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Rosario Avveduto

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# PAST, PRESENT, AND FUTURE OF INTELLECTUAL PROPERTY IN SPACE: OLD ANSWERS TO NEW QUESTIONS.

Rosario Avveduto<sup>†</sup>

*Abstract:* This comment critically analyzes international space law in the context of intellectual property. The issues explored, current and future, are at the crossroads of the international space legal framework and U.S. intellectual property law. The first stage of the analysis includes a brief history of space law, introducing the U.N. treaties on space activities and taking a hard look at the founding principles they enshrine. An analytical overview of the International Space Station Agreement follows, introducing the present application of space law to issues of intellectual property. This overview further considers the fundamental principles of U.S. intellectual property, especially patent law, including the peculiar mandate of the Patents in Space Act. Both preceding sections highlight issues specifically affecting intellectual property and its development or enforcement in outer space and reveal the ramifications of this complex topic. After dissecting the relevant legal norms, the comment explores the future of the interaction between space and intellectual property, building upon the preceding critical approach to examine two issues: orbital patents and flags of convenience for patent infringers in space. Having delineated a number of interpretive problems that scarcely find comfort in the language of the applicable law, the comment concludes that commercial development and innovation in outer space will either require an update of international space law principles or a conscious disregard of its provisions.

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## I. INTRODUCTION

Four fundamental forces shape the Universe. The existence of everything in the Universe and the explanation of every phenomenon is attributable to the effects of at least one of these forces, which are: gravity, electromagnetic force, weak force, and strong force.<sup>1</sup> These forces are also

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<sup>†</sup> LL.M. Candidate at the University of Washington, School of Law, Class of 2019. I would like to thank Professor Robert Gomulkiewicz for enthusiastically encouraging the undertaking of this project; fellow LL.M. and dear friend, Elena Ponte, for helping me in approaching and understanding space law; and the *Washington International Law Journal* Editorial Board and Staff for their invaluable suggestions and kind support.

<sup>1</sup> See generally *What Is the Standard Model of Particle Physics*, SCIENCE ALERT, <https://www.sciencealert.com/the-standard-model>.

referred to as interactions. They are fundamental because reduction to simpler interactions is not possible.<sup>2</sup> Figuratively, space law was born and is evolving as the point of convergence of a different set of four essential forces that operate in our world: sovereignty,<sup>3</sup> international law,<sup>4</sup> scientific advancement,<sup>5</sup> and intellectual property.<sup>6</sup> These categorical directives have informed the human approach to space and will do so in the future.

Sovereignty is the most fundamental relation between states, rooted in territory, population, authority, and recognition.<sup>7</sup> It is hard to imagine future mass expansion into outer space without picturing some sort of third-millennium “colonialism.”<sup>8</sup> Not surprisingly, the first international treaties on space specifically focused on the issues of national ambitions and expansion of sovereign states. In particular, the appropriation of space struck the drafters as a matter of utmost importance and one in need of specific provisions.<sup>9</sup> National sovereignty in outer space is formally nonexistent as a matter of international space law, because repudiated by the United Nations and not contemplated in their treaties.<sup>10</sup> The non-appropriation principle, as

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<sup>2</sup> See generally *id.*

<sup>3</sup> See U.N. Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, art. 2, Jan. 26, 1967, 610 U.N.T.S. 8843 (devoting a provision to this principle) [hereinafter *Outer Space Treaty*].

<sup>4</sup> See U.N. Off. for Outer Space Aff., Space Law, <http://www.unoosa.org/oosa/en/ourwork/spacelaw/index.html> (defining space law as rules, principles, and standards of international law).

<sup>5</sup> See SPACE CHRONOLOGY, <http://spacechronology.com/> (featuring a timeline of technical innovations related to space) (last visited Sept. 2, 2019).

<sup>6</sup> International Bureau of World Intellectual Property Organization, *International Property and Space Activities*, at 4 (2004), [https://www.wipo.int/export/sites/www/patent-law/en/developments/pdf/ip\\_space.pdf](https://www.wipo.int/export/sites/www/patent-law/en/developments/pdf/ip_space.pdf) (explaining how space technology is at the forefront of technical advancement and, as such, is the fruit of intellectual creations).

<sup>7</sup> THOMAS J. BIERSTEKER & CYNTHIA WEBER, *STATE SOVEREIGNTY AS SOCIAL CONSTRUCT*, at 14 (Cambridge Studies in International Relations), Cambridge University Press (1996).

<sup>8</sup> See Haris Durrani, *Is Spaceflight Colonialism?*, THE NATION (July 19, 2019), <https://www.thenation.com/article/apollo-space-lunar-rockets-colonialism/>; see also Caroline Haskins, *Private Space Companies No Longer Have To Follow The Law*, THE OUTLINE (May 8, 2018, 2:31 PM), <https://theoutline.com/post/4469/outer-space-treaty-commerce-free-enterprise-bill-spacex-blue-origin-boeing-lockheed-martin?zd=2&zi=yhwuys2>; see also *The Colonization of Space*, THE WEEK (Nov. 26, 2018), <https://theweek.com/articles/808840/colonization-space>.

<sup>9</sup> Matthew Thornburg, *Are the Non-Appropriation Principle and The Current Regulatory Regime Governing Geostationary Orbit Equitable for All of Earth's States?*, 40 MICH. J. INT'L L. (2019), <http://www.mjilonline.org/are-the-non-appropriation-principle-and-the-current-regulatory-regime-governing-geostationary-orbit-equitable-for-all-of-earths-states/> (last visited Aug. 31, 2019).

<sup>10</sup> *Id.*

it currently stands, is obsolete and will not survive the impact of future commercial expansion.<sup>11</sup>

International law balances out sovereignty through the implementation of international treaties and other legal instruments.<sup>12</sup> It contains the thrust of national ambitions by promoting an organized and stable legal framework set to defuse tensions and encourage cooperation. Although international law is mature on Earth,<sup>13</sup> it is still underdeveloped in terms of space law.<sup>14</sup> In the latter capacity, it mostly serves the preventative and programmatic purpose of laying the cornerstone of the interactions between governments in space.<sup>15</sup> International law and its space applications, therefore, run across parallel trajectories. Indeed, space law rises and falls with international law and diplomacy.<sup>16</sup> Where space law adopts the pre-existing channels and legal frameworks of international law, it inherits its limits and flaws as well.<sup>17</sup>

Science is the *sine qua non* of space exploration and research. Progress, as the consequence of understanding and promoting science, serves and improves society.<sup>18</sup> The world as we know it is the product of that understanding. This is particularly true when it comes to space exploration and space-related scientific efforts. In the context of international space law, scientific advancements play an essential role and constitute a relevant portion of state parties' obligations.<sup>19</sup> The importance of science is reflected in the requirements in terms of funding, effort, and competence, which are

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<sup>11</sup> *Id.*; see also Duncan Blake & Steven Freeland, *As The World Embraces Space, The 50 Year Old Outer Space Treaty Needs Adaptation*, THE CONVERSATION (July 9, 2017 3:54 PM), <https://theconversation.com/as-the-world-embraces-space-the-50-year-old-outer-space-treaty-needs-adaptation-79833>.

<sup>12</sup> See William R. Slomanson, *Fundamental Perspectives on International Law* 4 (6th ed. 2011) (quoting Restatement (Third) of the Foreign Relations Law of the United States § 101 (Am. Law Inst. 1987) (defining international law as the law regulating relations between states)).

<sup>13</sup> See GERRY SIMPSON et al., *GREAT POWERS AND OUTLAW STATES: UNEQUAL SOVEREIGNS IN THE INTERNATIONAL LEGAL ORDER* 30 (2004) (referring to the conventional origin of international law, the Treaty of Westphalia).

<sup>14</sup> See Kirsten Jusewicz-Haidle, *Space Law 2.0*, LIFE OF THE LAW (Nov. 24, 2015), <https://www.lifeofthelaw.org/2015/11/space-law-2-0/>.

<sup>15</sup> See generally *Outer Space Treaty*, *supra* note 3.

<sup>16</sup> See Kay-Uwe Schrogl, *Space Law and Diplomacy*, Eighth Nandasiri Jasentuliyana Keynote Lecture for the Fifty-Ninth International Institute of Space Law Colloquium on the Law of Outer Space (Sept. 27, 2016) at 1–2, <https://iislweb.org/docs/2016keynote.pdf>.

<sup>17</sup> See *id.* at 4.

<sup>18</sup> See Henk Wesseling, *History: Science or Art?*, 6.3 EUR. REV. 265, 267 (1998).

<sup>19</sup> See generally *Outer Space Treaty*, *supra* note 3.

exceedingly demanding and, therefore, point to a need for a reliable legal framework taking into account the specific needs of scientific research and technical innovation.<sup>20</sup>

Intellectual Property (“IP”) rights generally support and assure a continually growing intellectual community and technological progress.<sup>21</sup> Creating and incentivizing a supportive environment for research and development is vital to space exploration.<sup>22</sup> Without it, everything this comment examines would be nothing but scientific fiction. Different countries approach the foundational theories of IP in a different fashion, but the utilitarian, incentive-based theory is by far the most widely accepted.<sup>23</sup> Accordingly, the creation of socially valuable intellectual products would suffer if the creations were defenseless against misappropriation or undue reproduction.<sup>24</sup> Although the role of IP in space is not different than its role on Earth,<sup>25</sup> the consequences of its implementation in space might be significantly worse.<sup>26</sup> In the realm of space, a dysfunctional regime of IP rights not only entails economic and social costs,<sup>27</sup> but also undermines the successful pursuit of space exploration and settlement, as well as pushing forward the proximity of their achievement.<sup>28</sup>

This comment analyzes an unsettled question resting in between these four fundamental aspects: how will the territorial nature of IP react to the development of technology for use in outer space? The inquiry is centered upon territoriality, non-appropriation, and private actors: with IP expanding towards space, it is time to entertain the possibility that territoriality and

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<sup>20</sup> See International Bureau of World Intellectual Property Organization, *supra* note 6, at 23.

<sup>21</sup> WORLD INTELLECTUAL PROPERTY ORGANIZATION, WHAT IS INTELLECTUAL PROPERTY? 23 (2003), [https://www.wipo.int/edocs/pubdocs/en/intproperty/450/wipo\\_pub\\_450.pdf](https://www.wipo.int/edocs/pubdocs/en/intproperty/450/wipo_pub_450.pdf).

<sup>22</sup> See International Bureau of World Intellectual Property Organization, *supra* note 6. See also Kimberly Amadeo, *NASA Budget, Current Funding, History, and Economic Impact*, THE BALANCE (June 25, 2019), <https://www.thebalance.com/nasa-budget-current-funding-and-history-3306321> (discussing the extent of the ties between governmental space endeavours and national economy in the United States).

<sup>23</sup> See William Fisher, *Theories of Intellectual Property*, in NEW ESSAYS IN THE LEGAL AND POLITICAL THEORY OF PROPERTY 168, 168-169 (2001).

<sup>24</sup> See William M. Landes & Richard A. Posner, *An Economic Analysis of Copyright Law*, 18 J. LEGAL STUD. 325, 326 (1989).

<sup>25</sup> Star Wars: Protecting and Exploiting IP in Space, WORLD INTELL. PROP. REV. (Apr. 12, 2019), <https://www.worldipreview.com/contributed-article/star-wars-protecting-and-exploiting-ip-in-space>.

<sup>26</sup> *Id.*

<sup>27</sup> See Landes & Posner, *supra* note 24, at 348 (exploring social costs of unreliable intellectual property regimes).

<sup>28</sup> International Bureau of World Intellectual Property Organization, *supra* note 6, at 4–5.

non-appropriation are in fact outdated constructs.<sup>29</sup> As such, not only might these concepts be incapable of efficiently regulating the new wave of space commercialization, they may in fact slow it down.<sup>30</sup> Issues relating to the viability of a territorial IP in a space that lacks an uncontroverted authority have already been identified by scholars and practitioners. Examples of these issues are the circumvention of patents in space<sup>31</sup> and the appropriation of physical portions of outer space by way of patenting orbits.<sup>32</sup> Assertion and enforcement of IP rights through a legal framework whose structure appears impervious to change can be difficult and inefficient for the proper development of a business dimension in space.<sup>33</sup> Challenges arise out of the inherently conflicting nature of space law and intellectual property. Indeed, where international space law is non-territorial, uniform, and based on shared knowledge, intellectual property law is strictly territorial, not entirely uniform, and based on exclusive rights.<sup>34</sup>

A functioning extra-terrestrial legal infrastructure for the development and enforcement of IP is fundamental for a healthy and productive scientific environment in space.<sup>35</sup> This premise requires a critical assessment of the challenges faced by the legal system resulting from the juxtaposition of intellectual property rights to the U.N. treaties on space. The necessity of this effort is as current as ever.<sup>36</sup> Since Arianespace became the world's first commercial space transportation company in 1980, the world has witnessed the rise of commercial space actors and the gradual decline of the original,

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<sup>29</sup> Blake & Freeland, *supra* note 1111. See also Malcom Davis, *Avoiding a Free-For-All: The Outer Space Treaty Revisited*, THE STRATEGIST (Jul. 16, 2018), <https://www.aspistrategist.org.au/avoiding-a-free-for-all-the-outer-space-treaty-revisited/>.

<sup>30</sup> See Barbara Luxenberg, *Protecting Intellectual Property in Space*, PROC. OF THE TWENTY-SEVENTH COLLOQUIUM ON THE L. OF OUTER SPACE, 172, 172 (1984).

<sup>31</sup> See Adrian Taghdiri, *Flags of Convenience and the Commercial Space Flight Industry: The Inadequacy of Current International Law to Address the Opportune Registration of Space Vehicles in Flag States*, 19 B.U. J. SCI. & TECH. L. 405, 407 (2013); see also Theodore U. Ro, et al., *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. 202, 212–13 (2011).

