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## SPACE COMMERCIALIZATION AND ITS IMPLICATIONS ON PRIVATE INTERNATIONAL LAW

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### ABSTRACT

The increasing commercialization of outer space marks a significant shift from a state-centric model of space activities to one driven by private enterprises<sup>1</sup>. With the rise of private actors engaging in satellite operations, space tourism, and prospective resource extraction, the existing legal framework largely rooted in public international law faces growing pressure to adapt. This paper examines the implications of this transformation through the lens of private international law, focusing on key issues such as jurisdiction, choice of law, liability, and dispute resolution. The study highlights how traditional conflict-of-laws principles struggle to operate effectively in the unique, non-territorial environment of outer space. In particular, the absence of clear jurisdictional boundaries and the involvement of multiple national legal systems create uncertainty in resolving disputes arising from commercial space activities<sup>2</sup>. Additionally, the paper explores the gap between state responsibility under international treaties and the regulation of private actors under domestic laws, leading to inconsistencies in liability and enforcement.

By analyzing these challenges, the paper argues that the current legal framework is insufficient to address the complexities introduced by space commercialization. It emphasizes the urgent need for harmonized legal standards and greater international cooperation to ensure clarity, predictability, and accountability<sup>3</sup>. The paper concludes by suggesting that the development of specialized dispute resolution mechanisms and coordinated regulatory approaches will be essential for the sustainable growth of the space economy. Ultimately, the evolution of private international law will play a crucial role in shaping a fair and effective legal

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<sup>1</sup> G.K.S. Amruta, *The Role of Private Entities in Outer Space Activities*, 7 Int'l J. for Multidisciplinary Research (2025), <https://www.ijfmr.com/papers/2025/2/41334.pdf>

<sup>2</sup> Ariba Kadri, *Jurisdictional Challenges in Cross-Border Disputes: Navigating the Complexities*, INDIAN J. L. & LEGAL RSCH. (Mar. 29, 2024), <https://www.ijllr.com/post/jurisdictional-challenges-in-cross-borderdisputes-navigating-the-complexities>

<sup>3</sup> Madi Gates, *Houston, We Have a Problem: International Law's Inability to Regulate Space Exploration*, NYU J. Int'l L. & Pol. Blog (Jan. 2, 2025), <https://nyujilp.org/houston-we-have-a-problem-international-laws-inability-to-regulate-space-exploration/>

order in outer space.

**Keywords:** Space commercialization, Jurisdiction, Liability, Dispute Resolution, Conflict of law, Space Governance and Legal Harmonization.

## INTRODUCTION

Outer space has long been regarded as a global commons, a domain that does not fall under the sovereignty of any single nation<sup>4</sup>. Traditionally, its governance has been shaped by principles of public international law, particularly through multilateral treaties that emphasize peaceful use, non-appropriation, and collective benefit. For decades, space activities were almost exclusively carried out by states, primarily driven by strategic, scientific, and political interests. However, this landscape has undergone a significant transformation in recent years. The increasing involvement of private entities has shifted space activities from a purely state-centric model to a more commercially driven one<sup>5</sup>. Private companies are now actively engaged in launching satellites, providing communication services, and even developing space tourism ventures. This transition has been facilitated by technological advancements, reduced costs, and the growing willingness of governments to collaborate with or delegate responsibilities to private actors.

Space commercialization refers to the use of outer space for profit-oriented activities by private entities. This includes a wide range of operations such as satellite deployment, data services, and emerging sectors like space mining and tourism<sup>6</sup>. While this development has opened up new economic opportunities, it has also introduced complex legal challenges. At this point, the relevance of private international law becomes apparent. Private international law, or conflict of laws, deals with issues such as jurisdiction, choice of applicable law, and the recognition and enforcement of judgments in cross-border disputes<sup>7</sup>. While these principles function relatively well in terrestrial contexts, their application in outer space is far less clear due to the absence of territorial sovereignty and the involvement of multiple jurisdictions.

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<sup>4</sup> Pauline Pic, Philippe Evoy & Jean-Frédéric Morin, *The Contested Status of Outer Space as a Global Commons: Insights from an Analysis of Space Arrangements*, New Space Economy (Mar. 18, 2024), <https://newspaceconomy.ca/2024/03/18/the-contested-status-of-outer-space-as-a-global-commons-insightsfrom-an-analysis-of-space-arrangements/>

<sup>5</sup> India Brand Equity Foundation, *India's Private Spacetechnology Boom: A New Era Unfolds* (Sept. 5, 2025), <https://www.ibef.org/blogs/india-s-private-spacetechnology-boom-a-new-era-unfolds>

<sup>6</sup> John M. Logsdon, *Together in Orbit: Round One*, in *Ronald Reagan and the Space Frontier* 149 (Palgrave Macmillan 2019), [https://doi.org/10.1007/978-3-319-98962-4\\_12](https://doi.org/10.1007/978-3-319-98962-4_12)

<sup>7</sup> *International Private Law*, LawsLearned, <https://lawslearned.com/international-private-law/>

The central problem addressed in this paper is the difficulty of applying existing legal frameworks to regulate private actors operating in space. The current system, largely designed for state responsibility, does not adequately address the complexities introduced by commercial participation. This paper argues that space commercialization exposes significant gaps in private international law, particularly in relation to jurisdiction, liability, and dispute resolution, thereby necessitating urgent legal reconsideration and reform.

