Patent Protection for Inventions in Outer Space: Issues and Challenges

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Abstract

The increasing commercialization of space activities has highlighted the need for a robust legal framework to protect intellectual property (IP) in outer space. Currently, national and regional patent laws apply only within their respective jurisdictions, leading to challenges in enforcing patent rights beyond Earth. The existing international space law framework, which resembles maritime law, allows private entities to circumvent patent regulations by registering in jurisdictions with favorable IP policies, contributing to the "flags of convenience" problem. This regulatory competition threatens global patent protection, potentially discouraging innovation in space technologies.

India, despite being a signatory to major international space treaties, lacks a dedicated national space law to regulate IP rights in space-related activities. The growing involvement of private enterprises in India's space sector further necessitates comprehensive legislation to address patent protection, inter-departmental coordination, and commercialization of space innovations.

This article examines the challenges of enforcing patent protection in outer space, the inadequacies of the current international legal framework, and the implications of regulatory competition among states. It explores the necessity for national space legislation in India and discusses global solutions, including the establishment of a universal patent jurisdiction or a "Space Patent" regime. The article also evaluates proposals by WIPO and other international organizations to create a unified system for patent protection in space, ensuring stronger IP rights and fostering innovation. Finally, it highlights the need for global cooperation to address the legal complexities of space-related inventions and support sustainable space exploration and commercialization.

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I. Introduction

The twentieth century witnessed significant developments in intellectual property (IP) law as well as in the law governing outer space. Although IP law began evolving much earlier than space law, both fields experienced substantial growth in the latter half of the twentieth century.[2] Technological advancements related to outer space have led to the establishment of space stations, with future plans to develop similar facilities on the Moon and other celestial bodies. With this, human activities in outer space have expanded rapidly resulting in the possible intellectual creations in outer space that are entitled to IP protection. Consequently, the intellectual property regime is poised to overlap with the outer space legal framework in the near future[3].

The growth of the commercial space industry necessitates significant private investment in space technologies. As a matter of public policy, an effective patent system is essential for encouraging innovation and investment in high-technology industries. Patents grant inventors market exclusivity for their inventions in exchange for public disclosure of their innovations. This limited monopoly incentivizes companies to invest in new technologies, while the disclosure requirement enables further advancements and improvements in existing inventions.[4]

With the development and success of national and private space programs, we find ourselves on the verge of the next great exploration age. But in order to achieve this, "governments must have relevant and effective regulation to ensure that they meet their international legal obligations[5] and to

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[2] Sandeepa Bhat B, *Inventions in outer space: Need for reconsideration of the Patent Regime*, Journal of Space Law (University of Mississippi) Vol. 36, No. 1, Spring 2010, P. 1.

[3] Ibid.

[4] Matthew J. Kleiman, *Patent rights and flags of convenience in outer space*, https://www.thespacereview.com/article/1772/1#idc-container

[5] Klaus Welle, Secretary-General, European Parliament, Speech on Space Law and Policy, (2012).

provide a degree of stability and certainty for commercial companies in space and their investors[6]. In the sphere of space, a dysfunctional regime of Intellectual Property (IP) rights not only entails economic and social costs but also undermines the successful pursuit of space exploration and settlement and pushing forward the proximity of their achievement[7]. As a matter of public policy, an effective patent system can play a critical role in encouraging innovation and investment in budding high technology industries.

There is an interesting debate grappling the international community of Intellectual Property (IP) lawyers over the patents for inventions made and used in space. We are aware that patent rights are territorial in nature and can only be enforced in the jurisdiction of registration of the patent for an invention. Now the current enigma is two-fold, first, how does one get a patent for an invention made in space? The second is even more challenging than the first i.e., what is the remedy available for patent infringements in outer space? [8]

These questions need answers in the light of growing importance of the space industry in the 21st century. If we have made extraordinary strides in space activities, it is primarily because of the commercialization of space activities, where companies are competing to make technology that will advance space exploration, patenting them is the next logical step. Currently, there is much enthusiasm surrounding this industry, as it is viewed to be a rewarding investment despite the fact that it involves high risk. Space companies have ambitious projects to develop technology for asteroid mining, experts believe that if it is made possible, would pave way for space colonization. Apart from this, space tourism is also gaining much momentum. All these points out to the

