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Celestial Real Estate Laws: Private Ventures Lawful Stake Claims to Lunar Territory and Resources

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The advent of contemporary law on the exploration and development of space resources by Japan in 2021 has ignited controversy as to whether such laws can be promulgated domestically by sovereign states. It is not the first time that such mandates have been synthesised to acknowledge industrial activities on the lunar territories. The United States of America, Luxembourg, and the UAE are already equipped with laws concerning the management and regulation of resources derived from celestial objects. Experts posit that such domestic laws contravene the ratified ***Outer Space Treaty (OST)****, prohibiting expansion of masses and resource exploitation, otherwise subjected to provisions mandating the same, viz-a-viz celestial bodies. Albeit being thoroughly recognised and sanctioned by multiple states, recent trends tend to complacently challenge such laws by enacting both domestic and collective treaties and laws, redirecting to the notion that lunar resources are the 'common heritage of mankind' while 'de facto' utilising the doctrine in extending the realm of resource management and exploration to land acquisition and Real Estate modelling.*

This paper emphasises that the appropriation of such laws is a multidimensional concept, which derives its intricacies from international politics, treaties and conventions, systematic pragmatism, and extraterrestrial jurisprudence. The commentary pertains to suggestions regarding the structurization and hierarchy of law and its governance, the role of institutions at international forums, and policy formulation for minimising friction between sovereign states, drawing its analogy from persisting space laws such as the OST, the Moon Treaty, and the Artemis Accords. Whether silence of such international treaties on private ventures such as Space X, Blue Origin, Rocket Lab, Relativity Space, Sierra Nevada, etc and absence of competent legal framework indirectly facilitates competitive advantage for such entities to manage human settlement at such

celestial bodies and if so, what measures would limit activities of such private venture to exploit loopholes of law governing space activities.

Keywords: *lunar property rights, outer space treaty, resource extraction, space commercialisation.*

INTRODUCTION

The Moon is no longer the exclusive domain of scientific exploration and Cold War prestige. The coming decade will witness an unprecedented transformation as private companies such as SpaceX, Blue Origin, Intuitive Machines, and Firefly, alongside initiatives like NASA's Artemis program, accelerate plans for permanent bases, resource mining and even lunar tourism.[1] Recent successful commercial lander deployments and the maturation of heavy-lift launch systems have lowered the technological barrier to lunar access, enabling private actors to operate independently on the lunar surface.[2] What was once theoretical science fiction has become an imminent commercial reality.

Yet this technological and commercial acceleration has violently outpaced the development of adequate legal frameworks. The foundational Outer Space Treaty 1967,[3] drafted when lunar mining was purely hypothetical, prohibits nations from claiming sovereignty over celestial bodies but remains conspicuously silent on whether and how private entities may extract and own lunar resources.[4] The result is a profound legal vacuum. While NASA's Artemis Accords assert that resource extraction must comply with the Outer Space Treaty,[5] the Treaty itself contains no specific rules governing ownership of mined materials. Companies and nations are thus free to conduct lunar activities, yet it remains fundamentally unclear who, if anyone, acquires legal title to the water ice, minerals, and regolith they obtain.

[1] 'Artemis Program Overview' (*NASA*, 2023) <https://ntrs.nasa.gov/api/citations/20230012221/downloads/Cohenartemispresentation.pdf> accessed 20 November 2025
[2] 'IM-1 MISSION' (*Intuitive Machines*) <https://www.intuitivemachines.com/im-1> accessed 14 November 2025
[3] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies 1967
[4] Fabio Tronchetti, *The Exploitation of Natural Resources of the Moon and Other Celestial Bodies* (Brill 2009)
[5] 'The Artemis Accords' (*NASA*) <https://www.nasa.gov/wp-content/uploads/2022/11/Artemis-Accords-signed-13Oct2020.pdf> accessed 14 November 2025

This ambiguity has triggered a bifurcated response. On one hand, countries like the United States, Luxembourg, the United Arab Emirates, and Japan have enacted national legislation unilaterally legitimising private extraction rights,[6] creating an uneven legal landscape. On the other hand, multilateral treaty-making has stagnated, with deep geopolitical divisions emerging between the U.S.-led Artemis Accords and China's International Lunar Research Station coalition.[7] Without coordinated international action, critical questions surrounding safety zones, benefit sharing, environmental protections, and operational conflict resolution will be answered through ad hoc practices rather than deliberate governance.

The recent development could be measured in coherence with the political motivation for states to gain advantage over others, imposing restrictions on subdued states via enforcing international treaties such as the OST itself, and simultaneously challenging those laws through renovating their own domestic laws. This hypocrisy is the result of lucid probability that diffusion of such treaties lacks the very foundation of systemic structure, which incorporates such laws.

RESEARCH METHODOLOGY

This article combines doctrinal treaty analysis, comparative examination of national space legislation from the US, Luxembourg, UAE, and Japan, and interdisciplinary economic theory. It applies systematic pragmatism to develop lunar-specific legal frameworks, recognising that extraterrestrial governance requires novel approaches beyond traditional terrestrial or maritime precedents.

BACKGROUND AND EVOLUTION OF INTERNATIONAL SPACE LAW

The foundations of international space law emerged during the era of the Cold War, shaped by the intense rivalry between the United States and the Soviet Union.[8] When the Soviets launched Sputnik in 1957, it became clear that space activities required international regulation to prevent the extension of terrestrial conflicts beyond Earth.[9] The United Nations became the primary forum for developing space governance principles, driven by both

[6] US Commercial Space Launch Competitiveness Act 2015
[7] Agreement Governing the Activities of States on the Moon and Other Celestial Bodies 1984
[8] Steven Freeland, 'Peaceful Purposes? Governing the Military Uses of Outer Space' (2016) 18(1) European Journal of Law Reform <https://ssrn.com/abstract=2899901> accessed 14 November 2025
[9] Walter McDougall, *The Heavens and the Earth: A Political History of the Space Age* (Johns Hopkins University Press 1997) 117

superpowers' desire to avoid uncontrolled militarisation while maintaining their own strategic interests.

The cornerstone of this legal framework is the Outer Space Treaty of 1967, which established fundamental principles including the freedom of exploration and the prohibition of national appropriation of celestial bodies. Following this, the international community adopted a series of complementary agreements: the Rescue Agreement of 1968 addressed astronaut assistance,[10] the Liability Convention of 1972 clarified responsibility for space damage,[11] the Registration Convention of 1976 created transparency measures, and the Moon Agreement of 1979 attempted to establish resource governance, though it gained limited support.

