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Patents Beyond Earth and The Need for International Harmonization

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ABSTRACT:

Space and beyond is one such field to address as it is a happening field in the growing scientific world. This is a platform with a plethora of innovations and inventions. To speak on inventions and innovations it always becomes essential to touch upon the arena of protection which is possible through intellectual property rights. Inventions that are specific to jurisdictions in itself raise concerns coming to space and space related inventions give rise to serious ambiguity about jurisdiction and enforcement of intellectual property .When it comes to issues of patentability jurisdiction in a an unspecified and undefined territorial structure often involves the outer space treaties and international conventions. Historic legal issues have arisen as a result of human space travel, especially when it comes to protecting and upholding intellectual property rights. Because space transcends national boundaries, there is a great deal of ambiguity about jurisdiction and enforcement under traditional patent law, which is territorial. It considers the consequences for both public and private enterprises involved in space research, the difficulties of enforcing the law in a non-territorial setting, and the dangers of "flags of convenience" jeopardizing patent protection. A plethora of new inventions, from satellite technologies and propulsion systems to space mining and gadgets for extraterrestrial settlement, have resulted from the 21st century's tremendous advancements in space technology. The protection of technical innovation has been greatly aided by the role of intellectual property rights, including patents, as both public and private investors make greater investments in space exploration.In addition to promoting research and development, patents create legal ownership in a field that is characterized by global rivalry and collaboration. However, there are particular difficulties with applying patent law in space, including jurisdictional ambiguity, enforcement problems, and conflicts with international agreements like the 1967 Outer Space Treaty, which forbids national takeover of space. The shortcomings in the current national and international legal frameworks for the protection of patent rights for ideas created or used in space are critically examined in this study. The paper also addresses the relationship between patent law and space inventions is discussed in this abstract, which also highlights regulatory gaps, legal nuances, and the need for a unified international framework to permit the equitable protection and use of space-based technologies

Keywords: Patents, jurisdiction, outer space, space inventions, international

1. INTRODUCTION:

One of the most exciting areas of human invention is the exploration and use of space, which is being fueled by both public and private sector involvement and the quick development of technology. While

outer space itself remains out of reach for most of us, the results of space activities and developments from space technology are becoming ever-more integrated in our daily lives. Despite this, there is often little understanding of the importance of space technologies, how existing legal rules may apply in terms of protecting the technology, or whether legal protection, such as copyright, may be enforced if the unauthorised use takes place beyond conventional territorial borders in outer space.[1]The need to secure their ideas through intellectual property in these operations may become a pressing issue as long as commercial players continue to participate in space exploration, particularly when humanity establishes themselves on a new planet like Mars.The question of whether inventions relating to space can be patented is becoming more and more significant, particularly as the International Space Station (ISS) draws closer to completion. In a similar vein, the Space Station will employ patented Earth-based inventions. What types of experiments could be conducted aboard the ISS? Theoretically, only within the borders of designated nations are national and international patents enforceable. Antarctica and the high seas are examples of outer space that is not a part of any nation's sovereignty and is not subject to national appropriation. This suggests that using, claiming, or appropriating outer space in any way is prohibited.[2] There is currently no international regulatory framework for the protection of intellectual property rights on Mars or elsewhere in space, which may be preventing or restricting newcomers from the private sector from participating in space activities alongside governmental space agencies. This is true even though a number of public international agreements and treaties pertaining to space activities and intellectual property rights entered into force decades ago.[3] Protecting intellectual property (IP) rights, especially patents, is crucial as space activities spread outside of Earth's atmosphere and include satellite technology, propulsion systems, space mining, and possible interplanetary settlements. By providing legal ownership and encouraging investment in a fiercely competitive and cooperative global market, patents are an essential tool for promoting research and development (R&D). However, traditional IP systems, which are intrinsically linked to national jurisdictions, have particular difficulties due to the extraterritorial character of space. The expansion of commerce and exploration activities in space is posing a growing threat to the legal governance of intellectual property in outer space. Existing international agreements, like the Outer Space Treaty, don't provide enough guidance on intellectual property rights in space. The ownership and protection of inventions created in space must be handled under a clear and uniform legal framework. A key concern is striking a balance between encouraging innovation and providing resources in an equitable manner. Regulations in the future must change to support both technological development and international collaboration in space activities.[4]This study of the literature looks at how patents are changing in space, emphasizing the uncertainties surrounding international harmonization, enforcement, and jurisdiction. It emphasizes the need for a unified international system to guarantee fair protection of space-based ideas, thereby promoting sustainable space commerce and innovation for future generations, by examining important academic publications, treaties, and court decisions.

