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THE GALACTIC IMPERATIVE SUSTAINABILITY IN SPACE LAW

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ABSTRACT

The main aim of this paper "The Galactic Imperative: Sustainability in Space Law" is to address the urgent need for an international legal framework to ensure the sustainable use of outer space. Advancements in technology and increased participation from private and national actors is accelerating the exploration and utilization of outer space at a faster pace. This is increasing the potential for environmental degradation, resource depletion, and geopolitical conflicts. The Outer Space Treaty of 1967 is one of the foundational treaties which primarily governs the space law. Despite being fundamental, these treaties are also unable to handle contemporary challenges like planetary protection, space debris, and the use of extraterrestrial resources. Sustainability is the balance between the environment, equity, and economy. The concept of sustainability is not only confined within the earth but also beyond it. Sustainability is equally important in the outer space. Sustainable space law must therefore encompass the responsible management of space resources, the protection of space environments from contamination, and the equitable access to space benefits for all humankind. This paper suggests that in order to achieve these multifaceted sustainability goals, the international community should adopt a comprehensive and flexible legal framework.Further, the roles of key stakeholders, including nation-states, international organizations, private enterprises, and the scientific community, in shaping and enforcing these laws are also highlighted. It is absolutely necessary to coordinate and collaborate and establish regulatory bodies that can monitor compliance and mediate disputes. Asteroid mining, mega-constellations of satellites, and lunar settlement are examples of the burgeoning space economy that are examined to find specific legal lacunas and areas where policy innovation might be pursued.

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SUSTAINABILITY IN SPACE LAW

As humanity embarked on its grand journey into the cosmos, the necessity for an up-to-date set of rules and regulations became increasingly apparent. Space, once considered the final frontier, was rapidly becoming a realm of economic opportunity, scientific exploration, and potential conflict. In this current/recent era of space exploration and exploitation, the relevance of sustainability in space law emerged as a critical concern.

Space law, as a formal body of rules and regulations, began to take shape in the mid-20th century. The lift-off by the Soviet Union of the Sputnik in 1957 marked the dawn of the space age and the start of a race to conquer the cosmos. In response to the rapidly evolving space activities, the United Nations established the Committee on the Peaceful Uses of Outer Space (COPUOS) in 1959, tasked with addressing the legal and technical challenges of space exploration.

The Outer Space Treaty, adopted in 1967, was the first major milestone in space law. It laid the foundation for peaceful cooperation and prohibited the arrangement of nuclear weapons in space. Subsequent treaties, such as the Moon Agreement and the Liability Convention, further expanded the legal framework governing space activities. These early agreements focused on preventing conflict and minimizing the potential harm to celestial bodies.

Fast forward to the 21st century, and the landscape of space activities has undergone a profound transformation. Governments, private companies, and international organizations are now actively convoluted in an extensive range of space endeavors. Commercial satellite launches, space tourism, asteroid mining, and plans for human settlement on other planets have become realistic possibilities.

As space activities have expanded, so too have the challenges they pose to sustainability. The orbital debris problem[2], for example, has reached critical levels. Thousands of defunct satellites, spent rocket stages, and fragments from past collisions now clutter Earth's orbital environment. This space debris not only constitutes a threat to active satellites but also increases the risk of further collisions, creating a cascade effect known as the Kessler

[2] Jonathan O'Callaghan, "What is Space Junk and Why is It a Problem?" Natural History Museum, United Kingdom, (September 22, 2023, 04:15 PM) https://www.nhm.ac.uk/discover/what-is-space-junk-and-why-is-it-a-problem.html#:~:text=Space%20junk%2C%20or%20space%20debris,have%20fallen%20off%20a%20rocket.

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Syndrome[3]. Sustainability in space is not only about preserving the natural environment but also about maintaining a safe and stable orbital environment for future generations.

The relevance of sustainability in space law is closely tied to the ethical imperative of preserving the cosmos for future generations. Space, like Earth, is not an infinite resource. As humanity reaches out to explore and exploit the riches of the solar system, it must do so responsibly.

