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PROTECTION OF THE OUTER SPACE ENVIRONMENT AT STAKE? A LEGAL ANALYSIS OF THE PRESERVATION OF THE SPACE ENVIRONMENT AND ITS RELATIONSHIP WITH THE PROTECTION OF HUMAN RIGHTS IN HUMAN SPACE SETTLEMENTS

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ABSTRACT

The current lack of environmental protection for outer space under international conventional space law makes the outer space environment vulnerable to the impact of commercial and military activities. These activities vary from anti-satellite missile tests to

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the congestion of Earth's orbits due to an increase in satellite mega-constellations. The concept of space sustainability also implies a special link to human rights and the people who will live permanently in human space settlements. The outer space environment is a *conditio sine qua non* for the correct development and enjoyment of human rights in space settlements.

A corrupted space environment would endanger human rights such as the right to health, life, private and family life, and the emerging international human right to a healthy environment. From an analysis of *de lege lata*, this article points out the inadequacy of the current legal framework to protect the outer space environment and its negative impact on people's rights in future human space settlements. This inadequacy hinders the possibility of exploring a feasible alternative in International Environmental Law through Article III of the Outer Space Treaty (OST) to protect the outer space environment and consequently the human rights that are dependent on the fulfilment of this right.

I. INTRODUCTION

Since the beginning of the space race between the emerging superpowers after World War II, nations have used outer space by consistently evolving and developing newer and more sophisticated space technology. The first step towards launching satellites and developing a space economy[1] started with the V-2 rockets in Nazi

[1] The Organization for Economic Co-operation and Development (OECD) has provided a wide definition of what the space economy is. This includes military, scientific, commercial, and civil programs. This definition does not exclusively include private commercial investments. In 2012 the OECD defined space economy as

> . . . the full range of activities and the use of resources that create and provide value and benefits to human beings in the course of exploring, understanding, managing and utilizing space. Hence, it includes all public and private actors involved in developing, providing and using space-related products and services, ranging from research and development, the manufacture and use of space infrastructure (ground stations, launch vehicles and satellites) to space-enabled applications (navigation equipment, satellite phones, meteorological services, etc.) and the scientific knowledge generated by such activities. It follows that the space economy goes well beyond the space sector itself, since it also comprises the increasingly pervasive and continually changing impacts (both quantitative and qualitative) of space-derived products, services and knowledge on economy and Society.

Germany and progressed to the intercontinental ballistic missiles bearing nuclear warheads in the United States (US) and the Soviet Union.[2] Because of the US's apparent lack of interest in further space exploration and developing a space economy,[3] the Soviet Union launched the first human-made object into outer space, Sputnik-1, in 1957. From a legal perspective, this caught the attention of policymakers worldwide and raised the question about whether outer space was considered anyone's property. Due to the silence of the international community, some argued that the principle of non-appropriation emerged as instant customary international law (CIL) that would subsequently be codified in non-legally binding instruments and conventional law.[4]

From that moment forward, at the peak of the Cold War, some in the US feared the possibility of outer space not being free from militarization by the Soviet Union.[5] After the launch of Sputnik-1, the US adopted the legal policy for activities in outer space known as "peaceful uses of outer space."[6] Aside from avoiding the actual development of an armed industry in space, this legal policy would have a long-term direct impact on space sustainability and its dimensions: that is, space security, protection of the outer space environment, and space safety, due to anti-satellite (ASAT) tests.[7]

During the first phase of the space race, space programs strictly focused on the military applications of satellites, such as

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ORG. ECON. COOP. DEV., OECD HANDBOOK ON MEASURING THE SPACE ECONOMY 19 (2d ed. 2022), https://www.oecd.org/en/publications/2022/07/oecd-handbook-on-measuring-the-space-economy-2nd-edition_041ea015.html.

[2] Before the Soviet Union launched Sputnik in 1957, there was already a weaponization segment of the space industry. These were the V-2 rockets from Nazi Germany, which could be launched from point A to point B, crossing outer space. After Germany lost World War II, many rocket scientists were "caught" by the Americans and the Soviets. The developer of the V-2 Rocket and the creator of the Saturn V was Wernher von Braun. The US carried out "Operation Paperclip," which took some of the German rocket scientists, including von Braun, to NASA to develop their next rocket, the Saturn V. *See* FRED SCHARMEN, SPACE FORCES: A CRITICAL HISTORY OF LIFE IN OUTER SPACE (2021).

[3] ANDREA SOMMARIVA, THE POLITICAL ECONOMY OF THE SPACE AGE: HOW SCIENCE AND TECHNOLOGY SHAPE THE EVOLUTION OF HUMAN SOCIETY 30-40 (2018).

[4] BIN CHENG, STUDIES IN INTERNATIONAL SPACE LAW 147 (1997). Nonetheless, as analyzed in the next section, it is not possible to develop such an instant customary international law. The ICJ has stated that a "passage of time" must happen. *See* North Sea Continental Shelf (Ger./Neth., Ger./Den.), Judgment, 1969 I.C.J. 3, ¶¶ 73-74 (Feb. 20).

[5] SOMMARIVA, *supra* note 3, at 34–35.

[6] *See id.* at 35.

[7] SERGIO MARCHISIO, THE LAW OF OUTER SPACE ACTIVITIES 301-12 (1st ed. 2022).

surveillance and communications.[8] These satellites were launched by expendable space rockets that, having positioned their cargo, would orbit Earth as space debris.[9] Additionally, for the US and the Soviet Union, anti-satellite missile tests were considered part of the "peaceful uses of outer space."[10] These tests created large amounts of space debris that endangered the future of space exploration. For this reason, during the 1980s the US and the Soviet Union individually decided to voluntarily place moratoriums on ASAT tests.[11] The space economy up to this time was State-centered, changing in the 1980s when commercial space actors, both in the commercial infrastructure and the services arenas, started to play a major role.[12]

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[8] For instance, the Titan rocket built by Lockheed Martin for the US Air Force; even the Apollo Program had a military and politically oriented perspective on the space race. *See* SOMMARIVA, *supra* note 3, at 30–43.

[9] In the 2010 Space Debris Mitigation Guidelines, UNCOPUOS defines the concept of space debris as all non-functional space objects. Thus, this not only includes fragments of space objects, but all space objects that are *per se* not functional anymore: "space debris is defined as all [hu]man-made objects, including fragments and elements thereof, in Earth orbit or re-entering the atmosphere, that are non-functional." *See* UNITED NATIONS OFF. FOR OUTER SPACE AFFS., SPACE DEBRIS MITIGATION GUIDELINES OF THE COMMITTEE ON THE PEACEFUL USES OF OUTER SPACE (2010), *available at*: https://www.unoosa.org/pdf/publications/st_space_49E.pdf [hereinafter COPUOS DEBRIS MITIGATION GUIDELINES].

[10] Steven Freeland, *Peaceful Purposes? Governing the Military Uses of Outer Space*, 18 EUR. J. L. REFORM 35, 44-49 (2016). The interpretation of "peaceful uses of outer space" has been accepted to mean 'non-aggressive' uses of outer space, rather than 'non-military' uses of outer space. This means that States can carry out military operations in outer space with the sole prohibition that these operations are not aggressive, such as shooting down another State's satellite. This interpretation has been inferred from Article III of the Outer Space Treaty, which requires the application of international law, including the United Nations Charter to outer space activities. Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, Jan. 27, 1967, art. III, 18 U.S.T. 2410, 610 U.N.T.S. 205 [hereinafter Outer Space Treaty]. In this sense, States shall conduct their international relationships in a peaceful manner according to the UN Charter. U.N. Charter art. 1. This also means that in case of an attack in outer space, States can resort to self-defense pursuant to Article 51 of the UN Charter. U.N. Charter art. 51. In case of a war in outer space, International Humanitarian Law (IHL) shall be applied as well. Steven Freeland, *Peaceful Purposes? Governing the Military Uses of Outer Space*, 18 EUR. J. L. REFORM 35, 44-49 (2016)

[11] *See* Laura Grego, *A History of Anti-Satellite Programs*, UNION OF CONCERNED SCIENTISTS (Jan. 2012), https://www.ucsusa.org/sites/default/files/2019-09/a-history-of-ASAT-programs_lo-res.pdf (last visited Dec. 6, 2024).

[12] For instance, during the Ronald Reagan administration, the Commercial Space Launch Act of 1984 was passed, which aimed at stopping reliance on the Space Shuttle

The more private actors became involved in the space industry, the more Earth's orbit became congested. This rapid involvement of private space actors raised several challenges in legal terms. One of them, directly related to the protection of outer space, concerns the implications stemming from satellite constellations in a private-led space economy in which private actors hold 75% of the market.[13] The proliferation of increased launches, satellites, and space applications[14] has led some to reconsider the existing international space legal regime over the binding regulation of private commercial actors and their impacts on the sustainability of outer space *per se*, that is, the protection of the space environment.[15] Apart from the above-mentioned space activities, States and private enterprises are seriously considering the establishment of permanent settlements in outer space.[16] These settlements may be described as planetary settlements and artificial habitats depending on whether they are established on a planetary body, like Mars, or on an artificially created habitat. Whatever the case may be, the circumstances under which the settlers in outer space would have to live differ profoundly from those on planet Earth.[17] As will be argued below, a clean and healthy outer space environment is a

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program and opening new launching opportunities to the private sector. *See* CHAD ANDERSON, THE SPACE ECONOMY: CAPITALIZE ON THE GREATEST BUSINESS OPPORTUNITY OF OUR LIFETIME 109-32 (2023).

[13] STEVE MIRMINA & CARYN SCHENEWERK, INTERNATIONAL SPACE LAW AND SPACE LAWS OF THE UNITED STATES 262-71 (2022).

[14] For instance, it is predicted that Starlink will have 30,000 satellites. *See* Caleb Henry, *SpaceX Submits Paperwork for 30,000 More Starlink Satellites*, SPACE NEWS (Oct. 15, 2019), https://spacenews.com/spacex-submits-paperwork-for-30000-more-starlink-satellites/ (last visited Dec. 6, 2024). Project Kuiper aspires to more than 3,000 satellites. *See* Keumars Afifi-Sabet, *Project Kuiper: Amazon's Answer to SpaceX's Starlink Passes 'Crucial' Test*, SPACE.COM (Dec. 26, 2023), https://www.space.com/project-kuiper-passes-crucial-test (last visited Dec. 6, 2024). Chinese Sat Net is predicted to have 10,000 satellites. *See* Andrew Jones, *Chinese Firm Files Plans for 10,000-Satellite Constellation*, SPACE NEWS (May 27, 2024), https://spacenews.com/chinese-firm-files-plans-for-10000-satellite-constellation/ (last visited Dec. 6, 2024). OneWeb seeks 650 satellites. *See* Stephen Clark, *OneWeb Resumes Deployment of 650-Satellite Broadband Network*, SPACE FLIGHT NOW (Dec. 18, 2020), https://spaceflightnow.com/2020/12/18/oneweb-resumes-deployment-of-650-satellite-broadband-network/ (last visited Dec. 6, 2024).

[15] Peter Martínez, *The Role of Soft Law in Promoting the Sustainability and Security of Space Activities*, 44 J. SPACE L. 522, 523-40 (2020).

[16] *See* Rossana Deplano, *The Artemis Accords: Evolution or Revolution in International Space Law?*, 70 INT'L COMPAR. L. Q. 799 (2021).

[17] *See* Jonathan Lim, *Charting a Human Rights Framework for Outer Space Settlements*, 71 INT'L ASTRONAUTICAL CONG. – CYBERSPACE ED. (Oct. 12-14, 2020).

prerequisite for the enjoyment of various human rights by the inhabitants of space settlements.

The protection of the outer space environment against adverse practices directly relates to the concept of space sustainability and, therefore, to the correct development and free enjoyment of human rights in outer space by humans.[18] This pillar of space sustainability enables humans to enjoy their human rights in space stations and human space settlements. Therefore, a clean or adequately protected outer space environment is directly linked to human rights such as the right to life, private and family life, and the emerging international human right to a healthy environment. It is clear that international law applies to outer space, which means international human rights and international environmental law.[19] In this sense, the protection of the outer space environment, specifically in human space settlements, will provide protection to the human rights of the next generation of humans in outer space.

Consequently, we can conceive of the environment as a *conditio sine qua non* for the enjoyment of human rights. This means that without a healthy environment, there is fair concern about the development and protection of human rights.[20] The protection of the outer space environment becomes a crucial mission to guarantee a permanent, healthy, and sustained presence of humans in outer space where there is no other obstacle to the realization of their rights. This also, arguably, invokes the possibility to refer the existence of emerging international human rights to a healthy (outer space) environment. The right to a healthy environment is not yet an international human right under conventional law. However, there is emerging customary international law on the right to a healthy environment due to recent progress in the UN General Assembly,[21] the Human Rights Council,[22] in non-legally binding.

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[18] Danielle Ireland-Piper & Steven Freeland, *Human Rights and Space: Reflections on the Implications of Human Activity in Outer Space on Human Rights Law*, 9 GRONINGEN J. INT'L L. 101 (2021).

[19] *See* discussion *infra* Part III.

[20] *See* PHILIPPE SANDS ET AL., PRINCIPLES OF INTERNATIONAL ENVIRONMENTAL LAW 814-28 (4th ed. 2018).

[21] *See* U.N. GAOR, 76th Sess., U.N. Doc. A/76/L.75 (July 26, 2022) (proposing a resolution that recognizes international human rights to a healthy environment).

[22] *See* Human Rights Council Res. 48/13, U.N. Doc. A/HRC/RES/48/13 (Oct. 8, 2021)[hereinafter Human Rights Council Res.] The Human Rights Council has recognized this emerging international human right, "[n]oting that more than 155 States have

international caselaw,[23] and in regional[24] and national State

recognized some form of a right to a healthy environment in, inter alia, international agreements or their national constitutions, legislation or policies." *Id.*

[23] In Europe, the 1950 European Convention on Human Rights does not recognize a human right to a healthy environment. *See* Council of Eur., Convention for the Protection of Human Rights and Fundamental Freedoms and Protocol (1950). However, several cases before the European Court of Human Rights (ECHR) have shown the possibility of defending the environment by claiming other rights, such as the right to life (Art. 2) and the right to respect for private and family life (Art. 8). This is based on the idea that the environment is a *conditio sine qua non* for the enjoyment of human rights. *See López Ostra v. Spain*, App. No. 16798/90, Eur. Ct. H.R., Judgment (Dec. 9, 1994). In this case, the ECHR stated that

> Naturally, severe environmental pollution may affect individuals' well-being and prevent them from enjoying their homes in such a way as to affect their private and family life adversely, without, however, seriously endangering their health. Whether the question is analyzed in terms of a positive duty on the State - to take reasonable and appropriate measures to secure the applicant's rights under paragraph 1 of Article 8 (art. 8-1) -, as the applicant wishes in her case, or in terms of an "interference by a public authority" to be justified in accordance with paragraph 2 (art. 8-2), the applicable principles are broadly similar. In both contexts, regard must be had to the fair balance that has to be struck between the competing interests of the individual and of the community as a whole, and in any case, the State enjoys a certain margin of appreciation. Furthermore, even in relation to the positive obligations flowing from the first paragraph of Article 8 (art. 8-1), in striking the required balance the aims mentioned in the second paragraph (art. 8-2) may be of a certain relevance (see in particular, the Rees v. the United Kingdom judgment of 17 October 1986, Series A no. 106, p. 15, para. 37, and the Powell and Rayner v. the United Kingdom judgment of 21 February 1990, Series A no. 172, p. 18, para. 41).

Id. ¶ 51. *See also Rees v. U.K.*, App. No. 9532/81, Eur. Ct. H.R., Judgment ¶ 37 (Oct. 17, 1986); *Powell and Rayner v. U.K.*, App. No. 9310/81, Eur. Ct. H.R., Judgment ¶ 41 (Feb. 21, 1990).

[24] *See* Org. Am. States, Additional Protocol to the American Convention on Human Rights in the Area of Economic, Social, and Cultural Rights, OEA/Ser.A/44 (Nov. 17, 1988). The Protocol of San Salvador codifies the right to a healthy environment in Article 11: "1. Everyone shall have the right to live in a healthy environment and to have access to basic public services. 2. The States Parties shall promote the protection, preservation, and improvement of the environment." *Id. See also* ORG. AFR. UNITY, AFRICAN CHARTER ON HUMAN AND PEOPLES' RIGHTS (June 1981), https://au.int/sites/default/files/treaties/36390-treaty-0011_-_african_charter_on_human_and_peoples_rights_e.pdf. In Africa, the 1981 African Charter on Human and People´s Rights include a similar right in its Article 24: "All peoples shall have the right to a general satisfactory environment favorable to their development." *Id.*

practice,[25] which could have a positive influence on the legal development of the rights of people living in Human Space Settlements (HSSs).

This right to a healthy environment and the protection of the outer space environment is necessary to safeguard the human rights of people living in HSSs. In this regard, the next steps towards the permanent presence of humankind on other celestial bodies are the Artemis Program[26] and the International Lunar

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[25] At the national level, several different constitutions have recognized the right to a healthy environment. Consider the constitutional provisions of Spain, South Korean, and Brazil.

The Spanish Constitution:

> (1) Everyone has the right to enjoy an environment suitable for the development of the person, as well as the duty to preserve it.
> (2) The public authorities shall watch over a rational use of all natural resources with a view to protecting and improving the quality of life and preserving and restoring the environment, by relying on an indispensable collective solidarity.
> (3) For those who break the provisions contained in the foregoing paragraph, criminal or, where applicable, administrative sanctions shall be imposed, under the terms established by the law, and they shall be obliged to repair the damage caused.

Constitución Española, *Boletín Oficial del Estado* n. 311, Feb. 19, 2024, art. 45 (Spain).

The South Korean Constitution:

> 1. All citizens shall have the right to a healthy and pleasant environment. The State and all citizens shall endeavor to protect the environment.
> 2. The substance of the environmental right shall be determined by law.
> 3. The State shall endeavor to ensure comfortable housing for all citizens through housing development policies and the like.

Daehanminkuk Hunbeob [Hunbeob] [Constitution] art. 35 (S. Kor.).

