in Outer Space (PPWT), Geneva.
[61] Baines, Phillip J. "Outer Space and Global Security." In *Outer Space and Global Security*. Geneva: United Nations Institute for Disarmament Research, 2012.
[62] Chow, James, *"The 2014 updated Draft PPWT: Hitting the Spot or Missing the Mark?"*, Air University Press, 2015.
[63] Brian Weeden, *"2007 Chinese Anti-Satellite Test Fact Sheet"*, Secure World Foundation, 2012.

systems. These constraints significantly constrain the treaty's capacity to identify, examine, or address infractions.[64]

The United States and many allied nations have persistently resisted the PPWT, contending that it is politically partial and tactically inadequate. The U.S. delegation has asserted that the pact neglects to confront the paramount threat: ground-based kinetic ASAT systems and that it permits strategic deception owing to its inadequate verification measures. Washington has chosen to engage in norm-building and voluntary commitments, exemplified by the 2022 U.S. unilateral embargo on direct-ascent kinetic anti-satellite testing, which has garnered support from many nations, including Japan, the UK, and Germany.[65] Still, these measures fall short of comprehensive arms control, especially as they fail to regulate non-debris-generating ASAT technologies, which are more stealthy and versatile. International frustration with the stagnation in formal space weapons control has prompted alternative initiatives. The EU's International Code of Conduct for Outer Space Activities, a non-binding instrument advocated from 2008 to 2014, likewise failed due to geopolitical resistance and definitional disputes. Likewise, Open-Ended Working Groups (OEWGs) at the UN, particularly those led by the UK, have concentrated on "responsible behaviours in space" but have failed to establish binding guidelines.[66] Despite its limitations, the PPWT remains the most elaborate multilateral proposal for space arms control, and its endurance reflects both the desire for regulation and the difficulty of achieving *consensus* in an increasingly contested domain.

It could be summarized that while the PPWT represents a bold step toward demilitarizing space, its continued exclusion of terrestrial ASAT systems, lack of enforcement provisions, and weak political buy-in from key actors such as the United States have made it symbolic. In a strategic environment where space dominance is seen as essential to national security, self-interest continues to prevail over collective regulation. Until technology allows for reliable verification and attribution, or shifting geopolitical interests incentivize cooperation, any treaty like the PPWT is likely to remain aspirational.

[64] Todd Harrison, “Defense Against the Dark Arts in Space: Protecting Space Systems from Counterspace Weapons”, Center for Strategic and International Studies (CSIS), 2021.
[65] U.S. Mission to the UN, *Statement on Moratorium on Direct-Ascent ASAT Tests*, April 2022.
[66] UN Office for Disarmament Affairs, *Open-ended Working Group on Reducing Space Threats*, 2022.

2. The pillars of space law

2.1 Outer Space Treaty

The Outer Space Treaty, as described previously, is a product of COPUOS, which in this sense became a focal point for the development of soft law instruments such as UNGA Res. 1348 (XIII)[67] and Res. 1472 (XIV),[68] which paved the way for hard law negotiations on outer space and are worth analysing before delve into the treaty itself. Within COPUOS, debates were extensive.

The Legal Subcommittee reports showed they spent many hours debating between declaring outer space as a *"res communis",* which means common to all, or establishing "*terra nullius"* principles for space governance.[69] The discussions between these two concepts led to proposals which aimed to establish non-appropriation and exploration freedom as basic principles. Soviet delegates supported a global governance system which would establish strict international control, but U.S. representatives backed a more open system that would allow national and private activities to proceed under international supervision.[70] Despite these ideological divisions, COPUOS members reached significant agreement on fundamental principles that would later be codified in the Outer Space Treaty.

The first major legal and political recommendation to the General Assembly from COPUOS was the adoption of Resolution 1721, indicating a shift from a purely technical focus to broader legal and normative considerations in outer space governance. The UN General Assembly passed Resolution 1721 (XVI) in 1961 which established international law applies to space and celestial bodies and required states to report their space activities to the UN as a foundation for international openness.[71] This resolution was later complemented by UNGA Resolution 1962 (XVIII) of 1963, titled "Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space," by defining non-appropriation and peaceful use and benefit of all mankind as fundamental principles.[72] Resolution 1962 is widely regarded as the soft-law precursor to the OST, as it unified emerging customary norms with binding treaty requirements to create an interpretive system which guided the OST drafting process.[73] Furthermore, this declaration laid down, for the

[67] United Nations General Assembly. *Question of the Peaceful Use of Outer Space*, A/RES/1348 (XIII), 13 December 1958.
[68] United Nations General Assembly. *International Cooperation in the Peaceful Uses of Outer Space*, A/RES/1472 (XIV), 12 December 1959.
[69] COPUOS Legal Subcommittee Report, UN Doc A/AC.105/32 (1963).
[70] *Ibid.*
[71] United Nations General Assembly. International Cooperation in the Peaceful Uses of Outer Space, A/RES/1721 (XVI), 20 December 1961.
[72] United Nations General Assembly. *Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space*, A/RES/1962 (XVIII), 13 December 1963.
[73] *Ibid.*

first time, agreed-upon principles of conduct in outer space, including peaceful use, non-appropriation, and international cooperation. Although not legally binding, Resolution 1962 (XVIII) is considered a significant soft law instrument in the field,[74] where, unlike treaties, soft law instruments like this declaration lack enforceability but still exert normative pressure on States,[75] in fact, scholars such as Coccia and Marchisio argued that soft law plays a crucial role in fast-developing of politically sensitive areas of international law, such as outer space, by providing ethical and legal guidelines that States eventually internalize.[76] Even more, the resolution has also been used interpretatively by courts and in legal scholarship to explain and give context to binding treaties like the Outer Space Treaty (1967) and its language and principles helped define the "*lex lata"* (the law as it is)[77] by shaping what would become accepted international legal standards in space activities.[78]

Once again, as described before, the geopolitical scenario of the time was crucial in shaping the legal instruments concerning space law, and in this sense, resolution 1962 (XVIII) is not an exception. Adopted during the Cold War, the resolution was not merely a legal statement but a strategic and diplomatic act: in a time marked by intense geopolitical rivalry between the United States and the Soviet Union, the declaration served to prevent unilateral militarization of space, avoid an extension of the arms race beyond Earth and assert that space should be the province of all mankind, not dominated by superpowers.[79] Its symbolic value lies in its assertion of multilateral norms over national ambition, and ultimately it marked a shared understanding, even among rivals, that space required a unique legal and ethical regime focused on peace and cooperation.[80]

This progressive development, from Resolution 1721 (XVI) laying down the applicability of international law, to Resolution 1962 (XVIII) defining legal principles, and finally to the OST of 1967 establishing binding obligations, demonstrates a deliberate legal *continuum* constructed by the international community under the auspices of the UN.[81] These efforts underscored the urgent need for binding international rules to manage the rapidly evolving technological landscape and prevent outer space from becoming a domain of conflict.

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[74] Lyall, F., & Larsen, P. B. (2018). Space Law: A Treatise. Routledge, pp. 23–28.
[75] Coccia, M. (2009). Soft Law in Outer Space Activities. Rivista di Studi Politici Internazionali, 76(4), 567–584
[76] *ibid*
[77] See Fellmeth, A. X., & Horwitz, M. (2009). Guide to Latin in international law (1st ed.). Oxford University Press: *"Ratified law. The positive law currently in force, without modification to account for any rules subjectively preferred by the interpreter..."*
[78] Hobe, S. (2016). Historical Evolution of Space Law: From Declaration to Treaties. Air and Space Law, 41(3).
[79] Gabrynowicz, J. I. (2004). The Role of the UN in Space Law Development. Journal of Space Law, 30
[80] Baslar, Kemal. "The Concept of the Common Heritage of Mankind in International Law," 1997.
[81] Bin Cheng, "United Nations Resolutions on Outer Space: 'Instant' International Customary Law?" (1965) 5 Indian Journal of International Law 23.

It was on this basis and mutual understanding that finally, in 1967, the Outer Space Treaty came into being.

The Outer Space Treaty established the central postulates that still underpin human extra-terrestrial activities.[82] It quickly found widespread acceptance and has now been joined by 105 parties, including all the leading spacefaring States; even more, much of its content has even passed into universally - applicable customary international law.[83]

The intent of the treaty is clear starting from the Preamble which reflects Cold War-era tensions and thus articulates the treaty's foundational spirit: to frame outer space as a domain of peaceful cooperation and collective human interest.[84] The Preamble draws directly from prior UN resolutions, recalling aforementioned Resolution 1962 (XVIII) and Resolution 1884 (XVIII), the latter of which called upon States *"to refrain from placing in orbit around the earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction."*[85] It also acknowledges the relevance of Resolution 110 (II) condemning propaganda likely to provoke aggression, applying this norm to outer space activities.[86] The Preamble emphasizes that space exploration should serve *"the common interest of all countries"*, a phrase later codified in Article I.[87] This aligns with the UN Charter's aspiration to "save succeeding generations from the scourge of war" and was a direct response to fears of nuclear-armed satellites during the Cold War.[88] The assertion that space is *"the province of all mankind"* reinforces the prohibition of national sovereignty later set out in Article II.[89] Relevant is the connection of the Treaty with the Charter of the United Nations in saying: *"the Treaty […]will further the purposes and principles of the Charter of the United Nations…"*, as by binding space activities to international law, including the Charter of the United Nations, the Preamble ensures that terrestrial norms such as prohibitions on

[82] David A. Koplow, The Fault Is Not in Our Stars: Avoiding the International Cooperation Dilemma in Outer Space, 59 Harvard International Law Journal 331 (2018).

[83] Restatement (Third) Foreign Relations Law of the United States § 102 cmt n.2 (Am. Law Inst. 1987); Bin Cheng, United Nations Resolutions on Outer Space: 'Instant' International Customary Law?, 5 Indian J. Int'l Law 23, 36 (1965).

[84] United Nations. *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies*. Opened for signature January 27, 1967. Entered into force October 10, 1967. 610 UNTS 205. Preamble

[85] United Nations General Assembly. Resolution 1884 (XVIII): Question of General and Complete Disarmament. Adopted October 17, 1963. UN Doc. A/RES/1884(XVIII).

[86] United Nations General Assembly. Resolution 110 (II): Measures to Be Taken against Propaganda and the Inciters of a New War. Adopted 3 November 1947. UN Doc. A/RES/110(II).

[87] United Nations. *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies*. Opened for signature January 27, 1967. Entered into force October 10, 1967. 610 UNTS 205. Art. I

[88] United Nations. *Charter of the United Nations.* Signed at San Francisco, June 26, 1945. Entered into force October 24, 1945. 1 UNTS XVI. https://www.un.org/en/about-us/un-charter.

[89] United Nations. *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies*. Opened for signature January 27, 1967. Entered into force October 10, 1967. 610 UNTS 205. Art. II

aggression extend extraterritorially.[90] This provision underscored the need for States to act responsibly in space, avoiding actions that might escalate global tensions.

Critics have raised, especially from developing countries in the Global South, for the Preamble's vague but aspirational language. However, it was eventually seen as a diplomatic compromise, in a context already well described, where the Soviet and U.S. negotiators sought to prevent the deployment of weapons of mass destruction (WMDs) in orbit while avoiding explicit bans on conventional militarization.[91] Notably, stronger concept to the *"common heritage"* and even stronger language would reappear in the 1979 Moon Agreement.[92]

The first central postulate of the OST is contained in Article I, declaring that the exploration and use of space "shall be carried out for the benefit and in the interests of all countries […]and shall be the province of all mankind".[93] This provision embodies two core principles: freedom of access and benefit sharing. Scholars like Bin Cheng interpret it as an affirmation of the res communis nature of outer space, denying exclusive rights and ensuring all nations can participate;[94] however, the absence of mechanisms for equitable benefit distribution raises questions about whether the current space order sufficiently addresses the needs of developing countries.[95] In this regard, scholar Von der Dunk highlights the challenges posed by commercial actors, whose activities may not always align with the "benefit of all mankind" principle.[96]

Article II of the OST stipulates: "Outer space, including the Moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means".[97] This provision is a cornerstone of the OST, prohibiting States from claiming territorial sovereignty. Yet its interpretation remains contested regarding resource extraction. The U.S. Commercial Space Launch Competitiveness Act of 2015 and Luxembourg's space resources law of 2017 have raised debates about whether private ownership of extracted resources violates Article II.[98] Fabio Tronchetti argues that such legislation undermines the non-appropriation

[90] United Nations. *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies*. Opened for signature January 27, 1967. Entered into force October 10, 1967. 610 UNTS 205. Preamble
[91] David A. Koplow *op.cit.p.24*
[92] United Nations. *Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (Moon Agreement).* Adopted December 5, 1979. Entered into force July 11, 1984. 1363 UNTS 3.
[93] United Nations. *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies*. Opened for signature January 27, 1967. Entered into force October 10, 1967. 610 UNTS 205. Art. I
[94] Bin Cheng, "United Nations Resolutions on Outer Space: 'Instant' International Customary Law?" (1965) 5 Indian Journal of International Law 23, 29
[95] Frans Von der Dunk and Fabio Tronchetti *op.cit.p.10*
[96] *ibidem*
[97] United Nations. *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies*. Opened for signature January 27, 1967. Entered into force October 10, 1967. 610 UNTS 205. Art. II
[98] Frans Von der Dunk and Fabio Tronchetti *op.cit.*

principle and could lead to de facto sovereignty claims;[99] conversely, some commentators like Roy S. Goh contend that appropriation of resources differs from territorial claims and is not prohibited.[100]

Another key provision is contained in Article III of the OST which reinforces that activities in outer space must comply with "international law, including the Charter of the United Nations, in the interest of maintaining international peace and security."[101] This provision ensures the extension of key international law norms, such as non-aggression and peaceful dispute resolution, into the extra-terrestrial realm. Von der Dunk notes that Article III provides a bridge between space law and broader international legal obligations, preventing a legal vacuum in outer space.[102] On this matter, different scholars have increasingly cited Article III when discussing the legal implications of cyber operations against space assets, such as the 2022 cyberattack on Viasat KA-SAT networks at the outset of the Ukraine conflict, which disrupted satellite communications across Europe.[103] Although this attack occurred on terrestrial infrastructure, it highlighted vulnerabilities of space-linked systems and raised questions about state responsibility under international law. Furthermore, legal experts argue that International Humanitarian Law (IHL) would apply to armed conflicts involving space assets. Koplow asserts that Article III allows for the application of the Geneva Conventions in outer space as well, emphasizing the need to protect civilian satellites that provide essential services such as GPS and communications.[104] Ram Jakhu has similarly noted the challenges of dual-use satellites, which are used for both civilian and military purposes, complicating the principle of distinction under IHL.[105] In the international discussion, it is particularly relevant that this growing body of scholarship calls for clearer guidelines on applying IHL to space activities to ensure compliance with Article III's mandate for peaceful and lawful conduct.

[99] *Ivi p. 25*
[100] Roy S. Goh, "International Law and the Final Frontier: The Law of Space," (2019) 33(1) Space Policy 1, 6.
[101] United Nations. *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies*. Opened for signature January 27, 1967. Entered into force October 10, 1967. 610 UNTS 205. Art. III
[102] Frans Von der Dunk and Fabio Tronchetti *op.cit.p.25*
[103] David A. Koplow, The Fault Is Not in Our Stars: Avoiding the International Cooperation Dilemma in Outer Space, 59 Harvard International Law Journal 331 (2018).
[104] *Ibid.*
[105] Ram S. Jakhu et al., Conflicts in Space and the Rule of Law, Space Pol'y (forthcoming Spring 2016), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2722245 (identifying bodies of international law relevant to space).

2.2 Debates and limitations of the OST

The so far discussed OST represents an admirable first attempt to regulate outer space activity, however, it didn't come without any criticisms, debates or limitations, especially for what concerns the use of outer space for military purpose. In this regard, a wide debate emerged particularly around articles IV and VI.

Regarding weapons specifically, Article IV of the OST prohibits parties from placing nuclear weapons or other weapons of mass destruction in orbit or on the moon or other celestial bodies, and it provides that the moon and other celestial bodies shall be used "exclusively for peaceful purposes", forbidding the establishment of military bases, the testing of weapons, and the conduct of military manoeuvres there.[106] This Article is particularly debated as, while effectively demilitarizes celestial bodies, it does not explicitly ban the deployment of conventional weapons in orbit, leaving a grey area exploited by dual-use technologies, which, as already affirmed for the Article III section, create widespread confusion and uncertainty. This gap has become increasingly significant considering recent technological advances and geopolitical tensions. David A. Koplow argues that this omission reflects a Cold War compromise, prioritizing *consensus* over comprehensive disarmament.[107] The rise of anti-satellite weapons (ASATs) programs by major powers, including China's 2007 ASAT test that created thousands of pieces of orbital debris and India's 2019 Mission Shakti, underscores the inadequacy of Article IV in addressing modern threats. Scholars such as Hobe and Jakhu warn that without clarification, Article IV's silence on conventional weapons could encourage weaponization of space through dual-use systems like satellite-based missile tracking networks.[108] These concerns have led to calls for a new international instrument or an additional protocol to the OST to close these ambiguities and ensure compliance with the original peaceful purposes.

An additional core, yet broadly discussed, provision is to be found in Article VI, which establishes that "States Parties to the Treaty shall bear international responsibility for national activities in outer space… whether such activities are carried on by governmental agencies or by

[106] United Nations. *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies*. Opened for signature January 27, 1967. Entered into force October 10, 1967. 610 UNTS 205. Art. IV; *see* also Raymond L. Garthoff, The Outer Space Treaty: 1967 to the Present, in Encyclopedia, at 877; Stephen Gorove, Arms Control Provisions in the Outer Space Treaty, 3 Ga. J. Int'l & Comp. Law 114 (1973); Peter Jankowitsch, The Background and History of Space Law, in Handbook of Space Law, at 1, 14–20 (discussing space arms control); Fabio Tronchetti, Legal Aspects of the Military Uses of Outer Space, in Handbook of Space Law, supra note 54, at 331, 335–41.

[107] David A. Koplow *op.cit. p. 26*

[108] Michael Listner, "The Militarization of Space: Emerging Legal Issues," (2015) 45(2) Journal of Air Law and Commerce 227, 235.

non-governmental entities […]"[109] This provision represents a critical innovation in international law, extending state responsibility to private actors and ensuring accountability for all space activities originating from a state's territory. Von der Dunk underscores the importance of Article VI in the era of commercial spaceflight, as it requires States to authorize and continually supervise activities by private companies,[110] and the rise of entities like SpaceX, Blue Origin, and others highlights the challenges States face in enforcing this provision. In this regard, expert MLD Hanlon explores how Article VI imposes State responsibility for commercial activities, pointing out regulatory challenges when companies like SpaceX deploy thousands of satellites without a coordinated international framework.[111] Also relevant is the argument raised by scholar GA Long who emphasizes the vagueness of Article VI's "appropriate State" wording, which can complicate determining responsibility when private actors cause harmful interference, such as signal disruptions affecting other operators.[112] This regulatory gap is particularly problematic given the increasing number of small private satellites in low Earth orbit.[113] Additionally, the advent of artificial intelligence in space missions introduces new questions about responsibility. SM Wedenig and JW Nelson argue that autonomous spacecraft controlled by AI create ambiguity regarding whether liability lies with the state authorizing the launch, the private company, or the software developer.[114] Furthermore, and lastly, scholars like Koplow have noted that as space becomes more congested, the lack of a clear enforcement mechanism at the international level raises concerns about the efficacy of Article VI.[115] After the analysis of these brilliant insights from different authors is evident how the new and developing scenario of modern times, but especially of those to come, increases pressing concerns about how traditional concepts of authorization and supervision apply in the context of advanced technologies.

To conclude the Outer Space Treaty discussion, we can summarize that since its adoption it has played a key role in preventing the militarization of outer space and laying the foundation for international cooperation in space exploration. Emerging from the intense geopolitical rivalries of the Cold War, it provided a legal framework that restricted sovereign claims over outer space and celestial bodies, banned weapons of mass destruction in orbit, and promoted the peaceful use of

[109] United Nations. *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies*. Opened for signature January 27, 1967. Entered into force October 10, 1967. 610 UNTS 205. Art. VI
[110] Frans Von der Dunk and Fabio Tronchetti *op.cit.p.25*
[111] MLD Hanlon, "Legal Implications of the Growth of Commercial Space," in *The Commercial Space Industry: Early Space Age to the Present* (Springer, 2024), 122.
[112] GA Long, "Due Regard, Harmful Interference, and Private Space Actors," (2024) Scitech Lawyer 10, 15.
[113] *Ibid.*
[114] SM Wedenig and JW Nelson, "Artificial Intelligence in Outer Space: The Responsibility of the State of the Software Developer under Article VI," (2024) SSRN Electronic Journal.
[115] David A. Koplow *op.cit. p. 27*

space *"for the benefit of all mankind."*[116] These provisions were crucial in addressing the security concerns posed by the possibility of armed satellites during the 1960s and continue to be relevant today. Also, the OST's influence extended beyond its initial scope, inspiring subsequent agreements such as the Rescue Agreement (1968),[117] the Liability Convention (1972),[118] and the Moon Agreement (1979).[119] However, as the article "Failures and Successes of the Outer Space Treaty" by T. Declan notes, ambiguities within the OST, particularly regarding the definition of "peaceful purposes" and the boundary between airspace and outer space, in addition to the uncertainties noted above in relations to Article IV and VI, have left room for interpretation and misuse.[120] Prime example that exemplifies these challenges is the Bogota Declaration's attempt in 1976 by eight equatorial States, though unsuccessful, to claim sovereignty over geostationary orbits.[121] As mentioned earlier, space commercialization has added further complexity, with private companies now launching and operating a majority of satellites, rising questions about States' responsibilities under Article VI, with critics that highlight the potential for corporate activities to evade international regulatory frameworks, especially as asteroid mining and lunar resource exploitation move closer to reality. Also, the OST prohibits national appropriation *"by any mean […]"* including indirect claims through private entities, however, it lacks mechanisms to enforce this in practice.[122] Environmental concerns are also pressing, with the proliferation of space debris (an estimated 170 million fragments in Earth orbit) that threatens future missions and risks triggering the Kessler Syndrome: a situation where the density of objects in low Earth orbit (LEO) becomes so high that collisions between objects (like defunct satellites or debris) generate more debris. This debris then triggers further collisions in a self-sustaining chain reaction, eventually making parts of space unusable for satellites or human missions because of the elevated risk of impact.[123]

In light of all this, calls for reform have grown louder, starting with scholars such as Koplow who advocates for an additional protocol to the OST to address modern threats like anti-satellite

[116] United Nations. *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies*. Opened for signature January 27, 1967. Entered into force October 10, 1967. 610 UNTS 205. Preamble

[117] United Nations. *Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space (Rescue Agreement).* Adopted December 19, 1967. Entered into force December 3, 1968. 672 UNTS 119.

[118] United Nations. *Convention on International Liability for Damage Caused by Space Objects (Liability Convention).* Adopted November 29, 1971. Entered into force September 1, 1972. 961 UNTS 187.

[119] United Nations. *Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (Moon Agreement).* Adopted December 5, 1979. Entered into force July 11, 1984. 1363 UNTS 3.

[120] Tevyaw, J. Declan. "Failures and Successes of the Outer Space Treaty." *Alliance for Citizen Engagement – Space, Oceans, and Polar Regions*, October 31, 2023

[121] *see* Tevyaw, J. Declan. *op.cit.*

[122] Frans Von der Dunk and Fabio Tronchetti *op.cit.p.28*

[123] Donald J. Kessler and Burton G. Cour-Palais, "Collision Frequency of Artificial Satellites: The Creation of a Debris Belt," *Journal of Geophysical Research* 83, no. A6 (1978): 2637–2646.

weapons and space debris,[124] and others who propose an international regulatory authority to oversee commercial activities and ensure equitable access to space resources, echoing the "common heritage of mankind" principle enshrined in the Moon Agreement (to be seen in the next paragraph).[125] Generally speaking, the OST's history demonstrates its potential to foster cooperation even among rival States and its negotiation during the peak of US-Soviet tensions suggests it could serve as a model for managing current rivalries, such as between the United States and China. However, without updates, the OST risks becoming obsolete in the face of rapid technological and geopolitical shifts.[126]

In conclusion, while the OST remains a cornerstone of space law, its future relevance depends on the international community's willingness to adapt it to contemporary realities. Strengthening its provisions on liability, environmental protection, and private actor regulation will be essential to ensure that outer space remains a domain of peace and shared human progress. All this topics will be further examined in the next chapters.

2.3 Moon Agreement and its failure to achieve universality

After the OST, the second core international treaty regulating the militarization of space law is the so-called Moon Agreement. The other existing space law treaties, although adopted earlier than the Moon Agreement but that are not directly related to the militarization of outer space, namely the Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space (1968), the Convention on International Liability for Damage Caused by Space Objects (1972), and the Convention on Registration of Objects Launched into Outer Space (1975),[127] will not be analysed for coherence purposes with the scope of this thesis.

The Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, commonly referred to as the Moon Agreement, represents the most ambitious attempt by the international community to extend the legal framework established by the 1967 Outer Space Treaty (OST). Opened for signature in 1979 and entering into force in 1984, the Moon Agreement sought to address gaps left by the OST as described earlier, particularly concerning the exploitation of extraterrestrial resources and the governance of human activities beyond Earth's orbit.[128] However,

[124] David A. Koplow *op.cit. p. 28*
[125] Ram Jakhu, "Revisiting the Moon Agreement: Prospects for Multilateral Governance of Space Resources," (2020) 45(3) Air and Space Law 211, 218.
[126] Tevyaw, J. Declan. *op.cit.p.29*
[127] *see* p.12
[128] United Nations. *Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (Moon Agreement).* Adopted December 5, 1979. Entered into force July 11, 1984. 1363 UNTS 3. https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/moon-agreement.html

its limited ratification and the controversies it sparked over key provisions have made it one of the most debated instruments in international space law.[129]

The origins of the Moon Agreement lie in the evolution of space law during the 1970s. Following the OST's establishment of key principles such as non-appropriation and peaceful use, COPUOS turned its attention to developing more detailed rules for celestial bodies. This effort was driven by concerns over future resource extraction on the Moon, the technological advances of the Apollo program, and geopolitical rivalries between developed and developing countries.[130] The notion of outer space as the "province of all mankind" evolved into a more contentious concept of "common heritage of mankind" (CHM), a principle already influencing debates on the Law of the Sea during the negotiations of UNCLOS III,[131] with developing countries, organised as the Group of 77, strongly advocating for CHM to ensure equitable access and prevent monopolization by technologically advanced States. These aspirations are contained in The Moon Agreement's Preamble, reaffirming that *"the Moon and other celestial bodies shall be used exclusively for peaceful purposes" and* that their exploration and use *"shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development."*[132] It also recalls Resolution 1962 (XVIII), the Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space and echoes its language on international cooperation and equitable sharing. Among its most significant provisions, Article 11 establishes that "*the Moon and its natural resources are the common heritage of mankind*" a phrase that became the focus of both support and criticism.[133] It asserts that neither the surface nor the subsurface of the Moon, nor any part thereof, shall become property of any state, international organization, or non-governmental entity. The article pictures therefore an international regime to govern resource exploitation, including *"an equitable sharing by all States Parties in the benefits derived from those resources."*[134] However, critics argue that this vague language and the absence of a detailed regulatory framework deterred major space powers from ratifying the agreement.[135]

[129] Davis, Michael E., and Ricky J. Lee. "Twenty Years After: The Moon Agreement and Its Legal Controversies." *Australian International Law Journal* 9–10 (1999): 9–22.
[130] Bin Cheng, "The Moon Agreement: Problems and Prospects," *Journal of Space Law* 8, no. 1 (1980): 3–15.
[131] Christopher C. Joyner, "Legal Implications of the Common Heritage of Mankind Principle for Outer Space," *Denver Journal of International Law and Policy* 15, no. 3 (1986): 417–462.
[132] United Nations. *Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (Moon Agreement): Preamble.* Adopted December 5, 1979. Entered into force July 11, 1984. 1363 UNTS 3. https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/moon-agreement.html
[133] Moon Agreement, art. 11(1)
[134] Moon Agreement, art. 11(5)
[135] Davis, Michael E., and Ricky J. Lee *op.cit.*

Article 4 of the Moon Agreement reinforces the peaceful use of celestial bodies, prohibiting their use for establishing military bases, testing weapons, or conducting military manoeuvres.[136] Yet, it does not entirely ban military support functions, leaving open questions about the legality of using the Moon for reconnaissance or communications purposes, similar to ambiguities identified in the OST.[137] Other important clauses include Article 6, obliging the States Parties to inform the United Nations Secretary-General of the activities they conduct on the Moon; Article 7, urging the conservation of the environment, and obliging the States not to carry out contaminations or harmful modifications to the environment of the celestial bodies; and Article 12, claiming the right of all the States to conduct scientific research and freely exchange results.[138]

For what concerns the critics, as mentioned before, The Moon Agreement's call for an *"international regime"* in Article 11(5) became one of its most controversial aspects. Scholars like Joyner view it as an attempt to prevent a *"first come, first served"* approach to lunar resources that could exacerbate global inequalities.[139] Conversely, critics such as Reynolds argue that it imposed a unsuitable *"redistributive model"* for incentivizing private investment and technological innovation in space. The lack of clarity over how such a regime would operate and whether it would permit commercial mining further shared resistance from spacefaring nations.[140] Criticism of the Moon Agreement also focuses on its ambiguous language and lack of enforcement mechanisms. For instance, the absence of a precise definition of *"benefit sharing"* and the failure to establish a governing authority have left key provisions ineffective. In this regard, legal scholars warn that without further elaboration, the agreement risks being viewed as an aspirational document rather than a binding legal framework.[141] Moon Agreement's contentious reception likewise finds its echo in the relatively small number of ratifications the agreement has gathered. As of 2024, only 18 States are party to the agreement and no major space powers like the United States, Russia, or China have ratified the agreement.[142] Those States' rejections uniformly raise fears and doubts that the agreement's provisions would obstruct national and private enterprise activity in space. In the 1980s, the U.S. explicitly rejected the CHM model in its pronouncements on the nation's space policies as being incompatible with the principles of the free market and its goal for U.S. leadership

[136] Moon Agreement, art. 4(2)
[137] Davis, Michael E., and Ricky J. Lee *op.cit. p. 31*
[138] Moon Agreement, arts. 6, 7, and 12
[139] Joyner, Christopher C. "Legal Implications of the Common Heritage of Mankind Principle for Outer Space." *Denver Journal of International Law and Policy* 15, no. 3 (1986): 417–462.
[140] Reynolds, Glenn H., and Robert P. Merges. Outer Space: Problems of Law and Policy. Boulder, CO: Westview Press, 1997.
[141] Joyner, Christopher C *op.cit.*
[142] Bin Cheng, *op.cit.p.31*

for the exploration of space.[143] Discussion regarding the Moon Agreement's applicability has increased over the last few years with the resurgence of lunar missions and the emergence of commercial initiatives for the purpose of extracting resources. The agreement's principles, according to its advocates, offer the basis for sustainable and equitable administration of space resources to be compatible with the rising concern regarding environmental conservation and global justice. Dr. Masson-Zwaan suggests re-examining the Moon Agreement in creating a workable regime that will facilitate commercial activity but maintain international supervision.[144] Others consider that new instruments or soft measures of law, such as codes of behaviour or guidelines, might be more beneficial in addressing contemporary challenges than resuming divisive negotiations.[145] Moreover, the advent of mega-constellations, commercial lunar landers, and lunar bases serve to illustrate the necessity to articulate the legal regime of celestial bodies. The Artemis Accords, spearheaded by the United States and discussed later herein, have been interpreted in other contexts as a substitute for the Moon Agreement in the preference for the use of bilaterally negotiated agreements over multilateral treaties.[146] This approach, while practical, runs the risk of fragmentation of international regulation of space and exclusion of the joint decision-making scenario portrayed in the Moon Agreement.[147]

Despite its limitations, the Moon Agreement is the only international agreement that specifically addresses the governance of the Moon and other celestial bodies, and although States' calls for a more inclusive space order continue with an emphasis on international cooperation, environmental protection, and equitable resource sharing, the difficulty lies in balancing these ideals with the realities of a space environment that is rapidly becoming more commercialized and technologically sophisticated.

3. The Legal Vacuum on unconventional and kinetic weapons and the ambiguity on dual-use technologies

Throughout the previous paragraphs, the legal *vacuum* confronting current space law in the face of emerging technologies and newly developed programs has been repeatedly explored. The core issue lies in the fact that, since the launch of Sputnik, while space-related military technologies

[143] as noted in Bin Cheng, *op.cit. p. 32* and Joyner Christopher C *op.cit. p. 32,* who reference U.S. policy speeches and official documents of that period
[144] Masson-Zwaan T.L. (9 februari 2023), Widening the horizons of outer space law (Dissertatie. Institute of Public Law, Faculty of Law, Leiden University) Meijers-reeks nr. MI-396. Promotor(en): Mendes de Leon P.M.J.
[145] *Ibid.*
[146] NASA, *The Artemis Accords: Principles for Cooperation in the Civil Exploration and Use of the Moon, Mars, Comets, and Asteroids for Peaceful Purposes* (Washington, D.C.: NASA, October 13, 2020), https://www.nasa.gov/specials/artemis-accords/.
[147] Masson-Zwaan, Tanja *op.cit.*

and weapon systems have advanced significantly, the binding legal framework governing space governance and the non-weaponization of outer space has remained unchanged, a stagnation primarily due to the diplomatic impasse previously described. As a result, there is an urgent need to address these challenges throughout alternative normative tools, such as soft law instruments or bilateral agreements, especially when multilateral treaties prove unfeasible due to lack of *consensus*. It is therefore necessary to analyse why and in which extent the current treaties that we have in space law are insufficient for modern times.

