

ISSUES IN PROTECTION OF INTELLECTUAL PROPERTY CREATED IN OUTER SPACE: AN INDIAN OUTLOOK

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Summary

The 21st century, with the entry of number of governmental and non-governmental actors in space exploration provides a great opportunity to understand, discover and invent. The national intellectual property regimes are generally based on territoriality. The application of national law to situation in space might cause problems. The focus of this paper is to discuss the present space law regime vis-a-vis its implications on intellectual property protection of inventions made in the space. The first part introduces the subject. The second part examines the present space law regime and possible approach to intellectual property protection and liability of infringement in space. The third part of the paper provides a basic view of patentability criteria of inventions made in space. Trade secret protection is another area of discussion in collaborative research. Remote sensing principles and copy right protection is analyzed along with international law principle on remote sensing. The fourth part examines the Indian space activities and IP protection. The paper concludes that the present regimes are not sufficient to deal with inventions made in space and appropriate amendments should be made to the existing regimes to include inventions made in the space. Other aspects like, criminal, civil and tortuous liabilities are not part of this study.

Key Words: Intellectual Property Protection, Space, India.

1. Introduction

The scientific endeavour and quest for knowledge had always been the main driving force for any exploration, space exploration in particular.¹ The historic launch of Sputnik by the then Union of Soviet Socialist Republic (USSR) on October 4, 1957 laid the cornerstone of space race in the history of mankind.² In November 3, 1957, Sputnik II was launched with higher payload and carrying a dog named Laika.³ This was followed by the United States (US) with the launch of Explorer I in January 31, 1958. The first spaceflight carrying human was undertaken by the USSR on April 12, 1961 and Yuri Gagarin travelled in the Vostok-1 mission.⁴ There after several countries for e.g., China, European Union, India and many others have joined the space exploration and application programs. The monopoly of governments in space missions are going to be end with the launch of "Virgin Galactic," a private space ship (rocket plane) basically meant for space tourism by an American company located in New Mexico. In

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December 2009, the company unveiled its first space travel schedule within two years.⁵ This is declared to be the first manned commercial spaceship. Space law is mostly derived from international law. The scientific programs undertaken in space mission raises many questions on international law and the creation of new technological innovations and proprietary rights raises many questions on intellectual property (IP) protection at space.⁶ This assumes even more importance with the entry of private entrepreneurs in space exploration for scientific purposes.

The conventional attributes of property rights give the power to exclude others from enjoying it.⁷ On the other hand, space law mostly propagates that space is a common province of mankind.⁸ These two approaches may often collide. The Moon Treaty goes further by declaring that the moon to be the common heritage of mankind. The concept of common heritage of mankind and proprietary rights won't go hand in hand. Private commercial investors argues that the absence of property rights prevent them from getting external financing and getting appropriate income from their investments. Thus the argument was that lack of sovereignty in space jeopardizes their ability to make profits from investments.⁹

The absence of an international governing law and standard on rights and liabilities of IP protection for inventions made in space may require a sui-generis regime to deal with the situation or necessary amendments to the existing space law. The space research and huge investment by governments and private corporations requires specific regimes and protection of their IP generated in the space. Hence, it is imperative that the space faring nations should develop an international regime to foster space related science and technology research.

Presently the US, China and Russia have accomplished manned space flight. The EU, India and Japan have declared their intention to have manned space flight in the near future. The collaborative space missions are common at present, like the CARTOSTAT-2A launched by India along with eight nano-satellites of various countries into the orbit in 2008.¹⁰ Collaborative research raises many questions of IPR enforcement at different jurisdictions and the jurisdiction of infringement disputes resolution is not clearly mentioned in any of the agreements.

The property rights include intellectual property rights (IPRs) include industrial property rights like patents, trademarks, copyrights and database ownership. All these rights exclude others from enjoying it for a limited period of time. Next part analyzes the existing space law and its accommodation of intellectual property rights.