## **EVOLUTION OF SPACE ACTIVITIES: FROM STATE MONOPOLY TO PRIVATE PARTICIPATION**

The development of space activities has undergone a significant transformation, moving from an era of strict state control to one increasingly characterized by private sector participation<sup>8</sup>. In its early phase, particularly during the Cold War, outer space was dominated almost entirely by nation-states. The competition between the United States and the Soviet Union drove rapid advancements in space technology, but these efforts were primarily motivated by military, strategic, and political considerations rather than commercial interests<sup>9</sup>. Space exploration was viewed as an extension of national power, and activities such as satellite launches and human spaceflight were conducted exclusively by government agencies.

This state-centric model was reinforced by the development of international legal frameworks, most notably the Outer Space Treaty. The treaty established key principles governing outer space, including the non-appropriation of celestial bodies, the peaceful use of space, and the responsibility of states for national activities in space, whether carried out by governmental or non-governmental entities<sup>10</sup>. While the treaty did not explicitly prohibit private participation, it clearly placed the burden of authorization and supervision on states, thereby maintaining a predominantly public law orientation.

Over time, however, private entities began to play a more prominent role in specific sectors<sup>11</sup>.

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<sup>8</sup> KPMG, *Propelling India into a New Era of Space and Innovation* (Sept. 8, 2025), <https://kpmg.com/in/en/insights/2025/09/propelling-india-into-a-new-era-of-space-and-innovation.html>

<sup>9</sup> Smithsonian National Air and Space Museum, *Space Race*, Smithsonian Institution, <https://airandspace.si.edu/explore/stories/space-race>

<sup>10</sup> *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies*, Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205, available at <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspacetreaty.html>

<sup>11</sup> Dina Hestad, *The Evolution of Private Sector Action in Sustainable Development*, Int'l Inst. for Sustainable Dev. (Feb. 24, 2021), <https://www.iisd.org/articles/deep-dive/evolution-private-sector-action-sustainabledevelopment>

One of the earliest areas of commercial involvement was satellite communications, where private companies partnered with governments to provide broadcasting and telecommunication services. This was followed by the emergence of private launch service providers, which offered cost-effective alternatives to state-operated launch systems. More recently, the scope of private participation has expanded further to include space tourism and even ambitious plans for asteroid mining and resource extraction.

Several factors have contributed to this shift towards commercialization. Technological advancements have significantly lowered the barriers to entry, making space activities more accessible to private actors<sup>12</sup>. Innovations in reusable launch vehicles and miniaturized satellites have reduced operational costs, enabling companies to compete in a domain once reserved for states. Additionally, governments have increasingly adopted outsourcing models, relying on private companies for services that were previously managed in-house. This public-private collaboration has further accelerated the commercialization process.

Despite these developments, the existing legal framework has struggled to keep pace with the changing nature of space activities. International space law was originally designed with state actors in mind, and its provisions do not adequately address the complexities introduced by private participation<sup>13</sup>. As a result, there are growing concerns regarding regulatory gaps, particularly in areas such as liability, jurisdiction, and dispute resolution. This mismatch between evolving commercial realities and outdated legal structures highlights the need for a more comprehensive and adaptive legal approach.

## CONCEPT OF SPACE COMMERCIALIZATION

Space commercialization refers to the increasing involvement of private entities in activities that were traditionally carried out exclusively by governments in outer space<sup>14</sup>. It essentially denotes the transformation of space from a domain of scientific exploration and national prestige into one driven by economic interests and profit-oriented ventures. This shift has given

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<sup>12</sup> Landry Signé & Hanna Dooley, *How Space Exploration Is Fueling the Fourth Industrial Revolution*, Brookings Inst. (Mar. 28, 2023), <https://www.brookings.edu/articles/how-space-exploration-is-fueling-the-fourth-industrialrevolution/>

<sup>13</sup> United Nations, *International Space Law Explained*, <https://www.un.org/en/peace-and-security/international-space-law-explained>

<sup>14</sup> Cesare Sodi, *Commercial Space Revolution: From LEO Economy to Deep Space Ventures*, Space Strategies (Feb. 11, 2025), <https://spacestrategies.org/trends/commercial-space-revolution-leo-deep-space/>

rise to several key sectors within the space economy.

One of the most established sectors is the satellite industry, which includes communication, navigation, and Earth observation services. Private companies now play a dominant role in launching and operating satellites that support everyday activities such as internet connectivity, weather forecasting, and global positioning systems<sup>15</sup>. Another emerging sector is space tourism, where companies aim to provide commercial space travel experiences to private individuals. Although still in its early stages, this sector reflects the growing accessibility of space beyond governmental missions. Additionally, resource extraction, particularly asteroid mining, has gained attention as a potential future industry<sup>16</sup>. Private actors are exploring the possibility of extracting valuable minerals from celestial bodies, raising complex questions about ownership and exploitation of space resources.

Private corporations and startups are central to this transformation. With advancements in technology and reduced launch costs, companies are increasingly able to undertake missions that were once financially and technically unfeasible. Governments have also encouraged this participation through public-private partnerships and regulatory support, further accelerating commercialization.

The economic significance of space commercialization is substantial. The global space economy is expanding rapidly, with projections indicating continued growth in satellite services, space-based data markets, and emerging industries like tourism and mining<sup>17</sup>. This expansion not only generates revenue but also fosters innovation and competition.

However, commercialization also presents significant risks. The increasing number of satellites and missions contributes to the growing problem of space debris, which threatens both operational spacecraft and future activities<sup>18</sup>. Moreover, the dominance of a few large corporations raises concerns about monopolization and unequal access to space resources.

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<sup>15</sup> The Orbital Economy: A Review of Commercial Satellites in 2025, *New Space Economy* (Sept. 15, 2025), <https://newspaceconomy.ca/2025/09/15/the-orbital-economy-a-review-of-commercial-satellites-in-2025/>

<sup>16</sup> Josh Sims, *How Close Are We Really to Mining Asteroids?*, BBC Future (Mar. 20, 2025), <https://www.bbc.com/future/article/20250320-how-close-are-we-really-to-mining-asteroids>.