The Brazilian Constitution:

> Everyone has the right to an ecologically balanced environment, which is a public good for the people's use and is essential for a healthy life. The Government and the community have a duty to defend and to preserve the environment for present and future generations.

Constituição Federal [C.F.] [Constitution] art. 255 (Braz.).

[26] *See* Deplano, *supra* note 16. The Artemis Program aims to create the Lunar Gateway Space Station and pave the way for the construction of a permanent base on the Moon and, as the next step in space exploration, to Mars. ARTEMIS PLAN, NASA'S LUNAR EXPLORATION PROGRAM OVERVIEW (Sep. 2000), https://www.nasa.gov/sites/default/files/atoms/files/artemis_plan-20200921.pdf [hereinafter Artemis Program]; *id.* The Artemis Program is supported by the Artemis Accords, a non-legally binding

Research Station (ILRS),[27] as the Moon is the next step in the expansion of humanity to the solar system. To guarantee a permanent and sustained human presence on the Moon, there is a need to respect the international rules demanded by International Environmental Law (IEL) as they apply to outer space. As will be pointed out later, there are currently significant amounts of trash (as well as terrestrial biological matter) on the Moon's surface.[28] The lunar environment is different from Earth; it is hostile to humans. The lack of resources that support life on Earth alters the dynamics of human rights in lunar HSSs.

For these reasons, this article explores the current international legal obligations to the outer space environment and the application of IEL and human rights to HSSs, the outer space environment, and people living in space. From a legal perspective, this provides a solution for the effective development of human rights in HSSs and the rules that govern them.

II. OVERVIEW OF INTERNATIONAL LEGAL OBLIGATIONS TO PRESERVE THE OUTER SPACE ENVIRONMENT

Part of the international legal personality of States is the rights and obligations under which they operate in the international sphere. These binding international rights and obligations emanate from the sources of Public International Law (PIL).[29] Article 38 of the Statute of the International Court of Justice (ICJ) lists the sources of international law as treaties, customary

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agreement between the US and other States. The Artemis Accords: Principles for Cooperation in the Civil Exploration and Use of the Moon, Mars, Comets, and Asteroids, NAT'L AERONAUTICS & SPACE ADMIN., https://www.nasa.gov/specials/artemis-accords/img/Artemis-Accords-signed-13Oct2020.pdf [hereinafter Artemis Accords]; *id.*

[27] In 2021, China and Russia signed a Memorandum of Understanding that creates a roadmap to build the International Lunar Research Station (ILRS). This program aims to construct a lunar base on the South Pole of the Moon, which is open to other partners. *See* CHINA NAT'L SPACE ADMIN, INTERNATIONAL LUNAR RESEARCH STATION (ILRS) GUIDE FOR PARTNERSHIP (2021), https://www.cnsa.gov.cn/english/n6465652/n6465653/c6812150/content.html. This program now includes a total of 13 States. *See Lunar Space Cooperative Initiatives*, SECURE WORLD FOUND. (Oct. 25, 2024), https://swfound.org/lunar-space-cooperation-initiatives/ (last visited Dec. 6, 2024) [hereinafter *Lunar Initiatives*].

[28] SIMONETTA DI PIPPO, SPACE ECONOMY: THE NEW FRONTIER FOR DEVELOPMENT 97-99 (2023).

[29] MALCOLM EVANS, INTERNATIONAL LAW 94-103 (6th ed. 2024).

international law (CIL), and general principles of law.[30] There is no hierarchy between any of them, although the ICJ tends to apply treaty law first since it is easier to prove the existence of law when two States have an international dispute.[31] It is important to determine the interaction between these sources of law in practice. CIL is the oldest source of law, which, with the treaty-making era, has been vanishing, yet CIL remains a legally binding source of law capable of regulating international relations among States with the same legal value as treaties and general principles of law.[32] In this sense, treaties can crystallize an emerging CIL or declare an existing one. The immediate legal effect is that the legally binding content of the treaty may go beyond *inter partes* – that is, the status of CIL offers the possibility for the content of a treaty to be *erga omnes* for the whole international community, with some exceptions.[33]

This means that a breach of an international obligation that arises from a CIL source of PIL makes the State internationally

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[30] Statute of the International Court of Justice, Art. 38, June 26 1945, 6 L.N.T.S. 391-413. [hereinafter ICJ Statute].

> 1. The Court, whose function is to decide in accordance with international law such disputes as are submitted to it, shall apply:
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> a. international conventions, whether general or particular, establishing rules expressly recognized by the contesting [S]tates;
>
> b. international custom, as evidence of a general practice accepted as law;
>
> c. the general principles of law recognized by civilized nations;
>
> d. subject to the provisions of Article 59, judicial decisions and the teachings of the most highly qualified publicists of the various nations, as subsidiary means for the determination of rules of law.
>
> 2. This provision shall not prejudice the power of the Court to decide a case *ex aequo et bono*, if the parties agree thereto.

[31] Christopher Greenwood, *Sources of International Law: An Introduction*, UNITED NATIONS (2008), https://legal.un.org/avl/pdf/ls/greenwood_outline.pdf (last visited Dec. 6, 2024).

[32] Leonardo Alberto López Marcos & Rafael Moro Aguilar, *Some Comments on the Current State of International Space Law: An Open Window for the Future Development of Space Law*, 14 BOLETÍN OBSERVATORIO JURÍDICO AEROESPACIAL 34-40 (2024).

[33] There are two exceptions to the CIL effect *erga omnes*. The first is that the State objects during the formation of custom to its legally binding effects. This is the persistent objector doctrine. The requirement is that the State objects during the formation of CIL; thus, it is not possible to object after its formation. This has been controversial due to the decolonization process during the 1960s, under which the new States were subjected to the existing CIL, as they could not have objected to the formation of the preexisting CIL. *See* Asylum Case (Colom./Peru), Judgment, 1950 I.C.J. 266 (Nov. 20); *see also* Fisheries Case (U.K. v. Nor.), Judgment, 1951 I.C.J. 116 (Dec. 18).

responsible for committing an international wrongful act.[34] Therefore, when there is a breach of an international obligation derived from CIL, any State can demand that the perpetrator fulfill its international obligations and/or bring the breach before an international court. In this sense, any violation of CIL constitutes an international wrongful act under a primary rule of international law – in this case, CIL.

When it comes to general principles of International Space Law (ISL), international judicial practice and legal scholars have shown that, in practice, general principles are used after treaties and CIL are applied. This means that general principles are used to avoid lacunae cases in which no convention or CIL can be applied and where a judge must resolve a dispute.[35] General principles of law are legally binding sources of international law, with no hierarchy among the other sources.[36] As mentioned, judicial practice reveals a preference for first applying treaties and then CIL to a specific dispute, although this does not imply a hierarchy among these sources.

Unfortunately, ISL has shifted away from these legally binding sources of PIL outlined in Article 38 of the ICJ Statute to a more

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[34] Int'l Law Comm'n, Draft Articles on Responsibility of States for Internationally Wrongful Acts, with commentaries, Fifty-Third Session, U.N. Doc. A/56/10 (2001) [hereinafter Draft Articles on Responsibility]. Article I states that "Every internationally wrongful act of a State entails the international responsibility of that State," while Article II considers how to attribute that international wrongful act to a State: "There is an internationally wrongful act of a State when conduct consisting of an action or omission: (a) is attributable to the State under international law; and (b) constitutes a breach of an international obligation of the State." *Id.*

[35] *See* Barcelona Traction, Light and Power Company Limited 1970 I.C.J. 3 (Feb. 1970).

[36] *See* Int'l Law Comm'n, General Principles of Law Text of the Draft Conclusions Provisionally Adopted by the Drafting Committee on First Reading, U.N. Doc. A/CN.4/L.982 (2023)[hereinafter Int'l Law Comm'n]. In draft conclusion 11:

> Relationship between general principles of law and treaties and customary international law 1. General principles of law, as a source of international law, are not in a hierarchical relationship with treaties and customary international law. 2. A general principle of law may exist in parallel with a rule of the same or similar content in a treaty or customary international law. 3. Any conflict between a general principle of law and a rule in a treaty or customary international law is to be resolved by applying the generally accepted techniques of interpretation and conflict resolution in international law.

Id.

flexible normative instrument known as "soft law."[37] Instruments of soft law include multilateral/bilateral declarations, Memorandums of Understanding (MoUs), resolutions, and other such documents that are not legally binding on States. However, these instruments might carry normative value and could potentially express the *opinio juris* of States and reflect State practice, if consistent.[38] In the words of the ICJ in the Nuclear Weapons case: "General Assembly resolutions, even if they are not binding, may sometimes have normative value. They can, in certain circumstances, provide evidence important for establishing the existence of a rule or the emergence of an *opinio juris."* [39]

Thus, according to the ICJ and also the ILC, declarations can serve as evidence of emerging CIL or even crystallize it.[40] They can also be useful for interpreting space treaties according to the

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[37] In our opinion, what is law is law. This means that everything that is not law is not legally binding. Thus, the distinction between several types of law (i.e., soft law and hard law) is not necessary. This does not mean that non-legally binding instruments are useless. On the contrary, non-legally binding instruments have normative value, i.e., they can reflect a growing customary international law. *See* Ram S. Jakhu et al., *The Sources of International Space Law: Revisited*, 67 GER. J. AIR SPACE L. 606, 663–65 (2021).

[38] EVANS, *supra* note 29, at 107-110 "States' votes in respect of a resolution can constitute *opinio iuris*, which can give rise to a rule of customary international law." Additionally, some resolutions might be considered that they reflect already CIL, such as the UNGA 2625 Resolution. Military and Paramilitary Activities in and against Nicaragua (Nicar v. U.S.), Judgement 1986 I.C.J. 14, ¶ 191 (June 27). Ultimately, how States vote in the General Assembly (for instance, on resolutions) may constitute evidence of *opinio juris Id.* ¶ 188.

[39] Legality of the Use of Force by a State of Nuclear Weapons in Armed Conflict, Advisory Opinion, 1996 I.C.J. 66, ¶ 70 (July 8). *See also* Fabio Tronchetti, *"Soft Law" in* CHRISTIAN BRÜNNER & ALEXANDER SOUCEK (EDS.), OUTER SPACE IN SOCIETY, POLITICS AND LAW 625 (2011) "[S]oft law is extremely important for the identification as well as the progressive elaboration of relevant rules of customary law. States' compliance with soft law provisions may provide evidence of 'State subsequent practice' and '*opinio juris,*' the two elements which according to International Court of Justice are required to form 'custom.'"

[40] Draft conclusions on identification of customary international law, with commentaries 2018. *See* conclusion 4. GA Resolutions can "provide evidence important for establishing the existence of a rule or the emergence of an *opinio juris*." Nuclear Weapons *in* Armed Conflict 1996 I.C.J. ¶ 95, ¶¶ 150–155. How States vote in the General Assembly and the resolutions reflect *opinion juris.* Nicar. v. U.S., 1986 I.C.J. ¶ 188. *See also* EVANS, *supra* note 29, at 107-110 "States' votes in respect of a resolution can constitute *opinio juris,* which can give rise to a rule of customary international law."

general rules of interpretation in Article 31(3) of the 1969 Vienna Convention on the Law of Treaties (VCLT).[41]

Moreover, there are additional sources of law not covered by Article 38 of the ICJ Statute, such as *jus cogens* norms, which are crucial for the development of ISL.[42] Obviously, Article 38 was

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[41] Vienna Convention on the Law of Treaties art. 31(1), May 23, 1969, 1155 U.N.T.S. 331 [hereinafter VCLT]:

> 1. A treaty shall be interpreted in good faith in accordance with the ordinary meaning to be given to the terms of the treaty in their context and in the light of its object and purpose.
> 2. The context for the purpose of the interpretation of a treaty shall comprise, in addition to the text, including its preamble and annexes:
> (a) any agreement relating to the treaty which was made between all the parties in connection with the conclusion of the treaty;
> (b) any instrument which was made by one or more parties in connection with the conclusion of the treaty and accepted by the other parties as an instrument related to the treaty.
> 3. There shall be taken into account, together with the context:
> (a) any subsequent agreement between the parties regarding the interpretation of the treaty or the application of its provisions;
> (b) any subsequent practice in the application of the treaty which establishes the agreement of the parties regarding its interpretation;
> (c) any relevant rules of international law applicable in the relations between the parties.
> 4. A special meaning shall be given to a term if it is established that the parties so intended.

Id. Article 32 of the VCLT shall only be applied when general rules of interpretation leave an obscure or nonsensical meaning. This means that, as many do, one cannot skip Article 31 of the VCLT and study the preparatory works (*travaux préparatoires*) of a treaty in order to interpret it or any of its provisions. In its 1950 Advisory Opinion on the Competence of the General Assembly to admit States to the UN, the ICJ stated that:

> the Court considers it necessary to Say that the first duty of a tribunal which is called upon to interpret and apply the provisions of a treaty, is to endeavour to give effect to them in their natural and ordinary meaning in the context in which they occur. If the relevant words in their natural and ordinary meaning make sense in their context, that is an end of the matter. If, on the other hand, the words in their natural and ordinary meaning are ambiguous or lead to an unreasonable result, then, and then only, must the Court, by resort to other methods of interpretation, seek to ascertain what the parties really did mean when they used these words.

Competence of Assembly Regarding Admission to the United Nations, Advisory Opinion, 1950 I.C.J. 4 (Mar. 3).

[42] The concept of *jus cogens* rules are defined in Article 53 of the VCLT:

based on a solely State-centric approach, which did not foresee, for instance, the role of international organizations or even private actors in the development of ISL.[43]

A. Protection of the Outer Space Environment Under Treaty Law

Treaty law in ISL is reflected in the legally binding portions of the *corpus juris spatialis*; that is, the five treaties that rule outer space activities and specific issues around them.[44] The *Magna Carta* of outer space is the 1967 Outer Space Treaty (OST).[45] This treaty has arguably acquired, in many of its articles, the status of CIL; therefore, these are legally binding *erga omnes*. The OST was designed to avoid an escalation of a Cold War "armed" conflict in outer space, so it is not strange that it is silent concerning many important questions related to the use of outer space.

In this regard, there are some OST provisions that contain clauses related to certain space activities that could potentially affect the outer space environment. For example, Article IV of the OST requires "States Parties to the Treaty undertake not to place in orbit around the earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons on celestial bodies, or station such weapons in outer space in

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> Treaties conflicting with a peremptory norm of general international law ("*jus cogens*"). A treaty is void if, at the time of its conclusion, it conflicts with a peremptory norm of general international law. For the purposes of the present Convention, a peremptory norm of general international law is a norm accepted and recognized by the international community of States as a whole as a norm from which no derogation is permitted and which can be modified only by a subsequent norm of general international law having the same character.

VCLT, *supra* note 41, art. 53.

[43] ANA GEMMA LÓPEZ MARTÍN ET AL., DERECHO INTERNACIONAL PÚBLICO (Ana Gemma López Martín ed. 2022). *See* ICJ Statute, *supra* note 30, art. 38.

[44] Outer Space Treaty, *supra* note 10; Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, Apr. 22, 1968, 19 U.S.T. 7570, 672 U.N.T.S. 119 [hereinafter Rescue Agreement]; Convention on the International Liability for Damage Caused by Space Objects, Mar. 29, 1972, 24 U.S.T. 2389, 961 U.N.T.S 187 [hereinafter Liability Convention]; Convention on Registration of Objects Launched into Outer Space, Jan. 14, 1975, 28 U.S.T. 695, 1023 U.N.T.S. 15 [hereinafter Registration Convention]; Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, Dec. 18, 1979, 1362 U.N.T.S. 3 [hereinafter Moon Agreement].

[45] Outer Space Treaty, *supra* note 10.

any other manner."[46] Although this provision does not contain any mention of protecting the outer space environment *per se*, it clearly considers indirect damage that could be caused by a nuclear war or an accident in outer space, which may endanger the environment.

This expressed prohibition under Article IV OST precludes States (and by extension private actors in view of Article VI OST) from placing any weapons of mass destruction in Earth orbit or on celestial bodies. Although Article IV OST does not contain any specific reference to the protection of the outer space environment, it is evident that accidents caused by nuclear waste or the use of Weapons of Mass Destruction (WMD) could cause direct damage to the outer space environment. For this reason, Article IV of the OST must be interpreted as an indirect protection of the outer space environment.[47]

Other provisions in the OST also reflect indirect protections for the outer space environment. These can be found in the articles concerning a State's responsibility for its nationals. Here, Article VI (State responsibility) and Article VII (liability) of the OST imply a primary norm of PIL; that is, the duty of States to ensure private actors comply with the OST through, among other measures, a licensing regime.[48] In this sense, it seems appropriate to argue that States have the duty to supervise and monitor their nationals' space activities so they do not cause any harm that could negatively affect the outer space environment.[49]

Article IX of the OST also follows this idea in its due regard provision, stating that

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[46] *Id.* art. IV.

[47] Such an interpretation is not necessary for nuclear weapons. Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space, and Under Water, Aug. 5, 1963, 480 U.N.T.S. 43 [hereinafter PTBT]. The PTBT precludes nuclear explosion tests, which include *per se* rockets fueled by nuclear power (this is different from electrically powering spacecraft with nuclear power – Nuclear Power Sources, NPS) in the atmosphere and outer space. *See* Steven A. Mirmina & David J. Den Herder, *Nuclear Power Sources and Future Space Exploration*, 6 CHI. J. INT'L L. 149 (2005). *See* Vishakha Gupta, *Critique of the International Law on Protection of the Outer Space Environment*, 14 ASTROPOLITICS 1, 29 (2016).

[48] Outer Space Treaty, *supra* note 10, arts. VI–VII. *See* Gupta, *supra* note 47.