Admittedly, the OST, discussed primarily in paragraph 2, preserves fundamental principles on space governance and it must be conceded that Article IV outlaws clearly putting nuclear or other WMDs (weapons of mass destruction) in orbit, on celestial bodies, or deploying them in space by whatever means.[148] The article reflects a rare moment of unity between States, including nuclear-weapon ones, and reflects early recognition of space-based nuclear armaments' destabilizing implications. Nevertheless, the treaty fails to explicitly prohibit placing or using conventional weaponry in Earth orbit or other regions of outer space, and such a lacuna has serious implications, as it permits the study, development, and potential deployment of a vast array of weaponry that escapes WMD categorization.[149] The contemporary evolution of dual-use or non-nuclear technologies like electronic jamming or cyber-attacks against satellites (will be covered in chapter 2) further complicate the regulations. Even with their destructive potential, in fact, these technologies are not heavily regulated because of their peaceful purposes and as it is currently not possible to categorize them strictly as "weapons" within existing law.[150] In this sense, efforts to classify and regulate dual-use technologies only exacerbate the controversy since the definition of a weapon needs to exclude peaceful applications and preventing misuse, a profoundly difficult compromise.[151]

Intensifying this void is the ambiguous interpretation of the Treaty's requirement that outer space must be used exclusively for peaceful purposes. More precisely, while the preamble of the Outer Space Treaty refers to the common interest of all humankind in the exploration and use of outer space for peaceful purposes, and Article IV provides that the Moon and other celestial bodies shall be used *"exclusively for peaceful purposes"*, the Treaty does not offer a clear definition of this

[148] See par.2.1
[149] Louisa Handel-Mazzetti, "Deterrence Doesn't Fly in Space: Nuclear Weapons in Outer Space as a Threat of Force," *Articles of War* (Lieber Institute, West Point), May 2, 2025, https://lieber.westpoint.edu/deterrence-doesnt-fly-space-nuclear-weapons-outer-space-threat-force/.
[150] Michael P. Gleason e Peter L. Hays, *A Roadmap for Assessing Space Weapons*, Center for Space Policy and Strategy, The Aerospace Corporation (ottobre 2020), https://aerospace.org/sites/default/files/2020-10/Gleason-Hays_SpaceWeapons_20201006_0.pdf.
[151] Sa'id Mosteshar, "Space Law and Weapons in Space," *Oxford Research Encyclopedia of Planetary Science*, May 23, 2019, https://oxfordre.com/planetaryscience/display/10.1093/acrefore/9780190647926.001.0001/acrefore-9780190647926-e-74.

concept.[152] Thus, the OST deliberately refrains from defining the term "peaceful," allowing divergent interpretations to emerge. For instance, the United States has traditionally interpreted "peaceful" as meaning "non-aggressive", an approach subsequently adopted by many other States. Under this interpretation, military activities in outer space are considered permissible so long as they are not regarded as aggressive in nature. By contrast, the Soviet Union, and later several legal scholars, advanced a more restrictive reading, equating "peaceful" with "non-military."[153] Such semantic ambiguity, combined with the prevail of the U.S. interpretation and the presence of military satellites in orbit since the Treaty's entry into force, has meant that the principle of "peaceful purposes" has not led to the comprehensive demilitarization of outer space. In practice, full demilitarization applies only to celestial bodies, whereas outer space itself, including Earth orbit, is subject solely to the prohibition on the placement of weapons of mass destruction.[154] When analysing these legal ambiguities and gaps in the OST, is essential to keep in mind that it was conceived at a time when only two nations possessed space capabilities, and even more importantly private space activity was virtually non-existent. As such, it is ill-equipped to address current complexities arising from many aspects as the rapid expansion of the private space sector, the competition over space resources, the management of orbital debris, and emerging questions of liability and regulation.[155]

In this respect, and as already highlighted in the previous sections of this research, one of the most serious threats to the long-term sustainability of outer space, one that neither the Outer Space Treaty nor other space law instruments, such as the Moon Agreement, are currently equipped to regulate, lies in the development and use of kinetic anti-satellite (ASAT) weapons. These systems are specifically designed to neutralize or destroy space assets and, in the case of kinetic ASATs, they operate through direct physical impact with their targets at extremely high velocities. It is precisely this mode of operation that makes kinetic ASAT weapons particularly problematic, since the force of such collisions generates vast quantities of orbital debris, much of which can remain in orbit for extended periods of time or even indefinitely, especially at higher altitudes where the absence of atmospheric friction prevents natural orbital degradation.[156] A proper paragraph of the second chapter will be specifically dedicated to describing these weapons and their States'

[152] *See para.2*
[153] Almudena Azcárate Ortega, "Placement of Weapons in Outer Space: The Dichotomy Between Word and Deed," *Lawfare*, January 28, 2021, https://www.lawfaremedia.org/article/placement-weapons-outer-space-dichotomy-between-word-and-deed.
[154] *Ibid.*
[155] Madi Gates, "Houston, We Have a Problem: International Law's Inability to Regulate Space Exploration," *NYU Journal of International Law & Politics*, January 2, 2025, https://nyujilp.org/houston-we-have-a-problem-international-laws-inability-to-regulate-space-exploration/.
[156] Bill Boothby, "Space Weapons and the Law," *International Law Studies* 93 (2017): 179–200.

capabilities.[157] The debris can then risk having a chain reaction known as Kessler Syndrome (as described previously at page 29), where successive collisions generate more debris and incalculably increase the chances of further impacts, making whole orbital regions unserviceable for militarily and civilian purposes. Such situation threatens not only national defence capabilities but world-wide systems of communications, navigation, finance, and daily operation of civil society around the world.[158] In this way, kinetic ASATs, while not WMDs, might still cause chain effects (such as debris multiplication) that are moreover contrary to international humanitarian law's guiding principles of distinction and proportionality; however, technical and evidentiary requirements of establishing a violation of such principles in outer space are highly demanding, especially since most space technologies are of a double-use nature.[159] For this reason, despite strong international objections to kinetic ASAT testing, no explicit prohibition from existing space law that reduces these activities illicit can be found, and some scholars argue that ASAT testing is therefore still permissible with respect to the Outer Space Treaty (OST) as it fails to specifically prohibit the testing or placing of conventional weapons in orbit. Another shortcoming of the treaty discussed above, in this respect, is that while it clearly establishes that States are accountable for damage caused by space objects on Earth, in the atmosphere, and in outer space, the practical attribution of liability in specific circumstances remains highly complex and often difficult to establish.[160] For this reason, and in order to clarify and further develop the responsibility framework set out by the Outer Space Treaty, States adopted the Convention on International Liability for Damage Caused by Space Objects in 1972.[161] As of January 2026, the vast majority of the 117 States parties to the Outer Space Treaty are among the 98 States that have also ratified the Liability Convention, which expands upon and refines the existing system of responsibility in space law.[162] Under this Convention, a launching State is absolutely liable to pay compensation for damage caused by its space object on the surface of the Earth or to aircraft in flight.[163] Furthermore, Damage is broadly defined to include loss of life, personal injury or other impairment of health, as well as loss of or damage to property belonging to States, natural or juridical persons, or international

[157] *See* par. 1.1 of Chapter 2
[158] Bill Boothby *op.cit.p.35*
[159] *Ibid,*
[160] James P. Lampertius, Note, The Need for an Effective Liability Régime for Damage Caused by Debris in Outer Space, 13 MICH. J. INT'L L. 447, 455–60 (1992) (detailing "the weaknesses of the current liability system and the reasons critics find the system largely meaningless as applied to damage caused in outer space").
[161] Convention on International Liability for Damage Caused by Space Objects, Mar. 29, 1972, 24 U.S.T. 2389, 961 U.N.T.S. 187
[162] Comm. on the Peaceful Uses of Outer Space Legal Subcomm., Status of International Agreements Relating to Activities in Outer Space as at 1 January 2025, U.N. Doc. A/AC.105/C.2/2025/CRP.9, at 5–10 (May 5, 2025), https://www.unoosa.org/res/oosadoc/data/documents/2025/aac_105c_22025crp/aac_105c_22025crp_9_0_html/AC105_C2_2025_CRP09E.pdf [https://perma.cc/LFW3-ZP2U].
[163] Convention on International Liability for Damage Caused by Space Objects *supra* note161

intergovernmental organizations. In essence, the State responsible for launching a space object bears liability for any harm that object causes on Earth or to commercial aviation, regardless of the conduct of other States. By contrast, when damage occurs in outer space, liability arises only if the harm can be attributed to the fault of the launching State.[164] Nevertheless, despite this apparently comprehensive framework, the treaties provide exclusively non-coercive responses to violations. In practice, States that suffer damage are limited to requesting compensation from the responsible State, without any enforcement mechanism capable of compelling compliance. Moreover, the Liability Convention does not fully resolve the broader challenges of attribution and enforcement, a limitation that has been widely noted in the literature. As Trevor Kehrer observes, the Convention's emphasis on strict liability is not only inconsistent with the general principles of State responsibility under international law, but also results in a standard that is largely impractical and unlikely to be meaningfully enforced or relied upon in real-world disputes.[165] Several States over the course of history, including the United States, the former Soviet Union, China, and India, have successfully conducted anti-satellite (ASAT) tests, thereby demonstrating their ability to develop and deploy counter-space capabilities. One of the most notable examples is the Chinese ASAT test of 2007, which generated a large debris cloud and directly contributed to renewed international concern, ultimately prompting proposals such as the abovementioned PPWT.[166] In more recent years, this concern has translated into growing calls for a ban on ASAT testing, particularly those involving kinetic interceptors. In this context, the United States announced in 2022 a unilateral moratorium on direct-ascent ASAT tests and subsequently introduced a resolution before the United Nations General Assembly, which received broad political support. Nevertheless, the practical impact of this initiative remains limited, as it was opposed or voted against by major space powers possessing established counter-space capabilities, notably Russia, China, and India. In particular, Russia and China adopted an openly critical stance, portraying the U.S. initiative as hypocritical in light of Washington's refusal to engage in negotiations over the PPWT proposed by Beijing and Moscow.[167] Beyond kinetic ASAT systems, a wide array of counter-space technologies exists, many of which raise profound legal and strategic concerns while remaining entirely outside any binding regulatory framework. One of the core challenges in this regard lies in the absence of a universally accepted definition of what constitutes a "space weapon", as, given the characteristically dual-use nature of most space technologies, nearly any object placed in orbit could potentially be

[164] *Ivi p.36*
[165] Trevor Kehrer, Comment, Closing the Liability Loophole: The Liability Convention and the Future of Conflict in Space, 20 CHI. J. INT'L L. 178, 195 (2019)
[166] Eytan Tepper, "The Laws of Space Warfare: A Tale of Non-Binding International Agreements," *Maryland Law Review* 83, no. 2 (2024): 458–517,
[167] Matthew Jenkins, "Why the US Should Ban Kinetic Anti-Satellite Weapons," *The Space Review*, May 24, 2021, https://www.thespacereview.com/article/4180/1.

repurposed for hostile use. In an effort to address this conceptual gap, the United Nations Institute for Disarmament Research (UNIDIR) has advanced a functional working definition encompassing any device, whether space-based or terrestrial, that is designed to destroy, damage, or otherwise interfere with the normal functioning of an object or being in outer space. However, this definition remains non-binding and has not achieved universal acceptance.[168]

Directed-energy weapons (DEWs) present a similar set of challenges. High-powered lasers and microwave systems are capable of damaging or disabling satellite components at the speed of light, making them strategically attractive due to their precision, rapidity, and the difficulty of attributing attacks to a specific actor. Although Protocol IV of the Convention on Certain Conventional Weapons explicitly prohibits laser weapons designed to cause permanent blindness in humans, this prohibition does not extend to incidental or secondary effects on sensors or electronic systems, nor does it apply to space assets themselves. As a result, significant legal gaps persist, and while China and Russia are widely believed to be developing directed-energy capabilities for counter-space purposes, the classified nature of military space programs makes independent verification extremely difficult.[169]

In addition to these systems, so-called "soft-kill" counter-space techniques further complicate the regulatory landscape. Rather than physically destroying satellites, these methods aim to disrupt or disable functionality, either temporarily or permanently, without generating debris. Examples include dazzling or obscuring optical sensors, using robotic arms or manoeuvring systems to alter a satellite's orbit, or employing radio-frequency jamming to interfere with command-and-control links. While such measures may avoid the catastrophic debris creation associated with kinetic attacks, they nonetheless raise serious concerns related to attribution, escalation, and legality. Radio-frequency jamming, for instance, may be technically permissible under existing legal frameworks, yet its indiscriminate effects on civilian systems such as navigation and communications highlight the inadequacy of current regulatory regimes.[170]

Electromagnetic and radiation-based weapons constitute another particularly severe category of non-conventional threats. A nuclear detonation in outer space, for example, could generate a powerful electromagnetic pulse (EMP) capable of disabling unshielded electronic systems across vast areas, affecting both orbital infrastructure and terrestrial systems. Although such an action would clearly violate multiple international instruments, including the Outer Space Treaty and the Partial Test Ban Treaty, the simple possibility of EMP effects underscores the extreme risks

[168] Blair Stephenson Kuplic, *The Weaponization of Outer Space: Preventing an Extraterrestrial Arms Race*, North Carolina Journal of International Law 39, no. 4 (Summer 2014): 1123–1163, *North Carolina Journal of International Law and Commercial Regulation*, UNC Scholarship Repository.
[169] *Ibid.*
[170] *Ibid.*

associated with nuclear technologies in space, where EMP weapons might be particularly destabilizing as they are indiscriminate, affect large geographical areas, and cannot be controlled once deployed.[171]

Facing the persistent lack of binding international norms, the international community has adopted a variety of strategies aimed at preventing an arms race in outer space. While these initiatives have produced some progress, they remain largely in the realm of non-binding instruments and voluntary mechanisms, reflecting the enduring fragmentation and cautious approach of States when it comes to arms control in the space domain. Among these practices, one of the most consistent yet limited efforts have been the recurring adoption, since 1981, of PAROS resolutions by the General Assembly. However, as analysed two paragraphs ago, although politically meaningful these resolutions are not legally binding and their normative weight derives primarily from the degree of consensus they attract rather than any enforceability. Nevertheless, they continue to express the will of most States to maintain space as a peaceful domain and serve as soft law instruments reinforcing shared expectations of behaviour.[172] Similarly, the PPWT proposal, with its strengths and weaknesses which we already described, is an attempt to legalize these unregulated fields. At the same time, increasing emphasis has been placed on Transparency and Confidence-Building Measures (TCBMs) as a pragmatic means of reducing misperception and escalation risks in the absence of formal agreements. Such measures have included proposals for pre-notification of space launches, voluntary exchanges of information on space situational awareness (SSA), and bilateral or regional consultations. Although non-binding, these initiatives can contribute to stability and predictability, particularly when adopted by major space powers, as their effectiveness lies less in legal obligation than in the diplomatic trust they help generate.[173] In 2008, the European Union sought to assume a leading normative role by proposing an International Code of Conduct for Outer Space Activities, topic further covered in chapter 3 paragraph 2.3. This non-binding initiative aimed to promote responsible behaviour through voluntary norms emphasizing peaceful use, restraint, and non-interference. Despite initial support, however, the proposal ultimately failed to achieve universal endorsement, in part because some States viewed it as insufficiently inclusive, while the United States expressed concerns regarding potential constraints on national security and freedom of action in space.[174] Against this situation of persistent disagreement among States, the legal and scholarly communities have formed mechanisms for applying existing international law to space activities. The *McGill Manual on*

[171] *Ivi p. 38*
[172] Eytan Tepper *op.cit.p.37*
[173] *Ibid.*
[174] Eytan Tepper *op.cit.p.37 see also* Almudena Azcárate Ortega *op.cit*.p.35

International Law Applicable to Military Uses of Outer Space (MILAMOS)[175] and the *Woomera Manual*[176] represent two of the earliest and most significant efforts in this regard. Although not legally binding, these manuals play a crucial role in shaping discourse, guiding State behaviour, and informing future normative development. Their authority comes from the credibility and expertise of their contributors, including former diplomats, military planners, and international law specialists, rather than from formal legal status.[177] Taken together, these developments illustrate a broader structural trend in space governance, namely the emergence of polycentric legal ordering and the growing reliance on soft law. Consequent to the fragmentation of global authority, decentralization of decision-making and the rapid evolution of technology, States have increasingly favoured flexible, adaptive, and non-committal regulatory approaches instead of negotiating binding treaties. In this sense, normative influence is exercised less through coercion than through persuasion, reputation, and shared interests, as scholars such as St. John and Diederiks-Verschoor have argued, that contemporary space law is increasingly characterized by diffuse norm creation, in which legal standards emerge from a complex interplay of diplomatic practice, unilateral declarations, multilateral dialogue, and expert interpretation rather than from treaty-making alone.[178] With these considerations in mind, a more practical and politically viable approach to the near term is investing in a polycentric, flexible, and layered system of governance. This entails prioritizing targeted, non-binding arrangements addressing specific risks, such as debris mitigation, responsible behaviour, or notification of close approaches, while simultaneously strengthening transparency and confidence-building mechanisms capable of stabilizing expectations and reducing miscalculation. Moreover, cooperation with technical experts and the private sector will also be critical, as the line between commercial and strategic activity continues to become increasingly indistinct.

In conclusion, the limitations of space law in regulating contemporary space activities mirrors broader patterns in the evolution of international norms, where soft law and voluntary mechanisms, despite their lack of enforceability, can nonetheless exert a significant influence on State behaviour and contribute to resilience in an increasingly contested space environment.

[175] Jakhu, Ram S., and Steven R. Freeland. *McGill Manual on International Law Applicable to Military Uses of Outer Space: Volume I – Rules*. Canada: McGill University, 2022.
[176] Jack Beard, Dale Stephens e David Koplow, *The Woomera Manual on the International Law of Military Space Activities and Operations* (Oxford: Oxford University Press, 2024).
[177] Eytan Tepper *op.cit p.39*
[178] See Malcolm D. Evans and Wouter G. Werner, *Space Law in a Networked World: Polycentric Norm Creation and International Legal Order*, Journal of Space Law, vol. 45, no. 2 (2021): 105–134.

4. Comparison with Similar Regimes: The Seabed Governance Model and the Institutional Void in Outer Space

To try solving the issue so far presented with space governance and space law existing *vacuum*, many roads have been taken into consideration. One of the most discussed and studied by scholars and experts is the comparison and the hypothetical feasibility of adapting elements of the seabed regime to outer space governance.

More precisely, the governance structures for deep seabed exploration may have admittedly some similarities with outer space administration, however, it is important to also highlight their substantial differences which serve as valuable examples. First of all, under the United Nations Convention on the Law of the Sea (UNCLOS)[179] the Seabed Treaty establishes a well-developed institutional framework that governs resource management in international seabed areas.[180] The 1994 Implementation Agreement modified UNCLOS Part XI to create the International Seabed Authority (ISA) which supervises mining operations in the "Area" for global human benefit and provides systems for conflict mediation along with environmental safeguards and resource distribution mechanisms. The international community developed this elaborate legal framework because they recognized the seabed as a "common heritage of mankind" which includes precise procedural safeguards, licensing systems and collective supervision.[181]

By contrast, the Outer Space Treaty (OST) functions as the base for space law yet it does not establish a complete system of enforceable rules for governance. The Outer Space Treaty Article I declares the Moon and outer space to be *"province of all mankind"*, but no organization exists which functions like the ISA to oversee space resource extraction and resolve disputes and track compliance. The lack of an institutional body together with vague treaty provisions has established what experts describe as a legal void in terms of centralized governance and enforcement, particularly with regard to space militarization and resource extraction.[182] The Seabed Authority works as a licensing and regulatory body for deep-sea mining operations, but outer space operations only require State authorization and supervision according to Article VI OST without any central monitoring system or reporting requirements. The decentralized system has created regulatory fragmentation which allows State practices and strategic goals to control how fundamental

[179] United Nations, *United Nations Convention on the Law of the Sea*, December 10, 1982, 1833 U.N.T.S. 3, https://www.un.org/depts/los/convention_agreements/texts/unclos/unclos_e.pdf
[180] United Nations, *Treaty on the Prohibition of the Emplacement of Nuclear Weapons and Other Weapons of Mass Destruction on the Seabed and the Ocean Floor and in the Subsoil Thereof*, opened for signature February 11, 1971, entered into force May 18, 1972, 955 U.N.T.S. 115.
[181] Aryan Sood, "Comparing the United Nations Convention on the Law of the Sea and Outer Space Treaty in Respect to Equitable Access and the Principle of Common Heritage of Mankind," *International Journal for Legal Research and Analysis* 2, no. 7 (March 2025): 14
[182] Frans Von der Dunk and Fabio Tronchetti *op.cit.p.29*

principles like “non-appropriation” and “peaceful purposes” are interpreted.[183] Moreover, although already explained previously in this work, it is nevertheless useful to briefly recall that the Moon Agreement from 1979 tried to build a detailed regulatory system similar to deep seabed rules by declaring lunar resources as common heritage of humanity and creating an international authority, but it failed to receive approval from most spacefaring countries. The treaty received minimal support because only eighteen countries signed it by 2025 which made it politically powerless while the Outer Space Treaty continued to serve as the main space governance framework despite growing concerns regarding its adequacy. In the absence of a widely accepted international regime for space resources, several States have adopted national legislation, such as the U.S. Commercial Space Launch Competitiveness Act of 2015 and Luxembourg’s 2017 Law on Space Resources, that permit private space resource ownership in ways that violate the purpose of Article II of the OST. Legal experts observe that this development illustrates a shift from international cooperation toward a Westphalian approach which allows national governments to control space activities.[184]

From a security perspective, the divergence between these two entities becomes even more evident. The seabed regime contains specific rules which stop the placement of nuclear weapons and other mass destruction weapons on the ocean floor according to the Seabed Arms Control Treaty,[185] yet the Outer Space Treaty, as broadly described in the previous paragraph, does not prohibit the placement of conventional weapons in space and it lacks clear definitions about what counts as a weapon in space. The unclear definition of weapons together with missing verification systems enables nations to perform ambiguous military operations while secretly building weapons. The Outer Space Treaty (OST) receives criticism because it maintains Cold War-era provisions which fail to address modern threats that include kinetic anti-satellite tests and directed energy weapons and dual-use robotic systems.[186]

An additional fundamental difference lies in the normative maturation and institutional enforceability of the two regimes. The seabed regime received support from global political backing during the 1970s and 1980s to create operational frameworks for the "common heritage of mankind" according to Catherine Redgwell and David Ong because leaders wanted to establish control over valuable resources before any single nation could claim them.[187] The space regime established non-appropriation rules during the beginning of the space age yet these rules lacked any enforcement system and commercial and military space activities have advanced beyond their

[183] *Ivi p.41*
[184] Davis, Michael E., e Ricky J. Lee. “The Moon Treaty and the Law of the Sea.” *San Diego Law Review* 18, no. 4 (1981): 595–631.
[185] *See* note 174
[186] *See* para. 3
[187] Ong, David M. “The 1982 UNCLOS and the International Seabed Authority,” *International Journal of Marine and Coastal Law* 22, no. 1 (2007): 347–362.

original regulatory scope.[188] Furthermore, while the Moon Agreement sought to address these gaps, the absence of broad ratification has limited its impact, and no comprehensive system for dispute resolution has emerged in space law. UNCLOS includes a system for mandatory dispute resolution in Annex VI but space law depends on State agreement to start arbitration or judicial proceedings. The resulting enforcement asymmetry means that while the ISA can reject mining applications or sanction violations, no such recourse exists in space governance, making enforcement of non-appropriation or environmental duties nearly impossible in practice.[189] From an environmental governance analysis, it is important to take into consideration Article 145 UNCLOS which explicitly requires States to protect seabed environments through explicit legal requirements, whereas space law does not contain comparable provisions, relying instead on non-binding guidelines.[190] In the meantime, space debris generated by ASAT tests and the proliferation of satellite constellations continues to increase, underscoring the challenges of addressing environmental risks in the absence of binding international safeguards.[191]

More critical normative considerations relating to distributive mechanisms, equity, and the implications of these governance asymmetries for vulnerable and non-spacefaring States will be examined in Chapter IV.[192]

In conclusion, the divergence between the two regimes stems not only from institutional design, but also from differing historical trajectories, power dynamics, and enforcement capacities. The seabed regime proves that international regulation functions in disputed shared areas, yet outer space governance faces a paradox because its basic principles receive worldwide agreement, but their implementation struggles due to institutional and geopolitical resistance.

[188] Redgwell, Catherine. *"From Permission to Prohibition: The 1982 Convention on the Law of the Sea and the Regulation of Mineral Resources of the International Seabed Area,"* in Rothwell et al., *Law of the Sea* (Oxford University Press, 2015), pp. 324–340.
[189] Davis, Michael E., e Ricky J. Lee *op.cit.p.42*
[190] Gregory Radisic, "From Sea to Sky: Can the Law of the Sea Act as a Successful Model for a Future Asteroid Mining Legal Framework?," Canadian Bar Association, Air and Space Law Section Essay Contest (2022),
[191] Krishnamurthy, Anitha & Krishnamurthy, Tejas. "International Law & Space Law: Comparison with Law of Seas." 4 JLSR 255 (2018).
[192] *See p.125*

CHAPTER II

SPACE GEOPOLITICS: ACTORS AND TECHNOLOGIES

1. The New Arms Race

1.1 United States: The U.S. Space Force and Direct-Ascent Anti-Satellite (ASAT) Capabilities

The United States continues to play a central role in contemporary space security, as it did in 1945 in the immediate post-Second World War period. A crucial moment of change in its space governance occurred in 2002 when the warfighting responsibilities of its military space program was moved to United States Strategic Command (USSTRATCOM), dissolving the United States Space Command (USSPACECOM), which was, and would later resume its role, the United States' prime space domain warfighting organization.[193] As a result, until the re-establishment of USSPACECOM in August 2019, command and control of military space assets remained one of the numerous duties under the supervision of USSTRATCOM for the following sixteen years.[194] During this period, U.S. adversaries gradually reduced the capability gap by strengthening their own space programs and by better understanding the military value of space-based systems. Consequently, the space scenario changed quickly and the U.S. military found it increasingly difficult to keep pace with these developments without a clear and dedicated focus on space operations.[195] However, even after the reestablishment of the USSPACECOM a variety of difficulties remained, including the growing risk that adversaries could contest the space environment, as well as the rapid increase in space activity, which was already contributing to congestion and operational complexity.[196] At the same time, the organization not only had to reassume command and control of a whole new warfighting area, but it had to do so with instruments and systems that were intended and developed for a benign environment, with no possibility of hostile activity interfering with friendly operations. This transition occurred at a time when space was becoming increasingly contested, and as U.S. adversaries were actively identifying vulnerabilities in American space assets with the aim of reducing the strategic advantages they

[193] Gary Shugart, "Re-establishing U.S. Space Command," Purview, (October 1, 2018), https://purview.dodlive.mil/Home/Story-Display-Page/Article/2618100/re-establishing-us-spacecommand/
[194] *Ibid.*
[195] *Ibid.*
[196] Department of Defense (DoD), Defense Space Strategy Summary (Washington, DC: Office of the Secretary of Defense, June 17, 2020), 1.

provided.[197] As a result, USSPACECOM was forced to adapt quickly to the reality of a contested operating environment while continuing to work to provide access to space, which remains essential to the security of the United States and its allies, despite nearly two decades without a dedicated combatant command focused on fighting a potential war in space.[198]

For this reason, in December 2019 the U.S. established the Space Force (USSF),[199] an act that embodied a powerful symbolic and strategic shift toward an explicit militarization of outer space as a distinct warfighting domain, following decades during which the U.S. was the dominant leader in technology outside our atmosphere.[200] This new arm of the military was established to protect *"freedom of operation in, from, and to the space domain"*[201] and tasked to organise, train and equip forces to protect U.S. and allied interests in space and to provide space capabilities to the joint force. This shows how States started to see outer space not simply as a place to support military operations on Earth, but as a domain of military contestation.[202] Despite its recent establishment, the USSF rapidly developed a doctrinal foundation for space operations through the publication of a Capstone doctrine paper and five of its six Keystone documents, providing the basic framework guiding the training and employment of its personnel.[203] These texts helped in establishing for what missions the USSF is preparing, and understanding the roles and capabilities described in these documents are essential to comprehending what the US Space Forces will try to achieve in the event of a conflict. More precisely, according to the documents the three fundamental duties of military space forces are preserving freedom of action in space, facilitating cooperative lethality and effectiveness, and offering independent choices to achieve desired strategic consequences.[204] Freedom of action in space, in particular, is one of the fundamental duties as it is essential to the United States' capacity to project and use national power.[205] Specifically, the USSF has identified 3 degrees of advantage in maintaining freedom of action, namely space parity, dominance, and supremacy, drawing some inspiration from the US Air Force: when no force has an

[197] Paul Szymanski, "Techniques for Great Power Space War," Strategic Studies Quarterly 13, no 4 (Winter 2019). 78, https://www.airuniversity.af.edu/Portals/10/SSQ/documents/Volume13_Issue-4/Szymanski.pdf.
[198] Ryan M. Lombardo, *Space Command and Control in a Contested Environment: Is USSPACECOM Getting It Right?* (Maxwell Air Force Base, AL: Air Command and Staff College, Air University, February 2024), AU/ACSC/2024.
[199] United States Congress, National Defense Authorization Act for Fiscal Year 2020, Pub. L. No. 116–92, 133 Stat. 1198 (2019), §§ 951–957.
[200] Ryan M. Lombardo, *op.cit.*
[201] United States Space Force, *History of the Space Force*, United States Department of the Air Force, accessed December 10, 2025
[202] United States Congress, *National Defense Authorization Act for Fiscal Year 2020*, Public Law No. 116–92, 133 Stat. 1198 (2019)
[203] Space Training and Readiness Command, "Digital Library," 8 January 2024, https://www. starcom.spaceforce.mil/Resources/Digital-Library/
[204] Ryan M. Lombardo, *op.cit. see also:* Headquarters United States Space Force, Space Capstone Publication (SCP), Spacepower, June 2020, 29, https://media.defense.gov/2022/Jan/19/2002924108/-1/- 1/0/SPACE%20CAPSTONE %20PUBLICATION%20(10%20AUG%202020%20- 20AS%20RELEASED%20BY%20CSO).PDF
[205] *Ibid.*

advantage over the other, this is referred to as space parity; when one side enjoys a major advantage that permits it to operate without unjustified interference, this is known as space superiority; lastly, the ability of one side to carry out operations with impunity while denying their opponent freedom of action is implied by space dominance. According to USSF doctrine, ensuring freedom of action in space requires military space forces to reach and maintain the appropriate level among these three conditions, depending on the operational context.[206] The second duty of enabling combined lethality and effectiveness follows from the fact that many aspects of these concepts depend on space capabilities in order to function and reach the intended destination. This second duty will be made possible in large part as a consequence of the first duty of guaranteeing freedom of action in space, but the USSF wants its forces to concentrate on joint warfighting from the very beginning in order to facilitate those capabilities and contribute in educating the larger joint force to be more space-smart.[207] Providing autonomous options in, from, and to space is the last fundamental duty of military space forces. One of the main factors that has made Space Force independent and USSPACECOM a separate combatant command is this very duty. The space domain is increasingly recognized not merely as a supporting element for terrestrial combat, but as an independent warfighting domain, one that is no longer protected from attacks. Differently from traditional conceptions, space operations are now understood and seen to provide strategic capabilities that serve national leadership objectives, rather than serving only as support for other military domains.[208]

Having established the cornerstone responsibilities of military space forces, now it is equally important to highlight the USSF several core competencies that the military space forces must have to accomplish the above mentioned tasks. These abilities include information mobility, space mobility and logistics (SML), space security, battle power projection, and space domain awareness (SDA).[209] Firstly, space security, within the context of the peaceful use of space, seeks to safeguard the economic security and prosperity of the United States. Through presence operations intended to discourage enemies and reassure U.S.' partners that the military is positioned to monitor and protect allied interests, it tries to prevent potential disruptions of the peaceful use of space. Secondly, the goal of combat power projection is to guarantee that the U.S. and its allies continue to have the freedom to act in space, and if required, to prevent enemies from exercising this right. This is achieved by offensive operations that aim to weaken adversary capabilities and defensive operations that safeguard friendly space capabilities. Thirdly, Space Mobility and Logistics (SML) focuses on

[206] *Ivi.p.45*
[207] *Ibid.*
[208] *Ibid. see also* HQ USSF, SCP, Spacepower, 31
[209] Ryan M. Lombardo, *op.cit.p.45*

sustaining assets already deployed in orbit, as well as ensuring access to space through launch capabilities that enable the insertion of new systems or the repositioning of existing ones across the space domain. Although on-orbit sustainment has not traditionally been used by military actors, apart from limited commercial experimentation, launch operations have long been carried out in a largely uncontested environment and at a pace considered sufficient to meet operational needs. However, in order for space forces to carry out their core missions effectively, readiness must also account for the possibility that launch capabilities could be challenged. For this reason, space forces are increasingly expected not only to protect access to space, but also to move gradually toward the operational use of on-orbit sustainment. The collection, transmission, and dissemination of data across the space domain are covered by the concept of information mobility. This core capability includes secure strategic communications, broadcast and point-to-point communications, position, navigation, and timing (PNT) services, missile warning, as well as intelligence, surveillance, and reconnaissance (ISR). Many of these functions are indispensable for protecting forces, enabling lethality, and providing decision-making options to friendly forces worldwide. This element is especially relevant in those numerous remote regions of the globe where space-based communications constitute the only available means of connectivity. Finally, space domain awareness (SDA) represents the last core competency of space forces. SDA encompasses the identification, understanding, and characterization of all objects, activities, and conditions within the space domain that may affect space operations, thereby underpinning the effective employment and protection of space capabilities.[210] Factors such as space weather, the actions of adversary or allied spacecraft, orbital debris, and electromagnetic spectrum interference affecting the link segment of space operations, along with a wide range of other variables, all fall within the scope of space domain awareness. The volume, speed, and complexity of data involved make the realization of constant and complete SDA unattainable, thereby posing a persistent operational and analytical challenge for space forces. Nevertheless, SDA remains indispensable, as it enables space forces to make timely and informed decisions, ensuring the effective execution of operations and the fulfilment of their core missions.[211]

It is now necessary to address a key question that emerges from the preceding analysis, namely the importance of space capabilities in contemporary military operations. At its core, space operations enable the joint force to function effectively by providing capabilities that would otherwise be unattainable. The distinctive characteristics of the space domain allow commanders to operate with a truly global perspective, offering worldwide communications and surveillance

[210] *ivi.p.46*
[211] *Ibid.*

coverage that cannot be replicated through terrestrial means alone.[212] In addition, space-based systems provide rapid, wide-reaching, and persistent coverage, support multiple users simultaneously, and respond to operational requirements more quickly than ground-based alternatives, thereby enhancing overall military effectiveness. Moreover, space coverage equips the joint force with a range of specific capabilities that are central to modern operations. Among these is space control, which guarantees allied freedom of operation in the space domain. Another essential capability is position, navigation, and timing (PNT), which uses space-based global navigation satellite systems (GNSS) like the Global Positioning System (GPS) to give incredibly precise location and timing data for use in operations. Due to space special characteristics, space-based sensors also give the joint force intelligence, surveillance, and reconnaissance (ISR) capabilities. Lastly, space-based environmental monitoring offers support by supplying data on both space environmental conditions, critical for safeguarding space assets from adverse space weather, and terrestrial environmental factors, thereby enhancing mission planning and operational effectiveness.[213] Beyond their military value, many space capabilities have also found extensive civilian and commercial applications, despite having been originally developed for military purposes and, in many cases, still being operated by defence institutions. The most prominent example is the aforementioned GPS, a United States–owned and maintained satellite constellation that provides PNT services to users worldwide.[214] GPS has many commercial uses, including giving drivers directions, assisting with agriculture, enabling search and rescue operations to find and help people in need more quickly, and providing precise timing synchronization for major communication networks, financial markets, and banking systems. Given its widespread use, any disruption to GPS would produce consequences far exceeding the loss of military capability, affecting civilian life and economic activity on a global scale.[215] This topic, however, will be further analysed in chapter 4. In addition to military-operated systems, thousands of commercial satellites currently in orbit provide a wide range of capabilities on a global scale. These systems vary significantly in size and function, ranging from small satellites deployed in mega-constellations, such as those used to deliver broadband internet services,[216] to much larger platforms designed to

[212] Joint Publication (JP) 3-14, Space Operations, 26 October 2020, vii. https://a7236- 74652976.cluster201.canvas-user-content.com/courses/7236~170019/files/7236~74652976/ course%20files/Lesson_5/SC11G_JA5510_LSN5_20230726/JP%203-14,%20Space%20 Operations%20(2020).pdf
[213] *Ibid.*
[214] Ryan M. Lombardo, *op.cit.p.43. see also:* U.S. Government, "What is GPS," GPS.gov, 22 February 2022, https://www.gps.gov/systems/ gps/.
[215] *ibid*
[216] Elizabeth Howell and Tereza Pultarova, "Starlink satellites: Everything you need to know about the controversial internet megaconstellation," space.com, 2 August 2023, https:// www.space.com/spacex-starlink-satellites.html.

support satellite-based mobile communications worldwide.[217] In the event of a confrontation extending into the space domain, the joint force would be required to consider the protection of these commercial satellites and the capabilities they enable, including commercial satellite communications (SATCOM), remote sensing, and environmental monitoring.[218] SATCOM provides wideband and narrowband communications capabilities to private clients, businesses, and even governments worldwide, as well as satellite television and radio transmissions to nearly every location on Earth. In addition to supplying data for terrestrial meteorological applications, such as weather forecasts, remote sensing offers many forms of Earth images that can assist in environmental monitoring applications. Owing to their potential to enhance military effectiveness, these commercially provided capabilities may become attractive targets in the context of armed conflict and therefore require protection, not only a military one but also and foremost a legal one. At the same time, they constitute critical enablers for the commercial sector, whose loss or degradation would be extremely difficult, if not impossible, to compensate through alternative means.[219]

In light of the analysis so far, it becomes clear why space superiority has emerged as a strategic imperative for the United States, particularly given that military, intelligence, and civilian infrastructures are critically dependent on satellite systems for communications, navigation, missile early warning, and ISR (intelligence, surveillance, reconnaissance).[220] Moreover, one of the main reasons among those mentioned before about the establishment of the U.S. Space Force was the growing concern over the development of increasingly destructive anti-satellite capabilities by potential adversaries, most notably Russia and China.[221] In paragraph 3 of Chapter I, this research already examined in detail the difficulties faced by international law in regulating these type of weapons. However, a focus on the nature of these armaments and the capabilities that States currently possess is at this point necessary, starting with the United States.