[1] Tosaporn Leepuengtham, *The Protection of Intellectual Property Rights in Outer Space Activities* (Edward Elgar Publ'g 2017)
[2] *The Community and Space-Related Inventions*, 30 **J. Space L.** 1 (Spring 2004).
[3] Němcová, Terezie, *Is Human Settlement on Mars Marking the Beginning of a New Era of Intellectual Property Rights Protection in Outer Space?*, in *Assessing a Mars Agreement Including Human Settlements* 15–25 (2021).
[4] Hordeiuk, Alla, Andrii Ostropilets & Ihor Bohdaniuk, *Current Issues of Legal Regulation of Intellectual Property in Space Field, in Networks and Systems* 367 (2022).

2. BACKGROUND:

The advent of human activity has irrevocably expanded into outerspace driven by intensifying globalization, ever changing dynamics in space and rapid technological evolution. This rapid change necessitates the universal harmonization of industrial and IP laws. One of the standard forms of IPR which is the patents might help curb and reduce the tensions around the issue of patentability if space related inventions also the jurisdictional issues that might arise.The space sector is now a commercially viable sphere, involving a diverse set of public and private actors globally.Space operations are expanding and changing quickly, and they are increasingly being conducted by for-profit companies looking to become dominant players in their respective sectors.Private companies operating in the commercial space sector face numerous legal ambiguities about intellectual property.Theoretical and practical challenges surround intellectual property rights in space. It is challenging for legal institutions to stay up to date with emerging space technologies. Conflicts arise between commercial interests, international agreements, and national laws. Businesses and inventors are left in the dark about how to implement these processes. Conflicts over ownership and use rights will increase as commercial space develops. For IP to be effectively protected in the space environment, more unified and strong policies must be put in place.[5] Operations that take place outside of Earth's atmosphere are not covered by current patent laws. This puts space technology investment and innovation at risk. Businesses might not be able to prevent infringing on their innovations[6]. For the space industry to expand and innovate, more clear legal frameworks must be put in place. Space activities are described as being extremely technical and frequently disruptive, which inevitably involves mentioning the intellectual property that supports or is connected to them. Intellectual property is a vital resource for practically any entity involved in space activities, whether for commercial or non-commercial purposes. Without a doubt, this calls for the provision of sufficient intellectual property protection as well as the ability to enforce that protection, particularly in the case of a claimed violation.[7] For patent protection, the commercialization of space poses particular difficulties. The rights of private businesses operating in space are not well-represented in the legal frameworks in place today. It is essential to have a single legal framework for intellectual property in space to avoid conflicts between countries.The fragmented nature of the current regulation causes uncertainty for investors and enterprises. National and international legal inconsistencies could impede the advancement of technology. Standardized regulations would protect and encourage innovations in commercial space. For the global space sector to grow sustainably, consistent intellectual property rules are required.. Innovation and investment are made uncertain by ambiguities in national and international regulations. Without well-defined legal protections, businesses run the danger of infringement and have little options. Strengthening patent regulations is essential to foster a secure and competitive commercial space industry.[8]As commercial activity in outerspace accelerates, space related inventions and services have significantly commercial value.Protecting this value is crucial as space technologies require expertise and collaboration.Patents are

[5] Z. Chen & Y. Zhao, *Intellectual Property Protection in Outer Space: Conflict in Theory and Application in Practice*, *Space Pol'y* (2022)
[6] Gerald J. Mossinghoff, *Intellectual Property Rights in Space Ventures*, 10 J. Space L. 107 (1982).
[7] Catherine Doldirina, *Resolution of Disputes Regarding Infringement of Intellectual Property Rights Related to Space Activities*, Proceedings of the Int'l Astronautical Cong. (IAC) (2019).
[8] Liz Malmen, *Exploitation of Space and Patent Law: How the Current Legal System Ineffectively Protects Private Companies in the Commercial Space Industry*, 20 Santa Clara J. Int'l L. 80 (2021–2022).