<sup>17</sup> McKinsey & Company, *Space: The \$1.8 Trillion Opportunity for Global Economic Growth* (Apr. 8, 2024), <https://www.mckinsey.com/industries/aerospace-and-defense/our-insights/space-the-1-point-8-trillion-dollaropportunity-for-global-economic-growth>

<sup>18</sup> Mia M. Bennett, *Orbital Debris Requires Prevention and Mitigation Across the Satellite Life Cycle*, 4 *Comm'ns Eng.* 95 (2025), <https://doi.org/10.1038/s44172-025-00430-5>

In light of these developments, it becomes evident that space commercialization necessitates clear and effective legal regulation. The involvement of multiple private actors across jurisdictions creates uncertainties that existing legal frameworks are not fully equipped to address, thereby underscoring the need for greater legal clarity and coordination.

## OVERVIEW OF PRIVATE INTERNATIONAL LAW (CONFLICT OF LAWS)

Private international law, often referred to as conflict of laws, deals with legal issues that arise when a dispute involves more than one jurisdiction. It provides a framework to determine three key aspects: jurisdiction, choice of law, and the recognition and enforcement of judgments. Jurisdiction refers to the authority of a court to hear and decide a case. In cross-border disputes, multiple courts may potentially claim jurisdiction, and private international law helps identify the most appropriate forum<sup>19</sup>. Choice of law, on the other hand, determines which country's legal system should be applied to resolve the dispute. This becomes particularly important when the laws of different states lead to different outcomes. Lastly, the recognition and enforcement of judgments ensure that a decision given by a court in one country is acknowledged and implemented in another, thereby giving practical effect to judicial decisions in an increasingly interconnected world<sup>20</sup>.

Traditionally, private international law has been applied to resolve cross-border commercial disputes occurring on Earth. These include disputes arising out of international contracts, trade agreements, or business transactions involving parties from different countries. For example, in a contract between companies based in different states, questions may arise regarding which court has jurisdiction or which legal system governs the contract. Over time, well-established principles and conventions have developed to address such issues, often relying on territorial connections such as the place where a contract was executed, performed, or breached.

However, the emergence of space commercialization significantly complicates the application of these principles. One of the core challenges is the absence of territorial sovereignty in outer space. Unlike activities on Earth, outer space is not subject to the sovereignty of any single state, making it difficult to apply traditional jurisdictional rules that are largely based on

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<sup>19</sup> Katherine Todd et al., *Jurisdictional Issues in Cross-Border Litigation*, 1 J. Int'l Com. L. & Tech. 46 (2020), <https://jiclt.com/article/jurisdictional-issues-in-cross-border-litigation-74/>.

<sup>20</sup> Marta Requejo Isidro, *Recognition and Enforcement of Judgments*, in *Comparative Procedural Law and Justice* (Burkhard Hess et al. eds., Oct. 2024), <https://www.cplj.org/publications/14-7-recognition-and-enforcement-of-judgments>

territory<sup>21</sup>. Additionally, space activities often involve multiple actors from different jurisdictions, including private companies, states, and international organizations. For instance, a single space mission may involve a spacecraft registered in one country, launched from another, and operated by a private entity incorporated elsewhere.

This multi-jurisdictional nature creates uncertainty in determining which court has authority, which law should apply, and how judgments can be enforced. As a result, the traditional principles of private international law are increasingly strained in the context of space activities, highlighting the need for their adaptation to this rapidly evolving domain<sup>22</sup>.

### JURISDICTIONAL CHALLENGES IN SPACE COMMERCIAL ACTIVITIES

One of the most complex legal issues arising from the commercialization of outer space is the question of jurisdiction. Unlike terrestrial or maritime domains, outer space is characterized by the absence of territorial sovereignty. No state can claim ownership over outer space or celestial bodies, which fundamentally complicates the application of traditional jurisdictional principles under private international law<sup>23</sup>. On Earth, jurisdiction is typically determined based on territory, but in space, this foundational basis does not exist, creating significant ambiguity.

In the absence of territorial sovereignty, jurisdiction over space activities is primarily derived from alternative connecting factors. One such basis is the state of registration of a spacecraft<sup>24</sup>. Under existing international legal frameworks, a spacecraft is generally subject to the jurisdiction and control of the state in which it is registered. This effectively creates a legal fiction whereby the spacecraft is treated as an extension of the territory of the registering state. While this principle provides some level of legal certainty, it is not always sufficient in resolving disputes involving multiple actors from different jurisdictions.

Another important connecting factor is the nationality of the parties involved. In commercial space activities, private entities from different countries often collaborate or interact, leading

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<sup>21</sup> Wayne N. White Jr., *Property and Sovereignty in Space—As Countries and Companies Take to the Stars, They Could Run into Disputes*, THE CONVERSATION (Jan. 31, 2025), <https://theconversation.com/property-and-sovereignty-in-space-as-countries-and-companies-take-to-the-stars-they-could-run-into-disputes-245334>

<sup>22</sup> Zarlala Khan, *Private International Law in the Digital Age: Evolution and Application*, HERTFORDSHIRE L. & EDUC. SCH. BLOG (Apr. 10, 2024), <https://uhertslawblog.wordpress.com/2024/04/10/private-international-law-in-the-digital-age-evolution-and-application/>

<sup>23</sup> Edmarverson A. Santos, *International Law and the Regulation of Outer Space*, DIPLOMACY & LAW (July 4, 2025), <https://www.diplomacyandlaw.com/post/international-law-and-the-regulation-of-outer-space>

<sup>24</sup> LawsLearned, *Spacecraft Registration Processes*, <https://lawslearned.com/spacecraft-registration-processes/>

to situations where multiple national laws could potentially apply<sup>25</sup>. For instance, a contract between a satellite operator based in one country and a launch service provider in another may give rise to jurisdictional disputes if a disagreement arises. In such cases, courts may rely on nationality or contractual choice-of-law clauses, but these solutions are not always consistent or predictable.