2. International Law on Space and Intellectual Property Protection

The definition of space is vague and not defined in any international conventions. A universally accepted definition has not yet been adopted. The entire international law on space is contained in the following treaties and principles adopted by the UN from time to time.

Treaties

1. Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, 1967.
2. Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, 1968.
3. Convention on International Liability for Damage Caused by Space Objects, 1972.
4. Convention on Registration of Objects Launched into Outer Space, 1976.
5. Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, 1984.

Principles

1. Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space, 1963.
2. Principles Governing the Use by States of Artificial Earth Satellites for International Direct Television Broadcasting, 1982.
3. Principles Relating to Remote Sensing of the Earth from Outer Space, 1986.
4. Principles Relevant to the Use of Nuclear Power Sources in Outer Space, 1992.
5. Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking into Particular Account the Needs of Developing Countries, 1996.

The treaties and principles relevant to this paper discussion, "IP protection in space" has been examined below.

The earliest treaty on the space law is the Multilateral Treaty on *Principles Governing the Activities of States in the Exploration and Use of Outer Space including the Moon and Other Celestial Bodies*, Jan. 27, 1967 (Outer Space Treaty: OST).¹¹ The declared object of the OST is to "contribute to broad international cooperation in the scientific as well as the legal aspects of the exploration and use of outer space for peaceful purposes and the exploration and use of outer space, including the Moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development."¹² The treaty talks about freedom of exploration of outer space and other celestial bodies, non-appropriation of outer space, the exploration in accordance with the principles of international law and UN principles, demilitarization of outer space, retention of sovereign rights over the space crafts launched and liability for space activities.

Article II of the treaty states that “outer space... is not subject to national appropriation by claim of sovereignty...” the treaty declares that the exploration and use of outer space shall be carried out for the benefit and in the interests of all countries and shall be the province of all mankind.¹³ It stipulates that the use of space must be for the benefit of all nations regardless of their level of economic or scientific development.

Article VIII of the treaty provides that each party launches an object into outer space whose territory or facility an object is launched shall have jurisdiction and control over the persons on board. Participation of private entities like “Virgin Galactic” in outer space activities has not yet been contemplated in international law.¹⁴ However, Article VI provides that “States Parties to the Treaty shall bear international responsibility for national activities in outer space, including the Moon and other celestial bodies, whether such activities are carried on by governmental agencies or by non-governmental entities.” Even though it appears that “non-governmental entities” include private actors, it is not clear whether “national activities” include the activities of private companies or consortium of countries or personnel on board at the spacecraft and whether the registering country is liable for such activities.¹⁵ Furthermore, the treaty imposes an obligation on nations conducting outer space activities to inform the Secretary-General of the results of such activities.

All the spacecrafts have to be registered with the UN under the Registration Convention, 1967. It also provides that “States shall bear international responsibility for their national activities in outer space and refers to the State on whose registry an object launched into outer space is carried...”¹⁶ The jurisdiction is mostly explained as nationality rather territoriality. The liability of what is happening inside the spacecraft is clearly fixed in the convention as the liability of the launching state.¹⁷ Here the “launching state” is charged made responsible to ensure that a private actor in outer space is acting in conformity with the OST. Article 1 of the treaty defines the launching state as:

- (1) A State which launches or procures the launching of a space object;
- (2) A State from whose territory or facility a space object is launched.

One way it can be claimed that every space station is a part of the launching country. However, US courts refused to implement US patent laws and exercise jurisdiction over ships and plane on or over US airspace.¹⁸ The US government, in order to overcome these restraints imposed by the judiciary, has enacted legislation. The 1988 Space Station Intergovernmental Agreement (IGA)¹⁹ exempts the applicability of 35 U.S.C §, concerns the filing of patents in foreign countries. The parties agreed that respective national legal regimes will be applicable in case of any intellectual property infringements by other partner governments.²⁰ In the event an invention occurs on the Space Station, the country of inventorship will be determined by the ownership and registry of the Station’s element in which the invention has taken place.²¹ This does not impact the

ownership of the invention, not does it preclude the right to file for a patent in multiple countries. In 1990, the US enacted Section 105 of *Patent Code* which is known as *Patent in Space Act*.²² The Act stipulates:

Any invention made, used or sold on a space object or component thereof under the jurisdiction or control of the US shall be considered to be made, used or sold within the US.

