
REGULATION OF COMMERCIAL RESOURCE UTILISATION IN OUTER SPACE: LEGAL LANDSCAPE AND NEW RESEARCH ANGLES

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Abstract: The rapid growth of the global space economy, driven by technological advancements and private investment, has transformed the concept of commercial resource utilization in space from theory to a realistic near-term opportunity.¹ Extracting minerals, water, and other essential resources from celestial bodies like asteroids, the Moon, and Mars, including in-situ resource utilization (ISRU), could alter how humans engage in space activities. This swift progress has outpaced the creation of a solid legal framework to manage these activities. This highlights issues about ownership rights, environmental protection, and fair access to benefits. The existing space law in the international context, based on the Treaty of Outer Space in 1967, includes key principles. These principles prohibit national appropriation (Article II), require state authorization and oversight of private actors (Article VI), and mandate avoiding harmful contamination of space and Earth environments (Article IX). Additionally, existing "soft law" principles set by the UN support norms of peaceful use, cooperation, transparency, and sustainability.² Yet, inconsistent national laws, such as Luxembourg's Space Resources Act (2017)³ and the U.S. Commercial Space Launch Competitiveness Act (2015)⁴, leading to different jurisdictions and creating tensions with the "common heritage of mankind"⁵ Principle. This paper throws light on the current legal landscape, identifies regulatory gaps, and advocates for the development of unified international standards. These standards should balance commercial innovation with environmental care, conflict avoidance, and fair benefit-sharing to guarantee a long-term and cooperative future for space resource activities.

Keywords: Space Resource Utilization, Regulatory Gaps, International Cooperation.

I. INTRODUCTION:

Earth has been a resource of Human Growth for an exceptionally long time. All the minerals and valuable materials found in the Earth's crust have pushed Humanity's capabilities.⁶ As human capabilities rapidly progress, space exploration has increased, and the gathering of valuable materials from the heavenly bodies has increased. The Space Economy is growing with immense

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¹ Space Found., The Space Report 2025 Q2 (2025), <https://www.spacefoundation.org/2025/07/22/the-space-report-2025-q2/>

² Irmgard Marboe, Space Law Treaties and Soft Law Development, UN/China/APSCO Workshop on Space Law (2014), <https://www.unoosa.org/documents/pdf/spacelaw/activities/2014/pres02E.pdf>

³ Loi du twenty juillet 2017 sur l'exploration et l'utilisation des ressources de l'espace, Journal Officiel du Grand-Duché de Luxembourg, No. 674 (July 28, 2017).

⁴ U.S. Commercial Space Launch Competitiveness Act, Pub. L. No. 114-90, 129 Stat. 704 (2015).

⁵ Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies art. I, opened for signature Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205.

⁶ Mr. Thomas Cheney, Developing and Adapting Space Law to Govern Long-Term and Permanent Human Settlement of Outer Space, the Moon and Other Celestial Bodies, in Proceedings of the 61st International Institute of Space Law Colloquium on the Law of Outer Space 959 (P.J. Blount et al. eds., Eleven 2020), <https://core.ac.uk/download/334412146.pdf>

growth. In the year 2023, the global economy of space was recorded at approximately 570 billion U.S. Dollars, as compared to the previous year, it was 531 billion U.S. dollars.⁷ As an outcome, in 2017, the approximate worth of extraction from asteroid mining globally was calculated as 712 million USD, and by 2025, it's estimated to increase to some 3.87 billion USD.⁸ This market value refers to developing the required technological progress and spacecraft designs that will enable humans to gather raw materials from the celestial bodies. This rapid progress has caused a change, where government activity is declining and the private sector is taking over.⁹ Space 2.0 signifies a new wave of space travel.¹⁰ The growth in this area is marked by the private companies, including an increasing number of startups combining new tech innovations with new business models.¹¹ As of 3 November 2022, the total investment in space startups since 2014 has been 265 billion U.S. dollars, with two countries leading in the top 2 positions, the U.S. and China, with 46.3 billion U.S. dollars and 29.8 billion U.S. dollars, respectively.¹² India is leading with 2.3 billion dollars in this sector.¹³ This growth shows that there is a requirement for some rules and regulations that can help avoid any international conflict arising from it. The current authorities in Space Law at the International Level are not sufficient to formulate a legal foundation for the commercial discovery of valuable materials on heavenly bodies.¹⁴ As there is no framework governing it, there is unrestricted use, no ownership, and a clash on the principle of "common heritage of mankind," and confusion in commercial projects. Hence, there is a requirement to implement a framework of regulations that balances legal, policy, financial, and practical concerns.¹⁵ Despite the continuous growth of private entities in space conduct and the increase in the economy of resource extraction, the existing international and national legal frameworks remain fragmented and inadequate. This creates uncertainty over ownership and enforcement, raising the urgent question of how international space law can evolve to regulate commercial resource utilisation without stifling innovation. This paper delves into the legislative frameworks available in national or international regimes with a few comparisons and challenges, providing insight into the position of India at the present time.

II. OVERVIEW OF COMMERCIAL RESOURCE UTILIZATION IN SPACE

Commercial resource use in space focuses on exploring valuable materials beyond Earth, such as those on asteroids, the Moon, Mars, and other celestial bodies. It includes activities like mining and resource extraction, where minerals, metals, water, and other valuable elements are gathered.

⁷ Global Turnover of the Space Economy from 2009 to 2023 (in Billion U.S. Dollars) (Space Foundation), Statista, <https://www.statista.com/statistics/946341/space-economy-global-turnover/>

⁸ Market Value of Asteroid Mining in 2017 and 2025 (in Million U.S. Dollars) (GlobeNewswire), Statista, <https://www.statista.com/statistics/1023115/market-value-asteroid-mining/>

⁹ Eur. Space Pol'y Inst., The Rise of Private Actors in the Space Sector (2022), <https://www.espi.or.at/wp-content/uploads/2022/06/ESPI-report-The-rise-of-private-actors-Executive-Summary-1.pdf>

¹⁰ Countries Are Leading the Space Race 2.0, Statista, <https://www.statista.com/chart/28667/countries-are-leading-the-space-race-20/>

¹¹ The Growth of Private Space Companies: Investment & Funding Trends 2020-2030, Patent PC (Aug. 15, 2025), <https://patentpc.com/blog/the-growth-of-private-space-companies-investment-funding-trends-2020-2030/>

¹² *Ibid.*

¹³ *Ibid.*

¹⁴ Jonathan P. Ziga, Commercialization of Resource Extraction Throughout the Final Frontier: How Exploiting Outer Space Can Be Universally Beneficial While Avoiding the Tragedy of the Commons, 55 Case W. Res. J. Int'l L. 667, 670 (2023).

