

Charting the Course of Intellectual Property Laws in the Privatization of Outer Space

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I. INTRODUCTION

In September 2017, Space Exploration Technologies Corporation, popularly known as SpaceX — a company that “designs, manufactures[,] and launches advanced rockets and space[]craft[s,]”¹ — “outlined plans [] to begin cargo

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1. SpaceX, About SpaceX, *available at* <http://www.spacex.com/about> (last accessed Feb. 29, 2020) & Bloomberg, Aerospace and Defense: Company Overview of Space Exploration Technologies Corp., *available at* <https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=7702894> (last accessed Feb. 29, 2020).

flights to Mars by 2022 and human landings there two years later[.]”² To most, space flight and exploration seem simultaneously anachronistic and ultramodern. On the one hand, visiting outer space is a nostalgic relic of 1960s media,³ which documented every cosmic step the world took. As more manned missions went to space, the novelty wore off, and public enthusiasm for space programs seemed to wane after the Challenger explosion in 1986.⁴ Conversely, general space travel, to the public, remains the object of science fiction and children’s animation.⁵

In reality, the space industry is an entrenched part of the infrastructure, from manned international space stations to abundant satellites for entertainment and geographic positioning. The recent popular science fiction novel, *The Martian*, which details a Mars mission and long-term existence on the planet, is based on existing technology and set in 2035, fewer than 20 years from now.⁶ The United States (U.S.) National Aeronautics and Space Administration (NASA) identified nine technologies featured in *The Martian* that are already in development or in use in outer space.⁷ While the technology in *The Martian* is current, the space laws which the novel references to are decidedly dated. The governing Outer Space

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2. Ed Adamczyk, Musk’s SpaceX plans cargo trips to Mars by 2022, humans by 2024, *available at* <https://www.upi.com/Musks-SpaceX-plans-cargo-trips-to-Mars-by-2022-humans-by-2024/9551506682382> (last accessed Feb. 29, 2020).
 3. Randy Kennedy, *When the Space Age Blasted Off, Pop Culture Followed*, N.Y. TIMES, Sep. 25, 2007, *available at* <http://www.nytimes.com/2007/09/25/science/space/25pop.html> (last accessed Feb. 29, 2020).
 4. *See generally* Randy Stone & Jennifer Ross-Nazzal, *The Accidents: A Nation’s Tragedy, in NASA’S CHALLENGE, IN WINGS IN ORBIT: SCIENTIFIC AND ENGINEERING LEGACIES OF THE SPACE SHUTTLE 1971-2010* 32-41 (Wayne Hale, et al. eds., 2011).
 5. Kennedy, *supra* note 3.
 6. Doug Anderson, *The Martian is a survival story set in the year 2035*, SYDNEY MORNING HERALD, Sep. 1, 2017, *available at* <http://www.smh.com.au/entertainment/tv-and-radio/the-martian-is-a-survival-story-set-in-the-year-2035-20170901-gy8ux7.html> (last accessed Feb. 29, 2020).
 7. Janey Tracey, NASA’s Side-By-Side Comparison of The Martian and the Real Mission to Mars, *available at* <https://www.outerplaces.com/science/item/10042-nasa-s-side-by-side-comparison-of-the-martian-and-the-real-mission-to-mars> (last accessed Feb. 29, 2020).

Treaty⁸ was ratified in 1967,⁹ two years before Neil Armstrong walked on the moon.¹⁰ As such, the Outer Space Treaty and others that followed had the spirit of international cooperation and scientific exploration for the good of the planet.¹¹

Like the laws, these goals, while worthy, are not necessarily accurate today. In 2016, space start-ups received U.S.\$2.8 billion in private investment.¹² Private actors, such as SpaceX, are leading innovations and explorations in outer space.¹³ As a result, countries have enacted domestic laws to regulate the entities engaging in outer space activity. Every year, more nations add to the growing anthology of outer space law in an attempt to prepare for the time when the future becomes the present.¹⁴ Many of these laws specify that they are bound by the strictures of the governing international treaty foundation.¹⁵ The dueling aims of corporate profit and global benefit, though, create possible complications.