The language used here is “jurisdiction or control” and not “jurisdiction and control” used in IGA which conform to Article VIII of the OST. However, the above provision is subject to special agreement between the parties, if any other state launches space craft from US. This made the US to extend its patent law to inventions in space on US registered space objects.²³ It means that all inventions made in the space craft will get the same priority as if it had taken place in the US.²⁴ A space activity can invoke infringement of a US Patent.²⁵ Moreover activities taking place in the space will be considered as occurring within the US for “prior art” purposes.²⁶ The case law in this area is scanty but the US courts applied US laws to deal with government infringement of private patents.²⁷ In *O’Hair v. Paine*, an interesting question arose as during the launching of Apollo 8 and 11, whether the religious statement made by the astronauts in space violated the American Constitution. The court found no constitutional violation by NASA.²⁸

The *Liability Convention, 1972* talks about payment of compensation in case of damage caused by space objects to person and property. The claim can be made against the launching state by natural or juridical persons.²⁹ If multiple states are involved in launching of a satellite Joint and several liability is fixed under Article V.³⁰ So far the *Moon Treaty 1979* has been signed by only eight countries; most of them are related one or other way to space activities except the major space explorers including India.

3. Problems in Intellectual Property Protection in Outer Space

Patents were granted for inventions as early as 1443, and the text of the oldest patent law in the world, officially announced as “Inventor Bylaws” was created in 1474 in the Venetial Republic.³¹ In England, the patent law was enacted in the name of “Monopoly Act” in 1624. In US, patent protection provisions are explicitly provided in the Constitution itself. It provides that: “... in order to promote progress of useful technology and sciences the parliament shall grant limited exclusive rights for a certain period of time to inventors.” The patent law of 1790 was enacted in line with these provisions. It is clear that the mandates of the subsequent international agreements are to promote the protection of industrial property.

The patent rights are usually territorial in nature and it is valid only in the country where it was granted. Neither the national laws nor international conventions (multi-country protection) like Patent Co-operation Treaty (PCT) deal with infringements of inventions used in or made in the outer space. The

commercialization of space technologies require strong patent protection for technologies developed in the space. Liability for an existing patent infringement at the space has to be addressed by setting international norms through existing intellectual property regimes like the Trade Related aspects of Intellectual Property rights Agreement under the World Trade Organization (WTO).

The Paris Convention 1883 on intellectual property is the oldest one for the protection of industrial property not only on inventions it includes trademarks, service marks, industrial designs, utility models, appellation of origin etc. Under the Paris Convention, contracting parties granted right of priority in other states, if they are claiming the rights within 12 months from filing of the patent. The later applications will not be affected by the publication of the prior invention. The substantive provisions of the Paris Convention were included in the TRIPs agreement and applicable only to TRIPs members. Those countries that are not members of the Paris Convention are excluded from this agreement. TRIPs provided additional standards for all forms of intellectual property. The TRIPs agreement was signed by most of the space technology countries except Russia.

The PCT is another agreement concluded in 1970 and currently 142 countries are parties to it. PCT facilitates international procedures by multi-country registration of patents by filing of an application in a single office without delay and cost effectively. Before the PCT system, an applicant has to approach individual patent offices for registration. However, this multi-country registration arrangement does not provide an international patent rather it is largely a treaty for rationalization and cooperation with regard to the filing, searching and examination of patent applications and the dissemination of the technical information contained therein. India acceded to the instrument in 1998 as 98th contracting party. Perhaps PCT provides a possible inexpensive and less cumbersome way of filing patents in all countries involved in space related activities.

The patent laws of every country normally explain the basic patentability criteria envisaged in the TRIPs agreement which is novelty, non-obviousness and industrial application. These criteria may have an adverse bearing on the inventions made in the space and protection of patented technologies in the space.