The framers of Article II's non-appropriation principle intended to prevent territorial sovereignty claims over celestial bodies, ensuring that outer space remained accessible to all nations. This reflected Cold War anxieties about one superpower establishing exclusive control over strategic locations,[12] while promoting the notion of space as the common heritage of humankind rather than an arena for imperial competition.[13]

The Outer Space Treaty serves as the 'Constitution' of International Space Law. As of May 2025, 117 countries have signed on, including every major player in space. The thing is, this treaty was written during the Cold War, a time when people were more worried about nuclear missiles than asteroid mining. The drafters kept the language deliberately vague to get everyone to agree. However, that textual ambiguity of its key articles, designed to be broad enough to secure consensus in 1967, has allowed for divergent interpretations regarding commercial activities in the modern era.

Article II of the Outer Space Treaty straightforwardly states, 'Outer space, including the moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means.' The idea was simple to prevent another colonial scramble like what happened in the Americas or Africa. No country

[10] Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space 1968
[11] Convention on International Liability for Damage Caused by Space Objects 1972
[12] Fabio (n 4)
[13] Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space 1963

gets to plant a flag on the Moon and call it theirs.[14] The Cold War wasn't going to turn into a space land grab.

But here's where it gets messy. The treaty says nothing about resources. Can you claim the stuff you mine from an asteroid even if you can't claim the asteroid itself? Back in 1967, commercial mining sounded like science fiction, so the drafters didn't really hash it out. The preparatory documents show they agreed on banning territorial claims but left resource ownership in a grey zone.[15]

Fast forward to today, and you've got two camps. The United States and other spacefaring nations argue that the ban only applies to the celestial body itself and not to what you extract from it. The core argument behind it is that it's like fishing in international waters. You can't own the ocean, but the fish you catch are yours.[16] Once you've mined that lunar regolith or pulled platinum off an asteroid, it belongs to whoever did so. They argue that 'appropriation' in Article II means territorial annexation, not property ownership of extracted materials.[17]

Some scholars argue against it; they argue that if you're consuming the Moon's surface, you're effectively appropriating it. The treaty doesn't distinguish between the body and its parts, they say, so taking resources is still taking the Moon itself, but not directly, but slowly, piece by piece. In other words, appropriation 'by other means,' not directly.

Article VI of the Outer Space Treaty establishes a distinctive principle in space law by attributing private space activities to their sponsoring states. This provision requires States Parties to accept international responsibility for all national space activities, regardless of whether governmental or nongovernmental entities conduct them. The article emerged from

[14] Jinyuan Su, 'Legal status of abiotic resources in outer space: Appropriability, ownership, and access' (2020) 35(4) Leiden Journal of International Law <https://doi.org/10.1017/S0922156522000383> accessed 17 November 2025

[15] Kurt Taylor, 'Fictions of the Final Frontier: Why the United States SPACE Act of 2015 Is Illegal' (2019) 33(4) Emory International Law Review <https://scholarlycommons.law.emory.edu/cgi/viewcontent.cgi?article=1218&context=eilr> accessed 15 November 2025

[16] John E Noyes, 'The Common Heritage of Mankind: Past, Present, and Future' (2011) 40(1) Denver Journal of International Law and Policy <https://digitalcommons.du.edu/cgi/viewcontent.cgi?article=1156&context=djilp> accessed 15 November 2025

[17] Scott Atkins et al., 'Governance in outer space: The case for a new global order' (*Norton Rose Fulbright*, 01 November 2022) <https://www.nortonrosefulbright.com/en-us/knowledge/publications/e8862684/governance-in-outer-space-the-case-for-a-new-global-order> accessed 17 November 2025

negotiations between the Soviet Union, which preferred limiting space access to states only, and the United States, which championed private sector participation.[18]

Basically, this framework means private companies such as SpaceX and Astrobotic lack independent standing in international space law. Their actions are legally attributable to their home states, creating an obligation for states to authorise and continuously supervise private space operations. This supervisory duty compels states to establish domestic licensing systems ensuring compliance with international standards, including planetary protection requirements.

Article VI also generates significant liability concerns. The Liability Convention imposes absolute liability on launching states for surface damage caused by space objects, while orbital damage requires proof of fault. States thus face financial responsibility for private operator damages despite relying solely on domestic mechanisms for control. Ambiguities persist regarding fault standards for autonomous lunar systems and potential cyber-attacks compromising private spacecraft, where launching states might retain responsibility despite losing operational control.[19]

Article I says space exploration and use shall be the 'province of all mankind' and carried out for everyone's benefit. Though it sounds nice, what does it actually mean? It's not the same as the 'Common Heritage of Mankind' concept you see in the Law of the Sea or the Moon Agreement. 'Province of All Mankind' is generally read as a freedom of access principle—everyone gets to go to space. It doesn't say anything about splitting up the profits.[20]

This distinction is critical for commercial actors, who argue that 'benefit' can be realised through scientific knowledge sharing, the expansion of human capabilities, and the provision

[18] Frans G von der Dunk, 'The Origins of Authorisation: Article VI of the Outer Space Treaty and International Space Law' in Frans G von der Dunk (ed), *National Space Legislation in Europe: Issues of Authorisation of Private Space Activities in the Light of Developments in European Space Cooperation* (vol 6, Martinus Nijhoff 2011)
[19] Luca Erhart and Maria Boutovitskai, 'Transforming Article VI of the Outer Space Treaty into an Effective Mechanism of Space Debris Mitigation' (8th European Conference on Space Debris, Darmstadt, April 2021) <https://conference.sdo.esoc.esa.int/proceedings/sdc8/paper/223/SDC8-paper223.pdf> accessed 15 November 2025
[20] Carol R Buxton, 'Property in Outer Space: The Common Heritage of Mankind Principle v the First in Time, First in Right Rule of Property' (2004) 69(4) Journal of Air Law and Commerce <https://scholar.smu.edu/cgi/viewcontent.cgi?article=1712&context=jalc> accessed 15 November 2025

of services (like satellite communications), rather than a global tax or royalty regime.[21] State practice, particularly since the 1996 *Declaration on International Cooperation in the Exploration and Use of Outer Space*, supports the view that states retain the freedom to determine the modes of cooperation and benefit sharing, rather than being bound to a mandatory redistribution mechanism.

INTERNATIONAL TREATIES AND CONVENTIONS

- **Outer Space Treaty (OST)**
- **Moon Agreement, 1979**
- **Artemis Accord**

Commencement of space activities strikes its record through the history of the Cold War. The launch of Sputnik I by the Soviet Union in October 1957, as an 'Artificial Satellite', marked the era of space revolution, and since then, activities related to space exploration have proliferated, demanding regulatory provisions to characterise and manage concerning activities.