recognized internationally as aprimary indicator for measuring innovation serving as a crucial mechanism for securing the financial and intellectual assets for necessary space exploration.Global patent filing in the specific field of cosmonautics has seen worldwide growth in the past decade.[9]Allthe examined technologies domains specifies by the European Space Agency show a growing number of patent filings with three largest worldwide being space craft .This significant increase in worlwidde patent filings has been driven bu the chinese.[10]

3. DELINIEATING SPACE ACTIVITIES:

There is currently no clear definition of either 'outer space' or 'delimitation of outer space', and the two terms are employed synonymously. The present work will employ 'delimitation of outer space'. While the delimitation issue has been debated for years under the umbrella of the Committee on the Peaceful Uses of Outer Space, an organ of the United Nations since 1966, no consensus has yet
has been achieved. Although no delimitation of outer space exists under any regime of international law, definitions are included in some states' national legislation. Australia, for instance, revised its 1988 Space Activities Act in 2002 to define 'outer space' as a region outside the 100 km distance from mean sea level. One key consideration that stands in the way of consensus on the definition and delimitation of outer space is disagreement on the criteria for setting such delimitation. Two principal approaches, the 'spatial' approach and the 'functional' approach, have been advanced for consideration. There are two different approaches, namely the spatial and functional approachesThe spatial approach bases the outer space border on technical and scientific standards.Unlike the spatial approach, the boundary used under the functional approach is determined on the basis of the nature, type and conditions of different space activities. States opting for the functional approach propose that an distinction be drawn between aeronautical and
astronautical activities. Accordingly, activities are governed in terms of the specific mission and aim under a uniform legal regime either of air law or space law. Instead, there is no requirement to define a delimitation of outer space.[11]

4. GLOBAL TRENDS:

With significant events like the 1957 launch of Sputnik and the 1969 Apollo moon landings, human space exploration really got underway in the middle of the 20th century. At first, government organizations like NASA and Roscosmos controlled this field. Formally known as the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon, the 1967 Outer Space Treaty established fundamental principles that forbade national appropriation of space and placed a strong emphasis on using it for the good of all people. Later accords, such the Moon Agreement in 1979 and the Liability Convention in 1972, further delineated roles for space operations.
The commercialization of space has increased in the twenty-first century, driven by advances from private firms like SpaceX and Blue Origin as well as up-and-coming firms in space mining and tourism. Space-

[9] European Patent Office, European Space Policy Institute & European Space Agency, *Cosmonautics: The Development of Space-Related Technologies in Terms of Patent Activity* (June 2022)
[10] Ibid
[11] *The Protection of Intellectual Property Rights in Outer Space Activities* (Edward Elgar Publ'g 2017).

related innovations, like as sophisticated propulsion and debris removal systems, have increased dramatically as a result of this change. Traditionally, intellectual property rights have been territorial, enforceable only inside national borders, and are governed by international frameworks such as the Paris Convention. Space activities, however, cross these lines and give rise to conflicts with international space law. IP protection gaps have been brought to light by historical concerns, such as those resulting from the operations of the International Space Station. These issues include discussions over the applicability of national laws to space objects and the patentability of ideas developed in orbit. The literature reveals ongoing tensions between promoting The literature lays the groundwork for proposals for standardized international norms by exposing persistent conflicts between securing proprietary rights to attract private investment and advancing open access to space (as required by the OST's non-appropriation clause).n access to space (as per the OST's non-appropriation clause) and securing proprietary rights to encourage private investment, setting the stage for calls for harmonized global standards. The oute space sector has seen a very aggressive growth particularly sice 2013 with increase in usage of small spacecraft and double the times usage of satellites in less than a decade. Commercial revenues in the space sector reaced 336 USD on tye year 2019, postulated by rising financial market interest in new business findings. This evolution of technology fueled by high level of technological intrusion underlines the critical need for achieving universal balance of space industry and intellectual property law.The protection of these technology can be done through patenting as they provide a legal mechanism to secure the extensive investment and expertise for space related technology which ranges from propulsion systems and advanced robotics to networking satellites and space habitats. To be precise patents provide exclusive rights for specified period typically 20 years allowing not to commercially exploit these technologies. Delving into global trends in patent activity patent filing statistics serve as a reliable indicator for measuring innovation, commercialization and technological transfer trends within the space sector.Despite this rapid commercial growth and innovation the infr4atructure in space remains at the grass root level. The International Space Station provided an early example where IP protection comes into light with sparkling applicability of national laws to subject.