[49] *See* Joel A. Dennerley, *State Liability for Space Object Collisions: The Proper Interpretation of 'Fault' for the Purposes of International Space Law*, 29 EUR. J. INT'L L. 281 (2018).

in the exploration and use of outer space, including the [M]oon and other celestial bodies, States Parties to the Treaty shall be guided by the principle of co-operation and mutual assistance and shall conduct all their activities in outer space, including the [M]oon and other celestial bodies, with due regard to the corresponding interests of all other States Parties to the Treaty.[50]

It has been argued that Article IX of the OST is CIL, therefore, applying *erga omnes* beyond States Parties to the Treaty. This duty of due regard implies that States have a duty to consider other States' rights and interests in the outer space environment, which is different from the due diligence concept.[51]

Beyond the duty of due regard, Article IX of the OST also contains a specific clause–considered by some as the "green clause"–that involves the concept of the "outer space environment":

> States Parties to the Treaty *shall* pursue studies of outer space, including the [M]oon and other celestial bodies, and conduct exploration of them so as to *avoid their harmful contamination* and also *adverse changes* in the environment of the Earth resulting from the introduction of extraterrestrial matter and, where necessary, *shall* adopt appropriate measures for this purpose.[52]

Accordingly, when States (and by extension private actors) operate in outer space, they have two mandatory obligations: (1) States shall avoid the harmful contamination of celestial bodies; and (2) States shall avoid adverse changes in Earth's environment.[53]

There are, therefore, two classifications of contamination: First, forward contamination which refers to means the contamination that is being exported from Earth to outer space and its

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[50] Outer Space Treaty, *supra* note 10, art. IX.

[51] *See* CAROLINE E. FOSTER, GLOBAL REGULATORY STANDARDS IN ENVIRONMENTAL AND HEALTH DISPUTES: REGULATORY COHERENCE, DUE REGARD, AND DUE DILIGENCE 89-131 (2021).

[52] Outer Space Treaty, *supra* note 10, art. IX (emphasis added).

[53] Leonardo Alberto López Marcos, *Estudio Jurídico-Internacional sobre la Sostenibilidad del Medio Ambiente del Espacio Ultraterrestre*, *in* 2023 ANUARIO JURÍDICO SECCIONES DEL ICAM 45 (2023).

celestial bodies. Second, backward contamination, that is, the contamination that is imported from outer space to the Earth's ecosystem.[54]

However, it may be argued that forward and backward contamination in terms of Article IX OST do not include all types of contamination. Rather, based on the notions *harmful contamination* and *extraterrestrial matter,* it arguably includes some specific type of contamination.[55]

The first obligation under Article IX OST refers to a subtype of forward contamination by introducing the concept of *harmful contamination*. This concept is seemingly which might include, *inter alia*, space debris, nuclear waste, general waste, and organic waste). To determine the meaning of the concept "harmful contamination", it is necessary to apply Articles 31 and 32 of the Vienna Convention on the Law of Treaties. [56]

It may be argued that in outer space, the common and ordinary meaning of "harmful contamination" refers only to the release of chemical effluents, thus, resulting in chemical contamination.[57]

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[54] *See* Leonardo Alberto López Marcos, *Utilisation of Space Resources and Its Outer Space Environmental Impact: Application of the Precautionary Principle to the Protection of the Environment of Outer Space and Its Celestial Bodies from Space Mining Activities*, REVISTA ESPAÑOLA DE DERECHO AERONÁUTICO Y ESPACIAL 473 (2023), 505–507; Gupta, *supra* note 47, at 20-22; B. Sandeepa Bhat, *Application of Environmental Law Principles for the Protection of the Outer Space Environment: A Feasibility Study*, 39 ANNALS AIR & SPACE L. 323, 331-333 (2014).

[55] López Marcos, *supra* note 54, at 479-480. *See* Howard A. Baker, *Protection of the Outer Space Environment: History and Analysis of Article IX of the Outer Space Treaty*, 12 ANNALS AIR & SPACE L. 143, 159-170 (1987). *See* Gupta, *supra* note 47, at 20–23.

[56] This discussion adds to an ongoing debate centered around the interpretation of the concepts of "harmful contamination" and "backward contamination." *See* López Marcos, *supra* note 54, at 508. *See also* P. M. Sterns & L. I. Tennen, *Legal Aspects of Planetary Protection for Mars Missions*, 15 ADVANCES IN SPACE RSCH. 281, 282-283 (1995); Francesca Giannoni-Crystal, *Space Agriculture, Biotechnology, and Terraforming: Rethinking the Paradigm of Harmful Contamination*, 90 J. OF AIR L. & COM. 205, 222–234.

[57] According to the Oxford Reference Dictionary, contamination is "the act of polluting or contaminating . . . An increase in the background concentration of a chemical, micro-organism, or radionuclide. Also known as environmental contamination." OXFORD REFERENCE, https://www.oxfordreference.com/display/10.1093/oi/authority.20110810104649451?p=emailA0m0Vwwuei/eE&d=/10.1093/oi/authority.20110810104649451&print (last visited Dec. 4, 2024). This is a general concept of contamination that can include "chemical contamination," "micro-organism contamination" or "radionuclide." In the space sector, although it might be debatable, authors such as Gupta track the space praxis of the common meaning of harmful contamination as solely the release of chemical effluents amounting to chemical contamination. In this

This interpretation also finds support when applying other interpretative methods under the VCLT. The suggested limited scope of the meaning of harmful contamination (as chemical contamination) under Article IX OST is in accordance with the general rule under the VCLT that a treaty should be interpreted in light of its object and purpose. In this regard, the Preamble and Article I OST indicate that outer space should be freely used and explored under a limited number of restrictions (e.g., Art. II, III, IV OST).

When taking into account subsequent agreements to the OST in terms of article 31(3)(a) VCLT, the 1979 Moon Agreement, although of limited effective legal value, may provide some insight as to the interpretation of contamination. Article 7(1) of the Moon Agreement reads as follows:

In exploring and using the moon, States Parties shall take measures to prevent the disruption of the existing balance of its environment, whether by introducing adverse changes in that environment, by its harmful contamination through the introduction of extra-environmental matter or otherwise,

Article 7(1) of the Moon Agreement thus refers to forward general contamination as the "disruption of the existing balance of the environment." In addition, it establishes several subtypes of forward (general) contamination, namely "adverse changes in that environment" and "harmful contamination by introducing extra-environmental matter or otherwise." The latter term thus could include any sort of forward contamination that damages the Moon (and celestial bodies') environment. This further suggests that harmful contamination is not equal to general contamination which could include space debris.

This interpretation is further supported by taking into account subsequent practice in the application of the OST in terms of Article 31(3)(b) VCLT. In this regard, there has been a consistent practice at the international level to protect the outer space environment against specifically space debris by means of non-legally binding

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context, chemical contamination can be caused by many pollutants; however, it does not include the mere fact of the existence of, *inter alia*, space debris or biological contamination in outer space. Therefore, it is necessary to determine the meaning of harmful contamination by applying other methods of interpretation under the VCLT. *See* Gupta, *supra* note 47, at 25-28 (citing Carl. Q. Christol, *Protection of the Space Environment: Debris and Power Sources*, *in* CHIA-JUI CHENG, ED., THE USE OF AIRSPACE AND OUTER SPACE FOR ALL MANKIND IN THE 21ST CENTURY 260 (1995)).

instruments (e.g., 2010 and 2019 COPUOS Guidelines), due to the lack of sufficient environmental protection under the concept of "harmful contamination" in Article IX OST.[58] This is arguably because Article IX does not cover general forward contamination and space debris, but only harmful contamination in the form of chemical effluents resulting in chemical contamination as a subtype of forward contamination.[59]

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[58] For example, the Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space makes a differentiation between harmful contamination and environmental degradation or general contamination (e,g., space debris). COPUOS DEBRIS MITIGATION GUIDELINES, *supra* note 9. The background of the Guidelines states that "[t]he prompt implementation of appropriate debris mitigation measures is therefore considered a prudent and necessary step towards preserving the outer space environment for future generations." *Id.* ¶ 1. Following that, Guideline 6 states that "[w]hen making determinations regarding potential solutions for removing objects from LEO, due consideration should be given to ensuring that debris that survives to reach the surface of the Earth does not pose an undue risk to people or property, including through environmental pollution caused by hazardous substances." *Id.* ¶ 4. The background of the Guidelines refers to the need of mitigating space debris. It recognizes the existence of space debris as a risk to the sustainability of outer space environment. This shows that there might be a lack of a legally-binding protection of outer space from space debris. Hence, space debris might not be included under the concept of harmful contamination. Added to that, Guideline 6 makes clear that space debris can cause harmful contamination through hazardous substances. *Id.* Therefore, there might be a conceptual difference between harmful contamination and space debris. Chemical effluents resulting in chemical contamination could be even created by space debris. *See* Gupta, *supra* note 47, at 22.

On the other hand, the 2019 Guidelines for the Long-Term Sustainability of Outer Space Activities of the Committee on the Peaceful Uses of Outer Space also reveal the need to address space debris because it is not regulated under the concept of harmful contamination according to Article IX OST. The Guidelines are available at https://www.unoosa.org/documents/pdf/PromotingSpaceSustainability/Publication_Final_English_June2021.pdf [hereinafter LTS Guidelines Pamphlet]. Guideline D.2 tackles this need by stating that "States and international intergovernmental organizations should investigate the necessity and feasibility of possible new measures, including technological solutions, and consider implementation thereof, in order to address the evolution of and manage the space debris population in the long term." *Id. at 38.*

Ultimately, this trend that makes a differentiation between harmful contamination and space debris – and claims a deeper regulation of the latter one – has been also reflected by Section 11(2) of the Artemis Accords, that is, "the Signatories affirm that the exploration and use of outer space should be conducted with due consideration to the United Nations Guidelines for the Long-term Sustainability of Outer Space Activities adopted by the COPUOS in 2019, with appropriate changes to reflect the nature of operations beyond low-Earth orbit." The Artemis Accords, *supra* note 26 § 11(2). Under Section 11(2), the Artemis Accords confirm the differentiation made by the 2019 LTS Guidelines by endorsing them.

[59] There are other documents that addresses space debris as a type of environmental degradation, which is different from harmful contamination under Article IX of the

Article 31(3)(c) VCLT allows for the application of other branches of PIL to interpret a particular treaty. One of the most apt branches to determine the meaning of "contamination" is International Environmental Law (IEL). In the context of IEL instruments, the term "contamination" is treated as a chemical effluent that results in "chemical contamination".[60]

Ultimately, Article 32 VCLT identifies the preparatory work of a treaty as a supplementary means of interpretation. The preparatory work of the OST indicates that article IX OST was not *per se* designed to protect the outer space environment against all kinds of forward contamination. The drafters rather had the intention to

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Outer Space Treaty. For example, the 2023 European Space Agency World Zero Debris Charter deals with active debris removal and the sustainability of space objects to mitigate space debris, but it does not contain any references to harmful contamination or even chemical contamination. Zero Debris Charter, *available at* https://esoc.esa.int/zero-debris-community-update (last visited Dec. 4, 2024)[hereinafter ESA Zero Debris Charter]. *See also* Peter Stubbe, *Common but Differentiated Responsibilities for Space Debris – New Impetus for a Legal Appraisal of Outer Space Pollution*, 31 ESPI PERSPECTIVES, 1, 7-8 (2010).

Because of the absence of a legally binding international instrument to address the space debris problem, States have adopted national regulations to protect outer space environment from space debris. For instance, the US compels its companies to remove a satellite from orbit within the first 5 years after it became inactive. In the Matter of Space Innovation Mitigation of Orbital Debris in the New Space Age, FCC 22-74 (Sept. 30, 2022). For the first time, in October 2023, the FCC fined a company, here Dish Network, because it failed to remove its inactive EchoStar-7 satellite from its orbit. *See* Will Wiquist, *FCC Takes First Space Debris Enforcement Action* FCC NEWS (Oct. 2, 2023), https://docs.fcc.gov/public/attachments/DOC-397412A1.pdf.

[60] For example, Principle 6 of the Stockholm Declaration of 1972 refers to "the discharge of toxic substances or of other substances and the release of heat, in such quantities or concentrations as to exceed the capacity of the environment to render them harmless, must be halted in order." Declaration of the United Nations Conference on the Human Environment, Principle 6, available at https://docs.un.org/en/A/CONF.48/14/Rev.1. The 1974 OECD Recommendation states that "[f]or the purpose of these principles, pollution means the introduction by man, directly or indirectly, of substances or energy into the environment resulting in deleterious effects of such a nature as to endanger human health harm living resources and ecosystems, and impair or interfere with amenities and other legitimate uses of the environment." Recommendation of the Council on Principles Concerning Transfrontier Pollution, available at https://legalinstruments.oecd.org/en/instruments/OECD-LEGAL-0133. Thus, what we are seeing is that the term "harmful contamination" is contamination created by chemical effluents resulting in chemical contamination. Thus, Article IX of the Outer Space Treaty provides a limited protection of the outer space environment, and space debris is not included in that protection. *See also* P. V. Heijnsbergen, T*he "Pollution" Concept in International Law*, 5 ENV'T POL'Y & L. 11 (1979); Stubbe, *supra* note 59, at 7-8.

further space exploration with limited restrictions, as mentioned before.[61]

From the above discussion it could thus be concluded that Article IX of the OST only partially protects the outer space environment, by limiting "harmful contamination" to chemical effluents and therefore chemical contamination. It does not necessarily include other types of contamination such as space debris. Only if space debris results in the chemical contamination of outer space through the emission of chemical effluents, would it be regarded as "harmful contamination" for the purposes of Article IX OST. .[62]

The second classification of contamination under Article IX of the OST is backward contamination, that is, contamination imported from the extraterrestrial environment (e.g., a space exploration mission on asteroids) to Earth.[63] Backward contamination is contamination that affects the Earth .[64] It could be argued that Article IX of the OST provides for specifically only one type of backward contamination, that is, the introduction of extraterrestrial matter resulting in biological contamination.[65] This means that the Earth shall be protected against extraterrestrial matter (e.g., bacteria, microbes) that could alter the Earth's environment – e.g., Hence, the COSPAR Policy on the disinfection of space objects that returned to the Earth.[66] Consequently, it may be argued that only

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[61] This was intentionally included during the negotiations between the US and the Soviet Union. The Japanese delegation noted that the outer space environment was not protected against all kinds of contamination. The reason was to enhance space exploration in the future and not to restrain it. *See* Baker, supra note 55, at 158-165. *See also* López Marcos, supra note 54, at 505-507.

[62] *See* López Marcos, *supra* note 54. *See also* Bhat, *supra* note 54, at 332–333; Gupta, *supra* note 47*,* at 26–27.

[63] *See generally* Abbey A. Donaldson, *NASA's Bennu Asteroid Sample Contains Carbon, Water*, NAT'L AEROSPACE & SPACE ADMIN. (Oct 11. 2023), https://www.nasa.gov/news-release/nasas-bennu-asteroid-sample-contains-carbon-water/ (describing the quarantine procedures for the recovered samples here on Earth) (last visited Dec. 6, 2024).

[64] López Marcos, *supra* note 54, at 505-509. In this line, see Bhat, *supra* note 54, at 331-333. *See also* Gupta, *supra* note 47*,* at 21-30.

[65] *See* Outer Space Treaty, *supra* note 10*,* art. IX. *See* Gupta, *supra* note 47*,* at 21-22. *See also* Sterns & Tennen, supra note 56, at 281; Bhat, *supra* note 54, at 330.

[66] Gupta, *supra* note 47*,* at 21-30. For instance, the following guidelines refer to the introduction of extraterrestrial matter, as a result of biological contamination. *See* Comm. on Space Research (COSPAR), COSPAR Policy on Planetary Protection (2020) *available at* https://cosparhq.cnes.fr/assets/uploads/2020/07/PPPolicyJune-2020_Final_Web.pdf [hereinafter COSPAR PP]; Sterns & Tennen, *supra* note 56, at 282–283.

if a piece of space debris that fell on Earth caused biological contamination of the Earth's environment, would it fall within the ambit of Article IX OST.[67]

The rest of the *corpus juris spatialis* also partially protects the outer space environment. It is said to be partial because the Moon Agreement, being the only treaty that directly applies, effectively protects only the Moon and other celestial bodies, excluding the vacuum of outer space.[68] Article 7(1) of the Moon Agreement states that:

> In exploring and using the [M]oon, States Parties shall take measures to prevent the disruption of the existing balance of its environment, whether by introducing adverse changes in that environment, by its harmful contamination through the introduction of extra-environmental matter or otherwise. States Parties shall also take measures to avoid harmfully affecting the environment of the earth through the introduction of extraterrestrial matter or otherwise.[69]

In Article 7(1), the protection of the Moon and celestial bodies is fully covered by the expression "prevent the disruption of the existing *balance of its environment*, whether by introducing adverse changes in that environment, by its harmful contamination through the introduction of extra-environmental matter or otherwise."[70] Article 7(1) of the Moon Agreement thus protects the celestial bodies' environments against a broad concept of contamination, which could include chemical, biological, or space debris, among others. As many scholars have pointed out, and as is well known, the Moon Agreement has only a limited number of ratifying States, a number recently reduced. This, in addition to not having the reinforced status of CIL limits its enforcement capabilities under PIL. This, in addition to not having the reinforced status of CIL limits its

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See also López Marcos, *Estudio Jurídico-Internacional sobre la Sostenibilidad del Medio Ambiente del Espacio Ultraterrestre*, *Anuario Jurídico Secciones del ICAM 45, 47–50 (2023);* Bhat, *supra* note 54, at 330.

[67] On the nuclear contamination of Earth, *see* FRANCIS LYALL & PAUL B. LARSEN, SPACE LAW: A TREATISE 255-258 (2d ed. 2018).

[68] The scope of the Moon Agreement is limited to the Moon and other celestial bodies. Moon Agreement, *supra* note 44*,* art. 1.

[69] Moon Agreement, *supra* note 44, art. 7(1).

[70] *Id.* (emphasis added). *See also* Sterns & Tennen, supra note 56, at 282–283; López Marcos, supra note 54, at 508.

enforcement capabilities under PIL.[71] This, in addition to not having the reinforced status of CIL limits its enforcement capabilities under PIL.[72]

Although the Moon Agreement represents a clear option to defend the environment of celestial bodies among those States Parties to it, it does not mention the vacuum of the outer space environment. This is due to its limited material scope under Article I of the Moon Agreement, which declares that it covers only the Moon and other celestial bodies.[73] This represents another limitation, in addition to the reduced number of States Parties to the Moon Agreement, which prevents it from becoming an effective tool to protect the outer space environment from unsustainable activities.