Outer Space Treaty (OST): The Outer Space Treaty reached an agreement in 1966, codifying legal principles governing the activities of states in the exploration and use of outer space. The treaty envisioned that the sovereign states might, in the near future, expedite innovative measures to commit irrational trespass, claiming that such land used thereof on the precipice of mining and exploration of minerals and resources is henceforth owned by them. The Treaty was opened for signature by the three depository Governments **(the Russian Federation, the United Kingdom and the United States of America)** in January 1967, and it entered into force in October 1967. The prognostication led to the enactment of the OST, regulating such affairs and barring states from claiming sovereignty over the land disposed thereof by its use in mineral extraction and resource gathering.

Article II: Outer space, including the moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means.

[21] Isabel Feichtner, 'Mining for Humanity in the Deep Sea and Outer Space: The Role of Small States and International Law in the Extraterritorial Expansion of Extraction' (2019) 32(2) Leiden Journal of International Law 255 <https://doi.org/10.1017/S0922156519000013> accessed 24 November 2025

Article VI: The activities of non-governmental entities in outer space, including the moon and other celestial bodies, shall require authorisation and continuing supervision by the appropriate State Party to the Treaty. When activities are carried on in outer space, including the moon and other celestial bodies, by an international organisation, responsibility for compliance with this Treaty shall be borne both by the international organisation and by the States Parties to the Treaty participating in such organisation.

Article I: Outer space, including the moon and other celestial bodies, shall be free for exploration and use by all States without discrimination of any kind, on a basis of equality and in accordance with international law, and there shall be free access to all areas of celestial bodies.

Moon Agreement 1979 —

The resolution was passed in the 89th plenary meeting on 5th of December 1979 by the General Assembly. The resolution particularly aims towards the issue of management and usage of resources and land, and on the surface of the Moon. Similar to that of the OST, the Moon agreement was enacted, viewing the proliferating urge of the states to wash their hands of it in the persisting flow of the space race. Provisions provided nothing additional, comparing the preceding treaty and rendered experts sceptical as to the reasons for such a dogmatic approach.

Article III: The moon shall be used by all States Parties exclusively for peaceful purposes.

Article VI:

- There shall be freedom of scientific investigation on the moon by all States Parties without discrimination of any kind, based on equality and in accordance with international law.
- In carrying out scientific investigations and in furtherance of the provisions of this Agreement, the States Parties shall have the right to collect on and remove from the moon samples of its mineral and other substances. Such samples shall remain at the disposal of those States Parties which caused them to be collected and may be used by them for scientific purposes.

Article VIII: Activities of States Parties shall not interfere with the activities of other States Parties on the moon. Where such interference may occur, the States Parties concerned shall undertake consultations in accordance with article 15, paragraphs 2 and 3 of this Agreement.

Article IX: States Parties may establish manned and unmanned stations on the moon.

Article XI (2): The moon is not subject to national appropriation by any claim of sovereignty, by means of use or occupation, or by any other means.

Artemis Accord —

Even after recognition of the OST and the Moon Agreement, several nations opt for a separate Accord, distinctive from that of the preceding treaties, to regulate space affairs, rendering the consultation mechanism of the **UNOOSA (United Nations Office for Outer Space Affairs)** futile. The Accord prejudiced the crux of the treaty and allowed nations to set up their affairs outside the ambit of the General Assembly. The idea of the accord enumerates simple business, which is, inter alia, to establish a human settlement on the moon and other celestial objects and planets. Albeit the accord under its provisions explicitly mentions that the activities must correspond to the persisting COPOUS mandates, it is still managing to push for the **registration of celestial resources u/s Section 7** of the accord. The project Moon and beyond pushed forward that such a settlement is necessary if envisioned critically of the upcoming situation of planet Earth. NASA, which introduced the accord, has, on 24th July 2025, found 56 nations as signatories to the accord.

RECENT DOMESTIC LAW ENACTMENTS

After almost 6 decades of proliferating technological advancement in the field of space and research, sovereign states have now been more proactive than ever before. Elon Musk's idea to bombard Mars with nuclear weapons on its pole to make a habitable environment on Mars, projects and endeavours of states for missions on the other side of the moon, fictions such as Interstellar, findings related to black holes, etc., have struck humankind with a sense of curiosity to zoom their view into deep space. This curiosity is paralleled by what we see with the contemporary laws enforced by independent states.

Space Resource Exploitation and Utilisation Act (USA): The said act was enforced in 2015 by the government of the USA and is bifurcated into 4 different parts, but the relevance of

which is drawn from the last part of the act. The act proposed the commercialisation of space resource exploration and utilisation. The act promulgates that the fastest way to explore deep space is through the commercialisation of resources gathered by the process of exploration itself.

While we thoroughly scrutinise the act, an implicit doctrine of human settlement by means of land acquisition is imminent. The most reliable way that we found on earth to commercialise resources was through the way of globalisation. A prominent idea that the Americans persist in while resisting the soviets. The same analogy can be drawn here as well. Privatisation of space exploration. But the issue remains intact after a simple question. What is the incentive for such private ventures if they opt for deep space exploration and resource extraction? The answer to this is even simpler. Find a way to explore, gather information, share it, extract resources and claim the right over it after registration. After exploration holds the 'de facto' ownership of the land acquired by such exploration and extraction.

§ 51302: Commercialisation of space resource exploration and utilisation:

(a) IN GENERAL. —The President, acting through appropriate Federal agencies, shall—

(1) facilitate the commercial exploration and utilisation of space resources to meet national needs;

(2) discourage government barriers to the development of economically viable, safe, and stable industries for the exploration and utilisation of space resources in a manner consistent with the existing international obligations of the United States; and

(3) promote the right of United States commercial entities to explore outer space and utilise space resources, in accordance with the existing international obligations of the United States, free from harmful interference, and to transfer or sell such resources.

Law on the Exploration and Use of Space Resources (Luxembourg): Luxembourg, after the United States, became the 2nd country to enforce such domestic laws vis-à-vis space activities. The said act limits the OST, mentioning that the activity of mining is just the use of space. Luxembourg blatantly challenges the OST even though it is a signatory to the OST. The accord begins with the major statement that the resources gained by any entity via the means of exploration in deep space are subject to appropriation.

Article I: Space resources are capable of being owned.

Article IV: The authorisation for a mission shall only be granted if the applicant is a public company limited by shares *(Société anonyme)* or a corporate partnership limited by shares *(Société en commandite par actions)* or a private limited liability company *(Société à responsabilité limitée)* of Luxembourg law or a European Company *(Société européenne)* having its registered office in Luxembourg.