<sup>32</sup> See Thornburg, *supra* note 9.

<sup>33</sup> See Luxenberg, *supra* note 30, at 175.

<sup>34</sup> See Joanne Irene Gabrynowicz, *Opening and Closing Statements; Practitioner's Panel, Intellectual Property Resources in and for Space: The Practitioner's Experience*, in 32 J. SPACE L. 385, 406 (2006) [hereinafter *IP Resources*].

<sup>35</sup> See Marie Weisfeiler, *Patent Law in Space*, B.C. INTELL. PROP. & TECH. F. 1, 1 (2019) <http://bciptf.org/2019/03/patent-law-in-space>.

<sup>36</sup> International Bureau of World Intellectual Property Organization, *supra* at note 6, at 4–5.

all-public paradigm.<sup>37</sup> This fundamental change has reshaped the relations, the funding sources, and the prospects of technology in space.<sup>38</sup> The world has abandoned the armaments' race model developed during the Cold War; the driver of human expansion into outer space is no longer national pride or military supremacy.<sup>39</sup> Rather, it is the driving force behind the vast majority of human activities: business.<sup>40</sup>

From Virgin's space tourism projects<sup>41</sup> to SpaceX's deployment of the Starlink satellite constellation to Blue Origin's lunar landing ambitions,<sup>42</sup> private companies all over the globe are approaching new, mesmerizing opportunities. These enterprises require a significant amount of funding.<sup>43</sup> Investment, in turn, requires an assumption of risk offset by reasonable prospects of return:<sup>44</sup> with respect to technology and innovation, IP rewards meritorious intellectual creations by providing potential revenue in the form of monopoly rights.<sup>45</sup> Nevertheless, IP rights—as much as any other—only serve their purpose when enforceable. In a space where no sovereign exists, enforcement of IP rights is tied to extra-territorial extensions of jurisdiction or to old fashioned diplomacy. This creates the risk of loopholes and abuses threatening the protection of intellectual property.<sup>46</sup> The ultimate purpose of

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<sup>37</sup> Isabelle Bouvet, *Certain Aspects of Intellectual Property Rights in Outer Space*, at 3 (Nov. 1999) (unpublished LL.M. thesis, Air and Space Law Institute, McGill University) (on file with National Library of Canada) (explaining how the shift towards a private commercial space will happen gradually and that governmental entities still hold power in the form of preliminary approval).

<sup>38</sup> *Id.* at 4.

<sup>39</sup> *Id.*

<sup>40</sup> Loren Grush, *NASA is Opening the Space Station to Commercial Business and More Private Astronauts*, THE VERGE (June 7, 2019, 10:13 AM), <https://www.theverge.com/2019/6/7/18656280/nasa-space-station-private-astronauts-commercial-business>.

<sup>41</sup> See Jon Porter, *Virgin Galactic to Become the First Space Tourism Company to Go Public*, THE VERGE (July 9, 2019, 6:47 AM), <https://www.theverge.com/2019/7/9/20687323/virgin-galactic-publicly-traded-richard-branson-space-tourism-profitability>.

<sup>42</sup> Jeff Foust, *Blue Origin Unveils Lunar Lander*, SPACENEWS (May 9, 2019), <https://spacenews.com/blue-origin-unveils-lunar-lander/>; Caleb Henry, *SpaceX Launches 60 Starlink Satellites, Begins Constellation Buildout*, SPACENEWS (May 23, 2019), <https://spacenews.com/spacex-launches-60-starlink-satellites-begins-constellation-buildout/>.

<sup>43</sup> See *IP Resources*, *supra* note 34, at 404; see also Porter, *supra* note 41 (referring to investments for \$800 million).

<sup>44</sup> See *Risk*, INVESTOPEDIA, (July 24, 2019), <https://www.investopedia.com/terms/r/risk.asp>.

<sup>45</sup> See Landes & Posner, *supra* note 24, at 326.

<sup>46</sup> International Bureau of World Intellectual Property Organization, *supra* note 6. See also Luxenberg, *supra* note 30, at 176.

this comment is to indicate that, as humanity's approach to space evolves, intellectual property and international laws must be ready to adapt.<sup>47</sup>

Now that this introductory section has outlined the issues and questions that guide the analysis, the comment moves on to identify the applicable laws with respect to both space and intellectual property, providing an overview of the major U.N. Treaties, the ISS Intergovernmental Agreement, and then touching upon U.S. domestic legislation and legal principles. Following the survey of the primary sources of law, the comment addresses two particularized issues relating to IP as it interfaces with space. Finally, the comment presents the conclusions arising out of the analysis and argues that a new approach to space law is required to properly address ambiguities and interpretive conflicts.

## II. PAST AND PRESENT: OLD ANSWERS

A thorough examination of space law hinges upon the understanding of its history and a survey of its most relevant bodies of law, chief among them the U.N. Treaties as and the ISS Intergovernmental Agreement. A brief mention to similar treaties, namely the Antarctica Treaties and the U.N. Convention on the Law of the Sea, will assist in better understanding the policy underpinnings of these legal instruments. The consideration of domestic legislations will focus exclusively on U.S. law, due to its paradigmatic approach in the comprehensive regulation of intellectual property and space activities.<sup>48</sup>

### A. *A Brief History of Space Law*

The dawn of legislation on space matters bears the mark of the United Nations. In 1957, the Soviet Union launched Sputnik, the first man-made object orbiting the Earth, thereby inaugurating the space race.<sup>49</sup> The United Nations did not sit idle as space technologies sparked interest and wonder, and endeavored to assure that the new frontier would not be exploited for military purposes but rather for the sake of humanity's advancement.<sup>50</sup> In

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<sup>47</sup> See Weisfeiler, *supra* note 35.

<sup>48</sup> See Jocelyn H. Shoemaker, *The Patents in Space Act: Jedi Mind Trick or Real Protection for American Inventors on the International Space Station?*, 6 J. INTELL. PROP. L. 395, 398 (1999).

<sup>49</sup> Elizabeth Howell, *Sputnik: The Space Race's Opening Shot*, SPACE.COM (Aug. 22, 2018), <https://www.space.com/17563-sputnik.html>.

<sup>50</sup> See generally *Outer Space Treaty*, *supra* note 3.

1958, the U.N. instituted the Office for Outer Space Affairs (“UNOOSA”) to serve as the space expert unit of the U.N. Secretariat, the executive arm of the United Nations. The UNOOSA serves the General Assembly by implementing its decisions and by fostering intergovernmental cooperation and awareness.<sup>51</sup> In 1959, the General Assembly established another U.N. specialized body, the Committee on the Peaceful Uses of Outer Space (“COPUOS”). The COPUOS consists of a Scientific and Technical Subcommittee and a Legal Subcommittee, and is tasked with identifying legal problems related to space and devising the programs to be undertaken by the U.N.<sup>52</sup>

In this capacity, COPUOS negotiated and concluded five treaties addressing the majority of space law matters of international relevance. These treaties are widely recognized as the pillars of space law.<sup>53</sup> The first full-fledged international treaty on space is the 1967 Outer Space Treaty,<sup>54</sup> followed by the 1968 Rescue Agreement,<sup>55</sup> the 1972 Liability Convention,<sup>56</sup> and the 1975 Registration Convention,<sup>57</sup> all of which further elaborate on provisions contained in the Outer Space Treaty. Finally, the 1979 Moon Treaty,<sup>58</sup> with only 18 parties, is considered a failed treaty because, due to its stringent obligations and vague wording, not a single country engaged in manned space missions has ratified it.<sup>59</sup> It is noteworthy that the Treaties do not speak to private entities nor directly regulate their activities; instead,

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<sup>51</sup> Roles and Responsibilities, U.N. OFF. FOR OUTER SPACE AFF., <http://www.unoosa.org/oosa/en/aboutus/roles-responsibilities.html>.

<sup>52</sup> Committee on the Peaceful Uses of Outer Space (2019), U.N. OFF. FOR OUTER SPACE AFF. (2019), <http://www.unoosa.org/oosa/en/ourwork/copuos/index.htm>.

<sup>53</sup> Space Law Treaties and Principles, U.N. OFF. FOR OUTER SPACE AFF. <http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties.html>.

<sup>54</sup> See generally *Outer Space Treaty*, *supra* note 3.

<sup>55</sup> G.A. Res. 2345 (XXII), annex, Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space (Dec. 17, 1967).

<sup>56</sup> G.A. Res. 2777 (XXVI), annex, Convention on International Liability for Damage Caused by Space Objects (Nov. 29, 1971).

<sup>57</sup> G.A. Res. 3235 (XXIX), annex, Convention on Registration of Objects Launched into Outer Space (Nov. 12, 1974).

<sup>58</sup> G.A. Res. 34/68, annex, Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (Dec. 5, 1979).

<sup>59</sup> See Timothy G. Nelson, *The Moon Agreement and Private Enterprise: Lessons from Investment Law*, 17 *ILSA J. INT’L & COMP. L.* 393, 402 (2011). See also Michael Listner, *The Moon Treaty: Failed International Law or Waiting in the Shadows?*, *THE SPACE REVIEW* (Oct. 24, 2011), <http://www.thespacereview.com/article/1954/1>.

they impose obligations on states governments or their agencies, officializing their dual role of space actors and supervisory authorities.<sup>60</sup>

*B. The U.N. Treaties*

*1. The Outer Space Treaty:*

The Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space including the Moon and Other Celestial Bodies is the master document of space law, also referred to as the Space Constitution.<sup>61</sup> This is due to both the essential value of its legal tenets and its ratification by 109 countries as of July 2019,<sup>62</sup> the latter making it the most widely accepted legal instrument in space law. The Treaty revolves around a number of main principles: freedom of exploration and exploitation of outer space, non-appropriation, peaceful use, and national jurisdiction and responsibility over space objects.

Among these principles, chief is non-appropriation. Accordingly, outer space is not subject to national claim by virtue of sovereignty or other means.<sup>63</sup> The principle follows the general premise laid out in Article I, stating that the exploration and use of outer space is free for all states and all countries should benefit from it.<sup>64</sup> Outer space is solemnly defined as the province of all mankind.<sup>65</sup> However, it has been pointed out that freedom of

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<sup>60</sup> Comm. on the Peaceful Uses of Outer Space, Rep. of the Legal Subcomm. on Its Forty-Eighth Session, Annex 3, U.N. Doc. A/AC.105/C.2/L.2, A/5181 (2012) (reporting the discussion between the Soviet Union and the United States with respect to the scope of the U.N. Treaties namely, whether the Treaties would allow private actors free access to space or whether it should be limited to states). *See also* Berin Szoka & James Dunstan, *How the U.S. Can Lead the Way to Extraterrestrial Land Deals*, WIRED (Apr. 9, 2012, 1:58 PM), <https://www.wired.com/2012/04/opinion-space-property-rights/> (debating the inexistence of a loophole in favor of private actors based on the obligation of member states to the treaties to have their citizens conform to the treaties' provisions) (last visited Aug. 31, 2019).

<sup>61</sup> *See* Jill Stuart, *The Outer Space Treaty has Been Remarkably Successful – But Is It Fit for the Modern Age?*, THE CONVERSATION (Jan. 27, 2017, 11:59 AM), <https://theconversation.com/the-outer-space-treaty-has-been-remarkably-successful-but-is-it-fit-for-the-modern-age-71381>. *See also* Loren Grush, *How an International Treaty Signed 50 Years Ago Became the Backbone for Space Law*, THE VERGE (Jan. 27, 2017, 11:14 AM), <https://www.theverge.com/2017/1/27/14398492/outer-space-treaty-50-anniversary-exploration-guidelines> (last visited Sept. 1, 2019).

<sup>62</sup> *See Status of International Agreements Relating to Activities in Outer Space*, UNOOSA, <http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/status/index.html>.

<sup>63</sup> *Outer Space Treaty*, *supra* note 3, at 9–10 (art. II).

<sup>64</sup> *Outer Space Treaty*, *supra* note 3, at 9 (art. I).

<sup>65</sup> *Id.*

use and non-appropriation might, in fact, be conflicting concepts.<sup>66</sup> Indeed, the argument goes that states or private actors cannot carry out “use” of space without laying a claim to that particular portion of space, which represents a central issue in the context of asteroid mining.<sup>67</sup> The resulting uncertainty has several ramifications, the most comedic of which has been the sale of lunar and planetary acres by the company Lunar Embassy, following a self-proclaimed appropriation made in 1980 by its owner.<sup>68</sup> This is clearly an extreme case study, mostly irrelevant from a practical perspective; however, it exemplifies the great potential for misunderstandings and gray areas that this sector of the law harbors, other than highlighting states’ reluctance or inability to form a united front in addressing the matter.<sup>69</sup>

Another cardinal rule within the Treaty is the categorical prohibition of military applications in outer space, including orbiting weapons of mass destruction, military installations and facilities, weapon tests, and military maneuvers on or around celestial bodies.<sup>70</sup> The Treaty allows the use of military personnel, equipment, or facilities only for scientific purposes.<sup>71</sup> It is interesting to note the interplay between this comprehensive ban and two recent instances of professed military applications. First is the implementation of one of the United States Trump Administration’s directives involving space, announced in March 2018, which calls for the establishment of a space force for the purpose of assuring the peaceful use of space and the defense of the United States and its allies.<sup>72</sup> The force rises from the ashes of the U.S. Space Command and has earned the spotlight once again in August 2019, when the Administration announced its official

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<sup>66</sup> See Thornburg, *supra* note 9.

<sup>67</sup> See Jesse Dunietz, *Floating Treasure: Space Law Needs to Catch Up with Asteroid Mining*, SCIENTIFIC AMERICAN (Aug. 28, 2017), <https://www.scientificamerican.com/article/floating-treasure-space-law-needs-to-catch-up-with-asteroid-mining/>; see also Berin Szoka & James Dunstan, *Space Law: Is Asteroid Mining Legal?*, WIRED (May 1, 2012, 11:00 AM), <https://www.wired.com/2012/05/opinion-asteroid-mining/>.