¹⁵ Paul Stephen Dempsey, National Laws Governing Commercial Space Activities: Legislation, Regulation, & Enforcement, 36 Nw. J. Int'l L. & Bus. 1, 15-20 (2016).



In-situ resource utilization (ISRU) refers to using these materials where they are found.¹⁶ Mining and resource extraction involve getting materials like water, metals, minerals, and volatiles from space bodies. For instance, extracting water ice from asteroids or lunar soil could provide drinking water, oxygen for breathing, and hydrogen/oxygen for rocket fuel.¹⁷ ISRU is a practice of using materials found in the local space environment to support human and robotic missions. This approach lessens the need to launch everything from Earth, which is expensive and complicated.¹⁸ ISRU also includes eolith (surface soil) for construction materials.¹⁹

III. CURRENT INTERNATIONAL LEGAL FRAMEWORKS

- A. **Outer Space Treaty 1966:** In the mid-1960s, the delegates of the United Nations Legal Subcommittee executed the drafts which became the foundational Treaty for Outer Space (OST).²⁰ The new rules were added in 1963 after the declaration of legal principles in the previous year.²¹ It was opened for signature in January 1967 by the Russian Federation, the UK, and the US, and entered into force in October 1967. It establishes the core foundation for peaceful space conduct, affirming that all the States recognise the humanity's shared interest, and pledging to cooperate scientifically and legally in its exploration.²² According to the United Nations Office for Outer Space Affairs, by 5 May 2025, a total of 117 States have ratified the Treaty.²³ Key provisions of this treaty are –
1. Article I: Space belongs to Humanity for all nations.
 2. Article II: Restricts nations from claiming sovereignty or possession over celestial entities.
 3. Article VI: States are accountable for all space conduct conducted by their government or by private entities.
 4. Article VI: States must maintain oversight and grant official authorisation of any non-governmental space organisation.

¹⁶ NASA, In-Situ Resource Utilization (ISRU) (Aug. 1, 2024), <https://www.nasa.gov/mission/in-situ-resource-utilization-isru/>

¹⁷ P.T. Metzger et al., Thermal Extraction of Volatiles from Lunar and Asteroid Regolith for In-Situ Resource Utilization, J. Aerospace Engineering, Aug. 3, 2020, [https://ascelibrary.org/doi/10.1061/\(ASCE\)AS.1943-5525.0001165/](https://ascelibrary.org/doi/10.1061/(ASCE)AS.1943-5525.0001165/)

¹⁸ What is ISRU, and How Will it Help Human Space Exploration? Universe Today (Aug. 29, 2022), <https://www.universetoday.com/articles/what-is-isru-and-how-will-it-help-human-space-exploration/>

¹⁹ Leveraging Lunar Regolith to Further Space Exploration, NASA Science (Feb. 11, 2025), <https://science.nasa.gov/biological-physical/leveraging-lunar-regolith-to-further-space-exploration/>

²⁰ Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, UN Audiovisual Library (Dec. 31, 2007), <https://legal.un.org/avl/ha/tos/tos.html>

²¹ UNOOSA, Declaration of Legal Principles (May 17, 2015), <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/travaux-preparatoires/declaration-of-legal-principles.html>

²² Christopher D. Johnson (ed.), Insight - 2017 and the Fiftieth Anniversary of the Outer Space Treaty, Secure World Foundation, (Jan. 16, 2017), <https://www.swfound.org/publications-and-reports/insight---2017-and-the-fiftieth-anniversary-of-the-outer-space-treaty/>

²³ Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon, and Other Celestial Bodies, opened for signature Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205.



- B. The Moon Agreement (1979):** In the 1970s, the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies²⁴ was adopted by the UN in 1979 and came into force in July 1984 after the ratification by Austria.²⁵ This arrangement reaffirms the Outer Space Treaty and underscores that the lunar or conduct on other heavenly bodies should be done peacefully and must not harm their environments. It obliges parties to update the UN with information on such conduct on those surfaces. This arrangement recognises that the Moon's resources are the common heritage of humanity and creates an international regime to oversee the resource uses when such technological advancements are ready.²⁶ Key Provisions of this treaty are-
1. Article 11(1): Recognise that the lunar resources are for the shared interest of all humankind.
 2. Article 11(3): Restricts the claim of ownership or possession of surface or sub-surface or any resources.
 3. Article 11(5): A requirement to create an international regime to govern resource exploitation when such technological advancements are ready.
 4. Article 11(7): If exploitation is imminent, parties must collaborate to develop and agree upon the regime.
- C. Artemis Accord (2020):** In 2020, NASA, working with the Department of State of the U.S.A. and seven other initial signatories, established the Artemis Accords.²⁷ The accord establishes principles for managing civil exploration and use, growing space activities around the moon, and conducting missions and operations by the nations and private companies. The Artemis Accords reaffirm the commitment of signatory countries to the Outer Space Treaty, the Registration Convention, and the Rescue and Return Agreement to follow established best practices and conduct in space responsibly. This accord is not binding but is a political commitment. As of 24 July 2025, 56 countries are signatories to this accord.²⁸ Key Provisions of this treaty are-
1. Section 3 Peaceful Purposes: The activities should be peaceful and adhere to and maintain the standard established by international law.
 2. Section 4 Transparency: Signatory State Parties of this accord must share their space policies, mission plans, and scientific data publicly, ensuring transparency, which is also consistent with Article XI of the OST.
 3. Section 10.2 Space Resources: The gathering of valuable material from the heavenly entities does not amount to any domestic or sovereign claim under Article II of the OST.
 4. Section 11.7: Signatories will provide information regarding their activities and coordinate activities in designated 'safety zones' to avoid harmful interference.

²⁴ Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, opened for signature Dec. 5, 1979, 1363 U.N.T.S. 3, 18 I.L.M. 1434 (1979).

²⁵ UNOOSA, Moon Agreement (Apr. 29, 2014), <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/intromoon-agreement.html>

²⁶ Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, 5 December 1979, 1363, U.N.T.S. 3, 18 I.L.M. 1434 (1979).