Federal Law No. 12 of 2019 on the Regulation of the Space Sector (UAE): Next in line is the federal law of the UAE regulating space affairs. The law came into force in December 2019. The act also allows companies to venture into deep space, although it is strictly subject to restrictions and licensing by the agency concerning the affairs thereof. They also imposed liabilities on sun institutions for the damages that would be caused as a result of such exploration and mining. The purpose is to regulate the space sector, attract investment, ensure safety and security, and implement international space law obligations.

Act on Promotion of Business Activities Related to the Exploration and Development of Space Resources (Japan): The most recent law derived from the domestic legislation of Japan is considered a direct strike on the Jurisdictional issue and is regarded as a law so made that is in direct contravention to the existing international law regulating space affairs. The act permits private business activities, Acquisition of ownership, Licensing and regulation, inter alia, such as international cooperation and public transparency. This enactment is the 4th domestic law governing space affairs, and it is envisioned that the future would consist of more nations maintaining the same stance as that of these nations relating to the matters of space exploration and research.

ISSUE IN QUESTION

Anarchic International Forum: Exodus from planetary masses such as Earth, as fantasised by the human mind from an anachronistic time period. Curiosity led states to manufacture a method that could kick-start the journey of space exploration. The advent of the event started when the soviets started their first space mission, Sputnik, in the 1950s. Since then, the epoch has seen multiple advancements in the field, ranging from the Voyager Mission into deep space, the Hubble Telescope, etc. All nations committed their special agency for this purpose. However, this curiosity has led the states to visualise a human settlement at such planetary

masses. It's not very far that these ideas would become true for some in the future, looking at the present-day technologies. If we manage to settle on the moon, wouldn't it be a significant achievement for humankind itself? An end would give birth to new and more progressive minds and their curiosities, which would ultimately facilitate the whole idea of the venture from the beginning, which is 'Exodus'. Although these thoughts are tremendously pleasing, they need a comprehensive analysis of the drawbacks they encompass.

The first drawback is back on earth; the world is now multi-polar. States are now standing equally in terms of power, economy and other aspects, which is the result of globalisation itself. Each states have a different ideology related to any particular issue. The same goes for space exploration. Different states are launching their own mission, and 'humankind is divided'. Let us suppose colonies on the moon are now a trivial concept. The purpose of these colonies would, of course, be exploration and most of all exploitation of resources present in sun planetary masses. One part of these masses may contain more resources than any other in the region. States now eye such areas, as it is fundamental to human nature to gain resources. What would resist friction between the states in such an issue? The conflict is imminent. Whom to approach in case such a conflict appeared, and how would this issue be resolved by such an international forum? The most prominent option available is the United Nations. The verdict of the UN would be considered final, or would it not?

Every treaty, convention, or agreement is not binding upon any states, whether made by the United Nations, its subsidiaries, or by any other such institution. No state is bound to follow orders from these agencies. This is the flawed anarchic international forum. No real law addressing such an issue can be implemented to avoid conflicts among nations. Moreover, certain states such as the USA, Germany, UK, France & China, enjoy veto power in these agencies. The lack of an actual custodian makes it enormously difficult to regulate matters related to space activities, legally. No world government persist at the international forum. The geography stagnates the process of enforcement of a strong Uniform Code to regulate space affairs. Even persistent treaties open space to the whole humankind, and the only restriction is welfare, which could be misused in disguise. An international committee must be incorporated, which would be the conglomeration of experts from distinct fields and nations to address the issue of a lack of a systematic mechanism regulating the same.

Concept of Extra-Terrestrial Jurisprudence: The concept of law is far behind in space law. Pioneering for the same has recently gained recognition. Aviation and Space laws were disregarded as inoperable as of now. The advent of new reforms in Aerospace technology raised the issue that this advancement must not be misused. As the activities are now in the limelight, but the mechanism is in a vacuum, only order maintaining the issue for a resolution is Extra-Terrestrial Jurisprudence. It's not new that jurists find temporary solutions to hold the imbalance for a certain period of time. However, it's far from when this imbalance would result in a total crash. Every reasoning that is destined to be something and is used as something else surrounds itself with the doctrine of Extra-Terrestrial Jurisprudence.

This nascent field of law primarily indulges itself with the concept of Jurisdiction and governance, Ethics and rights, Property and intellectual property, interspecific communication, and trial *in absentia* of a governing forum. A glimpse of a similar framework can be seen in the extraterritorial jurisprudence, where the person in question faces a complication outside their mother territory.

LEGAL STATUS OF PRIVATE ACTORS: PRESENT, EMERGING, AND FUTURE DIMENSIONS

Nowadays, private space companies play a pivotal role in the space sector. They aren't just contractor anymore. Initially, they were just extensions of government programs, but now they're involved in the activities of building lunar bases, mining asteroids, and planning permanent settlements. Companies like SpaceX and Blue Origin are shaping the rules themselves, not just following them. Private actors transform from passive subjects into active players who actually influence how space law develops.

The Outer Space Treaty was written when only superpowers were competing for space sovereignty. Private companies weren't really an entity for consideration back then. Now we've witnessed a booming commercial space industry, and lawyers are trying to make the 1967 treaty fit 2025 realities. Several nations have enacted domestic space legislation to address the OST's silence on private property rights and provide commercial certainty. These laws function as delegation mechanisms through which states grant specific rights to private actors, thereby establishing state practice that shapes future treaty interpretation and tests international law boundaries.

Jurisdiction	**Key Legislation**	**Core Legal Provision Regarding Resources**	**Compliance Mechanism & Uniqueness**
United States	Commercial Space Launch Competitiveness Act (2015); Executive Order on Enabling Competition (2025)	US citizens are entitled to possess, own, transport, use and sell asteroid/space resources.[22]	Recent policy shifts are trying to speed up environmental reviews, in other words cutting red tape so companies can compete faster.[23] But there's a clear line: no country gets to claim extraterritorial sovereignty.[24]
Luxembourg	Law on the Exploration and Space Resources (2017)	It declares that space resources are capable of being appropriated.[25]	Luxembourg requires authorization and supervision but only for companies registered there. It's

[22] Scott Atkins, 'The commercialisation of outer space: How an international securities framework can be the launching pad for a global space economy' (*Norton Rose Fulbright*, June 2022) <https://www.nortonrosefulbright.com/en/knowledge/publications/102a426e/the-commercialisation-of-outer-space> accessed 17 November 2025

[23] James Hardman, 'For All Mankind? The United States' Race to Redefine Space Law' (2023) 91 University of Cincinnati Law Review <https://uclawreview.org/2023/03/23/united-states-race-to-redefine-space-law/> accessed 17 November 2025

[24] 'Enabling Competition in the Commercial Space Industry' (*The White House*, 13 August 2025) <https://www.whitehouse.gov/presidential-actions/2025/08/enabling-competition-in-the-commercial-space-industry/> accessed 17 November 2025

[25] Atkins (n 22)

			basically creating a space mining 'flag of convenience' system.
UAE	Federal Law on Space Activities (2019); Decree Law No. 46 (2023)	Permits resource activities subject to authorization; explicitly prohibits trading meteorites without government approval.[26]	It bans activities that violate international law and tightly controls dual-use goods. Their meteorite rules hint at a state-controlled view of space heritage.
Japan	Space Resources Act (2021)	Grants' Private property rights over extracted resources.[27]	Aligns with the US model; focuses on enabling commercial ventures like ispace while maintaining OST compliance.