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[6] Lauren Peterson, *Governing the Unknown: How the Development of Intellectual Property Law in Space Will Shape the Next Great Era of Exploration, Exploitation, and Invention*, 18 Nw. J. Tech. & Intell. Prop. 335 (2021). https://scholarlycommons.law.northwestern.edu/njtip/vol18/iss3/3

[7] International Bureau of World Intellectual Property Organization, International Property and Space Activities, at 4 (2004), https://www.wipo.int/export/sites/www/patent-law/en/developm ents/pdf/ip_space.pdf

[8] **Poornima Ramesh,** *Is the Discussion on Patent Laws for Outer Space Inventions Really All That Relevant?*, SPICYIP (May 2018), https://spicyip.com/2018/05/spicyip-fellowship-2018-19-is-the-discussion-on-patent-laws-for-outer-space-inventions-really-all-that-relevant.html.

promising future for space technology[9]. Therefore, traditional patent and intellectual property protections must be reimagined for applicability and enforceability in an age where travel, manufacturing, and invention exist beyond the confines of Earth.

II. International Space Law and Intellectual Property Law

Outer space and patents are governed by two fundamentally different thoughts of legal jurisprudence. While patents talk about the grant of exclusive private rights in the hands of the inventors, space law is about the commons. It looks at space as the common heritage of mankind and that activities in space should be for the benefit of all nations. This is at the root of the conflict between these two regimes of law. One reason for this divergence is because space encapsulates the territorial Earth and it cannot be divided into any natural or artificial boundaries as territories of nation states on Earth can be divided and controlled[10].

When the first space treaty entered into force in 1967, space exploration was in its infancy. Only ten years had passed since Russia launched the first satellite into space, and only six years had passed since the first human being orbited the Earth. Since then, there have been significant developments in space exploration. Numerous countries have sent humans into space, nations have collaborated to establish the International Space Station, and private companies have become major players in space technology[11].

IP rights can be acquired and applied in two ways: territorially (nationally) and internationally. When intellectual property is registered in one state, the IP rights are secured only within the jurisdiction of that state. However, under the present advanced multilateral treaty framework pertaining to IP rights,

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[9] *Ibid.*

[10] Sajal Sharma & Shashank Pathak, Patenting of Outer Space Inventions: In the Crossroads of Territorial and Outer Space Law, https://www.mpdnlu.ac.in/assets/pdf/12.%20Patenting%20of%20Outer%20Space%20Inventions.pdf

[11] Sarah Coffey, *Establishing a Legal Framework for Property Rights to Natural Resources in Outer Space*, 41 Case W. Res. J. Int'l L. 119 (2009), https://scholarlycommons.law.case.edu/jil/vol41/iss1/6.

securing and enforcing such IP rights is virtually global. A member state to a treaty may provide national treatment to a foreign IP right and enforce it through its domestic laws. The sovereign jurisdiction of a state is central to securing and enforcing IP rights. Consequently, challenges arise when IP rights are contemplated in outer space, where claims of sovereignty cannot be made[12].

The Outer Space Treaty was the first international space treaty, and 107 states have consented to be bound by it since it was entered into force on October 10, 1967. The Outer Space Treaty lays down two fundamental principles of international space law. First, the Outer Space Treaty extends the general application of international law into space. Second, the Outer Space Treaty sets out the concept of "non-appropriation," which reserves outer space and celestial bodies as free for exploration and use by all states and prohibits any nation from claiming territory or resources[13]. Articles 1 and 2 of the Outer Space Treaty of 1967 state that "the exploration and use of outer space, including the Moon and other celestial bodies, shall be carried out in the interests of and for the benefit of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind."[14] The treaty further provides for "freedom of scientific investigation in outer space, including the Moon and other celestial bodies, and States shall facilitate and encourage international cooperation in such investigation." Additionally, it prohibits national appropriation of outer space, including the Moon and other celestial bodies, by means of sovereignty claims, occupation, or any other means[15].

