

DEFINE OUR FUTURE

Analysing the Moon Agreement in the Artemis Era, Industry News Roundup, and Dissecting Space Law in an Age of Conflict

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40. IMPRESSUM

FEATURED ARTICLE

Considering the current debates within COPUOS regarding the future governance of space resource activities, it is also critical to assess the current space resource regime under existing, binding international law. Research is currently taking place within the United Nations Action Team on Lunar Activities Consultation (ATLAC), and the Working Group on the Legal Aspects of Space Resource Activities (SRWG), offering the potential of a new international mechanism and legal framework, respectively. However, any new legal aspect of the regime will be based upon the principles of established international law, namely the five space treaties.

In this month's introductory article, we discuss the applicability of the Moon Agreement (the 'MA'). The treaty has just 17 State Parties, and is viewed as a significantly unsuccessful Treaty. However, as discussions within COPUOS develop, some States, not only those that have ratified the Treaty, still refer to the MA as part of international space law. The Treaty did aim, for example, to provide some future-proofing regarding lunar activities, such as requiring the establishment of a space resources international regime, once resource activities begin to occur.

As the Treaty was also adopted at the UN General Assembly, and it did enter into force, it should still be considered in regard to current discussions on the future of space and lunar governance. This article will therefore analyse to what degree the Moon Agreement could remain relevant in the Artemis and ILRS generation.

The Moon Agreement in the Artemis and ILRS Generation

The dawn of the space age saw swift development of binding international space law, beginning with the Outer Space Treaty (OST) in 1967.¹ This was followed by the Rescue Agreement in 1968,² the Liability Convention in 1972,³ and the Registration Convention in 1976.⁴ The last in this series was the Moon Agreement in 1979 (also referred to as 'the Agreement').⁵

Building on principles of the OST, the Agreement was an effort to '...establish a basic legal framework for the exploration and later exploitation of the Moon...'⁶ However, the Agreement, as of May 2025, has just 17 ratifications,⁷ not including any leading space nation. Conversely, the US-led Artemis Accords have gained 70 State signatories since 2020.⁸ However, it

seems unlikely that adversaries of the US, namely Russia and China, will sign on to the Accords. Yet, they will still ‘...exploit the Moon independently’,⁹ which is already planned through the Chinese Chang’e lunar missions.¹⁰

This paper will establish the failures of the Moon Agreement, compared to the Artemis Accords. It will analyse whether the Moon Agreement could be revised in order to increase its lure for the Artemis States, as a treaty to provide binding principles on lunar resources activities. Otherwise, an ongoing lack of coordination between these space superpowers poses a significant danger, especially given the increasing activity of non-governmental operators intent on profit.¹¹

Research will include a comparative analysis of the frameworks, as well as considering principles shared within the OST. It will also discuss ongoing developments at COPUOS, expert and peer-reviewed commentary, as well as consider economic and geopolitical aspects. The paper will primarily focus on lunar resource activities, though arguments and future research could also apply to the exploitation of other celestial bodies.

Understanding the ‘Failure’ of the Moon Agreement

Article II of the OST prohibits the appropriation of outer space ‘...by means of use or occupation, or by any other means.’¹² Furthermore, Article I allows for freedom and exploration and use of outer space,¹³ which can be interpreted as freedom to ‘use’ lunar resources, differentiating this from ‘appropriation’.

However, according to Space Renaissance International, the OST ‘...is ambiguous or even silent concerning outer space resource activity, especially activity by the private sector.’¹⁴ This has provided the source of much debate on whether lunar resources are *res communis*,¹⁵ part of the global commons.¹⁸ The Moon Agreement was an attempt to settle this matter, declaring that the Moon and its natural resources are the common heritage of mankind.¹⁶

However, it is this aspect of the Agreement which has arguably prevented its uptake. Walker A Smith describes the prospect of lunar resource exploitation as potentially lucrative, and so the US and China are ‘...wary of binding themselves to any commitments that may hinder their ability to gain an advantage in this sphere.’¹⁷ In 2020, the US confirmed that it would not bind itself to the Agreement, stating that ‘Americans should have the right to engage in commercial exploration, recovery, and use of resources in outer space...’ and that, in their view, outer space is not a global commons.¹⁸ In the same year, the US also established the non-binding framework, the Artemis Accords,¹⁹ which conversely states that ‘...the extraction of space

resources does not inherently constitute national appropriation under Article II of the Outer Space Treaty.²⁰ According to Wedenig and Nelson, it is here where ‘...this understanding of the CHM (common heritage) principle that the Accords are often seen to conflict with the Moon Agreement.’²¹

It is clear to see why the US are steering away from preventative principles in the Agreement. A flurry of private sector activity is bringing the prospect of lunar resource extraction and utilisation much closer. US startups Interlune²² and Magna Petra²³ have set their sights on retrieving the rare helium-3 isotope for terrestrial applications such as quantum computing and fusion power, while ESA estimates that 100 missions lunar missions are planned by the end of the decade,²⁴ many of which will transport in-situ resource utilisation (ISRU) technologies, in order to produce water, fuel and materials for construction.²⁵ At the same time, geopolitical tensions between the US and China intensify, with the former NASA administrator declaring that they are ‘in a race’.²⁶

As an established treaty, the Moon Agreement could provide an opportunity to establish alignment with the Artemis nations, and similarities can be found with the UN Convention on the Law of the Sea 1982 (UNCLOS).²⁷ 170 States are currently Parties to the treaty,²⁸ but the US is the only major absentee. The reason can be found in article 136, stating that the seabed, ocean floor and subsoil thereof (‘the Area’)...and its resources are the common heritage of mankind.²⁹

In 1982, President Ronald Reagan announced ‘...that the deep seabed mining part of the convention does not meet United States objectives...’³⁰ However, a 1983 US Ocean Policy Statement said that”

“Following adoption of the Convention in 1982, it has been the policy of the United States to act in a manner consistent with its provisions relating to traditional uses of the oceans and to encourage other countries to do likewise.”³¹

Here, inspiration on how harmonisation of the Moon Agreement might be found, through amending article 11 of the Agreement. Doing so could provide an opportunity to bring the matter of resources governance back into the UN platform, aligning with section 10 paragraph 4 of the Accords, which calls for States to ‘...contribute to multilateral efforts to further develop international practices and rules applicable to the extraction and utilization of space resources, including through ongoing efforts at the COPUOS.’³²

Aspects Preventing Alignment of the Frameworks

Firstly, several conflicting aspects of Article 11, beyond the common heritage principle, still remain. Paragraph 7 requires that ‘...equitable sharing by all States Parties in the benefits derived from those resources...’, taking into account the interests of developing countries as well as those countries which have contributed to the exploration of the Moon.³³ While the Accords do recognise ‘...the global benefits of space exploration and commerce’,³⁴ it makes no mention of resource equity.

Furthermore, the Agreement is not being implemented by its Signatories, with Australia, a nation which is also a signatory to the Accords, diverging away from its obligations under Article 11. Under their ‘Moon to Mars Initiative’, the Australian Space Agency is working with industry to develop a lunar rover in cooperation with NASA, to collect lunar regolith. This is despite Article 11 stating that a resources regime should be established when extraction becomes feasible.³⁵ In this instance, it appears that Australia have chosen instead to align with the more favourable principles of the Accords. The resources regime requirement of the Agreement might also contradict the commercially-focussed principles of the Artemis Accords, which could be seen as somewhat restricting.

The Moon Agreement also prohibits ‘appropriation’ of resources ‘in place’, stating that:

“Neither the surface nor the subsurface of the moon, nor any part thereof or natural resources in place, shall become property of any State, international intergovernmental organization, national organization or non-governmental entity or of any natural person”

While this might not conflict with Article 1 of the OST,³⁶ and one could argue that ‘use’ does not amount to ‘appropriation’, it is still difficult to see how commercial resource retrieval could function within this provision. Without amending or removing paragraph 3, it is also difficult to see how States with national space resources legislation could align with the agreement, such as those from the US,³⁷ Luxembourg,³⁸ and Japan.³⁹ This is primarily in regard to what is defined as ownership of resources, and when space resources can become property of a State or private actor under international law. While this principle of the MA suggests that ownership can only exist after extraction (no longer ‘in place’), there is no clear definition to guide and deconflict activities in future.

