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— In Memoriam —
This volume is dedicated to the memory of

Gretchen J. Harris, J.D.

1977 - 2010

It is with great sadness that we are informing the space law community of the sudden loss of Ms. Gretchen Jeanette Harris, a 2009 graduate of the University of Mississippi School of Law and member of the second place team in the 2009 North American Round of the Manfred Lachs Space Law Moot Court Competition. Her team mates attribute their winning the 2009 Best Brief award to Ms. Harris' work. Ms. Harris was a superb student, finishing at the top of her class, a member of law review, an editor on the Journal of Space Law, and an excellent moot court competitor. She was a multifaceted, artistic, energetic young woman. In addition to law, her interests ranged from weaving, organizing benefits, and financial advising. Ms. Harris worked hard on fundraising events to help her town, Pass Christian, MS, recover from Hurricane Katrina. Just last week, I recommended her to the State of Missouri Bar Examiners and she was at the beginning of what would have been a very promising career. She was a good friend and colleague to all of us at the Center. She will be missed.

-Prof. Joanne Irene Gabrynowicz
Director, National Center for Remote Sensing,
Air, and Space Law

It is often in the darkest hour of loss that we become most acutely aware of the brilliant beauty of a life well-lived. Such was the case with the passing of Gretchen J. Harris, a promising young attorney who—for the last three and a half years—I had the distinct privilege and honour of calling my colleague, confidant, and friend.

I am certainly not the first—nor will I be the last—to praise Gretchen's tremendous work ethic or the sheer magnitude of her formidable intellectual powers. These were an important part of Gretchen's personality, to be sure, but she was also a wise advisor, a witty conversationalist, and an excellent friend. On numerous occasions, I had the opportunity to observe her staying late after school to help a fellow classmate memorize the rules of civil procedure or to assure a group of struggling 1L students that life truly got better after the first year. As a co-editor with Gretchen of this and another academic law journal, I always knew that she could be counted on to have the right answer about a challenging formatting question or to assist in finding a particularly-obscure article source. Outside the classroom, Gretchen could also be found helping others through her charity work or simply listening to their life struggles over a cup of coffee. Gretchen's brilliance was magnified through her kindness, and her example was an inspiration to us all.

The legal community has lost one of its brightest rising stars. Although we who knew her mourn her passing, the true loss belongs to the world.

- Jason A. Crook

FOREWORD

Joanne Irene Gabrynowicz[1]

Since the last issue of the JOURNAL OF SPACE LAW was published, there have been a number of significant events in space activities. The U.S. space shuttle *Atlantis* took its final flight and moved the entire shuttle program closer to retirement. A new space transportation company, SpaceX, successfully launched its *Falcon 9* that may become a vehicle capable of bringing cargo and personnel to the *International Space Station*. The *Hubble Space Telescope* had its 20th anniversary. China, Europe, and Russia began a collaborative research experiment in which six people will spend 18 months in a simulated interplanetary vehicle as preparation for a Mars mission. The U.S. *Lunar Reconnaissance Orbiter* continued to send back enormous amounts of data from the moon. South Korea launched, and lost, its *Naro* rocket carrying a climate observation satellite.

In aggregate, these events signal a changing space environment worldwide. They include endings to long-standing activities and practices as well as new beginnings, new actors, and new alliances. In short, the Cold War era space programs and activities have given way to the programs and activities of the globalization era. While the contours of future activities may be dimly discerned on the far horizon, it is still far from clear what the near and long-term future holds. It is a time when the first generation of space activities is receding into the past and the current generation activities are being prepared.

The voices that are heard in this issue of the JOURNAL OF SPACE LAW are the voices of the new generation's participants. This issue contains only papers from law students and recent

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[1] Joanne Irene Gabrynowicz is the Editor-in-Chief of the JOURNAL OF SPACE LAW. She is also a professor of space law and remote sensing law and the Director of the National Center for Remote Sensing, Air, and Space Law at the University of Mississippi School of Law. Prof. Gabrynowicz was the recipient of the 2001 Women in Aerospace Outstanding International Award and is a Director of the International Institute of Space Law and a member of the American Bar Association Forum on Air and Space Law.

graduates around the world. They are from China, India, the United Kingdom, and the United States. Some of them have other degrees in addition to their law degrees or previous professional experience in related fields. Some provide a fresh look at old issues; others seek to apply entirely new ideas to enduring issues.

In this last category are articles offered by three awardees of research scholarships from the National Center for Remote Sensing, Air, and Space Law of the University of Mississippi School of Law. Mr. Nicholas D. Welly applies the ideas of 2009 Nobel Laureate in Economic Sciences, Elinor Ostrom, regarding economic governance of a commons to space, a legal global commons in his article, *Enlightened State-Interest—A Legal Framework for Protecting the "Common Interest of All Mankind" from Hardinian Tragedy.* Mr. Paul Ordyna considers an activity with virtually no track record—commercial human spaceflight—in light of practices employed by a centuries-old industry by closely examining track records in his article, *Insuring Human Space Flight: An Underwriter's Dilemma.* Also considering the application of new ideas to old problems is Mr. Surya Gablin Gunasekara's article, *The March of Science: Fourth Amendment Implications on Remote Sensing in Criminal Law*. He traces the use of 20th Century technology to the two-century old Fourth Amendment of the U.S. Constitution.

Mr. Theodore W. Goodman and Mr. C. Brandon Halstead both consider an issue that has been on and off the agenda of the Legal Subcommittee for the U.N. Committee on the Peaceful Uses of Outer Space for more than three decades: the definition and delimitation of outer space in their respective articles, *To the End of the Earth: A Study of the Boundary between Earth and Space* and *Prometheus Unbound? Proposal for a New Legal Paradigm for Air Law and Space Law: Orbit Law*.