Similarly, the 1996 Declaration on International Cooperation in the Exploration and Use of Outer Space emphasizes that international cooperation in space exploration should be conducted in accordance with international law,

[12] Ritesh Mehra, Intellectual *Property Protection in Outer Space - An Overview*, *ILI Law Review*, *2* (Winter issue), 1, https://www.ili.ac.in/pdf/rm.pdf.
[13] Yong Bum Lee, *Public Space, Private Patents: Updating International Space Law to Protect Patents in Outer Space,* Harvard Journal of Law & Technology, Volume 33, Number 1 Fall 2019, p. 296
[14] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, art. 1-2, 1967.
[15] *Id.*

including the United Nations Charter and the Outer Space Treaty[16]. It mandates that space activities should be carried out in the interest and for the benefit of all states, irrespective of their economic, social, scientific, or technological development. Particular consideration should be given to the needs of developing countries[17]. Article VI of the Outer Space Treaty, which deals with international responsibility, states that "the activities of non-governmental entities in outer space, including the Moon and other celestial bodies, shall require authorization and continuous supervision by the appropriate State Party to the Treaty".[18]The treaty further asserts that states shall bear international responsibility for national space activities, whether carried out by governmental or non-governmental entities. Although private sector participation in space activities is increasingly visible, the principles of international cooperation and collective development remain fundamental, and outer space cannot be appropriated by sovereignty claims[19].

With respect to the patenting of inventions in outer space, there are two opposing arguments. On one hand, some argue that removing commercial enterprises' return on investment or compromising their IP rights through compulsory licensing may negatively impact technological R&D in space exploration. On the other hand, it is argued that remote sensing, earth observation, and telecommunication technologies have become indispensable for the socioeconomic development of developing states. Some scholars suggest that patent laws may keep both space technology and the means to access outer space out of the reach of developing states[20]. The World Commission on the Ethics of Scientific Knowledge and Technology (COMEST) has recommended taking all appropriate measures to provide researchers with free access to scientific data to promote knowledge-sharing and scientific progress. It further encourages placing scientific outer space data at the disposal of developing countries and defining

[16] United Nations, Declaration on International Cooperation in the Exploration and Use of Outer Space, A/RES/51/122, 1996.
[17] Space Benefits Declaration, 1996.
[18] Outer Space Treaty, art. VI, 1967.
[19] Vladimír Kopal, Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, https://legal.un.org/avl/pdf/ha/tos/tos_e.pdf.
[20] *Ibid.*

procedures for equitable benefit-sharing[21]. Similarly, Articles 66(2) and 67 of the TRIPS Agreement, 1995, suggest that developed member states may provide incentives to enterprises and institutions in their territories to promote technology transfer to least-developed member states. They may also offer technical and financial cooperation under mutually agreed terms and conditions[22].

There is an urgent need for a robust mechanism that fairly balances socio-economic justice with intellectual property rights in space activities. The United Nations has recognized the potential of space activities as a medium for globally inclusive socioeconomic development. The United Nations Office for Outer Space Affairs (UNOOSA) organized a High-Level Forum titled 'Space as a Driver for Socio-Economic Sustainable Development', which emphasized that space exploration fosters innovation, strengthens international cooperation, and creates new opportunities for addressing global challenges. The forum suggested establishing a global mechanism for exploration and innovation coordination[23].

The Outer Space Treaty establishes the principle of freedom in outer space, and it is up to individual nations to create legal frameworks that foster private enterprise participation in space activities while aligning with international obligations[24]. Barbara Luxenberg and Gerald J. Mossinghoff argue that private entities investing in commercial space ventures require strong protections for patents, trade secrets, and proprietary data and without such protections, companies will lack the incentive to invest in commercial space development. Intellectual property protection will play a significant role in developing viable space business models involving public-private collaborations[25]. Some scholars have identified the need to bring in a balance between both sides of the coin. The first one is to promote the private interest and

[21]World Commission on the Ethics of Scientific Knowledge and Technology: Report on Science Ethics https://www.thphys.uniheidelberg.de/~stamatescu/DIDEPG/SoSe22/TEXTE_PE_1/COMEST/Pub3_1_Science_Ethics_final.pdf.
[22] TRIPS Agreement, articles 66(2), 67, 1995.
[23] United Nations Office for Outer Space Affairs, *High-Level Forum: Space as a Driver for Socio-Economic Sustainable Development*, 2016.
[24] The Outer Space Treaty, 1967.
[25] Barbara Luxenberg & Gerald J, Mossinghoff, *Intellectual Property Rights in Outer Space Commerce*, 2000.

thereby grow a suitable environment for innovation and the other side is broader to be considerate towards the interest of the Human race. This is a balancing approach that they suggest to tackle the problems related to outer space.