These overlapping bases of jurisdiction often result in significant legal complications. One major issue is the possibility of multiple states claiming jurisdiction over the same activity or dispute<sup>26</sup>. For example, a spacecraft registered in one country, operated by a company incorporated in another, and causing damage to a satellite owned by a third country could trigger competing jurisdictional claims. This multiplicity creates uncertainty for private actors and increases the risk of conflicting legal outcomes.

Closely related to this is the problem of regulatory conflicts. Different states have varying legal standards, licensing requirements, and liability rules governing space activities<sup>27</sup>. When multiple jurisdictions are involved, private entities may face inconsistent or even contradictory obligations. This not only increases compliance costs but also discourages investment and innovation in the space sector.

Practical examples help illustrate these challenges more clearly. Consider a scenario involving a satellite collision in orbit. If two satellites owned by companies from different countries collide, determining which court has jurisdiction becomes highly problematic<sup>28</sup>. The states of registration, the nationalities of the companies, and even the location of ground control stations could all serve as potential jurisdictional links. Without a clear and uniform framework, resolving such disputes becomes both time-consuming and legally uncertain.

Similarly, commercial disputes between companies from different countries pose significant challenges. Contracts for launch services, satellite leasing, or data sharing often involve parties

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<sup>25</sup> Anirudhanath Likhitkar, *Navigating the Celestial Frontier: Space Law in an Era of Commercialization*, Lawful Legal (June 5, 2025), <https://lawfullegal.in/navigating-the-celestial-frontier-space-law-in-an-era-of-commercialization/>

<sup>26</sup> *Legal Implications of Transnational Jurisdiction Overlaps*, LEXYARA, <https://lexyara.com/legal-implications-of-transnational-jurisdiction-overlaps/>

<sup>27</sup> Muhammed Yaseen A K & Jyotirmoy Banerjee, *Addressing the Challenges of Diverging Business Laws and Procedures Across Countries*, Indian Journal of Integrated Research in Law (Vol. V, Issue I, 2025), <https://ijirl.com/wp-content/uploads/2025/01/ADDRESSING-THE-CHALLENGES-OF-DIVERGINGBUSINESS-LAWS-AND-PROCEDURES-ACROSS-COUNTRIES.pdf>

<sup>28</sup> Arbitrae Editorial Team, *Understanding Liability for Satellite Collision Damages in International Law*, ARBITRAE (May 17, 2024), <https://arbitrae.com/liability-for-satellite-collision-damages/>

from multiple jurisdictions<sup>29</sup>. While arbitration clauses are commonly included in such agreements, they do not entirely eliminate jurisdictional issues, particularly when it comes to enforcement of awards or involvement of third parties.

An emerging concern in this context is the concept of “flags of convenience” in space<sup>30</sup>. Drawing a parallel from maritime law, companies may choose to register their spacecraft in jurisdictions with more lenient regulatory regimes or lower compliance requirements. This practice can lead to a regulatory “race to the bottom,” where states compete to attract commercial space activities by relaxing legal standards. While this may benefit companies in the short term, it undermines the development of a consistent and robust legal framework for space governance.

Given these challenges, there is a pressing need for harmonized jurisdictional rules in the context of space commercialization<sup>31</sup>. A more coordinated approach at the international level could help reduce uncertainty and ensure that disputes are resolved in a fair and predictable manner. This could involve the development of uniform principles for determining jurisdiction, greater reliance on international arbitration mechanisms, and enhanced cooperation between national legal systems.

In conclusion, the current jurisdictional framework is ill-equipped to handle the complexities introduced by private commercial activities in outer space<sup>32</sup>. Without significant legal reform and harmonization, jurisdictional conflicts are likely to become more frequent and more difficult to resolve, posing a serious obstacle to the sustainable growth of the space industry.

## LIABILITY ISSUES AND LEGAL RESPONSIBILITY

In addition to jurisdictional concerns, space commercialization raises critical questions regarding liability and legal responsibility. The existing legal framework governing liability in

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<sup>29</sup> Mariangela Balestra & Marie Vanswevelt, *International Commercial Disputes: Challenges and Solutions*, LEX IBC (May 9, 2025), <https://www.lexibc.com/en/international-commercial-disputes-challenges-and-solutions/>

<sup>30</sup> Legal Service India, *Maritime Autonomous Surface Ships & UNCLOS: Flag State Jurisdiction*, LEGAL SERV. INDIA, <https://www.legalserviceindia.com/Legal-Articles/maritime-autonomous-surface-ships-uncos-flag-statejurisdiction/>

<sup>31</sup> *International Policy Harmonization for Emerging Technologies: Challenges, Structures, and Prospects*, J. Int'l Com. L. & Tech., <https://jiclt.com/article/international-policy-harmonization-for-emerging-technologieschallenges-structures-and-prospects-62/>

<sup>32</sup> Supriya Malviya, *Jurisdictional Challenges in IPR Disputes in Cyberspace: Judicial Trends*, E-JAIRIPA (Vol. V, Issue I, Jan.–June 2024), *Jurisdictional-Challenges-in-IPR-Disputes-in-Cyberspace-Judicial-Trends-by-supriya-Malviya.pdf*

outer space is primarily rooted in public international law, which focuses on the responsibility of states rather than private actors<sup>33</sup>. However, with the increasing involvement of private entities, this state-centric approach is proving to be inadequate.

