

Intellectual Property in Space Tourism: Gaps in International Law and the Need for New Regulations

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Space tourism, as one of the emerging forms of commercial exploitation of outer space, has raised numerous challenges in the field of international law. Among the most significant of these challenges is the legal status of intellectual property concerning technologies, inventions, trademarks, and artistic works associated with such travel. While the core space law treaties — including the 1967 Outer Space Treaty and the 1979 Moon Agreement — establish fundamental principles such as the freedom of use and the concept of the “common heritage of humankind,” none directly addresses the issue of intellectual property rights. Likewise, the key instruments of the international intellectual property system, such as the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) and the conventions administered by the World Intellectual Property Organization (WIPO), lack specific provisions applicable to transnational situations in outer space. Consequently, at the intersection of these two legal systems, there are evident gaps that could lead to conflicts between the private interests of commercial enterprises and the principle of safeguarding the common interests of the international community. Through a comparative analysis of existing regulations and practices in the United States, the European Union, and international legal instruments, this article demonstrates that the current framework of international law is insufficient to address the emerging issues of intellectual property in space tourism and highlights the urgent need for the development of new, globally recognized rules.

Keywords: *Intellectual Property; Space Tourism; International Space Law; World Intellectual Property Organization (WIPO).*

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1. Introduction

In recent decades, space tourism has transformed from a science-fiction concept into an emerging reality. Companies such as SpaceX, Blue Origin, and Virgin Galactic, by offering suborbital and short orbital flights, have demonstrated that outer space is no longer an exclusive domain for states and governmental missions but also a sphere for commercial exploitation

and private investment (Johnson, 2019). These developments have raised fundamental questions within international law, especially concerning intellectual property (IP), which is directly connected to advanced technologies and cultural outputs. The nexus between space technologies and IP is extensive. On one hand, inventions related to spacecraft design, navigation systems, and sophisticated software require legal



protection. On the other, trademarks and commercial brands associated with space tourism play a critical role in competitive markets (von der Dunk, 2015c). Additionally, space data generated through tourist missions hold significant economic and scientific value and may qualify for copyright protection (Franssen, 2021). Even artistic and cultural works created in space—from documentary films to digital content—fall under the scope of IP rights and require a clear international protection regime (Franssen, 2021).

Despite this importance, there are evident gaps in the international legal system. The main space law treaties, particularly the 1967 Outer Space Treaty and the 1979 Moon Agreement, focus primarily on principles such as freedom of use, non-appropriation, and the “common heritage of humankind,” yet none provides explicit provisions regarding IP rights (Christol, 1980; Gabrynowicz, 2010). Meanwhile, key global IP instruments, including the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) and the conventions administered by the World Intellectual Property Organization (WIPO), are designed largely on the principle of territorial jurisdiction and have not anticipated the transnational nature of outer space (Benkö & Schrogl, 2006; Correa, 2007). This structural tension between the two legal regimes creates gaps that may lead to serious conflicts between the private interests of commercial enterprises and the collective interests of humankind (Drahos, 2016b; von der Dunk, 2015b).

In light of these realities, the main research questions of this article are as follows: first, does the current framework of international law adequately address the emerging IP challenges in space tourism? Second, what legal gaps exist in this area and how can they be bridged? Third, what international mechanisms could balance private and public interests? Accordingly, the hypotheses of the study are: (1) the current international legal framework, due to its inherent and historical limitations, is insufficient to meet the legal needs of space tourism in the field of IP; (2) without developing new rules and fostering cooperation between WIPO and the United Nations Office for Outer Space Affairs (UNOOSA), the risk of conflicts of interest and legal disputes will increase; and (3) only by creating a complementary and harmonized legal system can a balance be achieved between the private interests of active companies and

the collective interests of humankind (Jakhu & Pelton, 2017; Wipo, 2019).

The methodology of this research is based on a descriptive-analytical approach combined with a comparative legal analysis. This means that the theoretical foundations and relevant international instruments concerning IP and space law are first examined, followed by an analysis of the existing gaps and challenges in light of practical examples and national experiences (such as those of the United States and the European Union) (European Space Policy, 2017; Lyall & Larsen, 2018). Finally, reform-oriented and structural recommendations are presented to outline a pathway for developing new rules at the global level. The research framework includes four main sections: the first discusses conceptual and theoretical foundations; the second analyzes current gaps and challenges; the third focuses on comparative experiences and existing practices; and the fourth examines the need for new rules and reform proposals. In doing so, this article aims to combine theoretical underpinnings with practical legal analysis to provide a comprehensive understanding of IP in space tourism and to underscore the urgent need for the international community to act promptly in closing existing legal gaps (Harrison, 2020; Hobe, 2020).

2. Materials and Methods

This study employed a descriptive-analytical research method and relied on library-based sources for data collection and analysis.

2.1. Theoretical Foundations

This section explains the concept and scope of intellectual property (IP) in international law and then addresses space tourism.