3.1 Patentability of Inventions Made in Outer Space

Patent rights are strictly territorial in nature where it was granted. With huge investments made in to space missions for scientific research by countries individually and collectively. It is agreeable that the intellectual property value of space technologies is enormous and in normal parlance the ownership questions of inventions are primarily with the creator. This is applicable to inventions made in space. In 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. In a first-to-file patent

system, time and place of invention are irrelevant. Most of the countries use first-to-file system for the determination of priority. In a first-to-file system, when more than one application claiming the same invention is filed, the priority of a right to a patent is based on the earlier-filed application.³²

Only US, Canada and Philippines follow first-to-invent system.³³ First to invent system differs from first to patent system and the place of invention is critical for first-to-invent system. The US follows the first-to-invent system under which it considers the inventor's date of invention as date of conception. The person who converted the application into practice first will be entitled to get the patent, not the first applicant. Actual and constructive reduction into practice should be distinguished. All other countries in the world follow the first-to-file system where the first applicant gets the patent irrespective of the date of invention. It is not possible to determine always that at what time the invention is made. Laboratory notebooks and other records are usually used for proving the claims. The inventions made in the space, the territorial rules will apply for patenting of such inventions. It is not clear how the inventor will prove that the experiment made and practiced in the space or whether it will exactly work in the earth as that of space. It is also questionable the patentability in the case some of the experiments made in space and it practiced in earth.

The second criteria for patentability are the non-obvious character of the invention which was not disclosed earlier. There is no way to determine the prior art disclosure of inventions made in the space. It means that on the date of application, the invention should not be disclosed. The inventions taking place in a spacecraft are shielded from public knowledge like experiments done in a laboratory. The patentability criteria will be protected until it has been disclosed to the public or commercialization of the technology. The unintentional broadcasting of news regarding space activities will invalidate the claim of patent protection. Hence, handling of inventions made in the space should be handled carefully. On the other hand, these restrictions prevents the right of the agency to inform the world about their inventions in the space and the right of the public to know about important scientific developments until the patent is filed on the ground.

Now there is lot of collaborative efforts to send most of the space vehicles by consortium of countries. The ownership of such patents produced by joint ventures of different countries makes the matter more complex. Such partnerships are based on specific agreements and the ownership of patents is also based on the agreements between the parties. It is advisable to agree upon the extent of protection and commercial benefits before sending the spacecraft and inventions. The entitlement of legal rights should be clearly mentioned in the agreement prior to launching. In a team effort, the question of who is an inventor is a critical question in the determination of proprietary rights.

3.2 Trade Secrets

Any company or a consortium involved in the production of new technologies must protect their trade secrets. The classification of technologies and multiple protections should be the part of the intellectual protection policy of the company. The protection of confidential information is another task in all cooperative projects. It is better to have separate agreements for individual projects. It is fundamental to the maintenance of a trade secret that it be kept confidential and not be disclosed to others except under circumstances and with agreements which recognize the holder's trade secret rights. This is important in the background that in most of the countries the nomenclature of the patent law is same, but there is no uniform law in countries to protect trade secrets and it substantially varies from countries to countries.³⁴ The absence of specific agreements will make it impossible to protect the confidential information of the organization.

Another area where the conflict of interest is in IP rights in space is infringement of any existing patents of third parties. It is advisable to take licenses from the existing inventors on likely infringements in the space.

3.3 Copyright in Remote Sensing Data

Copyright protection is available for literary and artistic works. The protection is for the manner of expression of original works fixed in a tangible medium. It does not protect ideas. *The Berne Convention for the Protection of Literary and Artistic Works, 1888* is the oldest international instrument which provides copyright protection in the member countries. This agreement facilitated better protection of copyright all over the world. It protects literary, scientific and artistic domain and all sorts of writings, photographs and maps.