One of the key ethical considerations is the preservation of celestial bodies. The Moon, Mars, and asteroids are not barren rocks; they are pristine environments with scientific value and, potentially, future habitats for humanity. Sustainability in space law means protecting these celestial bodies from contamination, over-exploitation, and irreversible harm.[4]

Imagine a scenario where lunar mining operations strip-mine the Moon without regard for its geological and environmental significance. Such actions not only undermine scientific research opportunities but also jeopardize the Moon's potential role as a stepping stone for future missions to Mars and beyond. Sustainable practices must be embedded in space law to prevent the wanton destruction of celestial bodies.

The emergence of private space companies has brought new dynamics to the space industry. Ventures like SpaceX, Blue Origin, and Virgin Galactic have ambitious plans to open space to commercial activities on an unprecedented scale. While these endeavors hold great promise, they also introduce new challenges for sustainability.[5]

Space tourism, for instance, has the potential to bring space experiences to the masses. However, the environmental impact of frequent suborbital flights and the potential for space tourism to contribute to space debris must be carefully considered. Space law needs to strike a delicate balance between fostering commercial innovation and safeguarding the long-term sustainability of space activities.

Similarly, asteroid mining, a burgeoning industry, holds the promise of vast wealth in the form of precious metals and minerals. However, the overzealous extraction of resources from asteroids could deplete these celestial bodies and disrupt their orbits, potentially posing

[3] Mike Wall, "Kessler Syndrome and the Space Debris Problem" Space.Com (2022).
[4]Separated At Birth, Signs of Rapprochement: Environmental Ethics and Space Exploration Erin Moore Daly and Robert Frodeman 13(1) 2008 ISSN: 1085-6633
[5] Michael Sheetz, "How SpaceX, Virgin Galactic, Blue Origin and Others Compete in the Growing Space Tourism Market" Investing in Space (2020).

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hazards to Earth. Sustainable practices and regulations are essential to ensure that asteroid mining benefits humanity without causing harm to the cosmos.[6]

The challenges of sustainability in space law are global in scope and require international collaboration. The principles of cooperation and peaceful use of outer space, enshrined in the Outer Space Treaty, remain as relevant as ever. In fact, they form the foundation upon which sustainability can be built.[7]

One key aspect of this collaboration is the sharing of information. Spacefaring nations and organizations must be transparent about their activities, particularly those that may impact the space environment. Sharing data on orbital debris, spacecraft trajectories, and collision avoidance measures is vital to maintaining a safe orbital environment.[8]

Moreover, space law should encourage responsible behavior through incentives and regulations. Tax incentives for companies that develop eco-friendly space technologies, liability provisions for space debris mitigation, and international agreements on space traffic management are all tools that can promote sustainability.[9]

Sustainability in space law is not without its legal challenges. Unlike terrestrial law, space law faces the unique challenge of applying regulations to an environment that knows no borders.[10] Jurisdictional issues, enforcement mechanisms, and defining responsibilities for space activities remain complex matters.

As space activities continue to evolve, space law must evolve with them. New treaties and agreements may be needed to address emerging issues, such as lunar and Martian colonization. These agreements should reflect the values of sustainability and environmental protection.

Furthermore, the enforcement of space law poses challenges. As private actors play an increasingly significant role in space, mechanisms for holding them accountable for

[6] J.D. Rummel, M.S. Race, G. Horneck, et.al., "Ethical Considerations for Planetary Protection in Space Exploration: A Workshop" Astrobiology (2012).
[7] United Nations Office of Outer Space Affairs, Space Law Treaties and Principles, UN Doc ST/SPACE/61/Rev.2.
[8] Hargrove E.C., editor. Beyond Spaceship Earth Environmental Ethics and Solar System. Sierra Club Books San Francisco in 1986.
[9] NRC Preventing the Forward Contamination of Mars. The National Academy Press; Washington, DC: 2006.
[10] J.D. Rummel, M.S. Race, G.Horneck, et al., "Ethical Considerations for Planetary Protection in Space Exploration: A Workshop" Astrobiology (2012).