A key distinction must be made between state liability under international treaties and private liability under domestic laws<sup>34</sup>. Under international space law, states bear responsibility for national space activities, regardless of whether they are conducted by governmental agencies or private companies. This means that if a private company causes damage in outer space, the state that authorized or registered the activity may be held internationally liable.

On the other hand, private liability is governed by domestic legal systems. National laws may impose liability on private companies for damages caused by their activities, often requiring them to obtain licenses and insurance coverage<sup>35</sup>. However, these domestic regimes vary significantly from one country to another, leading to inconsistencies in how liability is assigned and enforced. One of the central issues in this area is determining who is ultimately responsible for damages caused by private actors. While international law places liability on states, in practice, the damage may be caused by a private company operating for profit<sup>36</sup>. This creates a disconnect between the entity responsible for the harm and the entity held legally accountable. States may attempt to shift this burden back to private operators through indemnification agreements, but this is not always straightforward.

Another important issue is the concept of indirect liability of launching states. Under international legal principles, a launching state may be held liable for damage caused by a space object, even if the object is owned and operated by a private entity<sup>37</sup>. This creates a form of vicarious liability, where the state is held responsible for activities it may not directly control.

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<sup>33</sup> Asian-African Legal Consultative Organization, *Legal Issues in Outer Space* (2025), <https://www.aalco.int/63rdAnnualSession/Briefs2025/Final%20Legal%20Issues%20in%20Outer%20Space%202025.pdf>

<sup>34</sup> Shreya Sharma, *The Influence of International Treaties on Domestic Laws*, LawArticle (Aug. 27, 2024), <https://lawarticle.in/the-influence-of-international-treaties-on-domestic-laws/>

<sup>35</sup> Vikrant Rana & Shantam Sharma, *Modernising Space Liability: A Comparative Analysis of the UN Liability Convention and Indian Government Policy*, S.S. Rana & Co. (Feb. 14, 2025), <https://ssrana.in/articles/modernising-space-liability-a-comparative-analysis-of-the-un-liability-convention-and-indian-government-policy/>

<sup>36</sup> Sophie Goguichvili et al., *The Global Legal Landscape of Space: Who Writes the Rules on the Final Frontier?*, Wilson Ctr. (Oct. 1, 2021), <https://www.wilsoncenter.org/article/global-legal-landscape-space-who-writes-rulesfinal-frontier>

<sup>37</sup> Advik Rijul Jha, *Synchronising the Interpretation of Article VII of the Outer Space Treaty and State Obligations with the Growth of Private Players in Space*, The Contemporary Law Forum (Nov. 29, 2023), <https://tclf.in/2023/11/29/synchronising-the-interpretation-of-article-vii-of-the-outer-space-treaty-and-stateobligations-with-the-growth-of-private-players-in-space/>

As a result, states are often cautious in granting licenses for space activities and may impose strict regulatory requirements on private operators. The challenges in this area are further compounded by the lack of uniform liability standards<sup>38</sup>. Different countries have adopted different approaches to liability, including varying thresholds for fault, different caps on damages, and diverse insurance requirements. This lack of consistency creates uncertainty for private actors and complicates the resolution of cross-border disputes.

Another major difficulty lies in the proof of fault in space-related accidents. Space is a highly technical and complex environment, and determining the cause of an incident, such as a satellite collision, can be extremely challenging<sup>39</sup>. Factors such as space debris, orbital congestion, and technical malfunctions can all contribute to accidents, making it difficult to assign responsibility. In many cases, there may be insufficient evidence to conclusively establish fault, leading to prolonged disputes and unresolved claims.

To mitigate these risks, the space industry relies heavily on insurance mechanisms. Companies are typically required to obtain insurance coverage as a condition of their operating licenses<sup>40</sup>. This helps ensure that compensation is available in the event of damage, even if liability is disputed. However, insurance alone cannot address all legal uncertainties, particularly in cases involving multiple jurisdictions or large-scale damages.

Finally, there exists a significant gap between public international law and private law remedies. While international law provides a framework for state responsibility, it does not offer clear or direct remedies for private parties seeking compensation<sup>41</sup>. Victims of spacerelated damage often have to rely on domestic legal systems, which may not be equipped to handle the unique challenges of space activities. This fragmentation creates barriers to effective legal redress and undermines confidence in the legal system.

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<sup>38</sup> *India's Liability Insurance Landscape: Challenges & Opportunities*, Liability Insurance Practice (Mar. 2025), <https://www.liabilityinsurancepractice.com/wp-content/uploads/2025/03/Liability-Insurance-LandscapeChallenges-Opportunities-1.pdf>

<sup>39</sup> Randeep Bubbra, Laura Lintott & Michala Kucharikova, *Collisions in Space – May the Force of Law Be with You*, Watson Farley & Williams LLP (2024), <https://www.wfw.com/articles/collisions-in-space-may-the-force-of-law-be-with-you/>

<sup>40</sup> Matt Swayne, *A Guide to Space Insurance: How Insurers Master the Risky Stuff for the Space Industry*, Space Insider (Mar. 6, 2025), <https://spaceinsider.tech/2025/03/06/a-guide-to-space-insurance-how-insurers-master-the-risky-stuff-for-the-space-industry/>

<sup>41</sup> Jane Doe, *Global Justice and Trade*, 21 Wash. U. Glob. Stud. L. Rev. 345 (2022), <https://journals.library.wustl.edu/globalstudies/article/9034/galley/25778/view/>

In conclusion, the current liability regime is not fully adapted to the realities of space commercialization. The increasing role of private actors necessitates a more integrated approach that bridges the gap between state responsibility and private liability<sup>42</sup>. Without clearer rules and greater harmonization, issues of liability and legal responsibility are likely to remain a significant challenge in the evolving landscape of space law.