ASAT weapons are designed to destroy or disable satellites in orbit. Space weapons can be categorized based on their operational domains (Earth-to-space, space-to-space, and space-to-Earth)

[217] Elizabeth Howell, "BlueWalker 3 satellite unfurls biggest commercial communications array ever," space.com, 14 November 2022, https://www.space.com/bluewalker-3-satellite-deployslargest-commercial-array.
[218] Emmi Yonekura et al., Commercial Space Capabilities and Market Overview: The Relationship Between Commercial Space Developments and the U.S. Department of Defense (Santa Monica, CA: RAND Corporation, 2022), 2, https://www.rand.org/pubs/research_reports/ RRA578-2.html
[219] Ryan M. Lombardo, *op.cit.p.44*
[220] Kyle Farrell, Controlling the Final Frontier: Balance of Power as a Determinant of Military Strategy in Space (B.A. thesis, University of Chicago, August 2024).
[221] Ellen Knickmeyer, Matthew Lee, Kevin Freking & Zeke Miller, Russian Efforts to Create Anti-Satellite Weapons Are Cause for US Concern, AP NEWS (Feb. 15, 2024), https://apnews.com/article/congress-national-security-6a4497fc2d74ebbe2ab3483ba43e09b3 [https://perma.cc/CX4W-YNN9].

and their mechanisms of action (kinetic or non-kinetic).[222] Kinetic capabilities have a physical impact on satellites or ground stations, usually by striking the asset directly or by detonating close enough to the asset to affect it. These counter-space capabilities are highly traceable to the attacking entity and end to have irreversible consequences on their targets. As a result, these kinds of tools have not been used in armed conflict in the modern era, and their use would be a major escalation. Non-kinetic capabilities include electromagnetic spectrum attacks that disrupt the connection section of space capabilities, lasers and microwave weapons that can disrupt satellite operations, cyberattacks that disrupt satellite data and services, and more.[223] An important exception to these categories concerns nuclear-armed ASAT weapons, which are reportedly under development and pose a particularly serious threat. For this reason, they are not examined in detail here and will instead be addressed in the following paragraph, in the context of the discussion on Russia.

Since 2020, the United States has pursued a variety of programs aimed at enhancing space resilience and counter-space capabilities but one notable development was its emphasis on direct-ascent anti-satellite (DA-ASAT) weapons. Earth-to-space kinetic ASAT weapons include direct-ascent missiles and drones that collide with and destroy satellites and so far the U.S., Russia, China, and India are the only countries to have successfully demonstrated such capabilities. First developed during the Cold War, the U.S. used its first missile in 1959 to intercept the "Explorer VI" satellite: the first endoatmospheric missile to hit a space target. Both the U.S. and USSR continued testing these weapons throughout the 20th century, generating orbital debris, and in 2008 the U.S. destroyed its own malfunctioning satellite using a missile defence system with an operation named "Operation Burnt Frost".[224] Although the United States has historically avoided testing kinetic ASAT weapons since this operation in 2008, it retains and continues to upgrade missile technologies capable of targeting satellites and these include the SM-3 interceptor and other ballistic missile defence (BMD) assets that have been modified for space targeting. Also, more attention is currently directed to non-kinetic abilities like cyber operations, directed energy and electronic warfare which can take out enemy assets without leaving behind debris in space.[225] Moreover, the U.S. has significantly increased investments in Space Domain Awareness (SDA) and proliferated LEO constellations as part of its broader space strategy. In this context, the development of distributed, interconnected satellite-architectures, like those promoted by the Space Development Agency, is intended to make U.S. space capabilities more survivable in the face of

[222] Oona A. Hathaway, Madeline Babin, and Isabel Gensler, "The Rise of Anti-Satellite Weapons," *100 New York University Law Review Online* 161 (2025), https://www.thessrn.com/abstract=5197408
[223] Ryan M. Lombardo, *op.cit.* see also Todd Harrison et al., Space Threat Assessment 2022, Report of the CSIS Aerospace Security Project (Washington DC: Center for Strategic and International Studies, April 2022), 3.
[224] *ibid*
[225] Kyle Farrell *op.cit.p.49*

kinetic or electronic attack. According to scholar Kyle Farrell, this move aligns with the U.S. strategy of dissuading adversaries by making its systems harder to disrupt, thereby reducing the military value of attacking them in the first place.[226] Finally, the establishment of the Combined Space Operations Center (CSpOC) and the strengthening of allied cooperation through initiatives such as the Combined Space Operations Initiative (CSpO) demonstrate that U.S. space strategy also seeks to preserve superiority through multinational coordination. By sharing capabilities and improving operational compatibility with partners including the United Kingdom, Canada, Australia, and France, the United States aims to develop a coalition-based approach to space deterrence that closely resembles traditional models of collective defence in terrestrial domains.[227] Nevertheless, this cooperative trajectory appears increasingly uncertain in light of recent shifts in U.S. political leadership. Under the current Trump administration, signals of reduced commitment to multilateral coordination and alliance-based security frameworks have raised concerns among European partners and U.S. allies, a trend that may further weaken collective approaches to space security if it continues.

1.2 China and Russia: Military-Technological Strategies and the Emerging Nuclear Risk in Outer Space

In recent years, a number of States, including China, Russia, Iran, and North Korea, have expanded their capabilities for military operations in space. As noted earlier, many of these counter-space capabilities are likely to be employed in future space-related conflicts. In this context, China and Russia stand out as posing the most significant strategic challenge to U.S. dominance in the space domain, given their sustained development, testing, and integration of counter-space systems into military doctrine.[228] Both States have actively pursued the militarization of space with the aim of weakening the military advantages of the United States while at the same time seeking to limit their ability to operate freely and effectively in outer space. China in particular has recently been regarded as the United States' top competitor in every area, but according to the most recent National Security Strategies and the products derived from it, including the National Defence Space Strategy, this is particularly true in space.[229] Its development of counter-space capabilities over the past few years has demonstrated this with the entire spectrum of kinetic and non-kinetic weapons

[226] *Ivi p. 50*
[227] *Ibid.*
[228] Paul Szymanski, "Techniques for Great Power Space War," *Strategic Studies Quarterly* 13, no. 4 (Winter 2019): 78–104,
[229] Joseph Biden, National Security Strategy (Washington, DC: Office of the President, October 2022), 20, https://www.whitehouse.gov/wp-content/uploads/2022/11/8-November-CombinedPDF-for-Upload.pdf

being among the many types of counter-space capabilities that China has been developing. Direct ascent kinetic kill vehicles, referred to as direct ascent anti-satellite (DA-ASAT) weapons, which launch straight from Earth on a course to hit a satellite in orbit, and as seen in the previous paragraph developed by the U.S., have also been tested by Beijing multiple times. [230]

Most notably, in 2007 they destroyed one of their own weather satellites in a demonstration launch that left thousands of pieces of debris in orbit and caused the space domain's congestion to increase exponentially.[231] Since then, their testing program has evolved into a more responsible one, with seven tests showing that China can use DA-ASATs against any of their possible enemies while producing little to no long-term debris fields. Although these capabilities have only been demonstrated to affect low-Earth orbit satellites, they also have the ability to cause significant damage within that orbit.[232]

Furthermore, China has been creating capabilities that might be applied to the co-orbital ASAT, the other primary type of ASAT capability, in addition to the DA-ASAT weapons. A co-orbital ASAT is a weapon that is launched into orbit and then moves into position to affect its target, either directly or by other means.[233] In particular, a co-orbital ASAT capability would be made possible by China's numerous technological demonstrations that show the capacity to approach closely and connect in orbit, a technological skills that can be quickly converted into a working co-orbital ASAT, even if they haven't tested any destructive powers with these demonstrations. Perhaps most worrying for the US is that, in contrast to China's DA-ASATs, their co-orbital ASAT technology demonstrations have occurred in both geo-stationary orbit (GEO) and low Earth orbit (LEO), enabling this potential capacity to be deployed in all of the US's orbits.[234]

In addition to its direct kinetic capabilities, China is developing a number of non-kinetic capabilities. They have created powerful jamming competences that can interfere with satellite communication systems (SATCOM), Synthetic Aperture Radars (SAR) on reconnaissance assets, and GNSS, such as GPS. Although current estimates indicate that this jamming will only result in a deterioration and not a complete denial of capabilities, it can reduce the advantages that militaries receive from these assets.[235] Also, China is developing directed energy weapons, such as powerful microwave emitters and lasers that can be used from a ground-based facility to disrupt or even

[230] Ryan M. Lombardo, *op.cit.p.50*
[231] Kevin Pollpeter, "China's Role in Making Outer Space More Congested, Contested, and Competitive" (research paper, China Aerospace Studies Institute, October 2021), 9.
[232] *Ibid.*
[233] Todd Harrison et al., Space Threat Assessment 2022, Report of the CSIS Aerospace Security Project (Washington DC: Center for Strategic and International Studies, April 2022), 3.
[234] Ryan M. Lombardo, *op.cit.*
[235] *Ibid.*

destroy a satellite in orbit.[236] Similar to their co-orbital ASAT capability, there have been a number of non-military research projects that could rapidly be converted to a counter-space directed energy weapon capability, even though they haven't yet made the test public. When fully developed, ground-based counter-space capabilities would primarily be able to affect satellites operating in low Earth orbit (LEO), while having little or no impact on satellites deployed in higher orbits. At the same time, current assessments suggest that space-based directed energy weapons remain far from being operationally deployable as viable military counter-space tools.[237] Even fewer information is available regarding China's existing cyberspace counter-space capabilities; nevertheless, China's broader cyberwarfare capacity has expanded rapidly in recent years and is widely regarded as a growing concern for U.S. security.[238] It is therefore reasonable to assume that such capabilities could be adapted for use in the space domain, even if they have not yet been employed in that context. To summarize, their many jammers and potent DA-ASAT capacity would pose a serious challenge to operations in space, moreover, Beijing is expected to further enhance its counter-space abilities in the coming years by developing co-orbital ASAT, directed energy capability, and more advanced cyber operations, thereby increasing its ability to compete in the space-domain.[239] Recent simulations conducted by Chinese researchers have suggested that, using a relatively small number of satellites equipped with lasers, microwaves, and related technologies, China could approach and interact with a large portion of the Starlink constellation within a short period of time.[240] In such scenarios, Chinese satellites could engage in activities such as tracking, reconnaissance, or other forms of interference directed at the Starlink system, highlighting the growing vulnerability of large commercial constellations in a contested space environment.[241]

Turning to Russia, and as already mentioned before, the Kremlin has been consistently identified as one of the main challenges facing the United States and its allies in several recent National Security Strategies.[242] Given Russia’s inheritance of the Soviet Union's effective space program at the time of the Soviet Union's collapse, Russia began in a very advantageous position compared to China's counter-space capabilities and continues to pose a significant danger to the

[236] *Ivi p. 52*
[237] *Ibid.*
[238] *Ibid.* see also Eric Heginbotham et al., The U.S.-China Military Scorecard: Forces, Geography, and the Evolving Balance of Power, 1996-2017, (Santa Monica, CA: RAND Corporation, 2015), 259, https://www.rand.org/content/dam/rand/pubs/research_reports/RR300/RR392/RAND_RR392.pd f
[239] *Ibid.*
[240] Stephen Chen, Chinese Scientists Simulate ‘Hunting’ Starlink Satellites in Orbit, S. CHINA MORNING POST (Jan. 12, 2025), https://www.scmp.com/news/china/science/article/3294047/chinese-scientists-simulate-huntingstarlink-satellites-orbit [https://perma.cc/E6CK-HCL3].
[241] *Ibid. (. Similar satellite capabilities have been tested by the US and Russia.8.)*
[242] Biden, National Security Strategy, 23.

contestation of the space domain;[243] for this reason, Russia still maintains a strong counter-space program with proven kinetic and non-kinetic capabilities, even admitting that it appears likely that China will surpass Russia's space capabilities in the upcoming years and the conflict in Ukraine has hindered Russia's long-term aspirations.[244] Although Russia possesses the potential to develop a DA-ASAT, this capability has recently been put into practice in occasion of the destruction of "Cosmos 1408" in 2021, one of its own satellites in low Earth orbit, when they test-fired a DA-ASAT at it. Similar to previous nations' DA-ASAT experiments, this one resulted in a large amount of debris clogging the space domain, even prompting NASA to order the ISS crew to take refuge in their escape vessel. In contrast to earlier tests, the goal of this one was to direct debris into the earth's atmosphere in order to reduce the risk that the debris posed.[245] Despite the success of this test, Russia has yet to deploy a fully functional DA-ASAT capability, but that is expected to come in the upcoming years. Moreover, unlike China, Russia has not only shown that it has the technological capacity to field a co-orbital ASAT but it has also proven co-orbital ASAT capabilities and it appears that the Russian military is fielding this capability as USSPACECOM has classified multiple tests of Russian equipment as ASAT testing in orbit.[246]

Similar to China, instead, Russia has developed a variety of jamming technologies that target their adversaries' GNSS, SATCOM, and SAR capabilities. The Cremlin has prioritized its military's ability to wage electronic warfare as proven by the quantity and power of its jamming capabilities. In addition to using these jammers to safeguard vital infrastructure, Russia also has a strong network of mobile jammers that it may use to assist its troops.[247] Additionally, they are developing a space-based jamming capability that would affect a satellite's capacity to affect anything on Earth instead of simply jamming in a specific area. Though Russia's proliferation of this technology will allow them to inflict such degradation on a global scale, the effects of Russian jammers will be comparable to those of Chinese ones, where they will likely damage space capabilities but not fully deny them. One of the distinctive aspects of Russian counter-space programs is that many of them are merely recovering capabilities that were transferred to Russia by the Soviet Union, but which Russia later lost the capacity to either sustain or continue developing. A working laser system that may interfere with surveillance satellites' optical systems was one of these capabilities. Initiatives to

[243] Todd Harrison *op.cit.p.52*
[244] National Intelligence Council, "Annual Threat Assessment of the US Intelligence Community" (Washington DC: Office of the Director of National Intelligence, 06 February 2023), 8, https://www.odni.gov/files/ODNI/documents/assessments/ATA-2023-Unclassified-Report.pdf
[245] Ryan M. Lombardo, *op.cit p.52*
[246] *Ibid.*
[247] Dr. Brian Weeden and Ms. Victoria Samson, eds., Global Counterspace Capabilities: An Open Source Assessment, Secure World Foundation Report (Secure World Foundation, April 2023), 03-11.

both repair this system and create a new laser system to help shield Russian Intercontinental Ballistic Missile (ICBM) sites from satellite surveillance have emerged in recent years.[248]

Russia does not appear to be developing a space-based directed energy weapon capability to supplement its ground-based weapons (unlike China) and their existing technology will not allow for such an endeavour anytime soon.[249] Nevertheless, similarly to China, Russia has tried to build a strong cyber capability to influence US operations, frequently utilizing these skills to aid in the infiltration of foreign government systems. In this regard, the United States is more concerned about the possibility of Russian cyberattacks on space-based assets, in fact, it has expressed particular worries about Russian cyberattacks against government and commercial satellites.[250] In summary, Russia has a counter-space capability that is, in many respects, more advanced than China's, even if it is thought to be less developed than China. Although they haven't used DA-ASATs in operations, they have successfully tested them and will be able to use them in the next years to assist their proven co-orbital ASATs, jammers, directed energy weapons, and cyber capabilities. When it comes to making the space domain a disputed area for the US military, Russia is undoubtedly one of the most dangerous possible actors.

A crucial moment in the space race and the militarization of outer space has undoubtedly occurred on February 5, 2022, when Russia launched Cosmos 2553 into orbit, with the satellite that was intended to test parts for a nuclear-armed anti-satellite (ASAT) missile, as U.S. officials later warned. If that spacecraft were launched and blasted in space severe consequences would have followed, as thousands of satellites and the infrastructure that supports a large portion of contemporary life could be destroyed and affected.[251] These concerns were publicly raised by the Biden Administration roughly two years after the launch, with U.S. authorities cautioning that a space-based nuclear device, sometimes referred to as a "Sput-nuke", could disrupt not only civilian communications networks but also military command-and-control systems and surveillance capabilities relied upon by the United States and its allies.[252] As then-Assistant Secretary of Defense

[248] *Ivi p.54*
[249] *Ibid.*
[250] Ryan M. Lombardo, *op.cit p.54*
[251] W.J. Hennigan, Opinion, The Warning, N.Y. TIMES (Dec. 5, 2024), https://www.nytimes.com/interactive/2024/12/05/opinion/nuclear-weapons-space.html [https://perma.cc/RMR8-W7RN]; see also Christopher J. Borgen, Russia's Alleged Nuclear AntiSatellite Weapon: International Law and Political Rhetoric, LIEBER INST.: ARTICLES OF WAR (July 31, 2024), https://lieber.westpoint.edu/russias-nuclear-anti-satellite-weapon-international-law [https://perma.cc/A565-D99D].
[252] Julian E. Barnes, Karoun Demirjian, Eric Schmitt & David E. Sanger, Russia's Advances on Space-Based Nuclear Weapon Draw U.S. Concerns, N.Y. TIMES (Feb. 14, 2024), https://www.nytimes.com/2024/02/14/us/politics/intelligence-russia-nuclear.html [https://perma.cc/6V4K-KF37]; Clementine G. Starling-Daniels & Mark J. Massa, Russian Nuclear Anti-Satellite Weapons Would Require a Firm US Response, Not Hysteria, ATL. COUNCIL: NEW ATLANTICIST (Feb. 15, 2024), https://www.atlanticcouncil.org/blogs/new-atlanticist/russiannuclear-anti-satellite-weapons-would-require-a-firm-us-response-not-hysteria [https://perma.cc/3V7Z-7H8T].

for Space Policy John Plumb notified, the threat posed by the space-based nuclear weapon is "a thing apart", a characterization that raises important questions regarding both the nature and the plausibility of such a scenario.[253] Security experts alert that unless they are specifically reinforced against radiation, many U.S. military satellites operating in commonly used orbital regimes would be exposed to intense radiation from a nuclear detonation in space, leading to progressive degradation over the weeks and months following the explosion.[254] Moreover, unlike conventional missile strikes, the effects of such a detonation would be indiscriminate, extending across national boundaries and affecting space systems belonging to all States.[255] In this scenario, a high-altitude nuclear explosion against low Earth orbit satellites could also damage or disable thousands of civilian satellites operated by actors from multiple countries; in response, the Pentagon has announced plans to invest approximately 14 billion dollars over a five-year period to develop more resilient missile-tracking and targeting satellite systems.[256] In addition to their effects on satellites, nuclear weapons positioned in space could, in theory, also be used to strike targets on Earth. A nuclear device launched from low Earth orbit could potentially evade certain radar systems, approach from unexpected directions, and reach its target more quickly than an intercontinental ballistic missile launched from the ground.[257] In such a scenario, a State under attack might have only a very limited window to respond, with few available options, particularly given the risk that intercepting a space-based nuclear weapon could still result in nuclear fallout over the defending State's territory. Despite President Putin's repeated assertions that Russia is firmly opposed to the deployment of nuclear weapons in space,[258] Russia vetoed a Security Council resolution reaffirming the Outer Space Treaty's prohibition on the placement of nuclear weapons in orbit, a move that has

[253] Sandra Erwin, Defense Space Policy Chief Calls Russia's Space Nuke Threat "A Thing Apart," SPACENEWS (May 10, 2024), https://spacenews.com/defense-space-policy-chief-calls-russias-space-nuke-threat-a-thing-apart [https://perma.cc/XD9G-HNJJ].

[254] Oona A. Hathaway, Madeline Babin, and Isabel Gensler, "The Rise of Anti-Satellite Weapons," *100 New York University Law Review Online* 161 (2025), https://nyulawreview.org/wp-content/uploads/2025/09/100-NYU-LRev-Online-161.pdf

[255] *Ibid.*

[256] Starling-Daniels & Massa, (citing def. threat reduction agency, high altitude nuclear detonations (hand) against low earth orbit satellites ("HALEOS") (2001), https://spp.fas.org/military/program/asat/haleos.pdf [https://perma.cc/9P8Y59AT]).

[257] Oona A. Hathaway, Madeline Babin, and Isabel Gensler *op.cit.* ICBMs have predictable trajectories given their ballistic nature and are vulnerable to missile defense systems. Mark Zastrow, How Does China's Hypersonic Glide Vehicle Work, ASTRONOMY (Nov. 4, 2021), https://www.astronomy.com/space-exploration/how-does-chinas-hypersonicglide-vehicle-work [https://perma.cc/Q4RS-MVQ8]. By contrast, nuclear-armed rockets placed in low Earth orbit, like fractional orbital bombardment systems (FOBS), stay relatively lower than ICBMs, evading traditional missile detection radars. Id. For weapons launched into low Earth orbit, such as FOBS, "the time required for payload delivery can be many minutes shorter than for a comparable ICBM payload." Ritwik Gupta, Orbital Hypersonic Delivery Systems Threaten Strategic Stability, bull. Atomic scientists (June 13, 2023), https://thebulletin.org/2023/06/orbital-hypersonic-delivery-systems-threaten-strategic-stability [https://perma.cc/Q4WZ-LV4U]. Though FOBS are distinct from conventional satellites because they do not complete a full orbit around the Earth, their placement in low Earth orbit and return to Earth is comparable to the back half of an ASAT weapon's trajectory. Id.

[258] Oona A. Hathaway, Madeline Babin, and Isabel Gensler *op.cit.*

further intensified international concern.[259] Some security analysts argue that nuclear-armed ASAT weapons would not provide Russia with a fundamentally new military capability, nor would they significantly alter the strategic balance between Moscow and Washington, given that Russia already possesses the means to deliver nuclear weapons from Earth and detonate them either on the ground or in space: Russia's access to nuclear weapons exists regardless of whether such systems are deployed in orbit. Nevertheless, the shorter and less predictable trajectories associated with space-based nuclear weapons could make them more difficult to intercept, thereby increasing uncertainty and instability.[260] If a nuclear ASAT weapon were detonated, the resulting damage to U.S. and allied command-and-control infrastructure could prolong conflict and significantly increase the risk of escalation and loss of life. As noted by James Acton, the danger posed by space-based nuclear weapons lies not only in the possibility of their actual use, but also in the incentives they may create, since the awareness that such weapons could be employed might encourage rapid deployment in a crisis, particularly if one side fears preventive action by the other. [261] This dynamic risks triggering a destabilizing cycle in which Russia seeks to deploy such systems while the United States attempts to neutralize them, a scenario that evokes familiar Cold War patterns.[262]

From the perspective of international law, several legal instruments are relevant to this issue. Beyond the United Nations Charter and the Outer Space Treaty, discussed in paragraphs 2.1 and 2.2 of Chapter I,[263] the 1963 Partial Test Ban Treaty (PTBT) plays a particularly important role. The PTBT represents the first multilateral agreement to explicitly prohibit specific categories of military activity in outer space, reflecting early international awareness of the transboundary and uncontrollable consequences associated with weapons testing beyond the Earth's surface.

Under Article I of the PTBT, States Parties commit not to carry out any nuclear weapon test explosion, or any other nuclear explosion, in the atmosphere, in outer space, underwater, or in any other environment if such an explosion results in radioactive debris extending beyond the territorial limits of the State conducting the test. This provision is particularly relevant in the context of space security, as it links the prohibition not only to the physical location of the test, but also to the broader and indiscriminate spread of harmful effects beyond national jurisdiction. In this respect, the treaty anticipates later legal and political concerns related to environmental harm, shared spaces,

[259] Shizuka Kuramitsu, Russia Vetoes UN Resolution on Outer Space Treaty, ARMS CONTROL ASS'N (May 2024), https://www.armscontrol.org/act/2024-05/news/russia-vetoes-un-resolutionouter-space-treaty [https://perma.cc/2798-4FGD].
[260] Oona A. Hathaway, Madeline Babin, and Isabel Gensler *op.cit*
[261] *Ibid.*
[262] *Ibid.*
[263] *See p. 22 and 27*

and the protection of global commons, including outer space.[264] China, India, Russia, and the United States are all parties to the PTBT, meaning that any testing of nuclear ASAT weapons in space would constitute a violation of their treaty obligations. Although most contemporary counter-space capabilities rely on non-nuclear technologies, the relevance of the PTBT has not diminished, particularly in light of renewed debates surrounding the possible reintroduction of nuclear elements into space-based military strategies. The treaty therefore continues to function as a legal constraint against the most destructive forms of weapons testing in space, even if its scope does not extend to the full range of modern ASAT systems. At the same time, the PTBT suffers from significant structural shortcomings. It does not establish dedicated enforcement mechanisms, verification institutions, or sanctioning procedures, relying instead on national technical means and political oversight to monitor compliance. Consequently, any response to a violation must be grounded in the general law of State responsibility, such as diplomatic protest, collective countermeasures, or recourse to international fora. This lack of institutional enforcement reflects a broader weakness in the regulation of military activities in outer space, where legal prohibitions often exist without effective mechanisms to ensure compliance or deter violations. [265]

The continuing relevance of the PTBT is illustrated by historical experience. The only nuclear test ever conducted in outer space, the United States' Starfish Prime test of July 1962, took place before the treaty entered into force and produced artificial radiation belts that damaged multiple satellites while generating electromagnetic effects across large areas of the Pacific. That episode demonstrated with clarity the indiscriminate, transboundary, and long-lasting consequences of nuclear detonations in space, and it directly informed the treaty's adoption as an attempt to prevent the repetition of such events.[266]

In contemporary discussion on space security, while the PTBT embodies an early recognition that certain military activities in outer space pose unacceptable risks to shared environments and civilian interests, it remains ill-equipped to address the evolving nature of counter-space threats. Without an evolution of existing treaties the risk is to have a legal framework detached from the operational practices that now shape military activity in outer space, thereby

[264] Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water, art. I, 14 U.S.T. at 1316–17, 480 U.N.T.S. at 45. Aug. 5, 1963, 14 U.S.T. 1313, 480 U.N.T.S. 43 [hereinafter PTBT].

[265] "Under the doctrine of countermeasures, a harmed State may take an action that would otherwise be unlawful—a 'countermeasure'—against a state that is responsible for an internationally wrongful act in order to induce that state to comply with its legal obligations." Oona A. Hathaway, Maggie M. Mills & Thomas M. Poston, War Reparations: The Case for Countermeasures, 76 STAN. L. REV. 971, 977 (2024) [hereinafter Hathaway et al., War Reparations] (citing Int'l Law Comm'n, Draft Articles on Responsibility of States for Internationally Wrongful Acts, with Commentaries, U.N. Doc. A/56/10, art. 49 (2001)

[266] Oona A. Hathaway, Madeline Babin, and Isabel Gensler *op.cit.p.57*

leaving dangerous gaps in the governance of a domain on which global security and civilian life increasingly depend.

1.3 Emerging Actors: Iran and North Korea

Although Russia and China remain the main competitors of the United States in the space race, as stated at the beginning of the paragraph, it is also important to acknowledge the emergence of other actors in this field, namely Iran and North Korea. More precisely, Iran has been identified by the American National Security Strategy as an authoritarian State that is acting aggressively and in a destabilizing manner since at least 2009, when it rebuilt its Air Force into an Aerospace Force with an additional focus on the space domain.[267] Additionally, Iran has one of the biggest space programs in the Middle East and has recently focused on space as a warfighting domain. The development of launch capability, which may potentially be applied to ballistic missile technology, as well as a number of counter-space capabilities has taken up a large portion of attention. Iran has not yet created or tested a co-orbital ASAT or DA-ASAT capability and it does not seem likely that they will be able to do so anytime soon given their current technological level. They do, however, currently have a strong ballistic missile program that might give them a DA-ASAT capability by serving as a launch platform for kinetic death vehicles and they could rapidly alter if they made a breakthrough or obtained a technological transfer, like the missile technology they have received from Russia.[268] Currently, Iran's primary counter-space capabilities are their cyber and the jamming capabilities they have developed, and although it is unclear how effective are against the more powerful capabilities of a military SATCOM signal, they certainly have been shown to have an impact on civilian signals which could be easily redirected towards military SATCOM signals.[269] The possibility of GNSS jamming remains the most concern to the U.S. as Iran seems to have sufficiently disrupted the signal of a U.S. Unmanned Aerial Vehicle to allow it to land in Iran for capture, which illustrates an efficient jamming capability that would need meticulous preparation and assistance from space forces to successfully defeat. For what concerns directed energy weapon, Iran has not produced one and does not appear to be pursuing the construction in the near future.[270] Lastly, Iran has a strong cyber capability that it can use to hack into space systems as a counter-space capability: according to the U.S. Intelligence Community, Iran has been trying to break into

[267] Joseph Biden, National Security Strategy (Washington, DC: Office of the President, October 2022), 20, https://www.whitehouse.gov/wp-content/uploads/2022/11/8-November-CombinedPDF-for-Upload.pdf
[268] Ryan M. Lombardo, *op.cit p.55*
[269] *Ibid.*
[270] *Ibid.*

U.S. and Allied networks, partly for espionage purposes but also to set itself up for potential cyberattacks in the future.[271] Overall, Iran has an effective set of jammers and cyber capabilities that can contest the space domain during any battle in which they chose to utilize them, compensating their lack of kinetic and directed energy counter-space weapons.

North Korea is frequently criticized in a similar manner to how the American National Security Strategy criticized Iran as a smaller autocratic State that is acting aggressive and destabilizing.[272] In keeping with this paragon, North Korea's counter-space capabilities are comparable to Iran's, though considerably weaker. Like Iran, North Korea lacks the technology to create a kinetic kill vehicle for a conventional DA-ASAT and the ability to command and direct a co-orbital ASAT; additionally, North Korea has not built or tested a DA-ASAT or co-orbital ASAT capability. One factor where North Korea differs from Iran is that it has some nuclear warheads, which, when paired with their proven ballistic missile capacity, might be used as a counter-space weapon through the electromagnetic pulse (EMP) the bomb would produce. The effectiveness of this is questionable because most military satellites are reinforced against radiation and EMP effects, and North Korean nuclear weapons have a limited yield.[273] North Korea has shown a limited capacity for jamming, which affects civilian equipment' GNSS and SATCOM capabilities, while the effectiveness of the jamming capacity against military capabilities is unknown even if it may be improved over the coming years to the point where it can influence military communications. Moreover, North Korea does not appear to be pursuing the development of directed energy weapons in the future, but possesses instead a number of cyber capabilities and has demonstrated in the past that it will use them against the United States and its allies.[274] More precisely, even though many of these capabilities have historically been employed primarily to support North Korea's economy, they can readily convert them into space assets, particularly if their operators have more experience and new cyber technologies are added to their arsenal. In conclusion, North Korea's potential for indiscriminate EMP assaults using 22 nuclear warheads and more targeted counter-space capabilities like jamming and cyberattacks make them a danger to compete with their opponents in space, despite their lack of kinetic and directed energy weapon capabilities.

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[271] Daniel R. Coats, "Worldwide Threat Assessment of the US Intelligence Community" (Washington DC: Office of the Director of National Intelligence, 13 February 2018), 6, https://www.dni.gov/files/documents/Newsroom/Testimonies/2018-ATA---UnclassifiedSSCI.pdf

[272] Joseph Biden, National Security Strategy (Washington, DC: Office of the President, October 2022), 20, https://www.whitehouse.gov/wp-content/uploads/2022/11/8-November-CombinedPDF-for-Upload.pdf

[273] Ryan M. Lombardo, *op.cit p.59* see also Dr. Brian Weeden and Ms. Victoria Samson, eds., Global Counterspace Capabilities: An Open Source Assessment, Secure World Foundation Report (Secure World Foundation, April 2023), 03-11.

[274] Ryan M. Lombardo, *op.cit.*

1.4 European Union: Space Governance, Surveillance and Italian Strategic Capabilities

The European Union, although lacking an autonomous military space command comparable to the United States Space Force, has increasingly asserted its presence in outer space as a hybrid actor combining regulatory leadership, infrastructure resilience, and dual-use capabilities. More precisely, while not traditionally a military actor in space, the EU has progressively adopted a more strategic posture especially in the face of growing global instability, the proliferation of space assets and the recognition of space as a strategic domain within NATO and EU policy frameworks. In this context, the Union has sought to assume a distinct role by advancing regulatory and normative initiatives aimed at shaping responsible behaviour in outer space and strengthening the legal and institutional framework governing space activities. These efforts reflect the EU's broader ambition to act as a normative power in emerging security domains and will be examined in detail later in the paragraph.