Legal hurdles may appear beyond Article 11. Tronchetti and Liu argue that there is a fundamental difference in approach to governance; whereas the Moon Agreement is based

on multilateralism, the Artemis Accords are ‘...the result of a regulatory initiative undertaken at the domestic US level that reflects American interests and the foreign policy approach of the Trump Administration.’⁴⁰ This divergence may also be seen with France, a nation that signed the Agreement in 1980,⁴¹ but has yet to ratify it, which makes one assume that their intention is simply not to ratify the treaty,⁴² while they did sign the Artemis Accords less than two years after their founding.⁴³

Furthermore, on 5 January 2023, Saudi Arabia announced their decision to withdraw from the Agreement,⁴⁴ after joining the Accords only 6 months before.⁴⁵ Michael J Listner claims that they are aware that legal matters regarding space resources are ‘...outpacing the top-down approach of the Moon Agreement,’⁴⁶ and adds that they will also have noted that their membership was inconsistent with the Accords, and that the US framework offers a more fluid approach.⁴⁷

Non-binding frameworks could gain traction faster than treaty law. Notably, at the 2025 COPUOS legal subcommittee (LSC) meeting, the US delegation stated that they ‘...see potential benefits of a general, high-level initial set of non-binding principles...’ and that ‘...the Artemis Accords...form a starting point for our efforts on space resource activities.’⁴⁸ The US omitted the Moon Agreement in the ‘core treaties’, and according to Wedenig and Nelson, this has particular weight because the Accords’ signatories include parties to the Moon Agreement,⁴⁹ which is currently 9 States. Furthermore, it can also be seen that the US are content to legislate resource activities using the OST, further stating that ‘...removal is permitted by Article I of the Treaty, which provides that outer space, including the Moon and other celestial bodies, shall be free for exploration and use by all States.’⁵⁰

Tronchetti & Liu also observe that while the Moon Agreement is rooted in the common heritage principle, the US have made clear that lunar activities should pursue commercial goals, and that by joining the Accords, a country automatically also endorses the US legal approach,⁵¹ suggesting that the two frameworks diverge on fundamental aims. Amending the Moon Agreement to embody a more commercial focus could also create conflicts with other States, especially those who are already Parties, but also for China, who in 2024 submitted a white paper to the COPUOS Working Group on Legal Aspects of Space Resource Activities, requesting that they mitigate any potential negative impact of commercial resource activities.⁵²

The US also rejects any attempt by any other State to treat the Moon Agreement as reflecting customary international law,⁵³ suggesting a more fundamental disapproval compared to the UNCLOS issue. Evidence would also suggest that the Agreement was destined to fail, as shown within a 1971 memo from the National Reconnaissance Office, saying that discussions

on the Agreement were ‘...redundant in many regards to the 1967 Treaty...’ and that ‘...consensus is that it was proposed largely as a time consumer.’⁵⁴ Wedenig and Nelson claim that the strategy by the US and the Soviet Union was to occupy COPUOS’ time and prevent actions which might impede their ambitions.⁵⁵

Lastly, the OST was founded in the backdrop of the Cold War as a means to prevent the placement of nuclear weapons in outer space, and this era of broad treaty-making is now over.⁵⁶ Renegotiating the Agreement would also come against the backdrop of strained international relations due to geopolitical crises in Ukraine and perceived ‘isolationism’ from the Trump administration.

A Case for Harmonising the Moon Agreement and the Artemis Accords

A case for harmonisation, though, could lie within Article 11, paragraph 5 of the Agreement, which requests States to establish an international resources regime.⁵⁷ Firstly, this could be achieved via the Action Team on Lunar Resource Activities (ATLAC)⁵⁸ at the UN COPUOS, which was adopted in 2024 to ‘...develop recommendations aimed at improving consultations related to lunar activities...’⁵⁹ The subject of lunar resource regulation was considered as a potential topic within the team, as well as the commercial regulation of resource activities.⁶⁰ This could then be a compromise to satisfy the resources regime provision, as well as Artemis’ commercial ethos. ATLAC members also include Artemis Signatories as well as Russia and China,⁶¹ though final recommendations regarding the work of ATLAC are not expected until 2027.⁶²

Also, referring back to the UNCLOS example, it could be argued that the US do not necessarily disapprove of the establishment of the International Seabed Authority (ISA),⁶³ and currently sits as an observer.⁶⁴ Additionally, the US are also a Party to the International Telecommunication Union,⁶⁵ the International body used to allocate orbital resources. The Accords themselves also support ‘...multilateral efforts to further develop international practices and rules applicable to the extraction and utilization of space resources, including through ongoing efforts at the COPUOS.’⁶⁶

Also, the Recommended Principles for Space Resource Activities,⁶⁷ currently being drafted by the Working Group on Legal Aspects of Space Resource Activities at COPUOS, might provide another means of satisfying Article 11 obligations. At the 2025 LSC, the US delegation supported this notion, stating that ‘...we look forward to productively engaging in

the Working Group on space resources towards a pragmatic outcome to draft a set of high-level, non-legally binding principles...⁶⁸ Principle 6 from the draft version states that ‘...resource activities shall be conducted for the benefit and interests of all humankind and shall be the province of all humankind’⁶⁹ aligning with article 11 of the MA.

Both the Accords and the Moon Agreement also commit to the other four UN treaties, and therefore to the principle of outer space as a province of humankind. Both would then also align on the principle of the non-appropriation of outer space. Article 1 of the Moon Agreement also states that the provision of the Agreement applies to other celestial bodies in the solar system,⁷⁰ while the Accords also apply to the exploration and use of ‘the Moon, Mars, Comets and Asteroids.’⁷¹

Tronchetti & Liu note further similarities ‘...with regard to the assistance to astronauts and the release of scientific data.’⁷² Section 4 of the Accords requests Signatories to share data on a ‘good faith basis’, in accordance with article 11 of the OST, while article 5 of the Agreement requires States to inform the Secretary General of their activities concerned with lunar exploration. Article 11 of the OST asks States to provide details ‘...of the nature, conduct, locations and results...’ of space exploration missions, and the US did recently register private lunar missions from Firefly Aerospace, Intuitive Machines and Astrobotic, while Japan also registered the second mission from private lunar exploration company, iSpace.⁷³ Notably, the latter included details regarding the ‘commercial transaction with the National Aeronautics and Space Administration of the United States of America for lunar regolith acquisition.’⁷⁴ Both frameworks could then potentially establish alignment on the transparency of resource uses via Article 11 of the OST.

Similarities can be observed through environmental considerations. The Moon Agreement, through Article 7, requires States to ‘...take measures to prevent the disruption of the existing balance of its environment whether by introducing adverse changes in that environment, by its harmful contamination through the introduction of extra-environmental matter or otherwise’⁷⁵ while the Accords commit to the mitigation of lunar orbital debris, which could allow for alignment on the concept on due regard, embedded in the OST. However, while there may be similarities in relation to due regard in consideration of harmful interference, the Moon Agreement also presents due regard as paying towards the interests of present and future generations,⁷⁶ a concept not necessarily aligned with the Accords.

The principle is also evident in the Accords’ proposed application of lunar ‘safety zones’, an area wherein notification will be implemented to avoid harmful interference to others. Firstly, this could be viewed as a similar provision seen in Article 8 paragraph 3 of the Moon Agreement, which requests that States ‘...shall not interfere with the activities of other States

Parties on the moon,⁷⁷ and that concerned Parties should conduct consultations, aligning also with section 11 paragraph 3 of the Accords.⁷⁸

However, the purpose of safety zones has been brought into question, with Walker A Smith describing that concerns exist regarding using them as ‘...de facto areas of national appropriation...’⁷⁹ Evidence of this could be seen during a US House discussion in December 2023, with Michele Hanlon suggesting that vehicles which land or crash into the lunar surface create a safety zone around them, and therefore reserve the mineral resources within it.⁸⁰ This ties in with the broader geopolitical rivalry unfolding between the US and China, and any de facto appropriation would certainly contradict crucial principles of equity and non-appropriation of the Moon Agreement.

Similarly, Jack Wright Nelson observes that ‘...problems may arise concerning the Accords’ endorsement of lunar heritage...’,⁸¹ a provision to protect areas such as the Apollo landing sites. Whether this would conflict with the Moon Agreement is debatable, as firstly the Agreement states that the placement of vehicles ‘...shall not create a right of ownership over the surface or subsurface of the Moon or any areas thereof...’⁸² However, Nelson also questions whether the prolonged or indefinite occupation would amount to ownership, while the preamble of the Moon Agreement does note ‘...the achievements of States in the exploration and use of the moon...’ Both frameworks could perhaps also find harmonisation through the protection of lunar heritage, aligned with the common heritage of humankind principle.

