

NOTE

TO EXPLORE OUTER SPACE: THE INTELLECTUAL PROPERTY FRONTIER FOR PATENTS

I. INTRODUCTION

A new era of space exploration has emerged.¹ In 2018, Elon Musk successfully sent his red electric sports car—with a “spacesuit-clad mannequin driver” named Starman aboard the Falcon Heavy rocket—into the atmosphere of outer space.² This SpaceX mission expects Starman and the Falcon Heavy to orbit the sun for millions of years.³ This is not the first time that mankind has reached a considerable milestone in outer space exploration.⁴

In the middle of the twentieth century, the Cold War between the United States of America and the Soviet Union spawned the Space Race, and thus humanity began reaching for the stars.⁵ In 1957, the Soviet Union was the first to launch a human-made artificial satellite, *Sputnik I*,

1. Kenneth Chang, *Falcon Heavy, in a Roar of Thunder, Carries SpaceX's Ambition Into Orbit*, N.Y. TIMES (Feb. 6, 2018), <https://www.nytimes.com/2018/02/06/science/falcon-heavy-spacex-launch.html> (stating that “[t]he success gives SpaceX [a private company] momentum to begin developing even larger rockets” and discussing how Mr. Musk established that he wants a new space race and to aim for more ambitious goals in space).

2. *Id.* (discussing how Elon Musk is the first individual to send a car to outer space); see also Mike Wall, *SpaceX's 'Starman' and Its Tesla Roadster are Now Beyond Mars*, SPACE.COM (Nov. 3, 2018), <https://www.space.com/42337-spacex-tesla-roadster-starman-beyond-mars.html>. On February 6, 2018 SpaceX livestreamed the car orbiting in outer space, being driven by a mannequin with the monitor saying “Don’t Panic!” SpaceX, *Live Views of Starman*, YOUTUBE (Feb. 6, 2018), <https://www.youtube.com/watch?v=aBr2kKAHN6M>.

3. Chang, *supra* note 1.

4. See generally *A Brief History of Space Exploration*, AEROSPACE (June 1, 2018), <http://www.aerospace.org/education/stem-outreach/space-primer/a-brief-history-of-space-exploration>.

5. *Id.*; see also *The Space Race*, HISTORY (Feb. 22, 2010), <http://www.history.com/topics/space-race> (summarizing the history of the space race between the United States and the Soviet Union).

to orbit the Earth,⁶ while in 1969, the United States was the first nation to land on the moon.⁷

As nations started venturing into outer space, in 1967, the Outer Space Treaty was implemented and became the fundamental framework for space law.⁸ The Outer Space Treaty established that outer space, the moon, and other celestial bodies are open for exploration to all nations for “peaceful purposes.”⁹ Since then, a multitude of nations have begun to explore outer space.¹⁰ Thus, this Treaty invigorated space activity and started a trend for creating inventions relating to outer space.¹¹ Ultimately, this led to the formation of the International Space Station (“ISS”).¹²

The ISS is a multi-nation project where the nations collaborate on various inventions and investigate resources to better human life.¹³ These nations entered into the Agreement Among the Government of Canada, Governments of the Member States of the European Space

6. *Id.*

7. *The First Person on the Moon*, NAT’L AERONAUTICS & SPACE ADMIN., <https://www.nasa.gov/audience/forstudents/k-4/stories/first-person-on-moon.html> (last visited Apr. 22, 2019) (discussing that the United States sent Neil Armstrong and Edwin “Buzz” Aldrin to the moon. The United States reached another milestone when Neil Armstrong was the first person to step on the moon).

8. Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205 [hereinafter Outer Space Treaty]; see Matthew J. Kleiman, *Space Law 101: An Introduction to Space Law*, AM. BAR ASS’N, (Aug. 27, 2013) https://www.americanbar.org/groups/young_lawyers/publications/the_101_201_practice_series/space_law_101_an_introduction_to_space_law. See generally *Space Law*, U.N. OFF. FOR OUTER SPACE AFF., <http://www.unoosa.org/oosa/en/ourwork/spacelaw/index.html> (last visited Apr. 22, 2019).

9. Outer Space Treaty, *supra* note 8, at art. I (“Outer space . . . shall be free for exploration and use by all States without discrimination of any kind, on the basis of equality and in accordance with international law, and there shall be free access to all areas of celestial bodies.”).

10. See generally *The Impact of Space Activities Upon Society*, INT’L ACAD. ASTRONAUTICS & EUR. SPACE AGENCY (Feb. 2005), <http://www.esa.int/esapub/br/br237/br237.pdf> (discussing the increase in space activity, the plans to bring inventions into space, the impact space activities have on states, the need for harmony, and the perspectives of the contributors).

11. See *Patent Expert Issues: Inventions in Space*, WORLD INTELL. PROP. ORG., http://www.wipo.int/patents/en/topics/outer_space.html (last visited Apr. 22, 2019) (discussing that intellectual property rights are going to be of importance for outer space due to an “increasing . . . shift . . . from being state-owned activities to becoming private and commercial activities”).

12. *What is the International Space Station?*, NAT’L AERONAUTICS & SPACE ADMIN. (Nov. 30, 2011), <https://www.nasa.gov/audience/forstudents/k-4/stories/nasa-knows/what-is-the-iss-k4.html>.

13. Agreement Among the Government of Canada, Governments of the Member States of the European Space Agency, the Government of Japan, the Government of the Russian Federation, and the Government of the United States of America Concerning Cooperation on the Civil International Space Station, art. 1, 4, ¶1, Jan. 29, 1998, 1 U.S.T. 113 [hereinafter Space Station Agreement]; see also Elizabeth Howell, *International Space Station: Facts, History & Tracking*, SPACE.COM (Feb. 7, 2018, 8:25 PM), <https://www.space.com/16748-international-space-station.html>.

Agency, the Government of Japan, the Government of the Russian Federation, and the Government of the United States of America Concerning Cooperation on the Civil International Space Station (“Space Station Agreement”) and implemented an article specifically for intellectual property.¹⁴ Further, this agreement establishes that the nations will acknowledge each other’s jurisdiction, control over registered objects and personnel, and ownership of elements and equipment listed by each country.¹⁵ Jurisdiction is important for the ISS to determine which nation’s laws will apply when an innovation is invented in outer space.¹⁶ The ISS must look at who the inventor is and where the invention occurred.¹⁷ For example, if an individual representing Canada creates an invention on their own ship, then Canadian law will prevail, as it will be deemed that the invention and action took place in Canada.¹⁸

Aside from developments occurring on the ISS, there are both private companies and federal agencies developing projects for the investigation of space.¹⁹ For example, China has landed a robot on the far side of the moon where no nation, man, nor robot had ventured before.²⁰ SpaceX is planning to develop the first private lunar passenger flight around the moon.²¹ Further, the National Aeronautics and Space Administration (“NASA”) is creating the Mars 2020 rover to unfold the mysteries of the planet Mars.²² This leads to more questions about territory and jurisdiction in outer space, especially if the conception of the invention did not occur on the ISS and its patent was infringed.²³

14. Space Station Agreement, *supra* note 13, at art. 21.

15. *Id.* at arts. 5, 6.

16. Matthew J. Kleiman, *Patent Rights and Flags of Convenience in Outer Space*, AIR & SPACE L. (Feb. 7, 2011), <http://www.thespacereview.com/article/1772/1>.

17. *Id.*

18. *Id.*

19. See *What’s Next For NASA?*, NAT’L AERONAUTICS & SPACE ADMIN. (Apr. 24, 2018), https://www.nasa.gov/about/whats_next.html (discussing how NASA is developing other technology to explore the deep space, as well as missions it is working on); Danny Yadron, *Elon Musk Planning SpaceX Mission to Mars by 2018*, GUARDIAN (Apr. 27, 2016, 2:48 PM), <https://www.theguardian.com/technology/2016/apr/27/elon-musk-space-x-mars-mission-tesla>.

20. Michael Greshko, *China Just Landed on the Far Side of the Moon: What Comes Next?*, NAT’L GEOGRAPHIC (Jan. 2, 2019), <https://www.nationalgeographic.com/science/2019/01/china-change-4-historic-landing-moon-far-side-explained>.

21. *Mars*, SPACE X, <https://www.spacex.com/mars> (last visited Apr. 22, 2019).

22. See *Mars 2020 Mission Overview*, NAT’L AERONAUTICS & SPACE ADMIN., <https://mars.nasa.gov/mars2020/mission/overview> (last visited Apr. 22, 2019). This will be a robot that will look for signs of future and past life and gather samples from Mars to investigate possible natural resources. *Id.*

23. See *infra* Part III.

Patent law is territorial in nature.²⁴ The United States Patent and Trademark Office (“USPTO”) grants patents to the owner of the invention for a limited duration to protect the property rights.²⁵ Under the United States patent system, territory is an important condition for patentability.²⁶ There is only one statute, 35 U.S.C. Section 105, also known as the Patents in Space Act, that discusses inventions, outer space, and the United States’ jurisdiction.²⁷ It specifies that if a patent is infringed in a jurisdiction of the United States, then it is considered to be infringed within the United States.²⁸ Therefore, in accordance with the Registration Convention, nations have jurisdiction only on their space object.²⁹ This leads to an issue because United States patent law will not apply if an invention is made on another nation’s spacecraft.³⁰

Consequently, the question of which law will prevail in outer space must be addressed when there is a lack of territorial regime.³¹ What happens if an invention is infringed in outer space?³² Since patents are territorial-based, and outer space is open to all nations, would the act of infringing on a patent in outer space allow the owner to ultimately receive relief?³³ The issue now becomes: if the event occurred in outer space and not on Earth, under whose jurisdiction and authority will infringement cases be held?³⁴ By utilizing current international treaties as examples—such as the five United Nations treaties on outer space

24. Timothy R. Holbrook, *Extraterritoriality in U.S. Patent Law*, 49 WM. & MARY L. REV. 2119, 2129 (2008).

25. *Patents FAQs*, U.S. PAT. & TRADEMARK OFF., <https://www.uspto.gov/help/patent-help#1930> (last visited Apr. 22, 2019) (“[Question:] What is a patent? [Answer:] A patent is a limited duration property right relating to an invention, granted by the United States Patent and Trademark Office in exchange for public disclosure of the invention.”).

26. 35 U.S.C. § 102 (2012) (defining the conditions for patentability as it relates to territory requirements by no longer limiting the territory to the U.S.). “Under pre-AIA 35 U.S.C. 102(b), an invention that was ‘in public use’ precluded the grant of a patent only if such public use occurred ‘in this country.’” MPEP, U.S. PAT. & TRADEMARK OFF., https://mpep.uspto.gov/RDMS/MPEP/current#/current/ch2100_d20033_1d66c_1e5.html (last visited Apr. 22, 2019) (citation omitted). “Under AIA 35 U.S.C. 102(a)(1), there is no geographic limitation on where prior public use or public availability occurs.” *Id.*

27. 35 U.S.C. § 105 (effective since 1990). This Section is known as the “Patents in Space Act” or “Patents in Outer Space Act;” other nations do not have similar provisions.

28. *Id.* The invention must be “made, used or sold in outer space . . . under the jurisdiction or control of the United States . . .” *Id.*

29. 35 U.S.C. § 105(b); Convention on Registration of Objects Launched into Outer Space, art. II, Jan. 14, 1975, 28 U.S.T. 695, 1023 U.N.T.S. 15 [hereinafter Registration Convention].

30. *See infra* Part III.B.

31. *See infra* Part III.

32. *See infra* Part III.B.

33. Juan Felipe Jiménez, *Patents in Outer Space: An Approach to the Legal Framework of Future Inventions*, 98 J. PAT. & TRADEMARK OFF. SOC’Y 447, 450-52, 456 (2016).

34. *See infra* Part III; *see also* Jiménez *supra* note 33, at 456.