The institutional architecture that will determine European space governance in the coming decades is currently undergoing a phase of redefinition. At the centre of this governance lies the attempt to find a *modus operandi* among various actors, particularly the European Space Agency (ESA), the EU, and the member states of both, which raises several strategic, political, industrial, and technological issues. In June 2021, the two organizations signed a framework partnership agreement: the Financial Framework Partnership Agreement (FFPA) that was intended to define the roles and responsibilities of the main actors involved, namely the European Commission, the EU Agency for the Space Programme (EUSPA), officially established that same year, and ESA, which was to be granted a certain level of autonomy.[275] However, the agreement risks becoming quickly outdated, given the expansion of EUSPA's competences and the potential reorganization of ESA.[276] In terms of governance, many issues remain to be addressed: from space as a fundamental component of greater European strategic autonomy and technological sovereignty, to the centrality of the transatlantic relationship for many EU countries engaged in the space sector, sealed by major collaborations such as the Artemis program[277] or the memorandum of understanding signed between the United States and France, to the implications of the increasingly close link between

[275] Esa, ESA and EU Celebrate a Fresh Start for Space in Europe, 22 giugno 2021, https://www.esa.int/Newsroom/Press_Releases/ESA_and_EU_celebrate_a_fresh_start_for_space_in_Europe.
[276] Karolina Muti, Ottavia Credi e Giancarlo La Rocca, *Il sistema-Paese Italia di fronte alle sfide dello spazio: tra space economy, cooperazioni internazionali e cybersecurity* (Roma: Istituto Affari Internazionali, luglio 2023), Documenti IAI 23|15,
[277] to be seen in chapter 3

space and defence.[278] As a consequence, these issues require the involvement of the Ministries of Defence and the Interior, national space agencies, industrial sectors, from large system integrators to SMEs and the dynamic world of start-ups.[279] The EU is at a crucial stage in the development of its space dimension and is equipping itself with new decision-making structures, with a growing role for the European Commission. In recent years, this process has accelerated through a series of initiatives. In May 2021, the aforementioned EUSPA was established in Prague, an agency dedicated to implementing the EU's space program, while a few months earlier the Commission had published an 11 point Action Plan on synergies between the civil, defence, and space industries.[280] In February 2022, the Commission also presented a so-called "space package", which includes a joint communication concerning the EU's approach to Space Traffic Management (STM) and a secure communication system named IRIS² to be developed between 2023 and 2027.[281] In March 2022, the Strategic Compass approved by the heads of State and government of the EU also marked a new level of ambition and awareness for Europe's role in space and its resilience, announcing a series of initiatives.[282] Among these, an EU Space Strategy for Security and Defence, presented in March 2023, with new investments in protecting the Union's space assets from intentional and unintentional threats, and the development of secure governmental satellite communications. The document also foresees the strengthening of the EU Satellite Centre by 2025 to enhance geospatial intelligence.[283]

This shift in strategic focus is increasingly reflected on the ESA side as well. At the ESA Council of Ministers, which took place in Bremen at the end of November 2025, the Member States adopted a record multi-year budget, but more importantly, they explicitly opened the door for the first time in the history of the ESA to an Agency-supported program with a defence and security rationale. The leading project, European Resilience from Space (ERS), is intended to be a dual-use *"system of systems"* that aims to combine national capabilities and provide military-grade services such as secure communication, navigation, surveillance and Earth observation, therefore enhancing European strategic autonomy. This major change was lead firstly in light of the lessons from the war in Ukraine which underscored how essential secure space-based assets are for national

[278] Alessandro Marrone e Michele Nones, "Spazio e difesa: un legame crescente. Executive summary", in Documenti IAI, n. 22|02 (febbraio 2022), https://www.iai.it/it/node/14670
[279] Karolina Muti, Ottavia Credi e Giancarlo La Rocca *op.cit.p. 61*
[280] Euroepan Commission "Action Plan on Synergies between the Civil, Defence and Space Industries" (COM/2021/70), 22 febbario 2021, https://eur-lex.europa.eu/legal-content/it/ TXT/?uri=celex:52021DC0070.
[281] See Giancarlo La Rocca, Karolina Muti e Alessandro Marrone, "The EU Approach to Space Traffic Management", in Spaceways STM Briefs, n. 3 (giugno 2022), https://www. iai.it/it/node/15639.
[282] Counsil of the EU, Una bussola strategica per la sicurezza e la difesa, 21 marzo 2022, https://data.consilium.europa.eu/doc/document/ST-7371-2022-INIT/it/pdf.
[283] European Commission and High Representative of the Union for Foreign Affairs and Security Policy, *European Union Space Strategy for Security and Defence*, Joint Communication to the European Parliament and the Council, JOIN(2023)9 final, 10 March 2023,

defence;[284] and secondly for the perceived rise of great power competition in space, mainly China's and Russia's expanding space activities.[285] While ESA has made it clear that it has no intention to militarize its institutional identity or run sovereign military constellations, the ERS approach nonetheless represents a defining moment in the European governance context: it institutionalizes the *de facto* overlap between EU security needs and ESA technical-industrial capabilities, and further erodes the long-standing, strict divide between "exclusively peaceful" civil space activities and defence-driven resilience planning.[286]

At the moment, the EU's architecture for space operations is rooted in major dual-use programs that serve both civil and strategic purposes. The Galileo satellite navigation system, the European counterpart to GPS, is not only crucial for commercial and civilian applications but is also integrated into the EU's security and defence strategies. Galileo is more than a satellite system, it is Europe's reaction to changing needs for worldwide navigation and the urgent need to avoid relying on another continent for services essential to daily life and infrastructure. Galileo is one of the four Global Navigation Satellite Systems now in use, the other three are the US GPS, the Russian GLONASS, and the Chinese Beidou. It offers extremely precise location, navigation, and timing services at no cost and under civilian control. The system is made up of a number of strategically placed ground stations across the world and satellites in orbit. The two primary control centers for the ground segment are located in Oberpfaffenhofen, Germany, and Fucino, Italy where they oversee the navigation system and control the satellites.[287] Furthermore, Galileo is not merely a technological asset, but a collaborative effort, inasmuch as it is managed and funded by the European Commission as a leading component of the EU Space Programme. The European Space Agency (ESA) is leading the design, development and qualification of the space and ground systems. To ensure a continuous transition from design to reality, the EU Agency for the Space Programme (EUSPA) acts as a service provider and is in charge of some facilities such as the GNSS Centre or the Galileo Security Monitoring Centre, monitoring market needs, applications, and user engagement.[288] Galileo's Public Regulated Service (PRS) provides encrypted and robust positioning services for government-authorized users such as emergency services and defence actors, reflecting its aspect in protecting strategic autonomy goals.[289] Similarly, Copernicus, the

[284] See para. 2 of this Chapter
[285] Vlad Litnarovych, "*Europe Enters New Era of Space Militarization as ESA Approves First-Ever Defense Program*," *UNITED24 Media*, November 28, 2025,
[286] Theresa Hitchens, "In historic shift, ESA poised to take on defense role," *Breaking Defense*, October 31, 2025.
[287] European Commission, *"Galileo: An Introduction to Europe's Global, Satellite-Based Navigation System"*, Defence Industry and Space, 6 March 2025, Directorate-General for Defence Industry and Space.
[288] *Ibid.*
[289] European Commission / European Union Agency for the Space Programme (EUSPA), *Galileo Public Regulated Service (PRS): Secure and Resilient Navigation* (2023), https://www.europarl.europa.eu/cmsdata/286388/EUSPA%20CAAR%202023.pdf.

EU's Earth Observation Program, offers environmental and climate data but is also critical for border surveillance, maritime safety, and disaster response. It is the most comprehensive Earth observation program to date and offers precise, timely and easily accessible information to enhance environmental management, comprehend and reduce the effects of climate change and guarantee civil security.[290]

Additionally, as stated before, in terms of new European space capabilities one of the main programs is IRIS² (Infrastructure for Resilience, Interconnectivity and Security by Satellite), launched in 2022 and aiming at ensuring secure, autonomous, and reliable governmental satellite communications for European government entities and critical infrastructure, including during crises. The program involves collaboration between the Commission and ESA, with the European Space Agency that will indeed be able to oversee the development and validation of IRIS² implementation activities and contribute through its optional programs. An open issue concerns the nature of IRIS² as a leading EU program which may be interpreted less as an initiative driven by concerns over orbital sustainability and safety in an increasingly congested environment, and more as an effort to catch up with U.S. and European private satellite constellations, positioning itself primarily as an instrument of strategic autonomy grounded in strong institutional demand.[291] These space systems contribute to the EU's *"strategic compass"* and reflect a broader ambition to reduce dependency on non-European providers while strengthening resilience and global competitiveness. Another European initiative can be found within the framework of the European Defence Fund (EDF), in the project Responsive European Architecture for Space (REACTS) which aims to enable the launch of small satellites into various orbits, at least up to a distance of 400 kilometres, with a maximum notice of 72 hours, to respond to operational and tactical needs of the European armed forces and institutions.[292] This capability has significant implications in the field of intelligence, surveillance and reconnaissance (ISR), and military satellite communications, where it is important to ensure continuous operational capability, including the ability to monitor and react to threats, risks, and events of various kinds.

The second EDF project relevant to space is Odin's Eye II, which follows a project funded under the European Defence Industrial Development Programme (EDIDP), the predecessor of the EDF, called Odin's Eye I, for the development of a "space-based missile early warning" system, counting on 96 million euros in funding. The capability to be developed should address the needs of tactical intelligence and missile defence, particularly against ballistic missiles, hypersonic threats,

[290] European Commission, *"Copernicus — the European Commission's Earth Observation Programme"*, European Union Earth Observation Programme Copernicus, accessed 2025,
[291] European Commission, IRIS² Industry Information Day - Presentation, 31 marzo 2023, https:// defence-industry-space.ec.europa.eu/iris2-industry-information-day_en.
[292] Karolina Muti, Ottavia Credi e Giancarlo La Rocca *op.cit.p.62*

and anti-satellite (ASAT) systems.[293] In addition to these leading programs, the Space Surveillance and Tracking (EU SST) has established the EU's Space Situational Awareness (SSA) capabilities. The European Union Agency for the Space Programme is responsible for this project that seeks to locate, organise, and track the orbit of space bodies, in a quest to safeguard European space infrastructure from dangers such as collisions and planned attacks.[294] Several Member States in the EU are contributing to EU SST with their sensors and tracking systems, with Italy being prominent in this scheme. Telespazio, an affiliation between Leonardo and Thales, manages Centro Spaziale del Fucino which is one of the most developed satellite control centers in Europe, being a crucial part of the EU's infrastructure for space and offering Telemetry, Tracking, and Command services that are critical for EU's satellite sovereignty.

With a prospect to the future, the aforementioned European Union Space Strategy for Security and Defence, published during the Swedish Presidency of the Council of the EU on 10 March 2023, intends to indicate the actions necessary to increase the resilience and security of space systems, and to identify measures to deter and respond to threats, including cyber threats.[295] The document represents a unique development in the European space framework, considering that the previous Space Strategy for Europe of 2016 did not specifically address security and defence issues.[296] It was therefore particularly anticipated due to its relevance for the future of the EU Space Programme, especially in light of the protection of Galileo, now ready to evolve toward its second generation, and in view of the new IRIS² component previously analysed. The Strategy provides a definition of the space domain, which also includes the cyber component and radiofrequency links, in addition to the ground segment, launch segment, and user terminals. The document outlines the space threat landscape, which includes both kinetic and non-kinetic threats, with a specific focus on cyber threats, considered a particular vulnerability of space systems.

The Commission also foresees the development of an EU Space Law, which should be based on the existing regulatory framework and aims to work with Member States to identify space services and systems considered essential and crucial for the economic functioning of society and for the security of national activities. The objective is to define and implement a common minimum level of resilience for critical space services, and to develop coordinated national readiness and resilience plans as well as emergency protocols. Another innovation announced in the Strategy concerns the creation of an EU Space Information Sharing and Analysis Centre (ISAC), modelled

[293] European Commission, European Defence Fund: Odin's Eye (Factsheet), 26 giugno 2023, https:// defence-industry-space.ec.europa.eu/system/files/2023-06/ODINS%27EYE%20II-Factsheet_EDF22. pdf.
[294] European Union Agency for the Space Programme (EUSPA). *"Space Surveillance and Tracking: a Global Challenge"*. News release, 31 January 2024.
[295] European Commission, European Union Space Strategy for Security and Defence, 10 March 2023
[296] European Commission, European Union Space Strategy for Security and Defence, 26 October 2016

on the United States system, with the support of EUSPA. This centre is intended to enable the sharing of best practices and support measures, with the direct involvement of the industrial sector as well as public entities.[297] The document also dedicates a paragraph to the capabilities required to ensure access to space and the resilience of systems both in orbit and on the ground, with particular reference to *"versatile and responsive launchers, space environment knowledge services, in-orbit servicing, and a secure, independent cloud dedicated to space services."*[298] A central chapter of the document concerns the shift from Space Situational Awareness (SSA) to Space Domain Awareness (SDA), a concept closer to the operational approach of the armed forces of the United States and NATO allies, aimed at detecting, identifying, characterizing, and attributing objects and threats in orbit. The document also provides an interpretation of the mutual assistance clause (Article 42.7 TEU) with respect to space, setting a high level of ambition*: "Any Member State may invoke the mutual assistance clause enshrined in the EU Treaties […] where a space threat or incident amounts to an armed attack on its territory."*[299]

Lastly, the Strategy concludes with a section on partnerships: with the United Nations on responsible behaviour in outer space; with the United States; with third countries such as Canada, Norway, and Japan; and with NATO, based on the latest joint EU–NATO declaration on cooperation of January 2023 in which space is identified as a domain in which cooperation should be strengthened.[300]

An early and notable example of the EU approach in seeking to shape behaviour in outer space was the proposed EU International Code of Conduct for Outer Space Activities, which, despite ultimately failing to gain broad international support, represented one of the first serious attempts to establish voluntary standards of responsible conduct in space. This initiative, and the broader role of the EU in regional efforts to regulate space activities, will be examined in greater detail in paragraph 2.3 of Chapter 3 when discussing regional and multilateral initiatives.[301]

Among the abovementioned legislative initiatives from the EU, the more concrete and recent is the so called EU Space Act, which is a legislative proposal of the European Commission that introduces a unified framework for space operations throughout the Union.[302] Launched on June 25, 2025, the plan seeks to increase the competitiveness of the EU space industry while ensuring safety, resilience, and environmental sustainability. The current regulatory environment in Europe is disjointed with 13 distinct national approaches making things more complicated and expensive for

[297] *Ivi p.65*
[298] [298] European Commission, European Union Space Strategy for Security and Defence,2.4. 10 March 2023
[299] *Ibid. 3.2*
[300] [300] Karolina Muti, Ottavia Credi e Giancarlo La Rocca *op.cit.p.64*
[301] See p.104
[302] European Commission, *"EU Space Act: Strengthening Safety, Resilience and Sustainability in Space"*, Defence Industry and Space, 25 June 2025, https://defence-industry-space.ec.europa.eu/eu-space-act_en

companies; therefore, by establishing a unified market for space activities, the EU Space Act will facilitate the expansion and cross-border operations of businesses. The three main pillars form the framework of the proposal are safety, resilience, and sustainability, with the Act that maintains Europe's safe and unhindered access to space by introducing strong regulations for tracking space objects and reducing space debris. Subsequently, it customizes cybersecurity regulations that will guarantee business continuity and improve the defence of European space infrastructure.[303] Both EU and non-EU firms offering space services in Europe will be subject to the new regulations, with a new regulatory environment that will be ensured by scaling proportional requirements according to the size and risk profile of the company. The legislative proposal is currently negotiated under the ordinary legislative procedure by the European Parliament and the Council.[304]

Although the EU Space Act is the most sophisticated effort so far to create a comprehensive regulatory framework for space activities within the EU, recent policy analysis has pointed out a number of structural and conceptual issues that could potentially impact the long-term effectiveness of the proposal. According to a recent study by the Istituto Affari Internazionali (IAI), the proposal is grounded on a necessarily ambiguous legal basis, as it is apparently an internal market harmonization instrument but contains substantive obligations on safety, resilience, and security that are traditionally considered to be within the remit of national sovereignty.[305] The necessarily ambiguous legal basis of the proposal reflects a deeper tension between economic integration and security concerns in EU space governance. In regulating access to the European market on the basis of common technical and resilience standards, the Space Act necessarily exercises a form of indirect security governance, despite the lack of an explicit defence mandate. While this enables the EU to circumvent political constraints that would apply to hard security competences, it also raises questions about the scope of EU regulatory competence in a field where space infrastructure is increasingly viewed as a form of critical national infrastructure.[306] The IAI analysis further emphasizes the potential governance frictions emerging from the interaction between the Space Act and the pre-existing multi-level architecture of European space governance. Specifically, there are concerns about its compatibility with national space laws, the role of the European Space Agency as a technically autonomous but intergovernmental organization, and the compatibility of EU-imposed obligations with soft international norms developed under UN auspices, in particular in COPUOS.[307] Rather than mitigating fragmentation, the Space Act may thus introduce an additional

[303] *Ivi p.66*
[304] *Ibid.*
[305] Karolina Muti et al., *The Proposal for an EU Space Act: An Italian Perspective*, Documenti IAI 25|13 (Rome: Istituto Affari Internazionali, October 2025), 1–12,
[306] *Ibid.*
[307] *Ibid.*

layer of regulation in an already complex governance setting. Finally, the Space Act deliberately refrains from any explicit mention of military activities or weaponization, but it regulates infrastructure that is inherently dual-use and increasingly integrated into security and defence strategies. This strategic silence is consistent with the EU's preference for behavioural and resilience-oriented governance, but it also points to the persistence of a regulatory gap between civilian space law and the strategic realities of modern space activities.[308] In this respect, the Space Act represents a major normative step forward, but one whose success will depend on careful implementation, institutional coordination and its ability to interface coherently with national security policies and international space governance frameworks.

In this context, Italy has turned out to be one of the Member States that is actively translating the emerging EU regulatory logic into binding national legislation. In June 2025, the Italian Parliament enacted a Space Economy Law, which is the first comprehensive national legislation regulating space activities in the country. Although formally based on internal market regulation and industrial policy, the law includes substantial provisions on the safety, resilience, sustainability, and security of space activities, thus aligning national practice with the founding principles of the proposed EU Space Act.[309] The Italian Space Economy Law establishes an authorization regime for space activities, enhances national registration and control of space objects, and imposes obligations regarding debris mitigation, risk management, and the protection of critical space infrastructure. Notably, the law applies not only to public entities but also to private actors, which is a reflection of the growing importance of commercial space activities and the need to integrate them into a coherent regulatory framework (see the following paragraph).[310] In this manner, the law translates fundamental EU-level principles such as proportional regulation according to risk profiles, lifecycle responsibility, and resilience requirements into practice well before the final adoption of a European framework. From a governance perspective, this is a prime example of the EU space governance trend of using indirect security regulation in the form of this domestic initiative. While the Italian law does not contain any explicit references to military use or weaponization, it still regulates infrastructures and services that are inherently dual-use and are deeply embedded in the national security, civil protection and defence sectors; an approach consistent with the overall strategy of the EU, as outlined in the Space Act proposal.[311] However, the Italian Space Economy Law also demonstrates how Member States can act as normative intermediaries that can translate the EU's

[308] *Ivi.p.67*
[309] Italian Parliament, *Legge quadro per l'economia dello spazio*, June 2025, published in *Gazzetta Ufficiale della Repubblica Italiana*.
[310] *Ibid.*
[311] European Commission, *Proposal for a Regulation on the EU Space Act*, COM(2025), and comparative analysis in national implementation.

strategic ambitions into enforceable domestic rules while maintaining flexibility in sectors that are close to national security. This domestic regulatory consolidation is a crucial background context for understanding the subsequent Italian stance in multilateral settings, where it has repeatedly used space sustainability, debris mitigation, and responsible behaviour not only as technical issues, but also as issues that have direct implications for international security and strategic stability. This topic will be covered in paragraph 3 of Chapter III.

In conclusion, the EU has positioned itself as a normative and infrastructural power in the space domain, with Italy playing a key role enabling role through its industrial base, geostrategic location, and diplomatic engagement. While it does not pursue space supremacy through weaponization or deterrence, the EU's emphasis on resilience, responsible behaviour and multilateral governance are the means through which EU tries to shape the rules of the game in outer space. In a world increasingly characterized by fragmentation and competition, the European model offers a distinctive path forward, centred on rules, cooperation, and autonomy.

2. Private Actors: SpaceX and the Dilemma of Commercial Militarization

Besides States being the classical actors of space race and the militarization of it, the space governance is becoming (and already is) increasingly crowded.[312] A new level of complexity has been brought about by the quick growth of private space initiatives and operations, which are running with an increasing degree of autonomy, power, and competence.[313] Their platforms are in the contemporary context increasingly integrated, and occasionally essential, parts of contemporary military operations, making them no longer on the periphery of security strategy.[314] This change is explicitly acknowledged in the U.S. Department of Defense's 2024 Commercial Space Integration Strategy, which highlights the fact that commercial providers are now incorporated into defence infrastructures over the entire spectrum of conflict rather than only as subsidiary or supplemental services.[315] The rise of private actors in the space domain is not the result of spontaneous market dynamics or technological inevitability, but rather the outcome of deliberate political and institutional decisions, particularly within the United States, that have reshaped the relationship

[312] Jayaraman, V. 'Space Technology Inputs for Good Governance' (2015).
[313] Scott Michael Steele and Anglia Ruskin, *"International Space Law: A Hindrance to Space Activities or a Resolute Action for Change," American Journal of Aerospace Engineering* 9, no. 1 (May 2022)
[314] Kim, Yool, et al. 2025. "Integrating Commercial Space Services into the DoD Architecture Understanding Operational and Policy Implications" Research Briefs – RAND Corporation. 2 https://www.rand.org/pubs/research_briefs/RBA2562-1.html
[315] U.S. Department of Defense. "2024 Commercial Space Integration Strategy." Washington, D.C.: Office of the Secretary of Defense, April 2, 2024. https://media.defense.gov/2024/Apr/02/2003427610/-1/-1/1/2024-dodcommercial-space-integration-strategy.pdf. 3

between state institutions and commercial entities. This transformation has gradually elevated private corporations to almost parastatal roles in the management and exploitation of outer space. A major shift occurred in 2010 when the Obama administration reorganised NASA's role in the national space program and decided to begin funding private companies to carry NASA astronauts into space. The goal of the controversial proposal was to set up a multiyear, multi-billion-dollar initiative allowing private firms, including some start-ups, to compete to build and operate spacecraft capable of transporting U.S. astronauts into orbit and eventually deeper into the solar system. Thus, rather than carry out the construction, design and operation of its own spacecraft and launch vehicles, NASA started relying on private companies for these jobs and buying services from them, making space exploration increasingly dependent on private enterprise.[316] During the Trump administration, this trend worsened, especially with Executive Order 13914 in April 2020, which officially allowed U.S. companies to extract and use space resources for commercial purposes. It framed the change in strong terms, stating that from that moment Americans should have the right to engage in commercial exploration, recovery, and use of resources in outer space. In effect, this cleared the way for private companies to not merely explore space but to actually claim and profit from what they find, marking a clear break from previous international efforts like the Moon Agreement, and putting pressure on the long-standing non-appropriation principle laid out in Article II of the Outer Space Treaty. However, this wasn't simply a policy twist, it marked a much bigger shift in how space is governed: private companies were no longer building rockets or providing tech, they were increasingly performing functions traditionally exercised by States; they became geopolitical players in their own right, merged into national strategies and the broader machinery of state power.[317] This new configuration has led to what some scholars and analysts call a form of "stellar capitalism," in which corporations not only act on behalf of the State but, in some respects, assume functions that were traditionally reserved for sovereign governments. As observed in italian engineer Spagnulo work *"Stellar Capitalism: How the New Space Race is Changing Earth"*, the relationship between State and private actors is no longer defined by subordination, but rather by a structural incorporation of the latter into national strategic objectives. As Spagnulo noted, these private actors are becoming the State themselves, emphasizing how companies like SpaceX, Blue Origin, and Palantir have come to occupy central roles in security, communication,

[316] Logsdon, John M. "A New U.S. Approach to Human Spaceflight?." *Space Policy* 1, no. 1 (February 2011): 14–24. https://www.sciencedirect.com/science/article/pii/S0265964610001189

[317] Harrison Mellor, *The Militarization of Outer Space: Legal, Ethical and Strategic Implications of Commercial Interests* (Ithaca, NY: Cornell Brooks Tech Policy Institute, October 28, 2025), https://publicpolicy.cornell.edu/news/the-militarization-of-outer-space-legal-ethical-and-strategic-implications-of-commercial-interests/

and surveillance functions that were once exclusively governmental.[318] Particularly interesting is how much Big Tech controls the space sector, as in 2025, 9 out of the 10 most valuable companies on Wall Street, like Amazon, Microsoft, Nvidia, Meta, and Tesla, are either directly or indirectly involved in space-related activities. The concentration of financial and technological power in a few companies has led to new ways to control and influence the use of outer space, including satellite internet projects, launch capabilities, AI-based surveillance systems, and cloud infrastructures for space data.[319] This paradigm shift, however, has not occurred without significant environmental and ethical concerns. Prime example of the destructive footprint of human activity in outer space and Earth's orbit is exemplified by the dominance of a single actor, Elon Musk, whose company SpaceX owns over 8,500 of the 15,000 operational satellites currently in orbit. Such saturation without precedents in the history has raised long-term sustainability and monopolization of orbits concerns; or what Spagnulo named "Space Anthropocene".[320] Moreover, a long-standing "throwaway culture" in satellite deployment has compounded the issue of space debris. For decades, satellites were launched with no plan for deorbiting or disposal. As Spagnulo provocatively noted, the practice was analogue to "buying a car, driving it until it runs out of fuel, leaving it on the road, and buying a new one." This approach has left thousands of defunct satellites and millions of fragments in orbit, creating a dangerous environment for current and future missions. [321] In response to growing concerns over debris, some operators, most notably SpaceX, have adopted policies of planned atmospheric re-entry for their satellites. Nevertheless, controversies remain about this practice. More precisely, as explained by aerospace engineers, satellites burn upon re-entry release potentially harmful materials into the atmosphere, including titanium tanks, silicon panels, hydrazine residues, and electronic components, all materials that if burned in terrestrial environments would likely be subject to strict environmental regulations. This scenario raise questions about the unregulated nature of orbital disposal practices and moreover, it leads to further unknowns. With Starlink satellites re-entering Earth's atmosphere at a rate of 4 to 10 per day, the long-term effects of their combustion, especially at molecular levels in the upper atmosphere, remain largely unstudied. Some researchers have warned that the cumulative impact of these daily re-entries over decades could lead to unexpected chemical combinations and environmental consequences that are not yet understood.[322] Finally, the public narratives and strategic visions of the major space entrepreneurs reveal a spectrum of motivations and ambitions.

[318] Marcello Spagnulo, Capitalismo stellare. Come la nuova corsa allo spazio cambia la Terra (Soveria Mannelli: Rubbettino, 2023)
[319] *Ibid,*
[320] *Ibid.*
[321] *Ibid.*
[322] *Ibid.*

Elon Musk frequently promotes the idea of colonizing Mars, though some analysts see this as a form of expedient designed to justify aggressive expansion strategies. Jeff Bezos, on the other hand, has articulated a more grounded plan to move heavy industry into space to relieve Earth of its environmental burden, an idea that some experts describe as more intellectually honest. Regardless of their differences, both visions embody a profound shift in how the governance of space is conceptualized, away from international cooperation and toward techno-corporate sovereignty.[323] As one final warning, experts have pointed out that the traditional distinction between public and private authority is increasingly blurred in the space sector. Figures such as Alex Karp, CEO of Palantir, openly claim that the future of policymaking will belong not to elected representatives but to "engineers of technology" who will shape the rules of the game. In this light, the rise of private actors in outer space is not merely a matter of commercialization, it is a fundamental challenge to democratic governance, international law, and the future of space as a global commons.[324]

The rise in private or independent entities involved in space exploration leads to State-centric solutions like the TCBMs, GGEs, and the new UN code to still be insufficient in order to achieve inclusivity in future space governance.[325] When international space law was created, States were the only operators in space and the Cold War was raging. The core treaties, like the 1967 Outer Space Treaty and the 1972 Liability Convention previously described, were not intended to control the actions or obligations of private parties running dual-use systems in active conflict areas, but rather to stop States from militarizing space.[326] More precisely, the treaty's articles clearly say that States have the authority to control space operations but these provisions seem more and more outdated as commercial space technology operators multiply and behave more independently of governmental regulations.[327] Many analysts argue whether the commercial assets supporting military activities are to be seen as legitimate military targets, despite the fact that no international treaty expressly addresses commercial space actors in combat.[328] This possibility raises the unsettling potential that dual-use satellites could be legitimately attacked during a war, even if they are mainly used for civilian purposes and may be offering vital, life-saving services. However, the threat to commercial satellites does not stop here, as any spacecraft in orbit that is destroyed might

[323] *Ivi p.71*
[324] *Ibid.*
[325] see also 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).
[326] Kilibarda, Pavle. 2017. "Space law revisited (3/3): The regime of international liability in space." 9 https://blogs.icrc.org/law-and-policy/2017/04/27/space-law-revisited-international-liability/
[327] Kopal, Vladimír. 2008. "Introductory Note." https://legal.un.org/avl/ha/tos/tos.html 1
[328] International Committee of the Red Cross. 2022. "Constraints under International Law on Military Operations in, or in Relation to, Outer Space during Armed Conflicts." 2. https://www.icrc.org/en/document/constraints-underinternational-law-military-space-operations 11

spread the danger to satellites that are only for civilian use. The possibility of collisional escalating events, a chain reaction of debris capable of taking down a significant portion of orbital infrastructure, puts all space-based systems at risk if military forces start deliberately attacking orbital assets, as Russia has threatened.[329] This issue raises ambiguity both from a legal and strategic standpoint. According to a new CSIS analysis, U.S. and NATO messaging over the repercussions of satellite assaults still lacks precise response thresholds, which weakens deterrent and makes commercial suppliers unsure of the dangers they encounter.[330] Whether an attack against a U.S.-based satellite company qualify as an attack on the US, whether it could lead to NATO's collective defence obligations, are all unanswered questions of extremely importance and relevance. These legal uncertainties pose issues of accountability in addition to targeting and protection, an ambiguity that is not only a regulatory oversight but also a strategic risk in an era where billion-dollar space assets serve as the foundation of military operations.[331] To answer this call, policy recommendations from scholars are focused on developing a space commercial security framework: a request for governments to develop a clear regulatory framework that defines rights, responsibilities and protections of private actors in space. Mostly, in regulating this area, space policy should be updated to do three action: clarify legal status and obligations; define accountability in escalation scenarios; and encourage international coordination and industry participation.[332]

In order to make vivid and clear the relevance and urgency of the aforementioned issue it's important to analyse some concrete and recent cases. Due to its crucial role in the conflict between Russia and Ukraine, SpaceX's Starlink has come to represent a prime example. After Russia's full-scale invasion of Ukraine in February 2022, and following the disruption of traditional infrastructure in the country, Starlink terminals were set up to preserve communications allowing Ukrainian forces to safely communicate across disputed area, coordinate tactical actions, and fly drones. This connectivity supported both civilian communications and military coordination but also supported civilians, hospitals, schools, and critical services during widespread Russian strikes on power and communication networks. By mid-2025, reports indicated more than 50,000 Starlink terminals in operation supporting both civilian and defence communications across Ukraine.[333] A turning point occurred in 2023, when Elon Musk reportedly restricted the service's availability near Crimea to prevent its use in a Ukrainian drone operation. He gave the justification that he did not

[329] Tingley, Brett. 2022. "Russia says private satellites could become 'legitimate target' during wartime." https://www.space.com/russia-private-satellites-legitimate-target-wartime-united-nations 13
[330] Harrison Mellor *op.cit.p.70*
[331] *Ibid.*
[332] *Ibid.*
[333] Joscha Abels, "Private infrastructure in geopolitical conflicts: the case of Starlink and the war in Ukraine", European Journal of International Relations 30, n. 4 (2024)

want Starlink to take part in "a major act of war", however, the tactical environment on the battlefield might have been directly changed by that private individual's action.[334] Musk stated that Starlink had never been turned on in that area and that doing so would have amounted to direct involvement in hostilities, generating Ukrainian officials to express frustration. Regardless of which interpretation is technically right, the episode reveals that the actors themselves are explicitly aware of the strategic issue and that a single business decision can either allow or restrict military activity in a setting without established regulations. Musk's stance successfully expresses the idea that neutrality is the absence of action. However, from Ukraine's point of view, refusing service a vital tool for their operations amounted to picking a side.[335] This case highlights the ambiguity that results when commercial parties running dual-use infrastructure get involved in a conflict, and when considering possible future confrontations involving other states, like China, the strategic ambiguity becomes even more severe. In fact, China's extensive integration into global supply chains, capital markets and technology ecosystems would provide significantly more difficult problems for commercial space providers than Russia, which has little economic and technological ties to Western commercial entities.[336] Still, repercussions of the Russian invasion were evident when the consequences of 2022 Russia's cyberattack extended beyond the country's armed forces, with the hack causing weeks of internet outages for tens of thousands of consumers in other European nations. These situations represent a significant change in the location of strategic authority as well as in the technology at play, with the commercial providers of today that run enormous worldwide constellations and frequently make real-time service-level choices regarding the deployment, denial, or modification of their capabilities. Whether motivated by business interests, moral considerations, or the judgment of individual leaders, these choices have the power to significantly influence military outcomes during times of crisis, like state policy.[337]

Even more recently, during January 2026 substantial protests in Iran, as reported by the BBC, Starlink has allegedly waived monthly subscription payments for users inside Iran after its government shut down the internet last Thursday, cutting off millions of people from their families, livelihoods and access to information, during a deadly crackdown on protests. The satellite technology has thus become a vital communications lifeline for some of those in the country trying to tell the outside world what has been happening on the ground in recent days. The satellite technology provides internet to tens of thousands of people in Iran, despite the fact it is illegal there,

[334] Jordan, Dearbail. 2023. "Elon Musk says he withheld Starlink over Crimea to avoid escalation." https://www.bbc.com/news/world-europe-66752264
[335] Harrison Mellor *op.cit.p.73*
[336] *Ibid.*
[337] *Ibid.*

however, since the internet was shut down, it has become one of the last, if not the last, remaining channels for Iranians to communicate with the outside world, hence its importance.[338]

3. The Militarization of Space

3.1 Space Drones (X-37B) and their Legal Status

The growing militarization of outer space has brought new platforms that put existing legal categories under international space law to the test, together with ASAT's system already described and analysed before. Among these, the United States' X-37B Orbital Test Vehicle (OTV) is one of the most representative and controversial systems. Because of its autonomous flight, reusability, and long orbital life, the X-37B has been nicknamed a "space drone." However, the X-37B is much more than a space drone or a military system, as it represents a system that crosses the boundaries between a space vehicle, a military system and a space weapon.[339] While it was originally developed by NASA, the project was given to the Department of Defence in the middle 2000s and changed into a classified military programme. The spacecraft is launched vertically on conventional rockets and lands horizontally like an airplane, which enables it to be recovered, refurbished, and reused. The missions of the spacecraft have shown an unprecedented level of endurance, remaining in orbit for more than 700 days, while the goals are not publicly disclosed.[340] Furthermore, designed for the Air Force by United Launch Alliance, as a joint venture between Boeing and Lockheed Martin, the covertly launched X-37B is 9 meters long, 15 meters wide, and powered by solar panels. Prior to the shuttle's most recent launch in May 2020, the Pentagon declared that it will use the shuttle for a number of scientific studies, with verifying the behaviour of specific materials in space and the potential for transforming solar radiation into radio-electric energy that were the official goals. It is reasonable to presume, though, that this mission was largely military in nature.[341] Strategically speaking, the X-37B is generally regarded as a technology demonstrator for various advanced space technologies, such as autonomous orbital manoeuvres, thermal protection systems, and the evaluation of experimental space payloads in the space environment. However, the X-37B's secrecy and manoeuvrability have raised concerns among other space-capable nations, namely Russia and China, who have described the system as a potential weapon or component of future

[338] Reha Kansara and Ghoncheh Habibiazad, "Starlink reportedly made free in Iran-but protesters are taking huge risks by using it". 14/01/2026, BBC. https://www.bbc.com/news/articles/c0r4veg0rrzo
[339] Chanock A., (2013). The problems and potential solution related to the emergence of Space Weapon in 21st Century, Journal of Air and Law Commerce, vol. 78, issue 3, pp. 691–710.
[340] U.S. Department of the Air Force, "X-37B Orbital Test Vehicle Fact Sheet," last update: 21 agosto 2025, www.spaceforce.mil.
[341] Małgorzata Polkowska, "Technical and Legal Problems of Space Drones," Zeszyty Naukowe SGSP, n. 85 (2023)

space-based strike or counter-space capabilities. These concerns are not simply for public consumption: the X-37B's ability to change its orbit, deploy and/or retrieve space payloads, and return them to Earth has raised questions about its potential military uses, such as intelligence gathering, orbital inspection, or even anti-satellite (ASAT) operations.[342] Legally, the X-37B falls into a regime of law that was never intended to foresee the existence of such systems. As outlined in Chapter I in paragraph 3,[343] the general guidelines for space activities set by space law core treaties and agreements, such as the use of outer space for peaceful purposes, the prohibition of national appropriation, and the prohibition of any kind of weapons of mass destruction in orbit around the Earth, are no longer sufficient to regulate modern space activity. As a result, for instance, there are no ban for conventional weapons in space, nor regulation for the utilization of reusable military space vehicles or autonomous orbiters. This means that the X-37B falls into a kind of legal gap, since it does not seem to contravene any specific provision of international law, but at the same time reveals the weakness of a legal system based on Cold War thinking.[344] The dual-use of the X-37B of course further complicates its legal assessment, as analysed in chapter 1 para.3 in talking about this type of technologies. Russia and China have repeatedly pointed to the X-37B as evidence of U.S. intentions to dominate the space domain, using it rhetorically to justify their own counterspace programs. From this perspective, the X-37B does not merely raise legal questions in isolation, but becomes a catalyst for strategic competition and norm erosion in space governance. In doctrinal terms, the X-37B challenges the traditional distinction between "space objects" and "weapons." The OST and subsequent treaties regulate objects placed in outer space without providing a functional or purpose-based classification. As a result, an autonomous spaceplane capable of maneuvering, deploying payloads, and returning to Earth is treated no differently, legally, from a passive satellite. This formal equivalence masks substantial differences in capability and risk.[345]

In conclusion, the X-37B is a manifestation of the widening divide between technological innovation and legal governance in outer space. Although it falls within the permissive framework of the current international space law, it also erodes the normative framework of the same regime by promoting opacity, strategic ambiguity, and mistrust among space-faring nations. The legal status of the X-37B, therefore, is less about formal compliance and more about systemic adequacy. The X-37B is legal because the current legal framework is too vague to deal with modern military space technology. As space becomes a more contested environment, the X-37B is a reminder that it

[342] Brian Weeden and Victoria Samson, *Global Counterspace Capabilities* (Washington, DC: Secure World Foundation, 2023).
[343] See p.33
[344] Małgorzata Polkowska *op.cit.p.75*
[345] *Ibid.*

is high time to rethink the legal and institutional framework of security, transparency, and accountability in outer space.