Lastly, both frameworks may agree on regulating private actors, not least through alignment on Article 6 of the OST,⁸³ also reflected in Article 14 of the Moon Agreement.⁸⁴ However, while the Accords adhere to the OST, it must also be recalled that they also recognise the significance of private industry in space exploration,⁸⁵ and embody a commercially-driven focus. As the actions of private actors increase on the Moon, it will be seen whether these actors might seek a more favourable regulatory environment on the Moon.

Conclusion

In amending or removing the common heritage principle, there could be an argument in favour of resurrecting the Moon Agreement, though the contrasting popularity of the Accords can not be ignored. The non-binding aspect of the Accords may be seen as more favourable, and aligns with approaches being taken also with other frameworks, such as the Long-Term Sustainability Guidelines.⁸⁶ The Accords also embody a commercial approach to resource exploitation, one more favourable to benefit from the prospect of a lunar economy set to be

worth \$140 billion by 2040.⁸⁷ Current global geopolitical conflicts would also not seem to be conducive to reopening talks on international law at this time.

However, the frameworks could align on issues such as the resources regime. ATLAC and the Draft Principles on Space Resource Activities could be utilised, though here is where further research would be required in order to understand how these will be established in the coming years. Both frameworks are also founded on the principles of the UN space treaties, and could also align on transparency via Article 11 of the OST. There could also be common principles in the use of safety zones through due regard, though this will also require further research into the use and scope of proposed safety zones.

Lastly, ongoing research will be needed to understand the expanding role of the private sector, not only on the Moon, but also at law-making fora. For example, when observing the establishment of ATLAC, Dennis O'Brien observed that some States recommended the involvement of the private sector within discussions,⁸⁸ while Action 56 of the 2024 Pact for the Future calls for '...engagement of relevant private sector, civil society and other relevant stakeholders, where appropriate and applicable, to contribute to intergovernmental processes.'⁸⁹

The treaty-making era of the 60s and 70s may be over, and though the Moon Agreement in its current form may not provide an opportunity for alignment with the Artemis nations, there is a case for further debate.



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NEWS ANALYSIS



A NEWS

OPINION | ANALYSIS

Space Industry Roundup: Mars, Militarisation and a Maturing Industry

(Image: Unsplash)

Mars and the Question of Ambition

SpaceX has recently gone public at a valuation that makes it the world's fifth most valuable firm, and Elon Musk has previously stated his intention to send uncrewed Starship rockets toward Mars during the late 2026 orbital alignment window, with crewed landings potentially following by 2029 or 2031. It is a vision that has captured imaginations and attracted investors in equal measure.

A detailed analysis published this month by GeekWire, drawing on interviews with leading planetary scientists, provides a counterpoint to that enthusiasm. The conclusion of researchers is broadly consistent: the notion of a permanent colony within any near-term timeframe is not supported by the science. The central problem is not getting to Mars, but making it habitable. Mars is an extraordinarily hostile environment of deathly cold, with an unbreathable atmosphere of mostly carbon dioxide, near-zero pressure at the surface, exposure to cosmic radiation, and gravity one-third that of Earth, the long-term physiological effects of which on human beings remain entirely unknown.

Musk's vision depends critically on terraforming, the physical transformation of Mars into something approaching an Earth-like environment. Scientists are actively researching potential pathways, including localised warming through high-tech insulating blankets, orbital mirrors beaming sunlight to targeted areas, and the artificial introduction of aerosol particles to drive a planetary greenhouse effect. A paper published in April by Edwin Kite of the University of Chicago, co-authored by two dozen Mars scientists, assessed each of these approaches and found that none has been shown to be simultaneously affordable, safe, scalable, and capable of extending life beyond Earth. The timeframes involved are not decades but centuries, and possibly longer. A 1991 analysis by NASA astrogeophysicist Chris McKay calculated that warming the Martian surface to Earth-like temperatures might take 100 years, with the development of a breathable atmosphere through plant photosynthesis potentially requiring 100,000 years beyond that.

That is not to say the science is without hope. Erika DeBenedictis, a biological engineer and Mars scientist at Pioneer Labs, is pursuing research into genetically engineered microbes capable of surviving and eventually improving Martian soil conditions, an approach she believes could produce basic plant cover within her lifetime. The work is early-stage but represents a genuine scientific attempt to close the gap between ambition and reality. Bruce Jakosky, professor emeritus at the University of Colorado and a Mars scientist since the Viking mission in the 1970s, captures the wider scientific consensus with characteristic precision, noting that the question of when permanent human settlement on Mars might be possible is far enough into the future that it is indistinguishable from infinity.

None of this diminishes the engineering accomplishments of SpaceX or the near-term value of Mars exploration. Crewed landings in the coming decades, followed by scientific bases along the lines of those operated in Antarctica today, represent a realistic and scientifically valuable trajectory. What the planetary science community is pushing back on is the leap from that to a self-sustaining city of a million people, a vision that Musk continues to articulate with confidence while the scientific foundation for it remains, at best, highly speculative.

For investors who bought into the SpaceX IPO, this tension is worth understanding. The company's near-term revenues come overwhelmingly from Starlink and launch services, both robust and growing businesses. The Mars mission, positioned in SpaceX's IPO prospectus as the company's foundational purpose, sits in a very different category, one acknowledged even in that prospectus as involving technologies that do not yet exist and may require significant advancement. The gap between the inspirational narrative and the scientific reality does not undermine SpaceX's commercial value today, but it is a dimension of the company's long-term story that deserves clear-eyed attention.

Meanwhile, NASA is advancing its own Mars surface capabilities with a new rover design named “ERNEST” (Exploration Rover for Navigating Extreme Sloped Terrain), capable of lifting its wheels to climb over obstacles, addressing one of the persistent vulnerability of previous rover designs where terrain obstacles constrained operational range. It is a small but meaningful step in building the robotic infrastructure that any serious Mars programme will require.

Launch

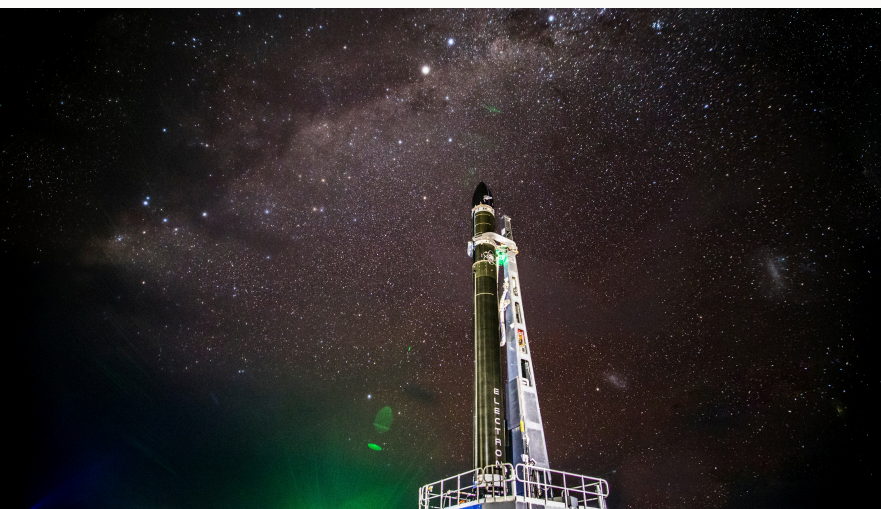


Image of Rocket Lab's Electron Rocket (Image: Rocket Lab)

VICTUS HAZE mission launched in just 16 hours and 42 minutes, setting a new record

Rocket Lab

Rocket Lab has reached a new benchmark in responsive space launch capabilities. The company launched the US Space Force VICTUS HAZE mission in 16 hours and 42 minutes, setting a new record for responsive space operations. The ability to deliver a satellite to orbit within hours of a tasking order represents a meaningful shift in the strategic calculus around space-based intelligence and domain awareness, reducing the window of vulnerability that adversaries might exploit following the loss or degradation of an on-orbit asset. Rocket Lab's performance reinforces its position as a trusted provider for responsive national security launch requirements.

