

Encouraging Innovation and Technological Advancement for Greater In-Depth Exploration of Outer Space through Patents

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How to best cultivate a robust ecosystem of private research, development and innovation capable of supporting sustainable, profitable business and industrial operations in outer space is a nuanced and oblique question. It is founded upon the understanding that innovation and technological advancement, which constitute the core engine of industrial and economic growth, also comprise the very essence of humanity's ascension into space. Terrestrial patent regimes provide the ability to protect technological advancements comprising inventions. Granting a protectable, "limited" monopoly to patent applicants enables inventors and investors to recoup otherwise sunk R&D costs, which could render an enterprise commercially infeasible. To implement a viable legal foundation for protection of inventions in outer space, a majority of large-market States must agree on a single multilateral regime. However, if such a system is not sufficiently inclusive of States active in space, the conventional flag of convenience problem analogous in maritime and aviation law, in conjunction with the ubiquitous temporary presence defense against patent infringement, will undermine the limited monopoly of patents. Ultimately, without adequate protection of inventions in outer space, prospective markets and royalties due appropriately to inventors or patent holders could be lost, detracting from the incentive to patent and potentially discouraging the incentive to conduct the R&D essential to advancing humanity's capabilities to access and explore outer space. Potential solutions to these challenges, as well as the capacities of the various relevant international fora for development and administration of a single outer space patent jurisdiction, will be investigated herein. However, the optimal form for such an outer space patent regime remains very much an open question. Such a system might comprise a

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“unitary” jurisdiction consisting of a sole authority governing grant and enforcement of patents, *i.e.* composed of and administered by specialized international bodies including an examination office and a court or dispute resolution panel, or an international agreement under which States Parties merely mutually extend their respective national patent laws to appropriately registered space objects. Alternatively, a hybrid of these two options or other solution might be preferable. Whatever the calculus, it remains clear that effective collaboration between the United Nations Committee on the Peaceful Uses of Outer Space, the World Intellectual Property Organization, and likely the World Trade Organization as well, will be crucial to successfully achieve States’ accession to such an outer space patent regime.

I. Introduction

Commercial space development has the capacity to spawn multiple robust industrial sectors, likely to include, from among many other prospective space applications, space tourism, asteroid and even lunar mining, materials and pharmaceuticals manufacture and possibly even energy production. As subsequently discussed in greater detail, without adequate protection for the use or practice of inventions in outer space, patent holders might lose royalties or prospective markets, ultimately dis-incentivizing the research and development necessary for advancement of the very technologies enabling access to and exploration of outer space. In this paper the Author investigates the best foundations on which to achieve adequate protection of inventions in outer space.

Considering the prospect of a single patent regime for outer space highlights that, although terrestrial patent regimes may have achieved a high degree of harmonization, many disparities persist in the substantive and procedural laws of patents. And, some pundits even assert that total harmonization of global patent laws is not actually possible.¹ With the most recent attempts to further harmonize international patent law generally considered to have failed, *e.g.* the Patent Law Treaty,² this position seems to ring true. Many

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- ¹ Christopher Miles, *Comments - Assessing the Need for an International Patent Regime for Inventions in Outer Space*, 11 TUL. J. TECH. & INTELL. PROP. 59, 70 (2008), available at <http://heinonline.org/HOL/LandingPage?handle=hein.journals/tuljtip11&div=5&id=&page=>, last accessed on 05/09/2014; Jerome H. Reichman, Rochelle Cooper Dreyfuss, *Harmonization Without Consensus: Critical Reflections on Developing a Substantive Patent Law Treaty*, 57 DUKE L.J. 85, 91-92 (2007), available at http://scholarship.law.duke.edu/cgi/viewcontent.cgi?article=2854&context=faculty_scholarship, last accessed on 05/09/2014.
- ² Contracting Parties to the Patent Law Treaty, WIPO-Administered Treaties, having 34 Contracting Parties, available at http://www.wipo.int/treaties/en/ShowResults.jsp?lang=en&treaty_id=4, last accessed on 05/09/2014.

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different, countervailing principles exist within the various national and international patent regimes. As of yet there is no universally recognized ‘international patent’.³ No definitive international law, save that regarding the respect for sovereignty of other nations, governs application of nationally granted patents on the high seas, or in *terra nullis*, international airspace or outer space. Consequently, without a reliable, solitary international patent regime for outer space, patent rights for each separate cooperative outer space endeavour between States and intergovernmental organizations must be independently negotiated.⁴

Potential solutions to the difficulties confronting protection of inventions in outer space will also be addressed, including a potential solitary regime of patent law. The greater the number of large market States that participate in such a single outer space patent regime, the greater the financial incentives that can be offered to inventors and patent holders to stimulate innovation and the more robust the system will be.

However, the open question remains as to whether such a singular patent regime for outer space should comprise 1) an agreement among States to mutually extend their national patent laws to appropriately registered space objects, 2) a “unitary” jurisdiction, *i.e.* a “sole-authority” responsible for patent grant *and* enforcement, to which all States Parties defer regarding creation and practice of patented inventions in outer space, 3) an alternative or hybrid solution. Ultimately, flags of convenience may be exploited to undermine the limited patent monopoly. Together with flags of convenience, the temporary presence defense can create significant inter-jurisdictional consequences.

II. Patent Protection in Outer Space

With technological advancement a primary driver of global economic growth,⁵ some economic models report “technological change” as creating up

³ Kurt G. Hammerle and Theodore U. Ro, *The Extra-Territorial Reach of U.S. Patent Law on Space-Related Activities: Does the “International Shoe” Fit As We Reach For The Stars?*, 34 J. SPACE L. 241, 247 (2008), available at <http://www.spacelaw.olemiss.edu/jsl/pdfs/back-issues/jsl-34-2.pdf>, last accessed on 05/09/2014; Rikard Mikalsen, Philipp Harlfinger, Anthony P. Roskilly, *Patent Protection in the Marine Industry: International Legal Framework and Strategic Options*, 225 PROC. INST. MECH. ENG., PART M: J. ENG. MARITIME ENV. 232, at 235-236 (2011), available at <http://pim.sagepub.com/content/225/3/232>, last accessed on 28/07/13; *Intellectual Property and Outer Space*, Issue paper prepared by the International Bureau of WIPO, at 4-5, 10, 22 (2004) [hereinafter WIPO Issue Paper], available at http://www.wipo.int/export/sites/www/patent-law/en/developments/pdf/ip_space.pdf, last accessed on 05/09/2014.

⁴ WIPO Issue Paper, *supra* note 3, at 22.

⁵ Thomas Cheng, *Putting Innovation Incentives Back in the Patent-Antitrust Interface*, 11 NW. J. TECH. & INTELL. PROP. 385, 387 (2013), available at <http://scholarlycommons.law.northwestern.edu/cgi/viewcontent.cgi?article=1195&context=njtip>, last accessed on 05/09/2014; C. Cicekci and H. Torun, *Innovation: Is the*

to 75 percent.⁶ National and regional patent regimes provide the ability and right to protect technological inventions. Patents give exclusive rights to the patent owner to prevent commercial exploitation of the invention by others. Patent holders may do so through outright sale of title or by granting permissions, *i.e.* licenses or promises to not sue for infringement for use of the invention.

By granting to patent holders a protectable commercial monopoly, albeit limited in geographic extent and duration, a period of market exclusivity usually lasting about 20 years;⁷ inventors, companies and investors can potentially command supernormal profits. This enables the ability to recoup research and development costs, which would otherwise be irretrievable as sunk costs that might render the enterprise commercially infeasible.⁸

Strong Patents Increase Technological Advancement

Patent regimes and the limited monopoly have traditionally been thought to incentivize innovation and investment in new technological developments by conveying the ability to charge supra-competitive, market monopoly prices.⁹ However, within the interrelationship between patent rights, innovation and economic growth exists an inherent tradeoff.¹⁰ Stronger patent rights enhance

Engine for the Economic Growth?, Ege University, April 2007, available at <http://www.tcmb.gov.tr/yeni/iletisimgm/Innovation.pdf>, last accessed on 05/09/2014; Robert Solow, *Technical Change and the Aggregate Production Function*, 39 REV. ECON. STATS. 312, (1957), available at <http://www9.georgetown.edu/faculty/mh5/class/econ489/Solow-Growth-Accounting.pdf>, last accessed on 05/09/2014.

⁶ Solow, *supra* note 5.

⁷ M.J. Kleiman, *Patent Rights and Flags of Convenience in Outer Space*, Patents in Space, The Space Review, (2011), available at <http://www.thespacereview.com/article/1772/1>, last accessed on 05/09/2014; Jon Schuchardt, *Basic Patent Law: II. Patents as Exclusive Rights*, Dilworth IP Intellectual Property Law (2013), available at <http://www.dilworthip.com/basic-patent-law-ii-patents-as-exclusive-rights/>, last accessed on 05/09/2014; WIPO Issue Paper, *supra* note 3, at 2.

⁸ T. Cheng, *supra* note 5, at 387-390, 414; Julie D. Cromer, *How on Earth Terrestrial Laws Can Protect Geospatial Data*, 32 J. SPACE. L. 253, 264 (2006), available at <http://heinonline.org/HOL/LandingPage?collection=journals&handle=hein.journals/jrsl32&div=21&id=&page=>, last accessed on 05/09/2014; Bronwyn H. Hall, *Patents and Patent Policy*, 23 OX. REV. ECON. POL. 568, 573 (2007), available at http://elsa.berkeley.edu/~bhhall/papers/BHH07_OxREP_patents.pdf, last accessed on 05/09/2014; Mikalsen, *supra* note 3, at 234; WIPO Issue Paper, *supra* note 3, at 4-5.

⁹ T. Cheng, *supra* note 5, at 387, 414; Stephan Kinsella, *Are Patents "Monopolies"?*, Ludwig von Mises Institute, (2009), available at <http://archive.mises.org/10272/are-patents-monopolies/>, last accessed on 05/09/2014; Kleiman, *supra* note 7.