Under the Outer Space Treaty and the Moon Agreement, treaty space law seems to fail to provide effective protection of the outer space environment; although the Moon Agreement does protect the Moon and its celestial bodies from space debris, it has a limited legally binding force. However, there is another treaty that might persuade States to protect the outer space environment as well as its celestial bodies, namely, the Liability Convention of 1972. This mechanism provides three possible solutions. First, the Liability Convention serves as an ex-post measure to repair the damage already caused by space objects. However, when the Liability Convention defines the term "damage," it does not encompass those that negatively affect the outer space environment. Therefore, damages to the outer space environment or celestial bodies' environments do not qualify for compensation unless there is permanent harmful space debris on other celestial bodies–i.e., through Article XXI of the Liability Convention. Therefore, damages to the outer space environment or celestial bodies' environments do not qualify for compensation unless there is permanent harmful space

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[71] *See generally* C.N.4.2023.TREATIES-XXIV.2 (Depositary Notification), *Withdrawal of Saudi Arabia*, effective Jan. 5, 2024, U.N.T.C. 23002 (Jan 5. 2023), https://treaties.un.org/doc/Publication/UNTS/No%20Volume/23002/A-23002-Saudi%20Arabia-0800000280603342.pdf [hereinafter Saudi Arabia Withdrawal].

[72] The Moon Agreement is not a failed treaty. Under Article 2(1)(a) of the VCLT, the Moon Agreement followed the required procedures to be considered a treaty. While some consider it a failed treaty due to the limited number of ratifying States, the correct argument would be to state that it has reduced legally binding force on the international community at large. Therefore, it is not a failed treaty.

[73] *See* Moon Agreement, *supra* note 44, art. 1.

debris on other celestial bodies–i.e., through Article XXI of the Liability Convention.[74] Therefore, damages to the outer space environment or celestial bodies' environments do not qualify for compensation unless there is permanent harmful space debris on other celestial bodies–i.e., through Article XXI of the Liability Convention.[75]

Second, the Liability Convention does not establish a quantum to compensate for the caused damage. This could serve as an *ex-ante* measure to indirectly protect the outer space environment. Because there is no quantum, this could be persuasive to States, effectively encouraging them to carry out technical standards and to comply with international non-legally binding instruments on space activities.[76]

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[74] *See* Liability Convention, *supra* note 44, art. I. "For the purposes of this Convention: (a) The term "damage" means loss of life, personal injury or other impairment of health; or loss of or damage to property of States or of persons, natural or juridical, or property of international intergovernmental organizations." *Id.*

[75] This is an important exception to the Liability Convention's normal rejection of requirements to protect the space environment:

> If the damage caused by a space object presents a large-scale danger to human life or seriously interferes with the living conditions of the population or the functioning of vital centres, the States Parties, and in particular the launching State, shall examine the possibility of rendering appropriate and rapid assistance to the State which has suffered the damage, when it so requests. However, nothing in this article shall affect the rights or obligations of the States Parties under this Convention.

Liability Convention, *supra* note 44, art. XXI. Normally, this refers to vital centers, which are contemplated to be on Earth. This reference, though vague, includes the Earth environment since the center of life and population is located there and those damages could be quantified under Article XXI of the Liability Convention. Additionally, when HSS are established on the Moon and Mars, the scope of Article XXI of the Liability Convention could be expanded and fully applied to those "vital centers," that is, those that support life, which could include the broader environment of the celestial bodies where those HSS are located. More controversial would be the application of Article XXI of the Liability Convention to commercial space stations and other space stations. Article XXI elevates the threshold of danger regarding the damages that can be inflicted, that is, when there is a population of people living in a permanent vital center. This could also include permanent outer space settlements with a regular and consistent population living there. This is understood to be an environment where a permanent city exists. *See* Leonardo Alberto López Marcos, *Colaboración Internacional en el Ámbito de los Recursos Espaciales sobre la Necesidad de Crear un Instrumento Internacional que Regule la Explotación y Apropiación de los Recursos Espaciales en la Luna y Otros Cuerpos Celestes*, 2 REVISTA ESPAÑOLA DE DERECHO AERONÁUTICO Y ESPACIAL 495, 532 (2022).

[76] *See DISH Operating L.L.C.*, DA 23–888 (Fed. Commc'n Comm'n, Oct. 2, 2023), https://docs.fcc.gov/public/attachments/DA-23–888A2.pdf (last visited Dec. 6, 2024).

Third, the Liability Convention could potentially, albeit indirectly, protect the outer space environment under several scenarios. By preserving space sustainability, specifically by avoiding collisions between space objects, Article III of the Liability Convention provides three scenarios:

a) Earth Orbit. Sending a space mission to another celestial body.[77] Earth orbit is still part of the outer space environment. Although some may argue that Earth's orbits constitute the so-called "Global Earth Environment," the nature of Earth's orbit is defined by the vacuum of outer space. It is a limited space resource that must be preserved under general principles of IEL such as sustainable development.[78] Still, the Liability Convention fully applies to Earth's orbit and could indirectly protect the space environment.

This scenario considers that before landing on a specific celestial body, the space object could encounter collisions with other space objects in Low Earth Orbit (LEO). Some space objects are powered by nuclear energy sources. In the event of a collision in LEO, environmental damage in outer space would be significant. This could render LEO unusable and, worse still, result in unknown damage to Earth. Under this hypothesis, the protection of outer space could be achieved through *ex-ante* measures designed to monitor and track Earth orbit space traffic, and through the related liability regime established under Article III of the Liability Convention.

b) Celestial Bodies. Once the space mission has left Earth's orbit, the next destination is a celestial body. Space activities on celestial bodies could vary. For instance, plans for the Moon suggest that a majority of lunar surface activities will occur at the South Pole due to its resource rich environment.[79]

Inevitably, several space actors, both private and public, will consider activities such as, among others, transportation, space mining, and energy production and distribution. These activities

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[77] The space mission could be commercial, scientific, military, civil, etc.

[78] *See* Jie Long & Wu Xie, *The Concept of Long-Term Sustainability of Outer Space Activities as an Emerging Source of International Law*, 45 J. SPACE L. 46 (2021).

[79] *See* DI PIPPO, *supra* note 28, at 141–42. The current programs aim to carry out missions to the South Pole of the Moon (e.g. Artemis, ILRS, etc.). For instance, there is ice water that can be converted into hydrogen and oxygen through the electrolysis process. These two elements are necessary to support lunar human settlements and provide fuel for spaceships. *Id.*

potentially could involve explosions and other damage to habitats, structures, and the space environment due to the nature of the space objects engaged in these endeavors. This includes collisions between space objects on the Moon and between them and habitats and structures. In such circumstances, the provisions of Articles III and XXI of the Liability Convention would fully apply. Such damages could have severe consequences for the lunar environment at the South Pole, potentially rendering it unsuitable for a permanent human presence.

c) Celestial Bodies' Orbits. Current plans indicate that the next densely populated celestial body orbit might be the Moon's orbit.[80] This situation could mirror the projected megaconstellations of satellites in Earth's orbit, and potentially lead to issues akin to the Kessler – Cour Palais Syndrome. The ultimate consequence of such damage could jeopardize lunar orbit due to unsustainable management of space activities. Life on the Moon is hostile; irresponsible behavior in lunar orbit could result in unimaginable damage to the lunar environment and lunar orbit, endangering habitats, human lives, and more. Articles III and XXI of the Liability Convention would be fully applicable in this scenario.

Each of these hypotheses could help protect the outer space environment and habitats, reducing the risk of collisions or accidents involving space objects. It is widely known that the Liability Convention has yet to be effectively utilized. While there have been several incidents that could have triggered the Liability Convention mechanisms (e.g. Claims for Compensation), they have, rather, been resolved through diplomatic negotiations.[81]

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[80] *See The Moon – Where No Satnav Has Gone Before*, EUR. SPACE AGENCY (Apr. 20, 2022), https://www.esa.int/Applications/Satellite_navigation/The_Moon_where_no_satnav_has_gone_before (last visited (Jan. 6, 2025). *See also NaviMoon Receiver and Low Noise Amplifier*, EUR. SPACE AGENCY (Apr. 15, 2022), https://www.esa.int/ESA_Multimedia/Images/2022/04/NaviMoon_receiver_and_Low_Noise_Amplifier (last visited Jan. 6, 2025); *What Is ESA's Moonlight Initiative?*, EUR. SPACE AGENCY (Nov. 9, 2022), https://www.youtube.com/watch?v=JeJrppAf78E (last visited Dec. 6, 2024).

[81] *See* Lesley Jane Smith, *Collisions in Space: Perspectives on the Law Applicable to Damage from Space Objects*, INT'L INST. SPACE L. 230, 232 (2012). For instance, neither the 1978 Cosmos 954 case nor the 2009 Cosmos 2251-Iridium Satellite case were resolved through the Claims of Compensations Mechanism under the Liability Convention. *See id*.

It is thus clear that Article IX of the OST does not provide sufficient legal protection against general contamination of the outer space environment, except when it is chemical in nature. Consequently, habitats, structures, and the human rights of people who will live in outer space are largely unprotected. As demonstrated in the following sections, there are other mechanisms that could protect the outer space environment as a *conditio sine qua non* for habitats, structures, and the free enjoyment of human rights. These include customary ISL and resorting to other branches of general international law through Article III of the OST.

B. Protection of the Outer Space Environment Under Customary International Space Law

The failure of international treaty law to protect outer space creates room to reconsider other opportunities for developing ISL. Article 38(1) of the ICJ Statute recognizes customary international law (CIL) as another valid source of PIL.[82] There is no hierarchy among the three sources of PIL—treaties, CIL, and general principles of law—as they all hold the same legal status.[83] Article 38(1) of the ICJ Statute merely outlines the application of these sources of PIL to particular cases without establishing any hierarchy.[84]

However, the role of CIL in space law differs from other branches of PIL for a few reasons. First, there is a limited number of actual spacefaring nations capable of independently launching space objects, which provides an interesting case for meeting the two requirements for the formation of CIL—State practice and *opinio juris*. Second, the codification of space law, both in treaties and non-legally binding instruments (e.g., declarations of principles), was prevalent during the last century as they clarified rules in outer space. Third, there is an absence of an immediately identifiable 'territory' (area) in which States can physically and easily perform their activities (which is different from the more easily identifiable territories or areas regulated by the Law of the Sea and International Environmental Law, for example). This inevitably complicates the creation of common State practice and *opinio juris*.

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[82] *See* Marcos & Aguilar, *supra* note 32, at 34-40; *see also* ICJ Statute, *supra* note 30, art. 38(1).

[83] *See* Int'l Law Comm'n, *supra* note 36.

[84] *See* ICJ Statute, *supra* note 30, art. 38(1).

Outer space represents a unique branch of PIL, not only in the adoption of treaty law but also in the formation of CIL.[85] In the *North Sea Continental Shelf Cases* (1969), the ICJ established two prongs necessary for the formation of CIL: the objective and subjective.[86] The former refers to State practice, the latter to State belief.[87] These prongs do not appear under Article 38 ICJ Statute; nonetheless they have been developed by the ICJ.[88]

This first prong is analyzed under three elements: duration, generality, and consistency.[89] First, as some argue, the formation of CIL by State practice cannot be instant; the ICJ and then the ILC have declared that a passage of time must need to happen. It could be short or long, but it needs to happen; in this sense, there is no room for instant customary international law.[90] Second, the State

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[85] *See* Comm. on the Peaceful Uses of Outer Space, Compendium on Rules of Procedure and Methods of Work Related to the United Nations Committee on the Peaceful Uses of Outer Space and Its Subsidiary Bodies, U.N. Doc. A/AC.105/2016/CRP.5 (2016). The decision-making rule at UNCOPUOS is consensus. Consequently, all member States must agree on decisions to be adopted, and they only have a *quasi*-veto right. *See id*; SECURE WORLD FOUND., MICHAEL FRIEDL, THE COPUOS BRIEFING BOOK 5 (Christopher D. Johnson ed. 2d. ed. 2025).

[86] *See* North Sea Continental Shelf, 1969 I.C.J. 3 (Feb. 20). In the North Sea Continental Shelf cases, the ICJ develops the objective and subjective elements of CIL. For instance, in paragraph 77, the ICJ develops the *opinio juris* concept by saying that two conditions must be fulfilled. Not only must the acts concerned amount to a settled practice, but they must also be such, or be carried out in such a way, as to be evidence of a belief that this practice is rendered obligatory by the existence of a rule of Law requiring it. The need for such a belief, i.e., the existence of a subjective element, is implicit in the very notion of the *opinio juris sive necessitatis*. The States concerned must therefore feel that they are conforming to what amounts to a legal obligation. The frequency, or even habitual character of the acts is not in itself enough. There are many international acts, e.g., in the field of ceremonial and protocol, which are performed almost invariably, but which are motivated only by considerations of courtesy, convenience or tradition, and not by any sense of legal duty.

[87] *See* North Sea Continental Shelf, 1969 I.C.J. ¶¶ 71-77.

[88] *See id. See also* Nicar. v. U.S., 1986 I.C.J. 14 (June 27); Asylum Case (Colom./Peru), Judgment, 1950 I.C.J. 266 (Nov. 20); Fisheries Case (U.K. v. Nor.), Judgment, 1951 I.C.J. 116 (Dec. 18).

[89] *See* North Sea Continental Shelf,1969 I.C.J. ¶ 73. *See also* Nicar. v. U.S., 1986 I.C.J. ¶¶ 184–86.

[90] *See* Nicar. v. U.S., 1986 I.C.J. ¶ 184. As the ICJ expresses:

> there is in fact evidence, to be examined below, of a considerable degree of agreement between the Parties as to the content of the customary international law relating to the non-use of force and non-intervention. This concurrence of their views does not however dispense the Court from having itself to ascertain what rules of customary international law are applicable. The mere fact that States

practice must be widespread or general, which is different from being universal. A general State practice considers the practice of those States whose interests are more affected, for the CIL. The problem is that even the ICJ considers as more important the State practice of those States whose interests are more affected, without defining what this means.[91] Third, when it comes to consistency,

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> declare their recognition of certain rules is not sufficient for the Court to consider these as being part of customary international law, and as applicable as such to those States. Bound as it is by Article 38 of its Statute to apply, inter alia, international custom "as evidence of a general practice accepted as law," the Court may not disregard the essential role played by general practice. Where two States agree to incorporate a particular rule in a treaty, their agreement suffices to make that rule a legal one, binding upon them; but in the field of customary international law, the shared view of the Parties as to the content of what they regard as the rule is not enough. The Court must satisfy itself that the existence of the rule in the *opinio juris* of States is confirmed by practice.

Id. On the other hand, the ILC has identified that there is no time limit to create CIL. *See* Int'l Law Comm'n, Draft Conclusions on Identification of Customary International Law, with Commentaries, U.N. Doc. A/73/10, at 122–56 (2018). The ILC points out that in the *North Sea Continental Shelf* cases the ICJ observes the passage of time to create a rule; therefore, there is no space for an instant formation of CIL. *See id*. at 138.

Paragraph 2 refers to the time element, making clear that a relatively short period in which a general practice is followed is not, in and of itself, an obstacle to determining that a corresponding rule of customary international law exists. While a long duration may result in more extensive practice, time immemorial or a considerable or fixed duration of a general practice is not a condition for the existence of a customary rule. The International Court of Justice Confirmed this in the *North Sea Continental Shelf* cases, holding that "the passage of only a short period of time is not necessarily, or of itself, a bar to the formation of a new rule of customary international law." North Sea Continental Shelf,1969 I.C.J. ¶ 74. As this passage makes clear, however, some period of time must elapse for a general practice to emerge; there is no such thing as "instant custom."

[91] *See* North Sea Continental Shelf, 1969 I.C.J. ¶ 73. When there is an emerging rule of CIL, the analysis of its requirements (objective and subjective elements) must be seen in light of those States whose interests are specifically affected. Nonetheless, the ICJ has not further defined this concept. Therefore, there are doubts about whose interests are most affected: space-faring nations, developing countries, or all of them? *See id.*

> With respect to the other elements usually regarded as necessary before a conventional rule can be considered to have become a general rule of international law, it might be that, even without the passage of any considerable period of time, a very widespread and representative participation in the convention might suffice of itself, provided it included that of States whose interests were specially affected. In the present case however, the Court notes that, even if allowance is made for the existence of a number of States to whom participation in the Geneva Convention is not open, or which, by reason for instance of being land-locked States, would have no interest in becoming parties

the ICJ does not require perfect consistency in State practice; there can be inconsistencies in the State practice of a State, but these must be labeled as breaches of the CIL rule.[92]

The second prong in developing CIL is *opinio juris*, that is, the belief that State practice is legally binding—i.e., Law. This belief is different from mere usages or practices in international relations among States—e.g., humanitarian assistance, parking for diplomats. The ICJ identified both prongs of CIL as dependent on one another; this means that State practice without *opinio juris* cannot solely create CIL, nor the reverse.[93] As for the evidence to prove

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> to it, the number of ratifications and accessions so far secured is, though respectable, hardly sufficient. That non-ratification may sometimes be due to factors other than active disapproval of the convention concerned can hardly constitute a basis on which positive acceptance of its principles can be implied: the reasons are speculative, but the facts remain.

Id.

[92] Nicar. v. U.S., 1986 I.C.J. ¶ 186.

> It is not to be expected that in the practice of States the application of the rules in question should have been perfect, in the sense that States should have refrained, with complete consistency, from the use of force or from intervention in each other's internal affairs. The Court does not consider that, for a rule to be established as customary, the corresponding practice must be in absolutely rigorous conformity with the rule. In order to deduce the existence of customary rules, the Court deems it sufficient that the conduct of States should, in general, be consistent with such rules, and that instances of State conduct inconsistent with a given rule should generally have been treated as breaches of that rule, not as indications of the recognition of a new rule. If a State acts in a way prima facie incompatible with a recognized rule, but defends its conduct by appealing to exceptions or justifications contained within the rule itself, then whether or not the State's conduct is in fact justifiable on that basis, the significance of that attitude is to confirm rather than to weaken the rule.