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sustainable practices must be established. Legal penalties for egregious violations of space sustainability norms may become necessary to deter harmful actions.

A well-established and strong legal framework supporting the sustainable care and usage of celestial bodies is provided by the principles and values of international human rights. Human rights have the potential to direct responsible state and non-state space actions during the coming years. This is especially true for human space activities that connect with resource exploration, extraction, trade, and utilization in space and on other celestial bodies.[11]

There are two ways to interpret the relationship between human rights and space. First and foremost, the implementation of space mechanism/innovation/technology and its applications to promote the fulfilment and upkeep of human rights commitments on Earth, such as the employment of remote sensing and Earth observation satellites to track humanitarian developments in Burma. Second, to control and direct human activities in space, the extension of human rights from the earth into space. This second intersection will have a significant impact on how mankind advances into space in the succeeding decades from an ethical, moral, and philosophical standpoint.[12]

The concept of Res Communis, or the Common Heritage of Mankind, is applied to the terrestrial bodies. As a result, it declares that no state has the right to legally interpret the regions encompassed by this principle, such as the ocean, space, etc. Major components of a CHM include:

- Legal status: a prohibition on acquiring or exercising sovereignty over the territory or resources in question and the granting of people rights to those resources.
- Making Use Of:
- Peaceful Uses: reserving the area in question for peaceful uses;
- Environmental Protection: safeguarding the environment;
- Benefit Sharing: an equitable division of the gains from the exploitation of the resources in question, with special consideration for the needs and interests of developing states.
- Single Management: the use of a single management framework for the governance of space activities.

[11] Lim and Jonathan, "A Human-Rights Based Approach to Space Resource Governance" 44th COSPAR Scientific Assembly (2022).
[12] Jonathan Lim, "Extending Human Rights Across the Final Frontier" Room Space Journal of Asgardia.

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Before the advent of space explorations, the moon, and other celestial bodies were considered under the concept of Res Nullius i.e., Ownerless Properties, and thus, sovereignty claims by nation-states were possible. However, several treaties established after the advent of space explorations and the building of spacecraft, declared these celestial bodies including the moon cannot be subjected to national sovereignty and that they are the Mankind's Common Heritage.[13]

This was specifically codified under the Outer Space Treaty of 1967. Article II of the Outer Space Treaty is described as:

> "A nation cannot claim sovereignty over the Moon or any other celestial body, use it or occupy it, or take anything else from them."[14]

This article makes it clear that no state, under any circumstances, has the power to claim sovereignty over cosmic and celestial spaces. These are resources that anyone can use, regardless of social standing. This was also established in Article I of the Outer Space Treaty, which is described as follows:

> "Irrespective of a country's degree of scientific or economic development, the exploration and use of space, including the Moon and other celestial bodies, must be done for the benefit and in the interests of all countries.
>
> All States must be free to explore and utilize outer space, including the Moon and other celestial bodies, without hindrance, on an equal footing, and in conformity with international law. Access to all areas of celestial bodies shall also be unrestricted.
>
> States shall promote and encourage international cooperation in such inquiry, and there shall be freedom of scientific investigation in outer space, including the Moon and other celestial bodies."[15]

This article states that space exploration undertaken by a country should be for the benefit of the entire human race and nation, regardless of whether they are economically developed nations or not, and that this includes countries that are not signatories to the Outer Space

[13] Enver Arikoglu, "The Concept of the Common Heritage of Mankind and the Legal Status of Outer Space in International Law" Istanbul University Press 112 (2021).
[14] Outer Space Treaty, 1967, Article II
[15] Outer Space Treaty, 1967, Article I

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Treaty. The investigation involved should be for encouraging international corporations and should not be used with regard to the sovereignty of one nation-state.