¹⁰ T. Cheng, *supra* note 5 at 414; B. Hall, *supra* note 8, at 572-573; Albert G.Z. Hu, I.P.L. Png, *Patent Rights and Economic Growth: Evidence from Cross-Country*

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R&D investment returns, but although they serve to make public details of the innovation they also limit the free transfer of such innovations.¹¹ Consumers consequently pay monopoly market prices for products embodying patented inventions, thereby enabling recovery of R&D costs.¹²

A 2009 published survey of 54 different manufacturing industries in 72 developed and developing countries over the period from 1981 to 2000 discovered evidence linking stronger patent rights with more rapid industrial growth. The impact of stronger patent rights also increased in the 1990s as compared to the 1980s. And, the faster growth and attendant impact were more strongly felt in patent-intensive industries and technologically advanced, higher income, economies, as compared to emerging economies.¹³

Without the capability of protecting inventions through patents, competitors could quickly, cheaply and easily reverse engineer and reproduce the technology.¹⁴ This would drive the price of products embodying the invention to the marginal cost of production, which excludes sunk costs, preventing recoup of research and development investments by patent holders, and as a result discouraging innovation.¹⁵ To balance this scenario, patent regimes leverage the benefit given to inventors in exchange for publication, thereby to accelerate innovation and technological advancement and improve the standard of living.¹⁶

Panels of Manufacturing Industries (2012), CELS 2009 4th Annual Conference on Empirical Legal Studies Paper, available at http://www.comp.nus.edu.sg/~ipng/research/2013_patent.pdf, last accessed on 05/09/2014.

- ¹¹ J.R. Green, S. Scotchmer, *On the Division of Profit in Sequential Innovation*, 26 RAND JOURNAL OF ECONOMICS 20, 20-33 (1995), available at http://scholar.harvard.edu/files/green/files/on_the_division_of_profit_in_sequential_innovation.pdf, last accessed on 05/09/2014; W.D. NORDHAUS, INVENTION, GROWTH AND WELFARE: A THEORETICAL TREATMENT OF TECHNOLOGICAL CHANGE, (1969); Hu, *supra* note 10, at 1; F. M. Scherer, *Nordhaus' Theory of Optimal Patent Life: A Geometric Reinterpretation*, 62 AMERICAN ECONOMIC REVIEW 422, 422-427 (1972) available at <http://are.berkeley.edu/courses/EEP143/fall2007/Scherer%20on%20Nordhaus.pdf>, last accessed on 07/09/2014.
- ¹² T. Cheng, *supra* note 5, at 387-390, 414; B. Hall, *supra* note 8, at 573.
- ¹³ Hu, *supra* note 10, at 1-2, 20; B. Hall, *supra* note 8, at 574-577.
- ¹⁴ T. Cheng, *supra* note 5, at 387; B. Hall, *supra* note 8, at 568.
- ¹⁵ T. Cheng, *supra* note 5, at 387; Patricia M. Danzon, *Differential Pricing: Reconciling R&D, IP and Access*, The Wharton School, University of Pennsylvania, slides 3-4 (2001), available at www.wto.org/english/tratop_e/trips_e/hosbjor_presentations_e/12danzon_e.ppt, last accessed on 07/09/2014.
- ¹⁶ T. Cheng, *supra* note 5, at 387.

Infringement of Rights Under Granted Patents

Infringement of patent rights “involves the unauthorized exploitation of subject matter covered by such intellectual property by a third party.”¹⁷ In addition, the responsibility to identify and take legal action against alleged patent infringement falls solely to the patent owner(s).¹⁸ And patent infringement lawsuits are exceptionally expensive, requiring large commitments of money, effort and time.¹⁹

Remedies which may be available to patent owner(s) typically include both civil and criminal sanctions. Civil sanctions may include award of damages, grant of injunction, or even the seizure and destruction of infringing devices, products, etc. Rarely used, criminal sanction may include imprisonment, fine, or both.²⁰

Detecting patent infringement is difficult in the first place without access to facilities and operations of potential infringers; neither is it possible to monitor every product on the market.²¹ However, for import or export of infringing products or products involved in contributing to or inducing patent infringement, customs authorities may assist by conducting search and seizure of such contraband.²²

The Temporary Presence Defense Exemption to Patent Infringement

Most States provide restricted exceptions to the “limited monopoly” of patents in their national laws. Such exceptions are carefully crafted to achieve specific public policy goals, provide for legitimate third-party interests and avoid any possible unreasonable interference with the lawful interests of such patent owners or the typical exploitation of such patents.²³

¹⁷ WIPO Issue Paper, *supra* note 3, at 4.

¹⁸ Patents: Essential Reading, U.K. Intellectual Property Office, pg. 4, available at <http://www.ipo.gov.uk/p-essentialreading.pdf>, last accessed on 05/09/2014; Mikalsen, *supra* note 3, at 235; WIPO Issue Paper, *supra* note 3, at 4.

¹⁹ Joseph J. Berghammer, Charles W. Shifley, *Building and Enforcing IP Value, An International Guide for the Boardroom, The Basics of US Patent Litigation*, Banner & Witcoff Ltd, available at http://www.bannerwitcoff.com/_docs/library/articles/basiclit.pdf, last accessed on 05/09/2014.

²⁰ WIPO Issue Paper, *supra* note 3, at 4.

²¹ Peter A. Elyjiw, *Detecting Patent Infringement*, Smart & Biggar, Fetherstonhaugh, (2008), “In some fields, there may be no getting around the practical difficulty of detecting patent infringement.” available at http://www.smart-biggar.ca/en/articles_detail.cfm?news_id=229, last accessed on 05/09/2014; Mikalsen, *supra* note 3, at 235.

²² Mikalsen, *supra* note 3, at 235; George R. Tuttle, III, *US Customs IPR Protection and Enforcement*, George R. Tuttle Law Offices, slide 34 *et seq.* (2008), available at <http://www.tuttlelaw.com/seminar/iprppt.pdf>, last accessed on 05/09/2014.

²³ WIPO Issue Paper, *supra* note 3, at 4.

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Domestic law may include exceptions, such as for “non-commercial” research or experimental use of patented inventions, the “temporary presence” defense for foreign vessels, ships, aircraft or other vehicles engaged in international commerce within the domestic territory, or even exploitation under a non-voluntary license to preserve public order and morality.²⁴

Typically granted on a reciprocal basis, the temporary-presence defense (TPD) is meant to encourage international commerce²⁵ and achieves this objective by exempting owners and operators of foreign space objects from claims of patent infringement while such space object is temporarily (or accidentally) present within the domestic jurisdiction.²⁶

Analogously to aircraft and ocean vessels,²⁷ the TPD allows operators and owners of foreign space objects to store equipment, components, accessories and spare parts, otherwise susceptible to claims of patent infringement, within the territory of another State.²⁸ However, the TPD does not extend to operation or sale wholly within or from the domestic territory.²⁹

The outer space activity analogous to an aircraft landing at an airport in or to an ocean vessel docking in a port of a foreign country is the docking of space objects registered by different States. And, although neither space object would effectively enter the area of jurisdiction and control of the respective other State, astronauts entering the respective other space object might be permitted to carry aboard devices and equipment embodying patented invention, especially if necessary for life support and safety, under an exemption similar to the TPD.

If a launching State does not have national laws or international agreements that mandate a TPD with respect to space objects, such launching State may freely allow infringement lawsuits to be prosecuted against owners and

²⁴ *Id.*

²⁵ T.L. Field, *The “Planes, Trains, and Automobiles” Defense to Patent Infringement for Today’s Global Economy: Section 272 of the Patent Act*, 12 *B.U. J. SCI. & TECH. L.* 26, 28-39 (2006), available at <http://heinonline.org/HOL/LandingPage?collection=journals&handle=hein.journals/jstl12&div=3&id=&page=>, last accessed on 06/09/2014.

²⁶ Agreement Among the Government of Canada, Governments of Member States of the European Space Agency, the Government of Japan, the Government of the Russian Federation, and the Government of the United States of America Concerning Cooperation on the Civil International Space Station, 29 Jan. 1998, 1998 UST. LEXIS 212 [hereinafter ISS IGA.], Art. 21; Paris Convention for the Protection of Industrial Property, *as amended on 14 July 1967 at the Stockholm Revision Conference*, 21 U.S.T. 1583; 828 U.N.T.S. 305 [hereinafter Paris Convention], Art. 5^{ter}; Field, *supra* note 25.

²⁷ Paris Convention, *supra* note 26, Art. 5^{ter}

²⁸ ISS IGA, *supra* note 26, Art. 21; Paris Convention, *supra* note 26, Art. 5^{ter}; ISS. Field, *supra* note 25.

²⁹ *Id.*

operators of such space objects.³⁰ This would, however, negatively impact the business efforts of an aspiring launching authority engaged in the space launch services industry. Patent protection in the maritime and aviation industries is strongly influenced by the nearly ubiquitous TPD.³¹ With international commercial space industries taking hold, the TPD will logically take a position of similar importance for certain sectors of this market.³²

Increasing Importance of Patents and IP

In recent years, intellectual property (IP) has increasingly gained prominence as an important concern due in part the growing globalization of space activities.³³ The 1996 U.N. Declaration on International Cooperation in the Exploration and Use of the Outer Space,³⁴ developed by the Committee on the Peaceful Uses of Outer Space (COPUOS) expressly refers to IP rights, indicating that:

States are free to determine all aspects of their participation in international cooperation in the exploration and use of outer space on an equitable and mutually acceptable basis. Contractual terms in such cooperative ventures should be fair and reasonable and they should be in full compliance with the legitimate rights and interests of the parties concerned as, for example, with intellectual property rights.³⁵

And, although such agreements legally bind the States Parties thereto, they are not applicable to independent activities nor do they legally bind third parties.³⁶

Allowing a lack of legal certainty to persist in this area will likely negatively impact international research and cooperation, corresponding potential technological advancements, and ultimately the commercial development of outer space itself.³⁷ Consequently, a simple, fair and dependable legal framework is needed to govern the application of patent and IP law within

³⁰ Field, *supra* note 25; Hammerle, *supra* note 3; Kleiman, *supra* note 7; WIPO Issue Paper, *supra* note 3.