2.2. The Concept and Scope of Intellectual Property in International Law

Intellectual property, as one of the fundamental domains of international law, consists of a set of exclusive rights granted to creators of intellectual works and technological innovations. Broadly, it is divided into two main branches: industrial property and literary and artistic property. Industrial property includes patents, trademarks, industrial designs, and geographical indications. Its primary aim is to protect technical

innovations and to distinguish products and services in competitive markets. For example, registering patents in the field of space technologies allows inventors to secure exclusive exploitation of their achievements and prevent unauthorized copying or misuse (Mirkarimi et al., 2013). Literary and artistic property — commonly referred to as copyright and neighboring rights — covers the protection of literary, artistic, musical, dramatic, and digital works. This branch primarily focuses on safeguarding cultural and artistic creativity and enables authors to enjoy both economic and moral benefits of their works (Ricketson & Ginsburg, 2006). At the international level, several key instruments constitute the foundation of the global IP regime. First, the Paris Convention for the Protection of Industrial Property, which provides the earliest comprehensive framework for cross-border protection of patents, trademarks, and industrial designs (Soleimani, 2008). Second, the Berne Convention for the Protection of Literary and Artistic Works, which introduced principles such as automatic protection and national treatment for cultural and artistic works (Ricketson & Ginsburg, 2006). Third, the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), adopted under the World Trade Organization, which sets binding minimum standards for both industrial and literary-artistic property (Correa, 2007). Finally, the World Intellectual Property Organization (WIPO), established in 1967 as a specialized UN agency, plays a central role in harmonizing national laws, drafting new treaties, and facilitating international cooperation in this field (Gervais, 2021; Wipo, 2019).

With the rapid advancement of modern technologies — particularly in biotechnology, information technology, and outer space — the relationship between IP and emerging technologies has become increasingly significant. Legal protection for space-related inventions, artificial intelligence software, and big data shows that the IP system must adapt to new environments (Drahoš, 2016b). For instance, data generated during space missions or digital content created in transnational contexts often do not fit neatly into traditional copyright frameworks and may require revisiting existing legal rules (Hugenholtz, 2016). Thus, while classic IP instruments provide a solid legal foundation, they face serious limitations in addressing innovations and activities such as space tourism.

2.3. *Space Tourism and Its Position in International Space Law*

Space tourism, as one of the novel developments in space activities, has in recent decades evolved from science-fiction into a tangible commercial venture. It refers to the travel of private individuals beyond Earth's atmosphere for purposes other than governmental or research missions and is often pursued for commercial, recreational, or even educational objectives (Masson-Zwaan & Freeland, 2010). This phenomenon presents not only economic and technological dimensions but also raises new legal questions at the international level. Among the most critical questions is whether the existing framework of international space law can respond to the legal challenges posed by space tourism. International space law is built on five core UN treaties. First, the 1967 Outer Space Treaty (OST), the foundational instrument, establishes principles such as the freedom of exploration and use of space by all states, the prohibition of territorial sovereignty, and the peaceful use of outer space (Gabrynowicz, 2010). Second, the 1979 Moon Agreement emphasizes the natural resources of celestial bodies and articulates the concept of the "common heritage of humankind," although it has been ratified by few states (Ghaffarian Keblou et al., 2022). Third, the 1972 Liability Convention defines the international liability regime of states for damages caused by space activities. Fourth, the 1976 Registration Convention obliges states to register launched objects in an international registry to increase transparency in outer space activities (von der Dunk, 2015a). Alongside these treaties, there are fundamental principles governing all space activities, including space tourism. These include: the principle of freedom of use, allowing all states to explore and use space as long as it does not interfere with others' rights; the principle of non-appropriation, which prohibits any country from claiming sovereignty or ownership over parts of outer space or celestial bodies (Jasentuliyana, 1992); and the principle of the common interest of humankind, requiring that the use of space benefit all countries regardless of their economic or scientific development. Nevertheless, these space law instruments do not explicitly regulate space tourism. At the time of their drafting, the concept was practically unimaginable. Consequently, there are multiple legal gaps today — including the undefined status of space tourists, the

scope of liability for private space companies, and the lack of clear IP protection for technologies and services related to space tourism (Tronchetti, 2015; von der Dunk, 2015c). The pressing question remains: how can the existing principles of international space law be expanded or complemented to address the legal challenges of space tourism?

2.4. *The Intersection of Intellectual Property and Space Law*

The increasing expansion of space activities — especially with the participation of private actors and the rise of phenomena such as space tourism — has triggered complex questions about the interaction between IP and space law. IP law is designed to protect human creativity, including inventions, trademarks, literary and artistic works, and scientific data (Gervais, 2021). Conversely, space law regulates the exploration and use of outer space and emphasizes freedom of exploitation, non-appropriation, and the common interest of humankind (Lyll & Larsen, 2018). The intersection of these two fields becomes apparent when technological innovations and data generated from space activities require legal protection against unauthorized use, while space law imposes constraints on the assertion of private ownership.