<sup>68</sup> Adam Mann, *Space Cases: The Weirdest Legal Claims in Outer Space*, WIRED (June 1, 2012, 6:30 AM), <https://www.wired.com/2012/06/space-cases/>.

<sup>69</sup> See Dunietz, *supra* note 67 (debating the different interpretations given to the Outer Space Treaty non-appropriation clause).

<sup>70</sup> *Outer Space Treaty*, *supra* note 3, at 4 (art. IV).

<sup>71</sup> *Id.*

<sup>72</sup> Marin Koren, *What Does Trump Mean by ‘Space Force?’*, THE ATLANTIC (Mar. 13, 2018), <https://www.theatlantic.com/science/archive/2018/03/trump-space-force-nasa/555560/>.

establishment.<sup>73</sup> The same issue also emerged in Europe. On July 13, 2019, France announced the institution of a new branch of the French Airforce, scheduled for official establishment in September 2019.<sup>74</sup> As noted, the announcement set forth an undisguised intention to implement defensive systems, *i.e.*, weapons, to protect satellites or ground installations, and it contemplates the incorporation of said space force into the traditional air force.<sup>75</sup> Given that such armed forces would operate in space in a military capacity, it is reasonable to interpret their presence and future activities as a violation of Article IV.<sup>76</sup>

Another foundational principle of the international law of space, as embodied in the Outer Space Treaty, is responsibility. Under Article VI, parties to the Treaty are responsible for national activities conducted in outer space.<sup>77</sup> Notably, the provision contemplates governmental actors as well as non-governmental ones, hinting at the supervisory and regulatory profile that states will maintain in the wake of space commercial actors.<sup>78</sup> This regulatory profile is envisioned in two main forms: authorization and supervision. The concept of responsibility is also reflected in Article VII, which provides that state parties are liable for damages caused by their space objects or their components, both in space and on Earth.<sup>79</sup> However, the provision points out that state liability defined as such will be pursued through diplomatic means.<sup>80</sup> This poses challenges to the overall workability and precedent-setting of these provisions, especially in the context of intellectual property, where enforcement is key.<sup>81</sup>

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<sup>73</sup> See Lara Seligman, *One Small Step for Trump's Space Force*, FOREIGN POLICY (Aug. 29, 2019, 4:36 PM), <https://foreignpolicy.com/2019/08/29/one-small-step-for-trump-space-force-space-command/>.

<sup>74</sup> See Andrew Liptak, *France's Air Force is Getting a Space Command*, THE VERGE (Jul. 13, 2019), <https://www.theverge.com/2019/7/13/20693087/france-military-air-force-space-command-president-emmanuel-macron>.

<sup>75</sup> *Id.*

<sup>76</sup> See Babak Shakouri Hassanabadi, *Space Force and International Space Law*, THE SPACE REVIEW (Jul. 30, 2018), <http://www.thespacereview.com/article/3543/1>.

<sup>77</sup> *Outer Space Treaty*, *supra* note 3, at 5 (art. VI).

<sup>78</sup> See Szoka, *supra* note 60 (asserting the obligation of state parties to have their citizens conform to international law, including the Outer Space Treaty).

<sup>79</sup> *Outer Space Treaty*, *supra* note 3, at 5 (art. VII).

<sup>80</sup> See Ann Deslandes, *The Bold Future of the Outer Space Treaty*, JSTOR DAILY (Aug. 1, 2018), <https://daily.jstor.org/the-bold-future-of-the-outer-space-treaty/>.

<sup>81</sup> Stefan Paterson & Robert Wulff, *The Role of Intellectual Property in Space*, SPACE TECH ASIA (Jul. 31, 2018), <http://www.spacetechnasia.com/the-role-of-intellectual-property-in-space/>.

National Jurisdiction is a concept that echoes throughout this comment and is indeed a main point of convergence between intellectual property and space law. Under the Outer Space Treaty, state parties retain jurisdiction and control over objects launched to space that appear on their registry, a special index kept by state authorities for purposes of keeping track of space objects.<sup>82</sup> Ownership of objects launched to outer space is not affected by their presence in space or their return to Earth, meaning that distance from Earth or location in outer space have no bearing on the legal status of an object launched to space.<sup>83</sup> This provision set the stage for the development of the Registration Convention and offered the first glimpse of a stable legal framework for space activities. However, the provision necessarily rests on the absence of independently launched space objects, i.e., objects launched outside of the jurisdiction and supervision of sovereign states. Notably, it is unclear whether this absence is predicated on the states' supposedly inescapable supervision powers or on the non-currency of the issue. It is reasonable to presume that the situation will change dramatically with the advancements of private commercial space capabilities such as micro-satellites, which would allow space actors with relatively limited resources to operate in space for purposes of space law.<sup>84</sup>

## 2. *The Rescue Agreements*

The so-called Rescue Agreements comprise the Agreement on the Rescue of Astronauts, the Return of Astronauts, and the Return of Objects Launched in Outer Space. The Agreements came into force in 1968 and elaborated on Articles V and VIII of the Outer Space Treaty, mandating the formation of a cooperative regime for the rescue and return of astronauts and objects to their home states.<sup>85</sup> The founding principle of the Agreements is simple: state parties must cooperate for the purpose of rescuing and recovering personnel or launched objects that incurred in an accident, emergency, or distress, resulting in the object unintentionally landing in

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<sup>82</sup> *Outer Space Treaty*, *supra* note 3, at 5 (art. VIII).

<sup>83</sup> *Id.*

<sup>84</sup> Debra Werner, *Small Satellites Are At the Center of a Space Industry Transformation*, SPACE NEWS (Aug. 22, 2018), <https://spacenews.com/small-satellites-are-at-the-center-of-a-space-industry-transformation/> (discussing Aerospace Corp.'s transmission of data from a 2.5 kilogram satellite).

<sup>85</sup> *Outer Space Treaty*, *supra* note 3, at 4–5 (art. V, art. VIII); *see also* Frans G. von der Dunk, *A Sleeping Beauty Awakens: The 1968 Rescue Agreement After Forty Years*, 34 J. OF SPACE L. 411, 415–16 (2008).

another state's territory.<sup>86</sup> The statement focuses on the rescue and assistance to personnel. Whereas astronauts in the Outer Space Treaty are loosely defined with no express indications as to whether the designation includes civilians (e.g., space tourists), the Agreements provide more clarity by using the more comprehensive term "personnel."<sup>87</sup>

### 3. *Liability Convention*

The Convention on International Liability for Damage Caused by Space Objects came into force in 1972, after nine years of negotiations led by the Legal Subcommittee of COPUOS.<sup>88</sup> The Liability Convention stems from the exigency to elaborate rules of states' liability for damage caused by space objects and establish dispute resolution procedures.<sup>89</sup> It is instructive to look at the definition of damage provided in the first provision of the Convention: damage is the "loss of or damage to property of States or of persons, natural and juridical."<sup>90</sup> The Convention provides another notable principle: damage caused elsewhere than on the surface of Earth by a state's object triggers liability only where the state is at fault.<sup>91</sup> Under this definition, states' liability can be indirect when arising out of the actions of personnel for which the state is responsible.<sup>92</sup> There are at least two features of interest: first, the definition of fault, and second, the extent of the responsibility for purposes of states' liability. The previously defined "absolute" liability of state parties is in fact mitigated by Article VI in cases where the damaging conduct consists of grossly negligent or intentional acts or omissions committed by the claimant state or the natural or juridical persons it represents.<sup>93</sup> The Liability Convention also specifies that a state is not liable for damage caused to its own nationals as well as foreign nationals participating in its operations.<sup>94</sup>

The Liability Convention's relevance within the two-headed framework of IP and space law rises and falls with the incorporation of IP

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<sup>86</sup> von der Dunk, *supra* note 85, at 415.

<sup>87</sup> G.A. Res. 2345 (XXII), *supra* note 55, at Article 1.

<sup>88</sup> U.N. Off. for Outer Space Aff., Convention on International Liability for Damage Caused by Space Objects, <http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introliability-convention.html>.

<sup>89</sup> G.A. Res. 2777 (XXVI), *supra* note 56.

<sup>90</sup> *Id.* art. I.

<sup>91</sup> *Id.* art. III.

<sup>92</sup> *Id.*

<sup>93</sup> *Id.* art. VI.

<sup>94</sup> *Id.* art. VII.

rights within the definition of property. The sweeping definition of property adopted by the Convention does not seem to obviate this ambiguity. Moreover, further reference to other U.N. documents indicates that intellectual property rights are generally deemed to be a subset of property rights.<sup>95</sup> The question is, therefore, whether inclusion of intellectual property can be inferred through a systematic interpretation of these two general principles. The scope of rights within the definition of property is relevant because the definition of damage within the Convention contemplates rendering the property unfit for its intended use.<sup>96</sup> A stretched argument could be made in favor of intellectual property within the scope of the Liability Convention and, subsequently, infringement of those rights as an instance of liability. Following this line of thought, a space object developing or reproducing infringing technology in space could in principle deprive the originally patented technology of its intended use, thereby causing damage under the Convention. Regardless of the merits of the argument, the consensus within the legal community generally refutes the extension of the U.N. Treaties to IP rights and, consequently, to patent infringement.<sup>97</sup>

Article IX represents an important provision for the purpose of this comment. The wording provides that a claim for compensation can only be presented through diplomatic channels.<sup>98</sup> To complicate matters, the provision adds that nothing in the Liability Convention bars the pursuit of claims in local courts by a state or its natural or juridical persons, and that state claims cannot address the same damages acted upon through diplomatic means.<sup>99</sup> The ramifications of this legislative choice are manifold. First and foremost, diplomatic intercourse is presented as the preferred venue for space-related disputes, possibly because of its non-

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<sup>95</sup> World Intellectual Property Organization, *What is Intellectual Property?*, *supra* note 21.

<sup>96</sup> See Joseph A. Burke, Convention on International Liability for Damage Caused by Space Objects: Definition and Determination of Damages After the Cosmos 954 Incident, 8 *FORDHAM INT'L L.J.* 255, 276 (1984) (citing W. F. Foster, The Convention on International Liability for Damage Caused by Space Objects, 10 *CAN. Y.B. INT'L L.* 137, 137 (1972)).

<sup>97</sup> See Weisfeiler, *supra* note 35, at 2 (citing to Juan Felipe Jimenez, *Patents in Outer Space: an Approach to the Legal Framework of Future Inventions*, 98 *J. PAT. & TRADEMARK OFF. SOC'Y* 447, 456 (2016)).

<sup>98</sup> G.A. Res. 2777 (XXVI), *supra* note 56, at art. IX.

<sup>99</sup> *Id.*

binding nature.<sup>100</sup> Secondly, the adjudication of space-related claims would conform to concepts of international influence and comity and, therefore, be unfit to supplant judicial determinations.<sup>101</sup> Finally, parallel litigation and behind-closed-doors settlements would hinder the development of a uniform “common law of space,” considering the historical and structural dissimilarities between the two resolution methods and their different precedential power.<sup>102</sup>

The failure of diplomatic discourse does not, however, exhaust the procedure.<sup>103</sup> The Liability Convention calls for the establishment of a three-member Claims Commission, which strongly resembles an arbitral tribunal. Indeed, on the sides, there are two appointees to serve the respective state parties, and in the middle, a joint appointee to serve as chairman. The Commission decides the merits of the dispute and determines the compensation.<sup>104</sup> At this point, however, the Convention takes a step back by providing that the decisions of the Commission are only final and binding when accepted by the parties, being otherwise merely recommendatory.<sup>105</sup>

#### 4. *The Registration Convention*

The Convention on Registration of Objects Launched into Outer Space entered into force in 1976. Its primary purpose was to create a system for the record-keeping and identification of space objects.<sup>106</sup> This Convention also intended to expand the scope of the U.N. Register of Objects Launched into Outer Space, established in 1961, and further regulate states’ responsibilities related to space objects.<sup>107</sup>

The Registration Convention holds particular value. The registration of a space object is, as explained *infra*, the necessary predecessor of the application of a nation’s domestic laws, including intellectual property

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<sup>100</sup> See GERARDINE MEISHAN GOH, DISPUTE SETTLEMENT IN INTERNATIONAL SPACE LAW 24 (2007) (noting that the closest approximation to a mention of a dispute settlement mechanism in the Liability Convention is the word “consultation”).

<sup>101</sup> Deslandes, *supra* note 80.

<sup>102</sup> See von der Dunk, *supra* note 85, at 412 (discussing the settlement of the Cosmos 954 dispute in what appeared to be an extra-treaty agreement).

<sup>103</sup> G.A. Res. 2777 (XXVI), *supra* note 56, at art. XV.

<sup>104</sup> *Id.*

<sup>105</sup> *Id.* art. XVI.

<sup>106</sup> G.A. Res. 3235 (XXVI), *supra* note 57.

<sup>107</sup> *Id.*

laws.<sup>108</sup> The Registration Convention provides a definition of launching state that is fundamental in the application of legal concepts, such as jurisdiction and territoriality.<sup>109</sup> A launching state is either (1) a state launching or procuring the launch of a space objects, or (2) a state from whose territory or facilities a space object is launched.<sup>110</sup> Critics have highlighted that this dual identification may in fact not coincide, thereby creating confusion.<sup>111</sup> Indeed, these definitions might create situations in which a space objects has two or more launching states<sup>112</sup> or none at all. The Registration Convention addresses the concern by providing that each state that qualifies under either of the two prongs can maintain the space object on its own registries.<sup>113</sup> However, the provision further recites that there can only be one “launching state” for the purpose of Article I; multiple launching states must jointly decide which one will serve that role.<sup>114</sup>

### 5. *The Moon Treaty*

From an international law viewpoint, the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies is the second most impactful of the U.N. treaties.<sup>115</sup> Conversely from the Outer Space Treaty, the relevance of the Moon Treaty derives from its unsuccessful adoption, which sheds light on the policy and legislative challenges that arise in connection with the development of uniform space governance. Indeed, one of the pivotal points of the Treaty is the cession of jurisdiction over all celestial bodies in the solar system to the authority of an international governing body.<sup>116</sup> The scope of application of the Treaty equates the moon to other celestial bodies within the solar system—except Earth—as well as orbits and trajectories around the moon itself.<sup>117</sup> It is unclear whether the Treaty also governs orbits and trajectories around

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<sup>108</sup> See Ro et al., *supra* note 31, at 208.