The use of remote sensing of the earth by satellite has grown tremendously since the US launched the first such satellite, Landsat 1, in 1972. In 1984, a private company named Earth Observation Satellite Company (EOSAT) was licensed to do the remote sensing under the *Land Remote Sensing Commercialization Act, 1984*. The raw data or primary data³⁵ was purchased by the data enhancing Industry and sell the processed data³⁶ for profit.

The OST provides that "The States Parties to the Treaty shall bear international responsibility for national activities in outer space, including the Moon and other celestial bodies, whether such activities are carried on by governmental agencies or by non-governmental entities..." it is not clear this responsibility will include liability for any copyright infringement by state parties or non-governmental entities in the space.

The United Nations (UN) has come up with international regulations on remote sensing when it adopted a resolution entitled *Principles Relating to Remote Sensing of Earth from Outer Space*.³⁷ It provides that "Remote sensing activities shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic, social or scientific and technological

development, and taking into particular consideration the needs of the developing countries."³⁸ If these principles had the force of a treaty, which they do not, intellectual property rights in enhanced data would not be possible.

Basically this agreement recognizing each country's sovereignty over its own wealth and resources, and also it attempts to prevent an entity from using information about a sensed state to exploit the state's resources. The processed satellite information is copyrighted and it was argued that this will reduce the accessibility of such data to users like developing countries.³⁹ However, it is necessary to protect the enhanced data produced commercially by this industry from piracy. Principle XV of the UN document stipulates that "any dispute resulting from the application of these principles shall be resolved through the established procedures for the peaceful settlement of disputes." Hence, it is not clear whether this provision will include disputes as to IP protection of data as well.

The *Berne Convention* protects the processed data and the space conventions and principles protect the interest of developing countries and purchases of processed data. With the strict implementation of remote sensing principles of the UN, the IP protection of remote sensing data will be difficult under the existing regime.

4. Indian Space Activities and Law on Intellectual Property Protection

India is emerging as a space power in the 21st Century. Its space programme has started in the 1950s as a part of the department of atomic energy by the visionaries Homi Bhabha and Vikram Sarabhai.⁴⁰ The formal programme had a modest start in 1962 with the constitution of Indian National Committee of Space Research under the chairmanship of Vikram Sarabhai.⁴¹ India started its space operations by launching its first rocket on November 21, 1963. In 1965, India established its Space Science & Technology Centre (SSTC) in Thumba. Indian Space Research Organisation (ISRO) formed under Department of Atomic Energy in 1969. The Government of India established the Department of Space in 1972. The ISRO was brought under the Department and the space programmes were executed by ISRO and it become a government organization in 1975.⁴² In 1975 India launched its first satellite remote sensing satellite Bhaskara-1 and 2, followed by other satellites like APPLE and Rohini. India sent its first astronaut Rakesh Sharma to the space in collaboration with USSR (then) in 1984 in space station Salyut -7. Indian Remote Sensing Satellite (IRS) System was commissioned in 1988.⁴³ The Antrix Corporation Ltd., established in 1992, a commercial entity of the Department is dealing with marketing of various commercial space products. For the last four decades India has launched more than 50 satellites for scientific and technological applications.

In the space sector, India (ISRO) and Canada (CSA) signed an interagency Memorandum of Understanding (MOU) in 2003, which provides for space cooperation with the rapid development and equally fast rate of commercialization of space science and technology, space-related products and

services are becoming elements of significant commercial value.⁴⁴ On February 1, 2008, both American National Aeronautics and Space Administration (NASA) and ISRO signed a framework agreement in order to continue and expand their space related cooperation.⁴⁵ India signed Framework Agreements with Argentina, Australia, Brazil, Brunei Darussalam, Bulgaria, Canada, Chile, China, Egypt, European Centre for Medium Range Weather Forecasts (ECMWF), European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT), European Space Agency (ESA), France, Germany, Hungary, Indonesia, Israel, Italy, Japan, Kazakhstan, Mauritius, Mongolia, Myanmar, Norway, Peru, Russia, Spain, Sweden, Syria, Thailand, The Netherlands, Ukraine, United Kingdom, United States of America and Venezuela.⁴⁶