## DISPUTE RESOLUTION MECHANISMS

With the rapid growth of commercial activities in outer space, disputes between private actors are becoming increasingly inevitable. At present, there is no dedicated or universally accepted mechanism for resolving such disputes<sup>43</sup>. Instead, parties largely rely on traditional legal avenues such as national courts and arbitration, both of which present significant limitations in the context of space-related activities.

National courts remain one of the primary forums for dispute resolution. In many cases, jurisdiction is determined based on factors such as the place of incorporation of the company, the location of contractual obligations, or the state of registration of a spacecraft<sup>44</sup>. However, this approach is not always effective in the space context. Space activities often involve multiple actors from different jurisdictions, making it difficult to determine which court has the most appropriate authority. Additionally, the absence of territorial sovereignty in outer space complicates the application of conventional jurisdictional principles. As a result, reliance on domestic courts may lead to overlapping claims or, in some cases, a complete lack of jurisdictional clarity.

Arbitration has emerged as a preferred alternative, particularly in commercial contracts involving private space companies. Many space-related agreements now include arbitration clauses, allowing parties to resolve disputes in a neutral and flexible forum<sup>45</sup>. Arbitration offers several advantages, including confidentiality, procedural flexibility, and the ability to appoint arbitrators with technical expertise in space law or related fields. This makes it particularly

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<sup>42</sup> Biswanath Gupta & K.D. Raju, *Understanding International Space Law and the Liability Mechanism for Commercial Outer Space Activities—Unravelling the Sources*, 75 *India Q.* 555 (2019), <https://doi.org/10.1177/0974928419874553>

<sup>43</sup> Clyde & Co LLP, *Overview of Dispute Resolution Mechanisms for SPAC*, <https://www.clydeco.com/en/insights/2024/03/overview-of-dispute-resolution-mechanisms-for-spac> (Mar. 2024).

<sup>44</sup> Smarika Singh et al., *Litigation & Dispute Resolution Laws and Regulations 2026 – India*, ICLG (Feb. 17, 2026), <https://iclg.com/practice-areas/litigation-and-dispute-resolution-laws-and-regulations/india>

<sup>45</sup> Narendra Madhu Associates, *The Rise of Arbitration in India: International Norms and Domestic Practice* (July 14, 2025), <https://nma.legal/the-rise-of-arbitration-in-india-international-norms-and-domestic-practice/>

suitable for resolving complex, high-value disputes arising from satellite operations, launch services, or joint ventures.

Despite its advantages, arbitration is not without its challenges. One of the key issues is the enforcement of arbitral awards across different jurisdictions<sup>46</sup>. While international conventions facilitate enforcement to some extent, practical difficulties may still arise, especially when parties operate in states with differing legal standards or limited cooperation. Similarly, judgments issued by national courts may not always be easily enforceable in other countries, further complicating dispute resolution.

Another major concern is the lack of specialized tribunals dedicated to space-related disputes. Unlike other fields of international law, such as trade or investment, there is no permanent international body specifically designed to handle disputes arising from space commercialization<sup>47</sup>. This gap becomes more evident as the number and complexity of such disputes continue to increase. Existing forums may lack the technical expertise or consistency required to address the unique legal and scientific issues involved.

In this context, arbitration institutions are playing an increasingly important role. Many parties prefer arbitration precisely because it offers a neutral forum that is not tied to any particular national legal system<sup>48</sup>. This neutrality is particularly valuable in disputes involving parties from different countries with potentially conflicting legal interests. Furthermore, arbitration allows for greater party autonomy, enabling stakeholders to tailor procedures to their specific needs.

Looking ahead, there is a strong case for the development of specialized international dispute resolution mechanisms for space law. Such bodies could provide a more structured and consistent approach to resolving disputes, while also incorporating technical expertise<sup>49</sup>. Whether through the establishment of a dedicated international tribunal or the adaptation of

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<sup>46</sup> S. M. Nawaz Ahmad, *Enforcement of Arbitral Awards: A Global Odyssey Through Legal Frameworks and Enforcement Challenges*, THE LEGAL QUORUM (Aug. 9, 2024), <https://thelegalquorum.com/enforcement-of-arbitral-awards-a-global-odyssey-through-legal-frameworks-and-enforcement-challenges/>

<sup>47</sup> Roys Qaribilla & Ahmad Khoirul Umam, *International Law and International Relations: Role and Relationship*, ResearchGate (2021), [https://www.researchgate.net/publication/351160217\\_INTERNATIONAL\\_LAW\\_AND\\_INTERNATIONAL\\_RELATIONS\\_ROLE\\_AND\\_RELATIONSHIP](https://www.researchgate.net/publication/351160217_INTERNATIONAL_LAW_AND_INTERNATIONAL_RELATIONS_ROLE_AND_RELATIONSHIP)

<sup>48</sup> Martin Taggart, *Role of Arbitration Institutions in International Dispute Resolution*, MARTIN TAGGART (Oct. 8, 2025), <https://martintaggart.com/arbitration-institution/>

<sup>49</sup> All Multidisciplinary Journal, MGE-2025-4-126.1, [https://www.allmultidisciplinaryjournal.com/uploads/archives/20250719141818\\_MGE-2025-4-126.1.pdf](https://www.allmultidisciplinaryjournal.com/uploads/archives/20250719141818_MGE-2025-4-126.1.pdf)

existing institutions, the creation of a more coherent dispute resolution framework is essential for ensuring legal certainty and fostering confidence in the commercial space sector.