<sup>109</sup> *Id.* (describing how the current territorial application of intellectual property in space relies on the definition of “launching state”).

<sup>110</sup> G.A. Res. 3235 (XXVI), *supra* note 57, at art. I.

<sup>111</sup> See Babak Shakouri Hassanabadi, *Complications of the Legal Definition of “Launching State”*, THE SPACE REVIEW (Sep. 2, 2014), <http://www.thespacereview.com/article/2588/1> (exploring the possibility of a spacecraft with three potential launching states).

<sup>112</sup> *Id.*

<sup>113</sup> G.A. Res. 3235, *supra* note 57, at art. I.

<sup>114</sup> *Id.*

<sup>115</sup> G.A. Res. 34/68, *supra* note 58.

<sup>116</sup> *Id.*

<sup>117</sup> *Id.* at art. 1.

celestial bodies other than the moon: the interpretive consensus favors a scope limited to circumlunar space.<sup>118</sup> Notably, there exists an exception for celestial bodies regulated by virtue of specific legal norms; the Treaty only applies in the absence of *sui generis* agreements.<sup>119</sup> This provision likely refers to internationally adopted legal norms. However, there is no express indication as to whether specific legal norms include multi-national agreements concluded outside of the vigilant eye of the United Nations.

The Treaty further elaborates on the well-known principle of non-appropriation by providing that the moon shall not be subject to claims of sovereignty or occupation.<sup>120</sup> Unlike the Outer Space Treaty, the prohibition to establish property rights on the surface or subsurface of the moon extends to non-governmental entities as well as natural persons. Notably, under the Treaty, the installation of facilities or modules does not create any property right whatsoever in the adjacent area.<sup>121</sup> The provision attempts to surpass the Outer Space Treaty in yet another fashion: Article 11 extends non-appropriation to natural resources in place on the satellite.<sup>122</sup> The stringency and apparent unworkability of the provisions, coupled with their ambiguities ultimately caused the Treaty's demise.<sup>123</sup> From this point of view, exemplary is another animating principle of the Treaty, summarized as the creation of an international regime for the governance and supervision of the exploitation, development, and management of the moon's resources.<sup>124</sup> Clearly another source of friction, the Treaty's experiment revealed the reluctance of states and the practical difficulties around the establishment of such an authority.

From an IP perspective, Article 15 tops its predecessors in terms of relevance. The provision calls for compliance with the Treaty by conferring a seemingly unfettered right to inspect on all coexisting states on the relevant areas.<sup>125</sup> Inspections under the norm encompass space vehicles, equipment, facilities, and installations. This measure, mitigated only by the

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<sup>118</sup> Nancy L. Griffin, *Americans and the Moon Treaty*, 46 J. AIR L. & COM. 729, 736 (1981).

<sup>119</sup> G.A. Res. 34/68, *supra* note 58, at art. 1, ¶ 1.

<sup>120</sup> *Id.* at art. 11.

<sup>121</sup> *Id.*

<sup>122</sup> Heidi Keefe, *Making the Final Frontier Feasible: A Critical Look at the Current Body of Outer Space Law*, 11 SANTA CLARA HIGH TECH. L. J. 345, 355–56 (1995).

<sup>123</sup> *Id.*; *see also* Nelson, *supra* note 59, at 401.

<sup>124</sup> G.A. Res. 34/68, *supra* note 58, art. 11, ¶ 5.

<sup>125</sup> *Id.* at art. 15.

requirement of reasonable advance notice, is predicated on the need to guarantee that the activities of other states are Treaty-compliant.<sup>126</sup> To complicate matters, the provision allows every state to act independently, with or without the assistance of other parties, with diplomatic discourse being merely optional.<sup>127</sup> To add to the confusion, the Treaty also contemplates a consultation procedure which, unlike inspection rights, is conditioned upon a reasonable belief that another state's activities are non-compliant.<sup>128</sup> The provision does not address the overlap between the two measures and therefore points to a double standard in the requirements despite their substantially similar purpose. Indeed, it is unclear why an innocuous consultation would have to be based on a reasonable cause, whereas a physical inspection could be carried out deliberately.<sup>129</sup> A non-exhaustive answer might be found in the measures' different purposes: where consultations seemingly aim at resolving disputes, inspections seek to determine the existence of the issue in the first place.<sup>130</sup> The relevance of the provision in the context of IP will emerge in the wake of space commercial expansion. Indeed, it is difficult to imagine private commercial modules and installations on celestial bodies, below their surface, or in orbit being freely accessible for inspection. Considering the increasing volume of interactions between governments and private actors, the subjects of this obligation may as well be private commercial entities, with foreseeable consequences in terms of distrust and reluctance to open the doors to foreign inspectors who might also be competitors.

The most illustrative feature of the Moon Treaty lies in the circumstance that not a single nation engaged in manned space missions has ratified it.<sup>131</sup> The instrument has consequently gained the infamous designation of failed treaty.<sup>132</sup> Concerns over the international regime overseeing the sharing and allotment of the Moon's resources led to the demise of the project, fueled by a general distrust towards its vague

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<sup>126</sup> *Id.*

<sup>127</sup> *Id.*

<sup>128</sup> *Id.* at art. 15, ¶ 2.

<sup>129</sup> See Keefe, *supra* note 122, at 356 (explaining that each state has a right to "check up" on the activities of other states).

<sup>130</sup> *Id.*

<sup>131</sup> See Nelson, *supra* note 59, at 402.

<sup>132</sup> See generally Listner, *supra* note 59.

language, prohibitive obligations, and seemingly socialist underpinnings.<sup>133</sup> Some scholars argue that the Treaty's failure did not involve its scope, but rather its means: its hastily arranged provisions depicted an unreliable legal environment for the development of private space activities and thus discouraged support from spacefaring nations.<sup>134</sup>

## 6. *A Policy Note*

It is not challenging to understand why the United Nations sought to impose stringent terms on the use of space and celestial bodies, and how these principles still echo in the Treaties, as well as in other international instruments. These policies might indeed look outdated and overly programmatic in the eyes of the third-millennium space enthusiast. However, one must remember that the Cold War deeply influenced the adoption of these instruments.<sup>135</sup> At the time of negotiation and adoption of the Treaties, space was deemed to have the potential to become the ultimate frontier for conflicts on the global scale.<sup>136</sup> While businesses carried on by private enterprises were not a comparable concern, many believed that a functioning commercial environment—in the absence of the U.N. treaties—would have required militarization of space, thereby increasing the chances of conflicts.<sup>137</sup> Those concerns have now abated, hence the need to reassess their footprint on the future development of international space law.

## C. *A Framework for International Territoriality: The Antarctic Treaty*

It is interesting to juxtapose the Outer Space Treaty to the Antarctic Treaty, adopted in 1959 and currently featuring 54 state parties.<sup>138</sup> In general

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<sup>133</sup> See Nelson, *supra* note 59, at 400 (citing to Kevin B. Walsh, *Controversial Issues Under Article 9 of the Moon Treaty*, 6 ANNALS AIR & SP. L. 489, 496 (1981)). See also Alan Duane Webber, *Extraterritorial Law on the Final Frontier: A Regime to Govern the Development of Celestial Body Resources*, 71 GEO. L.J. 1427, 1436–37 (1983) (explaining how rational private actors would not want to invest in a such a climate).

<sup>134</sup> See Nelson, *supra* note 59, at 401 (citing to Kevin B. Walsh, *Controversial Issues Under Article 9 of the Moon Treaty*, 6 ANNALS AIR & SP. L. 489, 496 (1981)).

<sup>135</sup> *Id.* at 402 (explaining how the moon treaty was attacked, among others, by free-enterprise enthusiasts who saw the 1970s ideology embodied in the agreement as an attack on free enterprise in space).

<sup>136</sup> See Benjamin D. Hatch, *Dividing the Pie in the Sky: The Need for a New Lunar Resources Regime*, 24 EMORY INT'L L. REV. 229, 246 (2010).

<sup>137</sup> *Id.* at 267.

<sup>138</sup> The Antarctic Treaty, SECRETARIAT OF THE ANTARCTIC TREATY, <https://www.ats.aq/e/antarctictreaty.html>.

lines, both treaties strive to regulate human activity in a hostile environment devoid of native human population and resources to support it. Their similar purpose reflects similar principles, chief among them the peaceful coexistence of different states in these environments. Indeed, U.S. President Dwight D. Eisenhower specifically referred to the Antarctic Treaty in his proposal of Article IV of the Outer Space Treaty to the United Nations.<sup>139</sup> The Antarctic Treaty's key provisions resemble those of the Outer Space Treaty: peaceful use of the environment, prohibition of military bases and activity, prohibition of nuclear weapons testing, freedom of scientific exploration and investigation, and interchange of scientific data and personnel between the parties.<sup>140</sup> Both the Antarctic and the Outer Space treaties apply to geographical areas demarcated by virtue of conventional definitions: where Antarctica is the land and ice shelves south of 60°S latitude<sup>141</sup>, outer space is everything above the so-called Karman Line, situated at 100 kilometers above sea level. Nevertheless, the scope of application of the Outer Space Treaty appears somewhat harder to define. A first reason can be found in the fact the conventional border of outer space, the Karman Line, is not mentioned nor referred to in the treaty.<sup>142</sup> Secondly, different authorities or nations adhere in fact to inconsistent definitions of the starting point of the outer space.<sup>143</sup> Both these circumstances affect the clear demarcation between space and Earth and impinge on the fundamental question of whether space law or national law applies in a determined area of air space.

The Outer Space Treaty and its Antarctic counterpart present another essential element of divergence; the Antarctic Treaty does not abhor sovereignty claims.<sup>144</sup> In fact, the Antarctic treaty recognizes and tolerates appropriation by providing that no obligation under the treaty shall conflict with a state party's claim on a portion of Antarctica.<sup>145</sup> Unsurprisingly, the signatories of the Antarctic Treaty, namely, Argentina, Australia, Chile,

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<sup>139</sup> Bin Cheng, *The Legal Status of Outer Space and Relevant Issues: Delimitation of Outer Space and Definition of Peaceful Use*, 11 J. SPACE L. 89, 102 (1983).

<sup>140</sup> The Antarctic Treaty Preamble, Dec. 1, 1959, 12 U.S.T. 794, 402 U.N.T.S. 71.

<sup>141</sup> *Id.*

<sup>142</sup> See generally *Outer Space Treaty*, *supra* note 3.

<sup>143</sup> See generally Nadia Drake, *Where, Exactly, is The Edge of Space? It Depends on Who You Ask*, NAT'L GEOGRAPHIC (Dec. 20, 2018), <https://www.nationalgeographic.com/science/2018/12/where-is-the-edge-of-space-and-what-is-the-karman-line/>.

<sup>144</sup> See generally *The Antarctic Treaty*, *supra* note 140.

<sup>145</sup> *Id.*

France, New Zealand, Norway, and the United Kingdom, all had territorial claims on the continent—some of them overlapping—prior to the adoption of the Treaty.<sup>146</sup>

It has been argued that peaceful coexistence of multiple sovereign claims in Antarctica is not the fruit of international treaties nor diplomacy efforts, but rather the absence of a sufficient incentive to engage in more substantial exploitation of the territory.<sup>147</sup> Drawing from notions of law and economics, the hypothesis is that compliance in this case is the outcome of a cost-benefit analysis, which is the value of resources under the surface of the continent against the investment necessary to extract and exploit them.<sup>148</sup> From this standpoint, we can anticipate difficult days for the principle of non-appropriation in outer space. The faster we advance towards space colonization or asteroid mining, the faster we approach a cost-benefit analysis with respect to its resources and the ability to extract them. Where one side of the ledger is represented by the chance to exploit virtually endless resources, it is not difficult to understand the value of these opportunities and their potential to tip the scales in favor of disregard of international space law.

#### D. *The ISS Intergovernmental Agreement*

Another international agreement sheds light and provides possible suggestions on how to structure a proper space legal infrastructure. It is the International Space Station Intergovernmental Agreement, comprising a general agreement between the governments of the United States, Canada, the European Union, Russia, and Japan; four Memoranda of Understanding between their space agencies; and various bilateral agreements.<sup>149</sup>

For the purpose of this comment, the analysis will focus solely on the Intergovernmental Agreement. The Agreement presents several features of interest, first among them a contractual rather than programmatic identity.

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<sup>146</sup> The Antarctic Treaty, *supra* note 138.

<sup>147</sup> Matthew Teller, *Why Do So Many Nations Want a Piece of Antarctica?*, BBC (Jun. 20, 2014), <https://www.bbc.com/news/magazine-27910375> (explaining how extraction of resources is, as of today, extremely difficult and prohibitively expensive).

<sup>148</sup> *Id.*

<sup>149</sup> *International Space Station Legal Framework*, EUR. SPACE AGENCY, [https://m.esa.int/Our\\_Activities/Human\\_and\\_Robotic\\_Exploration/International\\_Space\\_Station/International\\_Space\\_Station\\_legal\\_framework](https://m.esa.int/Our_Activities/Human_and_Robotic_Exploration/International_Space_Station/International_Space_Station_legal_framework).