5. STATEMENT OF PROBLEM:

Traditional patents has its roots in the concept of territorial sovereignty and are are ill equipped to handle the challenges posited in patentability of outer space inventions where complex inventions relating to space are developed which gives rise to significant territorial issues.The issue revolves around the core conflict between the territoriality issues of patents surrounding patents and extraterritorial nature of spatial inventions.Despite specific existing international agreements and principles like those governing the ISS,the application of the lex loci protectionis principle fails where the aspect of territoriality is a legal void.The assertion of property rights exclusively monopolies conflicts directly with the foundational principles of the Outer Space Treaty which prohibits national appropriation and mandates the activities be carried out for the “benefit and interests of all states.For investors thinking about using or producing space, this tension generates legal uncertainty. Due to the lack of a unified international framework that nations could adopt, private states are able to register their space objects in nations with flags of convenience or with little protection, which creates disputes that threaten the sustainability of space globally and deter private investment in nations with stringent intellectual property laws.Without harmonization, the resulting lack of clarity and legal certainty as to the extent of IP protection puts the development of space

technologies at risk.The issues pertaining to implementation of flags of convenience , that is in the absence of unified international framework that allows private actors to register theor spatial inventions that offer minimum standard of protetcion thereby leading to issues with regard to global space sustainability and discourage private investment in countries with rigid IP regimes.Thus without harmonization there is a intrinsic vaccum with regard to clarity anf legal certainty as to extent of IP protection puts development of space technologies at risk.

The special difficulties of space activities, where inventions may be created, utilized, or violated outside of any country's borders, are beyond the scope of traditional patent rules, which are based on territorial sovereignty. The outer space treaty , which forbids territorial claims in space while requiring collaboration, is one example of an international treaty that suffers from serious difficulties in jurisdiction, enforcement, and compliance. Among the main issues are: the absence of a unified international framework for intellectual property protection in space, which could lead to conflicts between national laws applied through "state of registry" principle; the dangers of "flags of convenience," in which organizations register space objects in jurisdictions with weak IP enforcement in order to take advantage of technologies; enforcement challenges in a non-territorial setting, like identifying violations on satellites or while debris removal is underway; and obstacles to private sector involvement, since legal ambiguities discourage investments in high-risk space projects like orbital manufacturing or Mars settlements. These disparities not only stifle creativity but also worsen inequality, giving preference to well-established firms and possibly sparking conflicts that jeopardize the sustainability of space on a global scale. The commercialization of space might stop in the absence of harmonization, which would restrict the fair advantages of space technologies for all people.

6. RESEARCH QUESTIONS

1. What are the international agreements in place to interact with national and international patent law?

2. What are the primary jurisdictional and enforcement challenges in applying patent protection to space-related activities, including inventions created on platforms like the International Space Station?

3. What is most feasible solution to harness the issue of patentability around the space sector?

7. OBJECTIVES:

1. To critically review existing literature on the intersection of patent law and space activities, identifying key legal principles and case studies.
2. To analyze the shortcomings in current national and international IP frameworks as they apply to extraterritorial inventions in space.
3. To evaluate the implications of IP protection gaps on space sustainability, commercial ventures, and equitable access to space technologies.

8. GLOBAL DYMAMIC SPACE PATENT ACTIVITY:

The space industry has undergrone a profound structural and commercial transformation moving from an exclusive domain of developed nations to an increasingly democratized and economically viable sphere attracting diverse public and private investment.This intense expansion emphasizes the critical role of patents which consistitute the core of the fuctioning of the NASA.This comparative study analyses various national strategies of major global players the US, China and India by examining their roles in global patenting trends,their approaches i handling this issue of territoriality in the space law and patents