Id.

[93] *See id.* ¶ 184.

> The Court notes that there is in fact evidence, to be examined below, of a considerable degree of agreement between the Parties as to the content of the customary international law relating to the non-use of force and non-intervention. This concurrence of their views does not however dispense the Court from having itself to ascertain what rules of customary international law are applicable. The mere fact that States declare their recognition of certain rules is not sufficient for the Court to consider these as being part of customary international law, and as applicable as such to those States. Bound as it is by Article 38 of its Statute to apply, inter alia, international custom "as evidence of a general practice accepted as law", the Court may

State practice and *opinio juris,* these could be shown in unconventional ways. That is, for instance, not only could a UNGA resolution show both the State practice of the State and its *opinio juris* through its vote, but also the way the State passes national law or how its judicial branch interprets the law could be used to show the same. All of these reflect State practice and *opinio juris*.[94]

The primary legal effect of creating a rule of CIL is its binding nature. While treaties are legally binding only among the States that have ratified them (*inter partes*), CIL is binding *erga omnes*; this means that the entire international community is legally bound by a rule of CIL.[95] In the context of space law, we propose that there are two types of CIL: CIL based on treaty law, and New Emerging CIL (NECIL). The former reinforces the legal status of the OST and declarations of legal space principles, demonstrating an interaction between sources of ISL, while the latter involves new emerging state practice that might fill legal gaps in the OST.[96]

> not disregard the essential role played by general practice. Where two States agree to incorporate a particular rule in a treaty, their agreement suffices to make that rule a legal one, binding upon them; but in the field of customary international law, the shared view of the Parties as to the content of what they regard as the rule is not enough. The Court must satisfy itself that the existence of the rule in the *opinio juris* of States is confirmed by practice.

[94] *See* JAN KLABBERS, INTERNATIONAL LAW 28-30 (2024).

[95] *See* North Sea Continental Shelf,1969 I.C.J. ¶ 71.

> In so far as this contention is based on the view that Article 6 of the Convention has had the influence, and has produced the effect, described, it clearly involves treating that Article as a norm-creating provision which has constituted the foundation of, or has generated a rule which, while only conventional or contractual in its origin, has since passed into the general *corpus* of international law, and is now accepted as such by the *opinio juris*, so as to have become binding even for countries which have never, and do not, become parties to the Convention. There is no doubt that this process is a perfectly possible one and does from time to time occur: it constitutes indeed one of the recognized methods by which new rules of customary international law may be formed. At the same time this result is not lightly to be regarded as having been attained.

Id.

[96] NECIL is a legal concept that we propose in order to explain the potential impact of the concept of space sustainability as CIL. NECIL does not have legal consequences yet, under Article 38(1)(b) of the ICJ Statute. In a similar vein (albeit in the context of space resource appropriation), Pershing refers to a "second shift" in customary international law. *See* Abigail D. Pershing, *Interpreting the Outer Space Treaty's Non-*

The process of forming the first type normative instruments of CIL in ISL began with the codification of several principles in the 1963 Declaration of Legal Principles.[97] In 1967, four years later, principles such as non-appropriation, freedom of use of space, applicability of international law to space activities, cooperation and mutual assistance, and international responsibility of States for national space activities were enshrined in the OST.[98] The key distinction between these instruments, although both were adopted by consensus, is that the former is a non-legally binding instrument while the latter is a treaty and thus legally binding as such. However, the normative significance of the 1963 Declaration was considerable, as it laid the foundational principles governing space exploration. Some of the principles from the 1963 Declaration of Legal Principles that were codified in the OST have attained the status of CIL. While some entities confirm the entire OST as having CIL status, one needs to be cautious since not all articles from the OST are considered CIL by the broader international community. Arguably, Articles I, II, III, IV, VI, VIII, IX, and XI have acquired the status of CIL.[99]

The other identified type of CIL in ISL—NECIL—involves new emerging concepts or activities that fill legal gaps in the OST. These include space sustainability and the development of anti-satellite (ASAT) tests. As argued in the previous section, there are limited references to effective protection of the outer space environment. This has allowed UNCOPUOS and States to enact international non-legally binding and national legislation/regulations on space

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Appropriation Principle: Customary International Law from 1967 to Today, Yale J. of Int'l L. 149 (2019).

[97] *See generally* G.A. Res. 1962 (XVIII) Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space (Dec. 13, 1963). One of the notable practices of United Nations Committee on the Peaceful Uses of Outer Space is that of consensus as a procedural rule, which not only reflects a consistent State practice but also a greater *opinio juris*. *See generally* FRIEDL, *supra* note 85.

[98] *See generally* Outer Space Treaty, *supra* note 10.

[99] *See* Comm. On the Peaceful Uses of Outer Space, Responses to the Set of Questions Provided by the Chair of the Working Group on the Status and Application of the Five United Nations Treaties on Outer Space, U.N. Doc. A/AC.105/C.2/CRP.6 (2017). This is argued by some scholars, which only considers a couple of articles from the OST as CIL. *See* Ram S Jakhu & Steven Freeland, *The Relationship Between the Outer Space Treaty and Customary International Law*, *in* 67TH INT'L ASTRONAUTICAL CONG. (2016).

sustainability issues.[100] One of the most notable examples is the 2018 UNCOPUOS Long-Term Sustainability Guidelines.[101]

Under this set of guidelines, the concept of space sustainability is defined as follows:

> The long-term sustainability of outer space activities is defined as the ability to maintain the conduct of space activities indefinitely into the future in a manner that realizes the objectives of equitable access to the benefits of the exploration and use of outer space for peaceful purposes, in order to meet the needs of the present generations while preserving the outer space environment for future generations.[102]

The references to the concept of sustainable development from IEL are tangible. First, the space sustainability concept includes the need to reconcile economic development with the protection of the outer space environment. Second, in the *Gabčíkovo–Nagymaros Project* case, the ICJ discusses the dynamic between economic development and its interference with the preservation of the environment.[103] Third, the concept of space sustainability also

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[100] At the national level, for example, the Federal Communications Commission adopted a rule that requires companies to deorbit their satellites within five years of end of life. *See supra* note 59.

[101] *See generally* Comm. On the Peaceful Uses of Outer Space, Guidelines for the Long-term Sustainability of Outer Space Activities, Guidelines for the Long-term Sustainability of Outer Space Activities, U.N. Doc. A/AC.105/2018/CRP.20 (2018) [hereinafter LTS Guidelines].

[102] *Id*. at 2.

[103] *See* Gabčíkovo-Nagymaros Project Case (Hung./Slovk.), Judgment, 1997 I.C.J. 7 (Sept. 25). Here, the ICJ states that they have an integrated relationship and declares the need to reconcile economic growth with the protection of the environment, since humans have been interfering with it for decades. *See id.* Accordingly, the ICJ states that

> Throughout the ages, [hu]mankind has, for economic and other reasons, constantly interfered with nature. In the past, this was often done without consideration of the effects upon the environment. Owing to new scientific insights and to a growing awareness of the risks for [hu]mankind - for present and future generations - of pursuit of such interventions at an unconsidered and unabated pace, new norms and standards have been developed, set forth in a great number of instruments during the last two decades. Such new norms have to be taken into consideration, and such new standards given proper weight, not only when States contemplate new activities but also when continuing with activities begun in the past. This need to reconcile economic development with protection of the environment is aptly expressed in the concept of sustainable development.

integrates intergenerational and intragenerational equity, which the ICJ developed in the *Nuclear Test Weapons* advisory opinion.[104] And finally, the 1992 Rio Declaration proclaimed that the same level of rights that the current generation enjoy are also the prerogative rights of future unborn generations (intergenerational principle); this also applies when it refers to the present generation (intragenerational principle).[105] The integration principle, as part of space sustainability and sustainable development concepts, leads to a direct relationship between the environment and economic development, that is, integrating environmental policies, to preserve the environment, into economic development policies.[106]

Id. at 77-78. What the ICJ states in this case reflects what is currently happening in Earth's orbit and what could happen in the Moon's orbit. As pointed out in the introduction, the number of space objects in Earth's orbit has increased exponentially since the first satellite, Echo-1, was launched into outer space in 1960. Back then, including pieces of space debris, there were only 13 space objects orbiting Earth. Today, this number has increased to over 10,000 active satellites and untold millions of pieces of space debris objects of various sizes. *See* Martínez, *supra* note 15, at 522–30; *see also UCS Satellite Database*, UNION OF CONCERNED SCIENTISTS, https://www.ucsusa.org/resources/satellite-database (May 1, 2023) (last visited Dec. 6, 2024); *see also Space Debris by the Numbers*, EUR. SPACE AGENCY (Aug. 15, 2024), https://www.esa.int/Space_Safety/Space_Debris/Space_debris_by_the_numbers (last visited Dec. 6, 2024).

104 *See* Nuclear Weapons in Armed Conflict, Advisory Opinion, 1996 I.C.J. 66, ¶ 29. In this case, the ICJ considers that the environment is no longer an abstract concept, involving the health of humans and future generations. This is extremely important because once the environment is "defined," States have positive and negative obligations regarding it. For instance, they are obligated to take care of the environment so that future generations can enjoy it. *See id.* The ICJ refers to this as it follows:

> The Court recognizes that the environment is under daily threat and that the use of nuclear weapons could constitute a catastrophe for the environment. The Court also recognizes that the environment is not an abstraction but represents the living space, the quality of life and the very health of human beings, including generations unborn. The existence of the general obligation of States to ensure that activities within their jurisdiction and control respect the environment of other States or of areas beyond national control is now part of the corpus of international law relating to the environment.

Id. ¶ 29.

105 *See* Report of the United Nations Conference on Environment and Development (1992), U.N. Doc. A/CONF.151/26 (Vol. I) (June 1992) [hereinafter Rio Declaration].

106 *See* Pulp Mills on the River Uruguay (Arg. v. Uru.), Judgment, 2010 I.C.J. 14 (Apr. 20). In the *Pulp Mills* case, the ICJ returns to its previous cases to reiterate the impact of economic development on the environment and the need to reconcile both. This is achieved by integrating one into the other in policymaking decisions so that these are not taken in isolation from each other.

The problem with applying the sustainable development principle to outer space is that this concept is based on the scarcity of resources and their efficient and fair management. The outer space environment is, however, different from this characterization, as there are, *a priori*, unlimited resources. However, when it comes to Earth's orbit, some scholars argue that this integrates into the so-called Global Earth Ecosystem. This is partially correct, since the orbits are a limited resource,[107] so some sustainable development subprinciples might be applied (e.g. the intragenerational equity

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> 76. In the *Gabčíkovo-Nagymaros* Case, the Court, after recalling that "[t]his need to reconcile economic development with protection of the environment is aptly expressed in the concept of sustainable development," added that "[i]t is for the Parties themselves to find an agreed solution that takes account of the objectives of the Treaty."
> 77. The Court observes that it is by co-operating that the States concerned can jointly manage the risks of damage to the environment that might be created by the plans initiated by one or other of them, so as to prevent the damage in question, through the performance of both the procedural and the substantive obligations laid down by the 1975 Statute. However, whereas the substantive obligations are frequently worded in broad terms, the procedural obligations are narrower and more specific, so as to facilitate the implementation of the 1975 Statute through a process of continuous consultation between the parties concerned. The Court has described the régime put in place by the 1975 Statute as a "comprehensive and progressive régime" since the two categories of obligations mentioned above complement one another perfectly, enabling the parties to achieve the object of the Statute which they set themselves in Article 1.

Id. ¶¶ 76–77 (internal citations omitted).

[107] *See* Int'l Telecomm. Union (ITU), art. 44, *Use of the Radio-Frequency Spectrum and of the Geostationary-Satellite and Other Satellite Orbits*, Constitution, at 49 (1992). Article 44 of the International Telecommunication Union (ITU) Constitution refers to the radio frequencies spectrum and its associated Earth orbits as a limited natural resource. Considering this characteristic, IEL principles might be applied here, specifically the principle of sustainable development. This same idea is reflected in Article 44 when it refers to the equitable access to those orbits:

> In using frequency bands for radio services, Member States shall bear in mind that radio frequencies and any associated orbits, including the geostationary-satellite orbit, are limited natural resources and that they must be used rationally, efficiently and economically, in conformity with the provisions of the Radio Regulations, so that countries or groups of countries may have equitable access to those orbits and frequencies, taking into account the special needs of the developing countries and the geographical situation of particular countries.

Id.

principle).[108] Yet Earth's orbit is specifically regulated under Article IV of the OST when it comes to the prohibition on the placement of nuclear weapons and weapons of mass destruction in outer space.[109]

From IEL to the specific characteristics of the space environment (e.g. "equitable access to the benefits," "to meet the needs of the present generations," "future generations"), space sustainability concepts adapt perfectly to the idea of sustainable development. Therefore, there is an autonomous and separate concept of sustainability between Earth and space *per se*. Space sustainability is a new concept that emerged under the definition found in the 2019 LTS Guidelines, although there have been other references in non-legally binding instruments.[110] This novel concept of space sustainability makes it possible to consider whether it reaches the status of CIL or not. Considering that space sustainability is not present, as such, in any conventional space law, it is interesting to wonder whether this might be a new rule of CIL.

Article 38 of the ICJ Statute does not specify the time and the conditions demanded for developing a new rule of CIL; although there is no time limit, it is highly unlikely that a new rule of CIL might arise from one day to another. In the context of space law, arguments for "instant" CIL have arisen due to the non-appropriation principle deriving from the launch of Sputnik in 1957.[111] The ICJ and the International Law Commission (ILC) have declared that the emergence of instant CIL is not possible, but they have not delineated the time that State practice needs to occur before it becomes CIL. There can be an instant *opinio juris* of what is law (the belief), but still the objective element (State practice) needs to be

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[108] *See* Bhat, *supra* note 54.

[109] *See* Outer Space Treaty, *supra* note 10, art. IV. "States Parties to the Treaty undertake not to place in orbit around the earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons on celestial bodies, or station such weapons in outer space in any other manner." *Id.*

[110] *See IADC Space Debris Mitigation Guidelines*, INTER-AGENCY SPACE DEBRIS COORDINATION COMM. IADC-02-01 (2020); COPUOS DEBRIS MITIGATION GUIDELINES, *supra,* note 9; Zero Debris Charter, *supra* note 59; *Space Systems – Space Debris Mitigation Requirements* (ISO 24113), INT'L ORG. FOR STANDARDIZATION (2023).

[111] *See* CHENG, *supra* note 4.

developed.[112] As stated by the ICJ, the formation of CIL can be fast or slow depending on the context, but there is still a need for a "passage of time" before State action can be considered a settled State practice.[113]

However, there is no problem asserting that space sustainability has not emerged as "instant" CIL. The importance of analyzing non-legally binding instruments to determine the status of this concept is because there are no legally binding instruments to clarify its status, at least as legally binding instruments. Even though the 2019 LTS Guidelines are non-binding for States, they have normative value; that is, they can turn into CIL if there is widespread, general, and consistent State practice accepting them and the belief that space sustainability is Law, and therefore legally binding.[114]

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[112] Nicar. v. U.S., 1986 I.C.J. ¶ 186. The ICJ states that the belief that something is law (*opinio juris*) cannot be isolated as a unique element for the formation of CIL. *Opinio juris* needs to be accompanied with the State practice (objective element). *Id.*

[113] North Sea Continental Shelf, 1969 I.C.J 3. In its Judgment, the ICJ clarifies that the time to develop CIL can be short, but there is still a need for "time" to develop it; therefore, the idea of instant CIL is not valid.

> As regards the time element, the Court notes that it is over ten years since the Convention was signed, but that it is even now less than five since it came into force in June 1964, and that when the present proceedings were brought it was less than three years, while less than one had elapsed at the time when the respective negotiations between the Federal Republic and the other two Parties for a complete delimitation broke down on the question of the application of the equidistance principle. Although the passage of only a short period of time is not necessarily, or of itself, a bar to the formation of a new rule of customary international law on the basis of what bras originally a purely conventional rule, an indispensable requirement would be that within the period in question, short though it might be, State practice, including that of States whose interests are specially affected, should have been both extensive and virtually uniform in the sense of the provision invoked;- and should moreover have occurred in such a way as to show a general recognition that a rule of law or legal obligation is involved.

Id. ¶ 74.

[114] The 2019 LTS Guidelines are a non-legally binding international instrument. However, when looking at the negotiation process, States showed great support for these guidelines. In addition, UNCOPUOS decision-making is based on consensus, which means every member of COPUOS must agree. This shows the *opinio juris* of each State. For instance, the Russian Federation considered during the negotiation process that these guidelines should be legally binding in the future. China recognized the importance of implementing the guidelines which represents the common concern of all States since there is a risk of Earth orbit congestion. The US positively reaffirmed the Guidelines as

It is quite relevant to consider the Artemis Accords as the current developer of space law in terms of CIL.[115] The Artemis Accords might have normative value because they are creating State practice and *opinio juris* necessary to establish CIL, to fill gaps in some areas not regulated, or barely regulated, by the OST. They might also have interpretative value with regard to the OST under Article 31 VCLT, by indicating subsequent State practice.[116] This value also comes from the number of its Signatory States, that is, it has more Signatories than States Parties to the 1979 Moon Agreement.[117] Over the course of four years, the growing number of States Signatories to the Artemis Accords has highlighted the importance of certain unilaterally agreed terms of space law.[118] Space

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a way to enhance transparency in outer space operations and responsible manners. Germany and France stated the same line as China, Russia and the US. *See infra* note 127.

[115] *See* Artemis Accords, *supra* note 26. The Artemis Accords are not a treaty according to the VCLT: "(a) "treaty" means an international agreement concluded between States in written form and governed by international law, whether embodied in a single instrument or in two or more related instruments and whatever its particular designation." VCLT, *supra* note 41, art. 2 (1)(a). Thus, the Artemis Accords are not legally binding and they adopt the form and content of a Memorandum of Understanding (MoU). *See* Deplano, *supra* note 16, at 801-02. In fact, the Artemis Accords themselves characterize the document as a "political commitment." Artemis Accords, *supra* note 26, § 1.

[116] EVANS, *supra* note 29, at 685–687.