In Europe, the launch sector continues to mature. Rocket Factory Augsburg has detailed upgrades to its RFA ONE vehicle alongside plans for the larger RFA TWO, as the company works to establish itself within an increasingly competitive European launch market. OHB has announced plans to raise €510 million to boost manufacturing capacity and invest in rockets, a significant commitment that reflects both the growing demand for European launch capability and the broader industrial investment cycle now underway across the continent.

Moon

ESA has announced it will seek a lunar mapping capability for its Argonaut lander, reflecting the recognition that precise, high-resolution surface data is a prerequisite for safe and effective large-scale cargo delivery to the lunar surface.

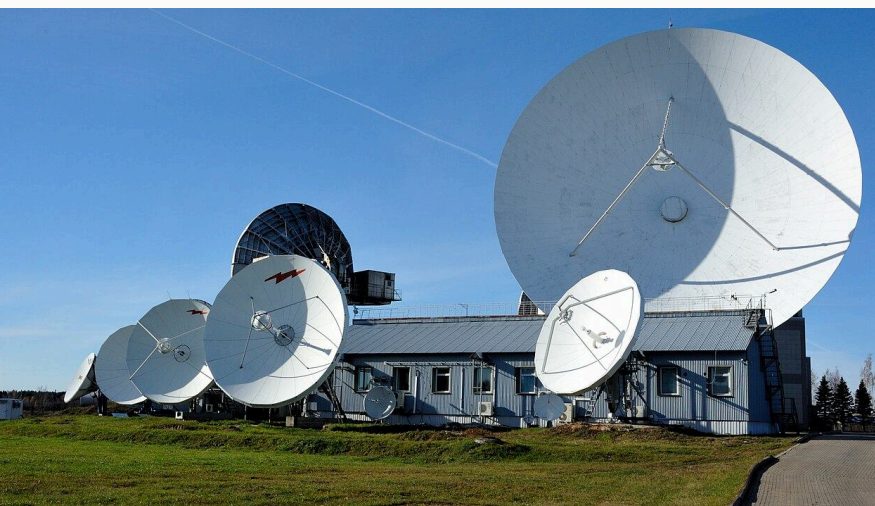
A recent paper has argued that the US Space Force may need a presence on the Moon, a position that is increasingly consistent with the broader trajectory of defence thinking about the cislunar domain. As lunar infrastructure develops and its strategic value grows, the question of how that infrastructure is protected is one that the defence community is beginning to take seriously. NASA, meanwhile, has invited media to a signing ceremony in Botswana for the Artemis Accords, continuing the recent trend of expanding the framework into Africa and building a genuinely global coalition around norms for responsible space behaviour.

Research into swarm robotics inspired by the collective behaviours of bees and ants is exploring how coordinated multi-robot systems could transform the future of space and planetary mining, with potential advantages in redundancy, coverage and adaptability over single-platform systems. While still at a research stage, the concept is consistent with the broader trajectory of lunar surface operations, which are expected to involve increasingly large numbers of relatively simple robotic assets working in coordination.

Earth orbit satellites. The development adds to the already acute congestion challenge in LEO and will feed into ongoing debates around debris mitigation standards and the broader question of how the international community enforces responsible behaviour in the shared orbital environment.

Defence, Conflict and Orbital Security

The war in Ukraine has introduced a stark new dimension to the space domain this month. Ukrainian forces have struck the Dubna Space Communications Centre, reported to be Russia's largest satellite teleport, in an attack that represents one of the most significant direct strikes on space-enabling ground infrastructure in the history of armed conflict. A second strike on a Russian space communications hub followed within the same week, suggesting a deliberate and sustained campaign to degrade Russia's satellite ground segment.



(Image: Vsatinet)

Ukrainian forces have struck the Dubna Space Communications Centre

 **ANASDA**

The vulnerability of ground segment infrastructure, which is often more exposed and less redundant than the space segment it supports, has been discussed in defence and policy circles for some time. Events in Ukraine are now providing a sobering operational data point that will inform resilience planning among space operators globally.

In orbit itself, a concerning pattern is also emerging. Reports indicate that China is depositing increasing numbers of rocket bodies in space, creating additional debris that endangers low Earth orbit satellites. The development adds to the already acute congestion challenge in LEO and will feed into ongoing debates around debris mitigation standards and the broader question of how the international community enforces responsible behaviour in the shared orbital environment.

Industry and Economy

Analysis published this month has explored the opportunity that the space economy presents for the automotive industry, a framing that reflects the growing recognition that the skills, manufacturing capabilities and supply chain infrastructure developed for complex vehicle production have direct applicability to space systems. It is a theme consistent with the broader industrialisation of the space sector, as it transitions from a domain of bespoke, government-funded programmes to one characterised by volume production, cost efficiency and commercial competition.

The picture this month is of a space sector operating across multiple registers simultaneously: the historic and the operational, the commercial and the military, the visionary and the cautionary. SpaceX is preparing to send hardware toward Mars while planetary scientists urge realism about what awaits there. Rocket Lab is launching national security satellites in under 17 hours. European manufacturers are raising hundreds of millions to build rockets. And in Ukraine, the ground infrastructure of space is being targeted as a weapon of war. The industry has matured to a point where its ambitions and its vulnerabilities are both fully real, and both deserve focused assessment.

SPACE LAW REVIEW



SPACE LAW & POLICY

SUSTAINABLE & PEACEFUL USES OF OUTER SPACE

Discussing the challenges, threats and opportunities to international space law and governance, arising out of evolving international relations, geopolitical dynamics and more.

Signing of the Outer Space Treaty in 1967 (Image: United Nations)

Key terms: COPUOS; LSC; Outer Space Treaty; Article IV; LTS Guidelines; PPWT; ICOC; United Nations; UNGA Resolution 1721; UNGA Resolution 1884; Limited Test Ban Treaty.

Analysing the Efficacy of Article IV of the Outer Space Treaty in the Age of Space Militarisation

Given the ongoing uses of outer space as a strategic defensive domain, this month's edition of the legal review analyses the suitability of the Outer Space Treaty to prevent conflict in outer space.

The Outer Space Treaty (OST) is observed as an arms control treaty, while its preamble recognises the '...use of outer space for peaceful purposes.' Referred to as the 'Magna Carta' of space, the OST remains the cornerstone of international space law, yet '... since the advent of space technology, outer space is increasingly being used as part of active engagement in the conduct of armed conflict.'

Article IV provides '...one of the very few particularly clear statements made in the Outer Space Treaty...', in identifying the prohibition on certain weapons. However, it does not

provide provisions for the broader ‘military’ uses of outer space, nor clear definitions. Fundamentally, Article IV, and the broader legal regime it supports, may not be enough ‘...to provide appropriate regulation for the increasingly diverse ways that outer space could be used during the course of armed conflict.’

This paper will analyse the efficacy of Article IV(1), in light of modern-day technical and geopolitical developments, concerning activities in Earth orbit. Section One strives to assess the provision on the prohibition on nuclear weapons and WMD, while Section Two will seek to understand the definition of ‘peaceful’ uses, with Article IV being understood, as Jinyuan Su writes, ‘...the cornerstone of the peaceful use of outer space.’ Furthermore, it will also address the growing role of commercial actors and ‘dual use’ technologies.

Lastly, Section Three analyses additional legal frameworks, which aim to build on the principles of Article IV, such as the Draft Treaty on the Prevention of Placement of Weapons in Outer Space, the Threat or Use of Force against Outer Space Objects (PPWT). To truly understand the efficacy of the Article, the research methodology will include a critical analysis of the Treaty text, as well as observing expert legal commentary. It will also seek to understand the purposive and contextual meaning of the Article, to properly dissect its meaning.

Considerations for the Prohibition of Nuclear Weapons and WMD in Orbit

President Johnson described the OST as ‘.....the most important arms control development since the limited test ban treaty...’ Indeed, the OST arrived at a time of heightened geopolitical tensions, and ‘...during the very hot war in Vietnam...’ Formative discussions were also held in the context of nuclear weapons testing, including the US ‘Starfish Prime’ high-altitude detonation in 1962, and ‘Tsar Bomba’ in 1961.