9. THE DOMINANT POSITION OF THE UNITED STATES:

Viewing it from a historical perspective in the US which has an extensive influence on patenting space and space related technologiesas it has been the prominent actor in the global space sector with a annual civil space budget and a thriving space private industry. US space based industries lead the overall 30 year statistics in cosmonautics patenting activity.Between 1976 and 2023, individuals and organisations located in the US were granted the largest number of space patents by USPTO totalling 7895.[12]This figure vastly outspaces Europe and Asia during the same period[13].The number of patent applications disclosing space inventions in the US grew tremendously in the recent decade. This is approximately four times higher than the growth rate for all patent applications.Central to this the US space industry pursue broad international protection, suggesting a strong focus on global commercial relevance.They demonstrate significant patent filing activity accounting for 32% of filings by inventor's country of origin in that territory, signaling that US entities view European space markets as highly valuable.[14]The US has implemented the most specific and far-reaching measure to curb patent issues in space through explicit national legislation.Thus one significant solution in the Patents in Space act 1990[15].This legislation establishes a mechanism for extending US patent law beyond terrestrial boundaries.The provision states the extra territorial application for the purposes of US patent law.[16]This essentially has its origin in the Outer Space treaty of and the Registration Convention of 1975 which asserts that a country of registration retains jurisdiction and control ove the space object in outer space.However there are twofold exceptions that is a space object that is where a space object specifically identified and otherwise provided for by an international agreement to which the US is a party.A spac object that is carried on the registry of a foreign country in accordance with the convention.The former is precise while the latter creates a lacuna where an entity can avoid patent infringement by registering its space object in a foreign country where the competitor's technology was not patented.The US along with other big players like Rusiisa, Japan, Canada and ESA member states utilizes the Intergovernmental agreement for the International Space Station to curb patent issues

[12] U.S. Patent & Trademark Office, *Intellectual Property and the U.S. Economy: Third Edition* (Office of the Chief Economist, 2021)
[13] Ibid
[14] European Patent Office & European Space Policy Institute, *Cosmonautics: The Patent Insight Report — The Development of Space-Related Technologies in Terms of Patent Activity* (July 21, 2021)
[15] Patents in Space Act of 1990, Pub. L. No. 101-580, 104 Stat. 2863 (codified as amended at 35 U.S.C. § 105).
[16] Prashanti Upadhyay, *A Comparative Study of Intellectual Property Rights Issues in Space Activities in U.S.A., Canada and India*,

.Regarding the issue of territoriality establishes a quasi territorial principles,meaning that an activity occurring within a ISS partner module is deemed to have occured in the terriotory of the partner state[17].This makes national patents enforceable against infringing acts taking place on the registered ISS modules.

INDIAN PERSPECTIVE:

India's involvement in space inventions is defined by a strong commitment to developing autonomous space capabilities and leveraging technology for national developmental and security needs. As a major space-faring nation,India's stance on Intellectual property Rights in the sector is charcterized by reliance on a robust domestic legal framework compliant with international standards,strategic international cooperation based on complementary strengths and an acute awareness of the urgent need for universal harmonization of space law to address the fundamental challenge of IPR territoriality in the cosmos.The foundation of India's space strategy is rooted in the technological self sufficiency and application development for national benefit.Space activities in India formally commenced in the 1961 under the department of atomic energy, subsequently transitioning through the Indian National Committee for space research operating under department of space created in 1972.India's core vision has consistently been to possess autonomous space capability. This commitment means teh country designs, develops, builds, launches and operates its indigenous launch vehicles and all classes of satellites for applications in various fields. India operates two major operational satellite systems, demonstrating advanced capabilities critical to its economy and security. One being the Indian National Satellite system used primarily for telecommunications, television broadcasting and meteorological services.The Indian Remote Sesing Satellite system employed to monitor and manage natural resources used for Earth observation applications. India has the worlds's largest constellation of civilian remote sesing satellites. In terms of launching capabilities, India fields two series of operational launch vehicles also the Polar satellite Launch Vehicle (PSLV) used primarily for launching remote sensing and scientific experimental satelloites up to 1600 kilograms into polar or low Earth orbit[18]and the Geosynchronous Satellite Launch Vehicle capable of putting 2,200 kilogram satellites into space.India's stance on IPR protection for space technology is primarily governed by its Patents act,which ensures alignment with global standards and provides a foundation for protecting innovations developed by ISRO, academia and the increasing number of private players.The national legal framework for IP protection in India is highly influenced by international agreements.The Indian Patents Act 1970, serves as the legal framework for patenting inventions,including those related to space technologies.This act aligns with international standards set by the TRIPS Agreement.TRIPS mandates that WTO member countries,including India which gives the minimum standard of protection for inventions related to space technologies,thereby harmonizing patent laws across countries and providing greater certainty for companies.India is also a member of the Patent Cooperation Treaty .The PCT provides a mechanism for investors to file a single international patent application that is recognized by multiple countries,which is particularly important given the global applicability of space innovations.This system is crucial for promoting the development and commercialization of space