## REGULATORY FRAGMENTATION AND NATIONAL SPACE LAWS

One of the most significant challenges arising from space commercialization is the increasing fragmentation of legal frameworks at the national level<sup>50</sup>. In the absence of a comprehensive and binding international regime governing private space activities, individual states have begun to develop their own domestic space laws. While this reflects a positive effort to regulate emerging industries, it has also resulted in considerable inconsistency across jurisdictions.

Different countries have adopted varied approaches to regulating private space actors, particularly with regard to licensing requirements. In some jurisdictions, licensing procedures are highly stringent, involving detailed compliance obligations and continuous regulatory oversight<sup>51</sup>. In others, the process is comparatively lenient, with fewer barriers to entry for private companies. This divergence creates an uneven regulatory landscape, where companies may choose to operate in jurisdictions with more favorable or less restrictive legal conditions.

Another area of significant variation is liability. Some states impose strict liability on private operators for damages caused by their space activities, while others provide liability caps or require mandatory insurance coverage<sup>52</sup>. These differences can have a substantial impact on the allocation of risk and the overall cost of commercial operations. As a result, companies may strategically select jurisdictions that offer more advantageous liability regimes.

This regulatory diversity gives rise to the risk of forum shopping, where parties deliberately choose a legal system that is most beneficial to their interests. While this may be advantageous for individual actors, it can undermine the integrity and predictability of the legal system as a whole. Additionally, regulatory competition between states may lead to a “race to the bottom,” where countries lower their standards in order to attract investment and promote their domestic

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<sup>50</sup> LawCrust Editorial Team, Navigating Space Law in India: Legal & Regulatory Challenges for Emerging Commercial Space Ventures, LAWCRUST, <https://lawcrust.com/space-law-in-india/>

<sup>51</sup> VeriCourt Legal Team, Licensing Law in Different Jurisdictions, VERICOURT, <https://vericourt.com/licensing-law-in-different-jurisdictions/>

<sup>52</sup> Vikrant Rana & Shantam Sharma, *Modernising Space Liability: A Comparative Analysis of the UN Liability Convention and Indian Government Policy*, S.S. Rana & Co. (Dec. 11, 2024), <https://ssrana.in/articles/modernising-space-liability-a-comparative-analysis-of-the-un-liability-convention-andindian-government-policy/>

space industries.

The lack of coordination between national legal systems further exacerbates these challenges. Without harmonized rules or mutual recognition frameworks, conflicts of law are likely to arise, particularly in cross-border disputes involving multiple parties<sup>53</sup>. This not only increases legal uncertainty but also raises transaction costs, as companies must navigate a complex web of differing regulations.

In light of these issues, there is a clear need for greater coordination and harmonization of national space laws. While complete uniformity may not be feasible, the development of common principles or model laws could help reduce inconsistencies and promote greater legal certainty. International cooperation, whether through formal agreements or soft law instruments, will play a crucial role in bridging the gaps between domestic legal systems<sup>54</sup>. Ultimately, a more coordinated approach is essential for ensuring that the growth of space commercialization is supported by a stable and predictable legal framework.

## **EMERGING ISSUES IN SPACE COMMERCIALIZATION**

The rapid expansion of commercial activities in outer space has given rise to several complex legal issues that remain inadequately addressed under existing frameworks. One of the most debated concerns is space mining and property rights. While technological advancements now make the extraction of resources from celestial bodies increasingly feasible, the legal status of such resources remains uncertain. International space law traditionally prohibits national appropriation of outer space, yet some states have enacted domestic laws allowing private entities to exploit space resources<sup>55</sup>. This creates tension between international obligations and national legislation, raising questions about ownership, jurisdiction, and the enforceability of rights across borders issues that fall squarely within the domain of private international law.

Another emerging sector is space tourism, which introduces significant concerns regarding consumer protection. As private companies begin offering commercial space travel, questions

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<sup>53</sup> World Jurisprudence Editorial Team, *Legal Pluralism and Conflict of Laws*, World Jurisprudence (May 15, 2024), <https://worldjurisprudence.com/legal-pluralism-and-conflict-of-laws/>

<sup>54</sup> Tan Hsien-Li, *No Longer Hard Law's 'Poor Relative': The Growing Respect for Soft, Non-Binding Legal Instruments in the International Order*, EJIL: Talk! (June 6, 2025), <https://www.ejiltalk.org/no-longer-hard-lawspoor-relative-the-growing-respect-for-soft-non-binding-legal-instruments-in-the-international-order/>

<sup>55</sup> The Legal Quorum, *Space Law and Commercial Exploitation: Regulating Private Players in Outer Space*, THE LEGAL QUORUM (Nov. 2, 2025), <https://thelegalquorum.com/space-law-and-commercial-exploitationregulating-private-players-in-outer-space-2/>

arise about passenger safety, liability for accidents, and the applicable legal regime governing such contracts. Given the multinational nature of these transactions—where the company, spacecraft registration, and passengers may all belong to different jurisdictions—determining applicable law and forum becomes increasingly complex.

The issue of data ownership from satellites further complicates matters. Satellites generate vast amounts of data used for commercial, governmental, and scientific purposes. However, there is no clear consensus on who owns this data or how it can be regulated, especially when data is collected over multiple jurisdictions<sup>56</sup>. This creates potential conflicts regarding intellectual property rights, privacy, and cross-border data transfers, all of which require coherent private international law solutions.

Environmental concerns, particularly space debris, also pose a serious challenge. The accumulation of debris increases the risk of collisions, potentially causing damage to operational satellites and spacecraft<sup>57</sup>. Determining liability for such damage is difficult, especially when multiple actors contribute to the problem. Existing liability frameworks are largely state-centric and do not adequately address the role of private actors, leaving significant gaps in enforcement and compensation mechanisms.