Understanding the purposive interpretation of Article IV helps clarify how it applies now. Following the launch of Sputnik-1, President Eisenhower expressed his concern about the spread of hysteria and alarm, with fears that Soviet technological achievements were not yet matched by the US. The resulting free access to space led to the need for space law to ‘...respond quickly to rapid technical developments.’ 1958 saw the first of a series of formative UN Resolutions, including Resolution 1721, which recognises ‘...the common interest of (hu)mankind in furthering the peaceful uses of outer space...’, and Resolution 1884, which calls upon States ‘To refrain from placing in orbit around the earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction...’ Importantly, in 1963, the nuclear States of the US, USSR and UK signed the Limited Test Ban Treaty (LTBT), with

Article I(1)(a) requiring that States undertake ‘...not to carry out any nuclear weapon test explosion...in the atmosphere; beyond its limits, including outer space...’, framing the Outer Space Treaty.

Moreover, Article IV of the OST is ‘...regarded as the focal point in the Outer Space Treaty...’ and is considered one of the ‘...first and most important provisions on arms control... complemented by other treaties of arms control.’ Article IV(1) specifically writes that:

“States Parties to the Treaty undertake not to place in orbit around the earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons on celestial bodies, or station such weapons in outer space in any other manner.”

The arms control principle was also included in the 1966 US Draft version of the OST, with Article 8 stating that ‘...no State shall station on or near a celestial body any nuclear weapons or other weapons of mass destruction.’ Furthermore, the Cologne Commentary notes that Article IV of the OST ‘...is taken from Articles 8 and 9 of the United States draft...’, while the Antarctic Treaty is viewed as a source of influence.

The efficacy of Article IV then seems clear, in that ‘...no placement of WMD in Earth orbit has occurred...’ Reaffirming this position, the UN General Assembly, in December 2024, adopted Resolution 79/18, which calls on States to ‘...not to place in orbit around the Earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction.’ However, Russia rejected it, while China abstained. This divergence is also evident in a proposed Security Council Resolution in the same year, which contained broadly similar text, and was vetoed by Russia, while China again abstained. An amendment was proposed by Russia and China, which calls upon States with major space capabilities ‘to take urgent measures to prevent for all time the placement of weapons in outer space and the threat or use of force in outer space.’ However, the amendment was rejected with seven States voting against it, and was accused of being ‘...inconsistent with the UN Charter, which permits the use of force for self-defence...’

Though Article IV remains binding, divergence between the space powers presents a challenge on the placement of WMD. NATO Chief, Mark Rutte, has accused Russia of considering using nuclear weapons against satellites in space, while at a meeting of the Security Council, the US stated that ‘...Russia seeks to distract global attention from its development of a new satellite carrying a nuclear device,’ and that should Russia have no intention of deploying a nuclear weapon, it would not have vetoed the US draft resolution.

Russia vehemently denies this accusation, yet the NATO Chief also suggested that due to its comparably outdated space technologies, ‘...the development of nuclear weapons in space is a way for Russia to improve its capabilities’, which could contravene the clear provisions of Article IV.

Analysis is also dependent on definitional interpretation. Gorove argues that there is a lack of ‘... definition of what constitutes a "nuclear weapon" or a "weapon of mass destruction,"’ and it may be presumed that ‘...all arms which utilize atomic energy...would be regarded as nuclear weapons.’ This presumption would theoretically reinforce the provisions of the Article, in proscribing nuclear technology in any form. However, as Tronchetti writes, ‘...not all forms of nuclear reactions in space are prohibited’, and Cheng suggests that the phrasing of Article IV(1), in prohibiting any other kinds of weapons of mass destruction, could mean that the Treaty only forbids the placement of nuclear weapons that cause ‘mass destruction’. Furthermore, Article IV does not necessarily prohibit the use of such weapons in space, but rather forbids their placement, meaning that the ‘...transit of weapons of mass destruction through outer space, for example by means of intercontinental ballistic missiles (ICBMs), does not fall under the prohibition of this Article.’

An additional challenge is defining WMD. The General Assembly defined WMD as ‘...atomic explosive weapons, radioactive material weapons, lethal chemical and biological weapons and any weapons developed in the future which might have characteristics comparable in destructive effect to those of the atomic bomb or other weapons mentioned above...’ This presents further ambiguity surrounding the use of other weapons, including anti-satellite (ASAT) weapons, which Tronchetti describes as not being prohibited by Article IV.

China carried out an ASAT test in 2007, and subsequently created a cloud of debris. Shirley Kan noted the long-term damage that such tests can create, and added that the debris from a US 1985 ASAT test took ‘...over 20 years to burn up in the atmosphere.’ It could then be argued that ASAT weapons fall under Article IV(1), considering the immediate or eventual damage they could cause. Freeland and Maogoto posit that such a strike ‘...could have a devastating impact...economies destroyed, and essential services incapacitated.’ The 2024 UNGA Resolution also touches upon this, observing the impact it could have ‘...on sustainable development, on the environment and on the provision of civilian services...’ The value of Article IV then rests on what should be classified as a WMD, especially concerning the threat posed to a rapidly increasing number of space objects.

An attempt was made to address this, with the adoption of UNGA Resolution 77/41 in 2022, which calls upon States to ‘...commit not to conduct destructive direct-ascent anti-satellite missile tests.’ However, though 154 States voted in favour, 8 abstained, which included Russia and China, again proving the divergence of the leading space powers on building upon Article IV.

However, Jakhu and Freeland write that Article II also states that outer space 'is not subject to' appropriation by way of use, stating that '...it follows that no amount of the use of outer space will ever suffice to justify, from a legal viewpoint, a claim of ownership rights over the whole, or any part of outer space, including the moon and other celestial bodies.'²²

The Principles do then seek to provide clarification and guidance, with Principle 2(A)(a) providing that '...States, international intergovernmental organizations or non-governmental organizations, national organizations or non-governmental entities, and natural persons may explore and extract resources from the Moon and other celestial bodies and utilize them.'²³ They also provide explicit provisions regarding commercial resource activities, stating that:

Interpretations of 'Peaceful' Uses and 'Space Weapons'

Rathnayake argues that Article IV '...does not expressly state about the prohibition of new space weapons...' Furthermore, there are differing interpretations of 'peaceful uses', and although the term is not explicitly stated in Article IV(1), it must be interpreted in connection with the whole Treaty. Furthermore, speaking at the COPUOS Legal Subcommittee meeting in 1966, US Ambassador Goldberg stated that the central issue in the treaty negotiations '...was to ensure that outer space and celestial bodies were reserved exclusively for peaceful activities.'

However, while Tronchetti states that the OST fails to define 'peaceful purposes', Bin Cheng writes that US position is that '..."peaceful" means "non-aggressive" and not "non-military"'. Freeland adds that the ongoing military uses of outer space '...is not entirely surprising, since the development of space-related technology was, at least initially, inextricably related to military strength...' The placement of defensive weapons in Earth orbit, then, appears to be consistent with Article IV(1), and would also be broadly in line with Article 51 of the UN Charter, as relevant principles of international law are extended to space activities through Article III.

This position then supports projects such as the US 'Golden Dome', which will include space-based interceptors (SBIs). Handel-Mazzetti argues that '...if such a system is indeed limited to defensive functions, its deployment could be argued as non-aggressive...' Similarly, the European Space Agency (ESA) has announced a \$1.6 billion funding plan toward space defence projects '...for non-aggressive defence purposes...' Also, despite US Space Force Chief of Operations, General Saltzman, accusing China of investing heavily in counter-space threats to '...deny, degrade, or destroy...' US satellites, this would still fall within the provision of 'peaceful' being 'non-aggressive', should the technology be used for defensive purposes.

However, a potential threat is caused by the extension of national rivalries into space, something which the formative resolution in 1958 aimed to prevent. This position was restated at COPUOS, where delegations expressed ‘...concerns regarding the weaponization of outer space...’ It seems clear that Article IV may not remain fit to address the spiralling militarisation of outer space, even if for ‘non-aggressive’ purposes.

The COPUOS Report also relays concern ‘...over recent instances where civilian space infrastructure had been used in armed conflict...’ Freeland also points out that ‘... the existing legal and regulatory regime has not kept pace with the remarkable technological and commercial progress of space activities.’ Indeed, commercial and civilian satellites might provide what is termed as ‘dual use’ objects, in supporting military objectives, as well as civilian ones. A case in point is the Ukraine War, and the use of commercial satellites. This gives rise to another legal quandary, that ‘...since an asset that could prima facie be regarded as a legitimate military target on the basis of military objectives might also - even at the same time - be providing civilian/commercial services.’ Russian officials have since warned that commercial satellites could be considered legitimate military targets. This also begs the question as to how the laws of armed conflict, *jus in bello*, would be applied to such objects, while Freeland argues that ‘...it is not clear how this will be done in practice...’