One of the earliest areas of overlap involves spacecraft design and related technologies. Private companies competing in the space tourism market invest heavily in novel hull structures, safety systems, and propulsion technologies. These innovations often qualify for patent protection or trade secret status (Harrison, 2020). However, enforcing such rights in outer space is challenging because the principle of non-appropriation in the Outer Space Treaty prevents any state from asserting absolute exclusive jurisdiction over activities conducted in outer space (von der Dunk, 2015b). Another key example is spacecraft navigation and flight control software. These complex programs, often powered by artificial intelligence and autonomous systems, may be protected as literary works or, in some jurisdictions, as patentable inventions (Reinbothe & Lewinski, 2015). Yet in multinational missions or commercial flights, determining jurisdiction and enforcing IP rights over such software becomes contentious.

Scientific and commercial data represent another significant area of overlap. Space tourism missions generate massive amounts of data, including imagery, biological experiment results, climate information, and even behavioral data about space tourists. These data are economically and strategically valuable and can be protected under IP regimes as database rights or trade secrets (Drahos, 2016a). However, the principle of the “common interest of humankind” in space law suggests that scientific outcomes from outer space activities should remain widely accessible, creating tension between scientific transparency and the need to protect private economic interests (Hobe, 2013; von der Dunk & Tronchetti, 2016).

Overall, the intersection of IP and space law is a dynamic and challenging field where public and private interests converge. Spacecraft design, navigation software, and scientific data illustrate areas requiring rethinking of international legal frameworks, particularly in the era of commercial space tourism. Without clear and harmonized rules, conflicts between exclusive IP rights and the foundational principles of space law will persist.

3. **Gaps and Challenges in International Law**

This section explains the gaps and challenges of international law in relation to the variables under discussion.

3.1. *Absence of Specific Rules on Intellectual Property in Outer Space*

One of the most prominent legal challenges in the realm of space tourism—and space activities more generally—is the absence of specific rules on the protection of intellectual property (IP) rights. The core space treaties adopted in the 1960s and 1970s, including the 1967 Outer Space Treaty, the 1979 Moon Agreement, and the 1972 Liability Convention, were largely drafted to regulate inter-state relations in the exploration and use of space and to prevent its militarization. These instruments enshrine principles such as freedom of use, non-appropriation, and utilization for the common interests of humankind (Lyll & Larsen, 2018). However, none of these treaties directly addresses IP, creating a legal vacuum precisely when advanced technologies and commercial services in space—including space tourism—increasingly depend on IP rights (Hobe, 2013).

In other words, space law sets out general principles for governing the use of outer space but does not offer a dedicated protective regime for innovations, inventions, or scientific and commercial data in this domain. In practice, therefore, protection of IP in space activities defaults to national legal systems. For example, if a company patents spacecraft guidance software in a particular state, enforcing that right in a spatial environment not subject to any single state's sovereignty becomes extremely difficult (Jakhu & Pelton, 2017).

On the other hand, the principal conventions administered by the World Intellectual Property Organization (WIPO) also face limitations in the space context. The 1883 Paris Convention for the Protection of Industrial Property and the 1886 Berne Convention for the Protection of Literary and Artistic Works provide important transnational protection regimes for technological innovation and creative works. Likewise, the 1994 Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) within the World Trade Organization framework establishes a higher level of binding protection standards (Gervais, 2021). Nevertheless, all of these instruments are premised on the territoriality of IP rights; that is, patents, trademarks, and copyrights are enforceable only within the jurisdictions that recognize them (Kur & Drexler, 2018).

In outer space, such a territorial basis effectively loses its operative force, because—under the Outer Space Treaty—space is not subject to national sovereignty. As a result, applying existing WIPO-based rules to space encounters a fundamental gap: there is neither a clearly designated forum for adjudicating IP disputes arising in space nor an international agreement that provides for extraterritorial application of IP rights in this domain (von der Dunk, 2015b).

This lack of coherent regulation poses a serious challenge to private investment in the space industry. Companies developing complex and costly technologies for space tourism require reliable assurances of effective IP protection. Without such assurances, incentives to innovate and invest in this nascent sector will diminish. Accordingly, the creation of new international legal frameworks that specifically address IP in outer space is an undeniable necessity (Tronchetti, 2015; Wipo, 2019).

3.2. *Challenges of Patent and Trademark Registration and Protection in Space Tourism*

Another major legal challenge associated with space tourism concerns the registration and protection of patents and trademarks in environments lacking clear territorial sovereignty, such as low Earth orbit and the International Space Station. In the traditional IP system, the protection of patents and trademarks is exercised on a territorial basis, and each state's laws apply only within its jurisdiction (Correa, 2007). Consequently, when technological activities occur in outer space—which, under the Outer Space Treaty, is not subject to any specific national sovereignty—enforcement and exercise of registered rights become fundamentally problematic. For example, suppose a private company has patented spacecraft guidance software or a particular spacecraft hull design in one country. If this technology is used on the International Space Station or in low Earth orbit, the central question is: which state has jurisdiction over an alleged patent infringement? Should the law of the state of registration apply, or the law of the state of registry/ownership of the space station module? In many cases, such questions lack clear answers in international treaties and case law (Koosha, 2024).