In April 2008, Antrix launched a remote sensing satellite, CARTOSAT-2A along with eight nano-satellites of various countries into the orbit.⁴⁷ The company is marketing Indian remote sensing data. In October 22, 2008 India entered into another era of space research by launching a spacecraft into the moon under the name Chandrayaan-1.⁴⁸ The prime objective of moon mission was to finding traces of water on the lunar surface besides mapping minerals and chemicals on the Moon. The experiments conducted by the mission revealed the presence of hydroxyl and water molecules in moon.⁴⁹ Now India is planning to launch its first manned mission in 2015.

The development of its own technologies and collaborative efforts made India a space power and used those technologies in a variety of applications like telecommunication, remote sensing, meteorological observation, radio and television broadcasting, satellite aided rescue and operations, navigation and mobile satellite communications. The National Remote Sensing Agency is vested with the authority of acquiring and dissemination of remote sensing data for value. The *Remote Sensing Data Policy (RSDP) of 2001* provides that all data of resolutions up to 5.8 m shall be distributed on a nondiscriminatory basis and on "as requested basis."⁵⁰ The policy doesn't talk about the intellectual property aspects of remote sensing data. Government of India come out with "Satcom Policy" in the 2001 which paved the way for commercialization of Indian satellite communication. India allowed TV broadcasting and up linking through Indian satellites.

4.1 Indian Compliance with International Space Law

India is a party to four out of five UN treaties on outer space law. They are: (1) Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, 1967; (2) Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, 1968; (3) Convention on International Liability for Damage Caused by Space Objects, 1972; and (4) Convention on Registration of Objects Launched into Outer Space, 1976. However, India is not a party to Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, 1984. India is also party to a number of space principles adopted by the UN General Assembly such as Declaration of Legal Principles Governing

the Activities of States in the Exploration and Use of Outer Space; Principles Governing the Use by States of Artificial Earth Satellites for International Direct Television Broadcasting; Principles Relating to Remote Sensing of the Earth from Outer Space; Principles Relevant to the Use of Nuclear Power Sources in Outer Space and Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking into Particular Account the Needs of Developing Countries.

India doesn't have a space law to enable the rapid development of space research and fixing liability under the international space law. However, the government started commercialization of the space activities including launching of satellites for other countries.

4.2 Indian Patent Law

The Indian patents legislation dates back to 1856, when it was enacted in line with the British Patent Act of 1852. However a full-fledged legislation was passed in 1911 named Indian Patents and Designs Act, 1911. After Independence Indian Government appointed Justice Rajagopala Ayyangar Committee and based on its report Indian Patents Act 1970 was passed, which prevailed over a period of three decades until it was amended in 1999.⁵¹ The commitments in the Uruguay Round and TRIPs Agreement compelled India to amend its patent regime in 1999, 2002, 2003 and 2005.

Article 27(1) of TRIPs provides that patents shall be granted to protect inventions, which are "new, involve an inventive step and are capable of industrial application." The agreement allows Member countries to interpret 'inventive step' as synonymous with 'non obviousness'.⁵² Similarly, a country can consider 'capable of industrial application' is synonymous with 'usefulness.'

The Indian Patents (Amendment) Act, 2005 defines what a "new invention" is.⁵³ The definition of invention and inventive step makes it clear that an existing knowledge or thing cannot be patented. Discovery is excluded from patenting subject to section 3 unlike the practice of granting patents for discovery in the US.⁵⁴ It means that discoveries made in space are patentable in US if the discovery leads to solution to a problem and the same is non-patentable in India. In the common English language, the expression "discovery" refers to "the act, process or an instance of gaining knowledge of or ascertaining the existence of something previously unknown or unrecognised."⁵⁵ Discovery essentially refers to finding out something which already exists in nature but was previously unknown or unrecognised. Therefore, unlike "invention" which refers to a new product or process involving inventive step and capable of industrial application [Section 2(1)(j) of the Patents Act, 1970].⁵⁶

Section 2(l) provides that "new invention" means any invention or technology which has not been anticipated by publication in any document or used in the country or elsewhere in the world before the date of filing of patent

application with complete specification, i.e. the subject matter has not fallen in public domain or that it does not form part of the state of the prior art." The question raised here is the patentability of a new form of already known substance in outer space.