²⁷ Artemis Accords, Wikipedia (May 14, 2020), https://en.wikipedia.org/wiki/Artemis_Accords/

²⁸ Artemis Accords, 13 October 2020, U.S. Dep't of State, <https://www.nasa.gov/artemis-accords/>



International treaties like the Outer Space Treaty and non-binding frameworks like the Artemis Accords establish the broad principles for peaceful, transparent, cooperative space activities. Still, they lack detailed, enforceable rules for commercial resource extraction and a binding force regarding property rights and benefit sharing. As a result, states such as the USA and Luxembourg have enacted their legislation, namely, the Commercial Space Launch Competitiveness Act of 2015²⁹ and Luxembourg's Law on the Exploration and Use of Space Resources (2017)³⁰, which provides their nationals' rights to possess and sell extracted resources from the celestial bodies. These national laws are not in accordance with the OST's Article II, which prohibits the claims being made in the name of a domestic or sovereign claim.³¹

IV. NATIONAL OR DOMESTIC LEGAL FRAMEWORKS

The OST, signed in 1967, establishes that space, including the lunar and other heavenly entities, cannot be a part of any claim of any nation as territory and emphasizes that space must be for the benefit of all humanity.³² However, the United States, Luxembourg, and other countries have developed national space laws because the OST, while restricting national appropriation of celestial bodies, explicitly places responsibility for space activities on individual countries, including activities by private companies for national space activities.³³ Since the OST explicitly places accountability for space conduct on individual countries, the countries can make individual laws on space conduct performed by them or private entities in their country.

A. United States

Commercial Space Launch Competitiveness Act (2015)³⁴ Provides Americans and companies the right to legally own resources, like minerals or water, taken from asteroids and other celestial bodies, and have possession, ownership, transport, use, and sale of valuable materials extracted from the heavenly entities. The law makes it clear that these rights do not equate to claiming sovereignty, exclusive rights, or authority over any celestial body, which is in line with the Outer Space Treaty. But let American companies own them. However, as the OST imposes an obligation on the Countries to supervise their own companies, this law obligates those companies to take permission from the U.S. space authorities, i.e., NASA and the Federal Aviation Administration, who will authorize and supervise those missions. The Act also provides flexibility for the private space sector by postponing specific federal safety regulations for spaceflight participants. This lets innovation grow without immediate regulatory pressures.³⁵ It provides government-backed protection to protect the companies

²⁹ U.S. Commercial Space Launch Competitiveness Act, Pub. L. No. 114-90, 129 Stat. 704 (2015).

³⁰ Loi du twenty juillet 2017 sur l'exploration et l'utilisation des ressources de l'espace, Journal Officiel du Grand-Duché de Luxembourg, No. 674 (July 28, 2017).

³¹ International Law's Inability to Regulate Space Exploration, N.Y.U. J. Int'l L. & Pol. (Jan. 1, 2025), <https://nyujilp.org/houston-we-have-a-problem-international-laws-inability-to-regulate-space-exploration/>.

³² Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, § art. II, opened for signature Jan. 27, 1967, 610 U.N.T.S. 205, 212 (entered into force Oct. 10, 1967).

³³ Sergio Marchisio, National Jurisdiction for Regulating Space Activities, in Proceedings of the UN/ESA/Austria Workshop on Space Law 3, 4 (2010), <https://www.unoosa.org/pdf/pres/2010/SLW2010/02-02.pdf>

³⁴ U.S. Commercial Space Launch Competitiveness Act, Pub. L. No. 114-90, 129 Stat. 704 (2015).

³⁵ U.S. Commercial Launches of Space Nuclear Systems: Insurance and Indemnification Considerations, Pillsbury Winthrop Shaw Pittman LLP 15-16 (2025), https://www.pillsburylaw.com/a/web/eTQjCfYJZLjjsDujnvCQf/us-commercial-launches-of-space-nuclear-systems-insurance-and-indemnification-considerations-accepted-version_05may2025.pdf

from any major third-party liability in case of any mishap.³⁶ The Act includes rules about indemnification, licensing, and oversight by the Federal Aviation Administration (FAA), making sure that private launch activities are authorised and regulated. In summary, while the Act allows for "commercial recovery" and rights to resources gathered, it does not clearly define what "commercial recovery" exactly means. This lack of definition affects legal certainty on how private entities can operate in space resource utilisation under U.S. law.³⁷

B. Luxembourg

Law on the Exploration and Use of Space Resources (2017).³⁸ It provides that companies in Luxembourg can own and sell any minerals extracted from space. However, it does not let the state claim any part of it as its territory. Instead, it creates a licensing system that enables them to authorise and supervise those activities.³⁹

C. United Arab Emirates

Federal Law No. 12 of 2019 on the Regulation of the Space Sector.⁴⁰ It states that space resources include minerals and water, and it mandates companies to mine in space only with a governmental permit and carry insurance.⁴¹ If a licensed company causes damage or creates an international liability, it must pay for any claims against the UAE. This clear structure of the framework permits insurance and liability rules to give investor confidence by spelling out exactly who is responsible for what.⁴²

D. Japan

Act on Promotion of Business Activities Related to the Exploration and Development of Space Resources (Law No. 85 of 2021)⁴³ The law of the resources of space lets Japanese companies own whatever they extract from space, unless there is any intention to own it.⁴⁴ It has also created a framework and the regulations under which the activities related to mining must either be launched from Japan or controlled by a Japanese-based entity, which enables the creation of a direct link between the country's jurisdiction and any resources pulled from space.

³⁶ U.S. Commercial Space Launch Competitiveness Act § 50914, Pub. L. No. 114-90, 129 Stat. 704, 715 (2015) (establishing three-tiered liability risk sharing regime).

³⁷ An Analysis of the United States' Commercial Space Sector, Critical Debates in Higher Sec. & Global Just. (Oct. 2, 2023), <https://criticaldebateshsgj.scholasticahq.com/article/88428-legislation-outpaced-by-innovation-an-analysis-of-the-united-states-commercial-space-sector/>

³⁸ Loi du twenty juillet 2017 sur l'exploration et l'utilisation des ressources de l'espace, Journal Officiel du Grand-Duché de Luxembourg, No. 674 (July 28, 2017).

³⁹ Philip De Man, Luxembourg Law on Space Resources Rests on Contentious Relationship with International Framework, Working Paper No. 189, KU Leuven 6-7 (July 2017), https://ghum.kuleuven.be/ggs/publications/working_papers/2017/189deman/

⁴⁰ Federal Decree Law No. 12 of 2019 on the Regulation of the Space Sector, Fed. Decree-Law No. 12/2019, U.A.E. Off. Gaz. (Dec. 19, 2019).