Space mining is another activity in space that has consequences for human rights. Resources like water, minerals, and precious metals are abundant throughout the Solar System and can be found on moons and asteroids.

Scientists and entrepreneurs alike have expressed interest in these resources. Such resources not only have a huge potential economic worth if brought back to Earth, but they could also be used for future space flight, settlement construction, and outpost construction. Despite the fact that the technological equipment needed for space mining is still very much in the developmental stages, progress is being made quickly.

This concept of space mining also brings in the aspect of sustainability as once these resources are being extracted, they must be used in a sustainable way. Further, the legalities with regard to space mining and the ownership over those resources are also of immense relevance for these resources are a part of the Common Heritage of Mankind.

There are certain new regimes put forth for the implementation of laws with regard to outer space one of which is the Artemis Accords signed by NASA and several partner countries including Australia, Canada, Italy, Japan, Luxembourg, United Arab Emirates, United Kingdom, and the United States of America.

The Artemis Accords should also be understood considering international human rights law, especially considering the accords' fundamental principles of peaceful space exploration, heritage preservation, conflict resolution, and safe disposal of space debris, all of which are connected to human rights pertaining to life, safety, and health.[16]

Another important aspect regarding the relevance of humanitarian laws regarding outer space is that of the environment. The obligations of governments regarding space activities are highly generic and frequently sets a greater emphasis on protecting human activities than on environmental issues, even though some of the rules in the space treaties may be important to the environment. As a result, the environmental management of space activities is not greatly aided by UN space legislation.

[16]Freeland, Steven Ireland-Piper, Danielle, et.al., "Space Law, Human Rights and Corporate Accountability" UCLA Journal of International Law and Foreign Affairs 23 (2022).

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The application of international environmental law to space appears clear given the obvious environmental concerns associated with many activities in outer space, particularly the production of space debris. The Outer Space Treaty's article III[17] further stipulates that states that are parties to the treaty must conduct their space operations in line with international law. This demonstrates that international environmental law is applicable to space.

In today's time, a metaphor for the future would be Space, which is not just about the cosmos beyond the atmosphere of the earth but for human evolution an arena of its own. Aerospace engineering and deep space exploration have during the reign of the 'space age' along with control and accessibility the defining characteristic of the present era in human civilization. Whenever there is a talk about deep space exploration a natural conflict exists between the rights of an individual and also about development and the rights of the state in the realm of sovereignty. Space sustainability and sustainable space exploration are in today's compelling dialogue to ensure that the physical environment of the space is for future use and cannot be misappropriated by any state as such.

"Space sustainability" can be defined as a guarantee that is given to humanity so that they can continue the use of outer space for peaceful purposes and the benefit of mankind at large which can be achieved through discussion, agreements and cooperation at the international level so that the outer space is secure and peaceful[18].

Similar to the concept of territorial sustainability which aims to provide a sustainable environment so that the needs of the current/present society are fulfilled without compromising the needs of the generation to come.[19]

There are certain criteria/instructions for the long-term sustainability of cosmic/deep space exercise and the context/background is that the orbital space of the earth has a finite resource that is being used by different states or through different international/inter-governmental organizations and even non-governmental entities by an increasing rate using the medication of the space debris, the increase in risk of collision and the obstacle/hurdle with the operation of space object can change/alter/exert influence on the long term sustainability of outer space activities. For this reason, to address the risk the States require international cooperation so

[17] Outer Space Treaty, 1967, Article III

18 Secure World Foundation, "Space Sustainability a Practical Guide" 4-35 (2018).

[19]Space Sustainability, Academic Accelerator, (September 23, 2023, 04:16 PM) https://academic-accelerator.com/encyclopedia/space-sustainability