(the “Five Treaties”),³⁵ treaties about the high seas,³⁶ and the Antarctic Treaty³⁷—a treaty can be created that establishes uniformity for patent law in space.³⁸ Further, the Five Treaties indicate that international cooperation is important for negotiations and that activities in outer space should be devoted to enhancing humankind.³⁹

For the purpose of creating a peaceful solution to establish the possibility of a territorial scheme of whose law or what law should prevail, this Note will first discuss in Part II the history of patent law and how it influenced other nations to create a patent system.⁴⁰ It will then examine the importance of space law which has started to form through the Outer Space Treaty.⁴¹ The framework of space law is continuously being established and grows on the principles of exploring for peaceful purposes and scientific development.⁴² This is illustrated through the treaties specifically about outer space and international treaties, such as treaties concerning the high seas and the poles of Earth.⁴³ Part II will further discuss the importance of the ISS and the Space Station Agreement among the nations.⁴⁴ Even though the Space Station Agreement has provisions regarding intellectual property, it establishes neither whose law prevails in infringement cases, nor jurisdiction outside of the ISS.⁴⁵ Furthermore, Part III will address the issues of jurisdiction, territory, and the negative impacts of patent infringement.⁴⁶ Part IV will

35. Outer Space Treaty, *supra* note 8; Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, Apr. 22, 1968, 19 U.S.T. 7570, 672 U.N.T.S. 119 [hereinafter Rescue Agreement]; Convention on the International Liability for Damage Caused by Space Objects, Mar. 29, 1972, 24 U.S.T. 2389, 961 U.N.T.S. 187 [hereinafter Liability Convention]; Registration Convention, *supra* note 29; Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, Dec. 18, 1979, 18 U.S.T. 2410, 1363 U.N.T.S. 21 [hereinafter Moon Agreement]; *see also Space Law Treaties and Principles*, U.N. OFF. FOR OUTER SPACE AFF., <http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties.html> (last visited Apr. 22, 2019).

36. United Nations Convention on the Law of the Sea, Dec. 10, 1982, 13 U.S.T. 2312, 1833 U.N.T.S. 3 [hereinafter UNCLOS].

37. The Antarctic Treaty, Dec. 1, 1959, 12 U.S.T. 794, 402 U.N.T.S. 71 [hereinafter Antarctic Treaty]; Convention for the Conservation of Antarctic Seals, art. 1, ¶ 1, June 1, 1972, 29 U.S.T. 441, 402 U.N.T.S. 71 (discussing the policies, rules, and boundaries of Antarctica).

38. *See infra* Part IV.A.

39. *Space Law Treaties and Principles*, *supra* note 35.

40. *See infra* Part II.

41. *See infra* Part II.B.

42. Outer Space Treaty, *supra* note 8, at pmb1.; *Space Law*, *supra* note 8 (noting the importance of space law and the variety of international rules, principles, and laws that are used to create the framework for space law).

43. *See infra* Part II.

44. *See infra* Part II.B.

45. *See infra* Part II.B.2.

46. *See infra* Part III.

discuss a beneficial solution to create an intellectual property treaty which will include a specific provision for patents.⁴⁷ This treaty will address the international jurisdiction for intellectual property, which may benefit the international communications on Earth.⁴⁸

II. BACKGROUND AND HISTORY

Patent law and space law have evolved to solve various issues.⁴⁹ Subpart A discusses the origin of patent law and how it molded the United States patent system.⁵⁰ It also emphasizes the differences between patent systems.⁵¹ Subpart B highlights the history of space law and emphasizes the treaties necessary to make outer space peaceful between all nations.⁵² It further illustrates the importance of the ISS regarding intellectual property rights and the Patent Cooperation Treaty.⁵³ Furthermore, Subpart C summarizes the United States' extraterritorial limits for jurisdiction.⁵⁴ Thus, it illuminates how one nation's law can prevail under certain circumstances.⁵⁵

A. History of Patent Law

The origin of patent law can be traced all the way back to the 1474 Venetian Republic.⁵⁶ The Venetian Republic enacted the Venetian Act of March 19, 1474, which is the first known written law that established patent principles.⁵⁷ Professor Luigi Sordelli's translation from old Venetian dialect to English is the most widely accepted version.⁵⁸ The Act rewarded each person who had a new ingenious innovation exclusive rights over that invention.⁵⁹ Similar concepts have been

47. See *infra* Part IV.

48. See *infra* Part IV.

49. See *infra* Part II.A.

50. See *infra* Part II.A.

51. See *infra* Part II.A.

52. See *infra* Part II.B.

53. See *infra* Part II.B.2.

54. See *infra* Part II.C.

55. See *infra* Part II.C.

56. John F. Duffy, *Inventing Invention: A Case Study of Legal Innovation*, 86 TEX. L. REV. 1, 19-23 & 22 n.74 (2007).

57. Randy Alfred, *March 19, 1474: Venice Enacts a Patently Original Idea*, WIRED (Mar. 19, 2012, 6:30 AM), <https://www.wired.com/2012/03/march-19-1474-venice-enacts-a-patently-original-idea>; see also Duffy, *supra* note 56, at 21-23, 22 n.74.

58. Ikechi Mgbefji, *The Judicial Origins of the International Patent System: Towards a Historiography of the Role of Patents in Industrialization*, 5 J. HIST. INT'L L. 403, 413 (2003).

59. *Id.* The act is translated to state:

[D]ecision will be passed that, by authority of this Council, each person who will make in this city any new ingenious contrivance, not made heretofore in our dominion, as soon

adopted by other countries and the United States to establish patent law.⁶⁰ For example, during the reign of Queen Elizabeth I (1558-1602)⁶¹ and King James I (1603-1624),⁶² the Royal Court granted patents only if the invention was a technique or commodity to their favored courtiers.⁶³ The English patent system further evolved in 1624 when Parliament enacted a Statute of Monopolies in Section 6.⁶⁴ The Statute of Monopolies stated that patents are granted only when the inventions are novel.⁶⁵ This statute influenced the requirements for patentability in both the United States and Europe.⁶⁶

The United States recognizes the importance of a patent system, which is evidenced in the United States Constitution.⁶⁷ The United States patent system began when it issued the first United States patent to Samuel Hopkins on July 31, 1790, for a process of making potash, which is an ingredient used in fertilizer.⁶⁸ Since then patent applications have flourished within the United States and throughout the world,⁶⁹ especially in China.⁷⁰

Inventors and businesses want to protect their intellectual property

as it is reduced to perfection, so that it can be used and exercised. . . . It being forbidden to any territory and place of ours to make any other contrivance in the form and resemblance thereof. . . .

Id. at 413-14; *see also* MacKenzie Brown, *A Brief History of Patents: Patent Law Past and Present*, CAD CROWD (Mar. 24, 2016), <https://www.cadcrowd.com/blog/a-brief-history-of-patents-patent-law-past-and-present>.

60. *See* Brown, *supra* note 59; *see also* Matt Kwong, *Six Significant Moments in Patent History*, REUTERS (Nov. 4, 2014, 3:47 PM), <https://www.reuters.com/article/us-moments-patent/six-significant-moments-in-patent-history-idUSKBN0IN1Y120141104>. The director of the Intellectual Property Center at Ohio's Case Western Reserve University, Craig Nard, said: "Everything we hold dear as sort of fundamental principles in today's patent system can be found in the Venetian statute." *Id.*

61. Stephen J. Greenblatt, *Elizabeth I*, ENCYC. BRITANNICA (Nov. 2, 2018), <https://www.britannica.com/biography/Elizabeth-I>.

62. David Mathew, *James I*, ENCYC. BRITANNICA (Nov. 5, 2018), <https://www.britannica.com/biography/James-I-king-of-England-and-Scotland>.

63. Kwong, *supra* note 60.

64. *Id.*

65. *Id.*

66. *Id.*

67. *See* U.S. CONST. art. I, § 8, cl. 8. The Constitution states that the Congress shall have power "[t]o promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries." *Id.* (emphasis added).

68. Press Release, U.S. Patent & Trademark Office, First U.S. Patent Issued Today in 1790 (July 31, 2001). This patent was signed by President George Washington, and the original document is currently in the collections of the Chicago Historical Society. *Id.*

69. Brown, *supra* note 59.

70. Press Release, World Intell. Prop. Org., World Intellectual Property Indicators: Filings for Patents, Trademarks, Industrial Designs Reach New Records on Strength in China (Dec. 3, 2018). To compare, in 2017 China filed 1.38 million patent applications, while the United States filed 606,956 patent applications. *Id.*

rights and their inventions from infringement, which is why obtaining a patent is important.⁷¹ The United States defines a patent as “[t]he right to exclude others from making, using, marketing, selling, offering for sale, or importing an invention for a specified period . . . granted by the federal government to the inventor if the device process is novel, useful, and nonobvious.”⁷² Under United States patent law, the exclusive rights are available for twenty years for patents⁷³ and fifteen years for design patents.⁷⁴

Patent systems vary in each country and have different rules and requirements.⁷⁵ For example, the United States is the only country that has an explicit provision regarding patents and outer space.⁷⁶ Additionally, another example is the differences between the United States’ and Europe’s patent systems.⁷⁷ The main difference is the

71. See David Pridham & Brad Sheafe, *The Top 10 Reasons Why Your Startup Needs Patents*, FORBES (Aug. 18, 2015, 4:46 PM), <https://www.forbes.com/sites/forbesleadershipforum/2015/08/18/the-top-10-reasons-why-your-startup-needs-patents/#329456fe22c7>.

72. *Patent*, BLACK’S LAW DICTIONARY 1300 (10th ed. 2014) (noting that this definition comes from 34 U.S.C. §§ 101–103) (2012).

73. 35 U.S.C. § 154(a)(2) (establishing that patents will receive protection for twenty years from the date the application was filed or the earliest filing date).

74. 35 U.S.C. § 173 (2012 & Supp. I 2013) (establishing that design applications that are filed on or after May 13, 2015 will receive fifteen years from the date of grant and applications filed before the date will receive a fourteen year term from the date of grant).

75. Kleiman, *Patent Rights*, *supra* note 16 (emphasizing that national governments grant patents, therefore, requirements or procedures may vary from country to country); see, e.g., Inayat Chaudhry, *The Patentability of Blockchain Technology and the Future of Innovation*, AM. BAR ASS’N, https://www.americanbar.org/groups/intellectual_property_law/publications/landslide/2017-18/march-april/patentability-blockchain-technology-future-innovation (last visited Apr. 22, 2019); see also Emmanuel Baud et al., *Patents, Trade Marks, Copyright and Designs in France: Overview*, THOMSON REUTERS, [https://uk.practicallaw.thomsonreuters.com/3-501-8767?transitionType=Default&contextData=\(sc.Default\)&firstPage=true&comp=pluk](https://uk.practicallaw.thomsonreuters.com/3-501-8767?transitionType=Default&contextData=(sc.Default)&firstPage=true&comp=pluk) (last visited Apr. 22, 2019) (discussing the requirements to obtain a patent in France); Matt Kwong, *How to Get a Patent in Canada and Protect Your Business Idea*, CBC (May 22, 2018), <https://www.cbc.ca/dragonsden/blog/patents-in-canada-when-do-you-own-your-idea> (discussing the Canadian requirements for an invention to be patentable); *Patent Law of People’s Republic of China*, CHINATRADEMARKOFFICE.COM, <https://www.chinatradermarkoffice.com/about/laws2.html#2> (last visited Apr. 22, 2019) (discussing general provisions and requirements for a Chinese grant of a patent right).

76. 35 U.S.C. § 105; see Lisa Williams, *Extra-Terrestrial Patent Infringement*, HASELTINE LAKE (Dec. 14, 2015), <http://www.haseltinelake.com/media-centre/blog/2015/december/extra-terrestrial-patent-infringement>; see also International Bureau of WIPO, *Issue Paper: Intellectual Property and Space Activities*, WORLD INTELL. PROP. ORG. 11 (Apr. 2004), http://www.wipo.int/export/sites/www/patent-law/en/developments/pdf/ip_space.pdf (“The United States of America is the only country that has enacted an explicit provision establishing a link between the three key elements: inventions, jurisdiction and territory.”).