The business and profit-making aspects of space activities in the era of globalization are raised by Sandeepa Bhat B. in *Inventions in Outer Space: Need for Reconsideration of the Patent Regime* and by Shane Chaddha in *U.S. Commercial Space Sector: Matured and Successful*. In her article, *High Hopes and Low Estimates: New Space's Rocky Contractual Road,* Ms. Marielle Elisabet Dirkx examines how the high entry costs to 21st

century space commerce can be devastating for companies unprepared to realistically account for them in business plans.

Finally, one of humanity's oldest conditions—conflict—is addressed as it applies to space in the era of globalization by Mr. Shang Kuan in *Legality of the Deployment of Anti-Satellite Weapons in Earth Orbit: Present and Future* and by Mr. Jinyuan Su in *Use of Outer Space for Peaceful Purposes: Non-Militarization, Non-Aggression and Prevention of Weaponization*.

In all, this issue of the Journal of Space Law demonstrates that new voices are ready, willing, and able to engage in the law for the new era of space activities.

CALL FOR PAPERS

JOURNAL OF SPACE LAW
UNIVERSITY OF MISSISSIPPI SCHOOL OF LAW

A JOURNAL DEVOTED TO SPACE LAW AND THE LEGAL PROBLEMS ARISING OUT OF HUMAN ACTIVITIES IN OUTER SPACE.

Volume 36, Number 2

The National Center for Remote Sensing, Air, and Space Law of the University of Mississippi School of Law is delighted to announce that it will publish Volume 36, issue 2 of the JOURNAL OF SPACE LAW in the second half of 2010.

Authors are invited to submit manuscripts, and accompanying abstracts, for review and possible publication in the JOURNAL OF SPACE LAW. Submission of manuscripts and abstracts via email is preferred.

Papers addressing all aspects of international and national space law are welcome. Additionally, papers that address the interface between aviation and space law are also welcome.

Please email manuscripts and accompanying abstracts in Microsoft Word or WordPerfect to:

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To be considered for the next issue, submissions should be received on or before October 15, 2010. However, the JOURNAL OF SPACE LAW will continue to accept and review submissions on an ongoing basis.

INVENTIONS IN OUTER SPACE: NEED FOR RECONSIDERATION OF THE PATENT REGIME

Sandeepa Bhat B.[*]

I. INTRODUCTION

The twentieth century evidenced tremendous developments in intellectual property law (IP) as well as in the law governing outer space.[1] Though IP law started to develop much earlier than space law, substantial growth in both fields took place almost in the same period of time, i.e. in the second half of twentieth century. The technological developments relating to outer space has resulted in the establishment of stations in outer space[2] and future plans for the establishment of similar stations on the Moon and other celestial bodies.[3] With this, human ac-

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[1] The launch of *Sputnik I* on 4 October 1957 marked the beginning of the space era. The legal developments in the field started soon after the entry of *Sputnik* into outer space.

[2] Mir and the currently operative *International Space Station* (*ISS*) are the examples of stations in outer space. The Inter-Governmental Agreement on the International Space Station was initially signed on 29 September 1988 by the United States, Japan, Canada and members of European Space Agency. *See* Agreement Among the Government of the United States of America, Governments of Member States of the European Space Agency, the Government of Japan, and the Government of Canada on Cooperation in the Detailed Design, Development, Operation, and Utilization of the Permanently Manned Civil Space Station, Sept. 29, 1988, *available at* 1992 WL 466295 [hereinafter 1988 IGA]. The members of the European Space Agency at the time of the signing of the 1988 IGA were: Belgium, Denmark, France, Germany, Great Britain, Italy, the Netherlands, Norway and Spain. With the Russia's inclusion in the project on 17 December 1993, new negotiations took place between the former participants and Russia. It resulted in the new Inter-Governmental Agreement on the *International Space Station*, which was signed on 29 January 1998. *See* Memorandum of Understanding Between the National Aeronautics and Space Administration of the United States of America and the Russian Space Agency Concerning Cooperation on the Civil International Space Station, Jan. 29, 1998, *available at* ftp://ftp.hq.nasa.gov/pub/pao/reports/1998/nasa_russian.html. The construction work is still going on and it is expected to be completed by 2010.

[3] The recent US plans also reveal its willingness to go beyond the ISS and to establish similar stations on the Moon and on Mars. *See* T. S. Subramanian and Y. Mallikar-

tivities in outer space have expanded rapidly resulting in the possible intellectual creations in outer space, which are entitled to IP protection. In other words, the IP regime is going to overlap with the regime of outer space in the near future. Three important types of intellectual property rights (IPR) that have direct connection with the activities in outer space are patents,[4] trade secrets[5] and copyrights[6]. Unfortunately, as the present IPR regime fails to clarify the issue of its applicability for activities in outer space, there is a legal vacuum in the field. This article, being confined to the inventions in outer space, looks into the problems associated with the patent regime in outer space.

II. AN INSIGHT INTO THE ROOT OF CONFLICTS

The overlap between the patent regime and the outer space regime has recently become a matter of debate. The large-scale diversities found in these two regimes have brought forward some critical legal questions. The major source of conflict is the difference in origin and applicability of the patents regime and the regime governing outer space. Patent law is fundamentally national in its origins and scope of application, notwithstanding

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jun, *First human being will land on Mars in 2037, says NASA official*, HINDU DAILY, Sept. 25, 2007, at 13, *available at* http://www.hinduonnet.com/thehindu/thscrip/print.pl?file=2007092556871300.htm&date=2007/09/25/&prd=th&.