III. Need for Intellectual Property Protection in the Space Regime

Space technology has always been at the forefront of technological advancements, and outer space activities are inherently the result of intellectual creations. However, it is only in recent years that intellectual property (IP) protection in relation to outer space activities has gained wider attention. One of the primary reasons for this increased focus is the shift of space activities from being state-owned to private and commercial enterprises[26]. These activities include remote sensing from space, direct broadcasting, research, and manufacturing in microgravity environments. The rise in commercialization, coupled with the privatization of space agencies, has led non-governmental entities to become increasingly conscious of their tangible and intangible assets. Furthermore, government agencies today collaborate extensively with private enterprises for space activities due to financial and technical constraints. Consequently, many licensing contracts have been concluded between governmental space agencies and private companies. Such private financing needs to be motivated by the expectation that the R&D investment could be recovered in the future.[27]

Private firms seeking to invest in space enterprises frequently cite international agreements prohibiting any government from claiming sovereignty over outer space or celestial bodies as a major impediment to the commercial development of space[28]. These firms argue that the absence of property rights hinders external financing, restricts investment protection, and reduces the ability

[26] Sharma S, *IPR protection in outer space activities*. Legal Services India, http://www.legalservicesindia.com/article/790/IPR-protection-in-outer-space-activities.html

[27] Adhikari, M, Legal Regulation of Private Actors in Outer Space: India's Role, (1st ed. 2019) Routledge. https://doi.org/10.4324/9780429325595

[28] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (1967), art 11, 18 UST 2410, 2413 (1969).

to generate profits from space-related ventures[29]. In essence, the lack of territorial sovereignty in space jeopardizes private sector participation. Consequently, effective intellectual property rights (IPR) protection in outer space activities can have a positive impact on private sector involvement in space exploration and development[30].

Another reason for the growing importance of IP protection in space is the globalization of space activities. The International Space Station (ISS) serves as a prime example, where space missions are increasingly conducted under international cooperation agreements[31]. Moreover, advancements in space technology are creating new business opportunities, further emphasizing the need for comprehensive IP protection. For instance, while space tourism remains in its infancy, progress in space transportation technology is paving the way for its future realization. Currently, discussions surrounding IP protection in space focus primarily on patent rights for inventions created or utilized in outer space, as well as copyright protections for databases derived from space-acquired data. However, as space tourism evolves, additional IP concerns, such as trademark and industrial design protections, may also arise[32].

The importance of a legal regime that ensures IP protection in space activities cannot be overstated. The absence of such a regime diminishes the effectiveness of international cooperation among states and other entities engaged in space research. The fundamental purpose of IPR protection is to stimulate human creativity for public benefit while simultaneously ensuring that creators and investors remain incentivized to contribute to space research and exploration. Establishing a clear and enforceable IP framework in outer space is essential to fostering innovation, attracting private investment, and ensuring the

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[29] Hertzfeld, Henry R. and von der Dunk, *Frans, Bringing Space Law into the Commercial World: Property Rights without Sovereignty*, (2005), Space, Cyber, and Telecommunications Law Program Faculty Publications. 15 https://digitalcommons.unl.edu/spacelaw/15 .

[30] Krishanu Das, *IPR Protection in Outer Space Activities*, Legal Services India, http://www.legalservicesindia.com/article/790/IPR-protection-in-outer-space activities.html.

[31] *Supra* Note 30.

[32] Pratyush Prakarsh, The Role of Intellectual Property in Fostering Innovation and Economic Growth, INTERNATIONAL JOURNAL FOR MULTIDISCIPLINARY RESEARCH, Vol. 6, Issue 5, September-October 2024

sustainable growth of the space industry[33]. This scenario highlights the necessity of a simple, uniform, and reliable international legal framework for IP protection. While national intellectual property laws are relatively harmonized, different jurisdictions apply distinct principles for granting and enforcing IP rights. This variation underscores the need for a uniform legal regime specifically addressing the protection of intellectual property in space activities.