77. See 35 U.S.C. §§ 101–103 (2012); *Guide for Applicants: How to Get a European Patent*, EU. PATENT OFF., https://www.epo.org/applying/european/Guide-for-applicants/html/e/ga_b.html (last visited Apr. 22, 2019).

patentability requirements for an invention.⁷⁸ The United States requires that the invention must be novel and *non-obvious*,⁷⁹ while Europe requires that the invention must be novel and involve an *inventive step*.⁸⁰ Since each nation has its own patent system, inventors must apply and obtain a patent in every country where they would like to protect their invention.⁸¹

However, there is also international patent law which deals with the harmonization of procedure and substantive law.⁸² Countries are continuing to create global uniformity.⁸³ There are three periods of change in international patent law: the Paris Convention;⁸⁴ the Patent Cooperation Treaty⁸⁵ and the European Patent Convention;⁸⁶ and negotiations with the Trade Related Aspects of Intellectual Property.⁸⁷ Each period has tried to foster some type of global uniformity by having

78. 35 U.S.C. §§ 101–103 (establishing the patentability requirements for United States); *Guide for Applicants: How to get a European Patent*, *supra* note 77 (illustrating the three patentability requirements: invention, novelty, and inventive step).

79. 35 U.S.C. § 103 (defining the non-obvious requirement for the United States patent system).

80. *Guide for Applicants: How to get a European Patent*, *supra* note 77.

81. ROBERT PATRICK MERGES & JOHN FITZGERALD DUFFY, *PATENT LAW AND POLICY: CASES AND MATERIALS* 64 (Carolina Acad. Press, 7th ed. 2017) (giving the example that “Japanese patents have force only in Japan,” unless the inventor obtains a patent with every other nation where patent protection is desired).

82. *Id.* at 64-74.

83. *Id.* at 73-74.

84. Convention of Paris for the Protection of Industrial Property, art. 2, 4, Oct. 31, 1958, 828 U.N.T.S. 107 (last revised in 1979). The Paris Convention was the first period of change when it comes to international patent law. MERGES & DUFFY, *supra* note 81, at 64-65; *see also Paris Convention for the Protection of Industrial Property*, WORLD INTELL. PROP. ORG., <https://www.wipo.int/treaties/en/ip/paris> (last visited Apr. 22, 2019). The Paris Convention concluded in 1883, and it was the first step to discuss national treatment, right of priority, and common rules to protect innovations in other countries. *Paris Convention for the Protection of Industrial Property*, *supra*.

85. Patent Cooperation Treaty, pmbi., June 19, 1970, 28 U.S.T. 7645, 9 I.L.M. 978 [hereinafter PCT] (explaining in the preamble the desire to contribute to the process of science and technology, to perfect legal protection, and to help economic development); MERGES & DUFFY, *supra* note 81, at 65-66; *PCT FAQs: Protecting Your Inventions Abroad: Frequently Asked Questions About the Patent Cooperation Treaty (PCT)*, WORLD INTELL. PROP. ORG. (Oct. 2017), <http://www.wipo.int/pct/en/faqs/faqs.html> (“[Question:] What is the Patent Cooperation Treaty (PCT)? [Answer:] [A]n international treaty with more than 150 Contracting States. The PCT makes it possible to seek patent protection for an invention in a large number of countries by filing a single ‘international’ patent application . . .”).

86. Convention on the Grant of European Patents, Oct. 5, 1973, 1065 U.N.T.S. 199; MERGES & DUFFY, *supra* note 81, at 65-66.

87. Agreement on Trade-Related Aspects of Intellectual Property Rights, pt. II, § 5, arts. 27-34, Apr. 15 1994, 1869 U.N.T.S. 299 [hereinafter TRIPS]; MERGES & DUFFY, *supra* note 81, at 66-73.

the application apply to more countries.⁸⁸ Yet, the goal of harmonization remains one of the most controversial issues in patent law.⁸⁹

B. History of Space Law and International Treaties

Space exploration started in the 1900s.⁹⁰ Exploration took off during the space race in the Cold War between the Soviet Union and the United States.⁹¹ The Soviet Union launched *Sputnik I*, the first artificial satellite, into space.⁹² This was a huge milestone for mankind.⁹³

With the competition intensifying, the United States developed proposals for international verification of the testing of space objects in early 1957.⁹⁴ Those proposals were to reserve space exclusivity for a peaceful and scientific purpose.⁹⁵ Subsequently, the United Nations and the United States created Five Treaties regarding space.⁹⁶ They are commonly known as the “five United Nations treaties on outer space,” and agreed on various principles.⁹⁷ These treaties helped shape a legal framework for outer space to peacefully resolve issues.⁹⁸

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 (“Outer Space Treaty”), was the first of the Five Treaties to be opened for signatures on January 27, 1967, and then

88. MERGES & DUFFY, *supra* note 81, at 74.

89. *Id.*

90. *See The Space Race, supra* note 5; *see also A Brief History of Space Exploration, supra* note 4 (discussing United States’ history of the space race and the desire to become the dominant super power country in the world).

91. *The Space Race, supra* note 5.

92. *Id.*; *see also A Brief History of Space Exploration, supra* note 4.

93. *The Space Race, supra* note 5.

94. Outer Space Treaty, *supra* note 8, narrative, <http://www.state.gov/t/isn/5181.htm#narrative>.

95. *Id.*

96. *Id.*; The Rescue Agreement, *supra* note 35; Liability Convention, *supra* note 35; The Registration Convention, *supra* note 29; The Moon Agreement, *supra* note 35.

97. *Space Law Treaties and Principles, supra* note 35 (discussing the five declarations and legal principles). The legal principles include: The Declaration of Legal Principle Governing the Activities of States in the Exploration and Uses of Outer Space; The Principles Governing the Use by States of Artificial Earth Satellites for International Direct Television Broadcasting; The Principles Relating to Remote Sensing of the Earth from Outer Space; The Principles Relevant to the Use of Nuclear Power Sources in Outer Space; and The Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking into Particular Account the Needs of Developing Countries). *Id.*; *see supra* note 35 and accompanying text.

98. Kleiman, *supra* note 8.

entered into force on October 10, 1967.⁹⁹ According to the United Nations Office for Outer Space Affairs, the status as of January 2018 is as follows: 107 states ratified or accepted the treaty and twenty-three states signed the treaty.¹⁰⁰ After the United States signed the Treaty, President Lyndon B. Johnson stated:

This is an inspiring moment in the history of the human race. We are taking the first firm step toward keeping outer space free forever from the implements of war. . . . This treaty means that the moon and our sister planets will serve only the purpose of peace and not war.¹⁰¹

The Outer Space Treaty became the foundation of international space law, which forbids weapons of mass destruction in space, by stating that “[s]tates . . . [are] not to place in orbit around the earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction”¹⁰² In addition, this Treaty established broad principles of subsequent international treaties and national laws.¹⁰³ Therefore, the Outer Space Treaty helps to reserve the moon and other celestial bodies for peaceful purposes.¹⁰⁴ This Treaty again established that “[t]he moon and other celestial bodies shall be used by all States Parties to the Treaty *exclusively for peaceful purposes*,” thus emphasizing that peace is the utmost important aspect for the exploration of outer space.¹⁰⁵ Moreover, the Outer Space Treaty of 1967 has established that outer space is free for all nations and states to roam and explore,¹⁰⁶ and therefore, there is no territorial regime.¹⁰⁷

99. Outer Space Treaty, *supra* note 8.

100. COMMITTEE ON THE PEACEFUL USES OF OUTER SPACE, *Status of International Agreements Relating to Activities in Outer Space as of 1 January 2018*, (Apr. 9, 2018), http://www.unoosa.org/documents/pdf/spacelaw/treatystatus/AC105_C2_2018_CRP03E.pdf.

101. Press Release, Lyndon B. Johnson, XXXVI President of the United States, Remarks at the Signing of the Treaty on Outer Space (Jan. 27, 1967).

102. Outer Space Treaty, *supra* note 8, at art. IV.

103. Kleiman, *supra* note 8. These principles include that: “[t]he exploration and use of outer space shall be carried on for the benefit and in the interests of all mankind;” “[o]uter space and celestial bodies are free for exploration and use;” “[o]uter space and celestial bodies are not subject to national appropriation;” “[n]o weapons of mass destruction are permitted in outer space;” “[t]he moon and celestial bodies shall be used for exclusively peaceful purposes;” “[s]tates shall be responsible for their national activities in outer space;” and “[s]tates shall retain jurisdiction and control over their space objects” among others. *Id.*

104. Outer Space Treaty, *supra* note 8, at pmb1. (“Recognizing the common interest of all mankind in the progress of the exploration and use of outer space for *peaceful purposes*.” (emphasis added)).

105. *Id.* at art. 4. (emphasis added).

106. *Id.* at art. 1.

107. *Id.* at art. 2.

2. International Space Station

Currently, fifteen nations have contributed to the construction of the ISS.¹⁰⁸ Since 1998, piece-by-piece, the ISS was taken into outer space, where both astronauts and robots helped build the space station.¹⁰⁹ The purpose of the space station is to “enhance the scientific, technological, and commercial use of outer space”¹¹⁰ and to “further promote cooperation in the exploration and peaceful use of outer space.”¹¹¹ The two main activities that astronauts spend time on are performing experiments and maintaining the station.¹¹² These activities help nations research ways to benefit life on Earth and to further explore space—such as NASA researching ways to send humans into deep space.¹¹³

Before the first piece of the station was launched into outer space in 1998, the governments of Canada, the Member States of the European Space Agency, Japan, the Russian Federation, and the United States entered into the Space Station Agreement.¹¹⁴ The Space Station Agreement established the cooperation between and among the parties regarding the “detailed design, development, operation, and utilization” of the space station “for peaceful purposes.”¹¹⁵ However, most importantly, the Space Station Agreement has an article dealing with intellectual property.¹¹⁶ The Space Station Agreement in Article 21, Section 2 states:

[F]or purposes of intellectual property law, an activity occurring *in or on* a Space Station flight element *shall* be deemed to have occurred *only* in the territory of the Partner State of that element’s registry. . . . For avoidance of doubt, participation by a Partner State,

108. Howell, *supra* note 13.

109. *Id.* The first module piece of the space station was launched in 1998. *Id.* The main construction of the space stations was completed in 2011. *Id.* However, since 2000, the space station has been continuously occupied. *Id.*

110. See Space Station Agreement, *supra* note 13, at art. 1.

111. *Id.* at pmbl.

112. Howell, *supra* note 13; see Debra Werner, *U.S. Intellectual Property Rules Hinder Space Station Research*, SPACE NEWS (Nov. 27, 2013), <http://spacenews.com/38389us-intellectual-property-rules-hinder-space-station-research> (discussing the projects that will hopefully be conducted by Zero Gravity Solution, such as producing plants and food that will thrive in various new environments, exploring possible benefits of microgravity, and developing pharmaceutical remedies); see also Press Release, William J. Clinton, XLII President of the United States, Address Before a Joint Session of the Congress on the State of the Union, (Feb. 4, 1997). Then-President Clinton stated in his address that “[The United States] must continue to explore the heavens, pressing on with the Mars probes and the international space station, both of which will have practical applications for our everyday living.” *Id.*

113. See Howell, *supra* note 13; *What’s Next for NASA?*, *supra* note 19.

114. See generally Space Station Agreement, *supra* note 13.

115. *Id.* at art. 1.

116. See generally *id.*

its Cooperating Agency, or its related entities in an activity occurring in or on any other Partner's Space Station flight element shall not in and of itself alter or affect the jurisdiction over such activity¹¹⁷

Thus, this agreement establishes that if an activity occurs in the space station, the jurisdiction is determined by the registry of that element.¹¹⁸ Additionally, this agreement was “the first time that the major space powers instated an international patent jurisdiction . . . showing that international outer space law could actually be sustained.”¹¹⁹ The Space Station Agreement in Article 21, Section 3 emphasizes patent law by stating:

In respect of an invention *made in or on* any Space Station flight element by a *person who is not* its national or resident, a Partner State *shall not apply* its laws concerning secrecy of inventions so as to prevent the filing of a patent application . . . in any Partner State that provides for the protection of the secrecy of patent applications containing information that is classified or otherwise protected for national security purposes.¹²⁰

Thus, again, this establishes the determination of the location and country of where the invention took place on the space station by looking at the ownership and registry of the Station's element.¹²¹ It emphasizes that the location of the invention does not require the individual to be a national or resident of the country and that it limits this applicability of United States patent law to that of which was invented within its territory.¹²² Further, this does not preclude the inventor to file for a patent in other countries.¹²³ In addition, the Space Station Agreement sets boundaries by saying that a mere temporary presence does not create the right for any proceeding for a patented invention.¹²⁴

117. *Id.* at art. 21, § 2 (emphasis added).