[117] It is interesting to highlight the interaction between the Moon Agreement and the Artemis Accords. In January 2023, Saudi Arabia withdrew from the Moon Agreement. Saudi Arabia Withdrawal, *supra* note 59. Saudi Arabia had joined the Artemis Accords only the year prior. Garrett Shea, *Saudi Arabia Signs Artemis Accords,* NAT'L AERONAUTICS & SPACE ADMIN. (July 14, 2022), https://www.nasa.gov/missions/artemis/saudi-arabia-signs-artemis-accords/ (last visited Dec. 6, 2024). *Stricto sensu*, there are no contradictions between the Moon Agreement and the Artemis Accords as States (like Australia) can be part of both. This is because the Moon Agreement, although having a reduced number of States Parties, is a treaty under Article 2(1)(a) VCLT–i.e., legally binding–while on the other hand, the Artemis Accords are not a treaty and therefore not legally binding. However, if, in the future, the Artemis Accords become CIL, they would contradict the Moon Agreement to some extent, e.g., appropriation of space resources and the concept of the province of all humankind v. common heritage of humankind. *See* Nivedita Raju & Héloïse Vertadier, *The Role of Customary International Law in Future Lunar Activities*, 45 J. SPACE L. 383 (2021).

[118] Unilateral statements can be legally binding on States. *See* Nuclear Tests (Austl. v. Fr.), Judgment, 1974 I.C.J. 253, ¶ 43 (Dec. 20). The ICJ declared that unilateral acts could bind States and cause international legal effects:

> It is well recognized that declarations made by way of unilateral acts, concerning legal or factual situations, may have the effect of creating legal obligations. Declarations of this kind may be, and often are, very specific. When it is the intention of the State making the declaration that it should become bound according to its terms, that

sustainability is one of these areas that has been included in the Artemis Accords, endorsing its concepts as included in the 2019 LTS Guidelines.[119] Should the Artemis Accords become CIL in the future, the concept of space sustainability could also acquire that status since the Accords endorse the 2019 LTS Guidelines in Section 11(2).[120]

There is another possibility. Article 31(3)(a) of the VCLT refers to a subsequent agreement as a method to interpret a treaty.[121] In this sense, the Artemis Accords could interpret Article IX of the OST considering the concept of space sustainability under the 2019 LTS Guidelines. Thus, all the problems in interpreting the various types of forward contamination studied in the previous section could be addressed in light of the space sustainability concept.[122]

All in all, it is more probable that the space sustainability concept contained in the 2019 LTS Guidelines will become both CIL and a method of interpreting treaties according to Article 31(3)(a)

> intention confers on the declaration the character of a legal undertaking, the State being thenceforth legally required to follow a course of conduct consistent with the declaration. An undertaking of this kind, if given publicly, and with an intent to be bound, even though not made within the context of international negotiations, is binding. In these circumstances, nothing in the nature of a *quid pro quo* nor any subsequent acceptance of the declaration, nor even any reply or reaction from other States, is required for the declaration to take effect, since such a requirement would be inconsistent with the strictly unilateral nature of the juridical act by which the pronouncement by the [S]tate was made.

Id.

[119] Artemis Accords, *supra* note 26, § 11(2). "The Signatories affirm that the exploration and use of outer space should be conducted with due consideration to the United Nations Guidelines for the Long-term Sustainability of Outer Space Activities adopted by the COPUOS in 2019, with appropriate changes to reflect the nature of operations beyond low-Earth orbit." *Id.* While the Artemis Accords recognize the normative authority of the 2019 LTS Guidelines, they also recognize that they need to be adapted to the vacuum of outer space and–considering the spirit of the Artemis Program–celestial bodies, such as the Moon.

[120] *Id.*

[121] *See* VCLT, *supra* note 41, art. 31(3)(a) ("any subsequent agreement between the parties regarding the interpretation of the treaty or the application of its provisions").

[122] This needs further study; in order to be a method of interpretation, a subsequent agreement to the treaty must fill some criteria that is contained in the ILC's 2018 draft conclusions on subsequent agreements and subsequent practice in relation to the interpretation of treaties. *See* Int'l Law Comm'n, Draft Conclusions on Subsequent Agreements and Subsequent Practice in Relation to the Interpretation of Treaties, with Commentaries, U.N. Doc. A/73/10 (2018).

VCLT, rather than the Artemis Accords. The 2019 LTS Guidelines were adopted under the auspices of UNCOPUOS by consensus, with the number of States involved in the negotiation process increasing to 92 members from the initial 70; additionally, the guidelines were endorsed by the United Nations General Assembly.[123] Spacefaring nations such as China and Russia approved the LTS Guidelines.[124] Meanwhile, the Artemis Accords were created by the US without any international forum to discuss their content and without consulting other major spacefaring nations that to date have not yet joined the Accords (e.g. Russia and China).[125] This drawback makes it easier to approach the concept of space sustainability as emerging CIL through the LTS Guidelines rather than through the Artemis Accords.[126]

The concept of space sustainability in the 2019 LTS Guidelines was approved by consensus among the spacefaring nations and other States.[127] This may thus be regarded as indicative of *opinio*

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[123] LTS Guidelines, *supra* note 58.

[124] *Id.*

[125] *See* Artemis Accords*, supra* note 26; *Lunar Initiatives, supra* note 27.

[126] *See* Martínez, *supra* note 15, at 539-42.

[127] LTS Guidelines, *supra* note 58. The 2019 LTS Guidelines are a non-legally binding international instrument. However, when looking at the negotiation process, States showed great support for these guidelines. In addition, UNCOPUOS decision-making is based on the idea of consensus, which means that every member of COPUOS must agree. This shows the *opinio juris* of each State that supported the LTS Guidelines.

For instance, on one hand, the Russian Federation considered during the negotiation process that these guidelines should be legally binding in the future. *See* Comm. on the Peaceful Uses of Outer Space, Additional Considerations and Proposals for Building Up Understanding of the Priority Aspects, Comprehensive Meaning and Functions of the Concept and Practices of Ensuring the Long-Term Sustainability of Outer Space Activities, Working Paper Submitted by the Russian Federation, U.N. Doc. A/AC.105/L.296 (2015). China also recognized the importance of implementing the guidelines, which represents the common concern of all States since there is a risk of Earth orbit congestion. *See* Comm. on the Peaceful Uses of Outer Space, Sci. and Tech. Subcomm., China's Position Paper on the Issues of Long-term Sustainability of Outer Space Activities, Working Paper by China, U.N. Doc. A/AC.105/C.1/2016/CRP.13 (2016). Finally, the US positively reaffirmed the Guidelines as a way to enhance transparency in outer space operations and responsible manners, while Germany and France took the same stance as China, Russia and the US. *See* Comm. on the Peaceful Uses of Outer Space, Proposal by Canada, France, Japan and the United States of America for the Establishment of a Working Group on Implementation of Agreed Guidelines and Related Aspects of the Long-Term Sustainability of Outer Space Activities, Conference Room Paper by Canada, France, Japan and the United States of America, U.N. Doc. A/AC.105/2019/CRP.7 (2019).

juris in relation to what responsible behavior in space should be.[128]

The ICJ was clear in stating that in the formation of CIL the *opinio juris* and State practice of those States whose interests were more affected by the CIL carried more weight.[129] Thus, when examining the concept of space sustainability, one should take a careful look at States whose interests are more affected. The problem here is that the ICJ has not clearly defined how to evaluate that principle.[130] As of writing this article, only twelve States and the ESA

On the other hand, the BRICS States stressed that the LTS Guidelines were an instrument to promote and enhance cooperation and transparency in space activities. *See* Comm. on the Peaceful Uses of Outer Space, Joint Statement of the Delegations of BRICS States at the 58th Session of the UNCOPUOS on Issues Pertaining to the Elaboration of the Guidelines on Long-Term Sustainability of Outer Space Activities, U.N. Doc. A/AC.105/2015/CRP.20 (2015). Meanwhile the GRULAC States advocated for establishing, in the future, a legally binding instrument based on the 2019 LTS Guidelines. *See* Comm. on the Peaceful Uses of Outer Space, Sci. and Tech. Subcomm., Comments and Proposed Amendments to the Updated Set of Draft Guidelines for the Long-Term Sustainability of Outer Space Activities (document A/AC.105/C.1/L.340), Submission by GRULAC, U.N. Doc. A/AC.105/C.1/2015/CRP.19/Rev.1 (2015).

Additionally, and of note, one might think that ASAT tests would restrict the emerging CIL relating to space sustainability. However, as the ICJ stated in the *North Sea Continental Shelf* case, there can be some inconsistencies in State practice, thus it is not required that perfect State practice occurs; rather, these inconsistencies should be treated as a breach or violation of CIL. North Sea Continental Shelf, 1969 I.C.J 3.

[128] It is important to include private actors in the 2019 LTS Guidelines analysis because a "bottom-up" process formed them. This means that non-governmental entities, private actors, and others were consulted during the negotiations, so the entire space sector was represented in producing the LTS Guidelines. This is different than the approach used by the European Union with the Draft of the International Code of Conduct. There, the draft used a top-down approach to tackle the issue of responsible behavior in outer space. *See Draft International Code of Conduct for Outer Space Activities Fact Sheet*, SECURE WORLD FOUND. (Feb. 2014) https://swfound.org/media/166384/swf_draft_international_code_of_conduct_for_outer_space_activities_fact_sheet_february_2014.pdf (last visited Jan. 6, 2025).

[129] *See* North Sea Continental Shelf, 1969 I.C.J. ¶ 73 ("With respect to the other elements usually regarded as necessary before a conventional rule can be considered to have become a general rule of international law, it might be that, even without the passage of any considerable period of time, a very widespread and representative participation in the convention might suffice of itself, provided it included that of States whose interests were specially affected.").

[130] *See id*.

> In the present case however, the Court notes that, even if allowance is made for the existence of a number of States to whom participation in the Geneva Convention is not open, or which, by reason for instance of being land-locked States, would have no interest in becoming parties to it, the number of ratifications and accessions so far secured is, though respectable, hardly sufficient. That non-ratification

have launched rockets into space; forty-two have some sort of space legislation; four have carried out ASAT tests; and eighty have had some access to and use of outer space.[131] Considering the aforementioned points, it is interesting to observe the evolution of space legislation that integrates the 2019 LTS Guidelines. There are still a growing number of States that are integrating the guidelines into their national legislation; for instance, through their licensing regimes when contracting with the private space sector.

The other side of the coin reveals potential irresponsible behavior by other States in outer space after the LTS Guidelines were adopted. Some argue that Russia's 2021 kinetic explosive ASAT test might be an inconsistency hindering the development of CIL on space sustainability. Nonetheless, a "small" inconsistency in a country's policy might not detract from the formation of CIL. While it is true that Russia is a spacefaring nation, even internally the decision to conduct the ASAT test was not without controversy.[132] Additionally, India, another spacefaring nation, carried out its own ASAT test on 27 March 2019 (while the Guidelines were adopted on 21 June 2019).[133] Although the altitudes of both ASAT tests were different, they had a clear impact on space sustainability.[134] Still, they were acts that have not been followed by binding statements opposing the formation of the concept of space sustainability.[135]

After the 2021 Russian ASAT test, other spacefaring nations and States have been showing support for the 2019 LTS Guidelines.[136] For instance, in April 2022, the US expressed its intention

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> may sometimes be due to factors other than active disapproval of the convention concerned can hardly constitute a basis on which positive acceptance of its principles can be implied: the reasons are speculative, but the facts remain.

131 *See* Katharina Buchholz, *The Countries Capable of Launching Space Rockets*, STATISTA (Jul. 18, 2022), https://www.statista.com/chart/27792/countries-capable-of-launching-space-rockets/ (last visited Dec. 6, 2024); *National Space Law*, UNOOSA, https://www.unoosa.org/oosa/en/ourwork/spacelaw/nationalspacelaw/index.html (last visited Dec. 4, 2024); Jeff Foust, *India Tests Anti-Satellite Weapon*, SPACE.COM (Aug. 10, 2022), https://www.space.com/india-tests-anti-satellite-weapon.html (last visited Dec. 4, 2024).

132 *See* MICHAEL BYERS & AARON BOLEY, WHO OWNS OUTER SPACE? INTERNATIONAL LAW, ASTROPHYSICS, AND THE SUSTAINABLE DEVELOPMENT OF SPACE 281–83 (2024).

133 Foust, *supra* note 131.

134 *See* BYERS & BOLEY, *supra* note 132, at 266–273.

135 *Id.* at 335-342.

136 *Id.* at 308-332.

to ban testing ASAT weapons based on environmental consequences and responsible behavior in outer space.[137] An official statement like this not only serves as *opinio juris* but also as a unilateral declaration that is legally binding on the US. Therefore, going against that declaration could invoke international responsibility under the principle of estoppel.[138] Following this unilateral declaration, in December 2022, the UNGA approved a resolution to halt Direct Ascent ASAT tests due, among other reasons, to space sustainability concerns.[139] One hundred fifty-five States voted in favor, nine were absent, and nine voted against the resolution.[140] This demonstrates the growing *opinio juris* surrounding the concept of space sustainability and its related activities in space.[141]

As mentioned earlier, this work supports the emerging CIL principle of space sustainability. In many instances national legislation still needs to integrate space sustainability and establish standards for addressing violations. This also applies at the international level where there may be a need to create more non-legally binding instruments that define and concretize standards for identifying violations of this emerging rule and, possibly, further modify the concept. Ultimately, until the ICJ determines whether this constitutes CIL, everything remains speculative. The ICJ has yet to rule on specific space issues, though this could change with shifts in geopolitical dynamics and the emergence of new actors in outer space.[142] A possible solution, one the authors consider an important

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[137] On April 18, 2022, Vice President Kamala Harris stated that the US would not carry out any DA-ASAT tests in the future. This declaration was a legally binding unilateral statement that bound the US to an international obligation. *Fact Sheet: Vice President Harris Advances National Security Norms in Space*, WHITE HOUSE (Apr. 18, 2022), https://www.whitehouse.gov/briefing-room/statements-releases/2022/04/18/fact-sheet-vice-president-harris-advances-national-security-norms-in-space/ (last visited Dec. 6, 2024).

[138] *See* Alexander Ovchar, *Estoppel in the Jurisprudence of the ICJ: A Principle Promoting Stability Threatens to Undermine It*, 21 BOND L. REV. 5 (2009); Legal Status of Eastern Greenland (Den. V. Nor.) 1933 P.C.I.J. (ser. A/B) No. 53, at 73 (Apr. 5).

[139] *See* United Nations General Assembly, Working Paper by the Takshashila Institution for the Third Session of the OEWG on Reducing Space Threats, U.N. Doc. A/AC.294/2023/NGO/4 (2023).

[140] *See id.*

[141] *Id.*

[142] Nuclear Weapons in Armed Conflict, Advisory Opinion, 1996 I.C.J. ¶ 86. The ICJ did not directly address outer space issues. Nonetheless, the ICJ asserted the application of international law to any domain, which includes outer space and space activities.

step, would be for States to request an advisory opinion from the ICJ to analyze whether space sustainability constitutes CIL.

C. Legal Solutions to the Protection of the Outer Space Environment: Applicability of International Environmental Law to the Space Environment and the Protection of Human Space Settlements

Considering the lack of environmental protection of outer space and the consequent risks to HSSs under conventional space law and CIL, there are opportunities in other branches of PIL, specifically IEL, where these protections could be developed. This branch of PIL can effectively contribute to the protection of outer space and thus HSSs, as IEL is essential for the proper functioning of HSSs and the safeguarding of space settlers' rights. Article III of the OST allows for the integration of the entire PIL system into space activities, which differs from the interpretative rule of Article 31(3)(c) of the VCLT ('any relevant rules of international law').[143]

> The Court shares that view. Indeed, nuclear weapons were invented after most of the principles and rules of humanitarian law applicable in armed conflict had already come into existence; the Conferences of 1949 and 1974-1977 left these weapons aside, and there is a qualitative as well as quantitative difference between nuclear weapons and all conventional arms. However. it cannot be concluded from this that the established principles and rules of humanitarian law applicable in armed conflict did not apply to nuclear weapons. Such a conclusion would be incompatible with the intrinsically humanitarian character of the legal principles in question which permeates the entire law of armed conflict and applies to all forms of warfare and to all kinds of weapons, those of the past, those of the present and those of the future. In this respect it seems significant that the thesis that the rules of humanitarian law do not apply to the new weaponry, because of the newness of the latter, has not been advocated in the present proceedings.

Id.

[143] While Article III of the Outer Space Treaty requires that space activities be conducted in accordance with international law, Article 31(3)(C) of the VCLT is a method of treaty interpretation. *Compare* Outer Space Treaty, *supra* note 10, art. III ("States Parties to the Treaty shall carry on activities in the exploration and use of outer space, including the [M]oon and other celestial bodies, in accordance with international law, including the Charter of the United Nations, in the interest of maintaining international peace and security and promoting international co-operation and understanding."), with VCLT, *supra* note 41, art. 31(3)(C):

> 1. A treaty shall be interpreted in good faith in accordance with the ordinary meaning to be given to the terms of the treaty in their context

The optimal branch of PIL to protect the outer space environment is IEL. As noted, there is an emerging CIL principle that aims to protect the outer space environment through the 2019 LTS Guidelines—i.e. space sustainability—although this is not yet legally binding. Consequently, there is a notable shift towards utilizing existing internationally legally binding instruments that safeguard the Earth's environment.

First, Article III of the OST embodies an existing rule of CIL, meaning it is binding on all States regardless of whether they are parties to the OST.[144] This reaffirms the legal significance of Article III of the OST, which asserts that all PIL should be applied, including IEL, to space activities.[145] With IEL's mandatory applicability established, the next legal analysis focuses on its specific provisions.

IEL is primarily designed to address Earth's environmental challenges, such as resource scarcity, environmental degradation, climate change, biodiversity loss, trade in endangered species, and protection of biodiversity beyond national jurisdiction. While these issues may not directly translate to the unique challenges of the outer space environment,[146] they should be considered in relation to a broader type of contamination previously mentioned: actual forward contamination that could degrade the outer space environment and celestial bodies. This should encompass not only chemical contamination, but also nuclear waste, space debris, biological contamination, and other types of pollutants.