IV. Patentability of Inventions Made in Outer Space

Patent rights are strictly territorial, meaning they can be enforced only within the jurisdiction where the patents have been granted. With significant investments in space missions for scientific research, both individually and collectively by various nations, the intellectual property value of space technologies is immense. Generally, the ownership of inventions rests with the creator, and this principle applies to inventions made in space. With respect to joint ownership of space stations and the resultant inventions made in such space stations makes it difficult to determine the ownership rights and place of registration of patents[34].

In a first-to-file patent system, the time and place of invention are not as relevant. Most countries follow this system, where the priority of a patent is determined by the earliest application filed. If more than one application claiming the same invention is filed, the patent is granted to the applicant with the earlier filing date[35]. However, the first-to-invent system, followed by the United States, Canada, and the Philippines, prioritizes the actual date of invention rather than the filing date. Under this system, the U.S. recognizes the date of conception as the date of invention. The inventor must provide evidence, such as laboratory notebooks, to prove their claim[36]. For inventions made in outer space,

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[33] Varshika, *From Exploration to Commercialization: Intellectual Property Challenges in Space, https://www.intepat.com/blog/from-exploration-to-commercialization-intellectual-property-challenges-in-space*

[34]Tun-Jen Chiang, *First-to-File as a Rule of Evidence, Yale Journal on Regulation, 2016, https://www.yalejreg.com/bulletin/first-to-file-as-a-rule-of-evidence/*

[35] *KD Raju, Issues in Protection of Intellectual Property Created in Outer Space: An Indian Outlook*, Current Developments in Air and Space Law 16.http://www.commonlii.org/in/journals/NLUDLRS/2012/37

[36]George E. Frost, *the 1967 Patent Law Debate: First-to-Invent vs. First-to-File*, Duke Law Journal Vol. 1967, No. 5 (Oct. 1967), P.923

if territorial patent rules apply, raises questions about proving that an experiment was conceived and practiced in space, and whether it will work similarly on Earth. Another challenge is determining prior art, a key criterion for patentability. Inventions in a spacecraft are shielded from public knowledge, much like experiments in a laboratory, ensuring patentability until public disclosure or commercialization. However, unintended broadcasting of space activities could invalidate patent claims[37].

The collaborative nature of modern space exploration further complicates patent ownership. Many space missions involve joint ventures between multiple nations, where ownership of patents depends on specific agreements. These agreements should ideally outline the extent of protection and commercial benefits before the spacecraft is launched. In team-based research, identifying the true inventor becomes crucial for determining proprietary rights[38]. Thus, the legal framework for patentability in space must address the unique challenges of jurisdiction, prior art disclosure, and collaborative research to ensure fair protection of intellectual property in extraterrestrial environments.

V. Jurisdictional issues in case of inventions made or infringed in Space

With respect to the applicability of national regulations governing patents, problems occur when an invention is used or infringed in outer space because these regulations are applicable only on the territory of the specified State which by definition, excludes the extraterritorial domain of outer space[39]. However, under international law, a state retains jurisdiction and control over objects it sends into outer space. The jurisdiction under the Outer Space Treaty is not only confined to space objects registered with the State, but also extends over any personnel thereof, while in outer space or on a celestial body[40]. Thus, a simple approach to addressing patent infringement in outer space would be to make patent laws applicable to space objects under a given country's jurisdiction

[37] *Supra* Note 33
[38] *Id.*
[39] Akanksha Mishra, *The Great Beyond: Understanding Patents in Outer Space*, Indian Journal of Intellectual Property Law. (2014-2015) Vol.7 , https://heinonline.org/HOL/LandingPage?handle=hein.journals/ijipl7
[40] Bhat B, S., *Inventions in Outer Space: Need for Reconsideration of the Patent Regime*, 36 *J. Space L.* 7, 8 (2010), https://studylib.net/doc/18698580/view-the-full-issue---national-center-for-remote-sensing..