A similar challenge arises for trademarks. Trademarks are designed to identify a company's goods or services and to prevent consumer confusion. Yet in space tourism, where goods and services are offered in a multinational and extraterritorial environment, determining ownership and ensuring protection of marks is difficult. For instance, a trademark registered in the United States may not enjoy the same legal protection in Earth orbit or on the International Space Station, since no state possesses territorial sovereignty over outer space (Habiba et al., 2023). In addition, the ownership and protection of space-generated data and outputs of commercial or tourist missions is complex and often contentious. Data collected from imagery, sensors, and scientific experiments may hold both commercial value and scientific significance. While private companies may seek to protect such data as trade secrets or protected databases, space law principles—particularly the notion of the “common interest of humankind”—urge that scientific results and space data be made as widely accessible as possible to the international community (von der Dunk, 2015b). This tension between private protection and public utilization represents one of the

most intricate practical challenges for IP in outer space. Ultimately, these issues indicate that national systems—and even existing international agreements—are inadequate for addressing patent and trademark registration and protection in the space environment. New legal frameworks are needed, including clear rules on jurisdiction, dispute resolution fora, and the protection of data and technologies in transnational settings, so that private investment incentives are preserved while remaining aligned with the foundational principles of space law (European Space Policy, 2017; von der Dunk & Tronchetti, 2016).

3.3. *Challenges Relating to Cultural and Artistic Works Created in Space*

With the growth of space tourism and the entry of the private sector into extra-atmospheric activities, the creation of cultural and artistic works in space has become a novel legal issue. Such works may include filming and documenting the space environment, producing music and live performances in zero gravity, as well as digital works and virtual-reality content related to space missions. From an IP perspective, these works are eligible for protection under copyright and neighboring rights (Ricketson & Ginsburg, 2006). However, the transnational and multinational character of outer space places serious pressure on traditional legal boundaries.

One principal issue is determining jurisdiction and the competent forum for enforcing authors' rights in outer space. In the traditional system, copyright protection is largely grounded in national law and in international treaties such as the 1886 Berne Convention and the WIPO Copyright Treaty (Ginsburg, 2018). These regimes generally presuppose that a work is created within a defined territory and benefits from territorial protection. When films, music, or digital content are created on the International Space Station or in Earth orbit, there is no clearly defined territorial base, and the enforcement of authors' rights becomes problematic.

Another challenge concerns the dissemination and distribution of such works. Space-created art is often digital and can be received and used simultaneously by users in multiple states. This feature exacerbates conflicts among national copyright systems and reveals the inadequacy of existing rules for transnational environments (Hugenholtz, 2016). For example, a

documentary recorded on the International Space Station might be copyrighted in the United States, yet users in Europe or Asia could re-distribute it without clearly violating their national laws, since there is no specific transnational framework governing the exercise of copyright in outer space.

Moreover, the principle of the common interests of humankind emphasized in space law may collide with the interests of owners of cultural and artistic works created in space. International organizations may request that data or content produced during space missions be made openly available for scientific or educational purposes, while creators seek to protect their economic and moral rights. This tension makes balancing public and private interests a central legal challenge (Franssen, 2021; von der Dunk, 2015b). Consequently, the legal gaps surrounding cultural and artistic works produced in space underscore the necessity of drafting new, harmonized international rules. Such rules should specify how to register and enforce copyright in transnational environments, determine jurisdiction, and balance private rights with the common interests of humankind. Given the digital nature and rapid replicability of such works, the new framework should also provide appropriate technical and legal tools for their protection in a non-territorial setting (Reinbothe & Lewinski, 2015).

3.4. *The Overlap of Private Interests and the Common Heritage of Humankind*

One of the most complex legal challenges for IP in space tourism is the overlap between private interests and the principle of the common heritage of humankind. The 1967 Outer Space Treaty and related instruments establish foundational principles such as non-appropriation and use for the common interests of humankind (Lyll & Larsen, 2018). These principles explicitly provide that no state may claim exclusive ownership over parts of outer space or celestial bodies and that space activities must benefit all humanity. By contrast, IP rights—such as patents and copyrights—grant exclusive rights of use and exploitation to their holders (Gervais, 2021). This fundamental tension between public and private rights raises serious questions about the legitimacy of asserting exclusive property-type control in transnational environments.

Exclusive rights stemming from IP can, in commercial contexts—especially in space tourism projects—enhance incentives for investment and innovation. Private companies developing advanced technologies and unique products need assurances that their rights will be protected. However, excessive exclusivity may conflict with the principles of space law. For instance, a patented spacecraft design, guidance software, or protected digital cultural content may restrict other states' or companies' access to essential technologies and data (Drahos, 2016b). Such restrictions risk over-commercialization of space and reduced public access to scientific and technological outcomes.

Conversely, the "common heritage of humankind" concept emphasized in the 1979 Moon Agreement requires that space resources and activities be used for the benefit of all humanity and that no individual or private entity enjoy absolute exclusivity over them (Christol, 1980). As private companies develop space tourism technologies and services, striking a balance between this principle and IP rights becomes a crucial challenge. Without a clear international framework, there is a risk that outer space could become a domain dominated by the economic power of a limited group of actors, contrary to the treaties' vision of equitable and peaceful utilization (von der Dunk & Tronchetti, 2016; Williamson, 2016).