[17] European Space Agency, *Patents and Space-Related Inventions*, Intellectual Property Rights, ESA
[18] supra

technologies on the international stage.Under the Indian Patents Act,patents are granted for inventions that are novel , involve an inventive step and are capable of industrial application.As space exploration technologies are often highlyadvanced,protecting such innovations ensures that companies and research institutions are incentivized to push technological boundaries.Given the hight cost and complexity of space related ventures,securing IPR's is vital for protecting investments and ensuring that technologies can be used profitably.The Indian Patents Act recognizes the important of industrial application,enabiling patent holders to profit from their inventions.The confidence provided by the Patents Act system filing patents related to space technologies,particularly with the increasing involvement of private players in space ventures in India.A key characteristic of the Indian stance as derived from the sources is the lack of a specified extraterritorial patent extension akin to US Patent Act.While the Indian Patents Act robust protection for inventions within India's territory the universal principle of IP law is territoriality.IP rights are legal rights granted by a state, and the owner can seek enforcement only within the state .Thisn reliance on strictly domestic IP law means that for inventions made or used purely in outer space , beyond a nationally registered object like an International Space Station module,India faces the same challenge as most other nations viz legal certainty regarding enforcement and jurisdiction.International cooperation has been a hallmark of the Indian space program, with ISRO signing over agreements dealing with various areas of space technologies and services.This strategy allows India to leverage its distntinct strengths by forming complementary partnerships.India maintains strong and active bilateral cooperation with the US , the Russian Federation and a number European countries.India - US ties have parallel led the nature and scope of their general and political and stratetgic relations,historically influenced by India's policy of non alignment.Currently,the two countries are establishing close relations in areas of significant importance,including trade,military cooperation,nuclear technology and space technology.They have commited themselves to agreements that would allow the launch of US satellites and satellites containing US components and technology by Indian launch vehicles.India, as a party to the five international treaties and agreements associated with international space law including the Outer Space Treaty,the Rescue Agreement,the Liability Convention,the Registration Convention and the Moon agreement attaches utmost importance to every international approach associated with peaceful uses of i=outer space.India continues to play an active role in the UN Commitee on the Peaceful Uses of Outer Space and its subcommittees, the only international forum for developing space law.The sources emphasize that the issue of IPR's in respect of inventions made or used in outer space might require harmonized international norms for their solution.This necessity arises from the inherent conflict between space law and IP law.Space law is extraterritorial,teh same for all states and says share benefits.Ip law is territorial different in each state and grants a monopoly.Since Ip protection is territorial,enforcing rights when an activity takes place in outer space,where no states claims sovereignty is highly problematic.This legal amobiguoity deters states and non governmsntal organizations afrom actively engaging in commercial space activities.

STRIKING THE BALANCE:

The inference from the above comparison states that patent filing serves as a key for measuring innovation,commercialization and knowledge transfer in the space sector.The data reveals three distinct trends regarding the scale and intent of patenting the US and India.The US has historically maintained the most prominent patenting activity globally..US entities have been granted the largest number of space