The efficacy of Article IV then hinges upon clearer definitions. According to Article 31(1) of the Vienna Convention on the Law of Treaties (VCLT), ‘A treaty shall be interpreted in good faith in accordance with the ordinary meaning to be given to the terms of the treaty in their context and in the light of its object and purpose.’ Nonetheless, it appears that Article IV is ‘...capable of differing interpretations and largely protective of a State's sovereign right to utilize force in self-defense...’

Recommendations and Proposals to Support Article IV

Proposals have been made which could build on Article IV. The Draft PPWT, introduced in 2008 at the UN Conference on Disarmament (CD) in 2008, and later updated in 2014, does propose a definition for “weapons in outer space”, meaning ‘...any outer space object or component thereof which has been produced or converted to destroy, damage or disrupt the normal functioning of objects in outer space...’ However, the PPWT ‘...has received mixed reviews and has not been accepted, signed or ratified by any state...’

US Ambassador Wood added concerns, in that the Chinese 2007 ASAT test would have been permitted under the PPWT. A letter to the CD in response to the US shows China arguing that it is ‘...fully in keeping with the fundamental law on outer space...’ but as the Treaty remains

unsigned, the 'hard law' path may not be the way to find harmonisation, as evidenced by Ambassador Wood, who also added that challenges could be addressed through '...non-legally binding transparency and confidence-building measures (TCBMs)...'

There is some comparable success in the 'soft law' approach, such as the 2019 UN LTS Guidelines, which provide voluntary guidelines on enhancing sustainability in space. Similarly, in 2021, the UK introduced Resolution 76/231, which called for an open-ended working group to make '...recommendations on possible norms, rules and principles of responsible behaviours relating to threats by States to space systems...'. The Group noted that Article IV, while prohibiting certain weapons, does '...not address other types of possible weapons'. The Draft Report also provided a set of recommendations, which includes that 'States should consider not to develop, produce, test or deploy weapons in space for any purpose', and should 'Refrain from destructive direct-ascent anti-satellite missile tests...'

Though these findings could enhance the efficacy of Article IV, the Group failed to provide a final report or formal set of recommendations, '...largely due to blocking by Russia and China...'. Finding consensus on weaponisation appears to be a major hurdle towards building on Article IV. In 2008, the European Union (EU) embarked on its own attempt to find an impasse, through its 'Draft International Code of Conduct for Outer Space Activities (ICOC)'. The framework calls for adherence to international space law, as well as noting '...the importance of preventing an arms race in outer space.' According to Lyall and Larsen, the ICOC was '...essentially a movement for greater situational awareness in outer space operations', yet the revised 2014 Draft went on to include the additions in relation to the Prevention of an Arms Race in Outer Space (PAROS). This, according to Listner, '...appears to offer a conciliation to Russia and China,' although both States rejected the ICOC, favouring the PPWT approach instead.

The ICOC also stalled when States were invited to the UN Headquarters in New York to negotiate the Draft. Firstly, it was '...not to be considered a UN event because there was no UN mandate', while there was also continued divergence between those delegations which supported the ICOC, and those that considered the inclusion of language on the 'right to self-defence' to risk a justification for space weaponisation, or as Rajagopalan observed in 2013, a likelihood that '...that it will be invoked to justify the carrying out of armed hostilities in outer space.'

The ICOC did establish one area which might be preventing engagement on Article IV. Box 15 of the Draft states that it is 'Without prejudice to ongoing and future work in other appropriate international fora relevant to the peaceful exploration and use of outer space...' such as

COPUOS and the Conference on Disarmament. This would mean that the ICOC would not impede the work being carried out in the Conference on Disarmament, such as PAROS and the PPWT. There is then fragmentation in UN space governance, which is split between the First Committee and COPUOS. The former is to address issues of space security, and the latter on civil space.

However, COPUOS does also address space security, in seeking to emphasise the need ‘...for further cooperation ...’ as well as understanding ‘...what relationship, if any, COPUOS should have with other UN bodies’, which are addressing the issues of space security and PAROS. However, the COPUOS Briefing also highlights ongoing ‘...disagreement between members... with respect to the Committee’s mandate, as to what degree the Committee should deliberate issues of space security and militarisation.’

Furthermore, the efficacy of international law must also be questioned, in light of recent political and geopolitical developments. In January 2026, President Trump issued an Executive Order, calling for ‘...Withdrawing the United States from and Ending Funding to Certain United Nations Organizations and Reviewing United States Support to All International Organizations.’ This follows the US decision to withdraw from the Paris Climate Agreement and the World Health Organisation. Another challenge sits among the permanent members of the Security Council. Russia violated the sovereignty of Ukraine, China refused to condemn it, and the US provided ‘...seemingly unconditional support for Israel’s atrocities against Palestinian civilians in Gaza...’ More recently, the US military operation in Venezuela was also condemned by the UN, stating that an unprovoked attack was a violation of Article 2(4) of the UN Charter.

The implementation of the principles of Article IV, and the whole body of international space law, requires that States abide by those principles. The current geopolitical climate would suggest an uphill challenge.

Conclusion

Article IV is regarded as a ‘focal point’ of the OST, making up a series of formative arms treaties of the time. Its efficacy can be proven in that no nuclear weapons have been placed into orbit, and adherence to this has been renewed through UN Resolution 79/18. However, it is unclear to what extent WMD might also encompass other conventional weapons, and there are differing interpretations of ‘peaceful uses’ and ‘space weapons’. Definitional issues also highlight the fragmentation between States in approaches to building upon Article IV, such as discussing legal matters at a single forum, while the efficacy of international law is questioned in the face of geopolitical crises.

What appears to be the case is that Article IV retains its position as a key principle. What will be required is deeper harmonisation on building upon Article IV, especially in light of increasing commercial and 'dual use' technologies. Further research could explore what normative behaviours are established regarding these technologies, to understand how Article IV can remain relevant.

Additionally, further research could also focus on ground-based weapons, which might fall outside of Article IV, in not being 'placed' in outer space, but perhaps falling within the realm of 'peaceful' and 'non-aggressive' uses. Lastly, this might also encompass further research on non-kinetic weapons, cyberattacks and signal jamming. Special attention might also be paid to rendezvous and proximity operations (RPO), especially considering the development of such technologies for addressing critical issues such as debris removal and satellite servicing.

The value of space is rapidly increasing. At the same time, investments in the military uses of outer space are spiralling. What is required, despite the challenges, is continuing discussions on how to maintain the safety and sustainability of outer space.



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July 2026

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15. Andrew Goodpastor, 'Memorandum of Conference with the President: October 8, 1957, 8:30am' (9 October 1957) <https://www.eisenhowerlibrary.gov/sites/default/files/research/online-documents/sputnik/10-9-57-early-memo.pdf> accessed 12 December 2025. Eisenhower described that the Russians had, in fact, done them a good turn, in unintentionally '...establishing the concept of freedom of international space...'
16. Francis Lyall and Paul B Larsen, *Space Law: A Treatise* (3rd edn, Routledge 2025) 34
17. UNGA Res 1348 (13 December 1958) UN Doc A/RES/1348. The resolution also established the ad hoc Committee on the Peaceful Uses of Outer Space, which became permanent the following year.
18. UNGA Res 1721 (20 December 1961) UN Doc A/RES/1721
19. UNGA Res 1884 (17 October 1963) UN Doc A/RES/1884
20. Treaty Banning Nuclear Weapons Tests in the Atmosphere, in Outer Space and Underwater, (adopted 5 August 1963, entered into force 10 October 1963) 480 UNTS 43, art I(1)(a).
21. Ajey Lele, 'Remembering Starfish Prime' *The Space Review* (8 July 2024) <https://www.thespacereview.com/article/4822/1> accessed 11 January 2026.
22. Schrogl and Neumann (n 2), 288
23. OST (n 1), art IV(1).
24. Draft Treaty Governing the Exploration of the Moon and Other Celestial Bodies (July 1966) A/AC.105/C.2/L.12, art 8.
25. Schrogl and Neumann (n 2), 293
26. The Antarctic Treaty (adopted 1 December 1959, entered into force 23 June 1961) 402 UNTS 71, art V.
27. US Department of State, 'Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies' (state.gov) <https://2009-2017.state.gov/t/isn/5181.htm> accessed 11 January 2026. President Eisenhower, on September 22, 1960, proposed to the UN General Assembly that the principles of the Antarctic Treaty be applied to outer space and celestial bodies.
28. Schrogl and Neumann (n 2), 289
29. UNGA Res 79/18 (2 December 2024) UN Doc A/RES/79/18. This was submitted by Japan, the US and Argentina.
30. United Nations Digital Library, 'Weapons of mass destruction in outer space : resolution / adopted by the General Assembly' (digitallibrary.un.org, 2024) <https://digitallibrary.un.org/record/4069200?ln=en> accessed 12 January 2026
31. UNSC Res 2024/302 (24 April 2024) UN Doc S/2024/302 (Draft). The Resolution includes the text calling on States '...not to place in orbit around the Earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons on celestial bodies, or station such weapons in outer space in any other manner.'
32. Security Council Report, 'Vote on a Draft Resolution on the Prevention of an Arms Race in Outer Space' (securitycouncilreport.org, 17 May 2024) accessed 12 January 2026