³¹ ISS IGA, *supra* note 26, Art. 21(6); Paris Convention, *supra* note 26, Art. 5^{ter}; Field, *supra* note 25, at 28, 34, 42.

³² WIPO Issue Paper, *supra* note 3, at 20.

³³ ISS IGA, *supra* note 26, Art. 21; WIPO Issue Paper, *supra* note 3, at 4-5.

³⁴ Declaration on International Cooperation in the Exploration and Use of the Outer Space for the Benefit and the Interest of All States, Taking into Particular Account the Needs of Developing Countries, G.A. Res. 51/122, U.N. GAOR, 51st Sess., U.N. Doc. A/RES/51/122, (1996); WIPO Issue Paper, *supra* note 3, at 8.

³⁵ WIPO Issue Paper, *supra* note 3, at 8.

³⁶ WIPO Issue Paper, *supra* note 3, at 4-5.

³⁷ *Id.*

the regime of international outer space law.³⁸ Exclusive rights to protect inventions and creations conveyed under the limited monopolies of patents and other IP would support healthy competition and the establishment of niche markets by space entrepreneurs seeking to provide unique products and services.³⁹

Whatever the outcome, what is clear is that the effective and cooperative collaboration between The United Nations Committee on the Peaceful Uses of Outer Space⁴⁰ (UN COPUOS) and the World Intellectual Property Organization⁴¹ (WIPO), and likely the World Trade Organization (WTO) as well, will be crucial to a successful outcome. UN COPUOS, particularly through the Legal Subcommittee,⁴² deliberates and develops all prospective international Treaties and Conventions prior to the presentation of draft materials to the UN General Assembly for final review and consideration.

UNISPACE III Workshop on IP Rights in Space

The Third U.N. Conference on the Exploration and Peaceful Uses of Outer Space⁴³ (UNISPACE III) was held in 1999. This “major intergovernmental conference for the purposes of creating a blueprint for the peaceful use of outer space in the 21st century[,]”⁴⁴ included the Workshop on Intellectual Property Rights in Space.⁴⁵ The conference plenary amended and then adopted recommendations made by the Workshop, which were reported in the conference proceedings. These recommendations included:

³⁸ *Id.*

³⁹ *Id.*

⁴⁰ United Nations Committee on the Peaceful Uses of Outer Space, United Nations Office of Outer Space Affairs, available at <http://www.oosa.unvienna.org/oosa/COPUOS/copuos.html>, last accessed on 06/09/2014.

⁴¹ World Intellectual Property Organization, available at <http://www.wipo.int/portal/index.html.en>, last accessed on 06/09/2014. One of 16 specialized agencies of the U.N., WIPO administers various Treaties dealing with IP and promotes IP protection globally through the establishment of international norms, in collaboration with States, and other international or intergovernmental organizations. *See* WIPO Issue Paper, *at* 1.

⁴² Legal Subcommittee of the United Nations Committee on the Peaceful Uses of Outer Space, United Nations Office of Outer Space Affairs, available at <http://www.oosa.unvienna.org/oosa/COPUOS/Legal/index.html>, last accessed on 06/09/2014.

⁴³ Report of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (Vienna, 19-30 July 1999) A/Conf.184/6, (1999) [hereinafter A/Conf.184/6].

⁴⁴ WIPO Issue Paper, *supra* note 3, *at* 9.

⁴⁵ Provisional Agenda of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III), A/Conf.184/1, 14 (1999).

405. More attention should be paid to the protection of intellectual property rights, in view of the growth in the commercialization and privatization of space-related activities. However, the protection and enforcement of intellectual property rights should be considered together with the international legal principles developed by the United Nations in the form of treaties and declarations, such as those relating to the principle of non-appropriation of outer space, as well as other relevant international conventions.

406. The feasibility of harmonizing international intellectual property standards and legislation relating to intellectual property rights in outer space should be further explored with a view to enhancing international coordination and cooperation at the level of both the State and the private sector. In particular, the possible need for rules or principles covering issues such as the following could be examined and clarified: applicability of national legislation in outer space; ownership and use of intellectual property rights developed in space activities; and contract and licensing rules.

407. All States should provide appropriate protection of intellectual property rights involving space-related technology, while encouraging and facilitating the free flow of basic science information.

408. Educational activities concerning intellectual property rights in relation to outer space activities should be encouraged.⁴⁶

UNESCO and COMEST

At a meeting of the UNCOPUOS Legal Subcommittee following UNISPACE III, several delegations proposed addressing IP concerns. The Subcommittee, however, declined as the proposal didn't have sufficient support.⁴⁷ The International Bureau of WIPO continues to meet and lecture on this topic.⁴⁸ In December 2001, the World Commission on the Ethics of Scientific Knowledge and Technology (COMEST), an advisory body of United Nations Educational, Scientific and Cultural Organization (UNESCO), adopted the Recommendations on the Ethics of Outer Space, which it submitted to the Director General of UNESCO.⁴⁹ COMEST believes space policy should

⁴⁶ A/Conf.184/6, *supra* note 43, *see quote at* 76.

⁴⁷ WIPO Issue Paper, *supra* note 3, *at* 9.

⁴⁸ *Id.*

⁴⁹ *Id.*

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conform to core OST principles⁵⁰ and that exploration and use of space should be for the benefit of all States “based on the concept of mutual and reciprocal benefits, while safeguarding fair competition and the principle of return on investment.”⁵¹

Regarding patents and IP, COMEST recommends taking “all appropriate measures to provide researchers with free access to scientific data in order to guarantee sharing of knowledge with a view to promote scientific progress; to place scientific outer space data at the disposal of the developing countries; to foster the definition of procedures to permit sharing of the resulting benefits, bearing in mind the legitimate interests of these countries and acting in the most equitable and balanced manner possible.”⁵²

Patent regimes worldwide share this objective, and patent applications are published as a repository of human knowledge. COMEST further recommends agreement on “management of intellectual property in manned stations and more broadly in the field of outer space industry, notably as to the eligibility for patenting of products or processes produced in orbital stations or associated with on-board materials or vehicles.”⁵³

III. Jurisdictional Bases for the Laws of Patents & International Space Law

Jurisdiction is the touchstone for the application of national and international patent regimes, respectively by States and regional authorities or a State Member. And, once a national Court of a State with a reasonable claim to jurisdiction receives a cause of action, the laws of such State will determine questions regarding international jurisdiction and conflicts of laws.⁵⁴ The law of the forum, *i.e. lex fori*, is the law which applies to all cases filed in that forum, and without a better reason to apply different law, *lex fori* operates as the default legal mechanism.⁵⁵ And, when parties in dispute reside in different

⁵⁰ Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, *entered into force* Oct.10,1967, 18 U.S.T. 2410, 610 U.N.T.S. 205, [hereinafter OST], Art. I.

⁵¹ OST, *supra* note 50, Art. I.

⁵² WIPO Issue Paper, *supra* note 3, at 18. *citing* Alain Pompidou, *The Ethics of Space Policy*, Working Group on the “Ethics of Outer Space”, UNESCO World Commission on the Ethics of Scientific Knowledge and Technology (COMEST), (2000); *see also* 32 C/Resolutions, Records of the General Conference, 32nd Sess., Paris, 29 September to 17 October 2003, Vol. 1, Resolutions, UNESCO, (2004).

⁵³ *Id.*

⁵⁴ *Id.*

⁵⁵ Tiong Min Yeo, *Tort Choice of Law Beyond the Red Sea: Whither the Lex Fori?*, Sing. J. Int'l Comp. L. 91, (1997), explaining an exception to the basic rule of *lex fori*, available at <http://law.nus.edu.sg/sybil/downloads/articles/SJICL-1997-1/SJICL-1997-91.pdf>, last accessed on 05/08/2014; Albert A. Ehrenzweig, *The Lex Fori: Basic Rule in the Conflict of Laws*, 32 Rocky Mntn. Rev. 13, 14 (1959-1960), available at <http://heinonline.org/HOL/LandingPage?collection=journals&handle=hein.journals/ucollr32&div=9&cid=&page=>, last accessed on 07/09/2014.

jurisdictions, the interests of the respective forums will likely be in conflict, and Courts must often decide which jurisdiction's laws to apply.⁵⁶

The nascent commercial space industry has a tremendous potential for robust development of many sectors, including mining, transportation, tourism and communications, but this will require substantial private investment in space related technologies.⁵⁷ The vast potential of commercial space endeavors could be squandered if not appropriately incentivized through a strategic, effective patent system.⁵⁸ So, inventions must be appropriately protectable or the world will risk discouraging the very innovation and invention necessary to explore outer space in greater depth.⁵⁹

Exercise of Jurisdiction Under Patents

Jurisdiction is the basis of the governmental power to police activities within the bounds of their territory, and also to adjudge disputes and judicial interpretation of the laws of the land.⁶⁰ Jurisdiction over IP, including patents, is based on "[a] government's general power to exercise authority over all persons and things within its territory."⁶¹ Typically granted by States, e.g. a rare exception being the grant of European Patents by the European Patent Organization (EPO), patents are valid and enforceable only within the territory under the jurisdiction of the issuing authority (whether national or supra-national).⁶² Therefore, patent rights generally subsist at the level of national authority, without a 'global' or 'world' patent, only international and regional application procedures.⁶³

National and regional patent laws govern acquisition and enforcement of patent rights only within the territory of the State or international authority in question.⁶⁴ However, enforcement of patents granted by regional authorities

⁵⁶ Cromer, *supra* note 8, at 267.

⁵⁷ Kleiman, *supra* note 7; Miles, *supra* note 1, at 60, 70.