[4] A patent is a monopoly right granted to an inventor to ripe the benefit out of his intellectual work for a limited period of time. The basic purpose is to encourage the public disclosure of the invented subject matter. *See* PAUL TORREMANS ET AL., INTELLECTUAL PROPERTY LAW 39 (2008). *See also* NARAYANAN, INTELLECTUAL PROPERTY LAW 12 (2005).

[5] Trade secrets are transferable technical information, which are not generally known and not patented. AKHIL PRASAD & ADITI AGARWALA, COPYRIGHT LAW: DESK BOOK 25 & 26 (2009). It includes ideas, concepts, inventions, manufacturing processes and other confidential information. *See* DAVID W. QUINTO & STUART H. SINGER, TRADE SECRETS: LAW AND PRACTICE 4 – 6 (2009). As these trade secrets give an added advantage to the industrialists in competing with others and in increasing their returns, they (industrialists) do not want to disclose it to others. Article 39 of the Agreement on Trade-Related Aspects of Intellectual Property Rights makes it clear that such trade secrets are entitled to protection as intellectual property. *See* Agreement on Trade-Related Aspects of Intellectual Property Rights, art. 39, Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1C, Legal Instruments-Results of the Uruguay Round, 33 I.L.M. 1125 (1994) [hereinafter TRIPs Agreement].

[6] Copyright is a set of exclusive rights that regulate the use of a particular expression of an idea or information. TINA HART & LINDA FAZZANI, INTELLECTUAL PROPERTY LAW 139 (2000).

efforts towards international harmonization.[7] The regime governing outer space is essentially extraterritorial in its origin and application.[8] The strong national root of patent regime has three major consequences. First, the patented invention is protected only in the country or countries where it is registered and not outside. Second, the law of the State where the invention is said to have been infringed shall be applicable for the determination of the infringement of patents. Third, the jurisdiction shall be exercised by the courts of that State where the invention is said to have been infringed. On the other hand, the strong international roots of space law favour uniform law to govern activities in outer space. It also tends towards the recognition of interests of everyone as opposed to the individual interest recognized by the patent regime.

The legal vacuum created by the interrelationship between the patent regime and the outer space regime is noticed very recently by the international community, especially after the establishment of the *International Space Station* (*ISS*). Now it is also well known that outer space, the Moon, and other celestial bodies can be used for conducting some important experiments, which cannot be conducted on the Earth with such a great effect.[9] Therefore there is every possibility of the investment of huge sums in such experiments. Though at present there is no reported instance of conflict relating to patents in outer space, the pace of technological development is showing its potentiality to bring forward such problems in the near future. Therefore, this seems to be the appropriate time to clarify the patent regime to avoid future conflicts.

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[7] *See* Anna-Maria Balsono & Bradford Smith, *Intellectual Property and Space Activities: A New Role for COPUOS?*, *in* OUTLOOK ON SPACE LAW OVER THE NEXT THIRTY YEARS 363 (Gabriel Lafferranderie & Daphne Crowther, eds., 1997).

[8] *See* Ruwantissa Abeyratne, *The Application of Intellectual Property Rights to Outer Space Activities*, 29 J. SPACE L. 1 (2003).

[9] It is possible to achieve greater level of purity in the pharmaceutical products in outer space, the Moon, and other celestial bodies. Sa'id Mosteshar, *Intellectual Property Issues in Space Activities*, *in* RESEARCH AND INVENTION IN OUTER SPACE - LIABILITY AND INTELLECTUAL PROPERTY RIGHTS 192 (Sa'id Mosteshar, ed., 1995).

III. PATENTS MONOPOLY VIS-À-VIS FUNDAMENTAL SPACE LAW CONCEPTS

Outer space and patents are subject to two different schools of jurisprudence, and their regimes do not go hand in hand.[10] Conferment of patent rights is based on the principle that every invention needs to be rewarded by providing protection in order to stimulate intellectual creations.[11] The patent regime advocates for monopoly rights for the person using the intellectual labour.[12] The inventor would be entitled to reap the benefits of his or her invention by getting exclusive rights to use it for a limited period of time. Space law on the other hand has some fundamental principles like the "province of all mankind,"[13] "common heritage of mankind,"[14] benefit of all countries,[15] among others, that advocate for common benefits. Therefore, when the patent regime is applied to activities in outer space, it always comes in conflict with these fundamental concepts of space law.[16] Particularly, the province of all mankind and common heritage of mankind advocate for sharing of benefits, which is not a part of individualistic patents regime. Therefore, one of the important questions in the field is, can a patent be granted at all for an invention created in outer space?

The strict application of province of all mankind and common heritage of mankind would clearly deny any claim of patent

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[10] The former is subject to the idealistic school and the latter to the realistic school.

[11] *See generally* Taking it Global, *Creative Commons*, http://issues.takingitglobal.org/intprop?gclid=CLyp5_mivpACFQssewod8zrEPQ (last visited Jan. 5, 2010).

[12] It prevents others from freely using them and consequently restricts the competition. Alejandro Piera, *Intellectual Property in Space Activities: An Analysis of the United States Patent Regime*, XXIX AIR & SPACE L. 42, 46 (2004).

[13] *See* Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies art. I, *opened for signature* Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205 [hereinafter Outer Space Treaty].

[14] *See* Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, G.A. Res. 34/68, 18 INT'L LEGAL MAT'S. 1434 (1979).

[15] Outer Space Treaty, *supra* note 13..