patents.This volume significantly surpasses that of EUROPE and the entire Asian region granted during the same period.The US innovation engine is accelerating in arate approximately four times higher than the growth rate for all applications US technological focus spans nine component areas,including satellite communications,poistion and earth observation.Crucially US actors pursue broad international protection,suggesting a strong focus on global commercial relevance.This commercial evolution is empirically=y substantiated by a steep worldwide growth in patent filing in cosmonautics in the past decade.This increasing patent activity is seen as an indicator of maturing market where contributing players actively seek to protect their intellectual assets.Geographically the patent landscape indicates a dramatic shift in globaol innovation dynamics.The most critical legal inference is the fundamental incompatibility between existing intellectual property law and the extraterriotorial nature of outer space.Patent rights originated from the law of the land,extending only within sovereign territorial bpopundaries.The territorial scope of IP laws may not fit well with the protection of intellectual property created and used in outer space.The fact that an invention is made in outerspace does not change the basic requirements of patentability.However issues involving IPRs in outer space require harmonized international norms for their solution due to complexity of the legal challenge.The application of international IP conventions is limites=d in outer space.crucially the commonly accepted rules for determining the applicable law in IP disputes such as the law of protecting country or law of country of origin are technically inoperative when the place of creation or infringement is in outer space as no national law is applicable there.While some states have extended jurisdiction to registered=d space objects the solution of extending domestic law to give extra territorial effect is limited, use in outer space would still fall beyond the scope of any national law.The clear conclusion is that private international law cannot sufficiently fill all gaps arising from disputes.Given the persistence of legal uncertainty the final inferenc eis the pressing need to move beyond existing legal isstruments abd create a specialized framework.The conclusion of this study emphasis the critical role in IP shaping the future of space innovation.The existing space treaties should be interpreted in a way to support and allow an increase in commercial activities in outer space.IPR is recognized as an efficient legal mechanism to ensure and secure the interest of private enterprises engaging in space activities.Although none demand the relinquishment of intellectual property rights , the principle of non appropriation and common heritage of mankind appear to bar protection of certain space activities such as private ownership of productus derived from space resources.Therefore the solution must reconcile the public benefit principles with interests of private entities.Taking into account the unique, extraterritorial nature of space activities, the conclusion endorsed by the sources is that the best solution would be the creation of a specially tailored regime for the protection of IP rights in outer space activities.This is necessary because private international law has been found to be insufficient to fill the identified gaps, particularly concerning the applicable law.This proposed regime could involve a new substantive IP law and the establishment of a Space Tribunal and Space Bureau, tasked to adjudicate and administer actions relating to space activities.India’s position within this dynamic environment infers a strategy of leveraging indigenous strengths through structures partnerships.The patent cooperation treaty is a central international instrument in striking balance between intellectual property alw and space law.Given that private international law cannot sufficiently fill in all the gaps there is need for new legal mechanism.

CONCLUSION:

According to the study, intellectual property rights (IPR) are crucial for promoting innovation and space industry development. Intellectual property is now the main focus for safeguarding investments and promoting innovation in space applications due to the rapid development of new technologies and the growing involvement of private firms.Given the growing commercial significance of space services and products, such as satellites, robotics, and space tourism, strong intellectual property rights (IPRs) are necessary to incentivize companies to take financial risks and invest in innovative technology. The space industry might fail without them as investors and inventors would not be safeguarded..However, the primary reason for the shortcomings of the current legal system is the inherent clash between the extraterritorial requirements of space law and the territorial nature of IP rules. Traditionally, intellectual property rights are territorial, meaning that they are granted and governed inside the borders of the state that grants them. But according to space law, which is governed by the 1967 Outer Space Treaty (OST), space is the "province of all mankind" and it is illegal for a country to appropriate space or celestial bodies. This conflict of values creates ambiguity in jurisdiction. For example, because there is no national law with jurisdiction outside of Earth, general procedures of Private International Law (PIL) cannot be applied effectively if an invention is made or duplicated in space.Private companies engaged in space operations are confused by these ambiguities, which makes it more difficult to enforce patents or protect proprietary innovations. Supporting technological growth is the aim of intellectual property, but it's also critical to stop monopolistic tendencies from undermining the spirit of international collaboration in space exploration.. Furthermore, intellectual property issues are not particularly addressed by present space accords, leaving gaps that are only partially filled by special-purpose contractual agreements, such as those pertaining to the International Space Station (ISS). The gaps would widen and endanger innovation and international cooperation as private organizations continue to engage in commercial lunar operations and asteroid mining.A uniform international framework of space IPR is required to address these issues. The first strategy would be to create a unique international space intellectual property regime by treating space as a single jurisdiction and enforcing a set of uniform regulations. This would resolve jurisdictional problems and provide stakeholders with clarity. Second, there must be regular enforcement mechanisms in place, such as a specialized Space Tribunal or Space Bureau, which are in charge of resolving disputes and keeping an eye on adherence to IP laws pertaining to space.Furthermore, the OST ideals and intellectual property rights protection would have to coexist. While providing innovators with a fair compensation, a compromise license system might permit the unfettered use of space technology for the good of all. Additionally, bilateral cooperation needs to be strengthened. For example, India and Canada can leverage their complementary skills s and India's low cost launch capabilities to promote joint innovation through legally binding agreements. Last but not least, the United Nations legislature and related national laws must minimize jurisdictional ambiguity and harmonize international patent systems. The international community would support the advancement of inventions, draw in private capital, and ensure the space economy developed sustainably and fairly by establishing a single, clear rule.

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