⁵⁸ Kleiman, *supra* note 7; Theodore U. Ro, Matthew J. Kleiman, Kurt G. Hammerle, *Patent Infringement in Outer Space in Light of 35 U.S.C. § 105: Following the White Rabbit Down the Rabbit Loophole*, 17 B.U.J. SCI. & TECH. L. 204-206 (2011), available at <http://heinonline.org/HOL/LandingPage?collection=journals&handle=hein.journals/jstl17&div=13&id=&page=>, last accessed on 06/09/2014.

⁵⁹ *Id.*; FRANCIS LYALL, PAUL B. LARSEN, *SPACE LAW: A TREATISE*, 127 (2009).

⁶⁰ Julie D. Cromer, *supra* note 8, at 264.

⁶¹ BLACK'S LAW DICTIONARY, 687 (7th ed. 2000); Cromer, *supra* note 8.

⁶² B. Hall, *supra* note 8, at 571-574; Hammerle *supra* note 3, at 246; Kleiman, *supra* note 7; Mikalsen, *supra* note 3, at 235; WIPO Issue Paper, *supra* note 3, at 10.

⁶³ Hammerle, *supra* note 3, at 247; Mikalsen, *supra* note 3, at 235-236; WIPO Issue Paper, *supra* note 3, at 4-5.

⁶⁴ B. Hall, *supra* note 8, at 571-574; Hammerle *supra* note 3, at 246; Kleiman, *supra* note 7; Mikalsen, *supra* note 3, at 235; WIPO Issue Paper, *supra* note 3, at 10; Ro, *supra* note 58, at 204-206, 207.

must often still be prosecuted within the national courts of States Members.⁶⁵ Due to the traditional basis of territorial jurisdiction underpinning the application of patent law, it is important to determine whether territorial jurisdiction based patent law is sufficient to support extension of national and regional patent regimes to respectively registered space objects.⁶⁶ However, recognition of the difference between activities carried out in outer space and space-related activities conducted in the territory of a State or regional authority.⁶⁷

Exercise of Jurisdiction in Outer Space

Under international outer space law, cooperation is primary, presenting a great opportunity to establish an exemplary international outer space patent regime.⁶⁸ In contrast, States may freely develop and implement their own unique patent regimes.⁶⁹ This innate contrast spurred at least one commentator: “[w]hile the scientific community considers the outer space as the ‘Great Unknown,’ so too does the legal community consider the protection of intellectual property in outer space.”⁷⁰

Multiple bases of potential jurisdiction that possibly may or may not apply under international outer space law, depending on the specific set of circumstances, present the primary difficulty that more than one State may claim jurisdiction over astronauts, personnel, or objects in outer space.⁷¹ As Dr. Bin Cheng explains:

⁶⁵ How to Apply for a European Patent, European Patent Organisation, available at <http://www.epo.org/applying/basics.html>, last accessed on 05/09/2014; European Patents, Irish Patent Office, available at http://www.patentoffice.ie/en/patents_europe.aspx, last accessed on 05/09/2014; Mikalsen *supra* note 3, at 235, “After a patent is granted, any dispute, such as infringement or patent validity questions, are handled individually by national courts.”; WIPO Issue Paper, *supra* note 3, at 10.

⁶⁶ *Id.*; Miles, *supra* note 1, at 62-64.

⁶⁷ WIPO Issue Paper, *supra* note 3, at 10-11; Ro, *supra* note 58, at 207.

⁶⁸ Cromer, *supra* note 8, at 263.

⁶⁹ *Id.*; Sa’id Mosteshar, *Issues Arising in Determining the Legal Regime Applicable to Intellectual Property Rights in Outer Space*, in RESEARCH & INVENTION IN OUTER SPACE: LIABILITY AND INTELLECTUAL PROPERTY RIGHTS, 133-134 (Sa’id Mosteshar ed., 1995).

⁷⁰ Leo B. Malagar, Marlo Apalisok Magdoza-Malagar, *International Law of Outer Space and the Protection of Intellectual Property Rights*, 17 B. U. INT’L L. J. 311, 349 (1999), available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1687422##, last accessed on 07/09/2014.

⁷¹ Cromer, *supra* note 8, at 265; Sergio Marchisio, *National Jurisdiction for Regulating Space Activities of Governmental and Non-Governmental Entities*, United Nations / Thailand Workshop on Space Law, 2 (2010), available at <http://www.oosa.unvienna.org/pdf/pres/2010/SLW2010/02-02.pdf>, last accessed on 07/09/2014.

[T]here can often be a concurrence of jurisdictions even in fairly normal circumstances. Thus a person on board a ship which is anchored in the port of a third State would simultaneously be under the jurisdictions of three separate States: (i) the territorial jurisdiction of the territorial State, (ii) the quasiterritorial jurisdiction of the flag-State of the ship, and (iii) the personal jurisdiction of his national State.⁷²

Extending the territorial jurisdiction legal principle underpinning patent law to outer space operations, e.g. extraterritorial activities on board a spacecraft, would necessarily involve modification beyond recognition because territorial jurisdiction of States extends only to the actual physical boundaries of the State's territory.⁷³

International agreements regarding outer space collaborations have, for the purposes of IP,⁷⁴ so far relied on treatment of registered space objects in accordance with 'quasi-territorial' or 'nationality' jurisdiction, under which States exercise authority "over ships and aircraft of its nationality, and all persons and things on board."⁷⁵ Under quasi-territorial jurisdiction, i.e. the law of the flag, jurisdiction attaches to the State of registry; rather than other different prospective jurisdictional bases, such as operation and control or even as contractually agreed.⁷⁶

However, this leads to a checkerboard of national IP laws each of which might apply their own special version of patent law only on domestically registered space objects.⁷⁷ Consequently, obtaining granted patents in all jurisdictions relevant to manufacture, sale, and use may be necessary to properly protect inventions.⁷⁸ This quickly becomes exceedingly burdensome, administratively and financially.⁷⁹

⁷² BIN CHENG, *STUDIES IN INTERNATIONAL SPACE LAW*, 622-623 (1997).

⁷³ CHENG, *supra* note 72, at 622-623; Cromer, *supra* note 8, at 264; Robert G. Howell, *Intellectual Property, Private International Law, and Issues of Territoriality*, 13 *Canadian Intellectual Property Review* 209, 211-213 (1996), available at <http://www.ipic.ca/reviews/CIPR1314.pdf>, last accessed on 07/09/2014; Ricky J Lee, *Reconciling International Space Law with the Commercial Realities of the Twenty-First Century*, 4 *SING. J. INT'L COMP. L.* 194, 211 (2000), available at <http://law.nus.edu.sg/sybil/downloads/articles/SJICL-2000-1/SJICL-2000-194.pdf>, last accessed on 09/09/2014.

⁷⁴ Cromer, *supra* note 8, at 264-266.

⁷⁵ CHENG, *supra* note 72, quote at 622; Cromer, *supra* note 8, at 264; OGUNSOLA O. OGUNBANWO, *INTERNATIONAL LAW AND OUTER SPACE ACTIVITIES*, 81 (1975); Frans von der Dunk, *Pandora's Box? The Basic Legal Framework for Doing Business with a Space Station: An Inventory of Problems*, in *LEGAL ASPECTS OF SPACE COMMERCIALIZATION*, 114, 125 (1991); WIPO Issue Paper, *supra* note 3, at 22.

⁷⁶ Cromer, *supra* note 8, at 266-267.

⁷⁷ WIPO Issue Paper, *supra* note 3, at 22.

⁷⁸ Field, *supra* note 25; Kleiman, *supra* note 7; Mikalsen, *supra* note 3, at 235.

⁷⁹ Kleiman, *supra* note 7; WIPO Issue Paper, *supra* note 3, at 3.

The Outer Space Treaty – Jurisdiction & Control

States of registry hold jurisdiction and control over space objects and any personnel under Article VIII, which provides that States Parties shall retain jurisdiction and control over any objects launched into outer space on an appropriate national registry. Further, “ownership of objects launched into outer space [...] is not affected by their presence in outer space or on a celestial body or by their return to the Earth.”⁸⁰

However, OST Article VI indicates States Parties must retain some degree of jurisdiction, via the requirement for States to “authorize” and “supervise”, over domestically registered private spacecraft. Under Article VI States Parties bear international responsibility “for national activities in outer space [...] whether such activities are carried on by government agencies or by non-governmental entities.”⁸¹

Under OST Article VI, States must ensure that, while in outer space, private actors properly conduct their space activities in accordance with the OST and the international laws of outer space.⁸² Where two or more launching States exist, they must determine by mutual agreement which State among them will register the space object.⁸³ However, such registration is without prejudice to appropriate agreements regarding which launching State will retain jurisdiction and control over the space object and any personnel.⁸⁴

In outer space, jurisdiction most often attaches through nationality, *i.e.* quasi-territoriality.⁸⁵ The OST integrates this “quasi-territorial” jurisdiction by requiring all States Parties to keep a national registry of space objects,⁸⁶ and by basing jurisdiction over such space objects upon the principle of *lex registri*, or jurisdiction according to the law of the State of registry.

⁸⁰ OST, *supra* note 50, Art. VIII.

⁸¹ OST, *supra* note 50, Art. VI.

⁸² VALÉRIE KAYSER, LAUNCHING OBJECTS: ISSUES OF LIABILITY AND FUTURE PROSPECTS, 43, 297-298 (2001); Miles, *supra* note 1, at 63; Bernhard Schmidt-Tedd & Michael Gerhard, *Registration of Space Objects: Which Are the Advantages for States Resulting from Registration*, in *ESSENTIAL AIR & SPACE L.126*, (Marietta Benko, Kai-Uwe Schrogl eds., 2005).

⁸³ Convention on the Registration of Objects Launched into Outer Space, *entered into force* 15 Sept. 1976, 28 U.S.T. 695, 1023 U.N.T.S. 15, [hereinafter RC], Art. II(2).