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that any harm to the space environment is avoided. We can all agree that space activityis a significant tool for the accomplishment of sustainable development goals. The long-term viability of space has been examined from a variety of angles by the Committee on the Peaceful Uses of Outer Space (COPUOS)[20]. This led us to the effort of the *Working Group on the Long-Term Sustainability of Outer Space Activity of the Scientific and Technical Subcommittee* to set in motion certain elective guidelines with an approach that is holistic in nature for the promotion of long-standing sustainability in outer space. These guidelines have been developed on the considerate that the cosmos should be steady, safe and peaceful for exploration by the modern and subsequent generations for the benefit of all the States without taking into consideration the economic or the scientific development of different states but based on the principle of equity a due regard is given without any discrimination of any kind.[21]

Space technology and data have an immense potential the contribute to sustainable development goals. The incorporation of a scientific discipline that is involved in space study and the study of deep space and further physical bodies including aerospace engineering astrobiology and space medicine.

Space sustainability focuses on ensuring space activities that would align with the conservation of the natural resources that are limited in nature so that there is an equitable use of such resources, including the orbital debris and the limitation that is being levied upon it.

The Montreal Declaration that was adopted in 2014 considered that there has been significant growth in this space economy and there are certain activities that pose a kind of threat to the current and the future sustainable use of space for the benefit of mankind as mentioned in the Preamble of the Montreal declaration. The core objective for the sustainable use of space resources is to be given visible importance. The concept of sustainability emerged by the means of addressing the environmental consequences and it is bound with the concept of environmentalism-that refers to the value that an environment carries and the intention to protect search environment.

[20]An ad-hoc intergovernmental committee set up on 13th December 1958 after the launch of Sputnik I in 1957.
21 Committee on the Peaceful Uses of Outer Space, guidelines for Long-Term Sustainability of Outer Space Activities of the Committee on the Peaceful Uses of Outer Space, UN Doc St/Space/79 (June 07, 2021)

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The dependency of Earth in the inter-galactic system of debris populations is it cause of concern the question is whether to ensure the sustainability of space in thelong-term effect and also the infrastructure that would not only benefit the present but also the future generations. To provide a solution to such an issue space actors brought in the concept of space sustainability exemplified by the Montreal Declaration.

The mitigation of the debris in the present situation is voluntary compliance by different states under their space debris mitigation guidelines and also the national legal legislation in this regard. The chances of falling space debris and causing significant damage to someone on Earthare fairly low but the potential environmental hazards especially the toxic fuel are radioactive material are obvious.[22]

Although at present there is currently no obligatory/mandatory regulation on *space debris* under international lawas mentioned above there are guidelines that have been adopted by the Scientific and Technical Sub-committee of the UNCOPUOS and that was endorsed by the UN General Assembly in 2007.[23]

The non-mandatory character of the space debris guideline still carries a moral and political value. The international community has contended that the duty to act on the issue of space debris concern the present as well as the future generation. It must be considered that a soft law guideline might have a legal value that would impact the law-making process in the international forum and then it would provide us with a premise for a customary law may be developed that would eventually lead to the conclusion of a treaty.[24]

CONCLUSION

The relevance of sustainability in space law cannot be overstated. As humanity's activities in space expand and diversify, the need to preserve the cosmic environment and ensure the responsible use of celestial resources becomes paramount. Sustainability in space law is not

[22]Anél Ferreira-Snyman, "The Environmental Responsibility of States for Space Debris and the Implications for Developing Countries in Africa" 46 The Comparative and International Law Journal of Southern Africa 19-51 (2013).

23 Committee on the Peaceful Uses of Outer Space, Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space, UN Doc 62/217 (Dec. 22, 2007).

[24]Anél Ferreira-Snyman, "The Environmental Responsibility of States for Space Debris and the Implications for Developing Countries in Africa" 46 The Comparative and International Law Journal of Southern Africa 19-51 (2013).

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merely an option; it is an ethical and practical imperative that will shape the future of our journey into the cosmos.

To safeguard the sanctity of space and secure its benefits for generations to come, international cooperation, innovative regulations, and ethical considerations must be at the forefront of space law. Only through a collective commitment to sustainability can we continue our exploration and exploitation of the cosmos in harmony with the universe itself.

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