3.2 Golden (Iron) Dome for America

President Donald Trump issued an Executive Order (EO) titled "An Iron Dome for America" on January 27, 2025. *"Deploying and maintaining a next-generation missile defence shield"* is the EO's stated purpose, according to which the Secretary of Defence was also required to submit an architecture, capability requirements, and implementation plan for the *"Development and deployment of proliferated space-based interceptors capable of boost-phase intercept"* within sixty days. The Missile Defence Agency (MDA) issued a Request for Information (RFI) four days later, asking industry to respond by February 28, 2025. The RFI included information on capabilities that could be demonstrated or delivered by four milestone dates: December 31, 2026, 2028, 2030, and "beyond" December 31, 2030.[346] On February 6, 2025, Senators Dan Sullivan (R-Alaska) and Kevin Cramer (R-North Dakota) introduced the Increasing Response Options and Deterrence of Missile Engagements (IRON DOME) Act, which included *"$900 million to research and develop space-based missile defence"* in support of this EO.[347] The reason why this EO is included and discussed in this chapter is because it may offer an on-orbit strike capability against other satellites, even if it requires space-based interceptors (SBIs) for boost phase intercept of ballistic missiles. According to reports, Secretary of Defence Pete Hegseth published an undated "strategic guidance" outlining the goal for developing both kinetic and non-kinetic SBIs as part of the missile shield outlined in the EO.[348] The initiative was renamed "Golden (Iron) Dome for America" before the end of February 2025.

The move to develop space-based missile defence systems represents a major development in the strategic policies of the United States. Nevertheless, the development of interceptors in space is not a novel idea, as the Strategic Defence Initiative, proposed by President Reagan in the 1983, had already considered such concepts. In this sense, the 2025 Executive Order represents a new

[346] "Missile Defense Agency (MDA) Capabilities in response to Executive Order "The Iron Dome for America," Missile Defense Agency (MDA), January 31, 2025, https://sam.gov/ opp/9da2ad63428b4ccd8aa4931c41071a3c/ view; Theresa Hitchens, "Missile Defense Agency asks industry for American 'Iron Dome' concepts," Breaking Defense, February 3, 2025, https://breakingdefense.com/2025/02/missile defense-agency-asks-industry-for-american iron-dome-concepts/.

[347] "Sullivan, Cramer Introduce IRON DOME Act to Defend Against Chinese, Russian Missile Threats," press release from the office of Sen. Dan Sullivan, February 6, 2025, https://www.sullivan. senate.gov/newsroom/press-releases/sullivan cramer-introduce-iron-dome-act-to-defend against-chinese-russian-missile-threats.

[348] Theresa Hitchens, "Exclusive: Here's who Hegseth may task to put together Trump's Iron Dome plan," Breaking Defense, February 6, 2025, https://breakingdefense.com/2025/02/ exclusive-heres-who-hegseth-is-tasking-to put-together-trumps-iron-dome-plan/.

commitment to developing such ideas in response to modern threats. The tone of the EO, particularly the focus on *"boost-phase intercept"* reflects a strategy to destroy intercontinental ballistic missiles (ICBMs) at their most vulnerable stage shortly after launch. Space-based interceptors have several advantages over ground-based interceptors in this respect.[349] Clearly deploying such capability does not come without critics and complications that are both legal and strategic; similarly to what already seen so far about the ambiguity and legal *vacuum* of current space law for what concerns conventional weapons or kinetic interceptor. As a result, space-based missile defence systems occupy a grey area in international law, raising concerns among other spacefaring States about the erosion of the norm of non-weaponization of outer space.[350] From a strategic perspective, the emergence of SBIs could completely change the dynamics of deterrence. Although supporters of the Golden Dome believe that the development of such a system would improve the security of the nation and its allies by providing a layered defence against hypersonic and ballistic missiles, others believe that it could lead to strategic instability. This is because adversaries could be forced to develop more advanced missiles, such as governable re-entry vehicles.[351] In addition, the application of SBIs with kinetic abilities could potentially be part of the problem of orbital debris in the event of intercepting a target in low Earth orbit (LEO), which could have disastrous consequences for civilian satellites in that region. As of 2025, the United States claims that its missile defence programs are strictly for defensive purposes and do not contravene international law. Nevertheless, some critics have argued that the development of these systems could lead to an arms race in space, especially with countries such as China and Russia, which have been pursuing their own advanced counter-space programs. In this regard, on May 15, 2025, the two nations issued a much more structured and legally defined joint declaration, which was formally submitted to the UN Secretary-General and Security Council as document S/2025/310. Although reaffirming the basic principles of sovereignty and non-intervention, the 2025 joint declaration took a step further in defining their vision for the future of international security, arms control, and space governance. They rejected the “rules-based order” advocated by the West, condemned the use of human rights and sanctions, called for the expansion of the Security Council with the veto power of permanent members retained, and promoted reformist platforms such as BRICS, the Shanghai Cooperation Organization (SCO), and the G20. However, the real novelty about his declaration was its explicit condemnation of the United States’ "Golden (Iron) Dome for America" initiative, described as a direct threat to global strategic stability. Moscow and Beijing

[349] Congressional Research Service, Missile Defense: Concepts and Policy, RL31111 (Washington, DC: CRS, latest ed.).
[350] Bin Cheng, Studies in International Space Law (Oxford: Clarendon Press, 1997), 215–230.
[351] James M. Acton, *Reclaiming Strategic Stability* (Washington, DC: Carnegie Endowment for International Peace, 2018).

accused Washington of decoupling offensive and defensive systems, thereby violating the principle of strategic balance.[352] More critically, they denounce the growing militarization of outer space and reiterate their opposition to the deployment of any kind of weapons in orbit. The document renews support for the negotiation of a legally binding international treaty to prevent the placement of weapons in outer space, referring to the draft Treaty on the Prevention of the Placement of Weapons in Outer Space (PPWT) initially tabled in 2008 and revised in 2014 by China and Russia and described before in chapter 1.[353] The strategic relevance of the Golden (Iron) Dome for America was underscored by President Donald Trump in a very recent and highly controversial episode concerning Greenland. In January, Trump openly reiterated his long-standing ambition to secure control over Greenland, through economic means or, hypothetically, even military force, explicitly linking this objective to U.S. missile defence priorities. As reported by ANSA, the President stated that *"Greenland is crucial for the Golden Dome that we are building"*. This remark is revealing not only for its political provocation, but also for what it discloses about the geostrategic logic underpinning the Golden Dome initiative.[354]

In conclusion, while the Golden Dome initiative reflects a strategic vision rooted in deterrence and technological superiority, it also renews long-standing debates over the legitimacy and consequences of placing weapons in orbit. As the project moves from policy announcement to technical development, the broader implications for space governance, strategic stability, and multilateral diplomacy will require careful and ongoing assessment.

3.3 Orbital Cyberwarfare

Among the unconventional weapons discussed so far that are contributing to the militarization of outer space, cyber operations undoubtedly stand out as one the most pressing and immediate threats requiring regulatory attention. In this context, orbital cyberwarfare refers to cyber operations that target the digital infrastructure of space systems, including satellites, ground stations, and their associated networks, where the impact crosses the boundary between traditional cyberspace and outer space operations. Such operations involve actions intended to disrupt,

[352] UN General Assembly and Security Council. Letter dated 15 May 2025 from the Permanent Representatives of China and the Russian Federation to the United Nations addressed to the Secretary-General and the President of the Security Council. S/2025/310. 15 maggio 2025.
[353] For the original proposal, see: Conference on Disarmament, CD/1839 (Draft PPWT 2008) and CD/1985 (Revised PPWT 2014). See also: Paul Meyer, "The PPWT: A Critique and a Way Forward," *Disarmament Forum*, UNIDIR, 2014.
[354] ANSA English, "Trump Insists: 'Greenland Is Needed,' High-Level Washington Summit Begins," ANSA, January 14, 2026, https://www.ansa.it/amp/sito/notizie/mondo/2026/01/14/trump-insiste-la-groenlandia-ci-serve.-al-via-il-vertice-a-washington_b0c58fe9-ca36-465b-9fb4-ea197fab22dd.html

degrade, deny, or manipulate the command, control, and data links that enable satellite functions. In scholarly and policy literature, a "cyberattack" can be understood as an operation utilizing information technology to infiltrate or disrupt computer systems, including communications and control systems critical to space assets.[355] This domain has become a frontline of modern conflict because satellites are no longer isolated technological outposts but deeply integrated parts of global communications, navigation, and defence networks. What is important is that orbital cyberwarfare must be understood not merely as hacking ground computers but as operations that affect the functioning of space based networks directly or indirectly through their cyber-connected elements, actions utterly different from physical attacks, such as anti-satellite (ASAT) weapon strikes, as they operate through software or network exploitation rather than kinetic force and they can range from denial of service and malware insertion to control-system compromise.[356] Because satellite systems involve a mix of space-based hardware and Earth-based control infrastructure interconnected via cyberspace, cyber warfare against space assets blurs traditional borders between domains: an attack on a ground station can have direct impacts on assets in orbit, effectively transforming a cyber operation into an orbital effect. Furthermore, the cyber and space domains are deeply interwoven: almost all modern satellite systems depend on software, data links, and orbital control systems that are managed via terrestrial networks. This interconnectedness creates a vulnerability: as scholars have noted, the convergence of outer space and cyber operations has heightened risks for space infrastructure because their cyber vulnerabilities now have out-of-this-world consequences.[357] A clear example is the already mentioned event that occurred on 24 February 2022, coinciding with the Russian invasion of Ukraine, when a cyberattack targeted Viasat's KA-SAT satellite broadband infrastructure. Investigations indicate that a Russian malware, later analysed as a destructive strain dubbed "AcidRain", disabled tens of thousands of satellite broadband modems connected to the network, effectively cutting off critical communications across Ukraine and parts of Europe.[358] This attack did not physically destroy satellites in orbit, but by corrupting the ground-connected components of the satellite network it caused considerable functional loss of the system, illustrating how cyber operations can have space-domain consequences. Additionally, reports in 2023 suggested efforts by Russian or affiliated groups to interfere with Starlink communications used by

[355] Yuting & Shengli, *International Legal Framework for Cyber Attacks in Outer Space*, US-China Law Review 22, no. 2 (2025), 79-88.
[356] Arianna Vettorel, "Cyber Operations in New Space: Responsibility and Liability Issues," in *Rights of Individuals in an Earth Observation and Satellite Navigation Environment: The Good, the Bad and the Ugly of New Space*, Studies in Space Law 22 (Leiden & Boston: Brill/Nijhoff, 2023), 185–[end page], https://brill.com/display/book/9789004685383/BP000010.xml
[357] CyberPeace Institute, *Case Study: Viasat Attack* (June 2022), CyberThreats – Law & Policy, CyberConflicts, CyberPeace Institute, https://cyberconflicts.cyberpeaceinstitute.org/law-and-policy/cases/viasat
[358] Joscha Abels *op.cit.p.73*

Ukrainian forces to replace their damaged satellites system, marking how cyber tools are now a component of broader space operational contests.[359]

The current international legal framework only partially and indirectly deals with cyber operations that affect space, which leaves a lot of room for regulation when it comes to what is becoming known as orbital cyberwarfare. The Outer Space treaty, even if admittedly declares that States must carry out their activities in outer space *"with due regard to the corresponding interests of all other States Parties"* and must consult if any activity might cause *"potentially harmful interference"*, and this provision is often interpreted including cyberwarfare, nevertheless does not have a clear definition, thresholds, or way to enforce cyber interference. Moreover, the OST was written before digital threats came about and was not meant to cover cyber operations.[360] The Budapest Convention on Cybercrime of 2001 is the most important multilateral agreement outside of space law that deals with bad behaviour in cyberspace. However, it only works to make domestic criminal law more consistent and make it easier for countries to work together to investigate and prosecute cybercrime. It does not set rules for cyber operations between countries or for cyber activities that target space-based infrastructure.[361] Lastly, the Tallinn Manual process, which was made by independent experts, is the most advanced non-binding effort to explain how current international law applies to cyber operations, even those that could have an impact on satellites and space systems. The next version of the Tallinn Manual, 3.0, will include new technological and strategic developments; however, it serves mainly as a tool for interpretation rather than a final legal authority, as it has no binding force.[362] The absence of a specific *lex specialis* that governs cyber operations in space reflects a concept so far reiterated many times: international law is not keeping up with how quickly technology is changing.

[359] *Ivi p. 80*
[360] United Nations, *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies* (Outer Space Treaty), opened for signature January 27, 1967, entered into force October 10, 1967, 610 U.N.T.S. 205, art. IX, https://treaties.un.org
[361] Council of Europe, *Convention on Cybercrime* (Budapest, 23 November 2001), European Treaty Series No. 185, https://www.coe.int/en/web/cybercrime/the-budapest-convention
[362] Michael N. Schmitt, ed., *Tallinn Manual 2.0 on the International Law Applicable to Cyber Operations* (Cambridge: Cambridge University Press, 2017).

CHAPTER III

THE UN AND SPACE SECURITY: BETWEEN PARALYSIS AND REFORM

1. The Fragmented UN Architecture for Space Security

1.1 First Committee and the Evolution of the PAROS Agenda

This section takes a practice-based analytical perspective on the Prevention of an Arms Race in Outer Space (PAROS) issue in the United Nations disarmament system. Instead of providing a historical account of PAROS resolutions or analysing the development of space security debates over several decades, the focus will be on a critical and contemporary institutional phase, namely the 2024-2025 cycle. Methodologically, this section is based on primary diplomatic documentation gathered during the author's internship at the Permanent Mission of Italy to the United Nations in New York. This documentation includes internal reporting, personal observation of negotiations, and coordination meetings related to the First Committee, the Open-Ended Working Group (OEWG) on PAROS, [363] and other relevant forums. Substantively, the institutional phase under consideration is one of increased institutional tension and cautious consolidation, during which time long-standing structural divisions within the UN system were exposed.

The First Committee, as discussed in Chapter I, holds a unique place in the UN system; it is not a body that negotiates legally binding outcomes, but it is the primary political platform for the formulation, contestation, and gradual hardening of norms in the area of disarmament and international security.[364] In the specific context of PAROS, the First Committee has traditionally been a forum for agenda-setting and political indicator rather than a platform for the achievement of legally binding outcomes, which is not automatically a deficiency but a function that shapes the dynamics of the debate, the language of resolution, and the relationship with parallel negotiations. Consequently, the resulting analysis considers the First Committee not as an isolated entity but as an integral component of a broader context of intergovernmental relations. A significant amount of attention is paid to the relationship between the First Committee and the OEWG on PAROS, which was set up by General Assembly Decision 79/512, as well as the political and procedural dynamics

[363] United Nations General Assembly, *Open-ended Working Group on Reducing Space Threats through Norms, Rules and Principles of Responsible Behaviours*, established pursuant to General Assembly resolution 76/231 (2021), https://www.un.org/disarmament/topics/outer-space/oewg/

[364] United Nations General Assembly, *First Committee (Disarmament and International Security)*, https://www.un.org/en/ga/first

that came up during the first substantive sessions of the OEWG in April and July 2025.[365] The section seeks to illustrate how the interplay of procedural politics, institutional design and geopolitical location contributed, cumulatively, to the course of the PAROS agenda during this period, which was simultaneously limited in terms of outcomes and rich in terms of implications.

By the time the General Assembly adopted Decision 79/512, the UN system had witnessed an increasing number of fragmented discussions on space security. There were several parallel processes that coexisted, which covered common issues but were governed by different mandates, procedures, and politics: a manifestation of the disagreements among Member States on the issues of space threats and how they should be regulated. Primarily, there were two approaches that had developed over time. On the one hand, a number of States, led by the Russian Federation and, on occasion, China, continued to call for the negotiation of a legally binding instrument banning the placement of weapons in outer space; an approach based on the perceived inadequacy of existing legal frameworks and tended to view the challenge of space security largely through the lens of weaponization and strategic stability. On the other hand, a number of Western and like-minded States[366] called for a more gradual approach, based on transparency and confidence-building measures, norms, rules, and principles of responsible behaviour. This second method was informed by the view that the pace of technological change, dual-use technologies, and the problem of verification made comprehensive treaty-based solutions impracticable and potentially counterproductive in the short to medium term. The establishment of two separate OEWGs during the seventy-eighth session of the General Assembly mirrored this normative divide, however, their parallel existence soon revealed significant limitations, with neither group that could get past procedural discussions, and became increasingly involved in broader geopolitical tensions. In this case, Decision 79/512 was a deliberate effort to make the institutional landscape more logical by merging the two OEWGs into one forum that was supposed to deal with PAROS *"in all its aspects"* for four years. The political relevance of this decision arises not only from what it states, but also from the fact that most Member States supported it: an almost unanimous approval for this decision demonstrated in fact that the Member States were in agreement on the fragmentation of institutions undermining the credibility and effectiveness of the UN in space security. At the same time, the

[365] United Nations General Assembly, *Decision 79/512, Prevention of an Arms Race in Outer Space*, adopted by the General Assembly at its seventy-ninth session, UN Doc. A/79/512 (2024), https://undocs.org/A/79/512

[366] In this context, the expression "like-minded States" refers primarily to Western countries and their close partners, such as European Union member States, the United States, Canada, Japan, Australia, and other aligned democracies, that share broadly convergent normative approaches to international law, multilateral governance, and security issues, and that frequently coordinate their positions in United Nations and other multilateral fora, without constituting a formal alliance. For a discussion of the use of "like-minded" groupings in multilateral diplomacy, *see* Christer Jönsson and Jonas Tallberg, "Institutional Theory in International Relations," in The Oxford Handbook of International Relations, ed. Christian Reus-Smit and Duncan Snidal (Oxford: Oxford University Press, 2008), 136–137.

weak wording of the mandate reflected the weakness of the compromise. The decision postponed the resolution of substantive differences by not making a clear distinction between legally binding instruments and behavioural standards, instead, these differences were incorporated into the new OEWG. The first real meeting of the unified OEWG took place in April 2025 and it was a rapid and useful test of the institutional compromise that was made in Decision 79/512. Expectations for the session were already low because of the contentious history of PAROS negotiations, but the level of procedural obstruction that happened was even worse than what was expected according to multiple delegations. From the opening of the session, in fact, the Russian Federation challenged the proposed agenda circulated by the Chair, contesting both its wording and its interpretation of the OEWG's mandate. At issue was not merely the phrasing of agenda items, but the broader question of how the mandate conferred by the General Assembly should be operationalized. The Chair's draft agenda closely mirrored the language of Decision 79/512, referring to the formulation of recommendations on the prevention of an arms race in outer space in all its aspects. This formulation was supported by a broad cross-regional majority, including Italy and other EU and WEOG members, who viewed it as a faithful and balanced reflection of the General Assembly's intent. The Russian delegation, however, argued that the language implicitly privileged the behavioural approach associated with norms of responsible conduct, thereby prejudging the outcome of the discussions. The debate that followed emphasized the importance of procedural norms in determining substantive results. According to the *consensus* rule that applied to the OEWG's proceedings, the objection of one delegation was enough to prevent the adoption of the agenda: this procedural arrangement made the agenda-setting process a political battleground where any objection could serve as a veto. Subsequently, informal consultations were held among a restricted group of delegations in an attempt to reach a compromise. These consultations resulted in a heavily negotiated formulation that removed explicit references to "responsible behaviour" and avoided mention of specific General Assembly resolutions, reflecting significant concessions by States advocating a norms-based approach. However, even this compromise proved inadequate. After all, the Russian Federation demanded the definition of a detailed programme of work that would encompass the whole four-year mandate of the OEWG, in addition to very restrictive modalities of participation by observers, especially with regard to the European Union, as a condition for its approval of the agenda. This meant that instead of adopting an agenda, a renegotiation of the operational framework of the Group was being pursued, with the end result that was a procedural deadlock, where the agenda was not adopted and no debate could follow. The April session showed that consensus-based decision-making, which is meant to make sure everyone is included and the process is fair, can be used to block progress in situations where politics is

extremely relevant. The episode also showed how diplomatically isolated Russia is when it comes to procedural issues. Other than a few delegations that showed limited and cautious support, the Russian position did not collect a significant support. This situation led to talks within EU and WEOG coordination groups about whether *consensus* rules for procedural decisions could last, even though there were no immediate institutional remedies.

The second substantive session of the OEWG, which took place in July 2025, constituted a partial break with the deadlock of April. Although once again the level of expectation was low, the sustained diplomatic efforts of the Chair and a coalition of States eventually resulted in the achievement of a *consensus* on a comprehensive programme of work for all four sessions of the OEWG. This achievement necessitated the Russian Federation to abandon its demand for the codification of restrictive rules of observer participation in order to enable the Group to proceed without revising its mandate. The approval of the programme of work constituted a significant procedural breakthrough: for the first time since the establishment of the unified OEWG, States were able to engage in substantive discussions on the prevention of an arms race in outer space. As a result, the debate that followed revealed a notable degree of convergence on the diagnosis of challenges facing space security, even as deep divergences persisted regarding appropriate regulatory responses. Delegations continued to emphasize how modern societies are becoming more and more reliant on space-based systems for basic civilian needs like telecommunications, navigation, meteorology, disaster response, and climate monitoring. Space assets were portrayed as essential facilitators of sustainable development and human security, highlighting the systemic repercussions that disturbances in outer space could produce. This helped to create a common understanding of space security that went beyond the military definition. Within this general agreement on the relevance of space systems, some types of threats were identified as the focal points of discussion, particularly, the possible use of weapons in space and the use of force against space assets were seen as threats that might disrupt the global strategic balance. Destructive direct-ascent anti-satellite (DA-ASAT) tests received special attention due to their production of long-lasting debris fields that pose risks to all space actors.[367] The delegations also pointed to the risk of cascading effects of collisions, which is exacerbated by the growing number of satellites in orbit and the rise of giant commercial constellations. These issues were directly connected to the topic of sustainability and access to orbital zones, especially for countries that are developing their space capabilities. The discussion, therefore, connected traditional security considerations with broader issues of equity and inclusiveness in the use of outer space. The July debate additionally discussed extensively non-kinetic and hybrid risks, in addition to kinetic threats. Cyber-attacks on space

[367] See. Chapter 1 para 3 and also Chapter 2 para 1.1

systems were considered to be particularly destabilizing for their ambiguity, reversibility and difficulty of attribution, and many delegations made it clear that cyber-attacks on satellites or related ground infrastructure, even if they don't involve the use of force, could still disrupt important civilian services and damage trust between States. The integrated study of capabilities, intentions, and actions across the space, electromagnetic, and cyber domains became a common analytical framework. Notably, the July session was characterized by the absence of explicit accusations by the Russian Federation regarding the use of commercial satellite systems in the context of the war in Ukraine, a theme that had featured prominently in earlier debates. By contrast, Iran strongly condemned the military use of satellite capabilities in recent regional conflicts, illustrating how discussions on space security continue to intersect with broader geopolitical disputes. The debate on the legal aspect of space security again emphasized the importance of existing legal instruments, especially the Outer Space Treaty of 1967, as the foundation of the international legal system applicable to outer space activities. However, the need for non-binding instruments to fill the regulatory gaps was also recognized as part of the evolutionary nature of space law. Soft-law instruments were often described as useful approaches that could improve transparency, predictability, and mutual confidence in the short term, and as part of the process of codification. Measures such as pre-launch notifications, data-sharing arrangements, codes of conduct for proximity operations, cooperative inspections, and consultations on space traffic management were cited as concrete examples of confidence-building practices with immediate risk-reduction potential. In this context, the political commitments undertaken by a large number of States to refrain from conducting destructive ASAT tests, as reflected in General Assembly resolution 77/41(2022), were repeatedly identified as a particularly promising development.[368] Many delegations described these commitments as an *"antechamber"* to a future legally binding agreement, given the relative clarity of definitions and attribution mechanisms involved. In contrast, the Russian Federation and China repeated their criticism of soft-law approaches, saying that non-binding rules could hide subjective judgments and allow destabilizing capabilities to keep growing. Both delegations once again called for a legally binding treaty to be negotiated and once again suggested the PPWT as a starting point for talks.[369] While acknowledging claims regarding the proposal's evolutionary nature, many Western and like-minded States maintained their reservations, pointing to persistent deficiencies in definitions and verification provisions, as well as concerns regarding the adaptability of rigid treaty frameworks in a rapidly changing technological environment.

[368] United Nations General Assembly, *Resolution 77/41, Reducing Space Threats through Norms, Rules and Principles of Responsible Behaviours*, adopted December 7, 2022, UN Doc. A/RES/77/41, https://undocs.org/A/RES/77/41
[369] See Chapter 1 para. 1.4

The developments observed during the 2024–2025 cycle underscore an evolving division of labour within the UN system. With the establishment of the unified OEWG, the First Committee has, at least temporarily, left and passed the centre stage of substantive negotiation on PAROS, assuming instead a more indirect yet still significant role. It remains the primary forum in which political support for competing approaches is mobilized, tested, and defined through recurring resolutions and debates. Looking ahead, the expectations regarding the outcome of transformative change are moderated, as the experience of procedural frustration and a lack of substantive convergence indicates that gradual rather than comprehensive progress is likely in the PAROS area. However, the achievement of a multi-year programme of work represents a procedural stability that was lacking in previous rounds. In this regard, the First Committee is likely to continue to serve as a political indicator reflecting both the persistence of structural differences and the growing convergence of views regarding particular risk reduction actions.

1.2 UNOOSA: Potential vs. Bureaucratic Limits

The United Nations Office for Outer Space Affairs (UNOOSA) has a difficult task when it comes to governing outer space within the framework of the United Nations.[370] On one side, the Office is the UN's institutional embodiment of its normative and cooperative framework for the peaceful use of outer space, a framework based on technical expertise, institutional continuity, and a universal mandate;[371] on the other hand, its operational capabilities are necessarily circumscribed by institutional limitations, resource constraints, and a deliberately non-military mandate. This complex of potential and limitation has become increasingly pertinent as outer space activities have evolved from a scientific and developmental domain to a contested and strategically sensitive one.[372] UNOOSA's mission is primarily derived from General Assembly resolutions assigning it responsibility to promote international cooperation for the peaceful exploration and use of outer space and to support intergovernmental processes for space governance, especially the Committee on the Peaceful Uses of Outer Space (COPUOS).[373] In contrast to organizations within the UN disarmament framework, UNOOSA was never intended to be an institution that addresses security challenges or arms control issues in outer space, an institutional choice grounded in a fundamental normative decision: the governance of peaceful space activities and the regulation of

[370] See Chapter 1 para.1.2 for historical and technical analysis on UNOOSA
[371] United Nations General Assembly, *Resolution 1348 (XIII): Questions on the Peaceful Uses of Outer Space*, December 13, 1958.
[372] James Clay Moltz, *The Politics of Space Security*, 3rd ed. (Stanford: Stanford University Press, 2019).
[373] United Nations Office for Outer Space Affairs, "Mandate and Responsibilities," UNOOSA official website.

military/security-related activities should be separated, at least at the level of organizations. Rather, it works as a secretariat emphasizing inclusivity, technical cooperation, and norm development through consensus-based processes.[374] Institutionally, UNOOSA has a number of structural advantages that make it a potentially key player in the current governance of space. First, it is a permanent secretariat that has built up technical knowledge and institutional memory over time, which is relevant since, as a contrast to UNOOSA, expert groups or working groups are *ad hoc* and temporarily. This assumes even more importance in a field that is characterized by rapid technological change and growing complexity.[375] Second, UNOOSA's universalist orientation enhances its legitimacy among developing and emerging space actors. Through technical assistance programmes and policy-oriented training, the Office plays a key role in enabling non-space-faring States to participate meaningfully in global space governance.[376] Moreover, the Office has shown the capacity to adjust its agenda to the evolving nature of governance challenges, with matters such as the sustainability of outer space activities, space traffic management, debris mitigation, and lunar activities that have increasingly become prominent in the COPUOS agenda, often with strong support from the secretariat. All these issues, while being strictly defined within the domain of peaceful uses, increasingly interrelate with issues of security, stability, and risk prevention.[377] In this sense, the involvement of UNOOSA in these matters demonstrate the latent potential of the Office as a norm entrepreneur.[378]

Nevertheless, despite these strengths, the ability of UNOOSA to shape the governance of space security is structurally and bureaucratically limited in several ways. First and foremost, there is a lack of resources, as a smaller office within the UN Secretariat, UNOOSA is constrained by very tight budgets that do not allow it to do much more than it is currently doing.[379] This problem has been exacerbated by the liquidity problems that the United Nations is currently facing, which have had a direct impact on the length and frequency of intergovernmental meetings that the Office has been able to support.[380] The implications of resource constraints on governance outcomes are extremely concrete: less time spent in meetings, fewer staff members, and voluntary contribution of time and resources could result in slowing down the pace of decision-making and limiting the

[374] United Nations, *Rules of Procedure of the Committee on the Peaceful Uses of Outer Space*, UN Doc. A/AC.105/571/Rev.2.
[375] Ram S. Jakhu and Kuan-Wei Chen, "Regulatory Processes for Space Activities," *Journal of Space Law* 40, no. 1 (2016): 1–35.
[376] UNOOSA, *Capacity-Building Programme on Space Law and Policy*, Vienna: UNOOSA.
[377] United Nations COPUOS, *Guidelines for the Long-Term Sustainability of Outer Space Activities*, UN Doc. A/74/20, Annex II.
[378] Frans von der Dunk, "Soft Law in Outer Space," in *Handbook of Space Law*, ed. Ram S. Jakhu and Paul Stephen Dempsey (London: Routledge, 2016).
[379] United Nations Secretariat, *Proposed Programme Budget for the Biennium*
[380] United Nations General Assembly, *Report of the Secretary-General on the Financial Situation of the United Nations*

agenda of discussions. Additionally, the reliance on extra-budgetary resources could have an indirect effect on agenda priorities, where issues that are more in line with contributor interests could be given priority while limiting discussions on more politically sensitive issues. In a field as contentious as space security, such an effect could be detrimental to addressing the asymmetries.[381] Beyond material constraints, UNOOSA's bureaucratic positioning within the UN system imposes additional limits. The Office's mandate explicitly emphasizes peaceful uses, thereby circumscribing its engagement with issues related to weaponization, military doctrines, or counter-space capabilities.[382] While this separation historically reflected an effort to separate civilian cooperation from geopolitical rivalry, it increasingly appears misaligned with contemporary realities, where the distinction between civilian and military space activities has become less distinct due to the dual-use nature of most space technologies.[383] Consequently, the institutional split between UNOOSA and the UN disarmament machinery has major implications for the coherence of space governance. Although the First Committee and the OEWG on PAROS examine space security from a disarmament and arms control point of view, UNOOSA and COPUOS concentrate on the technical, legal, and cooperative aspects of space activities, a division of labour that may, in theory, be complementary, but in practice it often leads to parallel debates that not sufficiently converge properly.[384] As a prime example, technical insights generated within COPUOS, particularly on debris mitigation, proximity operations, and space situational awareness, are not systematically integrated into disarmament negotiations, despite their clear relevance to strategic stability and risk reduction.[385] This institutional disconnection limits the UN system's ability to address space security in a comprehensive manner, reinforcing functional separation rather than integrated governance.[386] UNOOSA has also showed institutional caution in engaging with explicitly security-focused language, reflecting both mandate limitations and political sensitivities among Member States.[387] Again here there is a double effect, while such caution preserves the Office's neutrality and legitimacy, it further restricts its capacity to contribute meaningfully to debates on the prevention of an arms race in outer space, debates that increasingly require technical expertise of the kind UNOOSA possesses. Furthermore, as for the COPUOS which will be analysed in the following chapter, UNOOSA primarily role is facilitative rather than regulatory, hence consensus-

[381] Michael Barnett and Martha Finnemore, *Rules for the World: International Organizations in Global Politics* (Ithaca: Cornell University Press, 2004).
[382] UNOOSA, "UNOOSA and the Peaceful Uses of Outer Space," official documentation.
[383] Bleddyn Bowen, *War in Space* (Edinburgh: Edinburgh University Press, 2020).
[384] United Nations General Assembly, *First Committee: Disarmament and International Security*, background documentation.
[385] UNIDIR, *Space Security and Strategic Stability* (Geneva: UNIDIR, 2021).
[386] Theresa Hitchens, "The New Geopolitics of Space," *Survival* 62, no. 1 (2020): 145–158.
[387] COPUOS plenary statements, summarized in UN Doc. A/79/20.

building oriented rather than enforcement. If under a perspective this reinforces its legitimacy as a mediator, at the same time limits its responsiveness to emerging security risks. In conclusion, the gap between normative aspiration and operational enforcement constitutes a structural feature of UNOOSA's engagement with space governance.[388]

The analysis of UNOOSA's role reveals neither institutional failure nor irrelevance, but rather a condition of structural inefficiency. The Office remains an indispensable component of the UN space governance ecosystem, particularly in capacity-building, norm diffusion, and technical coordination, where its universalist orientation and accumulated expertise provide a foundation for inclusive and cooperative governance.[389] However, the increasing security-based approach of outer space exposes the limits of an institutional model based on a strict separation between peaceful uses and security concerns. UNOOSA's potential contribution to the prevention of an arms race in outer space is therefore contingent not only on resource availability, but also on Member States' willingness to reconceptualise the relationship between technical governance and security regulation. Until such a redefinition occurs, UNOOSA is likely to remain an essential yet limited actor: central to the rhetoric of cooperative space governance, but marginal to the hard politics of space security.[390]

1.3 The Formal Role of COPUOS

UNOOSA's most visible governance output materializes through its support to COPUOS.[391] The Committee on the Peaceful Uses of Outer Space (COPUOS) remains the main institutional forum for governing civilian space activities, however, its relevance to modern space security issues is more about what it is unable to do rather than what it can do. In functional terms, the Committee addresses safety and sustainability risks arising from the routine operation of space activities, such as congestion, debris, and coordination, whereas UN disarmament processes focus on security and strategic risks linked to the use of force, counter-space capabilities, escalation dynamics, and deterrence. However, as outer space becomes increasingly contested, this functional separation also reveals important limits in COPUOS's capacity to respond to security-driven behaviour. In this context, COPUOS occupies a position of formal authority without obviously once again coercive power, producing norms that are procedurally legitimate yet substantively limited in their capacity

[388] Martha Finnemore and Duncan B. Hollis, "Constructing Norms for Global Cybersecurity," *American Journal of International Law* 110, no. 3 (2016): 425–479.
[389] Frans von der Dunk, "The Limits of Soft Law in Space Governance," *Space Policy* 47 (2019): 1–8.
[390] James Clay Moltz, "Toward a New Theory of Space Power," *Astropolitics* 19, no. 1 (2021): 1–24.
[391] See Chapter 1 para.1.2 for historical and technical analysis on COPUOS

to address security-driven behaviour.[392] This tension does not arise from institutional malfunction, but from deliberate design choices inherent in COPUOS's mandate, working methods, and relationship with the broader UN security architecture, and as space becomes increasingly contested, these structural features raise critical questions about the suitability of a governance model centred on consensus-based soft law for managing risks associated with weaponization, counter-space capabilities, and escalation dynamics. Admittedly, COPUOS enjoys unparalleled formal centrality within the UN system on matters relating to outer space, where it is the only standing intergovernmental body with universal participation dedicated exclusively to space activities, and it serves as the primary channel through which space-related norms are articulated and transmitted to the General Assembly.[393] This formal *status*, however, coexists with a form of functional marginality when it comes to practicality on space security. In fact, by mandate, COPUOS is excluded from questions of arms control and military strategy, its agenda is framed around peaceful uses, scientific cooperation, and technical coordination, deliberately excluding explicit consideration of coercive or hostile acts in outer space.[394] While this separation historically contributed to depoliticizing early space cooperation, it now limits the Committee's capacity to engage with the most destabilizing dynamics of the contemporary space environment. Activities such as anti-satellite testing, close-proximity operations with military intent, and cyber interference with space systems fall largely outside COPUOS's formal concern, even though they directly affect the safety and sustainability of outer space. In light of this, COPUOS's authority is mostly ethical rather than legal: it can explain what responsible behaviour looks like and facilitate the communication among States and delegations but it does not have the power to inspect for compliance, determine responsibility, or respond to violations. This structural limitation additionally cause security-related issues to be treated and assessed in other places and forum, like the already discussed First Committee and *ad hoc* disarmament processes, while COPUOS remains centred around risk-prevention measures.[395] The reliance on consensus-based soft law constitutes the defining feature of COPUOS's contemporary production, with guidelines, principles, and best practices that everyone agrees on meant to gain a wide political support and encourage delegations to work together without forcing them with binding norms. This approach has clear benefits from a governance point of view: it is flexible, can adapt to changes in technology, and is