33. China and Russian Federation: amendment to the draft resolution contained in document S/2024/302 (24 April 2024) UN Doc S/2024/323 (Draft)
34. UN Meetings Coverage and Press Releases, 'Security Council Fails to Adopt First-Ever Resolution on Arms Race in Outer Space, Due to Negative Vote by Russian Federation' UN Meetings Coverage and Press Releases (24 April 2024) <https://press.un.org/en/2024/sc15678.doc.htm> accessed 12 January 2026. States voting against the amendment included the US, UK and France.
35. United Nations Treaty Collection, (treaties.un.org) <https://treaties.un.org/pages/showdetails.aspx?objid=0800000280128cbd> accessed 12 January 2026. Also, all leading space nations are Parties to the OST.
36. Euronews, 'NATO chief warns of possible Russian nuclear weapons in space' Euronews (12 April 2025) <https://www.euronews.com/2025/04/12/nato-chief-warns-of-possible-russian-nuclear-weapons-in-space> accessed 18 December 2025.
37. Security Council Seventy-ninth year 9630th meeting (May 2024) UN Doc S/PV.9630. This refers to the US-Japan Security Council Resolution S/2024/302.
38. Robert Greenall, 'Putin denies plans to deploy nuclear weapons in space' BBC (20 February 2024) <https://www.bbc.com/news/world-us-canada-68346874> accessed 12 January 2026. Despite US claims that Russia is developing anti-satellite weapons fitted with a nuclear warhead, President Putin stated that Russia has '...always been categorically against the deployment of nuclear weapons in space...'
39. Euro News (n 39).
40. Stephen Gorove, 'Arms Control Provisions in the Outer Space Treaty: A Scrutinising Reappraisal' (1973) 3 Ga. J. Int'l & Compar. L 115.
41. Fabio Tronchetti, 'Legal aspects of the military uses of outer space' in Frans von der Dunk and Fabio Tronchetti (eds), Handbook of Space Law (Elgar 2015) 336. Tronchetti states that '...small atomic bombs for propulsion of a spacecraft is allowed.
42. Bin Cheng, Studies in International Space Law (Oxford University Press 1997) 530. Cheng notes that this might not then proscribe, for example, '...mini-nuclear space mines, with very limited impact...' However, he also adds that '...their testing and use in peacetime may contravene, for those States that are parties to it, the Partial Nuclear Test Ban Treaty.'
43. Schrogl and Neumann (n 2), 310
44. Tronchetti (n 44), 337
45. UNGA Res 32/84-B (12 December 1977) UN Doc A/RES/32/84-B
46. Tronchetti (n 44), 337
47. TS Kelso, 'Analysis of the 2007 Chinese ASAT Test and the Impact of its Debris on the Space Environment' (2007) https://www.researchgate.net/publication/242460823_Analysis_of_the_2007_Chinese_ASAT_Test_and_the_Impact_of_its_Debris_on_the_Space_Environment accessed 18 December 2025. Kelso claims that it initially created '...at least 1,337 pieces of debris large enough to be routinely tracked by the US Space Surveillance Network and the NASA Orbital Debris Program Office estimated it generated over 35,000 pieces of debris down to 1 centimeter in size.'

48. Shirley Kan, 'CRS Report for Congress: China's Anti-Satellite Weapon Test' (April 2007) <https://archive.org/details/370838-chinas-anti-satellite-weapon-test/mode/2up> accessed 18 December 2025, 2. This was even though the US test took place at a lower altitude than the Chinese test.
49. Donald J Kessler and Burton G Cour-Palais, 'Collision frequency of artificial satellites: The creation of a debris belt' (1978) 83 J Geophys Res 2637. This could, for example, result in debris adding to the risk of the 'Kessler Syndrome'. Kessler posited that collisions could lead to an exponential increase in debris, eventually rendering Earth orbit unusable.
50. Freeland and Maogoto (n 4), 1093. The authors state that the damage may not necessarily have an immediate impact on civilians, but damage to, say, communications or weather satellites '...could have a devastating impact on a community, country, or even region of the world. Millions of lives and livelihoods could potentially be affected, economies destroyed, and essential services incapacitated.'
51. UNGA Res 79/18 (n 32)
52. Jonathan McDowell, 'Space Activities in 2025' (January 2026) <https://planet4589.org/space/papers/space25.pdf> accessed 12 January 2026. According to Jonathan McDowell, the number of payloads being launched per year has increased from just 221 in 2016, to 4522 in 2025.
53. UNGA Res 77/41 (12 December 2022) UN Doc A/RES/77/41
54. Prevention of an Arms Race in Outer Space: Report of the First Committee (November 2022) UN Doc A/77/383, 3.
55. RMTSK Rathnayake, 'Critical Analysis of the Article IV of the Outer Space Treaty and its Relevance for the Present Day' [2016] Proceedings in law, 9th International Research Conference-KDU, Sri Lanka 62, 63. She adds that the '...definition of the terms "space weapon" is also problematic.'
56. OST (n 1). For example, the preamble recognises '...the common interest of all mankind in the progress of the exploration and use of outer space for peaceful purposes.'
57. Committee on the Peaceful Uses of Outer Space Legal Subcommittee Meeting, Fifth Session: Summary Record of the Fifty-Seventh Meeting (October 1966) A/AC.105/C.2/SR.57.
58. Tronchetti (n 44), 338
59. Cheng (n 45), 515
60. Steven Freeland, 'Peaceful Purposes - Governing the Military Uses of Outer Space' (2016) 18 Eur JL Reform 35, 36.
61. Charter of the United Nations (adopted 26 June 1945, entered into force 24 October 1945) 1 UNTS 16, art 51.
62. OST (n 1), art III. This requires States to '...carry on activities in the exploration and use of outer space...in accordance with international law, including the Charter of the United Nations...'
63. The White House, 'Executive Order The Iron Dome for America' (27 January 2025) accessed 13 January 2026. Described as '...a next-generation missile defense shield...'
64. Theresa Hitchens, 'Golden Dome: Space Force awards first space-based interceptor prototype contracts' Breaking Defense (25 November 2025) <https://breakingdefense.com/2025/11/golden-dome-space-force-awards-first-space-based-boost-phase-interceptor-prototype-contracts/> accessed 13 January 2026. The US Space Force has already awarded contracts for the development of SBI prototypes.