Indeed, the Agreement is clearly oriented to the creation and governance of a partnership, and only tangentially enounces general statements of principle.<sup>150</sup> The Agreement is part of a complex framework whose scope is broader than the mere regulation of space activities by governments, encompassing management, contribution or disposition of resources, and future evolution of the International Space Station. Notably, it represents a first comprehensive regulatory instrument with respect to a specific set of space activities, which means it is the first major legal instrument to interface itself with the obligations imposed by the U.N. Treaties.<sup>151</sup> The Agreement represents a remarkable example of cooperative regulation of space that has been in force for more than 20 years.<sup>152</sup>

As Article 1 describes it, the Agreement is a cooperative framework for the design, development, and operation of a civil international space station, to be permanently inhabited.<sup>153</sup> There is a connection between the Intergovernmental Agreement and the U.N. treaties in the statement that the Station shall be used and operated in compliance with international law, including the U.N. treaties on space.<sup>154</sup> The Agreement does not alter the rights and obligations of partner states as imposed by the treaties nor does it affect the partner states with regard to space endeavors unrelated to the Space Station.<sup>155</sup> Notably, the instrument subscribes to the non-appropriation principle by providing that nothing in the agreement constitutes a basis for asserting a claim over outer space. The International Space Station Agreement recognizes the Registration Convention by reproducing its founding principle that each partner state retains jurisdiction and control over the modules it registers and its nationals who are onboard.<sup>156</sup> It is useful to note that partner states maintain the ability to transfer ownership in the modules to a non-partner state or private entity, subject to concurrence by

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<sup>150</sup> See A. Farand, *The Space Station Cooperation Framework*, ESA BULL., (May 1998), <http://www.esa.int/esapub/bulletin/bullet94/FARAND.pdf> (explaining how the drafters did not establish a set of homogeneous rules, but rather chose to deal with more mundane issues such as rules for the assertion of jurisdiction of partners states on their modules).

<sup>151</sup> *Id.*

<sup>152</sup> *Id.*

<sup>153</sup> International Space Station Intergovernmental Agreement, Comm. on the Peaceful Uses of Outer Space, Rep. of the Legal Subcomm. on Its Fifty-Second Session, U.N. Doc. A/AC.105/C.2, at 3 (2013) art. 1, Jan. 29, 1998, TK U.N.T.S. TK [hereinafter International Space Station Agreement].

<sup>154</sup> *Id.* at art. 2.

<sup>155</sup> *Id.*

<sup>156</sup> *Id.* at art. 5.

the partners.<sup>157</sup> Even more interesting is the United States' intent to divest its participation in the Station by 2025, because of the prohibitive maintenance costs.<sup>158</sup> Although a NASA-free Space Station would certainly be a dramatic and undesirable outcome, it certainly ignites one's curiosity to imagine the Station as a dynamic asset available to the highest bidder. For better or worse, the possibility of acquiring a stake in the use and physical modules of the Station supports the vision of the Agreement as a quasi-private legal framework, where divestible interest assumes priority over mere international obligations.<sup>159</sup>

A peculiar system governs utilization of the Station by the partners. Every partner receives so-called utilization rights based on the resources they contribute.<sup>160</sup> Resources, such as laboratories, can be user elements, or infrastructure elements, such as navigational software.<sup>161</sup> This third-millennium barter system contemplates a fixed share of use of certain elements in exchange for a set amount of resources.<sup>162</sup> Partners can further barter or sell their allotted utilization right, freely and among each other,<sup>163</sup> or dispose of said rights in favor of private entities. An opportunity, this one, embraced by NASA for the purpose of offsetting operating expenses and promoting commercial engagement.<sup>164</sup> For each proposed use, the partner state providing the element must determine whether the use is peaceful. This provision is further structured so as to minimize the risk that such assessment be invoked to prevent states from rightfully using the Station's infrastructure.<sup>165</sup>

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<sup>157</sup> *Id.* at art. 6.

<sup>158</sup> Corey S. Powell, *The ISS Was Never Supposed to End Like This*, NBC NEWS (Feb. 22, 2018, 8:09 AM), <https://www.nbcnews.com/mach/science/iss-was-never-supposed-end-ncna848771> (explaining how the projected cost of \$8 billion went up to \$90 billion over 19 years, coupled with annual operating expenses of \$3 to \$4 billion).

<sup>159</sup> *Id.* (describing the potential use of ISS modules as luxury hotel envisioned by Russian space contractor RKK Energia).

<sup>160</sup> *Id.*; International Space Station Agreement, *supra* note 153, at art. 9.

<sup>161</sup> *Id.*

<sup>162</sup> *Id.*

<sup>163</sup> International Space Station User's Guide, SPACEREF 1, 16–17 (April 2000), <http://www.spaceref.com/iss/ops/ISS.User.Guide.R2.pdf>.

<sup>164</sup> See Grush, *supra* note 40 (referring to NASA June 6, 2019 Interim Directive establishing policies, among others, to support manufacturing, production, and marketing of commercial goods intended for commercial sale on Earth, [https://www.nasa.gov/sites/default/files/atoms/files/s1701746119060610280\\_1.pdf](https://www.nasa.gov/sites/default/files/atoms/files/s1701746119060610280_1.pdf)).

<sup>165</sup> International Space Station Agreement, *supra* note 153, at art. 9.

Article 21 is a dense provision that substantiates the pragmatic spirit of the Agreement by specifically addressing intellectual property.<sup>166</sup> In this sense, the Intergovernmental Agreement constitutes the present of intellectual property in space. The Agreement reflects the increased awareness of the importance of intellectual property rights that stimulate and reward the development of technical innovations in space.<sup>167</sup> By reference to the Convention Establishing the World Intellectual Property Organization of 1967, intellectual property within the scope of the Agreement is defined to include inventions, performances, trademarks, unfair competition, scientific discoveries, literary works, industrial designs.<sup>168</sup> For the purpose of intellectual property laws, activities on the Station are deemed to occur in the territory of the partner state having the specific Space Station element on its national registry.<sup>169</sup> For instance, if a Canadian inventor develops an invention in a module registered with Canada, then Canadian law will apply because the invention is considered developed within the territory of Canada.<sup>170</sup> As far as European countries are concerned, any member state of the European Space Agency (“ESA”) can claim jurisdiction over the concerned activity in European flight elements as if it had occurred in its territory. In instances where more states participate in research or experiments, the participation of a second state does not by itself exclude the governing state’s exclusive jurisdiction. The wording of this provision does not seem to rule out a stipulation to the contrary.<sup>171</sup>

Paragraphs 4 and 5 of Article 21 consider the peculiar position of partner states that are also members of the ESA. With respect to ESA member states that operate on the International Space Station, the possibility exists that their national intellectual property laws may overlap.<sup>172</sup> The first provision contemplates instances in which a person or entity holds

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<sup>166</sup> *Id.* at art. 21.

<sup>167</sup> See Rochus Moenter, *The International Space Station: Legal Framework and Current Status*, 64 J.AIR L. & COM. 1033, 1052 (1999) (outlining the nexus between an increasing international industrial cooperation in space, the future commercialization of prospective technical inventions, and the protection of said inventions in the context of space activities).

<sup>168</sup> Convention Establishing the World Intellectual Property Organization art. 2, ¶ 8, July 14, 1967, 21 U.S.T. 1749, 828 U.N.T.S. 3.

<sup>169</sup> International Space Station Agreement, *supra* note 153, at art. 21, ¶ 2; see also von der Dunk, *supra* note 85, at 415 (referring to the system as quasi-territorial).

<sup>170</sup> Alexandra M. Davidson, Note, To Explore Outer Space: The Intellectual Property Frontier for Patents, 47 HOFSTRA L. REV. 889, 891 (2019).

<sup>171</sup> International Space Station Agreement, *supra* note 153, at art. 21, ¶ 2.

<sup>172</sup> See Moenter, *supra* note 167, at 1054.

intellectual property rights in more than one European state. It substantially bars multiple bites at the apple in the event of IP infringement on ESA-registered modules: consequently, an act of infringement on the same IP rights held in different ESA countries can only lead to one recovery.<sup>173</sup> This offsets the extreme applications of the principle giving ESA member states shared jurisdiction over conducts occurring on ESA-registered modules.<sup>174</sup> Notably, Article 21 Paragraph 4 also applies to acts of infringement generating different plaintiffs in different ESA states. In these cases, only the first-filed action can obtain redress. However, the provision does not impose the staying of subsequent proceedings, providing instead that a court may stay the proceeding pending the concurrent action.<sup>175</sup> This adds to the complexity of multi-state litigations and causes the first-to-file rule to battle with courts' efficiency and overall quality of the litigation process in the states involved.<sup>176</sup> One final nuance in the provision's terminology regards the difference between multiple damages awards and multiple court proceedings.<sup>177</sup> Since a bar on recovery presumes a winning plaintiff, the owner of IP rights in different states might force the adversary to fight multiple instances of litigation until either (1) the venues are exhausted, or (2) a court awards recovery. Fortunately, these concerns are marginal in relevance because several instruments, although imperfect, avoid abusive practices in European courts.<sup>178</sup> Moreover, Paragraph 5 provides a built-in, practical solution rooted in IP licensing principles: a European partner state cannot deny the validity of a license for purposes of defeating infringement claims, so long as that license is enforceable in at least one of the member states.<sup>179</sup> Compliance with the terms of such a license in one state bars recovery in every other ESA partner state.<sup>180</sup> Therefore, multi-state enforcement of the same IP rights against the same acts is limited where the acts are in compliance with a license that is valid in a European state.

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<sup>173</sup> International Space Station Agreement, *supra* note 153, at art. 21, ¶ 4.

<sup>174</sup> *Id.*

<sup>175</sup> *Id.*

<sup>176</sup> See Paulius Jurčys, International Jurisdiction in Intellectual Property Disputes: CLIP, ALI Principles and Other Legislative Proposals in a Comparative Perspective, 3 J. INTELL. PROP., INFO. TECH. & ELECTRONIC COM. L. 174, 214–15 (2012) (discussing the differences between European systems and the consequences on patent litigation, especially in terms of staying orders and protective measures).

<sup>177</sup> International Space Station Agreement, *supra* note 153, at art. 21, ¶ 4 (prohibiting only multiple damage awards stemming from the same conduct).

<sup>178</sup> See Jurčys, *supra* note 176, at 214–15 (highlighting the recognition of foreign judgments or the employment of stay orders in EU patent litigation).

<sup>179</sup> International Space Station Agreement, *supra* note 153, at art. 21, ¶ 5.

<sup>180</sup> *Id.*

The Agreement also provides that the presence of an object in the territory of a partner state for the purpose of transportation to the Station or another partner state cannot be the basis for patent infringement claims in the state where the transition occurs.<sup>181</sup> This is known as the principle of temporary presence, a legal fiction contemplated in several international legal instruments.<sup>182</sup> Accordingly, partner states are generally free to transfer to the Space Station technology that would otherwise infringe the IP laws of other member states by virtue of entering or crossing their territory in order to reach the Station. The point is seemingly to avoid the possibility that states with more developed space capabilities might frustrate the efforts of other partner states by, for instance, conditioning the use of their transit or launch facilities to the licensing of nationally developed technology.<sup>183</sup>

### *E. The U.S. Domestic Approach*

National legislators have heeded the call for a more reliable space law legal framework, for reasons ranging from commercial incentivization to compliance with international space law.<sup>184</sup> The present section's focus is on national space laws and intellectual property rights, with U.S. domestic legislation taking the lead role, for two reasons. First, because U.S. law is generally considered a mature and developed environment for intellectual property, with roots in experience yet great potential for change, due to its court-based system.<sup>185</sup> Second, because the U.S. moved early steps in the regulation of space legal issues, including the joint regulation of intellectual property and space law. The U.S. constitutes the benchmark of national regulations in both intellectual property and space law<sup>186</sup> and therefore, represents an assessable example of the workability and challenges of such

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<sup>181</sup> *Id.* at art. 21, ¶ 6.

<sup>182</sup> See J. Jonas Anderson, *Hiding Behind Nationality: The Temporary Presence Exception and Patent Infringement Avoidance*, 15 MICH. TELECOMM. & TECH. L. REV. 1, 2 (2008).

<sup>183</sup> Anderson, *supra* note 182, at 22 (explaining the origins of the temporary presence exception, focusing on the policy objective of eliminating the need to obtain licenses to avoid infringement).

<sup>184</sup> See *Space Law Is Inadequate for the Boom in Human Activity There*, THE ECONOMIST (July 18, 2019), <https://www.economist.com/international/2019/07/18/space-law-is-inadequate-for-the-boom-in-human-activity-there> (discussing how the presence of a pre-existing, working legal environment is essential to the development of new enterprises).

<sup>185</sup> See Steven Seidenberg, *US Perspectives: US IP Law – Big Developments on the Horizon in 2019*, INTELL. PROP. WATCH (Jan. 23, 2019), <https://www.ip-watch.org/2019/01/23/us-ip-law-big-developments-horizon-2019/> (highlighting several U.S. Supreme Court cases with the potential to drastically change the current law).

<sup>186</sup> See *Space Law*, SPACEPOLICYONLINE.COM, <https://spacepolicyonline.com/topics/space-law/#domestic> (last updated June 23, 2019, 4:28 PM) (compilation of U.S. statutory space laws).

intertwined bodies of laws. The following section introduces the U.S. intellectual property regime with a focus on patent law, focusing in particular on the so-called principle of territoriality. An overview of the Patents in Space Act follows, presenting an example of national legislation addressing issues of IP in the context of space activities.

### 1. *U.S. Patent Law*

As new technologies emerge and old technologies wane, courts struggle with the limits of a strictly territorial regime of intellectual property rights. The Internet challenged the conventional limits of trademarks and copyrights and provided an indication of the judicial discomfort surrounding the determination of the territorial limits of IP rights.<sup>187</sup> Following the diffusion of unbundled software and the extension of patents to software and intangible inventions, courts confronted similar interpretive issues affecting the territorial reach of patent rights.<sup>188</sup> Whether related to the aerospace industry or not, the innovations challenging the courts share one common feature: the ability to exist or operate, entirely or partially, outside national borders.<sup>189</sup> It is therefore instructive to look at how territoriality has developed and its current status.