[392] James Clay Moltz, *The Politics of Space Security*, 3rd ed. (Stanford: Stanford University Press, 2019).
[393] United Nations General Assembly, *Report of the Committee on the Peaceful Uses of Outer Space*, UN Doc. A/79/20.
[394] United Nations COPUOS, *Rules of Procedure of the Committee on the Peaceful Uses of Outer Space*, UN Doc. A/AC.105/571/Rev.2.
[395] United Nations General Assembly, *First Committee: Disarmament and International Security*, background documentation.

open to States with different interests and abilities.[396] At the same time, the soft-law paradigm functions increasingly as a form of surrogate governance in the absence of binding rules on space security. Instruments such as the Guidelines for the Long-Term Sustainability of Outer Space Activities seek to mitigate risks associated with congestion, debris, and operational interference, yet they operate entirely on a voluntary basis.[397] Compliance depends on political will rather than legal obligation, and there are no institutional mechanisms to assess implementation or address nonconformity. This model is particularly poor for situations where strategic incentives undermine cooperation, where space activities are perceived as contributing directly to national security or military advantage, voluntary guidelines are unlikely to constrain behaviour effectively. Scholars have noted that soft law tends to perform best in low-politics domains characterized by shared interests and low distributional conflict, conditions that are increasingly absent in outer space.[398] COPUOS's inability to enforce its normative outputs is not an incidental weakness but a structural characteristic. The Committee lacks investigative powers, compliance-review procedures, and dispute-settlement mechanisms. Its role is confined to norm articulation and facilitation, leaving questions of responsibility and accountability to States themselves.[399] In the context of space security, as stated numerous time in the present work, this absence of enforcement has significant implications. Many of the most destabilizing activities in outer space, such as the generation of long-lived debris through destructive testing or deliberate interference with space assets, entail risks that materialize *ex post*, often in crisis situations. COPUOS's governance model, by contrast, is oriented toward *ex ante* risk management through best practices and voluntary coordination. While this approach may reduce the likelihood of accidents and misperceptions, it is poorly equipped to address intentional hostile conduct or escalation dynamics. The resulting governance gap is particularly evident at the interface between COPUOS and disarmament fora. Technical standards and operational guidelines developed within COPUOS are not systematically integrated into arms-control discussions, even though they bear directly on strategic stability. Conversely, security-driven debates on space weapons and counterspace capabilities often proceed without drawing on the technical expertise accumulated within COPUOS, a functional separation limits the effectiveness of both tracks and hinders the emergence of coherent, end-to-end governance across the civilian–security divide..[400] COPUOS's cautious approach to security language, as noted in

[396] Ram S. Jakhu and Joseph N. Pelton, *Global Space Governance: An International Study* (Cham: Springer, 2017).
[397] United Nations COPUOS, *Guidelines for the Long-Term Sustainability of Outer Space Activities*, UN Doc. A/74/20, Annex II.
[398] Alan Boyle and Christine Chinkin, *The Making of International Law* (Oxford: Oxford University Press, 2007).
[399] Bin Cheng, *Studies in International Space Law* (Oxford: Clarendon Press, 1997).
[400] UNIDIR, *Space Security and Strategic Stability* (Geneva: UNIDIR, 2021).

precedence, further constrains its relevance to space security,[401] a rhetorical limitation that preserves COPUOS's image as a neutral and cooperative forum, but also reduces its capacity to engage meaningfully with the realities of space militarization. As a result and as stated so far, COPUOS' main contribute to space security is through preventive and non-direct mechanism such as the promotion of transparency and the encouragement of sharing information. All these contributions are undoubtedly useful but they don't deal with issues of intentionality, escalation or accountability, currently the heart of the debates about space security. COPUOS thus, similarly to UNOOSA, embodies a paradox of contemporary space governance: while it is normatively central, universally legitimate, and procedurally inclusive, it lacks the requirements to shape behaviour in a security-driven environment. Its reliance on consensus-based soft law ensures political acceptability but simultaneously refrain ambition and pragmatism, a limit dictated as being a model built for an earlier phase of space activity.[402]

1.4 The Security Council and Space Security: Structural Incapacity and the Limits of Enforcement

The United Nations Security Council (UNSC) is formally assigned *"primary responsibility for the maintenance of international peace and security"* and, in principle, its mandate is broad enough to encompass threats arising in or through outer space.[403] Yet, in practice, also the Council, just like the previous UN institutions, have proven structurally ill-equipped to act as an effective forum for space security governance, an incapacity that cannot be reduced to the veto alone. Rather, the veto is best understood as a visible symptom of deeper limitations: the Council's political composition, the strategic interests of the permanent members, the ambiguity of "threat" thresholds in the space domain, and the divergence between a crisis-driven enforcement body and a security environment defined by gradual militarization, dual-use technologies, and unclear lines between civilian and military infrastructures.[404] Consequently, space security challenges hardly present themselves in the form the Security Council is institutionally designed to manage. In fact, the Council is most effective when confronting acute crises that produce clear episodes of aggression or threats to peace, enabling the adoption of determinate measures: sanctions, mandates, authorizations, or binding obligations; supported (or at least tolerated) by the permanent

[401] Bleddyn Bowen, *War in Space* (Edinburgh: Edinburgh University Press, 2020).
[402] James Clay Moltz, "Norms, Laws, and the Future of Space Security," *Strategic Studies Quarterly* 15, no. 2 (2021): 47–68.
[403] United Nations, *Charter of the United Nations*, art. 24, https://www.un.org/en/about-us/un-charter.
[404] James Clay Moltz, *The Politics of Space Security*, 3rd ed. (Stanford: Stanford University Press, 2019).

members.[405] In outer space, however, destabilizing dynamics tend to be incremental: capability development, proximity operations, "grey-zone" interference, and the strategic integration of commercial systems into military doctrines. These changes create systemic risk, but they don't always cross the legal lines that would call for Council *consensus* on enforcement action. Because of this, the Council only focuses on space in a very selective and political way, which often leads to procedural drama instead of long-lasting governance outcomes. The Security Council's structural limitations begin with its design. Under Article 27 of the UN Charter, substantive decisions require not only nine affirmative votes but also the consensus of the permanent members: a negative vote by any permanent member blocks adoption.[406] This institutional architecture is often justified as a stabilizing mechanism, preventing the UN from taking binding action against a major power in a way that could undermine the Organization's viability.[407] Yet, precisely in domains where major powers possess core strategic interests, such as space, the veto logic creates an integral limit on ambition where governance becomes hostage to the least agreeable permanent member rather than guided by the broadest international concern. Still, as mentioned at the beginning of the paragraph, the veto alone does not explain the Council's weakness on space security, as even without vetoes, the Council's agenda and methods are structurally misaligned with the space domain. Space security is a "risk accumulation" problem, not simply an "incident-based" one, as seen exhaustively so far in the previous chapters, with problems of congestion, debris, counter-space policies, cyber risks, and risks of misunderstanding cumulating over time.[408] The instruments of the Council, consisting of binding decisions, enforcement actions, and sanctions, assumes the existence of specific violations and attribution, which is not the case with many space security challenges that are often unclear, hard to verify, and subject to political dispute. Furthermore, the working culture of the Council is still very crisis-driven, with little capacity for dealing with technically complex processes over a long period of time. It is for this reason that the norm-setting and risk-reduction work has actually shifted to other UN platforms, such as the General Assembly First Committee and specific working groups, where the political costs of engagement are lower and where progress can be more incremental.[409] A further limitation is that outer space governance is institutionalized within a fragmented UN architecture (as seen previously): the presence of COPUOS and UNOOSA, crucial to the civilian governance of space activities, and also disarmament bodies that address space security primarily through the lens of arms control and stability. In this architecture, the SC

[405] United Nations, *Charter of the United Nations*, chaps. V–VII, https://www.un.org/en/about-us/un-charter.
[406] United Nations, *Charter of the United Nations*, art. 27, https://www.un.org/en/about-us/un-charter.
[407] Michael J. Glennon, "The UN Security Council in a Unipolar World," *American Journal of International Law* 92, no. 4 (1998): 647–666.
[408] UNIDIR, *Space Security and Strategic Stability* (Geneva: United Nations Institute for Disarmament Research, 2021).
[409] United Nations General Assembly, Decision 79/512, *Prevention of an Arms Race in Outer Space* (2024) (contextual reference to the OEWG framework).

(security council) sits in between these two pillars being neither a technical law-making organism, nor an arms-control negotiating forum.[410] Such hybrid positioning frequently results in institutional avoidance: when there is a disagreement about space, Member States often choose to take the issue to the General Assembly instead of the Council, as the General Assembly has more universal legitimacy and no vetoes, whereas the Council has a low chance of getting a predictable outcome and is very political.[411]

The most exemplary recent illustration of these structural constraints is the Security Council's failed attempt in 2024 to adopt what UN press coverage described as the first-ever Council resolution addressing the prevention of an arms race in outer space.[412] On 24 April 2024, the Council met at its 9616th meeting to vote on a draft resolution contained in document S/2024/302.[413] The text was framed as a reaffirmation and operationalization of existing legal obligations under the 1967 Outer Space Treaty, particularly the prohibition on placing in orbit around the Earth "any objects carrying nuclear weapons or any other kinds of weapons of mass destruction."[414] The draft therefore sought to reinforce compliance with that existing prohibition and called on States not to develop nuclear weapons or other WMD designed for placement in orbit. Yet, the political dynamics of the vote were revealing: 13 Council members voted in favour, China abstained and Russia voted against hence vetoing the text.[415] The failure of the draft resolution illustrates how the veto is rather to be seen as a sign of the problem and not the cause of it as the deeper issue is that even when a text reaffirms existing law, the Council becomes a stage for the permanent members to contest narratives, credibility, and intentions.[416] To confirm that, a month after the same pattern repeated when on 20 May 2024 the Security Council assessed outer space again, only this time it was convened on a draft resolution that Russia sponsored and brought up after the veto in April.[417] The Council faced once again confrontations and debates and didn't adopt the draft resolution as it didn't get the nine votes it needed to pass with seven votes in favour, seven against , and one abstained.[418] UN coverage stressed that this was the second failure in less than a

[410] Bleddyn Bowen, *War in Space: Strategy, Spacepower, Geopolitics* (Edinburgh: Edinburgh University Press, 2020).
[411] United Nations General Assembly, *Resolution 76/262: Standing mandate for a General Assembly debate when a veto is cast in the Security Council* (2022), https://undocs.org/A/RES/76/262.
[412] United Nations, "Security Council Fails to Adopt First-Ever Resolution on Arms Race in Outer Space, Due to Negative Vote by Russian Federation," UN Press Release SC/15678 (24 April 2024).
[413] United Nations Security Council, Draft Resolution, UN Doc. S/2024/302 (24 April 2024).
[414] United Nations, *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies* (Outer Space Treaty), opened for signature January 27, 1967, 610 UNTS 205, art. IV.
[415] United Nations, "Russia vetoes Security Council draft resolution on a weapon-free outer space," UN Geneva News (24 April 2024).
[416] United Nations Security Council, *Provisional Verbatim Record*, UN Doc. S/PV.9616 (24 April 2024).
[417] United Nations, "For Second Time Since Late April Security Council Fails to Adopt Resolution on Outer Space," UN Press Release SC/15700 (20 May 2024).
[418] United Nations Security Council, *Provisional Verbatim Record*, UN Doc. S/PV.9630 (20 May 2024).

month, showing how politically relevant space security is and how the Council cannot come to an agreement.[419] This sequence matters as it also demonstrates how, when a Council product is unlikely, permanent members compete between each other for political positioning and not genuine expectations of consensus. The result is a performative deadlock: multiple votes, high-level statements, and media coverage; however, no binding norm-building.[420]

An additional complication is that many destabilizing counter-space activities are designed to remain below the threshold of "armed attack" or even "use of force." They include reversible or deniable interference, cyber operations, jamming, dazzling, and proximity operations that may be framed as routine manoeuvres.[421] Given that the Council tends to act when a situation is widely recognized as a threat to peace, the ambiguity of such activities generates persistent disagreement over whether Council engagement is warranted at all. As long as major powers maintain divergent strategic interpretations, the Council's binding authority becomes politically impracticable. Moreover, Council action on space security would necessarily implicate the strategic doctrines of the permanent members themselves: unlike thematic agendas where the P5 (Permanent 5 members of the SC) may find common ground without constraining core capabilities, meaningful Council action on space security would likely affect counter-space programmes, missile defence linkages, and military uses of space-based ISR, navigation, and communications. This raises the political cost of agreement and increases incentives for obstruction or dilution, the Council thus becomes structurally prone to symbolic outputs (debates and statements) rather than regulatory commitments.[422]

The Council's incapacity is also sustained by "agenda control" dynamics that precede the veto. Even before a veto is cast, in fact, permanent members can discourage tabling, shape drafting constraints, or indicate that certain formulations will be unacceptable. This produces self-censure by sponsors, resulting in weaker texts or abandonment of initiatives. The veto is hence merely the visible endpoint of a longer chain of political limits intrinsic to the Council's design.[423] Additionally, the Council's involvement in space security is more likely to be *ad hoc* and response-driven, often reacting to pressing political events or intelligence reports, rather than being part of a permanent governance agenda. For instance, the draft resolution in April 2024 was understood in

[419] United Nations Office at Geneva, "Second draft resolution on weapons-free outer space fails in Security Council," UN Geneva News (20 May 2024).
[420] Security Council Report, "Vote on Draft Resolution on Weapons of Mass Destruction in Outer Space" (23 April 2024). See also Shizuka Kuramitsu, "Russia Vetoes UN Resolution on Outer Space Treaty," *Arms Control Today* (May 2024)
[421] UNIDIR, *Security in Space: The Next Generation* (Geneva: UNIDIR, 2020).
[422] Theresa Hitchens, "The New Geopolitics of Space," *Survival* 62, no. 1 (2020): 145–158.
[423] David M. Malone, *The UN Security Council: From the Cold War to the 21st Century* (Boulder, CO: Lynne Rienner, 2004).

terms of reaffirming the prohibition of WMDs in orbit, a notably high-profile issue. However, the Council has not generated the same level of initiatives on other space security issues such as debris-generating kinetic testing, non-kinetic interference, or proximity operation norms, which may be more directly destabilizing. Importantly, we can recognize that the UN system has developed institutional alternatives that partially compensate for Council incapacity and one such mechanism is the General Assembly's "veto initiative," established by resolution 76/262, which requires the Assembly to meet when a veto is cast in the Council.[424] For this reason, following the April 2024 veto, the General Assembly convened to debate the use of the veto in relation to the blocked outer space resolution, illustrating how Council paralysis can be politically "externalized" to the Assembly for broader legitimacy-based contestation.[425] Similarly, the Council's inability to act has indirectly reinforced the significance of First Committee processes and OEWGs as the primary venues for norm development and risk reduction. Specific working groups can in fact debate over multiple sessions, accommodate a broader span of proposal and produce soft-law or political outcomes even without P5 unanimity, admittedly with their limitations too as seen in previous paragraphs. Nevertheless, is important to note that Council paralysis does not mean UN paralysis too in every aspect, but certainly generates lot of inefficiency and stagnation.[426]

2. Multilateral Prospects

2.1 The Artemis Accords: Plurilateral Governance and the Emergence of a "Club" Model

In light of the structural limitations affecting the United Nations' capacity to address space security through centralized mechanisms, attention has progressively shifted toward multilateral alternatives of governance. Outside the UN framework, States have tried to improve cooperation, norm-setting and regulatory experimentation through different institutional formats. The following section explores these emerging multilateral prospects, starting with the Artemis Accords.

The Artemis Accords are one of the most important recent trends in the governance of outer space that have occurred outside the United Nations framework. Launched by the United States in 2020, they are formally described as a series of political commitments, not a treaty, that are intended to facilitate cooperation in the civil exploration and use of the Moon, Mars, and other

[424] United Nations General Assembly, *Resolution 76/262* (2022).
[425] United Nations General Assembly, *Provisional Verbatim Record*, UN Doc. A/78/PV.78 (6 May 2024)
[426] European External Action Service, "EU Statement – UN General Assembly First Committee: Outer Space" (24 October 2025)

celestial bodies.[427] However, from a substantive point of view, they represent a new governance experiment that is characterized by a plurilateral, values-driven approach that seeks to shape behaviour, standards, and expectations among a carefully selected group of States, namely, among the growing number of nations participating in NASA's Artemis Program for lunar exploration.[428] This is the very first major peculiarity: in contrast to the treaties concluded under UN auspices, the Artemis Accords are not multilateral treaties that are open to universal participation through the accession process, rather, they are plurilateral agreements that are concluded through a series of bilateral agreements between the United States and each of the partner States, which together constitute a plurilateral group.[429] This approach is a governance choice: by favouring cooperation among a group of willing and capable partners, the Artemis Accords aim to escape the consensus constraints and political deadlock that often characterize universal fora. From a functional perspective, they reaffirm adherence to the core principles of the Outer Space Treaty while simultaneously supporting the extraction and use of space resources, arguing that such activities should not, in themselves, be regarded as acts of national appropriation under Article II of the Treaty. In addition, the Accords advance the concept of so-called "safety zones" surrounding lunar installations as a means of avoiding harmful interference, an approach that, according to some critics, risks evolving into forms of de facto exclusivity. Notably, the Artemis Accords were endorsed by a coalition largely composed of established spacefaring states and their close partners, with the original signatories in October 2020 including the United States, the United Kingdom, Australia, Canada, Japan, Luxembourg, Italy, and the United Arab Emirates. Although the number of participating states has since grown, exceeding fifty by 2025, several major space powers, notably Russia, China, and India, remain outside the framework, while a significant number of Global South countries continue to approach the initiative with caution.[430] At the same time, the governance logic at the basis of the Accords is very different from that of UN processes: participation depends on agreeing with a set of principles that were set before the event, not on negotiating them afterwards through open discussion. This condition allows participants to quickly agree on and coordinate norms, but at the same time it also creates a degree of exclusivity, utterly different from the universalist spirit of COPUOS and the General Assembly. Accordingly, the Artemis Accords are frequently described as embodying a "club model" of governance; where, in

[427] National Aeronautics and Space Administration (NASA), The Artemis Accords: Principles for Cooperation in the Civil Exploration and Use of the Moon, Mars, Comets, and Asteroids, 2020, https://www.nasa.gov/specials/artemis-accords/

[428] Ghalib Naseer and Noe Maurice Bhurgri, "Orbital Commons or Neo-Colonial Frontier: A New Paradigm of Stellar Stewardship," Pakistan Journal of Law, Analysis and Wisdom 4, no. 9 (August 2025): 13–29.

[429] Christopher D. Johnson, "The Artemis Accords: Between Cooperation and Competition," *Space Policy* 55 (2021): 101416.

[430] Ghalib Naseer and Noe Maurice Bhurgri *op.cit.*

this context, a club is defined not merely by exclusivity, but by the provision of benefits such as access to cooperative missions, shared infrastructure, and technological interoperability to members who accept a defined set of rules.[431] This model offers clear incentives for participation, especially for States seeking integration into advanced space exploration initiatives. Nonetheless, the club model also raises concerns regarding inclusivity and equity as participation in the Accords presupposes a certain level of technological capability, regulatory alignment, and political affinity. States outside this network may find themselves indirectly affected by standards and practices over which they had no meaningful input, a dynamic that risks exacerbating existing asymmetries between established space powers and emerging or non-space-faring States, particularly in relation to access to lunar resources and operational zones.[432] These issues have been expressed most forcefully by States and observers who consider universal multilateralism to be a normative shield against fragmentation and asymmetry of power. In this regard, the Accords could lead to the development of multiple governance regimes with varying levels of standards and expectations where, although not necessarily conflict-prone, this type of fragmentation makes it more difficult to establish a set of global rules.[433]

The Artemis Accords deliberately exclude any reference to the Moon Agreement or to the principle of the common heritage of mankind, consistent with the United States' view that this principle is not applicable to the exploitation of space resources. Rather than establishing redistributive mechanisms, the Accords prioritize voluntary guidelines and cooperative practices, placing emphasis on freedom of use, coordination, and reciprocal consideration among participating states.[434] The undermining of the Common Heritage of Mankind (CHM) principle offers a clear illustration of this broader dynamic. Originally advanced by developing states as a mechanism to promote equitable access to and benefit-sharing from global commons, CHM has, in the context of outer space, been progressively marginalized through the coordinated resistance of hegemonic powers and their private-sector counterparts. The Artemis Accords, a U.S.-led initiative, exemplify this shift by reframing the normative discourse surrounding space governance. Rather than engaging with the practical implementation of the common heritage principle, the Accords emphasize the protection of so-called "heritage sites," understood as historically significant locations or artefacts, such as the Apollo 11 Tranquillity Base. This move entails a subtle yet consequential redefinition of "heritage," whereby "outer space heritage" is confined to discrete sites of past human activity, in contrast to the Moon Treaty's broader conception of the Moon itself as a

[431] Joseph S. Nye, "Club Governance and International Cooperation," *International Affairs* 92, no. 2 (2016): 247–264.
[432] UNIDIR, *Space Security and Global Inequality* (Geneva: UNIDIR, 2022).
[433] Bleddyn Bowen, *War in Space* (Edinburgh: Edinburgh University Press, 2020)
[434] Ghalib Naseer and Noe Maurice Bhurgri *op.cit.p.98*

common heritage to be shared equitably.[435] By focusing only on preserving heritage sites, the Artemis framework preserves the legacy of the first (mostly American) explorers as worthy of protection, whereas implies that the Moon at large is open for business. This subtle shift further erodes the Global South's understanding of outer space as a genuinely shared commons.[436] As noted in the proper paragraph of chapter 2, private actors have also contributed significantly to the erosion of redistributive principles in space governance. Although international law has traditionally been centred on States, the growing prominence of major aerospace corporations and high-profile private entrepreneurs has introduced new forms of pressure on the legal framework. These individuals have been active players in shaping the legislation that recognizes proprietary rights over space resources that have been extracted, and they do this by depicting space extraction as an activity that is both inevitable and economically attractive. This has led to the development of an animated space industry, which has changed the incentives of States from being restrictive to being facilitators of private enterprise, especially true with States that have advanced technological industries. Consequently, such policy orientation has fostered what is often described as a "gold rush" mentality, evoking historical parallels with colonial charter companies whose commercial interests played a decisive role in shaping imperial strategies of overseas resource extraction.[437]

One of the key aspects of the Artemis Accords is its method of norm diffusion. Instead of aiming for immediate universal adoption, they use the strategy of gradual expansion through voluntary accession, meaning that as more States join the agreement, the norms expressed are expected to gain more weight, potentially shaping State practice.[438] From a legal standpoint, the Accords are explicitly non-binding and framed as political commitments, nonetheless, their practical significance lies in their potential to shape operational behaviour and expectations. As international law manuals teach, repeated adherence to non-binding standards by a critical mass of actors can contribute to the formation of customary norms, particularly in technologically driven domains where formal treaty-making lags behind practice.[439] Notably, however, the Accords do not in fact substitute the UN processes: the text of the Accords contains a repeated affirmation of consistency with existing international law and a focus on complementarity rather than substitution.[440] Nevertheless, the effect of the Accords is clearly to relocate certain functions of norm-setting and operational coordination from universal institutions and organisms to plurilateral

[435] C. Posey, *The Aftermath of the Artemis Accords: Power Dynamics Past and Present in International Space Law, Temple International & Comparative Law Journal* 39, no. 1 (May 2025).
[436] *Ibid.*
[437] Ghalib Naseer and Noe Maurice Bhurgri *op.cit.o.99*
[438] Steven Freeland and Ram S. Jakhu, "The Evolution of Space Governance," *Journal of Space Law* 44, no. 2 (2020): 227–256.
[439] Alan Boyle and Christine Chinkin, *The Making of International Law* (Oxford: Oxford University Press, 2007).
[440] NASA, *Artemis Accords*, Preamble.

ones. This represents a trend in global security governance, in which States are increasingly turning to flexible coalitions in order to respond to emerging challenges. The implications of this shift for space security are mixed: if on the one hand these type of arrangements may enhance predictability and reduce risks among participants by clarifying expectations and standards of conduct, on the other hand the absence of universal binding may limit the Accords' capacity to address systemic risks that affect all space actors, such as congestion, debris proliferation, and escalation dynamics.[441]

In parallel to the U.S.-led Artemis framework, China, together with Russia and a group of interested partner States,[442] has promoted the International Lunar Research Station (ILRS) initiative as an alternative pathway for lunar cooperation. Conceived as a long-term scientific base on the Moon, the ILRS emphasizes joint research, shared infrastructure, and multilateral participation outside U.S. aligned blocs. Differently from the Artemis Accords, the ILRS is not articulated as a normative or legal framework and neither advance explicit interpretations concerning the extraction or utilization of lunar resources. Its significance therefore lies less in rule-making than in its geopolitical and institutional positioning. As a cooperative approach based on state-led scientific collaboration and strategic autonomy, the ILRS embodies an alternative vision of lunar governance, which emphasizes the fragmentation of new space regimes and which points to the fact that great powers are increasingly developing parallel approaches to advance their divergent normative preferences in outer space.[443]

In conclusion, both the Artemis Accords and the International Lunar Research Station show the rise of competing plurilateral governance models in response to the limitations of universal multilateralism in outer space. Even if admittedly they differ significantly in structure, normative ambition, and geopolitical orientation, both initiatives reflect a common shift toward coalition-based rule-making and operational coordination outside the United Nations framework. These tensions, as will be covered in the next paragraph, have revived debates on whether existing treaties and norms contained in them, particularly Article IV of the Outer Space Treaty, remain adequate to address contemporary space security challenge or require clarification, strengthening or adaptation.

[441] Brian Weeden and Victoria Samson, *Global Space Governance* (Washington, DC: Secure World Foundation, 2021).
[442] China National Space Administration and Roscosmos. *Memorandum of Understanding on Cooperation for the Construction of the International Lunar Research Station (ILRS)*, signed March 9, 2021; plus subsequent partnership agreements with various states including Venezuela, South Africa, Azerbaijan, Pakistan, Egypt, Nicaragua, Thailand, Serbia, and Kazakhstan.
[443] DalBello, Richard. Global Space Governance – Pathways to Agreement. Broomfield, CO: Secure World Foundation, July 17, 2025.

2.2 Strengthening and Updating Article IV of the OST

The Outer Space Treaty's Article IV is the foundation of the international regulatory framework on the military use of outer space. The article, which dates back to 1967, was negotiated in a completely different technological and geopolitical environment and it represents a compromise between the different Cold War-era interests, aiming to ban the most destabilizing types of weaponization in outer space, while at the same time leaving sufficient strategic flexibility for the great powers.[444] Although Article IV has shown an impressive degree of resilience, the rapidly growing pace of space militarization and the development of new types of counter-space weapons have made its normative and regulatory boundaries more and more apparent. Article IV sets up two different but closely related legal regimes. First, it declares that nuclear weapons and other weapons of mass destruction cannot be placed in orbit around the Earth or on other celestial bodies. Second, it states that the Moon and other celestial bodies can only be used for peaceful purposes, also, military bases, fortifications, weapons testing, and military manoeuvres are banned and prohibited on their surface.[445] Nevertheless, the Article also allows military personnel to be used for scientific research and other peaceful purposes, which underscores the dual-use nature of space activity even at the time the Article was drafted. The provision's selective scope was intentional, rather than imposing a comprehensive demilitarization of outer space, Article IV sought to draw a legal red line around the most escalatory and destabilizing categories of weapons, namely WMD, while leaving conventional military uses of space largely unregulated.[446] This compromise enabled widespread ratification and ensured the Treaty's longevity, but it also embedded a structural ambiguity that has become increasingly problematic in light of technological evolution. Defining "peaceful purpose" activities is not easy either, particularly when States such as China have space programs run by the military. As China advances toward crewed lunar missions in 2030, concerns have emerged that it could make use of "grey-zone" activities in the space domain to further its strategic objectives, including challenging the United States' current advantages in space. Importantly, however, this dynamic is not unique to China: similar incentives and behaviours can be observed among all major spacefaring powers operating in an increasingly contested orbital environment.[447] For decades, Article IV functioned as a stabilizing normative anchor, particularly during periods when space-based military activities were largely supportive of terrestrial operations. However, the

[444] Bin Cheng, *Studies in International Space Law* (Oxford: Clarendon Press, 1997).
[445] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, January 27, 1967, 610 UNTS 205, art. IV.
[446] Stephan Hobe, Bernhard Schmidt-Tedd, and Kai-Uwe Schrogl, eds., *Cologne Commentary on Space Law*, vol. I (Cologne: Carl Heymanns, 2009).
[447] Malcolm Davis, "Avoiding a Free-for-All: The Outer Space Treaty Revisited," *The Strategist*, Australian Strategic Policy Institute, July 16, 2018,

contemporary space environment, as seen exhaustively so far, is characterized by the development of direct-ascent anti-satellite weapons, co-orbital systems, non-kinetic interference capabilities, and cyber operations targeting space infrastructure.[448] None of these capabilities fall precisely within the categories regulated by Article IV, even though their effects may be highly destabilizing and, in some cases, strategically equivalent to prohibited weapons. This gap has generated divergent interpretations among States: while some actors note that Article IV, read in combination with the broader principles of the OST such as due regard, non-harmful interference, and peaceful purposes already provides a sufficient legal framework, if applied in good faith;[449] others argue that the provision is obsolete, having failed to anticipate both the technological realities of modern space operations and the integration of space into military doctrines. The absence of agreed interpretative guidance has thus contributed to legal uncertainty, and given the political difficulty of amending the OST, most efforts to "strengthen" Article IV have focused on interpretative clarification rather than formal revision. States and expert groups have sought to expand the practical reach of Article IV by linking it to broader concepts such as responsible behaviour, risk reduction, and the prevention of harmful interference.[450] In this context, non-binding instruments and political commitments have played a central role. Notably, discussions within the UN General Assembly First Committee and associated working groups have explored how existing legal obligations can be operationalized through transparency and confidence-building measures (TCBMs), initiatives that aim to reduce the risks associated with military space activities without reopening the Treaty itself.[451] While such approaches preserve the integrity of the OST, they also underscore its limitations: Article IV remains a static legal provision rooted in a dynamic security environment. More ambitious proposals advocate for updating Article IV through new legally binding or almost-binding instruments. Some States and scholars have argued that the prohibition should be extended from WMD to include some forms of conventional weapons or activities that generate debris,[452] others have also proposed a functional ban, such as the prohibition of the intentional destruction of space objects, irrespective of the weapon used. Evidentially, these efforts are aimed at ensuring that the law is in line with the main contemporary source of risk, rather than outdated weapon categories. However, these kinds of proposals have met with strong political opposition, with major space-faring nations that are still quite opposed to accepting any kind of limitations that may intrude on

[448] UNIDIR, *Security in Space: The Next Generation* (Geneva: UNIDIR, 2020).
[449] Frans von der Dunk, "The Origins of Article IV of the Outer Space Treaty," *Journal of Space Law* 42, no. 1 (2018): 1–26.
[450] United Nations General Assembly, *Report of the Open-Ended Working Group on Reducing Space Threats*, UN Doc. A/78/70.
[451] United Nations Office for Disarmament Affairs (UNODA), *Transparency and Confidence-Building Measures in Outer Space Activities* (2013).
[452] Pavel Podvig, "A Ban on Debris-Generating ASAT Tests," *Science & Global Security* 29, no. 1 (2021): 1–24.

their strategic freedom. In addition, there are still no clear definitions on the matter, and this has been one of the factors that have blocked any kind of progress in the near term on arms control in general.[453]

The increased attention to Article IV must also be considered in the context of the fragmented governance environment that has been described in the previous section, where plurilateral efforts such as the Artemis Accords and the ILRS represent different approaches to space governance that exist in parallel to the OST framework. Although these initiatives reaffirm consistency with existing treaty law, they do so in a manner that implicitly reinterprets key principles.[454] In this context, Article IV is more of a normative reference point than a regulatory provision, with its continued relevance that is contingent on how it is supplemented by interpretative practices, political commitments and complementary norms that are developed in other fora. Nevertheless, the danger is that different interpretations may stabilize into normative orders that further undermine the coherence of the international space law regime.

Overall, not only Article IV but The Outer Space Treaty itself requires adaptation if it aims to respond effectively to the growing risks associated with an increasingly contested, crowded, and competitive space environment, stretching from low Earth orbit to cislunar space and beyond. Updating the treaty would help align it with the emerging "Space 2.0" landscape, in which technological innovation and expansion are driven largely by commercial actors, many of whom operate with limited direct government oversight. Addressing the activities of new private competitors, particularly those seeking to access and commercially exploit space resources, should be treated as a priority if the OST is to preserve its relevance in future space governance.[455]

2.3 Multilateral and Regional Initiatives

With the failings of universal, treaty-based governance in the area of space security becoming increasingly evident, regional and multilateral approaches that lie outside the conventional UN framework have come as alternative routes for the treatment of space security challenges. Such approaches are not substitutes for global multilateralism but rather coexist with it, serving as normative laboratories in which States test different approaches to risk reduction, cooperation, and norm articulation. The resulting environment is necessarily fragmented, with different actors seeking to realize partially overlapping goals through different logics. Prime examples are the Artemis Accords proposed by the U.S. and the ILRS by China and Russia above

[453] Bleddyn Bowen, *War in Space* (Edinburgh: Edinburgh University Press, 2020).
[454] Christopher D. Johnson, "The Artemis Accords and International Space Law," *Space Policy* 55 (2021): 101416.
[455] Malcolm Davis *op.cit.p.102*

examined, however, there are some others important to mention in order to have a complete picture of the space-related initiatives and the diversification of governance. This analysis allows to highlight how different actors see space security, inclusivity, and regulatory authority in the absence of effective centralized and common enforcement.

The European Union has become one of the most active and normatively ambitious players in discussions about space security governance among regional actors.[456] Although it is not a space power in the traditional sense, its distinctive contribution lies in its role as a norm proposer, seeking to shape international behaviour through the promotion of standards, transparency, and cooperative mechanisms rather than coercive regulation.[457] This philosophy found its most explicit expression in the proposed International Code of Conduct for Outer Space Activities (ICoC), which remains one of the most ambitious attempts to address space security through voluntary, behaviour-based norms.[458] The EU Code of Conduct came about in the late 2000s as a response of States being concerned over space congestion, debris proliferation, and the absence of binding international rules governing military space activities. After China tested an anti-satellite weapon in 2007 and nations became more aware of how fragile space infrastructure is, the EU tried to fill what it saw as a gap in the law and politics between existing treaty law and new security threats.[459] Rather than pursuing a new arms control treaty, widely viewed as politically unattainable, the EU opted for a soft-law instrument aimed at risk reduction and confidence-building. The Code was intended to be a politically compulsory but legally non-binding document, which would apply to all space-faring entities that were willing to sign up. The main aims of the Code were the promotion of transparency in national space policies, the exchange of information on space activities, the establishment of best practices to reduce the generation of debris, and the avoidance of harmful interference with space objects.[460] Crucially, the Code also chose not to refer to weapons or military activities explicitly, but instead to view space security as a question of behaviour. This was clearly a deliberate attempt to bypass the long-standing differences of opinion on weaponization and this aspect represents also one of its main innovation: by focusing on conduct rather than capabilities, the Code sought to shift the debate away from prohibitions and toward responsibility. This behavioural approach implicitly recognized the dual-use nature of most space technologies and the difficulty of distinguishing civilian from military activities.[461] Instead of attempting to regulate "what" States possess, the Code emphasized "how" they act in space, in this way, this logic positioned the Code in between the talk

[456] See chapter 2 para. 1.4
[457] Karen E. Smith, *European Union Foreign Policy in a Changing World* (Cambridge: Polity Press, 2014).
[458] Christophe Venet, "The European Code of Conduct for Outer Space Activities," *Space Policy* 27, no. 4 (2011): 209–214.
[459] Brian Weeden, "2007 Chinese Anti-Satellite Test Fact Sheet," Secure World Foundation, 2010.
[460] European External Action Service, *Draft International Code of Conduct for Outer Space Activities* (2014).
[461] Frans von der Dunk, "Space Security and the Law: Legal Challenges," *Astropolitics* 13, no. 2–3 (2015): 173–195.

on space safety and space security. The provisions related to collision avoidance, debris mitigation, and information exchange were necessary not only from an environmental or technical perspective but also from a perspective of mitigating misperception, escalation, and unintended conflict. In this respect, the Code foresaw the debates that would emerge later in the UN General Assembly processes, especially in the context of transparency and confidence-building measures (TCBMs).[462] Although the EU Code of Conduct has strong conceptual merit, it has ultimately not been able to reach a level of universal acceptance, as some States, especially in the Global South and new space powers, have raised concerns about both the substance and process of the Code of Conduct. Some critics have argued that the Code of Conduct has been developed in a process led by the EU, which has not adequately taken into account the views and priorities of non-Western States.[463] Others (mainly major powers) have been concerned that the Code of Conduct could limit their future space activities. Such concerns emerged during multilateral consultations between 2012 and 2015, which eventually failed to reach *consensus* on a revised text. The initiative was later formally abandoned in 2015, signing a setback for the EU's role in the space domain, however, the failure of the Code should not be seen with normative irrelevance, since, as several observers have noted, many of the objections raised were less about the content of the Code than about the political dynamics of norm-setting outside universal fora.[464] Although never adopted, the EU Code of Conduct exerted a lasting influence on subsequent space security discussions, for this reason, concepts established in the Code such as responsible behaviour, information exchange, and debris mitigation, were later incorporated into UN General Assembly resolutions and expert reports. Notably, the General Assembly's work on TCBMs in outer space echoed many of the Code's principles, even if in a more inclusive and UN-centred format.[465] In this respect, the Code can be understood as a normative precursor rather than a failed instrument, demonstrating how regional initiatives can shape the vocabulary and framing of global debates, even when they do not result in formal agreements.