Section 2(ja) provides; "inventive step" means a feature of an invention that involves technical advance as compared to the existing knowledge or having economic significance or both and that makes the invention not obvious to a person skilled in the art." The Indian patent law is not going to protect the discoveries made in space even if it is not known to the human beings prior to its discovery.

India require an exclusive space regime in the wake of more expeditions and activities in the space which should also include provisions for protecting its remote sensing data as well as inventions made by Indian astronauts in the future.

5. Conclusion

There should be an international patent regime to promote innovation and inventions in space. It is necessary to provide legal certainty and incentive to invest in space related research and creation of more intellectual property on space and other technologies by experiments in space. The current patent regimes in countries may be similar under the TRIPs agreement, but the output may not be uniform. The question of jurisdiction, liability of launching state and liability for patent infringement remains problematic areas. It is evident that space aspiring nations want to protect their IP rights in space. One of the basic principles contained in the space treaties is that the exploration and exploitation of outer space should be done for all national irrespective of their level of economic development. This synergy can be seen in international agreements on intellectual property rights like the TRIPs agreement. The substantial law has to be solving the jurisdictional problem in order to avoid forum shopping by citing the launching state responsibility. The private international principle of "proper law theory" can be used to solve the jurisdictional problem. Thus the launching state or the domicile of the owner of the space craft can be the proper jurisdiction in IP related litigation relating to space. However, the problem with choice of law theory is that countries would require them to submit to municipal jurisdictions of other countries which they don't want. Mc Dougal suggested "comprehensive interest analysis" theory as a solution to the choice of law theory application in international space law.⁵⁷

It is highly recommended for a uniform jurisdiction under the auspices of the WTO be formed, which will work effectively than any other organization. Copyright protection for processed data is necessary for further investment and development of the remote sensing industry. Moreover, any agreement on patent protection in space should also address the issue of enforcement and liability. The liability of private carriers for commercial and other purposes should be clearly fixed. Private tourism and commercial missions are already in the way. The space aspiring nations should come up with international principles that

effectively extend their notional jurisdiction to the space activities limited to the IP activities. There is no requirement of a *sui-generis* international agreement; amendments to the existing space law will serve the purpose. Harmonization with municipal laws is mandatory for successful implementation of proprietary rights in space. India should come out with its space regime quickly to cope up with its pace of development in the space activities and technologies.

However, any law should take into account the following basic premises:

1. Any law applicable to land may be inapplicable in space
2. The proposed law should cover all aspects of space activities
3. The overlapping of jurisdiction should be avoided
4. International law principles should be applicable to space activities, IP protection in particular
5. Intellectual property protection is necessary for further investment in space related scientific research.

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25. 35 U.S.C. Section 271(a), (1982).
26. 35 U.S.C. Section 101 &102, (1982).
27. See, e.g., *Hughes Aircraft Co. v. United States*, 29 Fed. Cl. 197 (1993) (ruling on issues of (1) government spacecraft infringing on private sector patents; (2) whether launchings constituted "use" of patents; and (3) government liability with respect to spacecraft associated with international space programs); *Beattie v. United States*, 756 F.2d 91, 99 (D.C. Cir. 1984) (using analogy of law governing Antarctica to the law of outer space).
28. Ty S. Twibell, "Space Law: Legal Restraints on Commercialization and Development of Outer Space," *UMKC Law Review*, vol. 65, 1997, p.609.