The principle of territoriality, particularly dear to patent law, is a cardinal rule of the system. Patents are temporary monopoly rights granted by governments which provide an exclusive right to make, use, sell or import the invention they attach to. Patents are in principle granted in the interest of a continually expanding human knowledge and technical advancement: the inventor contributes its knowledge in exchange for the temporary, exclusive right to commercially exploit that knowledge. Patent rights are necessarily limited to the territory subject to the issuing government's jurisdiction.<sup>190</sup> The U.S. Supreme Court eloquently stated the principle in *Microsoft Corp. v. AT & T Corp.*: "the presumption that United States law governs domestically but does not rule the world applies with particular force in patent law."<sup>191</sup> It follows that transnational enforcement of patents is fundamentally conditioned upon either international treaties or

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<sup>187</sup> Matthew T. Hanna, The Exclusive Economic Zone: A "No Man's Land" for United States Patent Law, 5 J. L. TECH. & INTERNET 51, 53 (2014).

<sup>188</sup> *Id.*

<sup>189</sup> See generally Ro et al., *supra* note 31.

<sup>190</sup> *Id.* at 207 (citing to *DeepSouth Packing Co. v. Laitram Corp.*, 406 U.S. 518, 531 (1972)).

<sup>191</sup> *Microsoft Corp. v. AT&T Corp.*, 550 U.S. 437, 455 (2007).

multi-state portfolios<sup>192</sup> of patents relating to the same invention.<sup>193</sup> The international filing of a patent is, however, burdensome and pricey because it requires an individual application to be multiplied by the number of countries in which the inventor seeks protection.<sup>194</sup> Uniform procedures, such as the one enshrined in the Patent Cooperation Treaty,<sup>195</sup> represent a first step towards a more uniform patent system. However, there is currently no such thing as an international patent. The Cooperation Treaty merely established a unified filing date for purposes of priority; each application still needs to be pursued individually in the respective jurisdiction.<sup>196</sup> From the viewpoint of developing technologies, territoriality poses one peculiar challenge. Considering that patent infringement under U.S. law requires an infringing activity in the United States,<sup>197</sup> the question is whether decentralized systems and processes partially residing outside of its borders, including in space, fall within this scope.

Courts initially struggled with the interpretive challenge presented by this issue, practicing restraint with respect to extra-territorial extensions of jurisdiction.<sup>198</sup> The Federal Circuit addressed the issue in 2005, in *NTP v. Research in Motion*, holding that use of a patent claiming a system can infringe even when the system's components reside abroad.<sup>199</sup> However, the court also held that methods or processes, because of their sequential nature and because of the individuality of each of their steps, cannot be practiced in the United States unless each step of the method or process is performed within the country's borders.<sup>200</sup> With respect to system or apparatus claims, infringement occurs, even when certain components are located outside of U.S. territory, so long as the United States is the place where the system as a whole is put into service.<sup>201</sup> Although the Federal Circuit looked at two factors previously adopted by the Court of Claims in *Decca Limited v.*

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<sup>192</sup> Portfolios comprising patents issued in more than one jurisdiction.

<sup>193</sup> See Ro et al., *supra* note 31, at 207 (citing to Kurt G. Hammerle & 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, 246 (2008)).

<sup>194</sup> *Id.*

<sup>195</sup> Patent Cooperation Treaty art. 3, June 19, 1970, 28 U.S.T. 7645, 1160 U.N.T.S. 231.

<sup>196</sup> See Ro et al., *supra* note 31, at 207.

<sup>197</sup> 35 U.S.C. § 271(a) (2019).

<sup>198</sup> Hanna, *supra* note 187, at 54 (citing Timothy R. Holbrook, *Extraterritoriality in U.S. Patent Law*, 49 WM. & MARY L. REV. 2119, 2127 (2008)).

<sup>199</sup> See *NPT, Inc. v. Research in Motion, Ltd.*, 418 F.3d 1282, 1317 (Fed. Cir. 2005).

<sup>200</sup> *Id.* at 1318.

<sup>201</sup> *Id.*

*United States*, control and beneficial use,<sup>202</sup> it ultimately adopted a slightly different standard that takes into account the location of the invention's components and use.<sup>203</sup> It is important to note the antithetic positions that Supreme Court and Federal Circuit traditionally adopt with regard to the statement of seminal principles in patent law; the standards in *NTP* and *Deepsouth* exemplify the dissimilarity in their views.<sup>204</sup>

The meaning of the *NPT* holding is illustrative of the IP side of this comment's inquiry. Concepts such as control and beneficial use and their counterparts in *NPT* determine the application of U.S. patent jurisdiction to cases where no country formally extends its law to an unregistered spacecraft. Their correct interpretation would allow patent holders to protect against infringers whose technology is partially or entirely far from the borders, in all cases where the technology's overall use, service, or control points to the United States. This would clearly include and support the extension of patent laws to spacecrafts or other space objects that are not registered for the purpose of the Registration Convention.<sup>205</sup>

The specific issue of patent infringement relating to technology operating in space appeared before the U.S. Court of Federal Claims in 1993.<sup>206</sup> The court addressed the issue of whether a satellite that had never entered the United States constituted infringing technology, where the satellite had been built and was primarily operated from the United Kingdom.<sup>207</sup> The court held that, despite the fact that the satellite's central communication link was a NASA facility in Maryland, the United States did not exercise sufficient control because, per *Decca*, no "master station" was present in the country.<sup>208</sup> Therefore, the satellite could not infringe on a U.S. patent because its use did not take place "within the United States." The court further elaborated on the control prong, reasoning that control would have surfaced had NASA "originated the [control] commands within the United States" and transmitted them directly from their facility.<sup>209</sup> The

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<sup>202</sup> See *Decca Ltd. v. United States*, 544 F.2d 1070, 1083 (Ct. Cl. 1976).

<sup>203</sup> Hanna, *supra* note 187, at 54 (explaining that where the Federal Circuit factored in the system's nature and its components' location, the Supreme Court disregarded the systems' location as a dispositive factor, focusing exclusively on control and use).

<sup>204</sup> *Id.*

<sup>205</sup> See Ro et al., *supra* note 31, at 213–14.

<sup>206</sup> See *Hughes Aircraft Co. v. United States*, 29 Fed. Cl. 197, 197 (1993).

<sup>207</sup> *Id.*

<sup>208</sup> *Id.* at 243.

<sup>209</sup> *Id.* at 242; See Ro et al., *supra* note 31, at 219–20.

decision clearly focuses on *Decca*'s control factors and does not consider any location or service factors as they were later explored in *NTP*.

Issues regarding the correct definition of territoriality within the scope of 35 U.S.C. § 271(a) have also caused concern outside the context of space. A paradigmatic example is the Exclusive Economic Zone. Under the United Nations Convention on the Law of Sea of 1982, to which the U.S. is not a party, the Exclusive Economic Zone (EEZ) is the area comprised between twelve and two hundred nautical miles from a state's coastal baseline.<sup>210</sup> Under the Convention, a nation has full sovereign rights over its own "territorial sea," i.e., within twelve nautical miles from its coast. A nation's sovereignty diminishes drastically after that point: this is the so-called contiguous zone, stretching as far as twenty-four nautical miles seaward. Within this area, states can only enforce their laws on foreign vessels that have committed certain violations while within their territorial waters.<sup>211</sup>

Commentators have pointed out to an ambiguity in the territorial language affecting the application of U.S. patent laws to the Zone.<sup>212</sup> In particular, the question is whether U.S. economic interests in the area and the nation's assertions of sovereignty over the same imply that the Zone is, for purposes of § 271(a), "within the United States." Only one case addressed the issue. In *WesternGeco L.L.C. v. ION Geophysical Corp.*,<sup>213</sup> the infringement suit related to cable-like devices for the seismic survey of marine environments. The alleged infringer shipped separate components of the device overseas for assembly into a device indistinguishable from the patentee's.<sup>214</sup> The District Court for Southern District of Texas held that practicing the patented invention beyond the twelfth mile off U.S. coasts did not constitute make or use-based infringement because the Exclusive Economic Zone was not "within the United States."<sup>215</sup> The court explained that the reluctance to extend patent law to cover infringement within the Zone was rooted in the absence of statutory instruction, thereby hinting that

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<sup>210</sup> United Nations Convention on the Law of the Sea art. 57, Dec. 10, 1982, 1833 U.N.T.S. 397.

<sup>211</sup> Hanna, *supra* note 187, at 57–58.

<sup>212</sup> *Id.* at 60.

<sup>213</sup> *WesternGeco L.L.C. v. ION Geophysical Corp.*, 776 F. Supp. 2d 342, 347 (S.D. Tex. 2011) [hereinafter *WesternGeco* 2011].

<sup>214</sup> *Id.* at 350.

<sup>215</sup> Hanna, *supra* note 187, at 69 (highlighting the court's reasoning that the EEZ is not part of the continental United States nor is it a possession or territory of it under the definition in 35 U.S.C. § 100(c)).

express Congressional action would resolve the issue.<sup>216</sup> *WesternGeco* also addressed territoriality with respect to 35 U.S.C. § 271(f), a provision amending the holding of *Deepsouth*<sup>217</sup> in order to prevent infringers from escaping liability by shipping unassembled components abroad.<sup>218</sup> The additional issue was whether infringers would be liable for using the invention assembled abroad in a way that would harm the U.S. patentee, for instance, by securing service contracts or otherwise competing with the patentee.<sup>219</sup>

The Federal Circuit reversed the lower court and held that a patent holder could not recover profits because “Congress [did not intend] to extend the United States patent law to cover uses abroad of the articles created from the exported components.”<sup>220</sup> The court reasoned that foreign exploitation by a defendant of a patented invention is not infringement when the extraterritorial production, use, or sale of the invention has no connection whatsoever with a domestic act of infringement.<sup>221</sup> Accordingly, a patentee “cannot recover lost profits resulting from its failure to win foreign contracts,” even when the failure stems from a previous act of the infringer occurred outside the jurisdiction of the United States. In 2018, the issue reached the Supreme Court, which reversed the previous decision and held once and for all that a patentee is entitled to recover lost profits for extraterritorial conduct provided there is a sufficient showing of infringement under § 271(f).<sup>222</sup> The Court highlighted the difference between extraterritorial conduct and damages consequential to said conduct: patent law is not applied extra-territorially simply because “damages occurred extraterritorially” as a consequence of foreign conduct.<sup>223</sup> In other words, the extraterritorial propagations of domestic infringing conduct can give rise to lost-profits based on damages occurred abroad. As applied to space, the holding signifies that patent owners can recover damages caused by infringement in U.S. territories—including orbiting modules or extraterrestrial facilities—in cases where damages arise out of the

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<sup>216</sup> *WesternGeco* 2011, *supra* note 213, at 369.

<sup>217</sup> *Ro et al.*, *supra* note 31, at 207 (citing to *Deepsouth Packing Co. v. Laitram Corp.*, 406 U.S. 518, 531 (1972)).

<sup>218</sup> *WesternGeco L.L.C. v. ION Geophysical*, 953 F. Supp. 2d 731, 755 (S.D. Tex. 2013).

<sup>219</sup> *WesternGeco L.L.C. v. ION Geophysical*, 791 F.3d 1340, 1351 (Fed. Cir. 2015).

<sup>220</sup> *Id.* at 1350.

<sup>221</sup> *Id.* at 1351.

<sup>222</sup> *WesternGeco L.L.C. v. ION Geophysical Corp.*, 138 S. Ct. 2129, 2139 (2018).

<sup>223</sup> *Id.* at 2138.

subsequent use, production, or sale of the invention in the territory of other countries.

## 2. *The Patents in Space Act*

This section examines a statute that has attempted to provide answers to issues of space commercial activities involving patents: The Patents in Space Act of 1990.<sup>224</sup>

The U.N. Treaties do not expressly address the applicability of national intellectual property laws to activities taking place entirely in space, as opposed to activities that partially take place on Earth.<sup>225</sup> Nevertheless, such application seems to derive from the joint application of the Outer Space Treaty and the Registration Convention, converging on the proposition that each state retains jurisdiction and control over the objects it launches into space and their personnel.<sup>226</sup> Jurisdiction and control include, for most interpreters, the extension of patent laws and thus the ability to grant patents for inventions developed onboard registered space objects.<sup>227</sup> The Patents in Space Act of 1990 sought to codify the principle through the injection of two short paragraphs in Section 105 of Title 35 of the U.S.C.<sup>228</sup> The section provides that inventions made, used, or sold in outer space on a space object or component under the jurisdiction of the United States are considered made, used, and sold within the United States for purposes of patent law.<sup>229</sup>

Accordingly, U.S. domestic patent laws can reach an invention conceived or reduced to practice on a U.S. registered spacecraft no matter how far from Earth.<sup>230</sup> By the same token, a U.S. patentee can bring an action for infringement of its patents based on the making, use, or sale of an invention on a U.S.-registered spacecraft.<sup>231</sup> Echoes of the statute reached the International Space Station Intergovernmental Agreement, which

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<sup>224</sup> 35 U.S.C. § 105 (1990).

<sup>225</sup> WIPO Issue Paper, *supra* note 6 (explaining how the latter would fall within the territorial reach of their respective countries' laws whereas out of space activities would escape it).

<sup>226</sup> See generally *Outer Space Treaty*, *supra* note 3; see also G.A. Res. 3235 (XXVI), *supra* note 57.

<sup>227</sup> Ro et al., *supra* note 31, at 208 (citing to Francis Lyall & Paul B. Larsen, *Space Law: A Treatise 2* (Ashgate, 2009)).

<sup>228</sup> See Shoemaker, *supra* note 48, at 405.

<sup>229</sup> 35 U.S.C. § 105(a).