These domestic laws don't claim sovereignty. At their core, they just posit that you own what you mine. The US explicitly denies any territorial claim. The key problem is that the mining requires exclusive access to a site. If one blocks others from one's dig site to protect one's equipment and extracted resources, then isn't that functional sovereignty? Different countries are taking different approaches, too. The US removes barriers to competition. The UAE treats some space materials like national heritage, requiring authorisation to sell meteorites. But the international legal tension remains unresolved.

[26] Federal Law No 12 of 2019 on the Regulation of the Space Sector
[27] Atkins (n 22)

Emergence of Private Actors from Contractors to Stakeholders: Private companies aren't just building rockets for governments anymore. They're running their own missions, outnumbering state programs. The relationship is shifting from agency-contractor to customer-provider, changing who controls operations and who bears the legal risk.

Shift to Public–Private Space Partnerships: The old model was simple; the governments designed everything, paid contractors cost-plus, and owned the final product. But those relations had changed significantly.

Firstly, they became an active participant like NASA's Commercial Lunar Payload Services program, which clearly shows how different things are now. Under CLPS, NASA doesn't own the lander or rocket; it just buys delivery services to the Moon.[28] Companies like Astrobotic and Intuitive Machines keep ownership and operational control. They decide essentials like trajectories, landing sites, payload integration, etc.[29] When missions fail, the company eats the financial loss, not taxpayers. Though the state still bears international liability, this setup pushes companies to develop their own safety standards.[30] Mission assurance used to be a government job. Now it's privatised.

This isn't just happening in the US. ESA and JAXA are treating private companies as partners, not just suppliers. JAXA's work with ispace on HAKUTO-R involved buying data, not hardware. The intellectual property stays private. These companies aren't executing state orders; rather, they're independent operators selling their own products.[31]

Not only are private companies setting the agenda. When SpaceX or Blue Origin develops methane-based propulsion or autonomous navigation systems, those become the technical standards everyone else has to follow. Commercial specs become de facto regulations. The 2025 Executive Order on Novel Space Activities streamlines authorisation for new mission

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[28] 'Commercial Lunar Payload Services (CLPS)' (*NASA*) <https://www.nasa.gov/wp-content/uploads/2023/09/nasa-op-vignette-commercial-lunar-payload.pdf> accessed 17 November 2025

[29] 'Audit of NASA's CLPS' (*NASA Office of Inspector General*) <https://oig.nasa.gov/wp-content/uploads/2024/06/final-report-ig-24-013-nasas-commercial-lunar-payload-services-initiative.pdf> accessed 17 November 2025

[30] Jay Jenkins, 'Exploration Science Strategy and Integration Office: Commercial Lunar Payload Services' (*NASA*, 22 June 2021) <https://explorers.larc.nasa.gov/2021APMIDEX/pdf_files/12-PEA-Provided-Access-to-Cislunar-Space-CLPS.pdf> accessed 17 November 2025

[31] Catherine G Manning, 'LunaNet Interoperability Specification' (*NASA*, 08 February 2023) <https://www.nasa.gov/directorates/somd/space-communications-navigation-program/lunanet-interoperability-specification/> accessed 17 November 2025

types—on-orbit servicing, commercial habitats, and things that don't fit traditional launch licensing. By cutting redundant environmental reviews and using performance-based regulations, the government is essentially saying private innovation moves faster than laws can keep up. Companies can proceed with novel operations assuming approval, rather than waiting for permission. This creates a presumption that the state favours commercial space activity.

Toward Private Property Rights on the Moon: Functional Occupation and the Evolution of Regulatory Practice. The Outer Space Treaty was written for a different time. Back in the Cold War, space was about prestige and military power, not profit.[32] The drafters wanted to prevent a colonial scramble, so they made space the 'province of all mankind.'[33] Nobody thought much about those because commercial mining seemed like a fantasy. Now, companies like SpaceX, Blue Origin, and Astrobotic are pouring billions into space ventures that depend on extracting resources and building permanent bases. They need legal certainty about ownership. The OST explicitly denies that.[34]

In reality, though these companies would not own any land directly, they would instead establish a de facto property regime through functional occupation. A company lands multi-ton infrastructure on the Moon, maintains control over it under Article VIII, establishes safety zones to prevent interference, and suddenly, you've got something that looks a lot like sovereignty.[35] They're not buying lunar deeds. They're just occupying the ground, excluding others, and turning 'freedom of use' into 'right to exclude.' Property in everything but name.

Deconstruction of Non-Appropriation Principle: To see how de facto ownership is forming, you have to look at what Article II actually prohibits and what it doesn't. The text says outer space and celestial bodies aren't 'subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means.' Back when it was written, this seemed like an ironclad ban on colonisation.

[32] Stephen Gorove, 'Interpreting Article II of the Outer Space Treaty' (1969) 37(3) Fordham Law Review 349 <https://ir.lawnet.fordham.edu/flr/vol37/iss3/2> accessed 18 November 2025
[33] Ben Love and Sagar Gupta, 'Investment Protection of Space Assets' (*Space Arbitration Association*) <https://space-arbitration.com/investment-protection-of-space-assets/> accessed 18 November 2025
[34] Michael J Listner, 'The (not quite) definitive guide to the legal construct of "space resources"' (*The Space Review*, 06 January 2025) <https://www.thespacereview.com/article/4915/1> accessed 18 November 2025
[35] Jinyuan Su, 'Safety Zones for Space Resource Activities: Legal Basis and Constraints' (2025) 24(3) Chinese Journal of International Law <https://doi.org/10.1093/chinesejil/jmaf029> accessed 18 November 2025

But now legal scholars and corporate lawyers read it differently. They argue it only prohibits formal state sovereignty, in other words, countries claiming territory. It doesn't say anything explicit about private commercial rights. That distinction matters significantly.