In this context, only IEL principles that are appropriate for protecting the outer space environment against such contamination

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> and in the light of its object and purpose. 2. The context for the purpose of the interpretation of a treaty shall comprise, in addition to the text, including its preamble and annexes: (a) any agreement relating to the treaty which was made between all the parties in connection with the conclusion of the treaty; (b) any instrument which was made by one or more parties in connection with the conclusion of the treaty and accepted by the other parties as an instrument related to the treaty. 3. There shall be taken into account, together with the context: (c) any relevant rules of international law applicable in the relations between the parties.

Id.

144 *See* Outer Space Treaty, *supra* note 10, art. III.

145 *See id.*

146 *See* COSPAR PP, *supra* note 66; *see also* COSPAR EARTH AND ENVIRONMENT, PLANETARY PROTECTION POLICY (2020).

should be considered. Conventional IEL law may not be applicable. For example, the Paris Agreement cannot be applied to the Moon, nor can the Biodiversity Convention be applied to the outer space environment. Therefore, IEL principles that intersect with various IEL conventions might offer the best option within IEL for application to outer space activities and subsequently for protecting the outer space environment and HSSs. An analysis of the principles of applicability of IEL to space activities involves two steps.

First, some IEL principles are functional while others are dysfunctional for the outer space environment. The hypothesis of the "polluter pays" principle assumes that the cost of contamination (externalities) should be borne by the polluter.[147] This can be achieved through taxes, standards, etc., that the polluter must pay to internalize the external costs of contamination. But there is a problem with this principle when applied to outer space: the polluter pays principle assumes there is an authority to which the polluter pays the costs of contamination, and that authority distributes the benefits of those costs throughout the system. There is no international space authority like the International Seabed Authority that that oversees the seabed and has authority to claim royalties and distribute benefits derived from seabed exploration.[148] Outer space is the province of all humankind, not the common heritage of humankind; therefore, no State can claim either property rights or sovereignty over it.[149] This complicates the application of the polluter pays principle.

Sustainable development may be applicable to Earth's orbit, not only as a principle that demands the rational use of this limited resource, but also through the sub-principles of inter- and intra-generational equity. This means that developing countries should

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[147] *See* Rio Declaration, *supra* note 105, Principle 16 ("National authorities should endeavor to promote the internalization of environmental costs and the use of economic instruments, taking into account the approach that the polluter should, in principle, bear the cost of pollution, with due regard to the public interest and without distorting international trade and investment.").

[148] United Nations Convention on the Law of the Sea, 833 U.N.T.S. 397, 21 I.L.M. 1261 (1982).

[149] *See* LAUREN PETERSON, THE FUTURE OF GOVERNANCE IN SPACE 177–209 (2021); *see also* Leonardo Alberto López Marcos, *Cuestiones Generales sobre el Establecimiento de una Nueva Barrera Legal Espacial que Delimite el Poder Estatal y las Actividades de los Actores Privados ante el Uso Intensivo del Espacio Ultraterrestre: Opciones, Posibilidades y Realidades*, EDITORIAL JURÍDICA SEPÍN 1, 1–4 (Sept. 2021).

have equal opportunities to access and utilize Earth's orbit as spacefaring nations do. The unsustainable use of Earth's orbits would diminish this right for present and future generations. The principle of common but differentiated responsibilities may also be relevant in assigning the burden of decontaminating or deorbiting space debris objects from Earth's orbits to those States whose activities have endangered the outer space environment.

Moreover, there are two specific principles that are applicable not only to Earth's orbits but also to the outer space environment and the environments in which HSSs will be established: the precautionary principle and the prevention principle.[150] These principles are sometimes conflated because they are related. The precautionary principle declares that States should not postpone preventive measures in the face of activities that could endanger the environment, even in the absence of scientific evidence.[151] In contrast, the prevention principle (e.g. alongside the CIL rule of prohibition of transboundary harm in areas beyond national jurisdiction) asserts that States should take measures to prevent harm from occurring due to an activity; the difference lies in the probability that an activity could cause harm to the environment.[152]

When it comes to outer space, there are several risks involved in any space activity due to their categorization as ultra-hazardous activities. The outer space environment is distinct from the Earth environment, and the consequences of damages are often uncertain. Therefore, the precautionary principle appears to provide a functional approach, as outlined in Article VI of the OST, which establishes a national monitoring system for space activities, such as authorization or licensing regimes.[153] Under Article VI of the OST, States can implement Environmental Impact Assessments (EIA) that may be integrated into licenses granted to private actors.[154] An EIA assesses whether the benefits of an activity outweigh its

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[150] *See* Arie Trouwborst, *Prevention Precaution, Logic, and Law: The Relationship Between the Precautionary Principle and the Preventative Principle in International Law and Associated Questions*, 2 ERASMUS L. REV. 105, 119-26 (2009). *See also* Nuclear Weapons in Armed Conflict, Advisory Opinion, 1996 I.C.J. ¶ 29.

[151] Trouwborst, *supra* note 150.

[152] *Id.*

[153] *See* Outer Space Treaty, *supra* note 10, art. VI.

[154] *See Environmental*, FED. AVIATION ADMIN., https://www.faa.gov/space/environmental (last updated May 2, 2025).

negative externalities or if these externalities are insignificant, evaluates potential scenarios with varying risks, and proposes preventive measures to mitigate them if they occur.[155] This demonstrates the inherent relationship under Article VI of the OST between the precautionary principle and the prevention principle, mandating measures to prevent harm.

Second, while some principles are functional, the analysis delves into whether they are legally binding under IEL. Despite Article III of the OST granting CIL status to the mandatory application of IEL, not all aspects of IEL are legally binding.[156] Some principles mentioned earlier do not enjoy CIL status or do so only partially. For instance, there is no universal agreement on whether the precautionary principle holds the legal status of CIL, whereas the prevention principle is generally considered as CIL.[157] Therefore, while sustainable development appears to have acquired CIL status, there remains ambiguity in defining the threshold beyond which it is considered to be violated.

III. THE RELATIONSHIP BETWEEN THE PRESERVATION OF THE OUTER SPACE ENVIRONMENT AND THE HUMAN RIGHTS OF INHABITANTS OF HUMAN SPACE SETTLEMENTS

In the context of this contribution, it may specifically be asked whether the right to a clean, safe, healthy, and sustainable environment could be guaranteed in a space settlement. Because of the interdependence between a clean, safe, healthy, and sustainable environment and human rights, it is well accepted that the former is necessary for the enjoyment of human rights, such as the right to

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[155] *Id.*

[156] *Id.*

[157] *See* Nathan Dinneen, *Precautionary Discourse: Thinking through the Distinction Between the Precautionary Principle and the Precautionary Approach in Theory and in Practice*, 32 POLITICS LIFE SCI. 2 (2013) (comparing the US, which follows a precautionary approach, and the EU, which has integrated the precautionary principle in its Treaty on the Functioning of the European Union. Consolidated Version of the Treaty on the Functioning of the European Union, art. 191.2, O.J. C326/7 (2012) [hereinafter TFEU] ("Union policy on the environment shall aim at a high level of protection taking into account the diversity of situations in the various regions of the Union. It shall be based on the precautionary principle and on the principles that preventive action should be taken, that environmental damage should as a priority be rectified at source and that the polluter should pay."). *See also* Mary Stevens, *The Precautionary Principle in the International Arena*, 2 SUSTAINABLE DEV. L. POL'Y 13 (2002).

life, health, food, water, sanitation, and dignity.[158] In this regard, Judge Weeramantry stated in a separate opinion of the ICJ that:

> The protection of the environment . . . is a vital part of contemporary human rights doctrine, for it is sine qua non for numerous human rights such as the right to health and the right to life itself. It is scarcely necessary to elaborate on this, as damage to the environment can impair and undermine all the human rights spoken of in the Universal Declaration on Human Rights and in other human rights instruments.[159]

Recognizing the right to a clean, safe, healthy and sustainable environment, in outer space settlements will reinforce "the broad recognition of the link between human rights and the environment."[160]

A. The Extraterritorial Application of Human Rights in Outer Space

In 1968, at a conference organized by the American Institute of Aeronautics and Astronautics, Carl Christol delivered a paper on human rights in outer space and observed as follows in his introductory remarks: "While Human Rights agreements have generally been identified as being earth orientated, there is no fundamental reason for not recognizing their applicability to the space environment."[161]

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[158] *See What Is the Right to a Healthy Environment? – Information Note*, UN ENVIRONMENT PROGRAMME (Jan. 25, 2023), https://www.unep.org/resources/publication/what-right-healthy-environment-information-note (last visited Dec. 6, 2024)[hereinafter UNEP Note].

[159] *See* Gabčíkovo-Nagymaros Project Case (Hung./Slovk.), Judgment, 1997 I.C.J. 7, 78.

[160] Ionel Zamfir, *A Universal Right to a Healthy Environment*, EUR. PARL. DOC. (PE 698.846) (Dec. 2021), https://www.europarl.europa.eu/RegData/etudes/ATAG/2021/698846/EPRS_ATA(2021)698846_EN.pdf (last visited Dec. 6, 2024).

[161] Carl Q. Christol, *Human Rights in Outer Space*, AM. INST. AERONAUTICS AND ASTRONAUTICS, at the Impact of Aerospace Science and Technology on Law and Governance Conference (Washington DC, 1968), https://arc.aiaa.org/doi/pdf/10.2514/6.1968-910 (last visited Jan. 6, 2025); *see also* Ireland-Piper & Freeland, *supra* note 18, at 110. Ireland-Piper and Freeland suggest that human rights treaties extend extraterritorially into outer space:

> Given international human rights law is part of international law generally, and it is generally accepted (dissenters aside) that international law applies in outer space. In our view and given the

Although the OST does not contain a specific provision regarding human rights in outer space, the idea that international human rights should apply to persons while traveling or living in outer space seems, nevertheless, to be suggested by the Treaty itself. Article III of the OST provides that States Parties shall carry out their space activities in accordance with international law, thereby confirming the applicability of international human rights law to outer space.[162] Reference could also be made to Articles IV and IX of the OST as examples of provisions that are sensitive to human rights. Article IV prohibits States from placing weapons of mass destruction in outer space and Article IX obliges States to undertake their exploration of outer space without causing harmful contamination of the outer space environment.[163]

Article 1(5) of the Vienna Declaration and Programme of Action (1993) describes the nature of human rights and the duty of the international community and individual States towards their realization as follows:

> All human rights are universal, indivisible, interdependent and interrelated. The international community must treat human rights globally in a fair and equal manner, on the same footing, and with the same emphasis. While the significance of national and religious particularities and various historical, cultural, and religious backgrounds must be borne on mind, it is the duty of States, regardless of their political, economic and cultural systems, to promote and protect all human rights and fundamental freedoms.[164]

The key words here are "globally" and "universal." The term "global" seems to be limited geographically to describe planet Earth (the "globe"), and it is suggested that to include outer space in its ambit would be to over-extend its literal meaning. The term "universal" generally denotes that human rights "are universal, because

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> undoubted increase in frequency and extent of human presence in outer space now and into the future, it would seem counter-intuitive to argue that the principles that are to guide the rights of humans on Earth would not also guide the rights of human [sic] in space.

Id.

[162] *See* Outer Space Treaty, *supra* note 10, art. III.

[163] *Id.* arts. IV & IX.

[164] World Conference on Human Rights, *Vienna Declaration and Programme of Action*, ¶ 5, U.N. Doc. A/CONF.157/23 (June 25, 1993).

everyone is born with and possesses the same rights, regardless of where they live, their gender or race, or their religious, cultural or ethnic background."[165] In this sense, the term "universal" should be understood to reflect the personal character of human rights as rights accruing to the individual wherever he or she might find him- or herself. However, geographically speaking, the term "universal" according to its literal meaning might be used to denote the entire universe (planet Earth and outer space) and need not carry only the limited meaning associated with the term "global."

As far as the extraterritorial application of human rights instruments is concerned, it should be noted that while the wording (or lack thereof) of international human rights instruments tend to create legal uncertainty as to their extraterritorial application, it seems that opinions and decisions of international judicial organs show a developing tendency to accept the extraterritorial application of international human rights instruments.[166] In fact, it has been explicitly stated that States must ensure the protection of human rights of those persons under their effective control even if they do not find themselves on the (sovereign) territory of the particular States.[167] The extraterritorial application of international human rights treaties thus seems to focus not so much on the question concerning whether the particular State has established sovereignty over the territory, but rather as to whether the particular State has effective control over the persons who are present on that territory.[168]

As was pointed out earlier, private companies (most notably SpaceX and Blue Origin) have their own ambitions to establish human settlements in outer space.[169] Uncertainty currently exists as to the extent of private companies' responsibility to respect, protect, and fulfill human rights on planetary bodies, such as Mars, and how to hold States responsible for controlling, monitoring, and

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[165] *See* UNFPA, *Human Rights Principles,* U.N. POPULATION FUND (2005), https://www.unfpa.org/resources/human-rights-principles (last visited Dec. 6, 2024).

[166] *See* Gerrit Ferreira & Anél Ferreira-Snyman, *The Extraterritorial Application of Human Rights Instruments in Outer Space Settlements*, *in* OUTER SPACE LAW: LEGAL POLICY AND PRACTICE, 492-95 (Yanal Abul Failat and Anél Ferreira-Snyman eds. 2d ed. 2022).

[167] *See id.*

[168] *See* Ireland-Piper & Freeland, *supra* note 18, at 108-09.

[169] *See* Deplano, *supra* note 16.

regulating the activities of private entities so as to take action when addressing human rights violations.[170] It could be accepted that there will always be some form of State involvement in a private company's activities in outer space. The involvement of a State would at least fulfill certain other legal requirements (for example, as it relates to launching and licensing) before a private enterprise would be allowed to perform the planned outer space activities. In that sense, the link between the State and the private enterprise could form the basis for the argument that the actions of the private enterprise could be attributable to the State, thereby bringing it under the scope of international human rights treaties to which the State may be a party.

Article VI of the OST "established the concept of general State responsibility[171] in the special area of outer space activities"[172] by determining that "States Parties to the Treaty shall bear international responsibility for national activities in outer space, including the Moon and other celestial bodies, whether such activities are carried on by governmental agencies or by nongovernmental entities" and that "the activities of non-governmental entities in outer space, including the Moon and other celestial bodies, shall require authorization and continuing supervision by the appropriate State Party to the Treaty."[173] Article VI could thus provide a basis for arguing that it is required from both the (appropriate) State and private entity to jointly exercise effective control over the settlement through authorization and continuing supervision by the State on the one hand, and responsibility for compliance with the OST by both the State and private entity on the other hand. The terms "authorization," "supervision," and "responsibility" all point to effective control.[174] Therefore, State responsibility in Article VI is an avenue for

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[170] *See* A. Kayum Ahmed, *Towards Multiplanetary Existence? The Human Rights Obligations of Corporations on Mars*, OPEN GLOBAL RIGHTS (May 9, 2023), https://www.openglobalrights.org/toward-multiplanetary-existence-human-rights-obligation-corporations-mars/ (last visited Jan. 6, 2025).

[171] *See* Draft Articles on Responsibility, *supra* note 34.

[172] Frans G. von der Dunk, *The Origins of Authorisation: Article VI of the Outer Space Treaty and International Space Law*, 69 SPACE, CYBER, AND TELECOMM L. PROGRAM FAC. PUBL'N 1, 4 (2011).

[173] Outer Space Treaty, *supra* note 10, art. VI.

[174] There has been divergence of opinion on the question whether "effective control" constitutes a suitable yardstick to determine State responsibility, or whether "overall control" should be applied as the most appropriate test. *See* Antonio Cassese, *The*

ensuring that companies running outer space settlements protect the human rights of the settlement's inhabitants.[175] While authorization for space activities is usually given in the form of licenses or permits,[176] it should be noted that the meaning of the phrase "continuous supervision" has not yet been clarified and that the manner and frequency of supervision is currently left to the discretion of States.[177]

B. The Right to a Clean, Safe, Healthy, and Sustainable Environment in Outer Space

Because outer space is such a unique environment, it will obviously require the protection of unique human rights. Several suggestions have been made on the types of human rights that need to be protected in prospective space settlements. For example, it has been suggested that a constitution for a settlement on Mars should contain a bill of rights that considers the very special circumstances under which the inhabitants of such a settlement would live and function.[178] Consequently, it has been argued that the proposed

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Nicaragua and Tadić Tests Revisited in Light of the ICJ Judgment on Genocide in Bosnia, 18 EUR. J. INT'L L. 649, 667 (2007); Ricky Lee, *State Responsibility and Space Tourism*, *in* SPACE TOURISM: LEGAL AND POLICY ASPECTS 77 (Sandeepa Bhat B. ed. 2024) (pointing out that the "overall control" test as applied in *Prosecutor v. Tadíc* was rejected by the ICJ in the *Case Concerning Application of the Convention on the Prevention and Punishment of the Crime of Genocide* by determining that "the 'overall control' test is unsuitable, for it stretches too far, almost to breaking point, the connection which must exist between the conduct of a State's organs and international responsibility.").

[175] *See* Ricky Lee, *supra* note 174, at 80 (arguing that "a private space activity cannot be carried on lawfully without the authorisation by the State, and the continual supervision must result in the State being able to give directions, impose conditions and otherwise subject the activity to its administrative and regulatory control. … If a State fails or omits to authorise or continuously supervise a private space activity for which it is the 'appropriate State', this failure or omission would constitute an international wrongful act for which [S]tate responsibility would be engaged.").

[176] *See* Stephan Hobe, *The ILA Model Law for National Space Legislation*, 62 ZLW 81, 89 (2013) (discussing how the ILA Model Law for National Space Legislation lists a number of conditions for authorizing space activities); Comm. on the Peaceful Uses of Outer Space Legal Subcommittee, Information on the Activities of International Intergovernmental and Non-governmental Organizations Relating to Space Law, U.N. Doc. A/AC.105/C.2/2013/CRP.6 (2013).

[177] *See* Tanja Masson-Zwaan, *Article VI of the Outer Space Treaty and Private Human Access to Space*, 51 PROC. INT'L INST. SPACE L. 536, 543 (2008).