⁴¹ Understanding Third-Party Liability in UAE Space Law, Chambers & Partners (Feb. 14, 2024), <https://chambers.com/articles/understanding-third-party-liability-in-uae-space-law/>

⁴² Legal and Regulatory Challenges in the UAE's Space Sector, 23 Problems & Perspectives in Mgmt. 426, 430, (2025), https://www.businessperspectives.org/index.php/journals?controller=pdfview&task=download&item_id=22086.

⁴³ Act on the Promotion of Business Activities for Exploring and Developing Space Resources (Act No. 83 of June 23, 2021), Kanpō (Official Gazette), June 23, 2021 (Japan).

⁴⁴ ³¹ Japan Information on the Mandate and Purpose of the Working Group on Space Resources, UNOOSA 3 (2023), https://www.unoosa.org/documents/pdf/copuos/lsc/space-resources/LSC2023/StatesResponses/Japan_Information_to_Space_Resource_WG.pdf



V. DIFFERENCES OF ARTEMIS ACCORD AND OUTER SPACE TREATY

A. The OST and the Artemis Accords

The OST was able to create a foundation for international space regulation. This treaty, though, broadly provided the principles governing space activities. However, it lacked detailed information regarding the implementation or the mechanisms, which provide a space for each state to determine for themselves how these principles will be incorporated into their domestic rules and frameworks. This flexibility has resulted in wildly different approaches among the nations. Some, like Russia, maintained strict State Control, while states like the U.S. promoted private enterprises.⁴⁵ Some states, like the U.S., Japan, etc., have also created laws to regulate these private space ventures. In contrast, some countries chose not to frame any specific legislative framework, leading to inconsistent regulatory environments.⁴⁶ In contrast, the Artemis Accords embed implementation mechanisms directly into their text. Section 2 focuses explicitly on implementing cooperative activities related to the exploration and use of outer space, specifying that legal and practical agreements, in which instruments like Memoranda of Understanding can be used. The accords also enabled the states to use open international standards by which they can create their hardware, data, and communications, or can even innovate new ones as needed, ensuring interoperability between different countries' space technologies.⁴⁷

B. Legal Aspect and its Nature

The OST is a legally binding treaty. As per the data of UNOOSA, on 5 May 2025, there were about 117 nations that ratified it, creating enforceable international obligations. States parties are legally responsible under Article VI for all national space activities, including activities conducted by any entity, whether they involve governmental or any private sector activities.⁴⁸ The Artemis Accords are not a treaty or any framework that is binding on any nation. It represents a political understanding rather than a binding agreement among nations regarding mutually beneficial practices. As per the data of 24 July 2025, 56 countries have signed this accord.⁴⁹

C. Mining of the Resources and Claims:

In OST, Article II explicitly prohibits claims made as of national or sovereign but lacks clarity on the appropriate resource extraction.⁵⁰ The Artemis Accords address this ambiguity in Section

⁴⁵ Fabio Tronchetti, *The Non-Appropriation Principle as a Structural Norm of International Space Law*, 33 *Air & Space L.* 277, 285 (2008).

⁴⁶ Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, opened for signature Jan. 27, 1967, 610 U.N.T.S. 205 (entered into force Oct. 10, 1967).

⁴⁷ Artemis Accords, Oct. 13, 2020, U.S. Dep't of State, [https://www.nasa.gov/artemis-accords/A_Salmeri_Interoperability_the_Artemis_Accords_and_the_Future_of_Space_Exploration_Spacewatch_Global_8_\(2020\)_https://orbilu.uni.lu/bitstream/10993/45184/1/A.%20Salmeri,%20Spacewatch%20Global.pdf](https://www.nasa.gov/artemis-accords/A_Salmeri_Interoperability_the_Artemis_Accords_and_the_Future_of_Space_Exploration_Spacewatch_Global_8_(2020)_https://orbilu.uni.lu/bitstream/10993/45184/1/A.%20Salmeri,%20Spacewatch%20Global.pdf).

⁴⁸ Outer Space Treaty, Art. VI.

⁴⁹ Artemis Accords, Oct. 13, 2020, U.S. Dep't of State, <https://www.nasa.gov/artemis-accords/>

⁵⁰ Cody Curabba, *The Outer Space Treaty vs. The Artemis Accords*, AMERICAN CENT. FOR SPACE POLICY (Nov. 5, 2012), <https://acsp.space/blogs/the-outer-space-treaty-vs-the-artemis-accords-a-roadmap-for-the-future/>

10.2, stating that the gathering of valuable materials from space does not amount to national appropriation under Article II of the Outer Space Treaty.⁵¹

VI. FIVE DECLARATIONS WITH PRINCIPLE FOR OUTER SPACE AND KEY LIMITATIONS:

A. Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space (1963)

This declaration created the core principles forming the foundation of the Outer Space Treaty, promoting peaceful exploration, non-appropriation, and equal access to space.⁵² However, as a General Assembly resolution, it is not legally binding and suffers from enforcement deficiencies. Key Limitations:

1. Non-binding nature: As noted by legal scholars, the declaration "could not establish binding norms of international law" despite its foundational importance.⁵³
2. Definitional ambiguities: The declaration fails to clearly define critical terms such as "outer space" boundaries, creating enforcement challenges.⁵⁴
3. Enforcement gaps: The lack of specific compliance mechanisms has created a gap that is "largely unenforceable on private actors".⁵⁵

B. Principles Governing the Use by States of Artificial Earth Satellites for International Direct Television Broadcasting (1982)

This declaration addressed cross-border satellite broadcasting issues. However, it faces notable implementation challenges in the modern era.⁵⁶ Key Limitations:

1. Technological obsolescence: The principles were designed as per the technology of 1982 and lack to address contemporary broadcasting challenges.⁵⁷
2. Compliance difficulties: The soft law nature means "no international responsibility will be imposed against the wrongdoer" in case of violations.
3. Jurisdictional confusion: There are no proper enforcement mechanisms when broadcasting crosses multiple authorities.⁵⁸

⁵¹ *Ibid.*

⁵² Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, UN Audiovisual Library (Dec. 31, 2007), <https://legal.un.org/avl/ha/tos/tos.html>.

⁵³ Abhishek Varshney, International Liability of Commercial Space Activities and Space Debris, 7 INT'L J.L. MGMT. & HUMAN. 591 (2024).

⁵⁴ Henry Hertzfeld, Current and Future Issues in International Space Law, 15 ILSA J. Int'l & Comp. L. 325, 325 (2008).