Sovereign v Private Entry Loophole: There's a long-standing debate: Does the ban on national appropriation also ban private appropriation? Some legal scholars take a textualist approach. The treaty says 'national' appropriation is forbidden. Private entities aren't nations. So maybe they're not explicitly barred from claiming property. Article VI makes states responsible for authorising and supervising private actors, but supporters of private property argue that a state can authorise ownership without claiming sovereignty itself. It's like fishing in international waters—you can own the fish without owning the ocean.[36]

This isn't just theory. It's been tested in court. In *Nemitz v United States*,[37] a guy claimed he owned asteroid Eros and tried to charge NASA parking fees when their probe landed on it. The courts dismissed his claim, but not because private ownership is definitively impossible under international law. They dismissed it because the U.S. government didn't recognise his claim, and he had no legal basis to sue. The implication? If Congress passed legislation recognising such claims, which it later sort of did with the SPACE Act for extracted resources, the outcome might be different.

Compare that to the 1976 Bogota Declaration. Eight equatorial countries tried to claim sovereignty over the geostationary orbit above their territories. The international community rejected it outright. But noticed that rejection focused on state claims, not private ones. Today, no state owns orbital slots, but companies have 'use rights' to those slots. They buy, sell, and lease them for millions. It's a functional property. And it's becoming the template for the Moon.

Most nations, especially the United States and Luxembourg, agree that the non-appropriation principle applies to the celestial body itself, not the resources you extract from it. The US made this explicit in the 2015 Commercial Space Launch Competitiveness Act,

[36] John G. Wrench, 'Non-Appropriation, No Problem: The Outer Space Treaty Is Ready for Asteroid Mining' (2019) 51(1) Case Western Reserve Journal of International Law <https://scholarlycommons.law.case.edu/cgi/viewcontent.cgi?article=2546&context=jil> accessed 18 November 2025

[37] *Nemitz v NASA* [2005] 126 F App'x 343 (9th Cir)

which grants American citizens the right to 'possess, own, transport, use, and sell' asteroid and space resources.

Sure, the law includes a disclaimer saying it doesn't assert sovereignty.[38] But operationally? That distinction is semantic at best. Mining requires exclusive access to a specific site for an extended period. If your company has the exclusive right to harvest resources from a crater and can exclude others from interfering, you've got the classic 'bundle of rights' associated with land ownership.[39] Whether or not you technically 'own' the underlying territory becomes irrelevant.

There's a terrestrial parallel: the Prior Appropriation Doctrine for water rights in the American West. Water was considered a public resource, but individuals could claim the right to use a specific quantity based on 'first in time, first in right' and 'beneficial use.' They didn't own the land, but they owned access to the water. On the Moon, the 'water' is regolith and the 'beneficial use' is extraction.

The OST stays silent on resource rights. The Moon Agreement, which tried to ban private property, was rejected. So domestic laws are filling the vacuum, creating property rights through the back door of resource utilisation.[40]

Functional Occupation and Quasi-Territorial Jurisdiction on the Moon: The establishment of de facto lunar ownership emerges through functional occupation principles derived from terrestrial international law. Historically, sovereignty over terra nullius required effective occupation through discovery, settlement, and administration. Although the OST prohibits

[38] Gershon Hasin, 'Developing a Global Order for Space Resources: A Regime Evolution Approach' (2020) 52 Georgetown Journal of International Law <https://www.law.georgetown.edu/international-law-journal/wp-content/uploads/sites/21/2021/03/DEVELOPING-A-GLOBAL-ORDER-FOR-SPACE-RESOURCES-A-REGIME-EVOLUTION-APPROACH.pdf> accessed 18 November 2025

[39] Jack Holmes, 'The Artemis Accords: A Critical Legal Analysis of Space Mining Reforms and Their Alignment with Current Space Law' (*ANZSIL Perspective*) <https://anzsilperspective.com/the-artemis-accords-a-critical-legal-analysis-of-space-mining-reforms-and-their-alignment-with-current-space-law/> accessed 18 November 2025

[40] 'Chapter 8: Exploring New Frontiers in Space Policy and Property Rights' (*Aerospace Security*) <https://aerospace.csis.org/wp-content/uploads/2021/01/EconReviewChapter8SpacePropertyRights.pdf> accessed 24 December 2025

de jure sovereignty, operational realities of space activities recreate conditions analogous to effective occupation.[41]

Article VIII grants the State of Registry jurisdiction and control over space objects and personnel in outer space or on celestial bodies, establishing quasi-territorial authority. While this jurisdiction remains temporary for transient satellites, stationary infrastructure like lunar bases or mining installations creates enduring territorial jurisdiction. When space objects require physical space to function, state jurisdiction extends to the occupied lunar surface. The International Space Station demonstrates this principle through its patchwork of national jurisdictions based on the module registry. Translated to the lunar surface, module-based jurisdiction becomes territory-based control.

As missions evolve from temporary scientific expeditions to permanent industrial installations, jurisdictional duration becomes indefinite. A base operating for fifty years under exclusive American jurisdiction creates a zone of national legal authority functionally equivalent to terrestrial property interests, excluding other nations and entities from interference.[42]

Permanent lunar infrastructure fundamentally transforms legal relationships with celestial terrain. NASA's CLPS program and Artemis campaign pursue a sustainable presence through landing pads, power grids, and habitats that physically alter the lunar surface.[43] Under Lockean property theory, underpinning American space resource policy, property rights emerge when actors mix labour with land.[44] Processing regolith for construction constitutes a tangible, irreversible transformation cementing occupier claims. Infrastructure becomes inseparable from terrain, blurring distinctions between owned objects and prohibited land appropriation.[45]

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[41] 'International Space Law: United Nations Instruments' (*United Nations Office for Outer Space Affairs*, 2017) <https://www.unoosa.org/res/oosadoc/data/documents/2017/stspace/stspace61rev_2_0_html/V1605998-ENGLISH.pdf> accessed 18 November 2025

[42] Bin Cheng, 'The Extra-Terrestrial Application of International Law' (1965) 18 Current Legal Problems <https://library.law.olemiss.edu/files/m_d_space_law.pdf> accessed 17 November 2025

[43] Matthew H Ormsbee, 'Lunar Landfill: Infrastructure and Governance for the Moon's Future' (2024) Journal of Law, Technology and Policy <https://illinoisjltp.com/file/241/Ormsbee_2024_Issue%201.pdf> accessed 18 November 2025