The overlap of private interests and the common heritage principle is also evident with respect to scientific data and cultural works produced in space. Data collected during tourist and research missions may have both scientific and commercial value. While companies may wish to restrict such data through IP protection, space law principles encourage making the results of space activities as accessible as possible to the international community. This conflict between economic incentives and the public interest highlights the need for novel, harmonized international regulations (Tronchetti, 2015; von der Dunk, 2015b).

Ultimately, the overlap between private interests and the common heritage of humankind creates a structural challenge for IP in outer space. To prevent excessive commercialization and to ensure sustainable and equitable use, it is essential to develop a new legal framework that both supports technological innovation and private investment and respects the foundational

principles of space law (European Space Policy, 2017; Hobe, 2020).

4. Comparative Analysis and Existing Practices

This section explains the existing practical approaches.

4.1. *The Experience of the United States and the European Union*

The United States, by enacting the Commercial Space Launch Competitiveness Act in 2015, has adopted an active and supportive approach to private ownership in outer space. This statute allows U.S. companies and citizens to claim exclusive ownership over mineral resources extracted from celestial bodies and over technology-based products manufactured in space, provided that the general principles of international space law are observed (Nasa, 2015). This move reflects the United States' effort to create economic incentives and to encourage private-sector investment in emerging space domains. From an intellectual property (IP) perspective, the statute emphasizes that innovations and technologies developed by private companies may receive full protection under U.S. IP law, and right holders will enjoy freedom to exploit and transfer such technologies. However, this approach has faced international criticism because it may conflict with the principles of non-appropriation and the common interests of humankind embodied in global space law treaties (Williamson, 2016).

By contrast, the European Union has adopted a more moderate approach aligned with the multilateral framework of international law. EU space policies emphasize fostering innovation, supporting scientific research, and encouraging private investment, while simultaneously requiring adherence to the principles of international space law (European Space Policy, 2017). In the field of IP, the EU—through coordinated systems for patent filing and trademark protection—enables companies to assert their rights within Europe and in multinational projects without directly guaranteeing exclusive rights in the non-territorial environment of outer space. This policy seeks to reconcile the promotion of innovation with maintaining a balance between public and private interests.

The experiences of the United States and the European Union reveal two distinct approaches to IP in commercial

space. The United States, by emphasizing private ownership and economic incentives, facilitates rapid development of the space tourism and space resource industries but heightens the risk of conflict with international space law. The European Union, focusing on alignment with international treaties and gradual support for innovation, prioritizes the preservation of a multilateral legal framework and the principles of the common interests of humankind. This divergence poses a significant challenge for crafting comprehensive international rules, since any new legal regime must both secure economic incentives and private investment and remain consistent with foundational principles of international space law and the common interests of humankind (Harrison, 2020; von der Dunk & Tronchetti, 2016).

4.2. *The Role of the World Intellectual Property Organization in the Space Domain*

With the rapid growth of commercial space activities and the emergence of phenomena such as space tourism, the World Intellectual Property Organization (WIPO) has sought to play an active role in developing international rules to protect IP in a non-territorial environment. One of WIPO's key efforts has been to convene meetings and expert committees to examine IP challenges linked to space activities and advanced technologies. The aim is to harmonize national systems and to develop international standards capable of protecting patents, trademarks, copyright, and scientific data in extraterritorial settings (Bently & Sherman, 2014). In recent years, WIPO has issued a report on "IP Challenges in Outer Space," which identifies existing gaps and offers options for coordinated frameworks, emphasizing that the transnational character of space activities, the rapid replicability of data, and technological complexity require flexible, extraterritorial rules (Kur & Drexler, 2018; Wipo, 2019). WIPO has also worked, through multilateral cooperation tools, to foster more consistent practices in the filing of patents and trademarks related to space activities so that companies and researchers can enjoy effective legal protection.

Despite these efforts, limitations remain. First, WIPO lacks independent enforcement authority to apply and supervise IP rights in space; it mainly performs coordinating and advisory functions, while actual enforcement still depends on national systems and bi- or

multilateral agreements (Ricketson & Ginsburg, 2006). Second, existing treaties are grounded in the territoriality principle of IP protection and therefore have limited effectiveness in extraterritorial environments such as Earth orbit or international stations. In practice, this complicates the determination of jurisdiction and dispute resolution among states and leaves a legal vacuum.

Ultimately, WIPO's role in space law—as an international coordinating body—is vital but insufficient. Without establishing enforcement mechanisms and specific international rules for non-territorial contexts, protection of IP in commercial and tourist space activities will remain severely constrained. This situation underscores the need to devise new frameworks, including extraterritorial norms and effective oversight tools, to secure private investment incentives while respecting the foundational principles of space law (Gervais, 2021; Hobe, 2020).