and control. Consequently, any act of patent infringement occurring inside a space object, in outer space, on the Moon, or on other celestial bodies would be subject to the jurisdiction of the state in which the space object is registered. However, the jurisdiction exercised under Article VIII of the Outer Space Treaty introduces complexities, particularly when multiple jurisdictions are involved. For example, if a space station is registered in one state but the space vehicle carrying astronauts who conduct the invention is registered in another state, both states could claim jurisdiction. Since Article VIII grants jurisdiction over activities conducted in a registered space object and also extends personal jurisdiction over astronauts even outside the space object, conflicts of jurisdiction may arise. This issue is further complicated when crew members are exchanged between space stations of different countries. Therefore, applying intellectual property (IP) rules based solely on the state of registration is not a foolproof solution and is fraught with jurisdictional conflicts[41].

Over the last decade or so scientists of the participating countries have been working both on the Earth and astronauts and cosmonauts in the ISS to carry out various tests, experiments and possible inventions for the benefit of humanity in the micro gravity environment of the ISS. In this mega project there are 15 countries that have countributed including USA, EU, Russia, and Japan. It has been launched as a major platform that allows performing research and inventions in space which are not possible on the surface or environment of the earth. Therefore, such inventions are bound to be significant and pathbreaking for humanity as a whole. Naturally there are questions related to the exercise of jurisdiction over the inventions on the ISS[42].

According to the Registration Convention, a launching state is defined as either: (1) a state that launches or procures the launching of a space object, or (2) a state from whose territory or facility a space object is launched[43]. The phrase

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[41] *Ibid*.

[42] Sajal Sharma* & Shashank Pathak, Patenting of Outer Space Inventions: In the Crossroads of Territorial and Outer Space Law, https://www.mpdnlu.ac.in/assets/pdf/12.%20Patenting%20of%20Outer%20Space%20Inventions.pdf

[43] Jayavelu, S., *Inventions Made/Used in the Outer Space – What Is the Protection Available and Where Can It Be Protected, Puthrans* (Apr. 27, 2021), https://www.puthrans.com/inventionsinspace

"launches or procures the launching of" is somewhat ambiguous, allowing private entities to exploit jurisdictional loopholes. A private commercial entity could, in theory, select its jurisdiction based on the location of its headquarters, production facilities, or even the state under which it chooses to register its spacecraft. This raises concerns that, without immediate clarification of jurisdictional rules, private space actors might engage in forum shopping registering their space objects under the most favorable legal regime to circumvent stringent regulations[44]. Addressing these jurisdictional ambiguities is crucial to ensuring a robust framework for the enforcement of patent rights in outer space and preventing regulatory arbitrage by private actors.

VI. Application of National or Regional IP Laws

National and regional intellectual property laws generally apply only within the territory of the respective country. Consequently, the enforcement of intellectual property rights in any given nation is governed by that country's applicable national intellectual property laws[45]. National patent laws typically do not have extraterritorial reach. However, if a country exercises command and control over a spacecraft, it could be argued that the spacecraft functions as an extension of that country's territory in space[46]. In the United States, this issue has not been explicitly addressed by statute. The National Aeronautics and Space Administration (NASA) has recognized this legal ambiguity and is currently studying the necessity of amending the Space Act to clarify and ensure certainty regarding the protection of intellectual property rights on space vehicles under U.S. jurisdiction[47].

To ensure compliance with responsibilities outlined in United Nations (UN) Treaties, such as supervision and liability for damages, many states have enacted national space laws to regulate space-related activities conducted under their jurisdiction[48]. These national space laws address various aspects, including

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[44] *Ibid.*
[45] Sharma, *Territorial Limitations in Patent Law and Their Implications for Space Inventions*, 18 J. of Intell. Prop. Rts. 145.
[46] *Ibid*.
[47] NASA, *Report on Intellectual Property Protection in Outer Space*, NASA Legal Office (n.d.).
[48] United Nations Office for Outer Space Affairs (UNOOSA), *The UN Treaties and Principles on Outerpace*, U.N. Doc. A/AC.105/C.2/L.300 (2021).

registration, safety, insurance, indemnification, environmental protection, and enforcement mechanisms. While such laws differ significantly in their treatment of each of these issues, they generally seek to balance state responsibilities with the potential liabilities posed by private entities engaging in space activities[49].