118. Rochus Moenter, *The International Space Station: Legal Framework and Current Status*, 64 J. AIR L. & COM. 1033, 1052-54 (1999).

119. See William C. Pannell, *Pirate Battles in Outer Space: Preventing Patent Infringement on the 8th Sea*, 46 UNIV. MEM. L. REV. 733, 747-48 (2016).

120. Space Station Agreement, *supra* note 13, at art. 21, § 3 (emphasis added).

121. *International Space Station Legal Framework*, EUR. SPACE AGENCY, https://www.esa.int/Our_Activities/Human_and_Robotic_Exploration/International_Space_Station/International_Space_Station_legal_framework (last visited Apr. 22, 2019).

122. Moenter, *supra* note 118, at 1052-54.

123. *See id.*

124. *See id.*; see also Space Station Agreement, *supra* note 13, at art. 21, § 6 stating:

The temporary presence in the territory of a Partner State of any articles, including the components of a flight element, in transit between any place on Earth and any flight element of the Space Station registered by another Partner State or ESA shall not in itself form the basis for any proceedings in the first Partner State for patent infringement.

Space Station Agreement, *supra* note 13, at art. 17.

However, a drawback is that if a discovery occurs on the space station, there are only five years of exclusive rights.¹²⁵ Thus, this establishes some kind of jurisdiction on the ISS.¹²⁶ However, the Space Station Agreement does not mention other space stations, moons, celestial bodies, stars, or space.¹²⁷ This leads to the question of whose law will apply and what kind of remedy would there be if the patent was infringed in outer space?¹²⁸

3. Other International Treaties Regarding Territory

a. Five United Nations Treaties

As mentioned, there are five United Nations treaties on outer space that helped form space law.¹²⁹ Besides the Outer Space Treaty, the Convention on the Registration of Objects Launching into Outer Space (“Registration Convention”)¹³⁰ is also relevant to patent law and intellectual property.¹³¹ The Registration Convention was opened for signature in 1975 and entered into force in 1976 to provide a mechanism for states to identify space objects.¹³² The preamble states that the treaty is:

[T]o provide State Parties additional means and procedures to assist in the identification of space object, [b]elieving that a mandatory system of registering objects launched into outer space would . . . assist in their identification and would contribute to the application and development of international law governing the exploration and use of outer space.¹³³

Providing the means and procedures for identification of space objects further implements the notion that nations have their own “territory” (for example, its space object) in outer space.¹³⁴ This is

125. Werner, *supra* note 112.

126. See Moenter, *supra* note 118, at 1052-54.

127. See generally Space Station Agreement, *supra* note 13.

128. 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, 420-23 (1999); see also *infra* Part III.

129. See notes 95-96 and accompanying text.

130. The Registration Convention, *supra* note 29.

131. See 35 U.S.C. § 105 (2012) (establishing that United States patent law has extended the United States’ jurisdiction for patent infringements to acts that occurred in outer space where it was “under the jurisdiction or control of the United States,” and implements the Convention on Registration of Objects Launched into Outer Space).

132. The Registration Convention, *supra* note 29, at pmb1.

133. *Id.*

134. See *id.* at art. 2, ¶ 2 (establishing that if there are two or more states for a space object,

similar to patent law because just as states have to register their space objects, inventors or owners have to file—in other words “register”—their invention for a patent.¹³⁵ Additionally, the Registration Convention recalls past treaties to continuously build international law regarding outer space.¹³⁶

The Registration Convention built on the notions and principles set forth by the Convention of the International Liability for Damage Caused by Space Objects (“Liability Convention”).¹³⁷ The Liability Convention states how a launching state¹³⁸ will be absolutely liable “for damage caused by its space objects on the surface of the earth or to aircraft” and “due to its faults in space.”¹³⁹ Thus, it further establishes how nations may be seen to have territory or jurisdiction of a space object for purposes of liability in case of damage occurring.¹⁴⁰ It also discusses reflections and different scenarios as to how each nation can help one another and when nations are liable for those damages.¹⁴¹

The Agreement on the Rescue of Astronauts, the Return of Astronauts, and the Return of Objects Launched into Outer Space (“Rescue Agreement”)¹⁴² and the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (“Moon Agreement”)¹⁴³

there must be an agreement as to which state has jurisdiction and control over the space object and over any personnel). Article IV provides the procedure as to what information is needed to register a space object. *Id.* at art. IV.

135. *See id.* at 699; *see also* 35 U.S.C. § 111 (providing the information needed to file a patent application in the United States).

136. The Registration Convention, *supra* note 29, at pmbl.

137. Liability Convention, *supra* note 35; The Registration Convention, *supra* note 29, at pmbl. (“The States Parties to this Convention, . . . Recalling further that the Convention on international liability for damage caused by space objects of 29 March 1972 establishes international rules and procedures concerning the liability of launching States for damage caused by their space objects.” (citations omitted)).

138. Liability Convention, *supra* note 35, at art. I (defining the term “launching State” to mean “[a] State which launches or procures the launching of a space object” or “[a] state from whose territory or facility a space object is launched”).

139. *Convention on International Liability for Damage Caused by Space Objects*, U.N. OFF. OUTER SPACE AFF., <http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introliability-convention.html> (last visited Apr. 22, 2019).

140. *See* Liability Convention, *supra* note 35, at arts. II, III; *see also* Jason Krause, *5 United Nations Treaties in Outer Space*, AM. BAR ASS’N (Apr. 2017), http://www.abajournal.com/magazine/article/space_law. In 1978, the Soviet Union’s nuclear-powered satellites crashed in Canada, and the Soviet Union was thereafter penalized under the Liability Convention. *Id.*

141. Liability Convention, *supra* note 35, at arts. IX-XXI; Michael Listner, *Revisiting the Liability Convention: Reflections on ROSAT, Orbital Space Debris, and the Future of Space Law*, SPACE REV. (Oct. 17, 2011), <http://www.thespacereview.com/article/1948/1> (discussing different scenarios which have different standards of liability).

142. Rescue Agreement, *supra* note 35.

143. Moon Agreement, *supra* note 35.

are the two remaining treaties that are a part of the Five Treaties.¹⁴⁴ The Rescue Agreement expands the notion of peaceful exploration of outer space between nations and the cooperation between the nations.¹⁴⁵ It furthers the cooperation between nations because it outlines the obligation of a nation to help any personnel of a spacecraft that is in danger once it becomes aware of the situation.¹⁴⁶ The Moon Agreement noted that the moon “has an important role to play in the exploration of outer space,” thus taking measures to provide an international regime to govern the resources from the moon.¹⁴⁷ It instituted that the United Nations is to be informed about any activities regarding the exploration and use of the moon.¹⁴⁸ However, more importantly, both of these agreements further the main principle of the Outer Space Treaty—peace.¹⁴⁹

b. The High Seas and the Poles

Nevertheless, the formation and construction of space law still has some issues.¹⁵⁰ Looking at other treaties that are similar to the Five Treaties, especially the Outer Space Treaty, can help formulate a working plan for patent law in outer space.¹⁵¹ The high seas, Antarctica, and the Arctic are other international territories that are similar to outer space because the territory is open to all nations.¹⁵² Both the Law of the Sea and the Antarctic agreements do not allow any party to assert a

144. See notes 96-97 and accompanying text.

145. Rescue Agreement, *supra* note 35. The preamble states:

The Contracting Parties, [n]oting the *great importance* of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, which calls for the rendering of all possible assistance to astronauts in the event of accident, distress or emergency landing, the prompt and *safe* return of astronauts, and the return of objects launched into outer space, [d]esiring to develop and further concrete expression these duties, [w]ishing to promote international co-operation in the *peaceful exploration and use of outer space*.

Id. at pmb1. (emphasis added) (footnotes omitted).

146. *Id.* at arts. II–V.

147. The Moon Agreement, *supra* note 35, at pmb1., art. 1; see also *Agreement Governing the Activities of States on the Moon and Other Celestial Bodies*, U.N. OFF. OUTER SPACE AFF., <http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/intromoon-agreement.html> (last visited Apr. 22, 2019).

148. Moon Agreement, *supra* note 35, at art. 5.

149. Rescue Agreement, *supra* note 35, at pmb1.; Moon Agreement, *supra* note 35, at art. 3, ¶ 1.

150. See *infra* Part III.

151. See *infra* Part IV.

152. See Antarctic Treaty, *supra* note 37; UNCLOS, *supra* note 36; see also Pannell, *supra* note 119, at 740 (noting that maritime law has similarities to outer space law).

claim of sovereignty over the territory, which causes issues.¹⁵³ For example, in *Blumenthal v. United States*,¹⁵⁴ the issue at hand was whose law to apply to a tort action that occurred on the high seas.¹⁵⁵ The Third Circuit found that no foreign law could apply to the case.¹⁵⁶ Thus, the court held that, since no foreign law can be applied to the tort case, United States law governs.¹⁵⁷ Similarly, no single nation's law can be applied in outer space.¹⁵⁸ However, after this case, countries have agreed upon territorial bounds regarding the sea.¹⁵⁹

The United Nations Convention on the Law of the Sea ("UNCLOS")¹⁶⁰ establishes the territorial regime for the sea, such as internal and territorial waters.¹⁶¹ Thus, nations are subjected to its exclusive jurisdiction on the high seas.¹⁶² It also implemented treaties from previous conferences, such as the Convention on the High Seas Treaty.¹⁶³ UNCLOS is similar to the Outer Space Treaty because it states that "[t]he high seas are *open* to all States, whether coastal or landlocked. Freedom of the high seas is exercised under [this Convention],"¹⁶⁴ and "[t]he high seas shall be reserved for *peaceful purposes*."¹⁶⁵ Furthermore, UNCLOS is similar to the Registration Convention because it provides laws about how all ships sailing in international waters must establish and register to a country or a flag state.¹⁶⁶ Unlike the Registration Convention, the ships do not have to be

153. See Antarctic Treaty, *supra* note 37, at art. IV; UNCLOS, *supra* note 35, at pt. VII., § 1, art. 89.

154. 306 F.2d 16 (3d Cir. 1962). Respondent claimed that Section 1346(b) of the Federal Torts Claims Act requires that liability be determined by the law of the place where the action giving rise to potential liability occurred. *Id.*

155. *Id.* at 17, 19.

156. *Id.* at 17.

157. *Id.* at 19-20 (Smith, C.J., concurring).

158. See generally Joseph A. Bosco, *Liability of the United States Government for Outer Space Activities Which Result in Injuries, Damages or Death According to United States National Law*, 51 J. AIR L. & COM. 809, 832-33 (1986); Larry S. Kaplan, *Space-Specific Remedies for Torts in Outer Space: What Path Will U.S. Law Follow?*, 22 INT'L LAW. 1145, 1146-51 (1988).

159. See UNCLOS, *supra* note 36, at pmbl., pt. II (discussing the laws and agreements between the nations and states regarding the law of the sea).

160. *Id.*

161. *Id.* at pt. II. The territorial regime also includes the air space and the bed and subsoil. *Id.* at pt. II, § 1, ¶ 2.

162. UNCLOS, *supra* note 36, at pt. II; see also *United States v. Arra*, 630 F.2d 836, 839-40 (1st Cir. 1980) (exemplifying jurisdiction over the high seas and showing how the court looked towards the Convention on the High Seas to determine that if a vessel is registered, then it acquires its nationality).

163. See generally United Nations Convention on the High Seas: Law of the Sea, Apr. 29, 1958, 13 U.S.T. 2312, 480 U.N.T.S. 83; UNCLOS, *supra* note 36, at pt. VII, § 1.

164. UNCLOS, *supra* note 36, at pt. VII, § 1, art. 87, ¶ 1 (emphasis added).

165. *Id.* at pt. VII, § 1, art. 88 (emphasis added).