⁸⁴ *Id.*

⁸⁵ Dan L. Burk, *Protection of Trade Secrets in Outer Space Activity: A Study in Federal Preemption*, 23 SETON HALL L. REV. 560, 573 (1993), available at <http://heinonline.org/HOL/LandingPage?collection=journals&handle=hein.journals/hlr23&div=25&id=&page=>, last accessed on 05/09/2014; B. Hall, *supra* note 8, at 571-574; Hammerle *supra* note 3, at 246; Kleiman, *supra* note 7; Mikalsen, *supra* note 3, at 235; WIPO Issue Paper, *supra* note 3, at 10. Ro, *supra* note 58, at 207; Miles, *supra* note 1, at 62.

⁸⁶ OST, *supra* note 50, Art. VIII; Miles, *supra* note 1, at 62.

The Registration Convention & Launching States

The Registration Convention of Objects Launched into Outer Space (Registration Convention or RC),⁸⁷ provides under Article I(a) that a “launching State” is “(i) a state which launches or procures the launching of a space object” or “(ii) a state from whose territory or facility a space object is launched.”⁸⁸ Subsection (ii) of the “launching state” definition is based on territorial aspects of a launch,⁸⁹ while subsection (i) relates to activities of States Parties.⁹⁰

Article II(1) requires launching States to register “space objects”⁹¹ in an national registry.⁹² Consequently, the Registration Convention makes launching States responsible for authorization and continuing supervision of activities conducted by non-governmental, private entities in outer space under the OST.⁹³

Therefore, under the Registration Convention and the OST space object “nationality” is determinative, *i.e.* the State of registration shall retain primary jurisdiction and control over registered space objects and any personnel,⁹⁴ unless otherwise agreed among the launching States.⁹⁵ Additionally, Registration Convention Article VII allows international intergovernmental organizations to register space objects upon specific conditions, including the undertaking of all attendant obligations.⁹⁶

However, relying on space object nationality to inform jurisdiction implicates some minor challenges.⁹⁷ Jurisdiction according to launching State has roots

⁸⁷ RC, *supra* note 83, Arts. II, VII; United Nations Office of Outer Space Affairs Overview of the Registration Convention of Objects Launched into Outer Space, available at <http://www.unoosa.org/oosa/en/SORegister/regist.html>. last accessed on 06/09/2014; Miles, *supra* note 1, at 62-63.

⁸⁸ RC, *supra* note 83, Art. I(a); Miles, *supra* note 1, at 63.

⁸⁹ RC, *supra* note 83, Art.I(a)(i), “a State from whose territory or facility a space object is launched”; Miles, *supra* note 1, at 63.

⁹⁰ RC, *supra* note 83, Art.I(a)(ii), “a state which launches or procures the launching of a space object,” meaning that the State may provide the launch vehicle or manages the launch process, or that the State pays for or obtains the launch; Schmidt-Tedd, *supra* note 82, at 132-133; Miles, *supra* note 1, at 63.

⁹¹ RC, *supra* note 83, Art. I(b): the term “space object” includes component parts of a space object as well as its launch vehicle and parts thereof.

⁹² RC, *supra* note 83, Art. II(1).

⁹³ OST, *supra* note 50, Art. VI.

⁹⁴ B. Hall, *supra* note 8, at 571-574; Hammerle *supra* note 3, at 246; Kleiman, *supra* note 7; Mikalsen, *supra* note 3, at 235; Ro, *supra* note 58, at 207; Burk, *supra* note 85, at 573; Miles, *supra* note 7, at 62; WIPO Issue Paper, *supra* note 3, at 10.

⁹⁵ OST, *supra* note 50, Art. VIII; RC *supra* note 83, Art. II(2).

⁹⁶ RC, *supra* note 83, Art. VII.

⁹⁷ KAYSER, *supra* note 82, at 43; Andrew Ritholz, *International and Domestic Regulation of Private Launching Ventures*, 20 STAN. J. INT’L L. 135, 142 (1984), available at

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both in territorial jurisdiction, *i.e.* Article I(a)(ii), in nationality jurisdiction, with respect to Article I(a)(i). Legal certainty is crucial to the business oriented perspective of a private commercial company, especially to one in the nascent space industry.⁹⁸

Generally, the national laws and international agreements of the launching authority will govern which patent laws are applicable to a space object under flag state jurisdictions.⁹⁹ However, reliance on national jurisdiction enforcement is vulnerable to the inherent flag of convenience problem.¹⁰⁰

IV. International Agreements – Patents & Invention in Outer Space

International agreements, including the Berne Convention (1886),¹⁰¹ Paris Convention (1883),¹⁰² Patent Cooperation Treaty (PCT, 1970),¹⁰³ and the Patent Law Treaty (PLT, 2000)¹⁰⁴ establish certain standards for protection of inventions, such as national treatment of inventors,¹⁰⁵ meant to encourage economic opportunity and enable inventors to obtain patents in all jurisdictions, regardless of citizenship or country of residence.¹⁰⁶ National patent systems have become increasingly standardized, converging at the global level through international Treaties and initiatives such as the Patent Highway Program.¹⁰⁷

<http://heinonline.org/HOL/LandingPage?collection=journals&handle=hein.journals/stanit20&div=11&id=&page=>, last accessed on 05/08/2014.

⁹⁸ WIPO Issue Paper, *supra* note 3, at 22-23

⁹⁹ RC *supra* note 83, Arts. II, VII; WIPO Issue Paper, *supra* note 3, at 8.

¹⁰⁰ Field, *supra* note 25, at 79; Kleiman, *supra* note 7.

¹⁰¹ Berne Convention for the Protection of Literary and Artistic Works, Sept. 9, 1886, *as amended* on 24 July 1971 in Paris, 1161 U.N.T.S. 30, and *as amended* in 1979, S. Treaty Doc. No. 99-27 (1986) [The 1979 amended version doesn't appear in U.N.T.S. or I.L.M.].

¹⁰² Paris Convention, *supra* note 26.

¹⁰³ Patent Cooperation Treaty, *as amended* on 19 June 1970, 28 U.S.T. 7645; 1160 U.N.T.S. 231; 9 I.L.M. 978.

¹⁰⁴ Patent Law Treaty, *entered into force* 28 April 2005, 39 I.L.M. 1047, [hereinafter Patent Law Treaty].

¹⁰⁵ Paris Convention, *supra* note 26, Art. 2; B. Hall, *supra* note 8, at 568-587.

¹⁰⁶ Summary of the Patent Cooperation Treaty (PCT) (1970), World Intellectual Property Organization, available at http://www.wipo.int/treaties/en/registration/pct/summary_pct.html, last accessed on 07/09/2014; Mikalsen, *supra* note 3, at 232.

¹⁰⁷ PCT-Patent Prosecution Highway Pilot (PCT-PPH), WIPO, http://www.wipo.int/pct/en/filing/pct_pph.html, last accessed on 31/7/13; Mikalsen, *supra* note 3.

European Patent Convention

Established in 1977, The European Patent Organization (EPO) is founded on the basis of the European Patent Convention (EPC), concluded in 1973.¹⁰⁸ The EPO currently includes 38 Member States, containing all EU Member States in addition to Albania, Macedonia, Iceland, Liechtenstein, Monaco, Norway, San Marino, Serbia, Switzerland and Turkey.¹⁰⁹

The EPO consists of two bodies, the European Patent Office and the Administrative Council,¹¹⁰ overseeing Office activities.¹¹¹ Further, the EPO has legal personality and is represented by the EPO President¹¹² from its seat in Munich.¹¹³ In accordance with the EPC, the EPO's primary objective is examination and grant of European patents.

The EPO achieves this objective by accepting single application submissions for review and potential grant of a "European patent",¹¹⁴ essentially a portfolio of national patent rights, a bundle of individual national patents in each Member State.¹¹⁵ The EPC specifically requires that from the date of publication of a European patent application States Members must at least ensure that the applicant can claim reasonable compensation under national law for infringement of the invention.¹¹⁶

Therefore, in accordance with the EPC,¹¹⁷ and because the EPC requires States Members to enact national patent infringement laws but ultimately leaves specific implementations to individual discretion of Member State, enforcement of European patents requires the financially burdensome task of prosecuting individual patent infringement lawsuits in each of the national jurisdictions where an offence has occurred.¹¹⁸

¹⁰⁸ European Patent Convention, European Patent Office, (14th ed., 2010), available at <http://www.epo.org/law-practice/legal-texts/epc.html>, last accessed on 07/09/2014.

¹⁰⁹ Member States of the European Patent Organisation, European Patent Organisation, available at <http://www.epo.org/about-us/organisation/member-states.html>, last accessed on 07/09/2014.

¹¹⁰ European Patent Convention, *supra* note 108, Art. 4(2).

¹¹¹ European Patent Organisation, European Patent Organisation, available at <http://www.epo.org/about-us/organisation.html>, last accessed on 07/09/2014.

¹¹² European Patent Convention, *supra* note 108, Art. 5; Legal Foundations, European Patent Organisation, available at <http://www.epo.org/about-us/organisation/foundation.html>, last accessed on 07/09/2014.

¹¹³ European Patent Convention, *supra* note 108, Art. 6.

¹¹⁴ How to Apply for a European Patent, *supra* note 65; European Patents, Irish Patent Office, *supra* note 65.

¹¹⁵ *Id.*

¹¹⁶ European Patent Convention, *supra* note 108, Art. 67(2).

¹¹⁷ European Patent Convention, *supra* note 108, Art. 64(3).

¹¹⁸ Patents: Essential Reading, *supra* note 18, at 14; Andrew Clay, *The Unitary Patent & The Unified Patent Court*, Squire Sanders, Intellectual Property and Technology Practice, 10 (2011), available at <http://www.squiresanders.com/files/Event/a9005f79-958c-4892-a10b-004a07cf2248/Presentation/EventAttachment/c00e5d60-19fb-4b79->

European Union Patent Having Unitary Effect

The proposed Council Regulation on the Community Patent¹¹⁹ and its subsequent revisions¹²⁰ included Article 3(2) providing that: “This Regulation shall apply to inventions created or used in outer space, including on celestial bodies or on spacecraft, which are under the jurisdiction and control of one or more Member States in accordance with international law.”¹²¹ However, the final version as passed by the European Parliament and the European Commission on 17 December 2012 and which took effect on 1 January 2014, does not include the provision of Article 3(2) and fails to address application of patents in outer space.¹²²

It is unclear as to precisely why the provision of Article 3(2) was removed from the final proposed legislation. Perhaps it was felt more appropriate for legislation directly concerning outer space.