Broadly, a state pursues two key objectives in this regard: (1) ensuring that private entities registered under its jurisdiction do not expose the state to excessive international liability under UN treaties, and (2) incentivizing private entities to register under its legal framework. However, these two objectives are often in conflict, as the former requires stricter regulations, while the latter encourages more relaxed regulatory frameworks to attract private space actors[50]. Addressing these jurisdictional challenges is essential to fostering legal clarity and ensuring the effective protection of intellectual property rights in outer space.

VII. Space Legislation in India

India, like many other countries, does not have dedicated national legislation governing space activities. However, India is a signatory to all major international space treaties, which constitute the primary body of international space law. Additionally, India has played a significant role in the adoption of legal principles through United Nations General Assembly Resolutions, which promote international law, cooperation, and understanding in space activities. As a result of the increasing commercialization of space activities and the involvement of private sector entities in India's space programs, it is imperative that the Parliament of India takes the initiative in enacting a comprehensive national space law. With national and global collaborations, as well as agreements between various agencies, governments, and international organizations, there is an urgent need for a robust legal framework to effectively regulate India’s evolving space policy.

A second critical reason for enacting space legislation in India is that Indian space activities have significantly expanded and diversified over the years. Given the complexity of interdepartmental coordination in space-related matters,

[49] Yong Bum Lee, *Public Space, Private Patents: Updating International Space Law to Protect Patents in Outer Space,* HARVARD JOURNAL OF LAW & TECHNOLOGY Vol. 33, Number 1 Fall 2019, Pp- 300-301.
[50] *Supra* Note 40.

establishing clear legal norms is essential to ensure smooth governance and regulation of space inventions. Third, India must clarify the applicable legal norms and rules governing both public and private law aspects of space activities. The experiences of countries such as the United States and Germany illustrate the importance of having well-defined laws to regulate space activities effectively[51].

Finally, with the commercialization of space products and the expansion of the global space economy, India has already begun marketing and selling its space technology and services. In this context, enacting a National Space Legislation is critical to supporting India's ambitions in the global space market. In light of the same, the government is going to introduce the Space Activities Bill, 2017 which has been submitted to the prime minister. The Space Activities Bill (Draft Bill 2017) aims to create a legal framework for regulating and promoting space activities, encouraging private sector participation, and ensuring the safety and security of space operations.[52] Section 25 of the proposed bill outlines provisions for protecting intellectual property rights arising from space-related activities. However, a significant issue with this provision is that it designates all intellectual property created onboard a space object as the property of the Central Government. This approach overlooks the interests of private entities, despite the government's initiative to encourage private participation in space activities. Additionally, the bill lacks clarity on crucial aspects such as orbital patents and the issue of flags of convenience, leaving key gaps in the legal framework for space-related intellectual property protection[53].

VIII. Issues and Challenges

Granting intellectual property (IP) protection for inventions made in outer space poses significant challenges due to the lack of clear jurisdiction, the principle of free access to space, and enforcement difficulties. Traditional IP laws operate on territorial principles, applying within national boundaries, whereas the

[51] *Id.*
[52] Nishu Kumar, *IP Laws in Outer Space*, https://www.mondaq.com/india/patent/1038616/ip-laws-in-outer-space
[53] *Ibid.*

Outer Space Treaty prohibits national sovereignty over outer space. This fundamental conflict creates uncertainty regarding which legal framework governs IP rights in space. Furthermore, enforcing IP protection in outer space is highly complex due to the absence of clear jurisdiction and the logistical difficulties posed by vast distances and harsh environmental conditions. Without a well-defined legal framework, inventors and private entities may struggle to secure their rights, potentially discouraging space-related innovation[54].