⁵⁵ Christina Isnardi, Problems with Enforcing International Space Law on Private Actors, 58 Colum. J. Transnat'l L. 489 (2020).

⁵⁶ United Nations Office for Outer Space Affairs, International Space Law 48-51 (United Nations Instruments 2018, UN iLibrary), <https://doi.org/10.18356/014c0e55-en/>

⁵⁷ Autonomy Has Outpaced International Space Law, War on the Rocks (Mar. 10, 2025), <https://warontherocks.com/2025/03/autonomy-has-outpaced-international-space-law/>

⁵⁸ Future Legal Issues and Challenges of International Space Laws, I Pleadings (Jan. 4, 2021), <https://blog.ipleadings.in/future-legal-issues-challenges-international-space-laws/>

C. UN Principles Relating to Remote Sensing of the Earth from Outer Space (1986)

This declaration addressed the principles for observations of the Earth that are to be made by the satellites. However, these principles contain significant regulatory gaps that become problematic to their effectiveness.⁵⁹ Key Limitations:

1. Major legal lacuna: Research identifies that ‘there is no provision requiring the negotiation between the sense state and the sensed state before the collection of satellite remote sensing data’.⁶⁰
2. Discriminatory application: Despite advocating direct access, several states have ‘started imposing the most detailed, complex and extensive national legal prohibitions on the collection and distribution of such imagery’.⁶¹
3. Soft law weakness: As there are non-binding guidelines, they fail to protect developing countries' interests effectively and lack enforcement mechanisms.⁶²

D. Principles Relevant to the Use of Nuclear Power Sources in Outer Space (1992)

This declaration created principles to provide safety frameworks for the use of nuclear power in space conducts, but it contains regulatory gaps regarding security implications and enforcement.⁶³ Key Limitations:

1. Verification absence: The principles lack ‘a verification mechanism to ensure compliance’ with nuclear safety standards in space.⁶⁴
2. Enforcement challenges: The issue remains that ‘how to effectively enforce’ prohibitions on nuclear weapons in space due to technological and diplomatic complexities.⁶⁵
3. Regulatory gaps: There remain ‘gaps regarding the governance of the utilisation of nuclear energy sources, especially with respect to their security implications’.⁶⁶

E. Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States (1996)

This declaration emphasises that there should be global cooperation and benefit-sharing for humankind. However, faces implementation challenges in practice.⁶⁷ Studies show that despite

⁵⁹ United Nations Treaties and Principles on Outer Space, UNOOSA ST/SPACE/11/Rev.2, at 45-48 (2017), https://www.unoosa.org/pdf/publications/st_space_11rev2E.pdf

⁶⁰ Loh Ing Hoe, Roslan Umar & Mohd Khairul Amri Kamarudin, Evaluation of Remote Sensing Principles 1986: The Unsolved Problems, 7 Int'l J. Acad. Rsch. Bus. & Soc. Scis. 1, 1 (2017).

⁶¹ *Ibid.*

⁶² *Ibid.*

⁶³ Irmgard Marboe, Space Law Treaties and Soft Law Development, UN/China/APSCO Workshop on Space Law 8 (2014), <https://www.unoosa.org/documents/pdf/spacelaw/activities/2014/pres02E.pdf>

⁶⁴ Buzzword or Real Threat? How Concerns over Nuclear Capabilities in Outer Space Can Trigger Extension of Space Security Discussions, FR. INST. FOR STRATEGIC ANALYSIS (Feb. 15, 2024), <https://www.frstrategie.org/en/publications/notes/buzzword-or-real-threat-how-concerns-over-nuclear-capabilities-outer-space-can-trigger-extension-space-security-discussions-2024/>

⁶⁵ *Ibid.*

⁶⁶ *Ibid.*

⁶⁷ Implementation of Soft Law Relating to Outer Space, Biblioteka Nauki 288, 295 (2023), <https://bibliotekanauki.pl/articles/48899365.pdf>

strong policy rhetoric about space as a "global commons," there is minimal institutional implementation of benefit-sharing principles.⁶⁸ Together, these declarations and principles create a solid ethical and operational framework for international space law. They highlight peaceful use, non-appropriation, mutual respect, responsibility, safety, transparency, cooperation, and equitable access, which are essential for sustainable and responsible space activities that benefit all humanity.⁶⁹

Declaration/Principles	UNGA Resolution and Year	Key Sections/Principles
Declaration of Legal Principles	Res. 1962 (XVIII), 1963	Principles 1–3, 6–7: Benefit of all; liberty in use; no claims; peaceful use; fair acknowledgement; international accountability
Broadcasting Principles	Res. 37/92, 1982	Principles 1–2, 5, 8: Sovereignty; prior consent; cooperation; equitable access
Remote Sensing Principles	Res. 41/65, 1986	Principles I, IV, XII, XIV: Benefit of all; respect for sovereignty; access to data; protection of sensitive information
Nuclear Power Sources Principles	Res. 47/68, 1992	Principles 3–4, 7, 9: Safety; prevention of hazards; notification of accidents; international cooperation
Benefits Declaration	Res. 51/122, 1996	Paragraphs 1, 3, 5, 7: Benefit of all States; non-discrimination; cooperation; data sharing; peaceful purposes

VII. CHALLENGES RELATED TO COMMERCIAL RESOURCE UTILISATION

A. Non-appropriation Principle under Article 2 of the OST⁷⁰

The OST forbids countries from claiming space beyond Earth, notably the lunar surface and other planets or heavenly bodies, through sovereignty, occupation, or use. This principle against appropriation is understood to prevent ownership claims over these celestial bodies by either

⁶⁸ Pauline Pic, Philippe Evoy & Jean-Frédéric Morin, *Outer Space as a Global Commons: An Empirical Study of Space Arrangements*, 17 Int'l J. Commons 288 (2023).

⁶⁹ Cassandra Steer, *Sources and Law-Making Process Relating to Space Activities*, in *Routledge Handbook of Space Law* 19, 25 (Ram Jakhu & Paul Stephen Dempsey eds., 2017).