[16] Bradford Lee Smith, *Towards a Code of Conduct for the Exercise of Intellectual Property Rights (IPR) in Space Activities - Moderation of the Monopoly?*, *in* PROCEEDINGS OF THE THIRTY-NINTH COLLOQUIUM ON THE LAW OF OUTER SPACE 176 (1997) [hereinafter *Towards a Code of Conduct*].

monopoly for the invention conducted in outer space.[17] But again the question is whether it is justifiable to extend the scope of space law concepts to such an extent so as to deprive an inventor from deriving benefit from his or her intellectual labour? The answer seems to be negative. The obvious reason for conflict between the patent regime and the outer space regime is that the space treaties were entered into at the time when States were the only actors in the field of outer space, and the concept of patent or invention in outer space was virtually unknown. Therefore States are the major subjects of space law, and consequently the rights conferred upon space activities are public in nature.[18] The space treaties are not oriented towards the protection of any private rights. Now with increased private space activities, we are confronted with the challenge of striking a delicate balance between private rights and the public rights. If private rights are not guaranteed, no one would be willing to conduct innovative activities in outer space, which would in turn adversely affect the scientific and technological development.[19]

Developing a fair scheme to strike the balance between private interests, which generate innovation, and the wider interests of humankind is not easy. Any solution to the problem would involve some compromise in both fields. Therefore, a viable solution to the problem is to grant a restricted patent monopoly with some sort of compulsory licensing scheme under the fair and reasonable terms and conditions.[20] The scope of the idealistic space law concepts should be limited to physical property while intellectual property, like patents, must be kept out of their ambit.

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[17] Sa'id Mosteshar, *Introduction: Research and Invention in Outer Space and their Commercial Exploitation: Liability and Intellectual Property Rights*, *in* RESEARCH AND INVENTION IN OUTER SPACE - LIABILITY AND INTELLECTUAL PROPERTY RIGHTS XVI (Sa'id Mosteshar ed., 1995).

[18] S. G. Sreejith, *The Pertinent Law for Outer Space Related Intellectual Property Issues: An Odyssey into TRIPS*, 45 INDIAN J. INT'L L. 180, 183 (2005).

[19] *See generally* Anna Maria Balsano, *Intellectual Property within Public International Research Organizations. The Example of European Space Agency*, *in* PROCEEDINGS OF THE THIRTY-SIXTH COLLOQUIUM ON THE LAW OF OUTER SPACE 3, 4 (1994).

[20] *See generally* Bradford Lee Smith, *Recent Developments in Patents for Outer Space*, *in* PROCEEDINGS OF THE FORTY-SECOND COLLOQUIUM ON THE LAW OF OUTER SPACE 190, 197 (2000).

Now, if we assume that intellectual creations in outer space can be subject to the patent regime, a related question for consideration is, who has the right to patent protection? Is it the one who has first invented or the one who has first filed an application for patent?[21] Both these patent systems are strongly supported by different countries of the world.[22] Therefore at present, identification of the patent rights' holder depends on the nationality of the inventor.[23] This would create problems in cases where the invention in outer space is conducted or sponsored by a group of people belonging to different States. Each of them would go to their respective countries and seek the registration of patent in their name either on the basis of first invention or on the basis of first filing. The problem becomes further complicated if the invention is partly carried out on the Earth and partly in outer space. In such a situation, the people carrying on the part of invention on Earth would be in an advantageous position to "first file" the application for registration of patents. At the same time, in a first to invent jurisdiction, the determination of first inventor would become a complicated question to answer. The only possible solution to this complication is the agreement of all the States on one specific system of patenting.

IV. INFRINGEMENT OF PATENTS IN OUTER SPACE

Another important problem regarding a patents regime in outer space is the question of availability of remedies in case of

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[21] Anna Maria Balsano, *Intellectual Property Rights and Space Activities,* 11(3) SPACE POL'Y 204 (Aug. 1995), *available at* http://esapub.esrin.esa.it/ecsl/ecsl15/ecsl15ba.htm.

[22] The United States follows the "first to invent" system and therefore whoever proves that they were the first to develop the invention has priority in obtaining the patent, even if someone else files first. C. Heather Walker, *Potential Patent Problems on the ISS*, *in* PROCEEDINGS OF THE FORTY-SECOND COLLOQUIUM ON THE LAW OF OUTER SPACE 60, 61 & 62 (2000). The rest of the world follows the first to file priority system. *See id.*

[23] If the inventor belongs to United States, he should be the first person to invent, and if he belongs to other States, he should be the first person to file an application for getting patent rights. *See* Bradford Lee Smith, *Intellectual Property Issues for the Galileo Project*, *in* PROCEEDINGS OF THE FORTY-FOURTH COLLOQUIUM ON THE LAW OF OUTER SPACE 207, 210 & 211 (2002).

the infringement of Earthly patents[24] in outer space. The strong national roots of patent regimes have confined their protection only to the States in which they are registered.[25] Moreover, as already mentioned, in case of infringement, the courts of the State where violation takes place exercise the jurisdiction, and the law of that State becomes applicable. As outer space does not belong to any one State, the complicated question of jurisdiction and applicable law comes into play in every case of infringement of Earthly patents.

A. Jurisdiction

In any case of infringement of Earthly patents in outer space, the first task is to ascertain the jurisdiction.[26] The Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies (Outer Space Treaty)[27] read with the Convention on Registration of Objects Launched into Outer Space (Registration Convention)[28] provides a special regime for the exercise of jurisdiction. Article VIII of the Outer Space Treaty[29] expressly confers the jurisdiction and control over the objects launched into outer space and the personnel thereof to the State of registry.[30] Article

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[24] A patent registered in any State on the Earth.

[25] G. Lafferranderie, *The United States Proposed Patent in Space Legislation - An International Perspective*, 18 J. SPACE L. 1, 2 (1990).