[44] Iseoluwa Akintunde, 'Lessons from John Locke: Envisioning a Multilateral Legal Regime for Property Rights over the Natural Resources in Outer Space, Including the Moon and Other Celestial Bodies' (McGill University 2016) <https://escholarship.mcgill.ca/concern/theses/w9505304m> accessed 18 November 2025

[45] Derek Webber, *Lunar Commerce: A Primer* (Springer 2024)

However, lunar scarcity challenges Lockean provisos requiring sufficient resources to remain for others. The Peaks of Eternal Light, offering near continuous solar illumination across mere square kilometres, represent critically scarce assets.[46] First mover occupation by American or Chinese entities violates the sufficiency requirement, transforming labour mixing from a property justification into a monopoly mechanism. Controlling exclusive viable energy sources grants private companies' economic strangleholds, forcing subsequent arrivals to negotiate access and effectively pay rent to de facto lunar landlords.[47]

Investment Protection and the Crystallisation of Lunar Property Rights: Private companies won't invest billions in lunar infrastructure without legal certainty. They need protection from expropriation or interference. That economic pressure is driving recognition of property-like rights through the legitimate expectations doctrine and international investment law.

Bilateral Investment Treaties might apply to space assets, even though the OST is silent on private dispute resolution. If a foreign state interferes with American lunar mining operations, companies could pursue remedies through investor-state dispute settlement instead of the OST's cumbersome liability procedures.[48] Arbitral tribunals interpret 'investment' broadly—they've treated exclusive government mining licenses as protected intangible assets. Under the Fair and Equitable Treatment standard from cases like *Tecmed v Mexico*, states must protect the basic expectations underlying foreign investment decisions.

Companies invest based on licenses from Luxembourg or the United States. Then, international enforcement of non-appropriation principles demands that they evacuate their sites. That could constitute regulatory expropriation. If new interpretations of common heritage render those investments worthless, affected companies could claim treaty violations.[49] This creates a regulatory chill. States fear billion-dollar arbitration claims, so they

[46] Robert Edgell, 'Sociotechnical Pathways: From Satellites and Stations to Envisioning Commercial Lunar Gateways and Beyond' (AIAA SciTech Forum 2025, Orlando, 2025) <https://doi.org/10.2514/6.2025-0612> accessed 18 November 2025

[47] Namrata Goswami and Peter A Garretson, *Scramble for the Skies: The Great Power Competition to Control the Resources of Outer Space* (Lexington Books 2020)

[48] 'Space Data as 'Investment' in International Investment Law' (*Völkerrechtsblog*, 12 June 2025) <https://voelkerrechtsblog.org/space-data-as-investment-in-international-investment-law/> accessed 18 November 2025

[49] Markus Wagner, 'Regulatory Space in International Trade Law and International Investment Law' (2015) 36(1) University of Pennsylvania Journal of International Law 821

hesitate to adopt international regulations that infringe on private space actors' rights. The threat of arbitration freezes the regulatory landscape in favour of private operators, allowing de facto land claims to solidify unchallenged.

The legitimate expectations doctrine protects investors who rely on specific state representations. The American CSLCA and similar laws from Luxembourg and the UAE are exactly those kinds of representations. They explicitly authorise private resource extraction, creating expectations of security of tenure. Companies building bases under American law could theoretically sue the government if subsequent treaties ban such activities, just like how the Antarctic Madrid Protocol restricted activities there.[50] To avoid that liability, spacefaring states have an incentive to diplomatically defend corporate de facto property rights internationally. States end up enforcing private lunar claims.

INMARSAT's privatisation shows where this goes. It transitioned from an intergovernmental organisation to a private company, demonstrating how public space assets get privatised. During conflicts like Afghanistan, the private entity reinterpreted the treaty's 'peaceful purposes' requirements as meaning non-aggressive rather than non-military.[51] Private companies are skilled at reinterpreting restrictive treaty language to protect commercial interests. That interpretive flexibility will inevitably get applied to the OST's non-appropriation provisions.

Safety Zones as Exclusionary Mechanisms and De Facto Property Boundaries: Safety zones are where de facto lunar ownership becomes most visible. They're considered technical safety measures, but functionally, they act as property lines.

The Artemis Accords introduce safety zones under the guise of preventing harmful interference per Article IX of the OST. Section 11 allows states or private licensees to declare operational zones requiring coordination for entry. Critics say this violates the OST's free access principles. When a private mining company declares a five-kilometers safety zone to

<https://scholarship.law.upenn.edu/cgi/viewcontent.cgi?article=1884&context=jil> accessed 18 November 2025

[50] John G Wrench, 'Non-Appropriation, No Problem: The Outer Space Treaty Is Ready for Asteroid Mining' (2019) 51(1) Case Western Reserve Journal of International Law <https://scholarlycommons.law.case.edu/cgi/viewcontent.cgi?article=2546&context=jil> accessed 18 November 2025

[51] Frans G von der Dunk, 'Customary International Law and Outer Space' in Brian D Lepard (ed), *Reexamining Customary International Law* (Cambridge University Press 2017)

protect against lunar dust damage, it excludes competitors from roughly seventy-eight square kilometres. These zones are massive because lunar low gravity and lack of atmosphere mean debris can travel enormous distances. Exclusion zones dwarf their terrestrial equivalents.[52]

Notification and coordination mechanisms transform safety into priority rights. First entities to land and declare safety zones establish 'first in time, first in right' claims.[53] The Accords call these zones temporary and operation-dependent, but continuous mining or permanent habitation makes them indefinite. Reciprocal recognition among Artemis signatories creates coalitions agreeing to respect each other's exclusion zones. It's a hallmark of property regimes. Even if China or Russia don't recognise these zones, physical realities like plume impingement naturally enforce them.[54] You can't have two operations in the same lunar space simultaneously. The Artemis Accords just codify that physical exclusion into legal privilege.

Government contracts add enforcement teeth. NASA's CLPS task orders contain strict non-interference clauses requiring contractors to prevent payload interference with other NASA payloads or historical sites like Apollo landing locations. These contracts privatise Article IX enforcement. By contractually obligating companies to respect specific coordinates, NASA creates protected site registries. When CLPS providers like Intuitive Machines land, the surrounding area becomes contractually protected. Though these are contracts between companies and NASA, cross-liability waivers and state responsibility mean the American government effectively guarantees zone sanctity against domestic interference and, through diplomatic pressure, foreign interference.