166. See *id.* at pt. VII, § 1, art. 91-92, 94; see also Pannell, *supra* note 119, at 740-41.

registered to the nation where the owner lives.¹⁶⁷ This is an issue because ships may register a flag of convenience, which can lead to forum shopping.¹⁶⁸ Moreover, UNCLOS does not mention protection of intellectual property on the high seas.¹⁶⁹

Other areas on Earth that no state can claim, own, or have any political sovereignty over are the Poles.¹⁷⁰ For example, the Antarctic Treaty was implemented to ensure “in the interest of all mankind that Antarctica shall continue forever to be used exclusively for *peaceful purposes* and shall not become the scene or object of international discord.”¹⁷¹ The Antarctic Treaty is also seen as an advanced model for the Arctic (the North Pole) governance¹⁷² and sets forth boundaries.¹⁷³ Additionally, it emphasizes that the territory is for peaceful purposes.¹⁷⁴ However, the North Pole is located in the central Arctic Ocean.¹⁷⁵ Therefore, it uses the law of the sea, which all nations have accepted as customary international law.¹⁷⁶ This exemplifies how negotiations, treaties, and customary international law can create peaceful solutions.¹⁷⁷

167. UNCLOS, *supra* note 36, at pt. VII, § 1, art. 91.

168. Pannell, *supra* note 119, at 741-42 (describing that using flag of convenience, ship owners would abuse the principle of registering to a nation to avoid their home country’s additional taxes, costs, and liabilities that would be required of them).

169. *See generally* UNCLOS, *supra* note 36.

170. Michael Byers, *Rules for the North Pole*, N.Y. TIMES (Aug. 18, 2011), <https://www.nytimes.com/2011/08/19/opinion/19iht-edbyers19.html>; Barbara Rhodes, *Who “Owns” the North Pole?*, 90 DEGREES N., <http://90north.tripod.com/northpole.htm> (last visited Apr. 22, 2019); *see also* *North Pole*, NAT’L GEOGRAPHIC SOC’Y, <https://www.nationalgeographic.org/encyclopedia/north-pole> (last visited Apr. 22, 2019).

171. Antarctic Treaty, *supra* note 37, at pmbl. (emphasis added).

172. Byers, *supra* note 170.

173. Antarctic Treaty, *supra* note 37, at art. VI (stating that the Antarctic Treaty provisions apply to the “area south of 60 [degrees] South latitude”).

174. *Id.* at pmbl., arts. I, II, V (stating that Antarctica is for peaceful purposes only, allowing freedom of scientific investigation, and prohibiting nuclear weapons that are not there for peaceful purposes).

175. Byers, *supra* note 170.

176. *Id.*

177. *Id.*

In the *North Sea Continental Shelf Cases*,¹⁷⁸ the Court held that customary international law requires equity,¹⁷⁹ a legal obligation.¹⁸⁰ An important stance that is derived from the case is that a treaty has the ability to codify custom.¹⁸¹ Customary international law is state practice and *opinio juris*.¹⁸² The custom and practice must be accepted as law, and the practice can be viewed as a norm.¹⁸³ A treaty may end up reflecting and utilizing customary international law as states may not have written customs.¹⁸⁴ Thus, space law can be viewed as a customary law that will be codified into a treaty.¹⁸⁵

4. The Patent Cooperation Treaty and the Trade Related Aspects of the Intellectual Property Agreement

The Patent Cooperation Treaty (“PCT”)¹⁸⁶ was enforced on January 24, 1978,¹⁸⁷ and has 152 contracting parties to date.¹⁸⁸ This is a treaty amongst countries that agreed for an “international” patent application worldwide.¹⁸⁹ It allows the patentee to request where they would like to

178. *North Sea Continental Shelf Cases* (Federal Republic of Germany v. Denmark; Federal Republic of Germany v. Netherlands), Judgment, 1969 I.C.J., Rep. 4 (Feb. 1969). *The North Sea Continental Shelf Cases* dealt with oil that underneath the sea bed. *Id.* at 34. The issue is that the three states that are side-by-side—Germany, Denmark, and the Netherlands—all want that oil. *Id.* at 52-53. The Netherlands argued that they should use the equidistant rule because the Geneva Convention is controlling. *Id.* at 11, 25. However, Germany is not a party of the Geneva Convention, and thus, the Convention is not binding on them. *Id.* at 25-26. Denmark argued that even though Germany is not a party to the treaty, the equidistant rule is customary international law. *Id.* at 12. The customary law is using a perpendicular line. *Id.* at 34. However, the problem with using that rule is that the ocean floor texture is not flat. *Id.* at 35. The court held that the equidistant rule will not apply because the states that used that rule did not do it as an obligation of law. *Id.* Therefore, the parties must delimit the continental shelf off their costs “in accordance with equitable principles.” *Id.* at 34.

179. *Id.* at 49-50.

180. *Id.* at 24.

181. *North Sea Continental Shelf Cases (Summary)*, PUB. INT’L L., <https://ruwanthikagunaratne.wordpress.com/2014/02/28/north-sea-continental-shelf-cases-summary> (last visited Apr. 22, 2019).

182. *Id.*

183. *See id.*

184. *See id.*

185. Christopher D. Johnson, *The Outer Space Treaty at 50*, SPACE REV. (Jan. 23, 2017), <http://www.thespacereview.com/article/3155/1>. “Many experts in international law believe that the fundamental provisions of treaty are so well-observed and respected that they exist as an entirely different set of legal rules, outside of the textual treaty as ‘customary’ international law.” *Id.*

186. PCT, *supra* note 85.

187. *Id.*

188. *WIPO-Administered Treaties*, WORLD INTELL. PROP. ORG., http://www.wipo.int/treaties/en/ShowResults.jsp?lang=en&treaty_id=6 (last visited Apr. 22, 2019) (illustrating the instrument used when each country signed the treaty—such as accession, ratification, and declaration—and when it went into force).

189. *Summary of the Patent Cooperation Treaty (PCT) (1970)*, WORLD INTELL. PROP. ORG.,

protect their patentable invention.¹⁹⁰ The purpose of the PCT is to aid patentees and nations and to foster better relationships with the contracting states.¹⁹¹ The PCT has been a prototype for other nations for processing, searching, and examining the patent.¹⁹² Furthermore, the importance of the PCT is that it serves to harmonize national law and procedures.¹⁹³ But yet, the PCT still acts as if the inventor filed in each state individually.¹⁹⁴

After the period of PCT, negotiations for the Trade Related Aspects of Intellectual Property Agreement (“TRIPS”) started.¹⁹⁵ TRIPS is part of the agreements established by the World Trade Organization (“WTO”),¹⁹⁶ which discusses international standards about intellectual property rights.¹⁹⁷ TRIPS’s preamble emphasizes “the importance of reducing tensions by reaching strengthened commitments to resolve disputes.”¹⁹⁸ Moreover, it uses a multilateral framework of principles, rules, and disciplines dealing with international trade.¹⁹⁹ TRIPS took one step closer to harmonization in the patent procedure.²⁰⁰

http://www.wipo.int/treaties/en/registration/pct/summary_pct.html (last visited Apr. 22, 2019) (“Ultimately, the PCT: brings the world within reach; streamlines the process of fulfilling *diverse* formality requirements; postpones the major costs associated with international patent protection; provides a strong basis for patenting decisions; and is used by the world’s major corporations, research institutions and universities in seeking international patent protection.” (emphasis added)).

190. PCT, *supra* note 85, at chp. I, art. 4, ¶ 1(ii).

191. *Id.* at pmbl. The preamble states the goals of the PCT:

Desiring to make a contribution to the *progress of science and technology*, . . . to perfect the legal protections of inventions, . . . to simplify and render more *economical* the obtaining of protection for inventions where protection is sought in several countries, . . . to facilitate and accelerate access by the public to the technical information contained in documents and describing new inventions, . . . to *foster and accelerate* the economic development of developing countries through the adoption of measures designed to increase the efficiency of their legal systems, . . . [to provide] easily accessible information on the availability of technological solutions applicable to their special needs and by facilitating access to the ever expanding volume of modern technology.

Id. at pmbl. (emphasis added).

192. Jay Erstling & Isabelle Boutillon, *Patent Cooperation Treaty: At the Center of the International Patent System*, 32 WM. MITCHELL L. REV. 1583, 1590-600 (2006) (discussing the legal framework, advantages, and accomplishments of the Patent Cooperation Treaty, such as applications making allegations and providing evidence of the truthfulness of the allegations and claims within the patent application).

193. *Id.* at 1598-660.

194. *Id.* at 1597.

195. MERGES & DUFFY, *supra* note 81, at 66.

196. *Id.* at 68.

197. *Policy*, WORLD INTELL. PROP. ORG., <http://www.wipo.int/policy/en> (last visited Apr. 22, 2019).

198. TRIPS, *supra* note 87, at pmbl.

199. *Id.* at arts. 1-8.

200. MERGES & DUFFY, *supra* note 81, at 73-74; *see also* TRIPS, *supra* note 87.

C. United States Extraterritorial Limits

Patents are territorial-based.²⁰¹ For patent infringement cases, if an invention is made, used, or sold in the United States, then the jurisdiction is the United States.²⁰² Currently, there are two cases that establish the territorial reach of United States patent law and when it may extend internationally.²⁰³ These cases illustrate and expand the definition of when an object is “used” in the United States.²⁰⁴

In 1976, the Court of Claims in *Decca Ltd. v. United States* held that there are three factors to be analyzed when determining whether the patented system was “used” within the territory of the United States.²⁰⁵ The patent system at issue was a worldwide navigational system called Omega.²⁰⁶ The system had three transmitting stations—two of which were located in the United States—to send signals to ships and aircrafts.²⁰⁷ The court held that since there were two stations in the United States, and the ship that received the information was registered to the United States, the Omega system was “used” within the United States.²⁰⁸ Hence, United States law prevailed for the patent infringement issue.²⁰⁹

In 2005, the United States Court of Appeals for the Federal Circuit in *NTP, Inc. v. Research in Motion, Ltd.* expanded and modified the factors used in *Decca* to determine the territorial limits of the United States.²¹⁰ The issue in this case involved the use of Blackberry phones and how emails can be received.²¹¹ The emails—the servers—were “physically” located in Canada, but were being used in the United States.²¹² The court held that infringement claims in the United States can have an extraterritorial reach if the three factors are fulfilled.²¹³

201. Holbrook, *supra* note 24, at 2130.

202. 35 U.S.C. § 271(a) (2012). This statute states that if any invention does not have authority, and that invention is either made, used, offered for sale, or sold in the United States then the jurisdiction should be in the United States. *Id.*

203. See *NTP, Inc. v. Research in Motion, Ltd.*, 418 F.3d 1282, 1316-18 (Fed. Cir. 2005) (creating a new service test, including *Decca* factors); *Decca Ltd., v. United States*, 210 Ct. Cl. 549, 550, 555 (Ct. Cl. 1976).

204. See *NTP*, 418 F.3d at 1316-17; *Decca*, 210 Ct. Cl. at 550, 552-53.

205. Pannell, *supra* note 119, at 739-40. Those factors include: (1) whether the control of a system occurred within the United States territory, (2) whether the system itself was owned by a United States entity, and (3) whether there is a beneficial use in the United States. *Id.*

206. *Decca*, 210 Ct. Cl. at 549.

207. *Id.* at 552-53.

208. *Id.* at 554-55; see also Pannell, *supra* note 119, at 739.

209. *Decca*, 544 F.2d at 596.

210. *NTP, Inc. v. Research in Motion, Ltd.*, 418 F.3d 1282, 1316-18 (Fed. Cir. 2005).

211. *Id.* at 1317.

212. *Id.* at 1318.

213. Pannell, *supra* note 119, at 740; see *supra* note 205.

Thus, this case illustrates how the United States has jurisdiction and authority over an infringement case in which space shuttles that are owned or used by the United States are transmitting signals elsewhere.²¹⁴

Additionally, the Patents in Space Act can be seen as the jurisdiction of the United States reaching extraterritorially towards outer space.²¹⁵ The purpose of implementing the Act is to extend United States jurisdiction to space.²¹⁶ However, the Act remains subject to international agreements to which the United States is a party.²¹⁷ Thus, the Patents in Space Act does not apply to the Space Station Agreement due to contradictions with the Act and the Treaty.²¹⁸

III. CONFLICTING JURISDICTIONS AND LAWS BETWEEN NATIONS

Space law does not specify which nation's law to use in certain cases, such as patent infringements.²¹⁹ As Kleiman noted, "Jurisdiction concerns *the power of the state to affect* people, property and circumstances and reflects the basic principles of state sovereignty, equality of states and non-interference in domestic affairs."²²⁰ Subpart A will examine the boundaries of Outer Space.²²¹ Subpart B will discuss the issue with jurisdiction—boundary issues—and Outer Space.²²² Then, Subpart C will illustrate the conflict with the Patent in Space Act and the Space Station Agreement.²²³ Lastly, Subpart D discusses the negative impacts on the economy due to patent infringements.²²⁴

A. Physical Boundaries of Outer Space

Before discussing jurisdiction issues, the question that needs to be addressed is: where does the atmosphere end and outer space begin?²²⁵

214. *Id.* at 739-40.