[26] States cannot be allowed to exercise concurrent jurisdiction. Exercise of concurrent jurisdiction would result in absolute uncertainty as to the research activities in outer space, the Moon and other celestial bodies. Pierre M. Martin, *The Legal Regime of Inventions in Outer Space*, *in* PROCEEDINGS OF THE THIRTY-SECOND COLLOQUIUM ON THE LAW OF OUTER SPACE 366, 367 (1990).

[27] Outer Space Treaty, *supra* note 13.

[28] Convention on Registration of Objects Launched into Outer Space, *opened for signature* Jan. 14, 1975, 28 U.S.T.
695, 1023 U.N.T.S. 15 [hereinafter Registration Convention].

[29] Outer Space Treaty, *supra* note 13, at art. VIII:

> A State Party to the Treaty on whose registry an object launched into outer space is carried shall retain jurisdiction and control over such object, and over any personnel thereof, while in outer space or on a celestial body. Ownership of objects launched into outer space, including objects landed or constructed on a celestial body, and of their component parts, is not affected by their presence in outer space or on a celestial body or by their return to the Earth…

[30] The principles of territoriality and nationality have received widespread recognition in international law as grounds for the exercise of jurisdiction. The Outer Space

II (1)[31] of the Registration Convention supplements the above provision by imposing an obligation on the launching State to register, nationally and internationally, any object launched by it. In case of a joint launching, the States must jointly determine which one of them would register the object.[32] Accordingly, the registering State exercises jurisdiction and control.

The jurisdiction provided under the space treaties is different from the flag State jurisdiction[33] under law of the sea. Flag State jurisdiction confers quasi-territorial jurisdiction to the Flag State over the ships of its nationality. Its application is limited to the activities conducted on board of the ship. Whereas, the jurisdiction under the Outer Space Treaty is not only confined to space object registered with the State, but also extends over any personnel thereof, while in outer space or on a celestial body. In other words, the State of registry exercises jurisdiction on the personnel even when such personnel are outside the space object.[34] Therefore any patent infringement in outer space, whether inside the space object or outside in outer

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Treaty has adopted the principle of territoriality for the exercise of jurisdiction. *See* V. S. Vereshchetin, *Legal Status of International Space Crews*, III ANNALS OF AIR & SPACE L. 545, 548 & 549 (1978).

[31] Registration Convention, *supra* note 28, at art. II(1).

> When a space object is launched into Earth orbit or beyond, the launching State shall register the space object by means of an entry in an appropriate registry which it shall maintain. Each launching State shall inform the Secretary-General of the United Nations of the establishment of such a registry.
>
> *Id.*

[32] *Id.* at art. II(2).

> Where there are two or more launching States in respect of any such space object, they shall jointly determine which one of them shall register the object in accordance with paragraph 1 of this article, bearing in mind the provisions of article VIII of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, and without prejudice to appropriate agreements concluded or to be concluded among the launching States on jurisdiction and control over the space object and over any personnel thereof.
>
> *Id*.

[33] S.S. Lotus Case, (Fr. v. Turk.), 1927 P.C.I.J. (ser. A) No. 9, (Sept. 7).

[34] *See* Bin Cheng, *Liability Regulations Applicable to Research and Invention in Outer Space and their Commercial Exploration*, *in* RESEARCH AND INVENTION IN OUTER SPACE - LIABILITY AND INTELLECTUAL PROPERTY RIGHTS 75 (Sa'id Mosteshar, ed., 1995).

space, on the Moon, or other celestial bodies is subject to the jurisdiction of the State where the space object is registered.

Such a type of jurisdiction under Article VIII of the Outer Space Treaty has brought forward the problem of conflicting jurisdiction. The rapid technological development has resulted in the establishment of the *ISS* and also in the plans to construct stations on the Moon and other celestial bodies. With this, the conflict of jurisdiction would arise in a case where the space station or a station on the Moon or other celestial body is registered in one State and the space vehicle carrying the astronauts conducting the inventions therein is registered in another State. By virtue of Article VIII, the State registering the space station would undoubtedly exercise jurisdiction over the activities in the space station. Similarly, the State registering the space vehicle carrying the astronauts would exercise jurisdiction over any activity conducted by those astronauts in outer space, since Article VIII also confers personal jurisdiction, which extends to an activity conducted outside the space object. The same problem would arise in case of exchange of crew among two or more space stations.[35]

Without any doubt, we can conclude that provisions of the space treaties relating to jurisdiction have become outdated. In the wake of private space activities, the jurisdictional issue needs to be clarified immediately. Otherwise, it might ultimately result in forum shopping by private entities. The void in the law would provide an opportunity for the private entities to register their objects under the most favorable regime to defeat the purpose of the law.[36]

B. Applicable Law

The second essential element in seeking a remedy for patent infringement in outer space is the determination of applica-

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[35] IMRE ANTHONY CSABAFI, THE CONCEPT OF STATE JURISDICTION IN INTERNATIONAL SPACE LAW 112 (1971).

[36] *See* Bradford Lee Smith and Elisabetta Mazzoli, *Problems and Realities in Applying the Provisions of the Outer Space Treaty to the Intellectual Property Issues*, *in* PROCEEDINGS OF THE FORTIETH COLLOQUIUM ON THE LAW OF OUTER SPACE 169, 171 (1998).

ble law. It is not susceptible to an easy answer.[37] The principle of *lex situs*[38] cannot be applied, as there is no national or international law governing every infringement of patents in outer space. Though the territoriality principle prevents the extraterritorial application of the municipal laws, the only solution to the problem is the transposition of municipal patents law to outer space. But again the question is how to determine which municipal law has to be transported? The answer to this question is pertinent because of the fact that the strong national root of patent regime is associated with the difficulty of dissimilarity in the laws of different countries. We find a large-scale difference in the determination of patentability, determining the person entitled to patent rights, procedure for registration and enforcement, and so on. Though the Agreement on Trade-Related Aspects of Intellectual Property Rights[39] makes an attempt to harmonize IPR laws, including patent laws, of different countries, it is more oriented towards providing minimum standards rather than unifying their laws. The developed countries are more interested in keeping control over their intellectual creations by subjecting them to their strong IPR regimes, and there is no reason to expect change in this attitude.[40] Therefore, the problem of difference in the patent laws of the States is continuing, and this makes the determination of the applicable patent law difficult when it is associated with activities in outer space.