[178] *See* Richard Hollingham, *How to Create a Bill of Rights for Mars Colonies*, BBC FUTURE (July 9, 2014), https://www.bbc.com/future/article/20140709-why-mars-needs-a-bill-of-rights (last visited Dec. 6, 2025).

constitution should *inter alia* make provision for the right to leave the settlement and the right to a continuous supply of oxygen.[179] The practical issues related to the realization of these rights is obviously immense.

There is currently no universal definition of the right to a clean, healthy, safe and sustainable environment, nor any standards to determine the violation of this right.[180] Because of the inherently hazardous space environment, Jonathan Lim favors the notion of a "right to a habitable environment" in the outer space over the "right to a healthy environment" as States (and private entities) may not be able "to adequately meet the comparable level of obligations to satisfy what is considered healthy in terrestrial terms."[181] Inherent in the right to a habitable environment would be the right to shelter, the right to be protected from radiation, and the right to a reasonable standard of gravity.[182]

However, there are significant challenges to realizing and protecting these rights in space settlements. If interplanetary travel becomes a regular feature of human life, space debris will inevitably increase dramatically in volume and may pose significant dangers to the health and safety of the inhabitants of a space settlement, as has already been seen, to a certain extent, in the case of the International Space Station (ISS). Moreover, the surfaces of the Moon and Mars have already been significantly polluted by human activities on these celestial bodies. It is estimated that more than 225,000 kilograms of waste have already been left on the Moon,[183] and that junk in excess of seven tons has been scattered across the surface of Mars.[184] It is self-evident that the potential dangers caused by pollution and space debris may have an impact on the realization of the inhabitants' right to a habitable environment.

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[179] *See id.*

[180] This is one of the main reasons why the Russian Federation abstained from voting either for or against the UNGA Resolution that considers the right to a healthy environment as an international human right. *See* Human Rights Council Res., *supra* note 22.

[181] *See* Lim, *supra* note 17, at 9.

[182] *Id.*

[183] *See* Emilia Stankeviciute, *What We Left Behind: How Human Activity Has Already Littered the Moon*, AEROTIME (Nov. 2, 2023), https://www.aerotime.aero/articles/how-human-activity-littered-the-moon (last visited Dec. 6, 2024).

[184] *See* Katherine Fidler, *Map Reveals the 7,000,000 kgs of Space Junk We've Already Left on Mars*, METRO.CO.UK (Mar. 28, 2024), https://metro.co.uk/2024/03/28/map-reveals-7-000-000kgs-space-junk-already-left-mars-20544581/ (last visited Dec. 6, 2024).

Although scientists are currently testing technology to remove debris from space, it is still uncertain how the irradiation of persons on board a spacecraft would be prevented and how any radioactive waste would be disposed of in outer space. Current plans to develop nuclear propulsion systems for future Mars missions[185] and proposals to use thermonuclear blasts to warm Mars[186] raise environmental concerns, specifically because of the potential toxic waste produced by such activities.

What is clear is that the unique circumstances that the inhabitants of space settlements would find themselves in will necessitate a novel interpretation of the "right to a clean, safe, healthy, and sustainable environment in outer space."[187] It may also even require the limitation of some human rights in outer space that are usually—at least on Earth—dependent on a clean, safe, healthy, and sustainable environment.

IV. ENFORCEMENT OF HUMAN RIGHTS IN OUTER SPACE SETTLEMENTS

The question has been posed about whether a group of people living in a settlement on a celestial body such as the Moon or Mars could be viewed as an extension of the sending State. Because of the customary law prohibitions in Article II of the OST on the establishment of sovereignty and appropriation by States in outer space, it must be accepted that, as it currently stands, no earthly entity will be able to establish itself in outer space as a nation State.[188]

This leads to the question whether the right to a clean, safe, healthy, and sustainable environment could be enforced against States by the inhabitants of space settlements. Although several human rights treaties indirectly refer to the right to a clean, healthy, and sustainable environment, it is not explicitly

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[185] *See* Roxana Bardan, *NASA, DARPA Will Test Nuclear Engine for Future Mars Missions*, NAT'L AERONAUTICS & SPACE ADMIN. (Jan. 24, 2023), https://www.nasa.gov/news-release/nasa-darpa-will-test-nuclear-engine-for-future-mars-missions/ (last visited Jan. 6, 2025).

[186] *See* Fiona MacDonald, *Watch: Elon Musk Says We Could Make Mars Habitable with Thermonuclear Bombs*, SCI. ALERT (Sept. 11, 2015), https://www.sciencealert.com/watch-elon-musk-says-we-could-make-mars-liveable-with-thermonuclear-bombs (last visited Dec. 6, 2024).

[187] *See* Human Rights Council Res., *supra* note 22.

[188] Outer Space Treaty, *supra* note 10, art. II.

guaranteed as an individual human right in and of itself in any international human rights treaty.[189] However, as was pointed out earlier, the right is provided for in some regional human rights treaties,[190] treaties dealing with procedural environmental rights,[191] and in the national laws of a significant number of States.[192] The inclusion of the right to a safe, clean, healthy, and sustainable environment in regional instruments and national laws may at least be indicative of an emerging CIL recognizing the right to a clean, safe, healthy, and sustainable environment. This development is further supported by the adoption of the non-binding UNGA Draft Resolution recognizing the human right to a clean, healthy, and sustainable environment.[193]

There are several examples where international and regional human rights frameworks have been used as a mechanism by tribunals, courts, and committees to provide redress to individuals whose human rights were violated because of States' failure to provide them with a clean, safe, healthy, and sustainable environment.[194] Thus, should a State have effective control over the inhabitants of a space settlement, its human rights obligations, in terms of the international and regional instruments to which it is a party, would also be applicable—extraterritorially—in the settlement. Moreover, although a State may not have signed and ratified an international human rights instrument, it may still be bound by specific obligations in that instrument where the obligation in

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189 *See supra* notes 22-25 and accompanying text.

190 *See id*.

191 *See id*.; Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters, Oct. 30, 2001, 2161 U.N.T.S., 447.

192 *See* UNEP Information Note, *supra* note 158 ("the right has been recognized by more than 80 percent (156 out of 193) of UN member States before the global recognition by the HRC and the GA Resolution."); *supra* notes 22-25 and accompanying text.

193 *See supra* notes 22-25 and accompanying text.

194 *See* Bridget Lewis, *Human Rights and Environmental Wrongs: Achieving Environmental Justice through Human Rights Law*, 1 INT'L J. CRIME JUST. 65, 71 (2012).

question can be allocated the status of an obligation *erga omnes*,[195] or where a human right has attained the status of *jus cogens*.[196]

In many instances, though, individuals must first exhaust domestic remedies before they will be able to approach an international or a regional human rights court or tribunal.[197] This begs the question about whether the national law of a State would be applicable extraterritorially in an outer space settlement. "Jurisdiction" may be described as "a technical means of establishing public authority, including over humans and human rights."[198] In terms of PIL, States may exercise three types of jurisdiction, namely, territorial, national, and universal (which is reserved for certain crimes under international law).[199] As will be further addressed below, Cheng also identifies quasi-territorial jurisdiction as standing in between territorial and personal jurisdiction as the "sum total of the powers of a State in respect of ships, aircraft and spacecraft (to the extent to which they are also granted legal personality) having its nationality or registration."[200]

The prohibition on sovereignty in outer space does not prevent a State from exercising certain sovereign rights in outer space.[201] This is evident from the Treaty itself; a State's responsibility for national activities under Article VI of the OST, referred to earlier, "necessarily require the authority and control over persons, objects

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[195] The ICJ describes *erga omnes* norms as "the obligations of a State towards the international community as a whole" and determines that due to "the importance of the rights involved, all States can be held to have a legal interest in their protection." *Barcelona Traction, Light and Power Company Limited* 1970 I.C.J. 3, at 32.

[196] *See* VCLT, *supra* note 41, art. 53 (describing *jus cogens* as a "norm accepted and recognized by the international community of States as a whole … from which no derogation is permitted and which can be modified only by a subsequent norm of general international law having the same character.").

[197] *See* Ireland-Piper & Freeland, *supra* note 18, at 124.

[198] *Id.*

[199] CHENG, *supra* note 4, at 73.

[200] *Id.*; *see also* Ireland-Piper & Freeland, *supra* note 18, at 125 (identifying "active-nationality jurisdiction" and "passive-nationality jurisdiction" in exercising criminal jurisdiction in space in the context of the ISS Intergovernmental Agreement); Agreement among the Government of Canada, Governments of Member States of the European Space Agency, the Government of Japan, the Government of the Russian Federation, and the Government of the United States of America Concerning Cooperation on the Civil International Space Station, *opened for signature* Jan. 29, 1998, T.I.A.S. No. 12927 [hereinafter IGA].

[201] Wanlu 'Laura' Zhang, *Extraterritorial Jurisdiction on Celestial Bodies*, 47 SPACE POL'Y 50 (2019).

and facilities in outer space," which may be the basis for establishing jurisdiction over the space activity.[202] Also, Article VIII of the OST provides for quasi-territorial jurisdiction—similar to that over ships and aircraft—by determining that the registering State shall retain jurisdiction and control over a space object, and over any personnel thereof, while in outer space or on a celestial body.[203]

The International Space Station (ISS), as a temporary habitat in space, is an apt example of States exercising personal and quasi-territorial jurisdiction in outer space.[204] However, the situation in permanent outer space settlements may be more complicated. While the ISS is an enclosed structure, which might more easily fit the (vague) definition of a "space object,"[205] a space settlement will comprise both structures and shared open spaces where different activities may take place—including ones with implications for a healthy environment, such as space mining. The question has therefore been asked whether these open spaces could be registered by any single State to provide the basis for quasi-territorial jurisdiction.[206]

Another potential complication relates to the status of the inhabitants of space settlements. In terms of the ISS Intergovernmental Agreement (IGA), the parties to the Agreement extend their national jurisdiction in outer space.[207] It is currently an open question as to whether the inhabitants of space settlements would have the status of astronauts and if terminology in the space treaties such as "astronaut", "personnel of a spacecraft," and "envoys of [hu]mankind" would consequently apply to any of them. It has been argued that space settlers would serve the same purpose as astronauts, in the sense that both are envoys of humankind by

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[202] *Id.*

[203] *See* CHENG, *supra* note 4, at 73; *see also* Zhang, *supra* note 201 ("By providing objects with a kind of nationality, space law transforms them into pieces of quasi-territory of a particular State.").

[204] *See* CHENG, *supra* note 4, at 73.

[205] *See* Liability Convention, *supra* note 44, art. 1(d) (defining a "space object" as including the "component parts of a space object as well as its launch vehicle and parts thereof").

[206] Zhang, *supra* note 201, at 152.

[207] IGA, *supra* note 200, art. 5 (determining that "each partner shall retain jurisdiction and control over the elements it registers and over personnel in or on the Space Station who are its nationals.").

representing the population of Earth as a whole.[208] Consequently, it is uncertain whether and how personal jurisdiction could be established by a State over the inhabitants of space settlements should they be regarded as envoys of humankind, rather than (primarily) the nationals of that State.[209]

Because of these jurisdictional uncertainties, Zhang suggests that "control" and "decisive influence"—which has a lower threshold than "control"—over an area may be the criteria to determine quasi-territorial jurisdiction, whilst "physical power and control" over people and objects may be the criteria for personal jurisdiction.[210] She submits that:

> The criteria of 'authority and control over persons' is significant in that it can solve the problems regarding the nationality of 'envoy of [hu]mankind' … There is a need for new criteria to sustain *ratione personae*. 'Physical power and control' is a valid replacement because the conception of a State is recognized as a group of persons, wherever located, who are subject to a common authority. People of the same nationality are subject to the same authority. In essence they are subject to the same 'power and control'. This is the fundamental [sic] of *rationae personae*. In the context of the cosmos, a group of people live together. If they are subject to the same physical power and authority, they are in comparison to people of the same nationality. Therefore, 'physical power and control' can serve as a criterion for the exercise of personal jurisdiction in outer space.[211]

The practical implications of this suggestion are not completely clear. Would the nationals of a particular State living in a space settlement controlled by another State, have dual nationality from their (earthly) State of nationality *and* from being inhabitants

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[208] Zhang, *supra* note 201, at 152.

[209] *Id.*

[210] *Id.* at 153.

> Literally speaking 'influence' is an effect that somebody/something has on the way a person thinks or behaves. Such influence can be direct or indirectly, physically or mentally, the result of an 'influence' can be significant as well as minor, whereas control signifies the ability to restrict, limit or managing something. 'Control' denotes a higher level of manipulation than 'influence.'

Id.

[211] Zhang, *supra* note 201, at 154.

of a space settlement—in terms of the jurisdiction of the State who has physical "power and control" over them in that settlement? Alternatively, would the inhabitants of the space settlement forfeit their earthly nationality?

In the case of competing jurisdictional regimes of different States, Zhang agrees with Cheng that the jurisdiction of the registering state takes priority within a fixed structure of the settlement.[212] She suggests that in shared open spaces, personal jurisdiction demonstrated by physical power and control would apply, and within the modules of the space settlement a State's quasi-territorial jurisdiction, based on its "decisive influence," would apply.[213]

On celestial bodies, States may well be silent about 'control' but nonetheless emphasise the effect a State has on technology, equipment and specific mission activities. This way, States refrain from proclaiming the 'control' of a territory but announce its 'decisive influence' on certain areas. Thus, those areas may be considered to be subject to a quasi-territorial jurisdiction.[214]

The practical exercise of both these forms of jurisdiction might however prove to be challenging in outer space settlements. It would obviously be very difficult for any State to exercise physical power and control over the activities in a space settlement on a celestial body that may be separated from Earth by distances measured in the millions of kilometers and in time by many months, if not years, of travel. In this regard, Ireland-Piper and Freeland mention—albeit in the context of criminal law—the practical realities of time, distances, and expense, which complicate the enforcement of State jurisdiction beyond Earth.[215] Moreover, the (legal) yardstick to determine whether a State's influence within a space settlement should be regarded as "decisive" is not clear. For example, if numerous States are involved in the development of equipment and technology for the settlement, which one State's influence would be regarded as being "decisive"? It is to be expected that the establishment of a space settlement will be characterized by the simultaneous involvement of several different States and private entities. This "fragmentation" of the rights and obligations between

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[212] *Id.*

[213] *Id.*

[214] *Id.* at 153.

[215] *See* Ireland-Piper & Freeland, *supra* note 18, at 126.

the various parties could create a lot of uncertainty as to which legal regime exercises control over what aspect of the space settlement. This could lead to accountability gaps in protecting the space environment and associated human rights of the settlement's inhabitants, which could have an obvious impact on the continued sustainable habitation of the space settlers.

V. CONCLUSION

There is a lack of effective legally binding protections for the outer space environment. International Conventional Space Law only partially protects the outer space environment against chemical contamination, leaving out protections against (among other issues) space debris and severe changes to the outer space ecosystem. This allows for a focus on the development of other sources of ISL, such as CIL. It has been argued that there is emerging CIL based on space sustainability from the 2019 LTS Guidelines that could effectively protect the outer space environment. Nonetheless, the ICJ needs to pronounce the status of space CIL regarding this new concept. Until that occurs, there are other feasible solutions under International Law that may be resorted to, specifically through Article III of the OST concerning certain principles of IEL.

The complexity of applying IEL principles to space activities arises from the unique nature of the outer space environment, which is different from Earth's (e.g. scarcity of resources), and the international legal status of these principles. Therefore, a legal analysis of these principles leads to the conclusion that some are functional while others are dysfunctional when applied to outer space activities. Yet, some principles, such as the precautionary principle, could provide environmental protection for the outer space environment.

The significance of providing legally binding protection for outer space is essential to protect people's human rights in outer space and HSS. The space environment must be seen as a *conditio sine qua non* for the development and enjoyment of human rights in outer space. As pointed out, only if the outer space environment is protected can space exploration and the space economy thrive, because then humans and their rights will be safeguarded from the naturally hostile space environment and inherently dangerous

space activities—such as space mining, increased activity on celestial bodies, or due to mega-constellations of satellites.

Because of the unique and dangerous circumstances that space settlers would find themselves in, it is imperative that the contents of a right to a clean, safe, healthy, and sustainable outer space environment be agreed upon by States. It is self-evident that inherent to this right should at least be the right to be supplied with oxygen or a "breathable atmosphere,"[216] and that the right to a clean, safe, healthy and sustainable environment should be provided in such a manner as to protect the core human rights to the life[217]and dignity[218] of the space settlement's inhabitants.

It is submitted that until such rights are recognized, a Working Group under the auspices of the UNCOPUOS should be created to deal with the pressing legal issues arising around the protection of human rights in outer space settlements on the Moon and Mars. In this process, the Office of the High Commissioner for Human Rights, and other UN human rights organs, could play an important role in assisting the Working Group to identify the novel human rights that would need protection when living in outer space. This Working Group should specifically include the application and contents of a right to a clean, safe, healthy, and sustainable outer space environment.

As was pointed out above, the establishment of State jurisdiction in outer space by means of physical power and other forms of control may be difficult in a permanent, self-sustaining space settlement located on a celestial body, which is likely millions of kilometers and many months, if not years, of travel from planet Earth. To ensure the effective protection of human rights in permanent outer space settlements, consideration should be given to establish some form of regulatory body in the settlement with administrative and legal powers to monitor environmental issues and to enforce

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[216] *See* Lim, *supra* note 17, at 8.

[217] *See id.* at 8 (cautioning that the lack of access to safe and sufficient water and sanitation may not only have a detrimental effect on the health and dignity of space inhabitants but may also heighten the "possibility of economic competition and armed conflict over water resources – threatening the right to health and the right to life.").

[218] *Id.* at 6 (pointing out that "[w]ithin the context of outer space, the preservation of dignity is central to ensuring the provision of the resources and services considered essential to individual personhood and existence – including food, housing, clothing, education, medical care, and social welfare.").

human rights within that settlement. The establishment and functions of such a body could be arranged by means of an agreement similar to the ISS IGA through which the ISS has been effectively managed for more than 25 years.