65. Louisa Handel-Mazzetti, 'Shielding the Nation, Testing the Peaceful Purposes Principle: the Golden Dome as a Self-Defense Zone' (Opinio Juris, 19 September 2025) <https://opiniojuris.org/2025/09/19/shielding-the-nation-testing-the-peaceful-purposes-principle-the-golden-dome-as-a-self-defense-zone/> accessed 13 January 2026. This could therefore be '... compatible with the peaceful purposes principle.'
66. Theresa Hitchens, 'ESA leaders greenlight \$1.6 billion for new 'non-aggressive' space security initiative' Breaking Defense (1 December 2025) <https://breakingdefense.com/2025/12/esa-leaders-greenlight-1-6-billion-for-new-non-aggressive-space-security-initiative/> accessed 13 January 2026.
67. General B. Chance Saltzman, 'Testimony of General B. Chance Saltzman, Chief of Space Operations, United States Space Force: Hearing on China's Ambitions in Space (April 2025) <https://libguides.swansea.ac.uk/Oscola/OfficialReports> accessed 13 January 2026.
68. Schrogl and Neumann (n 2), 292. The authors state that 'the common aim was that outer space should be used for peaceful purposes only and that the extension of present national rivalries into this new field should be avoided.
69. Report of the Committee on the Peaceful Uses of Outer Space (2025) UN Doc A/80/20, 10. It was also added that there '...was an urgent need to expedite intergovernmental dialogue...on the elaboration and adoption of a legally binding instrument on the prevention of an arms race in outer space.'
70. *ibid*, 11.
71. Freeland (n 63), 43.
72. Sandra Erwin, 'On National Security | Drawing lessons from the first "commercial space war"' Space News (20 May 2022) <https://spacenews.com/on-national-security-drawing-lessons-from-the-first-commercial-space-war/> accessed 11 December 2025. This had led to the conflict being dubbed as the first 'commercial space war'.
73. Marek Grzegorzczuk, 'Ukraine's Starlink dependency: Satellite salvation and strategic risk' Emerging Europe (14 March 2025) <https://emerging-europe.com/ukraines-starlink-dependency-satellite-salvation-and-strategic-risk/> accessed 13 January 2026. 'Starlink terminals have become indispensable tools on the battlefield.'
74. Tymon Miller, 'Russia is designing new 'weapon of fear' to wreak havoc in space' TVP World (22 December 2025) <https://tvpworld.com/90692503/russia-developing-anti-satellite-system-against-musks-starlink> accessed 13 January 2026.
75. Steven Freeland, 'In Heaven as on Earth? The International Legal Regulation of the Military Use of Outer Space' (2011) 8 US-China Law Review 272, 284. Freeland adds '...one is also drawn to the question of whether, and in what circumstances, such a satellite can (ever) be regarded a legitimate target of war.'
76. Vienna Convention on the Law of Treaties (adopted 23 May 1969, entered into force 27 January 1980) 1155 UNTS 331, art 31(1). Given this Article, this research finds that there is a somewhat clearer definition on the use of some weapons, and also establishes that there is a shared view of 'non-aggression' aligning with the ethos on peaceful uses.

77. Freeland (n 63), 1094. The author adds that it is '...by no means clear that the deployment of such weapons, or their use as an act of force, are proscribed in certain circumstances.'
78. Letter dated 2008/02/12 from the Permanent Representative of the Russian Federation and the Permanent Representative of China to the Conference on Disarmament addressed to the Secretary-General of the Conference transmitting the Russian and Chinese texts of the draft "Treaty on Prevention of the Placement of Weapons in Outer Space and of the Threat or Use of Force against Outer Space Objects (PPWT)" introduced by the Russian Federation and China (February 2008) UN Doc CD/1839.
79. PPWT (n 11).
80. *ibid*, art I(b).
81. Tronchetti (n 44), 379. Tronchetti also adds that it does not address ground-based weapons, such as ASAT weapons and has been criticised for various reasons, such as for including a vague definition of weapons.
82. Robert A. Wood, 'Ensuring the Long-Term Sustainability and Security of the Space Environment' (September 2014) <https://geneva.usmission.gov/2014/09/09/ambassador-robert-wood-ensuring-the-long-term-sustainability-and-security-of-the-space-environment/#:~:text=In%20considering%20options%20for%20international,2008%20version%2C%20remains%20fundamentally%20flawed.> accessed 13 January 2026. He adds that it would have been permitted under both the 2008 and 2014 versions.
83. Letter dated 11 September 2015 from the Permanent Representative of China to the Conference on Disarmament and the Charge d'affaires a.i. of the Russian Federation addressed to the Secretary-General of the Conference transmitting the comments by China and the Russian Federation regarding the United States of America analysis of the 2014 updated Russian and Chinese texts of the draft treaty on prevention of the placement of weapons in outer space and of the threat or use of force against outer space objects (PPWT) (September 2015) UN Doc CD/2042, 2.
84. Freeland (n 63), 50. Freeland argues that the 'treaty' approach to dealing with the militarization/weaponization of outer space is unlikely to come to fruition in the medium term, if at all, and any additional regulation that does emerge will thus only take the form of a voluntary non-binding basis.
85. Wood (n 89).
86. Report of the Committee on the Peaceful Uses of Outer Space (2019) UN Doc A/74/20, 22.
87. Guidelines for the Long-term Sustainability of Outer Space Activities of the Committee on the Peaceful Uses of Outer Space (2021) UN Doc ST/SPACE/79.
88. UNGA Res 76/231 (24 December 2021) UN Doc A/RES/76/231. This also included '...how they would contribute to the negotiation of legally binding instruments, including on the prevention of an arms race in outer space.'
89. Draft report of the Open-ended working group on reducing space threats through norms, rules and principles of responsible behaviours (August 2023) UN Doc A/AC.294/2023/CRP.1/Rev.1.

90. *ibid*, 49.
91. Secure World Foundation, 'Open-Ended Working Group (OEWG) on Reducing Space Threats Fact Sheet' (October 2023) https://cdn.prod.website-links.com/66dcc6872f6ed23bce1db235/6801551cf9f591e09a953b6d_fs23-12_oewg-on-reducing-space-threats_1023.pdf accessed 14 January 2026.
92. European Union, 'Draft International Code of Conduct for Outer Space Activities' (March 2014) https://www.eeas.europa.eu/sites/default/files/space_code_conduct_draft_vers_31-march-2014_en.pdf accessed 14 January 2026.
93. Lyall and Larsen (n 19), 268
94. Michael J. Listner, 'The International Code of Conduct: Comments on changes in the latest draft and post-mortem thoughts' *The Space Review* (26 October 2015) https://www.thespacereview.com/article/2851/1?utm_source=chatgpt.com accessed 14 January 2026.
95. Tommaso Sgobba, 'IAASS Statement On International Code of Conduct for Outer Space Operations' *Space Safety Magazine* (5 August 2015) <https://www.spacesafetymagazine.com/news/iaass-statement-on-the-international-code-of-conduct-for-outer-space-operations/> accessed 14 January 2026.
96. ICOC (n 100), box 51.
97. Rajeswari Pillai Rajagopalan, 'Space Code Debate and the Right to Self Defence under Article Fifty Five' *Space Daily* (31 July 2013) https://www.spacedaily.com/reports/Space_Code_Debate_and_the_Right_to_Self_Defence_under_Article_Five_999.html accessed 14 January 2026.
98. ICOC (n 100), box 15.
99. Listner (n 102).
100. Victoria Samson, 'Insight - Threats to space aren't just weapons' (Trends Research & Advisory, 24 February 2021) <https://www.swfound.org/publications-and-reports/insight---threats-to-space-arent-just-weapons> accessed 14 January 2026.
101. Michael Friedl, 'Current Agenda Items' in Christopher D. Johnson (ed), *The COPUOS Briefing Book* (SWF 2025), 30. This done through its agenda item 'Ways and Means of Maintaining Outer Space for Peaceful Purposes'
102. *ibid*.
103. The White House, 'Executive Order on Withdrawing the United States from International Organizations, Conventions, and Treaties that Are Contrary to the Interests of the United States' (7 January 2026) <https://www.whitehouse.gov/presidential-actions/2026/01/withdrawing-the-united-states-from-international-organizations-conventions-and-treaties-that-are-contrary-to-the-interests-of-the-united-states/> accessed 14 January 2026.
104. The White House, 'Fact Sheet: President Donald J. Trump Withdraws the United States from International Organizations that Are Contrary to the Interests of the United States' (7 January 2026) <https://www.whitehouse.gov/fact-sheets/2026/01/fact-sheet-president-donald-j-trump-withdraws-the-united-states-from-international-organizations-that-are-contrary-to-the-interests-of-the-united-states/> accessed 14 January 2026.

105. Leslie Vinjamuri, 'The UN is Turning 80. Is It Still Relevant?' The Chicago Council on Global Affairs (22 September 2025) <https://globalaffairs.org/commentary/analysis/un-turning-80-it-still-relevant> accessed 14 January 2026.
106. United Nations, 'UN experts condemn US aggression against Venezuela' United Nations (7 January 2026) <https://www.ohchr.org/en/press-releases/2026/01/un-experts-condemn-us-aggression-against-venezuela> accessed 14 January 2026.
107. Schrogl and Neumann (n 2), 288
108. Friedl (n 108), 30
109. OST (n 1), art V(1).
110. World Economic Forum, Space: The \$1.8 Trillion Opportunity for Global Economic Growth (World Economic Forum 2024). The space economy is set to be valued at \$1.8 trillion by 2035.

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