CLPS non-interference clauses function like restrictive covenants that run with the land, binding all actors in the American regulatory sphere to respect first-arrival property interests. International safety zone frameworks, reciprocal signatory recognition, and domestic

[52] Abby Jones, 'That's No Moon, It's a Space Station: Determining Ownership Rights on the Moon at the Intersection of International Treaty and Property Law' (2024) 72(4) Cleveland State Law Review <https://engagedscholarship.csuohio.edu/cgi/viewcontent.cgi?article=4281&context=clevstlrev> accessed 24 November 2025

[53] Glynn Torres-Spelliscy, 'Settling New Frontiers: Human Colonies Beyond Earth and the Legal Regulations Governing Their Establishment' (2024) SSRN <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4860023> accessed 18 November 2025

[54] Austin C Murnane, *Legal Considerations for Space Resources* (Springer 2023)

contractual obligations create layered exclusion mechanisms. Physical realities reinforce the legal constructs; simultaneous proximate lunar operations are technically infeasible without coordination.

This creates a priority-based access system functionally equivalent to terrestrial property. First movers secure protected operational zones through safety justifications, achieving exclusionary control without explicit appropriation. Multilateral frameworks legitimise the exclusion. Contractual mechanisms enforce it domestically. The result is a de facto property regime where temporal priority, physical occupation, and mutual recognition among spacefaring nations coalesce into durable exclusionary rights indistinguishable from property ownership in practice.

FINDINGS AND SOLUTION

- Ratification of non-binding treaties proves futile in establishing enforceable space governance; international treaties must integrate domestic laws and shift from restricting performable activities to providing clear liability frameworks in cases of damage or breach.
- The anarchic nature of world power dynamics influences the contemporary space race, necessitating sovereign states to ratify a Memorandum of Understanding similar to the Artemis Accords, wherein the non-appropriation principle is replaced with mandatory knowledge-sharing mechanisms among signatory states regarding resource discoveries.
- State activities in lunar operations must be restricted to ensure the welfare of humankind, with prominent operational roles assigned to private ventures that can more efficiently conduct extraterrestrial resource extraction and development.
- Property rights must be vested in the possessory entity or institution responsible for discovering or extracting resources, thereby enabling ventures to sell resources within a profitable market framework that incentivises continued investment.
- The concept of de facto land acquisition must be eliminated in favour of an international auction mechanism administered by a designated agency, wherein the highest bidder obtains rights over designated lunar territories, with differentiated rates for commercial versus settlement purposes and temporal upper limits on land acquisition to maintain equitable access for all ventures.

- Revenue accumulated from celestial land auctions must be exclusively allocated to fund space expeditions, with a Right to Information mechanism instituted to ensure transparency and prevent corruption in the management of auction proceeds.
- The auction mechanism should be administered either by a United Nations subsidiary body or a separate institution formed specifically for lunar governance, ensuring neutral and accountable management of extraterrestrial property allocation.
- The absence of a binding enforcement mechanism in the current space law regime creates a legal vacuum that can be remedied through the formation of a Global Space Tribunal operating under the auspices of the International Court of Justice to adjudicate disputes, with a collective security provision wherein encroachment on one entity's land constitutes encroachment on all, similar to Article 7 of the North Atlantic Treaty.
- The proliferation of investment treaties that encourage corporate dominance while undermining public control necessitates the insertion of space-specific public interest exceptions into investment protection agreements to safeguard collective welfare.
- The gradual erosion of the common heritage principle by profit-driven exploitation demands the mandatory implementation of benefit-sharing mechanisms and community reinvestment requirements for every lunar project undertaken.
- The institutional weakness of the United Nations in enforcing binding regulations on space activities requires the empowerment of UNOOSA with enforcement authority and mandatory compliance mechanisms to ensure adherence to international norms.
- The exploitation of legal ambiguity by first-mover nations and private corporations necessitates the creation of a ‘first in time, fair in access’ policy administered under international supervision to ensure equitable participation.
- Intellectual property rights, whether about patents on designs, models, or technologies, must be restricted to allow free flow of technologies across nations and ventures, ensuring equal leverage and preventing monopolistic control over critical space innovations.
- The risk that Artemis’ safety zones may transform into permanent exclusion areas necessitates the imposition of temporal limitations tied to mission duration, coupled with automatic review clauses to prevent indefinite occupation.
- The obstruction of unified space governance by geopolitical rivalries demands the

initiation of a neutral, multilateral dialogue forum dedicated to the harmonisation of space law across competing national interests.

- The absence of environmental protection standards for lunar activities, which may result in irreversible ecological damage, necessitates the introduction of a Lunar Environmental Protocol modelled on the Antarctic Treaty System's conservation principles.
- The potential for legal disputes and resource monopolies arising from unregulated private investments requires the development of a UN-backed arbitration framework specifically designed for extraterrestrial asset adjudication.
- The vagueness of the Outer Space Treaty's benefit-sharing clause, which lacks measurable implementation criteria, necessitates the definition of quantifiable benefit-sharing metrics and mandatory data disclosure requirements.
- The absence of a centralised system to track resource extraction and site claims globally requires the establishment of a Lunar Site and Resource Registry under UN oversight to ensure transparency and prevent conflicting claims.
- The lack of uniform legal education contributing to policy misalignment across jurisdictions necessitates the promotion of global academic programs and professional certification in international space law to foster coherent legal development.

CONCLUSION

As we're building a permanent presence on the Moon, the law has to catch up. Back in 1967, the Moon was supposed to be immune to sovereignty and ownership. Now it's caught between law, technology, and ideology. The better we get at space exploration, the more outdated our legal tools look. The Outer Space Treaty was a diplomatic achievement in its time, but does it apply to twenty-first-century space enterprise? It acts like a skeleton, which is moral in intent, silent in practice.

Private actors dominating lunar exploration have exposed the cracks in international space law. Through functional occupation, safety zones, and contractual non-interference, a de facto property regime has formed. Prohibitions against appropriation have become sophisticated systems of managed exclusion. Sovereignty isn't asserted through flags anymore; it's asserted through contracts, infrastructure, and orbital trajectories. What the law once forbade, practice now achieves through reinterpretation.

But this doesn't mean the non-appropriation principle is dead. It's transforming. Future space governance will depend less on static prohibitions and more on dynamic stewardship rules that balance commercial certainty with collective responsibility. 'The province of all humankind' needs to evolve from rhetoric to an enforceable ethic. One that ensures access without anarchy, innovation without imperialism.

The Moon has become a test of our legal maturity. Whether it becomes a theatre of resource monopolies or a laboratory for cooperative governance depends on our willingness to reconcile law with inevitability. We need an international framework that doesn't deny human enterprise or abandon human equity. A lex lunaria, lunar law forged not by conquest or convenience, but by conscience.