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[37] Dieter Stauder, *Issues of Intellectual Property in Relation to Research and Invention in Outer Space: European Community Perspective*, *in* RESEARCH AND INVENTION IN OUTER SPACE - LIABILITY AND INTELLECTUAL PROPERTY RIGHTS 143 (Sa'id Mosteshar, ed., 1995).

[38] The place where the infringement takes place is the major decisive element for the determination of applicable law in case of infringement of patents on the Earth. *See* R. Oosterlinck, *The Intergovernmental Space Station Agreement and Intellectual Property Rights*, 17 J. SPACE L. 23, 27 & 28 (1989).

[39] TRIPs Agreement, *supra* note 5. TRIPs, being one of the WTO Agreements, is the most comprehensive multilateral agreement on the IPR as of yet. It covers almost all the types of IPR that are related to trade. *See generally*, Adrian Otten & Hannu Wager, *Compliance With TRIPs: The Emerging World View*, 29 VAND. J. TRANSNAT'L L. 391 (1996).

[40] O. Vorobieva, *Intellectual Property Rights with Respect to Inventions Created in Space*, *in* RESEARCH AND INVENTION IN OUTER SPACE - LIABILITY AND INTELLECTUAL PROPERTY RIGHTS 180 (Sa'id Mosteshar, ed., 1995).

Whatever may be the difficulty in the determination of applicable municipal patents law, the only option in the absence of *lex situs* is resorting to municipal law. However, choosing such municipal law cannot be done randomly, but only on the basis of some connecting factors. This leads to another question, what should be appropriate connecting factors in determining the applicable law? There is again a wide-ranging debate over the issue between the group supporting nationality[41] and the group supporting registration[42] as a connecting factor.

The supporters of nationality as a connecting factor argue that the applicable law must be the law of the State to which the person(s) infringing inventions in outer space belong. However the use of nationality as a connecting factor for the determination of applicable law may result in absurd consequences. Complications would arise in the case where the infringement of patents is done by a group of persons having different nationalities. In a hypothetical case, where a patent is registered in India, the United States, Japan, France, and Germany, the application of nationality as a connecting factor would mean that a national of any State, other than the above five, could infringe the patents in outer space without attaching liability. This is the consequence of the fact that the application of nationality as a connecting factor would lead to the determination of infringement under the law of that State of which the infringer is a national, and under that law there is no infringement at all. Even if the nationals of the above five States infringe a patent, they would be subject to different laws, resulting in different sanctions. For the collective infringement of a registered patent, imposing different quanta of punishment for different persons seems unreasonable.

Similar problems can also be seen in cases where activities are conducted by multinational firms. Since it is very difficult to establish the nationality of firms in most cases, determination of

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[41] *See* Sa'id Mosteshar, *Issues Arising in Determining the Legal Regime Applicable to Intellectual Property Rights in Outer Space*, *in* RESEARCH AND INVENTION IN OUTER SPACE - LIABILITY AND INTELLECTUAL PROPERTY RIGHTS 135 (Sa'id Mosteshar, ed., 1995).

[42] *See* Oosterlinck, *supra* note 38, at 30.

applicable law also becomes difficult. In addition, nationality as the connecting factor completely discards the place of infringement in the determination of applicable law. This is not justifiable, as the place of infringement is the most relevant factor in determining patent infringement on Earth. Therefore, the nationality principle cannot be accepted as a decisive factor.

Registration as the connecting factor for determination of applicable law finds support from juristic writings,[43] in the Patents in Outer Space Act of 1990[44] and also in the *ISS* Intergovernmental Agreement (IGA).[45] The Patents in Outer Space Act of 1990[46] added section 105 to U.S. patent legislation,[47] which states that any invention made, used, or sold in outer space on a space object or component thereof under the jurisdiction and control of the United States must be considered to be made, used, or sold within the United States.[48] As discussed above, Article VIII of the Outer Space Treaty confers jurisdiction and con-

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[43] Carl Q. Christol, *Protection of Intellectual Property Rights in Outer Space*, *in* RECENT TRENDS IN INTERNATIONAL SPACE LAW AND POLICY 366 (V.S. Mani, S. Bhatt & V. Balakista Reddy eds., 1997).

[44] Patents in Outer Space Act, Pub. L. 101 – 580, Sec. 1(a), 104 Stat. 2863 (Nov. 15, 1990).

[45] *See* 1988 IGA, *supra* note 2. *See also* Stephen Gorove, *Legal Problems of Manned Space Flight*, *in* THE USE OF AIRSPACE AND OUTER SPACE FOR ALL MANKIND IN THE 21ST CENTURY 249 (Chia - Jui Cheng ed., 1995).

[46] Patents in Outer Space Act , *supra* note 44.

[47] *Towards a Code of Conduct*, *supra* note 16, at 177.

[48] *See* 35 U.S.C. § 105.