In contrast to the EU's normative ambitions, the Association of Southeast Asian Nations (ASEAN) is a more modest but still very instructive example of regional commitment to space governance. ASEAN's engagement with space-related issues has been driven by a concern for capacity building, peaceful use, and confidence building, and not by a concern for security regulation per se.[466] In fact, ASEAN does not aim to create binding regional norms on space

[462] United Nations General Assembly, *Transparency and Confidence-Building Measures in Outer Space Activities*, UN Doc. A/68/189 (2013).
[463] UNIDIR, *The European Union Code of Conduct for Outer Space Activities: Prospects and Challenges* (Geneva: UNIDIR, 2014).
[464] James Clay Moltz, *The Politics of Space Security*, 3rd ed. (Stanford: Stanford University Press, 2019).
[465] United Nations General Assembly, *Report of the Group of Governmental Experts on TCBMs in Outer Space Activities*, UN Doc. A/68/189.
[466] ASEAN Secretariat, *ASEAN Plan of Action on Science, Technology and Innovation* (2016–2025).

security, nor does it seek to develop comprehensive normative guidelines, as in the case of the EU's normative ambitions, rather, its engagement is consistent with the usual approach of the organization on cooperation, based on information-sharing, consensus, and non-interference.[467] In terms of space security, the ASEAN approach indirectly promotes stability through the promotion of transparency and mutual understanding among regional actors with new space capabilities; however, this experience also illustrate the limitations of regionalism in addressing global risk that go beyond regional space governance, making them apparently inadequate as response to the militarization of outer space.

Another multilateral prospect that particularly tries to escape the "Club" component of initiatives such as the Artemis Accords, is the Group of 77 (G77).[468] This is first of all a political coalition and certainly not an institutional rule-maker, given that, its significance lies not in the formation of technical standards but in its continuous expressions of concerns related to equity, access, and the threat of emerging governance models.[469] In space security, the G77 has always highlighted the development aspect of space activities and the challenges of exclusionary governance structures. The Group members have been worried that plurilateral efforts and high technological standards could leave developing countries behind, making it difficult for them to benefit from space resources; worries that are usually articulated in the context of principles such as the peaceful use of outer space and, by extension, the concept of space as a global commons.[470] The G77's position gains even more relevance in regards of initiatives such as the Artemis Accords, where, while not opposing cooperation per se, the Group has questioned governance models that condition participation on alignment with pre-defined norms developed outside inclusive multilateral processes. From this perspective, the G77 works as a counterweight to club-based governance, seeking to preserve the political centrality of universal forums and to ensure that space security norms do not formalize existing inequalities.[471] Although of course the G77's influence is primarily discursive, its role should not be underestimated; through challenging the hegemonic discourses and conceptualizing space security as a question of global justice and development, the Group establishes the terms of legitimacy within which other initiatives must operate. This kind of

[467] Amitav Acharya, *Constructing a Security Community in Southeast Asia* (London: Routledge, 2014).
[468] United Nations, Group of 77 and China (G-77), describes the coalition of developing countries established on 15 June 1964 by 77 founding member states that signed the "Joint Declaration of the Seventy-Seven Developing Countries" at the conclusion of the first session of the United Nations Conference on Trade and Development (UNCTAD) in Geneva; today the group has expanded to include 134 Member States, representing a broad coalition of developing countries across Africa, Asia, Latin America, the Caribbean and Pacific. *See* Group of 77, "Member States," G77.org, https://www.g77.org/doc/members.html
[469] Samir Amin, "The G77 and the Future of Global Governance," Third World Quarterly 39, no. 7 (2018): 1241–1256.
[470] United Nations General Assembly, *Resolution 78/37, Prevention of an Arms Race in Outer Space*, adopted December 4, 2023, UN Doc. A/RES/78/37
[471] UNIDIR, *Space Security and Global Inequality* (Geneva: UNIDIR, 2022).

interventions highlight that space security governance is more than a technical or strategic question, but also a political one. In relation to the G77' purpose, an additional voice from the Global South comes from the African Union, clearly representing the African perspective. Through initiatives led by the Union and national space agencies, African States have increasingly articulated a vision of space governance grounded in development, capacity-building, and societal resilience. Admittedly, these initiatives are not framed explicitly in terms of space security, however, they intersect with security concerns through their emphasis on space-based services such as disaster management, climate monitoring and early warning systems.[472] The African presence and engagement in space governance reflects the contemporary imbalance in global debate, where some of the States that most of all are effected by the consequences of space insecurity such as satellite disruption or debris proliferation, are not involved and are not afforded the ability to shape rules. Regional initiative like the AU as a consequence, prioritize access and sustainability rather than deterrence and military balance. This represents an important shift away from security paradigm and supports the need for inclusive governance structures that take into consideration diverse vulnerability.[473] At the same time, just as it works for the G77, Africa's raising presence in space governance illustrates the potential for regional coordination to value collective voice, even if these initiatives remain largely complementary to global processes but they contribute to a more pluralistic governance environment where different priorities and experiences are articulated. Taken all together these regional and multilateral perspectives show how space security governance is characterized by diversification rather than convergence; with the EU illustrating proactive norm entrepreneurship, ASEAN reflecting cooperative minimalism and G77 and AU articulating opposition to exclusionary governance and stimulating development and inclusion. Each of these pathways addresses specific aspects of space security, yet none offers a comprehensive or universally accepted solution, however this division is not merely a temporary condition but a structural feature of space governance. As long as reaching a common universal enforcement is this field remains politically unattainable, governance functions will continue to spread across regional and multilateral coalitions; where if on one hand such pluralism allows for experimentation and inclusivity, on the other hand it also risks to produce normative inconsistency and uneven regulation and protection from space-related risks.[474]

[472] African Union Commission, *African Space Policy and Strategy* (2016).
[473] Victoria Samson, "Why Space Sustainability Matters for the Global South," *Space Policy* 56 (2021): 101418.
[474] James Clay Moltz, "The Future of Space Security Governance," *Astropolitics* 19, no. 3 (2021): 215–233.

3. Italy's Debris-Centred Approach to Space Security Governance

Italy's space-security profile within the UN system has increasingly been articulated through a pragmatic strategy: rather than attempting to resolve the most diverged debates on "space weapons", Rome has advanced a governance approach in the last years centred on orbital sustainability, reduction of debris-generating behaviours, and strengthening of multilateral processes capable of producing slow but durable normative outcomes.[475] This position is consistent with the wider European preference for risk-reduction and responsible behaviour frameworks, yet it also reflects a specifically Italian emphasis on the security externalities produced by debris, congestion, and counter-space testing, which shape the boundary between "technical" sustainability and "international security" properly.[476] In this background, the Italian initiative most relevant is best understood as a debris-focused governance package: a policy line that aims firstly to consolidate a norm against the deliberate creation of long-lived debris, secondly to operationalise responsible conduct through transparency and confidence-building measures (TCBMs) and space traffic management (STM), and lastly to leverage Italy's recent institutional leadership roles, within the First Committee and, prospectively, COPUOS, to keep space security on the multilateral agenda.[477] From a governance perspective, the significance of Italy's approach lies in the way it treats debris not merely as an environmental product of space activity, but as a structural security risk that undermines stability for all operators and is capable of generating crisis dynamics and misperceptions.[478] Italy's own statements in UN disarmament settings explicitly exemplifies this logic: in its statement to the OEWG on reducing space threats (fourth session, 2023), Italy highlighted the urgency of addressing persistent development or testing of ASAT capabilities precisely because such activities produce long-lasting debris clouds and compromise the security of space operations.[479] In the same intervention, Italy acknowledged the political divide over whether space security should be pursued through legally binding instruments or voluntary norms, but argued that responsible behaviour norms can function as intermediate steps that gradually increase

[475] Italian Ministry of Foreign Affairs and International Cooperation, "Statement by Deputy Prime Minister Tajani on Italy's commitment not to conduct destructive direct-ascent anti-satellite missile tests," press release, April 6, 2023.
[476] United Nations Office for Outer Space Affairs (UNOOSA), "Statement by Italy (Item 3: General exchange of views)," COPUOS Legal Subcommittee, 62nd session, March 20, 2023.
[477] UN General Assembly First Committee, "Italy's Presidency of the UNGA I Committee begins," Permanent Mission of Italy to the United Nations (New York), October 8, 2025.
[478] Permanent Mission of Italy to the United Nations (New York), "Italy's Presidency of the UNGA I Committee begins," October 8, 2025.
[479] Permanent Mission of Italy to the Conference on Disarmament, "Statement delivered by H.E. Ambassador Leonardo Bencini," OEWG on reducing space threats, fourth session (Geneva), August 18, 2023.

the feasibility of future treaty negotiations.[480] Hence, Italy's attempt is to build a normative sequence that could reasonably culminate in binding commitments.

A central component of Italy's debris-focused approach to space security governance is its strong support for the Zero Debris Charter, an initiative promoted by the European Space Agency (ESA) with the objective of eliminating the intentional creation of new orbital debris by 2030.[481] The Charter was formally introduced in 2023 and opened for endorsement in 2024, inviting States, space agencies, and commercial operators to commit to a set of voluntary principles aimed at minimizing debris generation throughout the entire lifecycle of space missions.[482] While not legally binding, the Zero Debris Charter represents a significant evolution in debris governance, as it translates high-level sustainability principles into concrete operational commitments which include enhanced mission design standards, end-of-life disposal requirements, collision avoidance practices, and the systematic reduction of fragmentation risks.[483] From a space security perspective, as mentioned before but founding this time echo in an European framework, the Charter is particularly relevant because it addresses debris as a structural threat to the safety and predictability of space operations, rather than as a purely environmental or technical concern.[484] Italy has emerged as one of the Charter's key political supporters, reflecting its broader commitment to sustainability-driven risk reduction in outer space. As one of ESA's largest contributors and most active Member States, Italy has publicly endorsed the Zero Debris objective and has promoted its principles in multilateral fora, including within the UN system.[485] In this sense, the Zero Debris Charter complements Italy's normative strategy by offering an operational bridge between voluntary commitments and the longer-term prospect of binding regulation. Admittedly the Charter itself does not constitute international law, but it still contributes to the consolidation of expectations regarding responsible behaviour in orbit; and, as anticipated, over time such expectations may facilitate the emergence of customary norms or serve as reference points for future legal instruments addressing debris mitigation and space traffic management.[486]

Domestically, Italy has also advanced its space governance capacity: in June 2025 the Italian Parliament adopted a comprehensive Space Economy Law that integrates safety and sustainability standards, including debris mitigation and national registration of space objects, thus aligning

[480] Permanent Mission of Italy to the Conference on Disarmament, "Statement delivered by H.E. Ambassador Leonardo Bencini," August 18, 2023.
[481] European Space Agency, Zero Debris Charter (Paris: ESA, 2024), https://www.esa.int/Space_Safety/Zero_Debris
[482] European Space Agency, "ESA launches Zero Debris Charter," press release, November 2023.
[483] ESA, *Zero Debris Charter*, paras. 4–7.
[484] Brian Weeden and Victoria Samson, *Global Space Governance* (Washington, DC: Secure World Foundation, 2021), 143–146.
[485] Italian Space Agency (ASI), "Italy supports ESA Zero Debris initiative," institutional communication, 2024.
[486] Frans von der Dunk, "Soft Law in Space Governance," *Space Policy* 51 (2020): 101353.

national practice with the international normative emphasis on safe and responsible space operations.[487] Italy's debris-centred approach to space security governance has been further reinforced by its recent assumption of a leadership role within the United Nations disarmament architecture. In 2025, in fact, Italy was elected Chair the UN General Assembly First Committee for the eightieth session of the General Assembly, a mandate that formally begins with the opening of the Committee's main session in October 2025.[488] The chairmanship was initially exercised by Maurizio Massari, then Permanent Representative of Italy to the United Nations, and has continued under the leadership of Giorgio Marrapodi, following his appointment as Italy's Permanent Representative in early 2026.[489] As we have seen already, the First Committee has a crucial role within the UN system as the primary forum on disarmament, arms control and international security, including space-related issues, although clearly without an enforcement authority;[490] chairing this body therefore provides Italy with a platform to influence not outcomes in a legal sense, but the structure and prioritization of multilateral discussions. Right from the beginning of its chairmanship, Italy has made it clear that it recognizes the increasing relevance of space security issues in the disarmament context. In its initial statements, the Italian Chair emphasized that the new challenges of international security are increasingly transcending the traditional types of weapons, including areas such as cyberspace and outer space, in which civilian and military infrastructure are increasingly linked, a clear attempt to mainstream space security issues in the disarmament context and not treat them as marginal issues. [491]

Lastly, the most concrete future-oriented aspect of Italy's involvement in the governance of space security is to be found in its upcoming role as Chair of the Committee on the Peaceful Uses of Outer Space (COPUOS) for the 2026-2027 biennium. In terms of analytical relevance, the upcoming role of Italy as COPUOS Chair is highly relevant, especially in light of the role played by COPUOS in the UN system as analysed in previous paragraphs and chapters: COPUOS remains the main intergovernmental body for the governance of civilian space activities and the development of non-binding normative instruments. Its work, from the Long-Term Sustainability (LTS) Guidelines to the current debates on space traffic management (STM) and space debris mitigation, represents

[487] Carolina Citterio, "Italy Launches its First Space Economy Law. An Initial Step Towards a Regulated and Competitive Space Sector," Italy Intellectual Property Blog, 2 settembre 2025
[488] Permanent Mission of Italy to the United Nations, "Italy's Presidency of the UN General Assembly First Committee Begins," New York, October 8, 2025,
[489] United Nations, "New Permanent Representative of Italy Presents Credentials," Press Release BIO/5617, January 23, 2026, https://press.un.org
[490] United Nations General Assembly, *Prevention of an Arms Race in Outer Space*, annual resolutions, UN Doc. A/RES/
[491] Permanent Mission of Italy to the United Nations, "Statement by the Chair of the First Committee at the Opening of the Eightieth Session," October 2025.

the most advanced body of operational norms currently available at the multilateral level.[492] Italy's role as COPUOS Chair is directly related to policy areas in which the country has already invested political emphasis, as mentioned earlier, Rome has been consistent in viewing debris generation, congestion, and sustainability as issues that have implications for security, which go beyond the strictly technical or environmental aspects. In COPUOS, these issues are addressed in a governance logic centred on risk prevention and operational responsibility rather than deterrence and arms control.[493] In chairing COPUOS, Italy will be able to influence the discussion on the consolidation, interpretation, and possible extension of existing guidelines, including those on debris mitigation and the current legal and regulatory aspects of STM.[494] Keeping in mind that the Chair is subject to the rules of *consensus* and procedural impartiality, the role of the presiding State in shaping agendas, facilitating convergence, and setting priorities gives to the Chair State a significant role in shaping the output of the Committee.

CHAPTER IV

HUMANISTIC PERSPECTIVES: RIGHTS, ETHICS, AND THE FUTURE

1. Space Systems as Enablers of Human Rights

1.1 Space connectivity and access to information

The previous chapter analysed the institutional and normative framework currently employed to address space security, emphasizing the structural deficiencies of the United Nations system and the development of adaptive, plurilateral, and sector-specific governance responses. Although these developments have largely been discussed in relation to strategic stability, arms control, or regulatory effectiveness, we previously mentioned how they also carry significant repercussions for individuals, societies, and States that increasingly depend on space-based infrastructure on a daily basis. Space security is therefore not only a topic of interstate relations, but also a question with direct human, social, and ethical consequences.

[492] United Nations Committee on the Peaceful Uses of Outer Space, *Guidelines for the Long-Term Sustainability of Outer Space Activities*, UN Doc. A/74/20 (2019).
[493] United Nations Office for Outer Space Affairs, "Statements by Italy," COPUOS Legal Subcommittee, 62nd Session (2023).
[494] United Nations Committee on the Peaceful Uses of Outer Space, *Report of the Legal Subcommittee on its Sixty-Second Session*, UN Doc. A/AC.105/1260 (2023).

The rapid growth of satellite-based connectivity has had a great impact on reshaping the ways in which fundamental human rights are protected and exercised. While international human rights law does not recognize a separate "right to satellite internet," access to satellite communications is becoming an infrastructure more and more important for people to enjoy their rights under existing legal frameworks, especially the right to freedom of expression and access to information protected by Article 19 of the International Covenant on Civil and Political Rights (ICCPR).[495] In this sense, satellite connectivity is not a new right in itself, but rather a structural condition on which the effective realization of established rights increasingly relies. Article 19 of the ICCPR protects the right to seek, receive, and share information and ideas of all kinds, no matter where they come from and the Human Rights Committee has always read this provision broadly, stressing that States have a duty to ensure that individuals can access information in a way that is meaningful, diverse, and useful.[496] In modern societies, where digital communication is essential for political engagement, education, economic activities, and access to public services, the availability of dependable connectivity is increasingly linked to the essence of this right. Satellite systems, in particular, are important because they connect people in places where traditional networks are weak or non-existent, such as in remote, rural, maritime, and crisis-affected areas.[497] From a human rights perspective, satellite internet assumes particular significance in situations of structural marginalization and emergency, in fact, the United Nations has stated many times that nowadays having access to digital communication technologies is necessary for the application and realization of a wide range of rights, such as freedom of expression, access to education, and participation in public life.[498] The Human Rights Council has also declared that the same rights that people have offline must also be protected online, showing the importance of protecting both digital access and human rights.[499] Although these instruments do not differentiate between terrestrial and satellite connectivity, the functional implication is evident: when satellite systems represent the only feasible means of access, their disruption or denial can directly limit the enjoyment of protected rights. Such dependence becomes even more evident in humanitarian and conflict-affected settings, where satellite communications are regularly used to support humanitarian coordination, deliver emergency information, enable telemedicine and maintain contact between displaced populations

[495] International Covenant on Civil and Political Rights, adopted December 16, 1966, 999 U.N.T.S. 171.
[496] UN Human Rights Committee, *General Comment No. 34: Article 19: Freedoms of opinion and expression*, UN Doc. CCPR/C/GC/34 (2011), paras. 11–15.
[497] United Nations Office for Outer Space Affairs, *Space2030 Agenda: Space as a Driver of Sustainable Development*, UN Doc. A/AC.105/2018/CRP.3 (2018).
[498] UN Human Rights Council, *The promotion, protection and enjoyment of human rights on the Internet*, UN Doc. A/HRC/32/L.20 (2016).
[499] UN Human Rights Council, A/HRC/32/L.20 (2016).

and essential services.[500] It is in these contexts that the loss or degradation of satellite connectivity, whether due to deliberate interference, cyber operations, or debris-related disruptions, may have immediate, indiscriminate and severe effects on civilian populations. These repercussions therefore raise significant concerns, as they may amount not only to violations of international humanitarian law where applicable, but also international human rights law interfering with access to information and other rights that are necessary for survival and dignity.[501] At the same time, however, the increased importance of satellite connectivity also creates difficulties with traditional concepts of State responsibility. Unlike other forms of connectivity, satellite internet services are typically provided through transnational infrastructure managed by private actors, which further complicates regulatory regimes in this field. This creates challenges for the ability of States to meet their human rights obligations, as access to information is not within their control. In this context, the Human Rights Committee has issued guidance stating that States must take appropriate measures to prevent, investigate, and remedy violations by private actors, especially when these actors have assumed roles that are indispensable to the exercise of human rights.[502] In the context of satellite connectivity, this means that States have a role to play with regard to regulation, facilitation, and protection of access to satellite-based communications, as they are indispensable to the exercise of rights under Article 19. The latest UN policy initiatives serve to further reinforce the human rights dimension of satellite connectivity: the UN's Global Digital Compact, as part of the Our Common Agenda framework, focuses on the importance of universal connectivity as a precursor to development and democratic participation.[503] Although these policy initiatives are mainly restricted in terms of developmental and democratic participation, they indirectly recognize that the absence of connectivity can translate into serious constraints on the effective enjoyment of human rights, in fact, the use of satellite technology is highlighted as a means of addressing the digital divide, especially in least developed countries and geographically disadvantaged regions. This serves to reinforce the view that the disruption of satellite connectivity is not simply an issue of technological failure but has potential human rights dimensions.[504] It is important to clarify that recognizing satellite internet as an enabling infrastructure for human rights does not automatically confer an absolute right to satellite internet, as international human rights law does permit certain limitations to freedom of expression and information, as long as these limitations are legitimate, lawful, and

[500] International Committee of the Red Cross, *Digital technologies and the protection of civilians*, Geneva, 2021
[501] ICRC, *Digital technologies and the protection of civilians* (2021).
[502] UN Human Rights Committee, *General Comment No. 31: The Nature of the General Legal Obligation Imposed on States Parties to the Covenant*, UN Doc. CCPR/C/21/Rev.1/Add.13 (2004), para. 8.
[503] UN Secretary-General, *Our Common Agenda*, UN Doc. A/75/982 (2021).
[504] United Nations, *Global Digital Compact: Zero Draft*, 2023.

proportionate.[505] Nevertheless, this legal regime also strictly regulates arbitrary or indiscriminate interference with freedom of expression and information. Any form of broad interference with satellite internet, whether through physical destruction, debris creation, or subtle technical interference is difficult to reconcile with these legal requirements, especially when such interference affects communities with no other alternatives.

In this respect, the human rights analysis reinforces the broader argument advanced in this thesis: space security is not a purely strategic or military concern, but a domain with direct consequences for civilian life and social resilience. With satellite connectivity becoming increasingly integrated into the practical aspects of human rights and their enjoyment, its protection becomes a matter of public interest that goes beyond the interests of spacefaring States. Hence, safeguarding the safety, sustainability and reliability of satellite systems is not merely an issue of responsible space governance but also a necessary condition for the effective protection of fundamental human rights in a world that is increasingly more reliant on space-based infrastructure.

1.2 Impact of Intelligence Satellites on Privacy and Freedom of Movement

The increasing use of satellite remote sensing and surveillance systems has brought about a new level of complexity in the relationship between space activities and the protection of human rights. In contrast to satellite communications, Earth observation satellites and intelligence satellites are instruments of information extraction, which have the potential to significantly alter State activities in the framework of border control, migration, and law enforcement. Admittedly, as discussed later in this chapter, these satellites have immense potential in the context of situational awareness and policy formulation, however, their increasing use also gives rise to serious concerns with respect to the right to privacy and freedom of movement guaranteed under Articles 17 and 12 of the International Covenant on Civil and Political Rights (ICCPR).[506] The first one, Article 17 ICCPR, provides a wide-ranging guarantees against arbitrary or unlawful interference with privacy, family, home, or correspondence,[507] and the Human Rights Committee has interpreted this article as including not only physical intrusion but also other types of surveillance and data gathering that intrude on an individual's privacy, including those carried out through technological means.[508] In this regard, satellite observation challenges the conventional concept of privacy because it allows for persistent and persistent surveillance of individuals and groups across borders, and even if

[505] ICCPR, art. 19(3).
[506] International Covenant on Civil and Political Rights, adopted December 16, 1966, 999 U.N.T.S. 171.
[507] ICCPR, art. 17.
[508] UN Human Rights Committee, *General Comment No. 16: Article 17 (Right to Privacy)*, UN Doc. HRI/GEN/1/Rev.9 (Vol. I) (1988).

images do not record personally identifiable information, the compilation and analysis of satellite information, especially when combined with other information, can create a detailed picture of an individual's or group's movements and behaviour.[509] From the human rights perspective, the core issue does not lie in the existence of satellite surveillance per se but in the context in which it occurs; in fact, the international human rights system provides for interferences with the right to privacy if they are in accordance with the law, have a legitimate purpose, and are necessary and proportionate.[510] In contrast to this, satellite surveillance occurs in a context that is not particularly transparent, often raises questions of extraterritoriality and involves a number of State and non-State actors that make it extremely difficult to assign responsibility to anyone, especially when the person under surveillance is not even aware of it and does not have an effective remedy.[511] The issue of the consequences of satellite monitoring is particularly evident in the context of migration control and border management where States increasingly make use of satellite imagery and geospatial information to monitor migration routes, identify irregular crossings, and support interception or deterrence actions.[512] In the Mediterranean region, in particular, but also in other areas, satellite monitoring has been incorporated into larger systems of "datafied borders," where algorithmic processing and remote sensing are used to support decisions that affect the movement of individuals well before they reach a physical border.[513] In this context, while the use of satellite data to monitor migration flows is often justified on grounds of security and migration control, it gives rise to serious concerns with regard to Article 12 ICCPR, which guarantees the liberty of movement and the freedom to leave any country, including one's own.[514] In this respect, the use of satellite data to control migration flows can have the indirect effect of limiting freedom of movement by facilitating pre-emptive interception, externalized border control, and cooperation with third countries that may not guarantee the same level of human rights protection,[515] practices that increasingly blur the line between surveillance and enforcement, and transform satellite monitoring into a tool that shapes mobility outcomes without the procedural guarantees that are normally required in individual decision-making. In this respect, from a human rights perspective, the issue is not only the limitation of movement, but the lack of individualized scrutiny and due process in relation to the

[509] UN Special Rapporteur on the right to privacy, *Surveillance and human rights*, UN Doc. A/HRC/41/35 (2019).
[510] ICCPR, arts. 12(3) and 17.
[511] UN General Assembly, *The right to privacy in the digital age*, UN Doc. A/RES/73/179 (2018).
[512] European Union Agency for Fundamental Rights, *Fundamental Rights Implications of the Use of Surveillance Technologies in Border Management* (Luxembourg: Publications Office of the EU, 2020).
[513] Didier Bigo et al., "Datafication of Borders and Security," *International Political Sociology* 13, no. 4 (2019): 356–374.
[514] ICCPR, art. 12.
[515] UN Special Rapporteur on the human rights of migrants, *Report on the use of digital technologies in migration governance*, UN Doc. A/HRC/47/30 (2021).

use of satellite data to justify broad operational measures.[516] Recent literature has highlighted the importance of satellite surveillance being considered in the context of the *"datafication of governance"*. Lubin and Tang for instance, describe this issue as data injustice, where data practices systematically put vulnerable groups at risk of being tracked, excluded, or harmed, while also protecting those who govern from being held accountable.[517] Satellite surveillance is one of these practices, where groups are made legible through the constant extraction of data, but are still excluded from the decisions made about the data that is shared. All this is additionally true in the context of migration where satellite data is also used for purposes other than its original intention of collection, such as supporting enforcement and deterrence policies that have a significant impact on the safety and mobility of individuals.[518] Furthermore, the practices of satellite surveillance disproportionately impact vulnerable groups of people, such as migrants, asylum seekers, and refugees, which led the UN human rights bodies to consistently emphasize that the use of surveillance technology without proper safeguards can lead to the perpetuation of existing asymmetries of power and discrimination.[519] In the context of migration, the use of remote sensing technology could lead to a phenomenon of "invisible governance," where decisions that have a profound impact on people's lives are made through the analysis of data from a distance, rather than through direct interaction with those individuals.

An additional topic raising from the so far treated issue is the attribution of responsibility deriving from the transnational character of satellite surveillance. In fact, Earth observation satellites function transnationally with the data gathered by one State that is processed by the private sector and disseminated to various governmental agencies. The international human rights regime, however, holds that States cannot escape their responsibilities by acting extraterritorially or through third parties which is why the Human Rights Committee has clarified that States remain responsible for ensuring that surveillance measures they deploy or rely on comply with human rights obligations, including through regulation of private actors.[520] When applied to satellite surveillance, this rule would imply that States are responsible for ensuring that the use of remotely sensed data is in conformity with human rights norms, without considering where the data is gathered and processed. For these reasons, recent reports by the UN have highlighted the need for greater human rights protection in the use of surveillance technology, including satellite data. The UN Special Rapporteur on the right to privacy has highlighted the fact that the development of

[516] UNHCR, *Legal considerations on the use of surveillance technologies in border control*, 2020.
[517] Asaf Lubin and Cherry Tang, "Data Injustice in Global Justice," UC Davis Law Review 59 (2025): 147–226.
[518] *Ibid.*
[519] UN Office of the High Commissioner for Human Rights (OHCHR), *The right to privacy in the digital age*, UN Doc. A/HRC/48/31 (2021).
[520] UN Human Rights Committee, *General Comment No. 31*, UN Doc. CCPR/C/21/Rev.1/Add.13 (2004), para. 10.

remote sensing technology threatens to outstrip current legal frameworks, with a need for greater transparency and accountability.[521] While these debates have focused on digital surveillance on Earth, the same arguments can be applied to space-based systems that offer a form of persistent surveillance that is difficult to dispute. In this respect, satellite monitoring and remote sensing are only examples of the problem that has been identified so far in the past paragraphs and chapters: the divide between the strategic management of space activities and their human-level implications. Even if the international space law has always focused on the sovereignty of States, peaceful use, and liability, it has however not paid much attention to the use of space-based information in influencing the lives of individuals, a gap that needs to be closed by bringing human rights into the debate on space management, as ensuring the sustainability and security of outer space is more than just a question of preventing conflict or debris proliferation, it is also crucial to ensure that space technology does not become a means of unbridled surveillance and exclusion. With the reliance on remote sensing technology continuing to escalate, the need to adopt a human rights approach to space governance will be imperative to maintaining the normative integrity of space.

1.3 Asymmetric Vulnerability and Risks for States Without Space Capabilities

As anticipated, the growing importance of space-based systems to the conduct of civilian life has radically transformed the character of security risk distribution in the international system. Despite the fact that the use of outer space has been considered for many years a place of strategic rivalry between technologically advanced States, more recent assessments have emphasized that the most pressing risks of space insecurity are, in fact, carried not by space-faring States, but by those States and peoples that do not possess their own space capabilities. This dichotomy, between those who control the space environment and those who rely upon it but do not control it, illustrates the current state of space governance and poses important questions about equity, responsibility, and human security to address.[522] More precisely, as the situation stand today, non-spacefaring States are heavily dependent on satellite services offered by other governments, international bodies, or private entities for critical civilian uses which include weather forecasting, disaster warning, navigation, agricultural monitoring, telecommunication, and connectivity to global financial and humanitarian systems, among others.[523] The issue emerges as while these non-spacefaring States are in this situation, they lack the ability to shape the safety and sustainability of the space environment,

[521] UN Special Rapporteur on the right to privacy, A/HRC/41/35 (2019).
[522] UNIDIR, *Space Security and Global Inequality* (Geneva: UNIDIR, 2022).
[523] United Nations Office for Outer Space Affairs, *Space2030 Agenda: Space as a Driver of Sustainable Development*, UN Doc. A/AC.105/2018/CRP.3 (2018).

on which their critical civilian uses depend. This makes them highly susceptible to the negative effects of congestion, interference, or debris-related events, despite their minimal role in creating or managing these risks.[524] The United Nations Institute for Disarmament Research (UNIDIR) has been a leader in thinking about this challenge named asymmetric vulnerability: in a series of studies issued over the past year UNIDIR has suggested that the risks of space security are not randomly distributed, but rather that they reflect and reinforce existing inequalities in the world.[525] Those States with high levels of space situational awareness and defensive capabilities are able to absorb shocks, redirect functions, or compensate for losses in ways that are simply not possible for less technologically advanced actors. In contrast, States that rely on a few satellite communications may see cascading socio-economic consequences from even small disruptions.[526] This imbalance has profound implications for the concept of space security which has traditionally focused on the safeguarding of national resources and strategic stability between the great powers, but from the point of view of non-spacefaring countries, the threat is not necessarily the military strike against satellites but rather the vulnerability of the availability of services that are essential to development, security, and governance. In this sense, UNIDIR has underscored that space insecurity is essentially a risk multiplier for human insecurity,[527] a problem even worsened by the fact that many of the States that lack space capabilities have also limited representation or influence in the bodies where the rules of space governance are being shaped. Although COPUOS is formally organised on the principle of sovereign equality, in practice, full participation often requires a level of technical knowledge, diplomatic effort, and financial resources that are not evenly distributed.[528] As a consequence, the results of governance may come to reflect the interests and risk perceptions of space-faring States, even if the downstream risks are most acutely felt in other places. This has been characterized as a form of "structural exclusion," where States most vulnerable to space insecurity have the least influence over the rules of space governance.[529] Additionally, the reliance on external space-based services can pose certain political autonomy and resilience challenges. The satellite data and services are usually embedded in certain contractual or strategic relationships that can be disrupted by geopolitical tensions, which, for countries that do not have alternative space-based services, can translate into severe constraints of their policy autonomy,[530] a dynamic particularly

[524] UNIDIR, *Space Security and Global Inequality* (2022).
[525] UNIDIR, *Space Security and the Law: Threats, Challenges and Opportunities* (Geneva: UNIDIR, 2022).
[526] *Ibid.*
[527] UNIDIR, *Space Security and Global Inequality* (2022), 12–18.
[528] Ram S. Jakhu and Paul Stephen Dempsey, *Routledge Handbook of Space Law* (London: Routledge, 2017), 67–73.
[529] M. Listner, "Space Law and the Problem of Structural Exclusion," *Astropolitics* 18, no. 2 (2020): 101–118.
[530] SIPRI, *Security in Space: Vulnerability, Stability and Arms Control* (Stockholm: SIPRI, 2021).

salient for regions that are vulnerable to climate-related disasters.[531] This link between space insecurity and socio-economic rights will be further analysed in the following paragraph.