29. Richard Berkley, "Space Law Versus Space Utilization: The Inhibition of Private Industry in Outer Space," *Wisconsin International Law Journal*, vol. 15, p. 425.
30. The Liability Convention imposes absolute liability on the launching state(s) for terrestrial damage from space objects. In addition, the launching state(s) of space objects, including debris, that collide with other space objects and cause damage can be found liable following a showing of negligence.
31. http://www.jpo.go.jp/seido_e/rekishi_e/rekisie.htm, visited on 03.02.2010.
32. <http://www.ipfrontline.com/depts/article.asp?id=17632&deptid=2>, visited on 15.02.2010.
33. www.uspto.gov/web/offices/dcom/olia/harmonization/TAB29.pdf, visited on 15.02.2010.
34. Raymond E. Vickeyry. Jr., "The Law and Outer space: Intellectual Property," *The Journal of Law and Technology*, Vol.4(9), 1989, p.9.
35. Principle 1(b) of the *UN General Assembly Document No. A/RES/41/65, 3 December 1986*, explains the meaning of primary data as "the raw data that are acquired by remote sensors borne by a space object and that are transmitted or delivered to the ground from space by telemetry in the form of electromagnetic signals by photographic film, magnetic tape or any other means."
36. *Ibid.*, Principle 1(c) defines processed data as "the products resulting from the processing of the primary data, needed to make such data usable."
37. *UN General Assembly Document No. A/RES/41/65, 3 December 1986*.
38. *Ibid.*, Principle II & IV.
39. J. Richard West, "Copyright Protection for Data" 11 NW. J. INT'L L. & BUS. 403.
40. Upendra Chodhury, "Twenty-five Years of Indian Space Programme: An Evaluation," *Economic and Political Weekly*, vol.33, No.5, 1998, pp. 212-213.
41. He is considered as the father of Indian space programme.
42. <http://www.isro.org>, visited on 12.02.2010.
43. <http://www.spacetoday.org/India/IndiaSpaceHistory.html>, visited on 15.02.2010.
44. Geetika Gupta and Shubham Srivastava, "IPR Issues in Space Activities—A Comparative Study of India, USA and Canada,"

works.bepress.com/context/geetika_gupta/article/1000/type/.../viewcontent/, visited on 15.02.2010.

45. "NASA and India Sign Agreement for Future Cooperation" NASA Release: 08-033. 6 May 2008.
http://www.nasa.gov/home/hqnews/2008/feb/HQ_08033_India-agreement.html, visited on 15.02.2010.
46. <http://www.isro.org/scripts/internationalcooperations.aspx>, visited on 15.02.2010.
47. <http://www.antrix.gov.in/main/news2008.html>, visited on 12.02.2010. various satellites like Kitsat (Korea), Tubsat (DLR - Germany), BIRD (DLR - Germany), PROBA (Verhaert, Belgium), Lapan Tubsat (Indonesia), Pehuensat-1 (Argentina) aboard the ISRO's Polar Satellite Launch Vehicle (PSLV) in addition to the dedicated launch of Agile (Italy) were carried out.
48. <http://www.isro.org/satellites/spacemissions.aspx>, 15.02.2010.
49. http://isro.gov.in/news/scripts/Sep24_2009.aspx, visited on 12.02.2010.
50. Para.4 of the RSDP, 2001.
51. Srividya Raghavan, "Patent Amendments in India in the wake of TRIPs", *CASRIP News Letter*, Winter 2001, p. 1.
52. Footnote 5 to TRIPs Agreement.
53. The "new invention" means any invention or technology which has not been anticipated by publication in any document or used in the country or elsewhere in the world before the date of filing of patent application with complete specification, i.e. the subject matter has not fallen in public domain or that it does not form part of the state of the art.
54. The patentability criteria laid down that the invention was known or used by others in the country or published in a printed format within or in a foreign country or in public use for more than one year prior to the filing of the application are not eligible for a patent in the US.
55. The Webster's third International Dictionary of the English Language.
56. Swarup Kumar, *Intellectual Property Watch*, June 2007.
57. Comment, "Problems in the Resolution of Disputes Concerning Damage Caused in Outer Space," 59 *TUL. L. REV.* 747, 748, 755-56, (1985).