4.3. *International Litigation and Arbitration Practices*

As space technologies advance and commercial activities expand in transnational environments, IP disputes in the space sector have increasingly reached international courts and arbitral tribunals. These disputes typically involve patent infringement, trademark conflicts, rights in guidance and control software for spacecraft, and scientific and commercial data. In many instances, cases become legally complex because of the absence of a clear legal framework for non-territorial settings (Tronchetti, 2015). A notable category involves commercial arbitrations concerning satellite technologies, including breaches of technology contracts and disputes over rights to data collected in Earth orbit. In such cases, arbitrators are often tasked with balancing exclusive IP rights against principles of international space law, such as freedom of use and the common interests of humankind (von der Dunk & Tronchetti, 2016). For example, disputes among private companies providing data services on international platforms are frequently resolved through arbitration, as national court proceedings face complications related to territorial jurisdiction and the diversity of applicable national laws. Arbitration practice shows that the absence of specific treaties or regulations on IP in outer space produces both flexibility and uncertainty in decision-making: arbitrators commonly apply a hybrid of national laws,

space law treaties, and general international IP principles. While this hybrid method can deliver swift resolutions, it also reduces legal uniformity and predictability (Hobe, 2020).

Moreover, arbitration cases show that companies and investors, to reduce legal risk, draft their contracts with greater clarity and include detailed clauses on ownership of data and technologies and on copyrights in artistic works or software. Although these practices are operationally effective, they clearly indicate that current legal gaps increase the likelihood of disputes and uncertainty, thereby reinforcing the need to develop coherent international regulations for IP in outer space. In sum, international litigation and arbitration play an important role in resolving space-related IP disputes, but their structural limitations and inefficiencies highlight the urgency of establishing a comprehensive, harmonized, and enforceable international legal framework (von der Dunk, 2015b, 2015c).

5. The Need for Developing New Rules

This section explains why new international rules for intellectual property (IP) in outer space must be formulated.

5.1. Deficiencies of the Current System

With the rapid expansion of commercial and tourism activities in space, current legal frameworks have proven inadequate to address the challenges arising from the intersection of space law and IP. One of the most critical shortcomings is the lack of coordination between these two regimes. Core space law treaties, such as the 1967 Outer Space Treaty and the 1979 Moon Agreement, establish fundamental principles including non-appropriation, peaceful use, and the common interests of humankind (Lyall & Larsen, 2018). In contrast, IP law grants exclusive rights to inventors, trademark owners, and creators over the use and exploitation of their innovations (Gervais, 2021). This fundamental divergence makes it extremely complex to determine jurisdiction and enforcement mechanisms for IP rights in transnational and non-territorial environments such as outer space.

Another key deficiency concerns the risk that commercial interests may override public and scientific benefits. Private companies involved in space

technologies and tourism often seek to maintain exclusive rights and economic control over their innovations and space-generated data. Such exclusivity could limit access for other states, researchers, and scientific bodies to essential technologies and information, undermining the public interest and scientific advancement (von der Dunk, 2015b). For example, space imagery or research data with broad scientific relevance could be privatized, restricting open access despite space law's emphasis on equitable use and dissemination.

Additionally, current systems lack clear rules for establishing jurisdiction and resolving international disputes in non-territorial environments. National IP laws rely heavily on territorial application and have limited effectiveness in areas like low Earth orbit or the International Space Station (Tronchetti, 2015). This gap increases legal uncertainty for companies and investors and raises the risk of international conflict.

Ultimately, these deficiencies show that the present system cannot address the demands of modern space activities and that the danger of excessive commercialization and deepening conflict between private rights and public interests is real. Thus, the urgent development of new, internationally harmonized rules on IP for non-territorial and space environments is clear. Such rules must balance the protection of private innovation with the foundational principles of space law and the common interests of humankind (European Space Policy, 2017; Hobe, 2020).

5.2. Proposed Models for New Legal Frameworks

Given the existing legal gaps and challenges, the development of new rules to protect IP in space tourism and commercial activities appears essential. One proposed model is to create a supplementary protocol to existing space treaties. This protocol could complement the 1967 Outer Space Treaty and the 1979 Moon Agreement and provide a defined framework for applying IP rights in non-territorial settings and international stations. It could establish rules on jurisdiction, the scope and limits of exclusivity, and the balance between private and public interests (Lyall & Larsen, 2018).

A second model is to strengthen cooperation between WIPO and the United Nations Office for Outer Space Affairs (UNOOSA). Such cooperation could result in

coherent, enforceable international regulations. UNOOSA's expertise in space law and governance, combined with WIPO's specialization in IP systems, could lead to the creation of guidelines and practical standards for registering and protecting patents, trademarks, and cultural works produced in space (Bently & Sherman, 2014; Wipo, 2019). This multilateral collaboration could also help reduce tensions between private rights and the common heritage principle and prevent fragmented national practices.

A third model involves establishing an international registration system for space-related patents and trademarks. This system could function similarly to the Patent Cooperation Treaty (PCT) and Madrid System but adapted for space, covering inventions, software, and digital cultural content produced beyond Earth. Such a system would allow companies and researchers to register innovations extraterritorially and enjoy uniform international protection without duplicative filings. It could also include dedicated dispute resolution and arbitration mechanisms to ensure enforceability of IP rights in non-territorial environments (Tronchetti, 2015; von der Dunk & Tronchetti, 2016).

Overall, combining these three models could create a comprehensive framework for IP protection in commercial and tourist space activities. Such a system would maintain economic incentives for the private sector while upholding the fundamental principles of space law and safeguarding the collective interest of humanity.