215. Shoemaker, *supra* note 128, at 421.

216. *Id.* at 418-19.

217. See 35 U.S.C. § 105(a) (2012) ("Any invention made, used or sold in outer space on a space object or component thereof under the jurisdiction or control of the United States shall be considered . . . within the United States for the purposes of this title, except . . . otherwise provided by an *international agreement* to which the United States is a party." (emphasis added)).

218. Shoemaker, *supra* note 128, at 421-23.

219. See Kleiman, *Patent Rights*, *supra* note 16.

220. Frans von der Dunk, *Space Law in the Age of the International Space Station*, 6 SPACE, CYBER, & TELECOMMS. L. PROGRAM FAC. PUBLICATIONS 148, 152 n.152 (2009) (emphasis added) (citing MALCOM N. SHAW, INTERNATIONAL LAW 393 (Cambridge: Groutis Publ'ns Limited 3d ed. 1991)).

221. See *infra* Part III.A.

222. See *infra* Part III.B.

223. See *infra* Part III.C.

224. See *infra* Part III.D.

225. Skye Gould & Sean Kane, *Here's Where Outer Space Actually Begins*, BUS. INSIDER

Though there is still not a complete consensus among scientists, there are some general agreements.²²⁶ The earth has five distinct atmospheric layers: troposphere, stratosphere, mesosphere, thermosphere, and exosphere.²²⁷ These boundaries are essential to patent law to establish a nation's exercise of power and jurisdiction.²²⁸

Scientists believe that sixty-two miles above sea level, which is known as the Kármán Line, starts the boundary of space.²²⁹ The Kármán Line starts the boundary of space because it is “the point where the speed needed to maintain altitude is equal to escape velocity: the speed at which a craft ceases to follow the curvature of the Earth, and the craft begins to enter space.”²³⁰ To put this into perspective, the troposphere is eight miles above sea level, and the height of Mount Everest is approximately 29,000 feet (approximately 5.5 miles) above sea level.²³¹ Airliners, which fly in the stratosphere, reach about 30,000 to 40,000 feet (approximately 5.7 to 7.6 miles) above sea level, and military airplanes can go as far as 85,000 feet (approximately 16 miles) above sea level.²³² The ISS is 200 miles above sea level, which is placed in the exosphere and way beyond the boundary line of space.²³³ Therefore, for the purposes of this Note, the jurisdiction of outer space begins at sixty-two miles of altitude, at the Kármán Line, and extends throughout the universe.²³⁴

B. Legal Boundaries in Outer Space

Outer space is considered an international space where no law, nation, nor state can govern or claim.²³⁵ Similarly, no nation or state can govern or claim Antarctica,²³⁶ the North Pole,²³⁷ or the high seas.²³⁸ Outer space is open for all, and no nation can claim any celestial body,

(July 8, 2016, 9:00 AM), <http://www.businessinsider.com/where-does-space-begin-2016-7>.

226. *Id.*

227. *Earth's Atmospheric Layers*, NAT'L AERONAUTICS & SPACE ADMIN. (Jan. 22, 2013), https://www.nasa.gov/mission_pages/sunearth/science/atmosphere-layers2.html.

228. See Holbrook, *supra* note 24, at 2129 (discussing how patents are territorial in nature).

229. Gould & Kane, *supra* note 225. The thermosphere begins around fifty-four miles above sea level. *Id.*

230. *Id.*

231. *Id.*

232. *Id.*

233. *Id.*

234. *Id.*

235. See Darrel C. Menthe, *Jurisdiction in Cyberspace: A Theory of International Spaces*, 4 MICH. TELECOMM. TECH. L. REV. 69, 83 (1998).

236. Antarctic Treaty, *supra* note 37, at art. VI; Menthe, *supra* note 235 at 84, 88-89.

237. See *supra* notes 169-76 and accompanying text.

238. See *supra* notes 159-68 and accompanying text.

star, or moon.²³⁹ If no nation can claim territory, then potentially no law can be applied, and patent infringers can disregard the law without any consequences.²⁴⁰ However, the Five Treaties discuss some type of jurisdiction or territory owned by a nation.²⁴¹ For instance, specific space crafts, objects, and satellites that are registered through recognition or treaties establish that a specific nation *may* have jurisdiction.²⁴²

The problem now becomes under whose jurisdiction and authority will infringement cases be held if the act of infringing on an invention occurred in outer space and not on Earth or the ISS.²⁴³ Therefore, when it comes to international law, it is very difficult to decipher whose law will prevail, which can cause tension and conflict between the nations.²⁴⁴

Tension and conflict will occur because each country has its own requirements and framework to apply for a patent.²⁴⁵ For example, one difference is the novelty requirement—whether it is absolute or relative novelty.²⁴⁶ The difference is specific novelty requirements have significant ramifications on whether a United States entity would file in a foreign country.²⁴⁷ These examples illustrate how countries view the patent system differently, and thus, each country holds different values.²⁴⁸

C. *The Patents in Space Act and the Space Station Agreement*

The ISS, a large spacecraft, tests and researches the issue of how to make human life better.²⁴⁹ The results of these efforts are linked to the

239. Outer Space Treaty, *supra* note 8, at art. II.

240. See Pannell, *supra* note 119, at 738; see, e.g., 35 U.S.C. § 271(a) (2012) (discussing how, in infringement cases, if an owner has a patent in the United States, the infringement act must occur within the United States in order for the owner to have a cause of action).

241. See *supra* Part II.B.1, II.B.3.a.

242. Shoemaker, *supra* note 128, at 402-03.

243. See Pannell, *supra* note 119, at 749-53 (discussing issues regarding the Patent in Space Act).

244. MALCOLM N. SHAW, INTERNATIONAL LAW 393 (Cambridge: Groutis Publ'ns Ltd. 3d ed. 1991) (illustrating a conflict that happened between two European States—Germany and Italy—where both states tried to extend the scope of their “national, territorially-based” legislation and tried to protect their inventions that have been created on another European state’s module).

245. See *supra* note 75.

246. James Yang, *Foreign Patent Filing to Secure Protection in Other Countries*, OC PATENT LAW. (Jan. 7, 2016), <https://ocpatentlawyer.com/foreign-patent-filing-to-secure-protection-in-other-countries>; see *supra* note 75.

247. Yang, *supra* note 246.

248. See *supra* note 75 and accompanying text.

249. Flint Wild, *What is the International Space Station?*, NAT'L AERONAUTICS & SPACE ADMIN. (Nov. 30, 2011), <https://www.nasa.gov/audience/forstudents/k-4/stories/nasa-knows/what-is-the-iss-k4.html> (last updated Apr. 20, 2018); see also Howell, *supra* note 13 (discussing what the ISS is and where inventions are actually taking place and being made in space, which dictates the

increase of commercialization in outer space, which leads to the possibility of patentable inventions.²⁵⁰

The Patents in Space Act's goal is to extend patent infringement cases in the United States to outer space.²⁵¹ However, as discussed in Part II, the Patents in Space Act would not apply to the Space Station Agreement.²⁵² The Space Act and the Space Station Agreement are not compatible.²⁵³ The Space Act is "rendered powerless to protect United States inventions in the context of the ISS."²⁵⁴ There are many loopholes for entities to go through to avoid liability.²⁵⁵ Furthermore, the Space Act only extends the United States' jurisdiction but does not discuss conflicting laws of other nations.²⁵⁶ Additionally, it provides that the United States has temporary jurisdiction based on the registered space module.²⁵⁷

The Space Station Agreement briefly discuss that each Partner (State) "shall retain jurisdiction and control over the elements it registers . . . and over personnel in or on the Space Station who are its nationals."²⁵⁸ Additionally, this Agreement was created in accordance with international law, such as the Outer Space Treaty, the Rescue Agreement, the Liability Convention, and the Registration Convention.²⁵⁹ However, in Article 21 of the Agreement, which is labeled as Intellectual Property, a provision states that a Partner State may not establish their laws of another.²⁶⁰ The Space Station Agreement established:

In respect of an invention made in or on any Space Station flight element by a person who is not its national or resident, a Partner State *shall not apply* its laws concerning secrecy of inventions so as to prevent the filing of a patent application [] in any other Partner State

effects of commercialization and infringement).

250. Ginger Christ, *The Commercialization of Space: Selling the Final Frontier*, INDUSTRY WK. (Oct. 31, 2014), <https://www.industryweek.com/transportation/commercialization-space-selling-final-frontier>.

251. 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. 202, 212 (2011).

252. See *supra* Part II.C.

253. See Shoemaker, *supra* note 128, at 419, 421-23.

254. *Id.* at 419.

255. Pannell, *supra* note 119, at 749-50 (discussing how an entity could avoid liability by launching their space object from another country, and thereby the United States would not have jurisdiction, nor the ability to use their law for infringement cases). *Id.*

256. *Id.* at 749.

257. *Id.*; see also von der Dunk, *supra* note 220, at 153-54.

258. Space Station Agreement, *supra* note 13, at art. 5, ¶ 2.

259. See *id.* at pmbl. (exemplifying the importance of these treaties and how they are still good law).

260. *Id.* at art. 21, ¶ 3.

that provides for the protection of the secrecy of patent application containing information that is classified or otherwise protected for [a] national security purpose.²⁶¹

The conflict between the Patents in Space Act and the Space Station Agreement exemplifies the need for new law.²⁶² Especially, if the United States wants to “avoid failure of the ISS,” then the conflicting Patents in Space Act will most likely not be fully enforced.²⁶³ Therefore, the philosophies behind each nation’s patent protection are at issue with an international patent jurisdiction.²⁶⁴

D. Negative Impacts of Patent Law Infringement

Intentional infringement on patents has negative impacts on the world of intellectual property; innovation may decrease and competition may be fierce.²⁶⁵ “An ineffective patent system could reduce incentives for private space companies to innovate”²⁶⁶ Innovation drives economic growth and aids in increasing the amount of available jobs.²⁶⁷ Infringement will harm jobs in particular because intellectual property industries have higher wages and thus can help and contribute to trade.²⁶⁸ Hence, these industries help the economy.²⁶⁹ Furthermore, counterfeiting and piracy have many more economic effects.²⁷⁰

261. *Id.* (emphasis added).

262. *See infra* Part IV.

263. Shoemaker, *supra* note 128, at 421.

264. *See* Shoemaker, *supra* note 128, at 420-23; *see also supra* Part II.A.1.

265. Ro, et al., *supra* note 251, at 221; *see* Matthew D. Powers & Steven C. Carlson, *The Evolution and Impact of the Doctrine of Willful Patent Infringement*, 51 SYRACUSE L. REV. 53, 99-101 (2001) (discussing the development and consequences of the present doctrine of willful patent infringement). There are a number of consequences, mostly relating to incentives and money, that can deter inventors from innovation. *Id.*

266. Ro, *supra* note 251, at 221.

267. *The Impact of Intellectual Property Theft on the Economy*, U.S. SENATE (Aug. 2012), https://www.jec.senate.gov/public/_cache/files/aa0183d4-8ad9-488f-9e38-7150a3bb62be/intellectual-property-theft-and-the-economy.pdf.

268. Nam D. Pham, *The Impact of Innovation and the Role of Intellectual Property Rights on U.S. Productivity, Competitiveness, Jobs, Wages, and Exports*, NDP CONSULTING 4-6, 51 (Apr. 2010), https://www.amchamchile.cl/sites/default/files/NDP_IP_Jobs_Study_Hi_Res.pdf.

269. *Id.* at 4-6.