The European patent with unitary effect, also known as the EU patent, is based on EU patent legislation effective in the 25 participating EU Member States.¹²³ Italy and Spain have not participated primarily because application and enforcement will be conducted only in English, French, and German.¹²⁴

a50d-73f04c8f5e89/The-Unified-Patent-and-the-Unified-Patents-Court.pdf, last accessed on 06/09/2014.

¹¹⁹ Proposal for a COUNCIL REGULATION on the Community patent, COM(2000) 412 final, 2000/0177 (CNS), Commission of the European Communities, Brussels, 1.8.2000 [hereinafter Proposed Council Regulations].

¹²⁰ Proposal for a COUNCIL REGULATION on the Community patent, PI 122, 16113/09, Council of the European Union, Brussels, 27 November 2009 [hereinafter Proposed Council Regulation]; Proposal for a COUNCIL REGULATION on the Community patent, 7119/04, PI 28, Council of the European Union, Brussels, 8 March 2004 [hereinafter Proposed Council Regulations]

¹²¹ Proposed Council Regulations, *supra* notes 119 and 120, Art. 3(2).

¹²² Regulation (EU) No 1257/2012 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of December 2012 implementing enhanced cooperation in the area of the creation of unitary patent protection, L 361/1, Official Journal of the European Union, 31.12.2012 [hereinafter EU Reg. 1257/2012]; Council Regulation (EU) No 1260/2012 of 17 December 2012 implementing enhanced cooperation in the area of the creation of unitary patent protection with regard to the applicable translation arrangements, L 361/89, Official Journal of the European Union, 31.12.2012 [hereinafter EU Reg. 1260/2012]; *See also* Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL implementing enhanced cooperation in the area of the creation of unitary patent protection, COM(2011) 215 final, 2011/0093 (COD), Commission of the European Communities, Brussels, 13.4.2011, *see also* Explanatory Memorandum explaining development of the proposed legislation, available at http://eur-lex.europa.eu/smartapi/cgi/sga_doc?smartapi!celexplus!prod!DocNumber&lg=EN&type_doc=COMfinal&an_doc=2011&nu_doc=215, last accessed on 07/09/2014.

¹²³ EU Reg. 1257/2012 and EU Reg. 1260/2012, *supra* note 122.

¹²⁴ Patents, European Commission, 27 June 2013, available at http://ec.europa.eu/internal_market/indprop/patent/, last accessed on 06/09/2014;

Similar to the European patent granted under the EPC, during normal prosecution applicants may request EPO to issue a unitary patent, which provides for “sole-authority” application and enforcement procedures within the 25 participating EU States,¹²⁵ as implemented under the Agreement on a Unified Patent Court.¹²⁶

ISS Intergovernmental Agreement

The International Space Station (ISS) Intergovernmental Agreement (IGA)¹²⁷ signed in 1998, was designed specifically with microgravity experimentation and scientific research in mind.¹²⁸ Articles 21 and 16 of the ISS IGA are the most relevant to creation and practice of patents aboard the ISS, making jurisdiction and control over ISS flight elements the determinative criterion for application of respective legal regimes, establishing a temporary presence defense and also providing an exception for IP to the requirement for cross-waivers by States Parties.¹²⁹

Italy and Germany have effectively extended their national patent laws to ESA registered ISS flight elements by having incorporated the entire text of the ISS IGA into their national laws.¹³⁰

V. National Patent Law Regimes – Patents & Invention in Outer Space

Most States have not yet extended national patent laws to domestically registered space objects. However, many States do provide a temporary-

Stephanie Bodoni, *Spain, Italy Lose EU Court Appeal Over Patent System Adoption*, Bloomberg.com, April 16, 2013, available at <http://www.bloomberg.com/news/2013-04-16/spain-italy-lose-eu-court-appeal-over-patent-system-adoption.html>, last accessed on 06/09/2014.

¹²⁵ EPO – Unitary Patent, available at <http://www.epo.org/law-practice/unitary/unitary-patent.html>, last accessed on 06/09/2014; The EU Single Market, Industrial Property and Patent FAQs, European Commission, 19.06.2013, available at http://ec.europa.eu/internal_market/indprop/patent/faqs/index_en.htm, last accessed on 06/09/2014.

¹²⁶ Agreement on a Unified Patent Court, 2013/C 175/01, Notices From European Union Institutions, Bodies, Offices, And Agencies, C 175/1, Official Journal of the European Union, 20.6.2013.

¹²⁷ ISS IGA, *supra* note 26.

¹²⁸ Hammerle, *supra* note 3, at 244; Sandeepa Bhat, *Inventions in Outer Space: Need for Reconsidering of the Patent Regime*, 36 J. Space L. 1, 3 (2010), available at <http://www.spacelaw.olemiss.edu/jsl/back-issues/jsl-36-1.html>, last accessed on 06/09/2014.

¹²⁹ ISS IGA, *supra* note 26, Art.16(3)(d)(4) and Art. 21(2) and (6); WIPO Issue Paper, *supra* note 3, at 21.

¹³⁰ A.M. Balsano, J. Wheeler, *The IGA and ESA: Protecting Intellectual Property Rights in the Context of ISS Activities*, in *THE INTERNATIONAL SPACE STATION, COMMERCIAL UTILIZATION FROM A EUROPEAN LEGAL PERSPECTIVE*, 67 (Frans von der Dunk, M.M.T.A. Brus, eds., 2006).

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presence defense (TPD) exemption to patent infringement in their national laws.¹³¹ ISS IGA Partner States, who have made special provision, also expand the scope of their national patent laws to govern the creation of invention and enforcement of patents on domestically registered flight elements of the ISS.¹³² Due to the numerous States participating in the ISS IGA, national TPDs may exempt space objects, components, and accessories thereto, from patent infringement.¹³³

Currently, the primary means for the space industry to obtain comprehensive patent coverage is to prosecute patent applications in all jurisdictions important to manufacture, sale and use, *i.e.* States of ownership, registry or operation of the relevant space object.¹³⁴ Although expensive, it is important to obtain strategic patent protection in all such jurisdictions. Otherwise competitors could circumvent patent protection with a “flag of convenience”, *e.g.* a flag State which has not granted and does not recognize any valid patent.¹³⁵

Global companies typically file patents only in countries likely to comprise places of manufacture or significant markets for the patented technology.¹³⁶ The challenge facing the advancement of space technology is that space objects conduct operations wholly outside of all national territories, inhabiting a place where patent protections likely fail to apply, unless affirmatively extended beyond the traditional territorial basis of national patent jurisdictions.¹³⁷

Application of U.S. Patent law to outer space

The Outer Space Treaty dictates that States Parties shall retain “jurisdiction and control” over registered space objects, including any personnel, while located beyond national boundaries – in outer space or on a celestial body.¹³⁸ Consequently, such States may extend their domestic national law, including patent laws, to govern activities in, on or nearby such space objects.¹³⁹ The U.S. accordingly passed the the Patents in Space Act in 1990,¹⁴⁰ including Title 35 U.S.C. §105 to expand domestic U.S. patent law to cover “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.”¹⁴¹ However,

¹³¹ Field, *supra* note 25, at 28, 34, 42.

¹³² Balsano, *supra* note 130.

¹³³ Field, *supra* note 25, at 50-52, 89.

¹³⁴ Kleiman, *supra* note 7; Mikalsen, *supra* note 3, at 240.

¹³⁵ Kleiman, *supra* note 7; Field, *supra* note 25, at 79.

¹³⁶ Kleiman, *supra* note 7; Mikalsen, *supra* note 3, at 240.

¹³⁷ Kleiman, *supra* note 7; WIPO Issue Paper, *supra* note 3, at 10-11.

¹³⁸ OST, *supra* note 50, Art. VIII.

¹³⁹ See note 102, *supra*.

¹⁴⁰ Patents in Space Act 1990 (Pub. L. 101-580, Sec. 1(a), Nov. 15, 1990, 104 Stat. 2863).

¹⁴¹ Title 35 U.S.C. §105 – Inventions in outer space, Patents in Space Act, (1990), 35 U.S.C. § 105 reads as follows: “(a) Any invention made, used, or sold in outer space

this legislation specifically exempts any space object or component thereof specifically identified and otherwise provided for by an appropriate international agreement with the U.S., *i.e.* conveying jurisdiction and control, or which is carried on the registry of a foreign State in accordance with the Registration Convention.¹⁴²

Furthermore, Section 105 authorizes the making of international agreements between the U.S. and foreign partners to apply U.S. patent law to foreign space objects, registered under the Registration Convention, and to deem any creation, use, or sale of inventions on such space object as made, used, or sold in the U.S.¹⁴³ Moreover, when inventions are treated as created in the U.S. any applications for patents must be filed firstly with the U.S. Patent & Trademark Office.¹⁴⁴ And any claims for allegations of infringement of U.S. patents aboard spacecraft registered in the U.S. or in foreign States with an appropriate U.S. agreement in place, must be brought before U.S. courts.¹⁴⁵ So for “modern launches”, after the 1990 legislative expansion of U.S. national patent law to apply on board U.S. registered spacecraft, such as the SpaceX Dragon capsules and Falcon 9 rockets¹⁴⁶ used in ISS commercial resupply missions.¹⁴⁷ Further, Google Lunar X-Prize competitors can protect

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. (b) Any invention made, used or sold in outer space on a space object or component thereof that is carried out 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.”; Kleiman, *supra* note 7; A. Rush, *The Astronaut Inventor’s Best Friend*, 35 USC § 105, IP In Space, (2012), available at <http://ipinspace.com/2012/03/09/the-astronaut-inventors-best-friend-35-usc-%C2%A7105/>, last accessed on 06/09/2014.