<sup>230</sup> See Shoemaker, *supra* note 48, at 418–19.

<sup>231</sup> *Id.*

reproduced the principle by mandating that patent jurisdiction over ISS activities rests solely with the country of registration of the specific module hosting the activity.<sup>232</sup> The Act took upon itself to rectify a trend of jurisprudential rejection of the “floating island” theory, borrowed from maritime law: courts had begun to refuse the extension of patent law based on the mere registration of the vessel, with foreseeable consequences for the future of patent law in space.<sup>233</sup> The statute codified the extra-territorial reach of U.S. patent law by broadening the definition of infringing act. It is open to discussion whether this represents a way to heed the mandate of the U.N. Treaties or to supplant what could be argued to be their omission.<sup>234</sup>

The Act’s extension of jurisdiction is not unqualified. Three exceptions exist in the statute that displace the categorization of acts on U.S. space objects as infringing.<sup>235</sup> The first two exceptions are relevant to the present analysis. Extra-terrestrial patent jurisdiction does not apply where, first, the spacecraft or component at issue is the object of a separate international agreement to which the U.S. is a party; and second, where the spacecraft, regardless of being subject to U.S. jurisdiction, is registered with a foreign country for purposes of the Registration Convention.<sup>236</sup> The first exception encourages a cooperative space environment by displacing the extension of patent jurisdiction every time there is a *sui generis* agreement covering the spacecraft at issue. The necessity of fostering such an environment, at least at the international level, is dictated by order; if multiple countries adopted doctrines of extraterritoriality, the aggregate effect would be problematic.<sup>237</sup> As one of the examples *infra* illustrates, the second exception’s key difference between jurisdiction and registration creates compelling interrogatives, being theoretically able to restrict the power of the United States to enforce patents based on a decision of the relevant private operator, thereby threatening to create a loophole.<sup>238</sup> Indeed, registering one’s spacecraft under the law of a country different than the United States and practicing a patent onboard that spacecraft would not result in an infringing act, so long as the country is not otherwise bound to

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<sup>232</sup> International Space Station Agreement, *supra* note 153.

<sup>233</sup> Ro et al., *supra* note 31, at 212.

<sup>234</sup> International Bureau of World Intellectual Property Organization, *supra* note 6.

<sup>235</sup> Ro et al., *supra* note 31, at 213.

<sup>236</sup> 35 U.S.C. § 105.

<sup>237</sup> See Shoemaker, *supra* note 48, at 405.

<sup>238</sup> See Ro, *supra* note 31, at 213–14.

the United States by international agreements regarding patent recognition or enforcement.<sup>239</sup>

The exceptions in § 105(a) exclude application of U.S. patent law to cases of infringement occurring on spacecraft or extraterrestrial modules registered under the laws of another country.<sup>240</sup> Among these exceptions, the one centered upon registration of the spacecraft is the most relevant. Section 105(a) apparently superseded the principles and standards enshrined in *Decca* and later expanded by *NPT*. These standards now only applies to cases where a spacecraft or component is not registered with another country nor is it part of a *sui generis* agreement.<sup>241</sup> The necessary consequence of this choice, with respect to infringing acts in outer space, is that considerations of control, beneficial use, or overall service are now preempted by a formal registration of the spacecraft, creating the potential for a future problem of flags of convenience. Indeed, under § 105, technologies operating in outer space with enough connection to the United States would not fall within U.S. patent law so long as the concerned spacecraft is formally registered with another country.<sup>242</sup>

The Patents in Space Act provides an example of domestic law in harmony with the principles of international space law. However, the Act also exemplifies that adherence to the notions of a body of law whose policy and wording require modernization can be problematic. Merely incorporating the principle that jurisdiction is based on registration into domestic laws, as per the Registration Convention, does not eliminate the challenges affecting the treaties in the first place and it might in fact propagate them.

### III. THE FUTURE: NEW QUESTIONS

The future of intellectual property in space is an open question. An unaltered legal framework transitioning to the future on the back of the past instruments would struggle to support the development of intellectual property produced by booming space commercial activities.<sup>243</sup> As pointed

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<sup>239</sup> *Id.* at 218–19.

<sup>240</sup> *Id.*

<sup>241</sup> *Id.*

<sup>242</sup> *Id.*

<sup>243</sup> See *Space Law Is Inadequate for the Boom in Human Activity There*, *supra* note 184; see also Blake & Freeland, *supra* note 11.

out, the issue lies in the different nature of intellectual property and space law.<sup>244</sup> The underlying policies of these laws conflict as well, making convergence harder;<sup>245</sup> the application of strictly territorial intellectual property laws to space, which is supposedly the “province of all mankind,” might be problematic.

Territoriality does not fit space activities. Territoriality is a terrestrial construct because it can be reasonably assessed by reference to state borders or other boundaries. And even then, it’s not always unequivocally. Indeed, where natural bounds, such as the Karman line, may be subject to inconsistent definitions and measurements, areas such as the Aouzou Strip provide an example of contrasting artificial borders resulting in armed conflict.<sup>246</sup> The commercial dimension of outer space, including the assertion of intellectual property rights, cannot rely on territorial definitions that only work when supported by the consensus of the concerned parties. Territoriality is also incompatible with the non-appropriation principle of the Outer Space Treaty, prohibiting sovereign claims or occupation: absent clear boundaries over certain portions of space, recourse to legal fictions and extraterritorial laws will become more widespread, fueling inconsistencies and frictions.<sup>247</sup> The absence of a defined authority in space creates a vacuum of power and an incentive for unaccountable or unsupervised activities. It is reasonable to expect that the private space industry and state parties will gradually test the limits of the Liability Convention.<sup>248</sup> These critiques exemplify the inability of the old answers to fit to the new questions posed by space law. Failure to address these questions might create uncertainty, and uncertainty might hurt investments, thereby slowing the technological progress upon which space exploration inevitably depends.<sup>249</sup>

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<sup>244</sup> See *IP Resources*, *supra* note 34, at 404.

<sup>245</sup> See *id.*

<sup>246</sup> See generally Matthew M. Ricciardi, *Title to the Aouzou Strip: A Legal and Historical Analysis*, 17 *YALE J. INT’L L.* 301 (1992) (providing an example of formally defined but contested and disregarded borderlines).

<sup>247</sup> See generally Ro et al., *supra* note 31, at 209–21.

<sup>248</sup> See generally Joyeeta Chatterjee, *Legal Issues Relating to Unauthorised Space Debris Remediation*, 65 *INT’L. ASTRONAUTICAL CONGRESS* (2014) (concluding that international space law has fallacies and cannot properly address accountability in the context of space debris but calling for responsible space behavior from private entities).

<sup>249</sup> See Nelson, *supra* note 59, at 394.

A. *Orbital Patents: Keeping Patent Law with Its Feet on the Ground.*

The practice of patenting orbits within system or process patents is an example of situation whose regulation depends on both IP and space law. Navigational technologies applying orbital mechanics contribute to terrestrial economy and, indeed, ownership over particular orbits has been claimed by a number of countries in the past.<sup>250</sup> Patents involving orbits are numerous, growing in parallel with the satellite industry.<sup>251</sup> The idea of patenting an orbital route is far older than it would appear, owing its conceptualization to British writer and inventor Arthur C. Clarke.<sup>252</sup> Patenting an orbit, especially a geostationary one,<sup>253</sup> poses the fundamental issue of precluding access to that particular portion of space with respect to any other entity unauthorized by the patent owner. Indeed, intellectual property rights, although formally exclusive, do not in principle entail the subtraction of anything from another person, unlike exclusive rights in a parcel of land.<sup>254</sup> Despite patents' exclusionary powers being temporary, a conflict with the non-appropriation principle is unquestionable. Indeed, the Outer Space Treaty does not define a time limit after which appropriating portions of space becomes unlawful; the prohibition is categorical and omnicomprehensive.<sup>255</sup> Whether the mandate of the Outer Space Treaty will ultimately be respected is a question beyond the scope of this analysis because it does not affect the issues as they now exist in light of the applicable law.

The concept of orbital patents reverberates the debate over private ownership in space. Some argue that private entities are not bound by the Outer Space Treaty's non-appropriation clause because incapable of

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<sup>250</sup> See Sean Blair, *Space Property: Who Owns It?*, SCIENCE FOCUS (Aug. 1, 2011), <https://www.sciencefocus.com/space/space-property-who-owns-it/> (highlighting the 1976 Bogotá Declaration, where several South-American countries stated that a geostationary orbit is an extension of equatorial nations' airspace).

<sup>251</sup> *We Are Just a Few Units Short of Having Five Thousand Satellites Orbiting the Earth*, UNOOSA, <http://www.unoosa.org/oosa/en/spaceobjectregister/index.html> (last visited Sept. 13, 2019).

<sup>252</sup> See Becky Ferreira, *How Satellite Companies Patent Their Orbits*, VICE (Feb. 19, 2015), [https://www.vice.com/en\\_us/article/pgavez/how-satellite-companies-patent-their-orbits](https://www.vice.com/en_us/article/pgavez/how-satellite-companies-patent-their-orbits) (discussing how Arthur C. Clarke had imagined patented geostationary orbits in 1945).

<sup>253</sup> Geostationary orbits allow orbiting elements to follow Earth's rotation while being visible at all times from the same point on the ground. Geostationary differs from geosynchronous, the difference being that the latter has various inclinations, whereas the former only rotates on the same plane as the equator.

<sup>254</sup> See Fisher, *supra* note 23, at 184 (recalling the Lockean theory of intellectual property and its *strictu sensu* non-exclusive nature).

<sup>255</sup> *Outer Space Treaty*, *supra* note 3, at 23 (art. II).

asserting sovereign claims and, generally, because they are not the intended recipient of the Treaty's obligations.<sup>256</sup> Therefore, the argument goes, there would be no issue in the private ownership of a particular tract of space that is claimed as part of an orbital route, whether by patent or otherwise. On the opposite side, some claim that the issue of physically appropriating orbits routes does not stand because property titles in space would need to derive from a sovereign exercising its powers over the "territory," therefore private entities would be *ipso facto* crippled in their pursuit of "parcels of space."<sup>257</sup> Notwithstanding the debate on ownership, the Outer Space Treaty proclaims the free use of space for all mankind, thus including private entities.<sup>258</sup> Therefore, the issue is whether patenting an orbit falls within use of space or whether it spills over into ownership, excluded by the 50-year old treaty. The exclusionary nature of patented orbits seems to tip the scales in favor of the latter interpretation: the AMC-14 satellite case of 2008 provides an emblematic example.<sup>259</sup> A company owning a satellite abandoned its attempts to salvage the communications system due to the presence of a patent held by Boeing covering the route chosen for the satellite's deorbit and return.<sup>260</sup> Boeing refused to concede the right to practice the patent in order to obtain leverage in a related lawsuit, thereby sinking the satellite and de facto preventing unauthorized access to the specific route.

Another instance, this one of speculative nature, can be offered to better exemplify the issue of obtaining exclusionary rights on an orbital route. Space companies are exploring, and at various stages deploying, so-called satellite constellations.<sup>261</sup> Constellations work as a net, wrapping Earth in an invisible web to provide full coverage for communications services or remote sensing.<sup>262</sup> If we assume satellite constellations' orbits are

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<sup>256</sup> *Id.* See also Adam Mann, *Loophole Could Allow Private Land Claims on Other Worlds*, WIRED (Apr. 5, 2012), <https://www.wired.com/2012/04/moon-mars-property/>.

<sup>257</sup> See Michael J. Listner, *Op-Ed: A Reality Check on Article VI and Private Space Activities*, SPACE NEWS (Jun. 6, 2017), <https://spacenews.com/a-reality-check-on-article-vi-and-private-space-activities/> (discussing how the right of private entities to space activities is not absolute but rather derives from governmental concession).

<sup>258</sup> *Outer Space Treaty*, *supra* note 3, at 4 (art. I, ¶ 2).

<sup>259</sup> See *Boeing Patent Shuts Down AMC-14 Lunar Flyby Salvage Attempt*, SPACE DAILY (Apr. 10, 2008), [http://www.spacedaily.com/reports/Boeing\\_Patent\\_Shuts\\_Down\\_AMC\\_14\\_Lunar\\_Flyby\\_Salvage\\_Attempt\\_999.html](http://www.spacedaily.com/reports/Boeing_Patent_Shuts_Down_AMC_14_Lunar_Flyby_Salvage_Attempt_999.html)

<sup>260</sup> *Id.*

<sup>261</sup> See Dave Mosher, *Elon Musk Just Revealed New Details About Starlink, a Plan to Surround Earth with 12,000 High Speed Internet Satellites. Here's How It Might Work*, BUSINESS INSIDER (May 16, 2019), <https://www.businessinsider.com/spacex-starlink-satellite-internet-how-it-works-2019-5>.

<sup>262</sup> *Id.*

patentable technology and multiply the orbital slots by the number of satellites—projected to be in the tens of thousands—that a *single* constellation may comprise,<sup>263</sup> the portion of space that is claimed assumes relevant proportions. This clearly points to the finite number of available portions of space around Earth. Given that an exclusionary right's value is inversely proportional to the number of alternatives available to competitors, would, then, the patent claim be more than mere instructions for a navigational system? Would it not in fact render use of that portion of space subject to obtainment of licenses or other compensation and, in other words, appropriate it? The interrogative is further contextualized by the “spectrum warehousing” practice adopted by a number of companies. These entities apply for slots of low Earth orbit not to deploy new satellites, but to warehouse slots for the purpose of increasing the price of their own services and decreasing the slots available to competitors.<sup>264</sup> Whether by patent or otherwise, space is being appropriated without regard to the Outer Space Treaty. The question becomes whether to allow the law to follow the practice or endeavor to revamp a legal infrastructure that no longer serves its purpose.<sup>265</sup>

By assuming for the sake of argument that a patent can exist in an orbital route, claiming a portion of space for use within navigational systems but in fact reserving use of the territory, another interrogative arises: should the misuse of intellectual property, or other equitable doctrines, step in and avoid this outcome? The doctrine of patent misuse originated in late 1800s as a defense against claims of patent infringement, although it was officially embraced by U.S. the Supreme Court in 1917.<sup>266</sup> On that occasion, the Court rescinded the permissive scrutiny earlier afforded to patentees in structuring their business deals, and condemned the practice of tying the concession of patent licenses to the purchase of non-patented products.<sup>267</sup> The Court

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<sup>263</sup> *Id.* (explaining how the plans for a complete Starlink constellation contemplate nearly 12,000 satellites in orbit).