> (a) Any invention made, used, or sold in outer space on a space object or component thereof under the jurisdiction or control of the United States shall be considered to be made, used or sold within the United States for the purposes of this title, except with respect to any space object or component thereof that is specifically identified and otherwise provided for by an international agreement to which the United States is a party, or with respect to any space object or component thereof that is carried on the registry of a foreign state in accordance with the Convention on Registration of Objects Launched into Outer Space.
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> (b) Any invention made, used, or sold in outer space on a space object or component thereof that is carried on the registry of a foreign state in accordance with the Convention on Registration of Objects Launched into Outer Space, shall be considered to be made, used, or sold within the United States for the purposes of this title if specifically so agreed in an international agreement between the United States and the state of registry.
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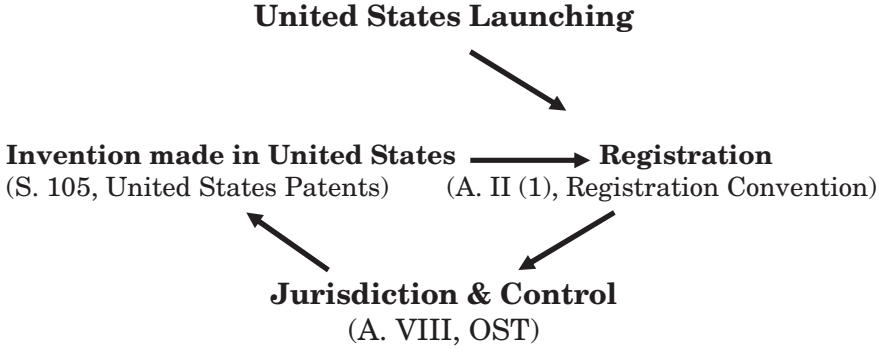
> *Id.*

trol over space objects and personnel thereof to the State of registration.[49] This leads to a series of consequences. If the United States launches any object into outer space, it must register the object on its national registry according to Article II of the Registration Convention.[50] Once the object is registered on the national registry, the United States exercises jurisdiction and control over that object and personnel thereof.[51] Once the United States exercises jurisdiction and control over the space object and personnel thereof, any activity conducted in the object or by the personnel thereof is subject to United States laws.[52]



The above diagram better illustrates the United States situation. One thing to be noted here is that the United States legislation points towards registration as a connecting factor and not launching. This is due to the fact that in case of joint launching, the United States may not essentially be the State of registry and if it is not, it cannot exercise jurisdiction and control under Article VIII of the Outer Space Treaty. Consequently, Section 105 of the patent legislation would not be applicable.

The *ISS* IGA also supports the above view by stating that an activity occurring in any part of the *ISS* complex is deemed to have been conducted in the territory of the State in which that element is registered.[53] However, this does not solve the

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[49] Outer Space Treaty, *supra* note 13, at art. VIII.
[50] Registration Convention, *supra* note 28, at art. II.
[51] Outer Space Treaty, *supra* note 13, at art. VIII.
[52] *See* 35 U.S.C. § 105.
[53] 1988 IGA, *supra* note 2, at art. 21.

problem completely. First, the *ISS* IGA is based on the legal fiction that the European States constitute a single territory subject to the same regulations. But in reality they do not form a single territory and are subject to different laws.[54] Second, and more importantly, the *ISS* consists of different elements contributed by different member States, and these elements are registered on the national registry of the respective contributing State.[55] In effect, different national laws govern the activities conducted in different elements of the *ISS*. If an activity infringing a patent right is conducted collectively in the laboratories situated in different elements of the *ISS*, the determination of applicable law by using registration as the connecting factor would fail.

Another issue associated with the use of registration as a connecting factor is the question of the status of the activities in unregistered objects found in outer space. These unregistered objects may be those that are naturally found in outer space, like celestial bodies, or those that are launched from the Earth. It is worth noting here that although the Registration Convention imposes an obligation on the States to register the objects launched by them,[56] it is binding only on the parties to the Convention.[57] To date, not every State is party to the Registration Convention. Therefore, if registration is considered as the connecting factor, the question of applicable law remains unsolved in cases of unregistered objects.[58] Moreover the place of registration would remain ambiguous, when future plans for launching objects from one celestial body to another are realized. This is the direct consequence of limited coverage of the Registration Convention, which speaks only of those objects that are launched into outer space from Earth and not of the objects launched from one celestial body to another.[59]

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[54] Anna Maria Balsano, *The European Space Agency: Intellectual Property Rights and International Cooperation*, *in* RESEARCH AND INVENTION IN OUTER SPACE - LIABILITY AND INTELLECTUAL PROPERTY RIGHTS 162 (Sa'id Mosteshar, ed., 1995).

[55] 1988 IGA, *supra* note 2, at art. 5.

[56] *See* Registration Convention, *supra* note 28.

[57] *Id.*

[58] Bin Cheng, *supra* note 34, at 75 & 76.

[59] *See* Registration Convention, *supra* note 28, at art. II (1).

The factors discussed above clearly indicate that the patent regime in outer space is far from satisfactory. This is not something unknown to the world community. In 1999, an attempt was made to find solutions to problems relating to the IPR regime in outer space by convening a *Workshop on Intellectual Property and Space Activities* at UNISPACE III, under the auspices of the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS).[60] The participants in the Workshop made a recommendation for the harmonization of the IPR regime with the space law principles.[61] It was also recommended that UNCOPUOS, in collaboration with World Intellectual Property Organization, should take up the initiative to investigate the legal uncertainties existing in the field. Unfortunately, no further progress has been made to solve the existing problems.