¹⁴² RC, *supra* note 83; Title 35 U.S.C. §105, *supra* note 141, 105(a); Kleiman, *supra* note 7.

¹⁴³ Title 35 U.S.C. §105, *supra* note 141, 105(a),(b).

¹⁴⁴ Kleiman, *supra* note 7; LYALL, *supra* note 59, at 124-127; Hammerle, *supra* note 3, at 241; Title 35 U.S.C. §105, *supra* note 141.

¹⁴⁵ *Id.*

¹⁴⁶ T. J. Mueller, *Pintle Injector Tip with Active Cooling*, United States Patent US 7,503,511 B2, March 17, 2009, available at <http://www.google.com/patents/US7503511>, last accessed on 05/09/2014.

¹⁴⁷ Space Exploration Technologies Corporation – Dragon, available at <http://www.spacex.com/dragon.php>, last accessed on 06/09/2014; Rush, *supra* note 141.

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inventions in their lunar rovers under U.S. patent law for rovers registered in the U.S. or other State of registry with a U.S. agreement.¹⁴⁸

The U.S. is so far the first and only such State to have affirmatively extended its national patent law to all domestically registered space objects through legislation explicitly “establishing a link between the three key elements: inventions, jurisdiction and territory.”¹⁴⁹ Consequently, U.S. patent law “provides quasi-territorial effect on a space object that is carried on the registry of the United States of America, unless otherwise agreed by an international agreement.”¹⁵⁰

The U.S. Temporary presence defense: title 35 U.S.C. § 272 in view of Hughes Aircraft Co. v. United States

The U.S. TPD is set forth in § 272 of U.S.C. Title 35.¹⁵¹ A special definition for the word “vehicle” under § 272 was incorporated into Title III, Section 305¹⁵² of the 1958 National Aeronautics and Space Act (Space Act) in 1981, especially impacting application of the U.S. TPD to activities in outer space as well as to ground activities related to terrestrial launch. Specifically, Section 305(k) of the Space Act states that “[a]ny object intended for launch, launched, or assembled in outer space shall be considered a vehicle for the purpose of § 272 of Title 35.”¹⁵³ This new definition broadened the meaning of “vehicle” for purposes of the U.S. TPD and with respect to outer space and launch related activities.¹⁵⁴

*Hughes Aircraft Co. v. United States*¹⁵⁵ is a rare U.S. case to interpret 35 U.S.C. § 272 in light of application to outer space activities. In *Hughes*, patentee sought compensation for alleged U.S. use of a patented system for control of a spin-stabilized attitude in various spacecraft entering the U.S. from the U.K.¹⁵⁶ Ultimately, the Court of Federal Claims (CFC) held that § 272 is a complete defense to patent infringement for spacecraft launched in the U.S. after 1981, when Congress passed the Space Act extending the definition of ‘vehicle’.¹⁵⁷ In addition, the CFC held the concerned spacecraft

¹⁴⁸ Rush, *supra* note 141.

¹⁴⁹ WIPO Issue Paper, *supra* note 3, at 11.

¹⁵⁰ *Id.*

¹⁵¹ Title 35 U.S.C. § 272, Temporary presence in the United States, Historical Revision Notes.

¹⁵² National Aeronautics and Space Act of 1958, Pub. L. No. 85-568, 72 Stat. 426, (1958) (codified as amended at Title 42 U.S.C. § 2451 *et seq.* (2000)).

¹⁵³ Title 42 U.S.C. § 2457(k) – Property rights in inventions, Subsection (k); Field, *supra* note 25, at 28.

¹⁵⁴ Hammerle, *supra* note 3, at 265-266.

¹⁵⁵ *Hughes Aircraft Co. v. United States*, 29 Fed. Cl. 197, 232 (1993) [hereinafter *Hughes*]; Field, *supra* note 25, at 26.

¹⁵⁶ *Hughes*, *supra* note 157, at 201; Field, *supra* note 25, at 28.

¹⁵⁷ *Id.*

to have been present only “temporarily” in the U.S. because they had entered “one time for the sole purpose of being launched into outer space.”¹⁵⁸ Further, the court noted that “the United Kingdom extends “similar privileges” to “vessels, aircraft and vehicles” of the United States.”¹⁵⁹ And furthermore, the court held that the invention was undoubtedly “used exclusively for the needs of the vehicle, and... not sold or used for manufacture within the United States.”¹⁶⁰

Extraterritorial Application of Domestic Patent Law?

Some argue that other States not having yet enacted such an explicit extension of national patent laws lack appropriate legal authority to extend national patent regimes to cover appropriately registered space objects.¹⁶¹ However, others would argue that considering the “broad concept of territoriality according to which national patent law may be applicable on ships which fly that State’s flag on the high seas and on aircrafts which are registered by that State,” appropriately registered space objects should be subject to national patent law by way of analogy regardless of whether or not the national patent law expressly provides for such application.¹⁶²

With the EU having eschewed extending application of the unitary patent regime to appropriately registered space objects and since the U.S. is the only State to have fully extended national patent law to such space objects, to, the choice for obtaining patent protection of commercial or research activities in outer space beyond the ISS becomes that of deciding between arguments to justify the extraterritorial application of national patent law, updating national patent legislation and entering an official agreement for the application of U.S. patent law.

The outcome of arguing for extraterritorial application of national patent law before an appropriate domestic Court is not the surest way to protect inventions. And although States may decide to extend national patent law, if a State does not have a large market or independent access to space, such a gesture may lack economic significance.

In contrast, the best way to obtain economically significant patent protection in outer space, is to enter an appropriate international agreement with the U.S. Effectively the U.S. provides an opt-in patent regime covering space objects in outer space and on celestial bodies, but this regime can be circumvented with relative ease by selecting the State of Registry of such space objects from among the various launching State jurisdictions.

¹⁵⁸ *Hughes*, *supra* note 157, at 240-241; Field, *supra* note 25, at 28.

¹⁵⁹ *Id.*

¹⁶⁰ *Id.*

¹⁶¹ A. M. Balsano, *Industrial Property Rights in Outer Space in the International Governmental Agreement (IGA) on the Space Station and the European Partner*, 35 COLL L. OUTER SP. 216, (1992); WIPO Issue Paper, *supra* note 3, at 11.

¹⁶² WIPO Issue Paper, *supra* note 3, at 11-12, citing Arnold Vahrenwald, *Industrial Property on the Space Station FREEDOM*, 15 E.I.P.R., (1993), in footnote 22.

VI. The Flag of Convenience Problem

Regulation of the creation and practice of invention is left to the discretionary, typically quasi-territorial application by States of their respective national patent laws. For instance, the U.S. has extended national patent law to cover space objects registered in the U.S. and also with other States and intergovernmental organizations with an appropriate U.S. agreement.¹⁶³ However, flags of convenience may circumvent such patent protection within the international space law.¹⁶⁴ Because competitors can escape patent enforcement via registration under flags of convenience, patent owners may be deprived of appropriate compensation.¹⁶⁵

Therefore, for manufacturers of spacecraft, components, spare parts or accessories thereto, obtaining comprehensive protection of an invention requires prosecuting patent applications and obtaining and maintaining patent protection in every jurisdiction important for manufacture, sale, and use, *i.e.* launch, registration, or operation.¹⁶⁶ Although costly, time consuming, and administratively burdensome, obtaining patents in all relevant jurisdictions is critical because failure to do so can create safe havens, encouraging competitors to avoid specific patents and corresponding patent regimes with flags of convenience.¹⁶⁷

Jurisdiction and control is based on registration of space objects and Article II of the 1975 Registration Convention provides that only a “launching state”, *i.e.* a State launching or procuring the launch of a space object, or the State from whose territory or facility a space object is launched, may register a space object.¹⁶⁸ Therefore, it is possible to select an outer space flag of convenience through incorporation and location of its business, or through launch or registration of its spacecraft in the desired State.¹⁶⁹ This lack of meaningful patent coverage in international space law may ultimately undermine the capability incentivize commensurately the risk of investment required for technological advancements important to outer space and to spur the commercial development of space.¹⁷⁰

¹⁶³ Title 35 U.S.C. §105, *supra* note 141; Field, *supra* note 25; Kleiman, *supra* note 7.

¹⁶⁴ Field, *supra* note 25, at 79; Kleiman, *supra* note 7; Mikalsen, *supra* note 3, at 239-240; R.S. Toh and S.Y. Phang, *Quasi-flag of convenience shipping: the wave of the future*, 33 *TRANSP. J.* 31, (1993), available at <http://www.jstor.org/stable/20713194>, last accessed on 06/09/2014; *What are Flags of Convenience?*, International Transport Workers’ Federation, available at <http://www.itfglobal.org/flags-convenience/sub-page.cfm>, last accessed on 06/09/2014.

¹⁶⁵ *Id.*

¹⁶⁶ *Id.*

¹⁶⁷ Kleiman, *supra* note 7; Field, *supra* note 25, at 79.

¹⁶⁸ RC, *supra* note 83, Art. II; Kleiman, *supra* note 7.

¹⁶⁹ Kleiman, *supra* note 7; LYALL, *supra* note 59, at 94

¹⁷⁰ Kleiman, *supra* note 7.