⁷⁰ Non-Appropriation Principle, *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies*, § art. II, opened for signature Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205.

states or private parties. However, the domestic law of some nations, like Luxembourg's space resource laws⁷¹ and the U.S. Commercial Space Launch Competitiveness Act (2015)⁷², allows companies of the private sector to possess, own, and sell resources taken from space bodies without asserting sovereignty over those bodies. This situation creates legal confusion and conflict, as some see it as a violation of the non-appropriation principle. They argue that owning resources may suggest actual appropriation.⁷³ Although U.S. and Luxembourg laws state that owning extracted resources does not mean claiming sovereignty or territory, critics and some international scholars believe this 'dualism' undermines the OST's goals and creates a divide in international space law.⁷⁴

B. Interpretation of 'Use' vs. 'Appropriation'

Some nations contend that extracting and owning resources is "use" and not "appropriation," and therefore allowed under the OST, while others argue ownership of extracted resources amounts to a form of appropriation inconsistent with the treaty's spirit.⁷⁵ This semantic and legal ambiguity fuels disputes over the legality of commercial space mining ventures.⁷⁶

C. Absence Of A Clear Guideline On Both Senses

The UN Guiding Principles on Business and Human Rights (UNGPs) are now the global standard for responsible corporate behaviour.⁷⁷ There is confusion over whether it is sufficient to merely have a framework of procedures (process) or whether the firms must always be evaluated on the actual-world outcomes of those procedures (outcome), for instance, UNGPs guide a tech company deploying satellites for global communications to conduct "human rights due diligence" i.e., to map and mitigate risks to individuals across their operations.⁷⁸ But the regulations do not state if it is sufficient that the company simply uses a checklist (the process), or if it is necessary to see to it that nobody gets injured or exploited due to their activity (the outcome). The companies can simply state compliance by demonstrating that they have a policy and procedure without guaranteeing their application or the result of said process.⁷⁹

⁷¹ *Loi du twenty juillet 2017 sur l'exploration et l'utilisation des ressources de l'espace*, Journal Officiel du Grand-Duché de Luxembourg, No. 674, (July 28, 2017).

⁷² *U.S. Commercial Space Launch Competitiveness Act*, Pub. L. No. 114-90, 129 Stat. 704 (2015).

⁷³ Fabio Tronchetti, *The Non-Appropriation Principle as a Structural Norm of International Space Law*, 33 *Air & Space L.* 277, 285 (2008), <https://kluwerlawonline.com/journalarticle/Air+and+Space+Law/33.3/AILA2008021/>

⁷⁴ Zois A. Paliouras, *The Non-Appropriation Principle: The Grundnorm of International Space Law*, 27 *Leiden J. Int'l L.* 37, 42 (2014).

⁷⁵ Andrew Pershing, *Interpreting the Outer Space Treaty's Non-Appropriation Principle: Customary International Law from 1967 to Today*, 42 *Yale J. Int'l L.* 149, 161 (2019), <https://openyls.law.yale.edu/bitstreams/53f751d8-60f8-41bc-a263-26bfff3fd375f/download/>

⁷⁶ Johnson-Freese & Weeden, *Application of Ostrom's Principles for Space*, 3(1) *Global Policy* 72 (2012).

⁷⁷ United Nations, *Guiding Principles on Business and Human Rights: Implementing the United Nations "Protect, Respect and Remedy" Framework*, UN Doc. A/HRC/17/31 (2011), https://www.ohchr.org/documents/publications/guidingprinciplesbusinessshr_en.pdf

⁷⁸ Anna Marie Brennan, *Developing Principles of Corporate Human Rights Due Diligence for Outer Space Use and Exploration: A Critical Evaluation*, 5 *Lex ad Coelum* 1 (2025).

⁷⁹ *Understanding and Implementing the UN Guiding Principles on Business and Human Rights*, Oxford Law Practice (May 13, 2025), <https://academic.oup.com/oxford-law-pro/edited-volume/59931/chapter/512682392/>

D. Lack of International Consensus and Dispute Resolution Mechanisms

There is no international legal framework that specifically addresses how to regulate commercial resource extraction, ownership, and conflict resolution. This leads to uncertainty.⁸⁰ The Moon Agreement (1979) tried to regulate resource exploitation as the "common heritage of mankind," but major spacefaring nations, including the U.S. and Luxembourg, reject it. This lack of global agreement and enforcement mechanisms creates different interpretations about commercial mining and resource use rights.⁸¹

E. Accountability And Supervision By The State Under Article VI Of The OST⁸²:

As per the OST, states must authorise and frequently oversee the conduct of their nationals in space. This creates questions about how states can ensure that private resource utilisation is consistent with international obligations, especially where domestic laws might promote expansive commercial exploitation.⁸³

F. Intellectual Property And Commercial Rights:

Emerging issues on the protection of intellectual property rights (IPR) in space resource technologies and exploitation add another layer of legal complexity.⁸⁴, with potential conflicts between private commercial interests and international public goods.⁸⁵ Conflicting legal provisions revolve around the tension between the OST's international treaty obligations, especially non-appropriation, and newer national laws that seek to stimulate private commercial resource activities with rights to ownership of extracted materials. The resulting legal ambiguity and diverging interpretations create uncertainty and potential disputes within the international space law regime. These conflicts suggest a pressing need for an updated, multilateral regulatory framework to clarify rights, responsibilities, and dispute mechanisms for commercial resource utilisation in space.⁸⁶

G. Address Of The Space Debris:

The current regime does not explicitly address the issue of the debris caused by nations. Debris in space is not considered in the treaties established by the U.N.⁸⁷ Due to this, there has been a

⁸⁰ Space Resource Discussions in the UN Committee on the Peaceful Uses of Outer Space, *Opinio Juris* (July 10, 2021), <https://opiniojuris.org/2021/07/11/space-resource-discussions-in-the-un-committee-on-the-peaceful-uses-of-outer-space/>

⁸¹ Florian Rabitz, Space Resources and the Politics of International Regime Complexity, 17 *Int'l J. Commons* 288, 295 (2023), <https://thecommonsjournal.org/articles/10.5334/ijc.1274/>

⁸² *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies* art. VI, opened for signature Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205.

⁸³ John G. Wrench, Non-Appropriation, No Problem: The Outer Space Treaty Is Ready for Asteroid Mining, 51 *Case W. Res. J. Int'l L.* 437, 445 (2019).

⁸⁴ Varshney, Abhishek, "International Liability of Commercial Space Activities and Space Debris," 7 *Intl. J.L. Mgmt & Humanities* 591 (2024).

⁸⁵ Melissa de Zwart, Space Resource Activities and the Evolution of International Space Law, 89 *Acta Astronautica* 534, 540 (2023).