5.3. *Approaches to Balancing Public and Private Interests*

The commercialization and tourism-driven use of space create an inherent tension between private IP rights and the principle of the common heritage of humankind. To achieve a fair balance, innovative legal approaches are necessary. The common heritage principle requires that space resources and activities benefit all humanity and prohibits absolute private control (Christol, 1980). Reconciling this with IP rights calls for rules that preserve public access to essential scientific data and critical technologies while maintaining incentives for private innovation.

One proposed approach is to apply temporal and territorial limitations to IP rights in space. For example, patents or proprietary technologies relevant to space

activities could enjoy exclusivity for a reasonable term and scope, after which the underlying technology and data would become publicly accessible. This preserves initial commercial incentives while promoting long-term scientific and public benefit (von der Dunk, 2015b).

Another approach is to establish internationally supervised data- and technology-sharing frameworks. Inspired by open innovation and open science models, private actors could maintain limited exclusivity over certain space-generated data or technologies while ensuring that a portion remains available to researchers, universities, and international organizations. This system would promote innovation and fair competition while preventing over-commercialization of space.

Additionally, creating specialized international arbitration and oversight mechanisms to resolve disputes between private and public interests is essential. Such mechanisms should provide transparent criteria for determining what portion of space-derived data and technologies remains proprietary and what must be accessible to the broader international community (Tronchetti, 2015; von der Dunk & Tronchetti, 2016).

In summary, these approaches aim to strike a fair balance: guaranteeing IP rights to encourage innovation and investment while upholding the foundational principles of the common heritage of humankind. Effective implementation will require coordinated international action, the adoption of supplementary protocols, and the joint involvement of specialized bodies such as WIPO and UNOOSA.

6. Conclusion

The findings show that the intersection of space law and intellectual property creates significant practical and theoretical challenges that, if left unaddressed, may jeopardize the sustainable development of the space industry and the protection of technological innovation. One of the most important findings is the lack of coordination between IP law and space law. Existing space treaties emphasize principles such as non-appropriation, peaceful use, and the common interests of humankind, while IP regimes grant exclusive exploitation rights to inventors and creators of cultural works. This fundamental contradiction has created a legal vacuum in non-territorial environments, international stations, and Earth orbit, leaving many

companies and investors uncertain about competent jurisdiction and enforceable rights.

Another challenge is the threat posed to public and scientific interests by private commercial claims. Innovations and data generated by space activities have exceptional scientific and societal value, yet private ownership may restrict open access and compromise scientific objectives and global benefits. Limitations in registering and protecting patents, trademarks, and cultural works in non-territorial environments further increase the risk of international disputes and legal uncertainty for investors.

Comparative analysis of national and regional experiences shows that leading space-faring powers have taken divergent approaches. The United States, through supportive legislation, has promoted private ownership and economic exploitation of space technologies, while the European Union has focused on alignment with international space law and has offered gradual, more controlled support for innovation to maintain a balance between private and public interests. International arbitration practices and the efforts of global organizations such as WIPO also reveal that, in the absence of comprehensive legal frameworks, current approaches remain limited and inconsistent, emphasizing the need for harmonized and extraterritorial legal mechanisms.

Answering the research questions confirms that without the development of new rules, IP in commercial and tourist space activities will face serious difficulties. Potential solutions include creating a supplementary protocol to existing space treaties, strengthening cooperation between WIPO and the United Nations Office for Outer Space Affairs, and designing an international registration system for space-related patents and trademarks. It is equally essential to secure a fair balance between public and private interests through time-bound and scope-limited exclusive rights and through internationally supervised systems for data and technology sharing.

The future of IP in the space tourism industry depends on broad international cooperation, legal clarity, and the development of flexible frameworks that both encourage innovation and ensure fair access to scientific and technological advancements. Comprehensive and harmonized regulations can stimulate healthy competition and sustainable commercial activity while

safeguarding the collective interests of humankind. Given the rapid growth of the space sector and the increasing involvement of private investment, continued attention from researchers, legislators, and international bodies is vital to preserve the foundational principles of space law and simultaneously promote technological and economic development. Ultimately, the success of the space tourism industry and the protection of both public and private interests will only be possible through international collaboration, the creation of new legal instruments, and the establishment of effective extraterritorial enforcement and oversight mechanisms, paving the way for sustainable IP governance in outer space.

Authors' Contributions

Authors contributed equally to this article.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethical Considerations

In this research, ethical standards including obtaining informed consent, ensuring privacy and confidentiality were observed.