V. A NOTE ON INDIAN PERSPECTIVE

India has recently joined the elite club of the very few States who are actively involved in the exploration of the Moon.[62] Plans are also being devised for carrying humans to outer space, the Moon, and other celestial bodies. So it is evident that India's entry into outer space inventions is not a far-fetched dream. However, there has not been much lateral thinking in the direction of developing a comprehensive national law to govern activities in space. The only attempt made by the Indian Space Research Organization (ISRO) in association with the National Law School of India University, Bangalore has not been successful to date.[63] Even though India is a State-Party to

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[60] *See* Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space, G.A. Res. 54/68, U.N. Doc. A/RES/54/68 (July 19 – 30, 1999).

[61] *See generally* Encyclopedia of the Nations, *Peaceful Uses of Outer Space – UN Conferences on Outer Space*, http://www.nationsencyclopedia.com/United-Nations/Peaceful-Uses-of-Outer-Space-UN-CONFERENCES-ON-OUTER-SPACE.html (last visited Jan. 30, 2010).

[62] India achieved this feat by launching *Chandrayaan - I*. There is also a likelihood of *Chandrayaan - II* in 2011. *See Chandrayaan II launch likely in 2011: ISRO official*, HINDU DAILY, Jan. 3, 2008, at 17, *available at* http://www.thehindu.com/2008/01/04/stories/2008010456001500.htm.

[63] The draft space legislation prepared by the National Law School of India University, Bangalore has not come into force. *See generally* K. R. Sridhara Murthi, V. Gopal-

the Outer Space Treaty, the Rescue and the Return Agreement, the Liability Convention, and the Registration Convention, the provisions of these space treaties are not directly enforceable at the municipal level due to the fact that India follows the theory of specific adoption.[64]

The Indian Patents Act,[65] like its counterparts in other parts of the world, is restricted in its application to Indian territory.[66] Therefore, all the above-mentioned problems relating to granting of patents rights, jurisdictional problems, and the dilemma as to what law would be applicable law in case of an invention in outer space by the Indians, are relevant to India.

VI. CONCLUSION

The patent regime and the outer space regime, at present, are diametrically opposite due to some foundational conceptual differences. This should not be a reason for depriving patent rights from persons creating inventions in outer space. However, once we agree on the preliminary issue of granting of patents for inventions in outer space, the more complicated problem of infringement of Earthly patents in outer space arises. While the nationalistic patent regimes are diversified, international space law is completely outdated in this regard. This has ultimately resulted in complete chaos as to the determination of jurisdiction and applicable law in case of patent infringement.

The uncertainty in the patent regime governing outer space has made it not conducive to attract the much-needed private investment for activities in outer space including the Moon and other celestial bodies. The individualistic national responses have been a major source of contention in the patent regime. Therefore, this is high time for having an international framework to govern the patent regime in outer space. Undoubtedly,

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krishnan and Partha Sarathi Datta, *Legal Environment for Space Activities*, 93 CURRENT SCI. 1823, 1827 (2007), *available at* http://www.ias.ac.in/currsci/dec252007/1823.pdf.

[64] The treaties are not binding upon Indian Courts unless they have been implemented by legislation. *See* H. O. AGARWAL, INTERNATIONAL LAW AND HUMAN RIGHTS 51 (2005).

[65] Patents Act, No. 39 of 1970 (Amended 1999), *available at* http://indiacode.nic.in/.

[66] *Id.* § 1.

UNCOPUOS must take the lead in this direction. To conclude, the author is of the view that it is the responsibility of the legal community to see to it that the saying "science soars like an eagle and law drags on like a turtle"[67] is not applicable in the field of outer space inventions.

[67] Carl Q. Christol, *Space Stations; A Lawyer's Point of View*, 4 INDIAN J. INT'L L. 488 (1964).

U.S. COMMERCIAL SPACE SECTOR: MATURED AND SUCCESSFUL

Shane Chaddha[*]

I. INTRODUCTION

The United States has laid down a space infrastructure that offers affordable human and robotic space services to government and commercial enterprises, including individuals, and that economically sustains its private space industry. One landmark event that encouraged the United States to seize a new and potentially thriving industry in commercial space transportation, occurred on June 21, 2004. In a competition for the Ansari X Prize, with the winning competitor receiving U.S. $10 million, the pilot and first astronaut, Mike Melvill, launched and flew a privately funded spacecraft, *SpaceShipOne*, to outer space.[1] Bromberg takes the view that "[this] historic flight highlighted the ability of innovative entrepreneurs to overcome historical impediments to meet the growing public demand for low-cost access to space."[2] According to a report by the U.S. Federal Aviation Administration (FAA), the economic impact of the private space industry on the United States economy has seen a significant rise from 1999 to 2006.[3] Growth is particularly evident from 2004 to 2006, however.[4] In other

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[1] Frans von der Dunk, *Passing The Buck To Rogers: International Liability Issues In Private Spaceflight*, 86 NEB. L. REV. 400, 405 (2007). Further details as to the nature of the X Prize are provided by the organisers on the XPrize website. *See* XPrize Foundation, *Ansari XPrize*, http://space.xprize.org/ansari-x-prize (last visited Jan. 6, 2010). *See also*, Spencer H. Bromberg, *Space Travel – 2005: A Legal Odyssey into the Current Regulatory Environment for United States Space Adventures Pioneering the Final Frontier*, 70 J. AIR L. & COM. 639, 640 (2005).

[2] Bromberg, *supra* note 1.

[3] FAA, ECONOMIC IMPACT OF COMMERCIAL SPACE TRANSPORTATION ON THE US ECONOMY, at 22 (April 2008), *available at* http://www.faa.gov/news/updates/media/EcoImpactReport2008.pdf [hereinafter ECONOMIC IMPACT].

[4] *See* OFFICE OF SPACE COMMERCIALIZATION, TRENDS IN SPACE COMMERCE (June 2001), *available at* http://www.space.commerce.gov/library/reports/2001-06-trends.pdf