⁸⁶ Space Resource Regulation: From National Approaches to the Need for a General Framework, Space Generation Advisory Council (Sept. 18, 2024), <https://spacegeneration.org/space-resource-regulation-from-national-approaches-to-the-need-for-a-general-framework/>

⁸⁷ Legal Issues Surrounding Space Debris and Satellite Regulation, Bhatt & Joshi Associates (Jan. 3, 2025), <https://bhattandjoshiassociates.com/legal-issues-surrounding-space-debris-and-satellite-regulation/>

loss of several countries due to debris existing in space, and there is no mechanism to address that accountability.⁸⁸

VIII. INDIA'S CHANGING LANDSCAPE IN SPACE ACTIVITIES:

India started its journey with the establishment of the Indian National Committee for Space Research in 1962, and then, after 7 years, the Department of Space (DOS) was founded in 1969.⁸⁹ Over these decades, India has progressed with immense growth in developing robust space capabilities with the Indian Space Research Organisation (ISRO), pioneering satellite launches, telecommunications, remote sensing, and successful interplanetary missions like Chandrayaan and Mangalyaan.⁹⁰ Previously, India had state-led space activities. With the developments and growth in the changing times, in the last decades, there has been a turn in the growth of private enterprises and commercial participation. This shift is in accordance with global commercial mining in space and the utilisation of celestial materials or their resources, prompting India to reconsider its present legal and institutional framework.

A. Present Legal Frameworks Governing Space Activities In India:

1. **Remote Sensing Data Policy (2011):** This framework created a centralised system granting the license and developing regulations for remote sensing data in India under the Department of Space (DoS). It established state ownership of all Indian remote sensing satellite data and made a system that enabled private users to apply for licenses to access and use such data. It aimed to balance the concerns regarding the security of the nation with promoting data-driven applications in agriculture, disaster management, and urban planning.⁹¹
2. **Indian Space Policy 2023:** This policy embarked on a significant shift by opening "end-to-end" space activities, including the production or manufacturing of the satellite, launch vehicles, remote sensing, and, importantly, commercial recovery of space resources, to private and non-governmental entities. The Indian National Space Promotion and Authorisation Centre (IN-SPACe)⁹² It was created as the primary agency operating under the Department of Space to oversee and facilitate space-related activities in India, an autonomous regulator for authorising, promoting, and supervising commercial space activities, fostering industry growth while ensuring regulatory compliance with safety, security, and international standards.⁹³
3. **Norms, Guidelines & Procedures (NGP 2024):** It was released by IN-SPACe in 2024. It provided detailed operational guidance, procedures, as well as criteria for implementing the Indian Space Policy 2023. It outlined the application procedures, eligibility criteria,

⁸⁸ Abhishek Varshney, International Liability of Commercial Space Activities and Space Debris, 7 INT'L J.L. MGMT. & HUMAN. 591 (2024).

⁸⁹ Indian Space Research Organisation, Genesis, ISRO, <https://www.isro.gov.in/genesis.html>

⁹⁰ Achievements of India's Space Program, NextIAS (Aug. 11, 2025), <https://www.nextias.com/blog/achievements-of-indian-space-program/>

⁹¹ Remote Sensing Data Policy, Dep't of Space, Gov't of India (2011), https://www.isro.gov.in/media_isro/pdf/Policies/rsdp_policy_2011.pdf

⁹² Indian National Space Promotion and Authorisation Centre (IN-SPACe), Indian Space Research Organisation, <https://www.isro.gov.in/about-isro/in-space/>

⁹³ Indian Space Policy – 2023, Dep't of Space, Gov't of India (Apr. 20, 2023), https://www.isro.gov.in/media_isro/pdf/Policies/Indian_Space_Policy_2023.pdf

compliance requirements, insurance and liability norms, and ongoing supervision mechanisms for various space activities, including commercial resource utilisation beyond the Moon. These guidelines make regulation stronger in the absence of any ambiguity and support safe, transparent, and effective commercialisation of space in India.⁹⁴

4. **India's Draft Space Activities Bill, 2017:** This Bill has not been enacted yet. This bill intends to establish a comprehensive legal regime that will enable a system of issuance of licences, supervision, liability, and penalties related to space activities, including commercial resource extraction. In early 2025, this bill is still in the advanced stages of approval.⁹⁵

B. Lack Of Legislative Attention And Areas That Require Some Work:

India has seen immense growth in the last decades, creating a robust space technology and advancements. However, with this growth, new challenges have emerged that require regulations. India has some framework to govern these activities, but there is a gap or lack of legislative attention in it:

1. **Lack of Enacted Comprehensive Law:** The absence of a passed Space Activities Act leaves ISP 2023 and NGP 2024 lacking a statutory backing, making them vulnerable to incorrect implementation.⁹⁶
2. **Ambiguity on Property Rights:** ISP 2023, though, hints at private ownership rights on the extracted resources from the celestial bodies. However, it conflicts with the no-claim principle of the Outer Space Treaty (OST), posing legal tension that requires a comprehensive legal backing.⁹⁷
3. **Jurisdictional Uncertainties:** The Draft Bill does not explicitly provide the regulations for Indian Nationals' activities abroad or foreign actors operating in India.⁹⁸
4. **Environmental and Debris Policies:** There is no dedicated regulation or statutory framework that can address the safeguards of the environment and orbital debris mitigation.⁹⁹
5. **Liability and Insurance and Investments:** Formal regulations on liability, multi-tier insurance framework, or indemnity provisions compared to U.S. or UAE laws have not yet been developed. Though 100% FDI is allowed, screening and cybersecurity frameworks need more strengthening and clarification.¹⁰⁰

⁹⁴ Norms, Guidelines and Procedures for Implementation of Indian Space Policy – 2023, IN-SPACE, Gov't of India (May 2024), <https://www.inspace.gov.in/sites/default/files/NGP2024.pdf>

⁹⁵ The Space Activities Bill, 2017, Dep't of Space, Gov't of India (Draft, Nov. 2017), https://www.isro.gov.in/media_isro/pdf/Policies/About-Space-Activities-Bill2017.pdf

⁹⁶ Norms, Guidelines and Procedures for Implementation of Indian Space Policy – 2023, IN-SPACE, Gov't of India (May 2024), <https://www.inspace.gov.in/sites/default/files/NGP2024.pdf>

⁹⁷ Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, art. II, opened for signature Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205.

⁹⁸ V.S. Rana, *Outlining Inconsistencies in the Indian Space Policy 2023*, WB Nat'l Univ. Juridical Scis. Blog (May 2023), <https://nujs.edu/casl/outlining-inconsistencies-in-the-indian-space-policy-2023/>

⁹⁹ Dep't of Space, Gov't of India, *ISRO Space Debris Mitigation Measures*, <https://www.isro.gov.in/SpaceDebrisMitigation.html>

¹⁰⁰ Convention on International Liability for Damage Caused by Space Objects, Mar. 29, 1972, 961 U.N.T.S. 187.