References

- Benkö, M., & Schrogl, K. U. (2006). *Space law: Current problems and perspectives for future regulation*. Carl Heymanns.
- Bently, L., & Sherman, B. (2014). *Intellectual Property Law*. Oxford University Press.
- Christol, C. Q. (1980). The Moon Treaty: Fact and Fiction. *Journal of Space Law*, 8(2), 345-368.
- Correa, C. M. (2007). *Trade-related aspects of intellectual property rights: A commentary on the TRIPS Agreement*. Oxford University Press.
<https://doi.org/10.1093/law/9780199271283.001.0001>
- Drahos, P. (2016a). *Intellectual property, technology transfer and development*. Edward Elgar.
- Drahos, P. (2016b). *Intellectual Property, Trade and Development: Strategies to Optimize Economic Development in a TRIPS-Plus Era*. Edward Elgar.
- European Space Policy, I. (2017). *European Space Policy: Innovation, Regulation, and Governance*. ESPI.
- Franssen, V. (2021). Intellectual property and cultural production in outer space. *Air and Space Law*, 46(1), 85-104.
- Gabrynowicz, J. I. (2010). The 50th Anniversary of the Outer Space Treaty. *Mississippi Law Journal*, 78(2), 431-442.
- Gervais, D. J. (2021). *The TRIPS Agreement: Drafting history and analysis*. Sweet & Maxwell.
- Ghaffarian Keblou, M., Pashazadeh, H., Rahbar Farsha Pira, N., & Masoudi, N. (2022). International Requirements of Intellectual Property in International Community and Its Application in the Laws of Iran and the United States. *International Studies Journal (ISJ)*, 19(3), 271-286.
- Ginsburg, J. C. (2018). *International Copyright Law and Policy*. Oxford University Press.
<https://doi.org/10.1093/oxfordhb/9780198758457.013.23>
- Habiba, S., Kazemi, H., & Sadeghi, M. (2023). Intellectual Property Rights and Technology Transfer in the Space Industry. *Space Science and Technology*, 15(1), 107-119.
<https://doi.org/10.30699/jst.2022.1331>
- Harrison, J. (2020). Intellectual Property Challenges in the Commercial Space Industry. *Air and Space Law*, 45(2), 205-225.
- Hobe, S. (2013). The Current and Future Perspective of Space Law. *Zeitschrift für Luft- und Weltraumrecht*, 62(2), 119-135.
- Hobe, S. (2020). *Space Law and International Commercial Arbitration: Conflicts and Resolutions*. Springer.
- Hugenholtz, P. B. (2016). Copyright and the Digital Space: Challenges Beyond Earth. *Journal of Intellectual Property Law & Practice*, 11(3), 201-215.
- Jakhu, R., & Pelton, J. (2017). *Global Space Governance: An International Study*. Springer. <https://doi.org/10.1007/978-3-319-54364-2>
- Jasentuliyana, N. (1992). *Perspectives on International Space Law*. Kluwer Law International.
- Johnson, S. (2019). *Commercial space exploration: Law and policy*. Oxford University Press.
- Koosha, S. (2024). Protecting the intellectual property rights of tourists and advancing space tourists industry. *Journal of Law and Political Studies*, 4(1), 84-97.
- Kur, A., & Drexler, J. (2018). *Intellectual Property and General Legal Principles: Is IP a Lex Specialis?* Edward Elgar.
- Lyall, F., & Larsen, P. B. (2018). *Space Law: A Treatise*. Ashgate.
<https://doi.org/10.4324/9781315610139>
- Masson-Zwaan, T., & Freeland, S. (2010). *Introduction to Space Law*. Kluwer Law International.
- Mirkarimi, P., Mirabbasi, S. B., & Moradi, M. (2013). Investigating the role and status of intellectual property rights in the system of public international law. *Iranian Monthly of Political Sociology*, 5(11), 3368-3384.
- Nasa. (2015). Commercial Space Launch Competitiveness Act (Space Act 2015): Overview and Implications. Washington, DC: NASA Office of Legislative Affairs.
- Reinbothe, J., & Lewinski, S. v. (2015). *The WIPO Treaties on Copyright: A Commentary on the WCT, the WPPT, and the BTAP*. Oxford University Press.
- Ricketson, S., & Ginsburg, J. C. (2006). *International Copyright and Neighbouring Rights: The Berne Convention and Beyond*. Oxford University Press.
- Soleimani, H. (2008). Intellectual property international system of protection of rights Bglass. *Public Law Research*, 11(26), 243-261.
- Tronchetti, F. (2015). Intellectual Property Rights in Outer Space Activities: Emerging Challenges. *Journal of Space Law*, 41(2), 307-325.
- von der Dunk, F. G. (2015a). Intellectual Property in Space Activities: New Challenges. In F. G. v. d. Dunk & F. Tronchetti (Eds.), *Handbook of Space Law* (pp. 233-255). Edward Elgar. <https://doi.org/10.4337/9781781000366>
- von der Dunk, F. G. (2015b). The Registration Convention. In F. G. v. d. Dunk & F. Tronchetti (Eds.), *Handbook of Space Law* (pp. 209-230). Edward Elgar.
<https://doi.org/10.4337/9781781000366>
- von der Dunk, F. G. (2015c). Space tourism, private spaceflight and the law. *Zeitschrift für Luft- und Weltraumrecht*, 64(2), 113-128.
- von der Dunk, F. G., & Tronchetti, F. (2016). Arbitration in Outer Space: Legal Challenges and Practical Solutions. *Air and Space Law*, 41(3), 171-189.
- Williamson, M. (2016). Ownership and Property Rights in Space Resources: US Perspectives. *Journal of Space Law*, 41(1), 45-62.
- Wipo. (2019). Intellectual Property Challenges in Outer Space Activities: Report of the Committee on Development and Intellectual Property. Geneva: WIPO Publications.