Temporary Presence Defense & Flags of Convenience

The doctrine of temporary presence defense allows acts that would otherwise constitute domestic patent infringement, *e.g.* between Partner States of the ISS, including foreign “launch” of a space object from and storage of components, accessories and spare parts within such jurisdiction.¹⁷¹ Therefore, if patent holder has failed to obtain patent protection in all ISS Partner States, the invention can be freely made, sold or used, *i.e.* launched, registered and operated, in Partner State jurisdictions where patentee has no patent protection.¹⁷²

Consequently, space objects, etc., embodying foreign patented inventions may be made, sold and used in Partner State jurisdictions without protection, and may even enter “temporarily”, *i.e.* under a formal TPD, other Partner State jurisdictions having one or more enforceable patents without any compensation to the patent holder.¹⁷³ However, obtaining patent protection in all jurisdictions important for manufacture of such space object should hopefully provide adequate protection by securing the manufacturing base.¹⁷⁴

Potential Solutions to the Flag of Convenience Problem

Currently, the flag of convenience problem is exacerbated by the fact that many States have not extended their national patent laws to cover domestically registered space objects. WIPO asserts that a reliable legal framework for patents in outer space “would facilitate maximizing the collective utilization of public and private resources in the area of space technology for the benefit of all nations.”¹⁷⁵

Therefore, the ideal way to solve the flag of convenience problem and to appropriately incentivize advancement of space technology is the establishment of a single patent jurisdiction for patent application and enforcement.¹⁷⁶ Many international organizations and space law experts have advocated a single outer space patent regime, but the major space-faring nations have repeatedly rejected this idea.¹⁷⁷ The primary barrier to such a jurisdiction remains the traditional disinterest of terrestrial nations in surrendering sovereignty to international organizations.¹⁷⁸

¹⁷¹ Field, *supra* note 25, at 50-52.

¹⁷² Field, *supra* note 25, at 79; Kleiman, *supra* note 7; Mikalsen, *supra* note 3, at 240.

¹⁷³ *Id.*; ISS IGA, *supra* note 26, Art. 21(6); Paris Convention, *supra* note 26, Art. 5^{ter}.

¹⁷⁴ *Id.*

¹⁷⁵ Kleiman, *supra* note 7; LYALL, *supra* note 59, at 127, *see* “general and uniform patent protection for inventions made in outer space would give investors confidence in outer space research and encourage such activities”; WIPO Issue Paper, *supra* note 3, at 22-23, *see* assertion that the best solution is “to declare space and its accessories (for example, launch sites and vehicles) as a single territory with a single and uniform law and with a single and universal enforcement body”;

¹⁷⁶ Kleiman, *supra* note 7; WIPO Issue Paper, *supra* note 3, at 22-23.

¹⁷⁷ Kleiman, *supra* note 7; LYALL, *supra* note 59, at 560-561.

¹⁷⁸ Kleiman, *supra* note 7.

VII. Conclusions

The principle of ‘non-appropriation’ under the OST,¹⁷⁹ has been misinterpreted to possibly preclude ownership of IP and patents. However, in Article VIII the Outer Space Treaty explicitly condones ownership, irrespective of location in outer space, of space objects, which the Liability Convention defines in Article I as including all components thereof as well as launch vehicles.

And, although the respective foundational principles underlying space law and patent law may diverge, national and regional patent laws are applied within the context of space objects, personnel and technology deployed into space analogously to terrestrial regimes. One expert in the field has boldly proposed to declare space and its accessories, *e.g.* launch sites and launch vehicles, as a single “territory” for the purposes of establishing a “unitary” type patent system with “a single and uniform law and with a single and universal enforcement body.”¹⁸⁰ However, such a regime would have serious conflicts under the present system, among others, with current launch providers. Consider the Sea Launch platform; if it is held to be within and part of the “territory” of outer space, what happens if it smashes into an ocean liner? Would the Sea Launch State of registry be liable under the Liability Convention? On further investigation of such a regime many similar inconsistencies would become evident.

The study mentioned above by Hu, *et al.*, clearly links stronger patents with higher industrial growth. According to Hu, effects of patents are intensified in industrialized States, compounding their effect on the bottom line of economic development. The study by Hu, seems to suggest that the more quickly a globally harmonized single patent regime is established to govern patents in space, the faster we will strengthen and intensify economic growth, stimulated by innovation and invention in the first place.¹⁸¹

Plurality of National Patent Laws vs. a Sole Authority

Extension of national patent laws to outer space activities or creation of a unitary outer space patent regime would both be best accomplished through a multilateral agreement. Jurisdiction is the most important factor to resolve. Activities in creating and practicing patented inventions on board spacecraft could be legally deemed to have occurred under any particular jurisdiction available on Earth. However, prevention of forum shopping should also be a

¹⁷⁹ OST, *supra* note 50, Art.II; Miles, *supra* note 1, at 64.

¹⁸⁰ WIPO Issue Paper, *supra* note 3, at 22-23, citing Bradford Smith, *Matching space-related intellectual property rights to space industry needs*, Echanges ASPI-1997, No.53, 1 Space Studies 261, (1996), available at http://link.springer.com/content/pdf/10.1007%2F978-94-011-5692-9_29.pdf, last accessed on 07/09/2014.

¹⁸¹ Hu, *supra* note 10.

primary objective.¹⁸² And, a “unitary” patent regime requires a separate terrestrial-independent jurisdiction.¹⁸³ Although a “unitary” patent jurisdiction for outer space would remedy any latent jurisdictional complications and given that a single “unitary” patent regime for outer space poses a potentially ideal solution to problems of complicated jurisdictional structures in existing territorially driven patent laws and the flag of convenience problem, nonetheless attaining the broad consensus needed to support such a far reaching international legal instrument seems impossible. Several clear choices exist for terrestrial jurisdiction, from among the launching States, domicile of the owners of the space objects in question, or the State of registry of the space objects.¹⁸⁴ This situation could easily lead to multiple vying claims of “launch State jurisdiction.” For patents, ascribing jurisdiction over a space object, and personnel thereof, to the State of registry is most favorable.¹⁸⁵ This scenario, analogous to that already present on Earth, could provide the legal certainty needed to encourage private investment in outer space.¹⁸⁶ This solution would help resolve the jurisdictional question in favor of quasi-territorial, nationality jurisdiction, and give better detail to the potential scope of liability and duty to enforce the national patent laws of with respect to private activities conducted on board appropriately registered space objects.¹⁸⁷ However, substantive differences between national patent systems may still encourage some limited forms of launch forum shopping.¹⁸⁸

Further, the inconsistencies between respective national patent laws do not seem to have particularly impaired technological development on Earth.¹⁸⁹ Consequently, the incentives provided by the practice of patent law in outer space under nationality-jurisdiction should resemble the terrestrial system. Importantly, an international agreement for a single patent regime should also create effective enforcement mechanisms.¹⁹⁰

Whatever the outcome, an agreement that resolves outstanding questions of jurisdiction and liability is possible and would provide much needed legal certainty and incentive to invest in outer space R&D required for profitable business models.¹⁹¹ With the current state of international outer space law, courts could reasonably reach similar, but different results regarding

¹⁸² Miles, *supra* note 1, at 71.

¹⁸³ *Id.*

¹⁸⁴ *Id.*

¹⁸⁵ WIPO Issue Paper, *supra* note 3, at 18. *citing* Alain Pompidou.

¹⁸⁶ Field; *supra* note 25; Miles, *supra* note 1, at 70-72; WIPO Issue Paper, *supra* note 3, at 4-5.

¹⁸⁷ Miles, *supra* note 1, at 72.

¹⁸⁸ *Id.*

¹⁸⁹ *Id.*

¹⁹⁰ Miles, *supra* note 1, at 73.

¹⁹¹ Miles, *supra* note 1, at 69-74.

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jurisdiction, liability, and the duty on behalf of launching States to enforce domestic national patent laws in outer space.¹⁹² Such a situation is detrimental to business, and consequently acts as a drag on the pace of innovation. If the world is not yet ready for a “unitary” patent regime in outer space, it should at least extend national patent laws to outer space activities to help accelerate the technological development of outer space.

However, there are other intermediate solutions to the flag of convenience problems. One such option, that would also reduce financial and administrative costs facing patent holders, would be to provide member states a single jurisdiction for patent prosecution, with optional mutual recognition and enforcement based on reciprocity.¹⁹³ Such a system could be modeled on the European Patent Convention (EPC), but would nonetheless be politically difficult and would not entirely resolve flags of convenience. The EPC experience has demonstrated that a unified, cost-effective patent filing system is possible. Reciprocal patent recognition and enforcement agreements would reduce the number of countries, and the associated effort and costs, where inventors must file patent applications to obtain meaningful protection.¹⁹⁴

A single patent regime covering the territory of outer space, and possibly including its accessories, *i.e.* launch sites and vehicles, that enables participation at various scales, *e.g.* full reliance on a “sole-authority” or recognition of granted space patents but retaining authority regarding enforcement, by Member States, becomes the preferable solution, in part due to its adaptability. The lowest tier of participation would be extension of national patent laws to domestically registered space objects. The most involved scale could include mutual recognition of patents granted through a single process of harmonized patent prosecution.

The goal would be to have as many participating Partner States as possible to provide the new outer space patent regime with the broadest possible base and the greatest chance at success. Without some form of international outer space patent regime, flags of convenience will continue to threaten the ability to recoup the investments in outer space technology R&D.

Providing tax incentives and government contracting preferences to companies that register their spacecraft within the unified system would discourage the use of flags of convenience by making it more difficult to compete in outer space for companies that register their spacecraft in non-participating countries. This would help mitigate the threat posed to innovation and invention in outer space by flags of convenience.¹⁹⁵

A unified patent regime for outer space has the potential to disruptively accelerate the technological advancement necessary to development of new

¹⁹² Miles, *supra* note 1, at 70.

¹⁹³ Kleiman, *supra* note 7.

¹⁹⁴ *Id.*

¹⁹⁵ *Id.*; WIPO Issue Paper, *supra* note 3, at 22-23.

abilities with respect to use and exploration of outer space. Providing the legal certainty of a patent regime would encourage venture capital, hedge funds, and other opportunity seekers to invest in improved technologies crucial to the access, use and exploration of outer space.

Stronger patents increase economic development and investments in innovation and invention, providing a positive reinforcement mechanism that accelerates technological advancement. Providing a cohesive, unified patent regime for outer space could help resolve the looming flag of convenience problem, thereby removing this threat to legal and financial certainty.