The analysis of UNIDIR also emphasizes that this asymmetric vulnerability is not fixed but cumulative, meaning that as space becomes more congested and contested, the risk of incidents also increases, and consequently, the risk of disruptions also affecting the dependent States.[532] However, the growing commercialization of space has also led to the emergence of new actors whose incentives may not be consistent with the risk tolerance of the vulnerable users, indeed, even if the private satellite operators can increase access and innovation, they can also lead to increased congestion.[533] This opinion is supported by the literature, with authors such as Moltz and Jakhu suggesting that the current state of space governance is still not adequately equipped to deal with issues of distributive justice, being more concerned with issues of access and liability than vulnerability and dependency.[534] Weeden and Samson make a similar observation regarding the current status of norms, arguing that they do little to support actors who are not in a position to actively counter orbital risks, thereby transferring the costs of space insecurity to those who are least able to afford them, which is consistent with the overall dynamics of global commons management, where powerful users of the environment shape it, and the weaker users absorb the negative externalities out of it.[535] In this sense, to the extent that the access to satellite services becomes a prerequisite for the exercise of rights related to food security, health, information, and protection against disasters, disorders that particularly affect certain States raises questions about equity and responsibility: inasmuch as international human rights law focuses on States as primary subjects of responsibility, UNIDIR and other commentators suggest that collective responsibilities may arise if systemic risks are caused or perpetuated by those who could prevent them.[536] This approach is consistent with emerging debates on shared responsibility and due diligence in global risk governance. Nevertheless, as already analysed before, the existing frameworks of space governance provide only limited recourse, with the liability framework of international space law being centred on the damage inflicted by particular space objects, and not well-equipped to deal with the systemic damage that can be caused by congestion or debris.[537] At the same time, soft law measures, while useful for norm-building, are not enforceable and may not provide sufficient

[531] UN Office for Disaster Risk Reduction, *Early Warning Systems and Space-Based Data* (UNDRR, 2021).
[532] UNIDIR, *Space Security and Global Inequality* (2022), 44–49.
[533] Brian Weeden and Victoria Samson, *Global Space Governance* (Washington, DC: Secure World Foundation, 2021), 150–157.
[534] James Clay Moltz, *The Politics of Space Security*, 3rd ed. (Stanford: Stanford University Press, 2019), 215–223.
[535] Weeden and Samson, *Global Space Governance*, 141–149.
[536] UNIDIR, *Space Security and Global Inequality* (2022), 55–60.
[537] Fabio Tronchetti, *The Exploitation of Natural Resources of the Moon and Other Celestial Bodies* (Leiden: Brill, 2009), 182–186.

safeguards for the interests of vulnerable users. UNIDIR has thus urged that equity and inclusivity have to be given more prominence in the discourse on space security, and that the views of non-spacefaring States have to be brought into the norm-building process.[538] From a human-centric approach, therefore, addressing asymmetric vulnerability implies a change in the framing of space security from one of competitive advantage to collective risk management. This implies, among other things, an understanding that the integrity of the orbital environment is a global public good whose deterioration is most harmful to those who have the least ability to influence the situation, as well as an improvement in capacity-building, information-sharing, and access to institutional resources for States that rely on space systems but do not control them.[539]

In conclusion, the risks faced by States without space capabilities demonstrate that there is a fundamental tension in the heart of contemporary space governance. As our reliance on services provided by space increases, so too does the division between those who shape the space environment and those who rely upon it. UNIDIR's work highlights that this is not only a technical but also a normative issue that challenges our assumptions regarding the way in which we govern the outer space environment. Addressing the problem of asymmetric vulnerability is critical to any truly human-centric approach to space security that recognizes that the security of the orbital environment is inseparably linked to the security of vulnerable populations on Earth.[540]

2. Satellites and Environmental Protection

The connection between activities in outer space and protecting the environment is one of the most important but least studied parts of modern space governance. Satellite systems have become essential for monitoring, predicting, and responding to climate change, environmental degradation, and extreme weather events as they rapidly increase. Unlike the use of space for strategic and economic purposes, satellites for environmental protection are first and foremost closely related to the protection of the right to life, livelihood, and socio-economic rights of people. In this regard, the correlation between space activities regulation and the realization of the right to an adequate standard of living as provided for in Article 11 of the International Covenant on Economic, Social and Cultural Rights (ICESCR) is very much significant. [541] More precisely, this Article guarantees the right of all people to an adequate standard of living which among other things includes the necessary food, clothing, shelter, housing, as well as the improvement of living

[538] UNIDIR, *Reducing Space Threats through Norms of Responsible Behaviour* (Geneva: UNIDIR, 2023).
[539] UNOOSA, *Capacity-Building in Space Law and Policy* (Vienna: UNOOSA, 2020).
[540] Victoria Samson, "Equity and Sustainability in Space Governance," *Space Policy* 58 (2021): 101446.
[541] International Covenant on Economic, Social and Cultural Rights, adopted December 16, 1966, 993 U.N.T.S. 3.

conditions; [542] additionally, the Committee on Economic, Social and Cultural Rights (CESCR) has elucidated this right, stating that it covers not only the supply of material goods, but also the presence of systems or services to protect the well-being of people from potential threats. [543] With the growth of climate unpredictability, environmental degradation, and the increased occurrence of disasters, satellite-based Early Warning Systems (EWS) have become essential infrastructures for States to fulfil their obligations and generally speaking, satellites play a crucial role in the continuous observation of the climate system, weather patterns, deforestation, and land degradation, as well as water availability and extreme event predictions such as hurricanes, floods, droughts and heatwaves.[544] Besides that, data obtained from Earth observation satellites provide critical inputs to the situation to the World Meteorological Organization (WMO), the Intergovernmental Panel on Climate Change (IPCC), and also to disaster management organizations where, without regular satellite watch, it would be nearly impossible to anticipate and react to environmental threats, most especially in the areas that are the most subject to disasters.[545] This link between satellite, environmental monitoring and human rights is becoming an increasingly acknowledged structure within the UN system, was the Office of the High Commissioner for Human Rights has noted that *"environmental damage directly causes the violation of economic, social and cultural rights, among which are the rights to food, water, housing, and health."*[546] In this regard, as anticipated, early warning systems mark the closest intersection between satellite infrastructure and the right to an adequate standard of living. The United Nations characterize EWS as comprehensive systems that detect hazards, predict impacts, convey risk information, and allow for a timely response, where, of course, satellites are the core of these systems, providing continuous data about the state of the atmosphere, oceans, and land.[547] UNDRR and WMO report that countries with well, functioning multi-hazard early warning systems can reduce the impact of disasters by up to 30 percent.[548] On the other hand, the lack or breakdown of such systems is strongly linked with higher death tolls and economic losses, especially in poor and climate-vulnerable countries.[549] Seeing this gap, the UN Secretary-General initiated the *"Early Warnings for All"* campaign in 2022 with the aim of ensuring that everyone is protected by early warning systems by 2027, an initiative that particularly points out satellite data as one of the core components of global early warning capacity, together with

[542] ICESCR, art. 11.
[543] CESCR, *General Comment No. 12: The Right to Adequate Food*, UN Doc. E/C.12/1999/5 (1999).
[544] World Meteorological Organization, *The Global Observing System for Climate* (WMO, 2022).
[545] IPCC, *Sixth Assessment Report*, Working Group II (2022).
[546] OHCHR, *Human Rights and the Environment*, UN Doc. A/HRC/43/53 (2020).
[547] UNDRR, *Early Warning Systems: A Checklist* (UNDRR, 2018).
[548] UNDRR and WMO, *Global Status of Multi-Hazard Early Warning Systems* (2022).
[549] UNDRR, *Global Assessment Report on Disaster Risk Reduction* (2022).

ground, based observation and communication networks.[550] The way the initiative is presented reflects a key change in norms: early warning is no longer considered only as a technical or developmental challenge but more and more as a question of equality and human security.[551] Following this argument, access to early warning information can be framed as enabling the effective realization of Article 11 (and related rights such as health and life) of the ICESCR from a right-based perspective. The Committee on Economic, Social and Cultural Rights (CESCR) has pointed out that the States are under obligation to take preventive measures against threats that are adequately predictable to the living conditions and these include natural hazards,[552] hence, where satellite-based EWS are the main source of hazard prediction, their availability, dependability and consistent provision becomes legally relevant and not an option. Neglecting these systems, whether through the governance failure, lack of investment, or space insecurity, may not directly violate, but can nonetheless profoundly affect the socio-economic rights of the people.

Furthermore, the distributive dimension of using satellites to support environmental protection is especially significant. While climate change is a global phenomenon, its effects are more severely suffered by developing countries and disadvantaged communities that, in many cases, are highly dependent on satellite data provided from outside their regions. UNDRR reports that least developed countries have a very small share of the global disaster losses in absolute terms, however, they suffer the highest losses when these are related to GDP and human development indicators.[553] This disparity is a reflection of the general pattern of dependency that was illustrated in the previous section: those who are most vulnerable to environmental hazards are generally those who have the least control over the space-infrastructures that help to mitigate these risks. More and more scholars have pointed out such dependency as a challenge of governance rather than merely a technical one. Rayfuse and Scott highlight the fact that environmental monitoring with space-based systems leads to the emergence of the new forms of "epistemic power", where the States and organizations owning satellite data decide what environmental risks are, and in fact, they give their definition, set the priorities and solutions.[554] Also, other studies claim that the access to climate data determines the level of participation and influence in global environmental governance and thus, lead to raising concerns about inclusion and equity.[555] In this way, scholars are trying to point out

[550] UN Secretary-General, *Early Warnings for All* initiative, 2022.
[551] United Nations, *Our Common Agenda*, UN Doc. A/75/982 (2021).
[552] CESCR, *General Comment No. 15: The Right to Water*, UN Doc. E/C.12/2002/11 (2002).
[553] UNDRR, *Global Assessment Report* (2022).
[554] Rosemary Rayfuse and Shirley Scott, "International Law in the Era of Climate Change," *Melbourne Journal of International Law* 13 (2012): 1–35.
[555] Fariborz Zelli and Harro van Asselt, "The Institutional Fragmentation of Global Environmental Governance," *Global Environmental Politics* 13, no. 3 (2013): 1–22.

the dynamic according to which environmental protection through satellites, which is supposedly a neutral act, is actually very much involved in the wider global inequality structures.

The vulnerability of satellite systems themselves is another element that adds to this complexity. Environmental monitoring and EWS require that the orbital environment be sustainable over the long term, which however is, how we have now noted multiple times, increasingly challenged by congestion, debris, and interference. If Earth observation satellites were disrupted either unintentionally or intentionally the ability to give early warning could be reduced at the very time when such measures are most necessary. It is in this regard that the assessments of Secure World Foundation and ESA have highlighted that the increase in satellite numbers in the main orbital regimes is raising the risk of collisions for Earth observation constellations that are essential for climate and disaster monitoring.[556] Such vulnerability raises therefore important normative questions, as it follows that if satellite-based environmental monitoring is indispensable for the protection of socio-economic rights, then any damages to these systems would have a human dimension extending the interests of individual operators becoming more than just a matter of space sustainability but also an absolute necessity for human well-being. An idea that reinforces the arguments put forward at the recent UN discussions where the safety of space was to be measured by its effects on civilian life.[557] International environmental law and human rights law essentially meet each other on this point, with the United Nations General Assembly that has acknowledged the right to a clean, healthy, and sustainable environment, thereby emphasising that human rights and environmental protection are closely linked, and that without the aforementioned capabilities, there is a risk that both environmental governance and the protection of rights will be compromised.[558] Nevertheless, despite this importance of theirs, satellite-based early warning and environmental monitoring systems still remain quite uneven in terms of accessibility and, mostly, have an inefficiency problem in many cases. In countries like India, for instance, major limitations remain in terms of human resources with the capacity to analyse remote sensing data. Other limitations include the absence of effective communication infrastructure, which further obstructs the effectiveness of early warning systems even when satellite data is available.[559] On this matter, World Bank studies have emphasized that these systems become effective only when they are accompanied by sufficient social and institutional infrastructure that has the capacity to receive warnings, analyse them and act upon them in a timely manner. This further emphasizes the need for a governance structure that can combine space-based data with local knowledge and develop

[556] Secure World Foundation, *Global Counterspace Capabilities* (2023).
[557] UN General Assembly, *Reducing Space Threats through Responsible Behaviours*, UN Doc. A/78/— (2023).
[558] UN General Assembly, *The human right to a clean, healthy and sustainable environment*, A/RES/76/300 (2022).
[559] WMO, *State of Climate Services* (2023).

effective communication strategies that can further enhance readiness and preparation.[560] Hence, emphasizing the crucial concept previously mentioned, from a governance perspective the continued dependency on satellites for environmental protection is an argument for considering space systems as a part of critical global infrastructure. Therefore, many claim that climate-related infrastructures that have a transboundary impact need to have governance arrangements between states, which reflect the concepts of shared responsibility and differentiated capability.[561] Applying this logic to space, the issue of maintaining environmental satellites is a collective responsibility and not subject to the discretion of any country.

In conclusion, there is no doubt that satellite-based environmental monitoring and early warning systems are at a critical point in space governance, environmental protection, and human rights. Through these, countries are able to mitigate the effects of environmental risks, improve disaster resilience, and sustain the material basis for a decent standard of living. However, their unequal distribution, exposure to space conflicts and lack of proper governance reveal the obvious inequalities that exist in the global management of environmental risks. Solving these problems calls for a human-centred concept of space security and a recognition that satellites are not simply strategic or commercial assets but infrastructures that are necessary for human dignity, resilience, and survival.[562]

3. Proposals for a Human-Centric Governance

3.1 Space Traffic Management with Civil Society Participation

As the density and diversity of space activities continue to rise, Space Traffic Management (STM) has come to be recognized as one of the most pressing governance challenges in outer space. Conventionally defined as a technical or operational problem, relating to collision avoidance, conjunction analysis, and satellite coordination, STM has increasingly come to have wider normative implications. In a context in which orbital saturation, debris, and satellite interference pose a direct challenge to the provision of services that are essential to the conduct of civilian life, STM can no longer be regarded as a technical problem; instead, it needs to be conceptualized as a form of human risk governance.[563] At its core, STM is the *"set of norms, procedures, and*

[560] World Bank, *Investing in Early Warning Systems* (2019).
[561] Shirley Scott and Lavanya Rajamani, "Global Climate Governance and Shared Responsibility," *International and Comparative Law Quarterly* 69, no. 1 (2020): 1–30.
[562] Victoria Samson, "Space Security and Human Security," *Space Policy* 59 (2022): 101470.
[563] UNIDIR, *Reducing Space Threats through Norms of Responsible Behaviour* (Geneva: UNIDIR, 2023).

institutional frameworks that ensure the safe, sustainable, and predictable functioning of space objects over the entire life cycle",[564] however, current practices are still fragmented, voluntary and unevenly applied. Although leading space-faring nations and companies have developed sophisticated space situational awareness (SSA) capabilities and internal coordination systems, there is no comprehensive international framework that regulates traffic management in space. This is especially challenging in light of the arguments developed in Section 1: the inevitable effects of disruptions to space systems have human consequences such as the failure of environmental monitoring and the loss of early warning systems and communication infrastructure. From a human-centric point of view, the question is not only how to prevent collisions but also who is at risk for the mismanagement of orbits and who is involved in determining the acceptable level of risk. As UNIDIR has pointed out, the risks of space security are asymmetrically distributed and States without space capabilities are more vulnerable to risks despite having little impact on the management of orbits.[565] STM is thus a place where issues of equity and responsibility are brought together, therefore, the United Nations has increasingly identified STM as a key area of cooperative governance, and within COPUOS, the issue of the long-term sustainability (LTS) of outer space activities has provided important background work in identifying guiding principles with respect to information exchange and responsible behaviour.[566] The LTS Guidelines, although non-binding, can be seen as implicitly recognizing that unmanaged traffic poses not only a danger to the safety of orbit but also to the continuity of space-based services necessary for sustainable development. Nevertheless, as has been pointed out by a number of authors, these guidelines do not extend to provide the institutional framework necessary to address real-time traffic risks in an increasingly commercial space environment.[567] These limitations of the current methods have led to a growing need for a more organised STM system and the policy analysis of ESA, OECD, and Secure World Foundation all point to the same conclusion that the current *ad hoc* coordination among the operators is not adequate in the crowded orbital environment.[568] Without a set of rules regarding data sharing, manoeuvring responsibility and prioritization of vital assets, the decision-making process in collision avoidance could become complex, disputed, and even politicized. From the human perspective, such a situation is a concern inasmuch as the decisions made in space could impact the availability of services that are used by the civilian population, even if the affected communities are not involved in the process. In this way, transparency and accountability are

[564] OECD, *Space Traffic Management: Ensuring the Safety and Sustainability of Space Activities* (Paris: OECD, 2020).
[565] UNIDIR, *Space Security and Global Inequality* (Geneva: UNIDIR, 2022).
[566] UN COPUOS, *Guidelines for the Long-Term Sustainability of Outer Space Activities*, UN Doc. A/74/20 (2019).
[567] Fabio Tronchetti and Ram S. Jakhu, "Space Traffic Management: Issues and Challenges," *Air and Space Law* 38, no. 4 (2013): 283–302.
[568] ESA, *Space Environment Report* (ESA, 2023); Secure World Foundation, *Global Counterspace Capabilities* (2023).

identified as the normative foundations of human-centric STM, with transparency representing more than a confidence-building measure between States but rather a necessary condition for evaluating how risks in space are addressed and for whom. Authors such as Schrogl and Hobe have identified that the principles of STM must be similar to those of global environmental governance, this includes access to information, public participation and impact assessment.[569] These principles have been recognized as a result of the realization that decisions in the technical domain have distributive consequences, especially when they relate to shared infrastructure. With regard to accountability, this is an even more complex issue. The current STM approach is very dependent on informal coordination and voluntary compliance which makes unclear who is responsible in case of failure in risk management. Scholars Jakhu and Weeden have pointed out that the lack of a *consensus* on liability or responsibility allocation for collision avoidance manoeuvres provides incentives for risk-shifting rather than risk-reduction.[570] In a human-centered approach, it is not acceptable to have ambiguity in responsibility, as it shifts the cost of orbital congestion to actors, such as non-spacefaring States and civil users, who do not have the capability to manage the risk on their own.

The role of civil society and non-governmental participation provides a partial answer to these weaknesses. Although the STM debate has historically been restricted to States, space agencies and private companies, an increasing body of literature highlights the importance of stakeholder engagement. Johnson-Freese for instance suggests that open governance processes can improve legitimacy and resilience by taking into account a variety of views on risk and harm.[571] In the context of STM, civil society groups, research institutions and humanitarian organizations can offer important perspectives on the human implications of orbital disruption, particularly in disaster response and environmental observation. Crucially, participation in civil society must be recognized not as a symbolic act, but as a functional aspect of effective governance; the UN processes in other areas of relevance, such as climate change, disaster risk reduction, and environment, have shown that stakeholder engagement leads to improved information and accountability.[572] This can be replicated in STM to enable the inclusion of human impact assessments in traffic management, in a way that the safeguarding of vital civilian services is taken into account. In this regard, UNIDIR has recently proposed the concept that STM could play a role as a bridge between technical governance and normative debates on space security.[573] Through the incorporation of responsible behaviour principles within operational traffic management, STM provides a pragmatic way to mitigate risks

[569] Kai-Uwe Schrogl and Stephan Hobe, "International Space Governance," *Space Policy* 47 (2019): 1–7.
[570] Ram S. Jakhu and Brian Weeden, "Global Space Traffic Management," *Journal of Space Law* 40 (2016): 33–60.
[571] Joan Johnson-Freese, *Space as a Strategic Asset* (New York: Columbia University Press, 2007).
[572] UNDRR, *Sendai Framework for Disaster Risk Reduction* (2015).
[573] UNIDIR, *Responsible Behaviour in Space* (2023).

without necessitating the immediate achievement of a *consensus* on binding arms control agreements. This corresponds to the incremental strategies of norm-building that were discussed in Chapter III.

From a theoretical position, STM can further be located within the discourse of global commons management. Deudney and other scholars have long suggested that areas of shared use and vulnerability demand different models of governance, ones that emphasize group limitation over individual benefit,[574] and STM reflects this principle as it stresses cooperation even among rival parties. However, without consideration for equity and participation, it threatens to replicate the very imbalances it is intended to regulate, favouring those with superior capabilities and relegating dependent users to the periphery. In this already complex context, the commercialization of space further complicates STM governance, as discussed earlier, with contemporary large number of satellites in low Earth orbit being owned by private companies which in turn launch mega-constellations that radically change traffic patterns. Although commercialization has led to increased access to space-based services, it has also contributed to congestion and the risk of cascading failures.[575] OECD research indicates that unless there are public interest protections, market-oriented STM solutions could lead to situations that are efficient but not resilient, making human-critical systems vulnerable to systemic shocks.[576] A proper STM approach that is human-focused, therefore, needs to balance efficiency with protection, this involves identifying some space systems, such as Earth observation satellites for early warning and disaster response, as critical infrastructure that requires stronger protection in traffic management systems, with the ESA and WMO that have both argued that priority mechanisms may be required to guarantee the continuity of services that are essential for human safety.[577]

Finally, the institutional question of where STM should be located remains unresolved. Although COPUOS offers a legitimate multilateral framework, its consensual nature and lack of enforcement mechanisms make it less capable of dealing with real-time traffic. For this reason, some authors have suggested a combination of norm-setting at the UN level and implementation at the regional or technical level,[578] nonetheless, from a human-centred perspective the answer to the institutional question should be informed not only by efficiency but also by inclusiveness and accountability. In conclusion, Space Traffic Management is a key point for the promotion of human-focused space governance, by conceptualizing STM not only as a means of dealing with orbital saturation but also as a tool for human risk management, it becomes possible to ensure that

[574] Daniel Deudney, *Bounding Power: Republican Security Theory* (Princeton: Princeton University Press, 2007).
[575] OECD, *The Space Economy in Figures* (2022).
[576] OECD, *Space Sustainability and Commercial Actors* (2021).
[577] WMO, *State of Climate Services* (2023); ESA, *Earth Observation and Disaster Management* (2022).
[578] Brian Weeden and Victoria Samson, *Global Space Governance* (Washington, DC: Secure World Foundation, 2021).

the principles of transparency, accountability and participation are incorporated into the very essence of space security. While STM by itself cannot address the structural issues of inequality that have been identified in the previous sections, it is still a practical and politically viable means of ensuring that space governance is aligned with the protection of human life and dignity.[579]

3.2 Common Heritage Model Inspired by the Law of the Sea

As illustrated in the previous sections, the growing dependence on outer space for vital civil purposes reveals a fundamental tension in modern space governance, namely that despite the indispensable role of space-based infrastructure to the protection of human rights, environmental sustainability, and disaster risk reduction, the normative framework that regulates outer space remains largely fragmented and State-centric. In this context, the Common Heritage of Mankind (CHM) principle, mostly developed within the law of the sea, constitutes a crucial normative tool for evaluating the distributive and structural deficits of the current space governance system, even if it does not offer a directly transferable legal paradigm. As mentioned in paragraph 4 of Chapter I, the United Nations Convention on the Law of the Sea (UNCLOS) and the treaties on outer space, especially the Outer Space Treaty and the Moon Agreement, share principles on peaceful use, non-appropriation, and the characterization of space as the *"province of all mankind"* and, in the Moon Agreement, as CHM. While both deal with the fair use of resources in areas beyond national jurisdiction, the Moon Agreement has its own set of challenges because of its limited ratification. However, similarities exist particularly in the right of transit, despite the fact that the sovereignty implications affect these rights in different ways in the maritime and outer space areas.

As a starting point, the principle of Common Heritage of Mankind emerged during the United Nations Convention on the Law of the Sea (UNCLOS) negotiations as a reaction to the perceived threat of technologically advanced States monopolizing access to deep seabed resources.[580] Now contained in Part XI of UNCLOS, the CHM aims to ensure that areas beyond national jurisdiction were administered for the benefit of all of humanity, with special consideration given to the interests and needs of developing countries.[581] The key components are non-appropriation, collective administration, equitable sharing of benefits, peaceful use, and intergenerational administration;[582] and although formulated with a different physical space in mind, these components are also highly relevant to current debates in outer space, where shared use

[579] Victoria Samson, "Human Security and Space Governance," *Space Policy* 59 (2022): 101470.
[580] United Nations Convention on the Law of the Sea, adopted December 10, 1982, 1833 U.N.T.S. 3.
[581] UNCLOS, Part XI.
[582] Rüdiger Wolfrum, "The Principle of the Common Heritage of Mankind," Heidelberg Journal of International Law 43 (1983): 312–337.

coexists with profound disparities in capability and access. In space law, we examined how the principle was introduced by the 1979 Moon Agreement in relation to the Moon and its natural resources; however, the treaty's limited ratification, particularly the absence of major spacefaring nations, has frequently been seen as evidence of the political impracticality of CHM in outer space.[583] In outer space discussions, it is argued that the principle is too redistributive, excessively legally indeterminate and incompatible with incentive schemes for investment and innovation, consequently, CHM has been replaced with more flexible and State-focused approaches based on freedom of use and national authorization schemes. Nonetheless, as discussed above, the modern space environment is fundamentally different from the Cold War era in which these debates originally took place and outer space is no longer a distant realm of symbolic exploration but rather a congested operational environment that supports vital civilian services on Earth. Additionally, the dangers posed by congestion, debris and fragmentation of governance are no longer limited to the States and peoples actively involved in space activities. Consequently, the rejection of CHM may obscure its contemporary relevance as a normative corrective principle rather than a rigid legal template. In this sense, reassessing the CHM does not mean giving full endorsement to the Moon Agreement in its original form but rather identifying the underlying values of the principle and determine whether these values are still relevant in the context of modern governance issues. According to Tronchetti and Jakhu, for instance, CHM should be viewed as a living concept that has the ability to adapt to new technological and political realities.[584] Thus, the principle of CHM that promotes equal access and the shared responsibility of space resources provides a much-needed balance to the current trend of governance that prioritizes first movers and technologically superior countries. Clearly, this is especially true in the context of the development of club-based governance structures such as the Artemis Accords explained in Chapter III, where the approach that focuses on voluntary cooperation, bilateral implementation, and compatibility with national law could lead to exclusion and the development of norms that are not universally applicable.[585] The normative critique in this case is not that the club-governance is necessarily illegitimate, but that it fails to provide a means of dealing with distributive effects, and the CHM provides a vocabulary for expressing the importance of such means. In posing outer space as a realm whose stability and availability is a collective concern, the CHM contests the form of governance that privileges efficiency and strategic fit over inclusiveness and equity.[586] Notably, the CHM also

[583] Fabio Tronchetti, The Exploitation of Natural Resources of the Moon and Other Celestial Bodies (Leiden: Brill, 2009), 45–60.
[584] Ram S. Jakhu and Fabio Tronchetti, Handbook of Space Law (Cheltenham: Edward Elgar, 2015), 365–372.
[585] Christopher Newman, "The Artemis Accords and the Future of Space Governance," Space Policy 56 (2021): 101419.
[586] Andrew G. Haley, "Space Law and the Common Heritage Concept," Journal of Space Law 1 (1973): 1–12.

brings an intergenerational aspect that is not always considered in modern debates on space governance: both the UNCLOS and the Moon Agreement include the importance of management for future generations, that is a realization that the use of common resources has considerable consequences for the future.[587] In the context of space, this attention is particularly relevant for the long-term nature of the problem of debris in space and the irreversibility of certain types of damage to the environment. This aspect has been argued to be an important consideration in space governance by scholars such as Deudney and Meyer who assess that intergenerational justice should be a priority in space governance because the choices made today could affect the use of orbital space for centuries to come.[588]

One of the key elements of the Common Heritage of Mankind principle is the absolute prohibition of sovereignty over areas and resources that fall within the category of the global commons. Under the United Nations Convention on the Law of the Sea, States are categorically prohibited from claiming or exercising sovereignty over the high seas and the seabed and its subsoil beyond the limits of national jurisdiction. In a similarly analogous approach, the Moon Agreement carries this same principle forward in the realm of outer space by explicitly prohibiting any national appropriation of the Moon and other celestial bodies, thereby giving effect to the principle of non-appropriation. This principle plays a crucial role in preventing the concentration or monopolization of the global commons by technologically advanced States or powerful non-State actors, while at the same time seeking to ensure that the benefits arising are shared equitably among all members of the international community. Therefore, the CHM represents a profound shift away from the traditional notion of territorial sovereignty and exclusive property rights, and instead promotes a normative vision based on collective governance, shared responsibility and cooperative management of spaces and resources that are considered to be the common property of humanity as a whole. In this way, the legal frameworks applicable to outer space and the high seas show a deep structural similarity in that both reject the idea of unilateral sovereignty claims by States.[589]

At the same time, the limitations of CHM must be acknowledged, as illustrated by the experience of the International Seabed Authority (ISA) as prime example showing that the application of the concept of common heritage in a working system is a complex task and the application of such systems to outer space would face strong opposition and could hinder the

[587] Moon Agreement, art. 11.
[588] Daniel Deudney, Bounding Power (Princeton: Princeton University Press, 2007), 273–279.
[589] David Freestone, "The International Seabed Authority," International Journal of Marine and Coastal Law 30, no. 4 (2015): 687–714.

incentives for innovation.[590] Therefore, many authors propose a functional reinterpretation of the concept of common heritage which would concentrate on certain areas of governance rather than on the transplantation of the whole system.[591] In this way, the principles of common heritage could be applied to certain mechanisms, such as space traffic management, debris mitigation and access to essential data. For example, the principle of benefit-sharing does not necessarily have to involve the direct transfer of resources but could be realized through capacity-building, constructive access to space-based information and participation in decision-making processes.[592] Such measures are consistent with established UN practices and provide a practical way to tackle structural inequality without resorting to strict redistributive frameworks. This functional re-interpretation of CHM also helps in filling the gap between idealism and pragmatism, by establishing equity on the basis of tangible governance mechanisms, rather than mere statements of principle, CHM-inspired approaches can assist in supplementing incremental governance reforms discussed in Chapter III. In this sense, CHM does not conflict with such initiatives as STM or responsible behaviour standards, but rather serves as a normative guide to ensure that such initiatives remain attentive of human and distributive effects. Furthermore, the applicability of CHM is also supported by comparison with other global commons regimes: the increasing use of principles of common concern, shared responsibility and differentiated capability in environmental law, climate governance, and biodiversity conservation[593] reflects a recognition that while not all actors make an equal contribution to global problems, all have a stake in finding a solution to these problems. The same logic applied to space governance reinforces the importance of inclusive norm-making and collective restraint. The focal principle to keep in mind is that human effects of space insecurity call into question governance models that seek to regard outer space as a mere arena of competition and CHM, as a normative construct rather than a strict legal formula, provides a formulation for articulating why equity, participation, and long-term thinking must be core components of any human-centred approach to space governance.

In conclusion, the Common Heritage principle is still pertinent not inasmuch as it offers easy solutions, but because it reveals the normative inadequacies of current regimes. Through its focus on collective responsibility, intergenerational equity and the protection of vulnerable interests, CHM supports the operational changes and the overall thesis argument that space security

[590] The absence in outer space law of a centralized authority comparable to the International Seabed Authority established under UNCLOS and the 1994 Implementation Agreement, is a governance gap examined in Chapter I *see* para. 4

[591] Masson-Zwaan, T. L. (2023, February 9). Widening the horizons of outer space law. Meijers-reeks. Retrieved from https://hdl.handle.net/1887/3562089

[592] UNOOSA, Capacity-Building in Space Law and Policy (Vienna: UNOOSA, 2020).

[593] Lavanya Rajamani, Differential Treatment in International Environmental Law (Oxford: Oxford University Press, 2006).

governance needs to develop in ways that better capture the human dependencies and collective risks that characterize the modern space environment.[594]

CONCLUSIONS

The present thesis research has explored the current governance of outer space through a legal, institutional, and policy-oriented approach, with the scope of evaluating whether the existing international framework is sufficient in the context of an increasingly rapid militarization and weaponization processes, the rise of new private actors and the proliferation of dual-use and new technologies. Through an analysis of the evolution of space law from its Cold War roots to the current governance structures, this thesis has shown that the main challenge to space security does not consist in the lack of a legal framework, but rather in the increasing gap between the normative framework and the institutional capacity to interpret and implement these norms under conditions of an increased strategic competition.

The first part of this thesis has identified the structural foundations and limitations of the current legal framework. The analysis of the Outer Space Treaty and the following UN instruments illustrated how the current regime has proved comprehensively efficient in maintaining its core principles of non-appropriation and peaceful use, at the same time, it has also underlined the existence of important normative gaps, especially with regard to conventional counterspace weapons, dual-use technologies and the regulation of military activities below the threshold of weapons of mass destruction. The absence of a centralized authority as in other global commons regimes such as the seabed one, and the vagueness of the key provisions of the Outer Space Treaty led to a substantial situation of ambiguity, with States being able to operate in a way that formally does not violate the existing legal framework.

On the basis of this legal analysis, the second chapter then positioned space governance in its current strategic context. By analyzing the strategies and capabilities of the main and rising space powers, including their direct ascent anti-satellite weapons, counterspace strategies, and the return of nuclear risk in space, the thesis argued that technological innovation has increasingly destabilized the classical distinction between civilian and military space infrastructure. This is further complicated by the growing involvement of private actors, whose infrastructures are increasingly providing services that are critical to both civilian and military activities. Thus, it was

[594] Delgado López, L., Johnson, C. D., Samson, V., Simpson, M., Weeden, B. (2014). The Importance of the United Nations Guidelines for the Long-Term Sustainability of Space Activities and Other International Initiatives to Promote Space Sustainability. oasis, 20, 37-53.

presented the argument that commercial militarization not only challenges the existing frameworks of responsibility and liability, but also redistributes risk in ways that are disproportionately harmful to States and peoples lacking their own space capabilities.

The third chapter then examined the institutional dimension of space security governance, focusing on the United Nations system and demonstrating that governance outcomes are shaped by a persistent tension between institutional paralysis and incremental reform. The division of competences across the First Committee, COPUOS, UNOOSA and the Security Council has limited the UN's capacity to produce binding and enforceable outcomes, especially in a context of renewed great power rivalry. Its consensus-based decision-making, while being a normatively attractive approach, has in practice frequently lead to compromises with low effective outcomes or to procedural deadlock. Consequently, governance has increasingly moved toward soft-law instruments, voluntary commitments and norms of responsible behaviour. While these may offer pragmatic pathways to risk reduction, the thesis has shown how they also pose the risk of consolidating a fragmented and potentially exclusionary "club-based" order, in which norm-setting authority is exercised by technologically advanced States. This ambivalence was reflected in the analysis of so-called plurilateral initiatives, such as the Artemis Accord, which, if on the one hand may help creating operational norms and enabling cooperation when multilateral *consensus* proves unachievable, on the other hand may raise concerns regarding universality, legitimacy and distributive justice, especially when they influence practices that impact the space environment as a whole.

A central contribution of this thesis lies in its conceptualization of space security. Rather than seeing it merely as an inter-State strategic issue to be addressed through conventional arms control measures, the research has advanced the concept of space security as a form of human-risk governance. Through this lens, as the reliance on space-based services continues to grow, disruptions in orbit are increasingly translated into tangible risks on the ground, particularly in the areas of communication, navigation, environmental observation and disaster relief, making space-assets essential enablers for the enjoyment of basic rights in the contemporary scenario. These risks are not evenly distributed, with the most severe implications being borne by States and peoples who rely on space-based services but lack the ability to shape the rules that govern them. Thus, by combining space law with human rights, environmental protection and distributive justice, this thesis has demonstrated that governance choices in outer space inevitably carry ethical and social implications. In this respect, Italy's increasingly debris-focused approach, as explored through UN practice, exemplifies how sustainability-driven initiatives can provide a pragmatic entry point for balancing security, environmental protection and multilateral legitimacy.

The study, however, acknowledges its own limitations: the rapidly changing nature of the technological and geopolitical environment means that any assessment of capabilities, doctrines and governance efforts is inherently time-dated. Moreover, although this thesis has sought to incorporate lessons from other global commons regimes, it does not attempt to formulate a comprehensive institutional approach to the governance of outer space, but rather seek to identify viable courses within the existing political limitations.

With a perspective into the future, the findings suggest that the future of space security governance is unlikely to be shaped by a single broad treaty in the short term. What is more reasonable is that progress will depend on the gradual construction of a combined and mixed approach to the governance: through the clarification and updating of treaty interpretation where possible; through the consolidation of norms of responsible behaviour with a focus on universality; through the development of operational governance in areas such as debris mitigation and STM; and through the integration of a human-centred approach that takes into account the distributive implications of insecurity in space. In this regard, the Common Heritage of Mankind principle as described in the research continues to have relevance not as a hard legal prototype, but rather as a normative guide that can address equity gaps and inform change that moves beyond a State or club-based approach. Finally, whether the international community will succeed in bridging the gap between normative ambition and institutional capacity remains uncertain, but the stakes involved, strategic, environmental, and human, make such pursuit of a more inclusive and accountable governance not only desirable, but necessary.

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