Another major challenge arises from the principle of free access to outer space, as outlined in the Outer Space Treaty. This principle allows all nations to freely explore and use space, which could clash with exclusive IP rights that grant inventors control over their creations. Additionally, enforcing patent rights in space is complicated by the difficulty in identifying and prosecuting infringers, particularly when violations occur beyond Earth's jurisdiction. The lack of an effective space control mechanism further exacerbates the problem, making it difficult to assess and address instances of infringement. To ensure innovation continues while maintaining equitable access to space, international cooperation and the establishment of a specialized legal framework are essential for protecting IP rights in the evolving space economy[55].

IX. Solutions for Consideration

One potential solution is the establishment of an international space patent system, overseen by a neutral global authority, to ensure uniform protection and enforcement of IP rights across all space-faring nations. Such a system could function under the guidance of international organizations like the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) or the World Intellectual Property Organization (WIPO). Additionally, bilateral and multilateral agreements between space-faring nations could help create mechanisms for dispute resolution, jurisdictional clarity, and enforcement protocols. By harmonizing IP laws for space inventions, the global community can encourage private sector participation, foster technological advancements,

[54] World Intellectual Property Organization (WIPO), *Intellectual Property and Space Activities*, https://www.wipo.int/meetings/en/doc_details.jsp?doc_id=484906.
[55] United Nations Office for Outer Space Affairs (UNOOSA), *The Committee on the Peaceful Uses of Outer Space and International Space Law*, https://www.unoosa.org/oosa/en/ourwork/spacelaw/index.html.

and promote responsible innovation while ensuring that space remains accessible for all.

The primary criticism of this proposal is its lack of political feasibility. Many nations may insist that their national patent laws should be incorporated into the legal framework, potentially leading to jurisdictional conflicts. An alternative approach, proposed by the World Intellectual Property Organization (WIPO), is the creation of a universal patent law with a corresponding space patent jurisdiction[56]. Under this system, outer space would be recognized as a distinct jurisdiction for patent enforcement, with a single, globally enforceable patent system[57].

In this model, inventors would file a single patent application, which would provide uniform protection throughout outer space, eliminating the need for multiple national filings. A key advantage of this system is that it closes legal loopholes, preventing companies from avoiding patent enforcement by simply choosing a favorable jurisdiction for space object registration. Moreover, a single, harmonized patent system would simplify and streamline the patenting process for inventors[58]. However, one significant obstacle to establishing a space patent jurisdiction is the traditional reluctance of states to relinquish sovereignty to an international governing authority. Many nations may oppose a universal patent regime, fearing a loss of control over their domestic IP policies.

X. Conclusion and Suggestions

With the projected expansion of the space economy and the increasing accessibility of space, the protection of space-related intellectual property (IP) has become more crucial than ever. Space exploration is expanding at an extraordinary rate and the need to consider legal aspects like IPR cannot be ignored as mankind continues to explore more outer space. Even current regimes, like the Outer Space Treaty, have problems in applying modern ideas of intellectual property to space. The global community recognizes space activities as a driver for socio-economic sustainable development, making it imperative to

[56] WIPO, *A Global Approach to Intellectual Property Protection in Outer Space*, WIPO Doc. SCP/30/2 (2020).
[57] *Ibid.*
[58] *Id.*

safeguard innovations in outer space. As technological advancements progress, inventions will not only take place in Earth's orbit but will soon extend to the Moon, Mars, and beyond, where human settlements and protected research environments are expected to emerge. Thus, a comprehensive legal framework is required to address the unique challenges of patent protection in international space cooperation.

A global jurisdictional framework for space-related patents is a natural solution to the current fragmented international IP system. The establishment of a global authority with patent jurisdiction through an additional multilateral treaty could ensure that innovators and investors receive consistent legal protections for their inventions in space. Such an authority would provide greater legal certainty, thereby fostering confidence in outer space research and development.

Additionally, this framework would help mitigate the erosion of patent protections caused by regulatory competition among states seeking to attract private space enterprises. Unlike a fully harmonized global patent system, which may face significant political and sovereignty-related challenges, a limited patent jurisdiction focused solely on space activities presents a pragmatic and targeted solution. This approach would allow coexistence between national regulatory competition and a specialized international regime, ensuring balanced legal protection for space-related innovations. Thus, in order to promote responsible innovation and safeguard intellectual property rights in outer space, it is imperative to establish a global patent jurisdiction specifically designed for the unique challenges of space activities.