270. *See The Economic Impact of Counterfeiting and Piracy: Executive Summary*, OECD 16-21 (2007), <https://www.oecd.org/sti/38707619.pdf>. Those effects include that: “(i) innovation is undermined, (ii) criminal networks gain financially, (iii) the environment is negatively impacted, [and] (iv) workers are worse off.” *Id.* at 17-18. Additional effects include losses in business sales, damaging the brand value, lowering of royalties, lessening of incentives to invest in new products and processes, higher costs due to increasing spending efforts, and the potential reduction in their overall operation. *Id.* at 18.

Infringement will make other inventors hesitant and nervous about developing technology in the same area.²⁷¹ There are problems regarding free-riding, where private companies may not want to do work anymore.²⁷² Thus, these threats deal with less incentives and increased costs.²⁷³ Additionally, if ideas are being stolen or infringed upon, businesses may lose revenue and profits.²⁷⁴ The negative impacts are both local and international.²⁷⁵ The issue of intent and willfulness tends to obstruct negotiations and further deter inventors and companies from working together.²⁷⁶ Companies may then find it more difficult to secure funding for research projects and develop activities that deal with outer space.²⁷⁷ Therefore, there is a need to protect patents, especially in outer space, when the inventions can be helpful to humanity.²⁷⁸

IV. INTELLECTUAL PROPERTY GALAXY TREATY

The last agreement between nations regarding outer space was the Space Station Agreement in 1998.²⁷⁹ Thus, space law needs to be updated.²⁸⁰ Even though there have been no cases that deal with patent infringement in space, it seems that with the change in times and advancement in technology, a violation would predictably occur.²⁸¹

271. *Why Patent Trolls Are Not All Bad*, FORBES (Dec. 7, 2015, 9:53 AM), <https://www.forbes.com/sites/knowledgewharton/2015/12/07/why-patent-trolls-are-not-all-bad/#308641178ed5>.

272. Mark A. Lemley, *Property, Intellectual Property, and Free Riding*, 83 TEX. L. REV. 1031, 1039-43 (2005).

273. *Id.* at 1042.

274. *See, e.g.*, Arthur Herman, *Feeding the Fire of Genius: Intellectual Property and America's High-Tech Future*, FORBES (Sept. 18, 2018, 3:41 PM), <https://www.forbes.com/sites/arthurherman/2018/09/18/feeding-the-fire-of-genius-intellectual-property-and-americas-high-tech-future/#2a3f805971b4> (discussing intellectual property theft and that it has been concluded that “Chinese theft of American IP currently costs between \$225 billion and \$600 billion annually”).

275. *See generally* Pham, *supra* note 268, at 10-11.

276. *See, e.g.*, Andrew H. DeVoogd & Christopher G. Duerden, *Insincere Licensing Discussions Can Support a Willful Infringement Claim*, MINTZ INSIGHT (June 4, 2018), <https://www.mintz.com/insights-center/viewpoints/2231/2018-06-insincere-licensing-discussions-can-support-willful>.

277. Pannell, *supra* note 119, at 751-53.

278. *See infra* Part IV.

279. *See generally* Space Station Agreement, *supra* note 13; *see also* *Space Law Treaties and Principles*, *supra* note 35.

280. Duncan Blake & Steven Freeland, *As the World Embraces Space, the 50 Year Old Outer Space Treaty Needs Adaption*, 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> (discussing how, since 1967, there has been a lot of change throughout the world).

281. *See generally id.*

An international treaty can provide a closure to this rift.²⁸² This Note recognizes that treaties are difficult for nations to negotiate, and even after negotiation, it is difficult for nations to agree to sign them.²⁸³ This new international treaty will create uniform patent protection,²⁸⁴ as harmonization has been a goal “to fuel innovation by establishing consistent principles of world patent law.”²⁸⁵ Subpart A discusses the benefits and purpose of a treaty specifically for intellectual property.²⁸⁶ It emphasizes the creation of a uniform patent system, specifically directed towards outer space.²⁸⁷ Next, Subpart B illustrates the requirements of a patent provision in the treaty.²⁸⁸ Further, Subpart C exemplifies how the treaty will be implemented with the nations.²⁸⁹ It further highlights the importance of having a patent provision in the treaty and possible issues that may arise.²⁹⁰

A. Purpose of the Intellectual Property Galaxy Treaty

The official purpose of implementing an Intellectual Property Galaxy Treaty (“IP Galaxy Treaty”) is to protect the principles of intellectual property law and to expand the fundamental principles of the Outer Space Treaty.²⁹¹

A uniform patent system in outer space would ultimately have similar effects as the PCT.²⁹² However, there are possible setbacks to a

282. See Ro et al., *supra* note 251, at 207.

283. Rick Gladstone, *A Treaty Is Reached to Ban Nuclear Arms. Now Comes the Hard Part.*, N.Y. TIMES (July 7, 2017), <https://www.nytimes.com/2017/07/07/world/americas/united-nations-nuclear-weapons-prohibition-destruction-global-treaty.html>. This article discusses how long the effort for a global treaty takes to be negotiated. See *id.* The treaty in this article is an “effort to avert a nuclear war.” *Id.* However, it is difficult for nations to then agree to sign the treaty. *Id.* For example, the United States, Britain, and France released a joint statement after the treaty was adopted, which states: “We do *not* intend to sign, ratify or ever become party to it.” *Id.* (emphasis added).

284. FRANCIS LYALL & PAUL B. LARSEN, *SPACE LAW: A TREATISE* 124-27 (2009) (“A general and uniform patent protection for inventions made in outer space would give investors confidence in outer space research and encourage such activities.”).

285. MERGES & DUFFY, *supra* note 81, at 74.

286. See *infra* Part IV.A.

287. See *infra* Part IV.A.

288. See *infra* Part IV.B.

289. See *infra* Part IV.C.

290. See *infra* Part IV.C.

291. See generally Outer Space Treaty, *supra* note 8.

292. See *PCT FAQs*, *supra* note 85 (“[Question:] What are the advantages of the Patent Cooperation Treaty? [Answer:] Ultimately, the PCT: brings the world within reach; streamlines the process of fulfilling diverse formality requirements; postpones the major costs associated with seeking multinational patent protection; provides a strong basis for patenting decisions; and is used by the world’s major corporations, research institutions and universities when they seek multinational patent protection.”).

globalized patent system.²⁹³ First, the patent process may cause a firm to become a monopoly.²⁹⁴ Second, inventors may be “patent troll[s],” who just obtain patents and collect damages and remedies on those who infringe on their invention.²⁹⁵ Lastly, it can also have a negative economic effect on certain countries because the difference in each state’s patent system affects global innovative activity differently.²⁹⁶

Yet, ultimately a uniform patent system would: (1) encourage trade, (2) create less of a burden in prosecuting international patent applications, and (3) reduce the cost of prosecution.²⁹⁷ Encouraging trade results in increased opportunities to develop stronger relations between nations.²⁹⁸ Similar to the Outer Space Treaty, the IP Galaxy Treaty “believes that such co-operation” of the signing of the treaty “will contribute to the development of mutual understanding and to the strengthening of friendly relations between states and peoples.”²⁹⁹

The IP Galaxy Treaty will echo the Outer Space Treaty to further “the common interest of all mankind in furthering the exploration and use of outer space for peaceful purposes.”³⁰⁰ A uniform patent system would eliminate the problem of deciphering whose law will prevail, and it would decrease the tension and conflict between the nations.³⁰¹ Protecting intellectual property rights in space activities will need a legal regime.³⁰² The goals and ambitions of the IP Galaxy Treaty would be iterated in the preamble and would state:

293. Walter G. Park, *Issues in International Patenting* 1, 17 (Apr. 1997) <http://auapps.american.edu/wgp/www/Issues%20IntlPat.pdf> (discussing through research the arguments against patent uniformity).

294. *Id.* at 2.

295. See Steve Brachmann, *New Hampshire Supreme Court to Hear Appeal in ‘Patent Troll’ Defamation Case*, IP WATCHDOG (Feb. 13, 2019), <http://www.ipwatchdog.com/2019/02/13/new-hampshire-supreme-court-hear-appeal-patent-troll-defamation-case/id=106228>.

296. Park, *supra* note 293, at 11-17. Nations are at different levels of technological advancement. *Id.* at 17. Having a global patent system can be harmful because of the huge gap. *Id.* at 17-18.

297. Randy L. Campbell, *Global Patent Law Harmonization: Benefits and Implementation*, 13 *IND. INT’L & COMP. L. REV.* 605, 605, 617, 618-19, 625-27 (2003).

298. See *id.* 617-19.

299. Outer Space Treaty, *supra* note 8, at pmb1.

300. *Id.*

301. See *supra* notes 243-45 and accompanying text.

302. Leo B. Malagar & Marlo Apalisok Magdoza-Malagar, *International Law of Outer Space and the Protection of Intellectual Property Rights*, 17 *B.U. INT’L L.J.* 311, 348-49 (1999) (emphasizing the importance of having a legal regime for intellectual property rights, and noting that the protection will encourage creators and investors “to be more active in space research and exploration,” thus, ultimately helping human kind).

The States parties to this Treaty;
Inspired by the great prospects of innovations as a result of humankind entry into outer space;
Recognizing the common interest of all mankind in furthering the exploration and use of outer space for peaceful purposes;
Recalling that the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Celestial Bodies of 27 January 1967; the Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space of 22 April 1968; the Patent Cooperation Treaty of 19 June 1970; the Convention on International Liability for Damage Caused by Space Objects of 29 March 1972; the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Celestial Bodies of 27 January 1967; the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies of 5 December 1979;
Desiring to contribute to the people for beneficial innovations;
Desiring to create harmony between nations as well as the scientific and legal exploration and use of outer space for peaceful purposes;
Convinced that the Intellectual Property Galaxy Treaty will further the purpose of intellectual property law;
Convinced that cooperation among nations will greatly facilitate the attainment of these aims.³⁰³

This preamble utilizes similar language to the previous treaties mentioned, including, but not limited to, the Outer Space Treaty, the Registration Convention, and the High Seas Convention.³⁰⁴ Intertwining these treaties will aid in succeeding the goals necessary for the IP Galaxy Treaty, and since various treaties have been implemented into other treaties, there is a higher rate of success for the States to be able to come to a negotiation and sign the IP Galaxy Treaty.³⁰⁵ After the preamble, the IP Galaxy Treaty will discuss the requirements for a Space Patent³⁰⁶ and the provisions to ensure a remedy.³⁰⁷

303. See Antarctic Treaty, *supra* note 37, at pmb1.; Outer Space Treaty, *supra* note 8, at pmb1.; Rescue Agreement, *supra* note 35, at pmb1.; PCT, *supra* note 85, at pmb1.; Liability Convention, *supra* note 34, at pmb1.; Registration Convention, *supra* note 29, at pmb1.; Moon Agreement, *supra* note 35, at pmb1.; UNCLOS, *supra* note 36, at pmb1.

304. See Antarctic Treaty, *supra* note 37, at pmb1.; Outer Space Treaty, *supra* note 8, at pmb1.; Rescue Agreement, *supra* note 35, at pmb1.; PCT, *supra* note 85, at pmb1.; Liability Convention, *supra* note 35, at pmb1.; Registration Convention, *supra* note 30, at pmb1.; Moon Agreement, *supra* note 35, at pmb1.; UNCLOS, *supra* note 36, at pmb1.