<sup>264</sup> See Caroline Haskins, *The Price of the Internet is the Space Race Nobody Knows About*, THE OUTLINE (Mar. 23, 2018), [https://theoutline.com/post/3868/satellite-broadband-internet-internet-space-monopoly-spectrum-warehousing?utm\\_source=TW&zr=bn5idtli&zd=4&zi=o2vyo fl3](https://theoutline.com/post/3868/satellite-broadband-internet-internet-space-monopoly-spectrum-warehousing?utm_source=TW&zr=bn5idtli&zd=4&zi=o2vyo fl3).

<sup>265</sup> See Blake & Freeland, *supra* note 11; see also Athina Balta, *Space Property Rights: The Winds of Change*, ALTHINA BALTA LAW GRP. 8 (2016), [http://www.unoosa.org/documents/pdf/hlf/1st\\_hlf\\_Dubai/Presentations/101.pdf](http://www.unoosa.org/documents/pdf/hlf/1st_hlf_Dubai/Presentations/101.pdf) (exploring the possibility of recognizing space property rights based on a modified theory of first-possession).

<sup>266</sup> See generally *Motion Pictures Patents Co. v. Universal Film Mfg. Co.*, 243 U.S. 502 (1917).

<sup>267</sup> *Id.*

stressed that whatever prohibition or term the patentee decided to employ would be valid as long as not grounded in patent law. Since patent law gives the exclusive right to an inventive contribution, its reward must be commensurate to the object of that contribution.<sup>268</sup> The outlined doctrine, as applied to the issue of orbital appropriation, poses the question: would it be possible to invoke misuse to avoid the inequitable result of allowing patents to impede access to portions of space?

The sharp difference in contexts makes it difficult to reconcile the case law from the early twentieth century and the practice of patenting orbital routes; however, the effort is not futile. Against the application of patent misuse, the owner of a patent claiming an orbit could argue to have rights in nothing more than the orbit path as an element of the patented process or system. Conversely, depending on how far the equitable nature of the defense stretches,<sup>269</sup> one could argue that an element of the physical world cannot strictly be claimed as part of a patent and therefore lies beyond the scope of the granted monopoly. The application of patent misuse to orbit will most likely depend on the specific benefit sought by the patent owner, and whether this benefit (e.g., prohibition of passage for the specific route) will be found to stem from patent law or fall outside of its scope.

Assuming that certainty of the law and competition are the seeds of a thriving commercial environment, the importance of misuse exceeds equity and touches upon antitrust, as well.<sup>270</sup> The AMC-14 Satellite case showed that orbital patents may be leveraged to restrain a competitor's activities and that their powers may extend beyond the realm of the patent law. Therefore, antitrust might be another device to avoid or rectify the consequences of de facto orbital appropriation by means of patents.

In conclusion, the Outer Space Treaty's lexical ambiguities and broadly stated principles seem to impact its ability to remain the master document for human expansion into space.<sup>271</sup> Indeed, with respect to the assertion of ownership claims in space, national domestic laws do not seem concerned about the old Treaty's non-appropriation clause. As exemplified

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<sup>268</sup> *Id.* at 513.

<sup>269</sup> See generally Daryl Lim, *Patent Misuse and Antitrust: Rebirth of False Dawn?*, 20 MICH. TELECOMM. & TECH. L. REV. 299 (2014) (exploring the equitable nature of the defense).

<sup>270</sup> *Id.* at 302 (highlighting the influence of antitrust doctrine on the development of patent misuse).

<sup>271</sup> See Keefe, *supra* note 122, at 357–58.

by orbital patents, it is imperative for international space law to consider a new array of problems and take a clear stand on the regulation of forthcoming commercial space activities, whether by abolishing the principle of non-appropriation or by appropriately defining its contours.

*B. Flags of Convenience: The Patent Infringer's Guide to the Galaxy.*

The evolution from a public aerospace industry model to a private one has caused yet another relevant change: relations in or across space increasingly involve private entities, rather than just governments. Private entities will one day interact with each other in a global environment where the extent of national laws might be either limited or overreaching. Their interactions may well include instances of patent infringement related to inventions developed in space. How will extra-terrestrial enforcement of patents interface with the current spacecraft registration regime? Scholars have put forward for discussion the argument that territorial IP applied to international space law, and specifically to the U.N. Treaties, will cause an issue comparable to the so-called “flags of convenience.”

The phenomenon, familiar to maritime law and admiralty connoisseurs, consists in the registration of a vessel under the laws of a country that has no relationship whatsoever with the vessel, its ownership, or its activities but that, on the other hand, provides favorable tax regimes or otherwise comparable benefits.<sup>272</sup> A vessel so registered is therefore officially subject to the convenience state's laws and jurisdiction. Given that the Registration Convention ties jurisdiction over spacecraft to a formal registration with a state's registry, it seems plausible to expect at some point in the future the migration of flags of convenience from maritime to space law.<sup>273</sup> The issue is far into the realm of imagination when applied to full-fledged spacecrafts used in transportation, supply, or exploration. However, the perspective changes when applying the same principle to satellites or similar objects. It is indeed not difficult to imagine abuse of technical innovations intended to store, acquire, or otherwise process information

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<sup>272</sup> See generally *Why So Many Shipowners Find Panama's Flag Convenient*, BBC (Aug. 5, 2014), <https://www.bbc.com/news/world-latin-america-28558480> (explaining how Panama operates on an open registry: shipowners can often apply only and obtain advantages in terms of tax, cheap labor, and regulations' enforcement).

<sup>273</sup> Frans G. von der Dunk, *Towards “Flags of Convenience” in Space?*, 76 *SPACE, CYBER & TELECOMM. L. PROGRAM, FAC. PUBL'N* 4 (Mar. 2012), <https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1075&context=spacelaw>.

through satellites registered in a country with favorable regulations. The issue is far more interesting in light of the cloud computing and distributed ledger<sup>274</sup> technologies, which aim to disassemble and decentralize traditional computing, storing, and processing systems.

Infringement and the ability to enforce IP rights depend on a nation's jurisdiction over the concerned spacecraft or space module. Jurisdiction depends, in turn, on the nation having listed the object on its registry, a requirement that each "launching state" must satisfy for purposes of the Registration Convention.<sup>275</sup> A country qualifies as a launching state when: (1) it launches the object; (2) it procures the launch; (3) the object is launched from its territory; or (4) the object is launched from one of its facilities.<sup>276</sup> However, as discussed *supra*, the U.S. enacted the Patents in Space Act to extend the scope of its patent laws to inventions occurring in outer space. Commentators have speculated that, in doing so, the U.S. created a loophole that would prevent infringement actions in the U.S. where a company operates from a spacecraft or module that is registered in a different country.<sup>277</sup> Indeed, under the language of 35 U.S.C. § 105(a), the presence of infringing technology on a spacecraft providing a service that is used, controlled, or procured from the U.S. would not be actionable infringement if the spacecraft is formally registered elsewhere.<sup>278</sup> Similar to maritime law, the presence of this loophole would encourage, in the future, the adoption of favorable regulations by countries that are not bound to recognize U.S. IP rights.<sup>279</sup> These countries would be able to exploit the economic thrust of private space commercialization by offering the possibility to escape infringement claims at the expense of companies that operate through spacecraft or modules registered in the United States. Similarly, U.S. companies could outsource space launch services to overseas partners operating in such countries to avoid regulations or other obligations.<sup>280</sup>

The question is therefore whether U.S. courts would be able to extend their jurisdiction over patent infringement occurring on spacecraft formally

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<sup>274</sup> Distributed ledger technologies are also known as blockchain.

<sup>275</sup> G.A. Res. 3235 (XXVI), *supra* note 57, at art. II, ¶ 1.

<sup>276</sup> See Lyall and Larsen, *supra* note 227, at 124–27.

<sup>277</sup> See generally Ro et al., *supra* note 31.

<sup>278</sup> *Id.*, at 206–207.

<sup>279</sup> *Id.*, at 219–20.

<sup>280</sup> *Id.*, at 217.

registered in another country but effectively operating, under the case law standards discussed *supra*, “within the United States.”<sup>281</sup> It has been concluded that such extension is in principle barred by 35 U.S.C. § 105(a), because the formal registration with another country’s registry trumps considerations of control and use within the United States. Nevertheless, the argument has been made that certain principles of international law might rectify such a rigid rule and extend one state’s jurisdiction over formally foreign spacecrafts: for example, territorial jurisdiction, protective jurisdiction, or the passive personality principle.<sup>282</sup> Similarly, it is noteworthy that the U.S. requires every U.S. person to obtain a license for space activities, regardless of whether the launching, re-entry, and flight operations occur within the country, and thus establishing a certain degree of supervision over these activities.<sup>283</sup>

It is clear that the international legal framework as it stands is inadequate to support the expansion of human activity in space: its vacuums and uncertainties are being filled by iterative domestic-law efforts that might one day conflict with one other, adding to the confusion and fueling the circumvention of obligations. The repercussions of such a rigid regime of registration not only affect U.S. patent law in its ability to pursue its underlying policy of progress and advancement, but also affect U.S. obligations under the Outer Space Treaty, in particular the responsibility that every state has with respect to its natural and juridical persons.<sup>284</sup> Where some companies might seek to avoid application of U.S. patent law to preclude the benefit of a patentee, others might employ the tactic to exclude application of U.S. law in a way that would harm their interests. In both cases, there is potential for unscrupulous tactics, for which the United States would in principle be “internationally responsible.”<sup>285</sup>

It is instructive to remember that, unlike the U.N. Convention on the High Seas,<sup>286</sup> the jurisdiction over spacecraft contemplated in the Outer Space Treaty may not be exclusive.<sup>287</sup> The several circumstances giving rise to “launching state” status under the Registration Convention might well be

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<sup>281</sup> 35 U.S.C. § 271(a) (2010).

<sup>282</sup> Ro et al., *supra* note 31, at 219.

<sup>283</sup> *Id.*, at 220.

<sup>284</sup> *Id.*, at 221–23.

<sup>285</sup> *Outer Space Treaty*, *supra* note 3, at 3.

<sup>286</sup> Convention on the High Seas, art. 5–6, Apr. 29, 1958, 450 U.N.T.S. 11.

<sup>287</sup> *Outer Space Treaty*, *supra* note 3, at 5 (art. VII).

shared by different countries, although only one country can have the spacecraft on its registry for purposes of the Convention.<sup>288</sup> Therefore, it is not difficult to outline the confusion and interpretive issues that arise from such a legal framework; not only national IP laws might conflict in an operative sense by creating uncertainty, they might in fact be in violation of a state's supervisory obligations under the Treaties. Once again, the ultimate issue is determining how the international community should look at the Treaties. The fact that international space law and its national counterparts are prone to interpretive issues will potentially affect the possibility to keep track of and properly apportion the responsibilities of launching states and private space actors. Continuing to allow national laws to fill the gaps left by the U.N. Treaties is a half measure at best. Although it may provide answers in the short term, it might also lead to conflicting national laws, thereby incentivizing unregulated practices such as flags of convenience.

#### IV. CONCLUSION

The space race has transferred from the arena of national pride to that of private enterprise. However, the transition is far from complete, first, because the role of governments will be, for the foreseeable future, quite relevant; and second, because the only internationally relevant body of law purporting to regulate space activities does not directly speak to private entities. This points to certain fallacies in space law. The challenge for governments and international authorities rests in deciding whether to let a 50-year old legal framework recede into the background, supplanted by practice and extraterritorial domestic legislations, or whether to endeavor to update the instrument that many consider fundamental for the future of mankind.

The relations between IP, as an extension of private commercial activity, and international space law appear to be a facet of the challenge. As explained, the advancement of one seem to inevitably undermine the other. Nevertheless, solutions are being explored that would ease the relationship between these two bodies of law without the drawback of renouncing international obligations or creating an uncertain legal environment for pioneering space businesses. The ISS Agreement has been a successful

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<sup>288</sup> G.A. Res. 3235 (XXVI), *supra* note 57, at art. II.

example thus far, although its markedly practical and quasi-private structure points to the real issue behind international regulation of outer space. Indeed, the foundational problem resides with compliance with and enforceability of international law. Relying on channels of diplomacy and treaty-making might indeed prove uneventful once private space transportation and exploration will reach critical mass, multiply, and gradually grow distant from national governments and their supervision.

The U.N. Treaties do not seem fit to address new questions such as orbital appropriation or flags of convenience. This inability derives from their nature of international law instruments as well as the specific language they adopt. The future of commercial expansion and IP into space cannot rely on a legal framework that, by virtue of its omissions, outdated policies, and close-to-immutable nature, is unable to adapt to and overcome new challenges. The risks of employing such a framework without a critical filter include slowing down progress, hindering states' ability to reach or enforce the settlement of disputes, and incentivizing unscrupulous business practices.

Although revamping the U.N. Treaties is envisioned by many as the optimal outcome, the solution hardly addresses all the concerns. As the stringent obligations of the Treaties show, subjecting commercial expansion and intellectual property in space to a set of outdated international rules might in fact work against their development. As the commercial approach to space evolves, international space law needs to determine whether to lead or follow. At stake in this determination is the pace at which we will proceed, outwards or inwards, through the Universe.