IX. DISPUTE RESOLUTION AND CASES

As there's no proper framework to address such commercial disputes, Arbitration is one of the best ways to resolve conflicts in a peaceful manner, keeping all the crucial info related documents safe, as they can be used as subject to national interest, and it's speedy in nature.¹⁰¹ In 1899, Hague, Netherlands, an arbitration court was established for handling disputes between states, which is a neutral platform. It was termed the Permanent Court of Arbitration. The primary handling of cases by this court is related to states, organisations and private entities on issues like territorial disputes, maritime boundaries, commercial contracts and investment conflicts.¹⁰² While primarily dealing with traditional problems, in recognition of suitability for the arbitration of space-related disputes, the PCA in 2011 published its Optional Rules for Arbitration of Disputes Relating to Outer Space Activities.¹⁰³ However, a strong framework is required on both international and national levels, primarily focusing on the national level. India needs a strong and comprehensive legal framework to make it viable for disputes to be resolved.

*Case 1: Unauthorised Launch of Swarm Technologies' Space Bee Satellites (2018)*¹⁰⁴ On 12 January 2018, four US-built nanosatellites (Space Bee 1–4) were launched aboard India's PSLV-C40 via Antrix Corporation, despite the US Federal Communications Commission (FCC) explicitly denying authorisation in December 2017 due to safety risks from their extremely small size. Swarm Technologies bypassed this denial through a commercial rideshare agreement with Spaceflight Industries. The FCC investigated post-launch and imposed a \$900,000 penalty, acknowledging it was lenient but imposing strict licensing restrictions. The main issue was whether a private company could legally launch satellites abroad after being denied by its own regulator, and the responsibility of the launching state under international law. Under Article VI of the Outer Space Treaty, oversight rests with the state of nationality (here, the US). International law does not obligate foreign launch providers or states like India to verify domestic authorisations unless bound by bilateral agreements. This highlighted a regulatory gap as firms may evade national restrictions by using foreign launch providers.

*Case 2: Liability Convention – Cosmos-954 (1978)*¹⁰⁵ On 24 January 1978, the Soviet Cosmos-954 satellite, powered by a nuclear reactor, disintegrated over Canada, scattering radioactive debris across 124,000 square kilometres. Cleanup under Operation Morning Light cost \$14 million CAD, and Canada sought compensation under the 1972 Liability Convention, which makes launching states fully liable for damage caused on Earth. The USSR contested Canada's claim, citing Article 5 violations for excluding Soviet specialists and questioning whether environmental damage qualified as "damage." After lengthy negotiations, a settlement was

¹⁰¹ Darcy Beamer-Downie & Leonor D'Albiousse, *Space Law and Arbitration: Dispute Resolution Mechanisms for Space-Related Disputes*, Clyde & Co (Apr. 18, 2024), <https://www.clydeco.com/en/insights/2024/03/overview-of-dispute-resolution-mechanisms-for-space/>

¹⁰² History, Permanent Court of Arbitration (Dec. 31, 2024), (established by the 1899 Hague Convention), <https://pca-cpa.org/en/about/introduction/history/>

¹⁰³ Optional Rules for Arbitration of Disputes Relating to Outer Space Activities, Permanent Court of Arbitration (Dec. 6, 2011), <https://www.mcgill.ca/iasl/files/iasl/optional-rules-arbitration-disputes-outer-space-6dec2011.pdf>

¹⁰⁴ Swarm Technologies, Inc., *Unauthorized Launch and Operation of Space Bee Satellites*, Memorandum Opinion & Order, FCC File No. SAT-LOA-20161205-00117, 33 FCC Rcd 603 (2018) (Fed. Comm'n's Comm'n).

¹⁰⁵ Agreement Between the Government of Canada and the Government of the Union of Soviet Socialist Republics on the Settlement of Questions Arising from the Cosmos 954 Incident, Can.-U.S.S.R., Apr. 2, 1981, 20 I.L.M. 689.



signed in April 1981 in Moscow, with the USSR paying \\$3 million CAD—far less than Canada's initial claim but accepted as final. The case set a precedent for applying the Liability Convention and demonstrated the preference for diplomatic resolution over litigation in space law disputes.

X. CONCLUSION

The rapid rise of a commercially driven Space 2.0 era is defined by significant private investment, technological innovation, and ambitious projects like asteroid mining and lunar resource extraction. This has surpassed the current international legal system. While the potential rewards of commercial space resource use are considerable, including in-situ resource use (ISRU) for sustainable deep-space missions, the lack of universally accepted regulations has grave legal, geopolitical, and environmental challenges. The OST (1967) serves as the foundation of space governance. It includes principles of non-appropriation (Art. II), state responsibility and supervision (Art. VI), and environmental protection (Art. IX). The Moon Agreement (1979) further builds on this by stating that lunar resources are the "common heritage of mankind" and an international system for their use. However, few countries have ratified it, which limits its effectiveness. Soft-law instruments like the UN Declarations and Principles range from the 1963 Declaration of Legal Principles to the 1996 Benefits Declaration, reinforcing norms of peaceful use, cooperation, and fair access. At the national level, laws such as the U.S. Commercial Space Launch Competitiveness Act (2015)¹⁰⁶ and Luxembourg's Space Resources Act (2017)¹⁰⁷ give private entities specific rights to the resources they collect, while making it clear that this does not amount to sovereignty claims. However, these independent approaches may lead to regulatory confusion and disputes over compliance with international obligations. With increasing investment billions of dollars every year and growing geopolitical interest, there is an urgent need for clear, enforceable, and globally accepted rules for commercial space resource use. This framework should balance the commercial incentives driving innovation with principles of environmental protection, peaceful use, and fair benefit-sharing. In the end, the sustainable and cooperative development of outer space as a shared domain will rely on aligning binding treaties, national laws, and non-binding best practices into a clear, universally respected system that ensures space remains a realm of opportunity for all humankind.

¹⁰⁶ *U.S. Commercial Space Launch Competitiveness Act*, Pub. L. No. 114-90, 129 Stat. 704 (2015).

¹⁰⁷ *Loi du 20 juillet 2017 sur l'exploration et l'utilisation des ressources de l'espace*, Journal Officiel du Grand-Duché de Luxembourg, No. 674 (July 28, 2017).