305. See Moon Agreement, *supra* note 35, at pmb1.

306. See *infra* Part IV.B.

307. See *infra* Part IV.C.

B. The Requirements of a Space Patent

First, for the purpose of this Note, the jurisdiction of the IP Galaxy Treaty begins at the Kármán Line, which is sixty-two miles above sea level and extends throughout the universe.³⁰⁸ Just as both the high seas and Antarctic agreements do not allow any party to assert a claim of sovereignty over any portion of the land or water, the IP Galaxy Treaty would treat space similarly and will use those treaties as precedent.³⁰⁹ Therefore, similar to the Antarctic Treaty, the IP Galaxy Treaty will be the advanced model of law for purposes of outer space, the moon, celestial bodies, stars, and galactic bodies, and will set forth the boundaries as mentioned.³¹⁰

The PCT is the closest treaty to a global patent system, as it has the possibility to protect an invention in various countries by filing an international patent application.³¹¹ However, it does not establish a uniform system because the patentee would use the laws and rules of specific countries they want protection in.³¹² For purposes of the IP Galaxy Treaty and the legal regime, the patent system would follow the procedures of filing under the PCT.³¹³

Therefore, the PCT will be recognized in the IP Galaxy Treaty.³¹⁴ The uniform patent system would *only* apply to outer space due to the fact that there are issues and different laws regarding an effective patent system on Earth.³¹⁵ Therefore, countries that have agreed to the IP Galaxy Treaty would be applying the laws and remedies set forth below.³¹⁶ The nations will need to come together and compromise on remedies.³¹⁷

Additionally, for the purpose of this Note, the global patent system would use a few requirements from the PCT and the United States Patent

308. See *supra* Part III.A.

309. See *supra* Part II.B.3.b.

310. See *supra* note 173 and accompanying text. See generally Outer Space Treaty, *supra* note 8.

311. See *supra* note 189 and accompanying text.

312. See generally *Summary of the Patent Cooperation Treaty (PCT) (1970)*, *supra* note 189.

313. See PCT, *supra* note 85, at chp. I, arts. 3-23, 25-26, 28-30 (discussing the filing procedures); see also *Summary of the Patent Cooperation Treaty (PCT) (1970)*, *supra* note 189 (discussing advantages of the PCT procedure).

314. See *supra* Part IV.A.

315. See *supra* Part II.A.1.

316. See, e.g., *infra* Part IV.C.

317. See Nat'l Research Council, *Seven Recommendations for the 21st-Century Patent System*, in A PATENT SYSTEM FOR THE 21ST CENTURY 81-83 (Stephen A. Merrill, Richard C. Levin & Mark B. Myers eds., Nat'l Acad. Press 2004). Even though the book was written in 2004 which is before the American Inventors Act, it is still relevant today, with similar issues still open for discussion such as a non-obvious standard. See also *id.*; 35 U.S.C. § 103 (2012).

System.³¹⁸ One requirement that will be used is to have an open-ended, unitary flexible patent system because it would give a broader exposure and a wide variety of sources of legal and innovative help.³¹⁹ This will lead to more positive economic benefits because having an open-ended system creates a wide variety of experts applying for patents, which generates more innovative ideas, and thus, there will be an increase in jobs in all areas of innovation-related law.³²⁰

Furthermore, there will need to be more discussions on the globalized patent system for outer space, such as other requirements necessary to be eligible for a patent and the possible remedies.³²¹ Some other requirements to be kept in mind include: using a non-obviousness standard,³²² an open review procedure,³²³ a diverse research liability for patent infringement,³²⁴ the three litigation elements to prosecute,³²⁵ and a greater grace period for filing an application after publication.³²⁶ Since the United States has a grace period of twelve months, while other nations vary from six to twelve months, an agreement should be made for twelve months.³²⁷

The novelty requirement would be narrowly interpreted for outer space.³²⁸ For example, the invention must be *for purposes of outer space*, therefore the definition of an invention for outer space should include both being “publicly used” *in* outer space and being “publicly known” *anywhere* in the world.³²⁹ This differs because some countries

318. See Nat'l Research Council, *supra* note 317, at 81-83 (discussing that in a global system several steps must be taken for an efficient patent system, such as that the patent system should be open-ended, have a non-obviousness standard, an open review standard, use three litigation elements for prosecution, and have a smaller grace period for filing an application about publication).

319. See *id.* at 83-87 (discussing why the patent system should preserve a flexible, unitary, open-ended patent system, believing that a broader exposure towards legal and economic factors will greatly influence innovation for the better).

320. See *supra* Part III.D.

321. See generally Nat'l Research Council, *supra* note 317.

322. *Id.* at 87-95 (establishing the non-obviousness standard to ensure that the invention is novel and using prior art).

323. See *id.* at 95-97 (discussing the beneficial reasons for a consistent patent standard which branches off an open review procedure).

324. See generally *id.* at 81-83.

325. *Id.* at 82-83. The three provisions are: (1) willful infringement, (2) the doctrine of best mode, and (3) the doctrine of “inequitable conduct.” *Id.* The authors of the book go into depth about the importance of each element and decipher some remedies for the patentee. See generally *id.*

326. See *id.* at 83.

327. See Michael Kahnert, *Inside Views: Introduction of a Grace Period in Europe*, INTELL. PROP. WATCH (Mar. 13, 2018), <http://www.ip-watch.org/2018/03/13/introduction-grace-period-europe>.

328. See Chaudhry, *supra* note 75.

329. *Id.*

only allow a cause of action for patent infringement cases if the invention was only publicly used and known in their own country.³³⁰ Thus, this broad requirement allows for a uniform patent system.³³¹

Conversely, harmonization among countries will create uncertainty because each state's patent law regime is shaped by the country's views on how patent law affects economic welfare and efficiency.³³² Each country has attained a different level of technology, so having a global patent system may not be "optimal for each nation's growth or welfare objectives."³³³ Harmonization will help create a widespread diffusion of knowledge and will increase international trade.³³⁴ Uniformity would help minimize the use of the patent system for strategic trade purposes, which benefits companies.³³⁵ Furthermore, it should be noted that an international patent jurisdiction would need every country to sign the IP Galaxy Treaty, making it difficult to nearly impossible for this Treaty to succeed.³³⁶

However, the globalization of the patent system is strictly only for the legal regime of outer space.³³⁷ To date, only three countries have sent their own astronauts into space aboard its own rockets.³³⁸ Therefore, the IP Galaxy Treaty is aimed at the countries who have the ability to reach outer space and the nations who have already agreed to work together with the ISS.³³⁹ The IP Galaxy Treaty will not interfere with creating a uniform patent system on land and between many nations.³⁴⁰ The IP Galaxy Treaty has precedent from the international community, as evidenced by the passing of the Space Station Agreement; nations have already come together to work for the purpose of furthering scientific discovery.³⁴¹

330. *Id.*

331. *See generally id.*

332. Park, *supra* note 293, at 17-21.

333. *Id.* at 17.

334. *Id.* at 18.

335. *Id.*

336. Pannell, *supra* note 119, at 755-56.

337. *See supra* note 315 and accompanying text.

338. The countries are the United States, Russia, and China. Steven Lee Myers & Zoe Mou, 'New Chapter' in Space Exploration as China Reaches Far Side of the Moon, N.Y. TIMES (Jan. 2, 2019), <https://www.nytimes.com/2019/01/02/world/asia/china-change-4-moon.html>.

339. *See supra* Parts II.B.2, IV.A.

340. *See supra* Part IV.A.

341. *See* Space Station Agreement, *supra* note 13, at pmb1.

C. Patent Provision

Each country that agrees to the IP Galaxy Treaty shall be able to use their own court system for litigation.³⁴² This would increase international communication and protect innovations.³⁴³ For example, prior to the IP Galaxy Treaty, it was more likely that a European partner would *only* recognize a license to an enforceable patent under the laws of *any* European Partner State.³⁴⁴

Thus, for purposes of uniformity, the IP Galaxy treaty should govern the law, especially when deciding what would constitute patent infringement.³⁴⁵ The provision would be similar to the United States statute and is as follows:

- (a) Any object, invention that was made, used, sold, or invented for outer space purposes or in outer space, or has been infringed while located in the jurisdiction of outer space, without the consent of the inventor or owner *shall* have a remedy for infringements set forth in this treaty.
- (b) Any invention made, used, sold, or invented for outer space purposes or in outer space, shall be considered to be made, used, or sold within the outer space jurisdiction for the purposes of this provision if specifically so agreed in this international agreement.³⁴⁶

An issue that may arise is that if a private entity (who is not a party to the treaty) is looking for infringement remedies, which nation's judge should hear the proceedings?³⁴⁷ If this were to arise, it could be possible to implement a panel of judges from each state to hear and decide the case. However, since each nation's judge may have different ideologies, the United Nations Office for Outer Space Affairs should take charge to create an unbiased panel as they have done with the United Nations Committee on the Peaceful Uses of Outer Space on International Cooperation under the Legal Subcommittee.³⁴⁸ This committee should create a subcommittee for the purpose of intellectual property disputes between the states that have signed the IP Galaxy Treaty and use judges from each nation.³⁴⁹

342. See, e.g., TRIPS, *supra* note 87, at pt. III, § 1, art. 41.

343. See *supra* notes 292-98 and accompanying text.

344. See *supra* note 302 and accompanying text.

345. See *supra* Part III.C.

346. See generally 35 U.S.C. § 105 (2012).

347. See Pannell, *supra* note 189, at 753-55; see also *supra* Part II.A.1.

348. See, e.g., *Committee on the Peaceful Uses of Outer Space*, UNOOSA (2018), <http://www.unoosa.org/oosa/en/ourwork/copuos/index.html>.

349. *Id.* (discussing how and when the committee was set up, and that its purpose is “to govern the exploration and use of space for the benefit of all humanity: for peace, security and

V. CONCLUSION

Technology is at the frontier of outer space.³⁵⁰ Whether the mission is to send a car into space or work on the ISS.³⁵¹ The ISS is one of many examples where nations have come together to work and to explore outer space with peace being the number one priority.³⁵² However, the Space Station Agreement gives jurisdiction to a nation's registered vehicle and its specific area on the ISS.³⁵³ Therefore, the issue remains to be: if a patented object that is in space and not on the ISS is infringed, then whose jurisdiction and law will prevail?³⁵⁴

The Outer Space Treaty is a foundation of international space law and has established that outer space should be for all nations to explore freely.³⁵⁵ Other treaties, such as the Registration Convention, the Rescue Agreement, the Moon Agreement, and the Liability Convention, have mentioned and expanded the Outer Space Treaty's principles.³⁵⁶ Each of the Five Treaties are continuously a success and have helped establish peace in outer space between nations.³⁵⁷ Yet, jurisdiction throughout outer space has not been defined in these treaties and this will be an issue within the field of intellectual property because patents are based on territory.³⁵⁸ Therefore, one legal issue to consider is whose law will prevail in a patent infringement case?³⁵⁹ This is especially consequential when patent infringements can cause a decrease in innovation.³⁶⁰ On Earth, each nation has its own patent system, and if an inventor wants to patent their invention throughout the world, they would need to apply to each nation separately.³⁶¹ This is time-consuming and costly.³⁶² Therefore, ideas of an international uniform patent system have been considered but denied due to the nations' different ideologies about the patent system.³⁶³

development;" additionally, the committee's platform monitors at a global level, and discusses the space exploration and technological advancements).

350. See *supra* Part III.

351. See *supra* note 2; see also Part II.B.2.

352. See *supra* Part II.B.2.

353. See *supra* Part II.B.2; see also *supra* Part II.B.3.

354. See *supra* Part III.

355. See *supra* Part II.A.1.

356. See *supra* Part II.B.3.

357. See *supra* Part II.B.3.

358. See *supra* Part III.B.

359. See *supra* Part III.

360. See *supra* Part III.D.

361. See *supra* Part II.A.1.

362. See *supra* Part IV.A.

363. See *supra* Part IV.A.

However, this proposed treaty, the IP Galaxy Treaty, deals only with outer space territory.³⁶⁴ The IP Galaxy Treaty uses the Outer Space Treaty and the Space Station Agreement as fundamental blocks, which indicates that this proposed treaty will likely succeed in compromises between nations, especially with the very few nations who have reached outer space and even the moon.³⁶⁵

The IP Galaxy Treaty's utmost importance is to protect the rights of the inventors or entities and to continue to have peace while developing scientific innovation.³⁶⁶ A uniform patent system would: (1) encourage trade, (2) create less of a burden in prosecuting international patent applications, and (3) reduce the cost of prosecution.³⁶⁷

Space law needs to be updated, and must continue to promote "the common interest of all mankind in furthering the exploration and use of outer space for peaceful purposes."³⁶⁸ A uniform patent system set forth in the IP Galaxy Treaty, which is specifically designed for outer space, would eliminate the problem of deciphering whose law will prevail, decrease the tension and conflict between the nations, increase international communication, and ultimately benefit the field of intellectual property law.³⁶⁹

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364. *See supra* Part IV.

365. *See supra* Part IV.

366. *See supra* Part IV.A.

367. *See supra* Part IV.A.

368. *See supra* Part IV; *supra* text accompanying note 300 and accompanying text.

369. *See supra* Part III.D; *see also supra* Part IV.

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