Finally, there are broader ethical concerns, especially the tension between militarization and commercialization of outer space. As private entities collaborate with governments, the line between commercial and military uses becomes blurred. This raises questions about accountability and regulatory oversight in situations where private activities may indirectly contribute to strategic or military objectives.

Overall, these emerging issues highlight the limitations of existing private international law in addressing cross-border disputes in outer space. The absence of clear jurisdictional rules, uniform standards, and enforcement mechanisms creates legal uncertainty, which could hinder the sustainable development of space commercialization.

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<sup>56</sup> Climate & Societal Benefits Subcomm. of the Nat'l Space Council Users' Advisory Grp., *Space Data Ethics: The Next Frontier in Responsible Leadership* (Dec. 1, 2023), <https://www.nasa.gov/wp-content/uploads/2024/02/white-paper-space-data-ethics-2023-12-01-final-002.pdf>

<sup>57</sup> World Economic Forum, *Why Space Debris Is a Growing Problem: These Leaders Have a Plan to Tackle It*, WORLD ECON. F. (June 13, 2023), <https://www.weforum.org/stories/2023/06/orbital-debris-space-junkremoval/>

## NEED FOR LEGAL REFORM AND HARMONIZATION

In light of the challenges posed by space commercialization, there is a pressing need for legal reform and greater harmonization of laws at the international level. The current legal framework, which largely relies on state responsibility, is insufficient to regulate the growing involvement of private actors<sup>58</sup>. Therefore, developing uniform international standards is essential to ensure consistency and predictability in legal outcomes. Such standards could address key issues like liability, jurisdiction, and dispute resolution in a manner that accommodates both state and private interests.

One possible approach is the adoption of model laws or new international treaties that specifically address commercial space activities. Model laws could serve as a guide for states when formulating their domestic legislation, thereby reducing inconsistencies across jurisdictions. At the same time, new multilateral treaties could help clarify the rights and obligations of private entities operating in outer space, while reinforcing existing principles of international space law.

There is also a need to strengthen the interaction between public international law and private international law. While public international law governs state conduct in outer space, private international law plays a crucial role in resolving disputes involving private parties<sup>59</sup>. A more integrated approach would help bridge the gap between these two fields, ensuring that legal principles are applied coherently in complex, multi-jurisdictional scenarios.

International cooperation will be key to achieving effective regulation. Given the global nature of space activities, unilateral approaches by individual states are unlikely to succeed<sup>60</sup>. Collaborative efforts through international organizations and forums can facilitate dialogue, promote consensus, and encourage the adoption of common standards.

In terms of practical frameworks, both multilateral agreements and soft law instruments can play an important role. While binding treaties provide legal certainty, soft law mechanisms

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<sup>58</sup> Oxford Research Encyclopedia of Planetary Science, *Astrobiology (Overview)*, Oxford University Press, <https://oxfordre.com/planetaryscience/display/10.1093/acrefore/9780190647926.001.0001/acrefore9780190647926-e-42>

<sup>59</sup> Law Society Online Editorial, *Understanding Private vs Public Space Law: Key Differences Explained*, Law Society Online (May 19, 2024), <https://lawsocietyonline.com/private-vs-public-space-law/>

<sup>60</sup> Center for Strategic & International Studies, *Strengthening International Governance in Space*, CSIS (n.d.), <https://www.csis.org/analysis/strengthening-international-governance-space>

such as guidelines, codes of conduct, and best practices offer flexibility and can be developed more quickly in response to technological advancements. Together, these tools can create a balanced regulatory environment.

Ultimately, any legal reform must strike a careful balance between encouraging innovation and ensuring regulation. Over-regulation may stifle technological progress and investment, while under-regulation could lead to legal uncertainty and potential misuse of space resources<sup>61</sup>. A well-designed legal framework should therefore promote responsible commercialization while safeguarding the long-term sustainability of outer space activities.

## CONCLUSION

In conclusion, the rapid expansion of commercial activities in outer space has clearly moved faster than the development of corresponding legal frameworks. What was once a domain controlled almost entirely by states is now increasingly shaped by private actors engaging in satellite operations, space tourism, and even resource extraction. This shift has exposed significant limitations within existing legal systems, particularly in the sphere of private international law. Issues relating to jurisdiction, applicable law, and enforcement of decisions become far more complex in an environment where traditional notions of territory do not apply. As a result, conflicts involving multiple parties across different legal systems remain difficult to resolve with certainty and consistency.

This paper has argued that space commercialization not only challenges the adequacy of current public international law regimes but also highlights critical gaps in private international law. The absence of clear and harmonized rules governing private disputes in space creates legal uncertainty, which can ultimately hinder both accountability and commercial growth. Therefore, the need for a more coherent and adaptable legal framework becomes evident.

There is an urgent necessity for the international community to address these challenges through legal reform and greater cooperation. Developing uniform principles, encouraging harmonization of national laws, and strengthening dispute resolution mechanisms will be essential steps in this direction. Looking ahead, space law must evolve in a manner that

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<sup>61</sup> Avinash Verma & Divyansh Singh, *Regulating the Digital Leviathan: Legal Challenges and Reform Pathways in India's AI, Data, and Cybersecurity Landscape*, Indian J. L. & Legal Rsch., <https://www.ijllr.com/post/regulating-the-digital-leviathan-legal-challenges-and-reform-pathways-in-india-s-aidata-and-cybe>

balances innovation with responsibility, ensuring that commercial activities are conducted fairly, disputes are effectively resolved, and the long-term sustainability of outer space is preserved for future generations.