One such area is intellectual property. The treaties generally do not contemplate the assertion of private ownership rights. As several of the key space players are using Internet-driven fortunes to fund activities,¹⁶

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8. Treaty on principles governing the activities of States in the exploration and use of outer space, including the moon and other celestial bodies, *opened for signature* Jan. 27, 1967, 610 U.N.T.S. 205 [hereinafter Outer Space Treaty].
 9. *Id.* The Outer Space Treaty entered into force in 1967. *Id.* at 206, n. 1. *See also* Outer Space Treaty, *supra* note 8, art. XIV, ¶ 3.
 10. John Noble Wilford, *Men Walk on Moon: Astronauts Land on Plain; Collect Rocks, Plant Flag*, N.Y. TIMES, July 21, 1969, at A1.
 11. Outer Space Treaty, *supra* note 8, pmbl.
 12. Clay Dillow, Investors pour billions into commercial space start-ups as they approach exit velocity, *available at* <https://www.cnbc.com/2017/08/09/investors-pour-billions-into-spacex-blue-origin-planet.html> (last accessed Feb. 29, 2020).
 13. Monica Grady, Private companies are launching a new space race – here’s what to expect, *available at* <http://theconversation.com/private-companies-are-launching-a-new-space-race-heres-what-to-expect-80697> (last accessed Feb. 29, 2020).
 14. *See generally* JULIAN HERMIDA, LEGAL BASIS FOR A NATIONAL SPACE LEGISLATION 73-183 (2004).
 15. Heidi Keefe, *Making the Final Frontier Feasible: A Critical Look at the Current Body of Outer Space Law*, 11 SANTA CLARA COMPUTER & HIGH TECH. L.J. 345, 348-57 (1995).
 16. Grady, *supra* note 13.

intellectual property rights are crucial. The challenge will be to create a universe where corporate profit and global benefit can coexist peacefully. This Article examines how national legislatures are handling intellectual property in the outer space industry, how bilateral and multilateral agreements have addressed it and other private interests, and whether intellectual property can fit into the current outer space treaty structure. This Article will first look at recent activities in outer space. Then, this Article will examine the international treaty framework that has governed outer space activity since 1958. The subsequent discussion tackles bilateral and multilateral agreements that attempt to regulate national legislation to learn what individual nations have done, as well as to identify some of the conflicts with the international framework.

II. INTELLECTUAL PROPERTY ACTIVITIES IN OUTER SPACE

At first glance, it may not appear that the issue of outer space presents any problems for the current regime of intellectual property. The World Intellectual Property Office (WIPO) has noted that intellectual property in the realm of “outer space” is not entirely different than intellectual property in other novel areas of technology.¹⁷ Most of the inventing, creating, and authoring, while dealing with the particular space industry, occur on Earth, and do not necessitate any deviation from the familiar application of intellectual property laws as they currently exist.

By the very nature of the industry, however, issues specific to outer space and the intellectual property derived from outer space activities are bound to arise. Dr. Yun Zhao, Professor of Law at the University of Hong Kong and Space Law specialist, identified five categories of patentable inventions that are relevant to outer space:

- (1) inventions made on earth for space applications;
- (2) inventions made on earth for terrestrial applications as a result of space activities (including telecommunications);
- (3) inventions made in outer space for terrestrial applications;
- (4) inventions made in outer space for spatial applications; [and]

17. Tomoko Miyamoto, World Intellectual Property Organization, Technical Presentation at the 754th Meeting of United Nations Committee on the Peaceful Uses of Outer Space, Legal Subcommittee, Vienna (Mar. 29, 2007) (transcript *available* at http://www.unoosa.org/pdf/transcripts/legal/LEGAL_T754E.pdf (last accessed Feb. 29, 2020)).

- (5) inventions patented on earth for spatial applications used in outer space.¹⁸

The first two categories of inventions are earth-based and territorial, and can likely be governed adequately by the intellectual property regimes already in place.¹⁹ The last, an invention patented on earth for spatial applications used in outer space, would receive its State-based patent, but infringement could occur if the invention is made or used once the maker or user is in space.²⁰ The inventions conceived in space create additional problems, as “outer space” lacks the territory that would typically define the applicable law for a patentable right. The International Space Station (ISS) has a Low Earth Orbit, about 400 kilometers above the Earth’s surface.²¹ Space objects orbiting at that altitude are traveling at 28,000 kilometers per hour and often pass the territorial borders of several nations in an hour’s time.²² Inventions made in outer space, regardless of their application, present procedural and jurisdictional challenges to the administration of intellectual property laws. The notion of scientific discovery and invention in space itself is not farfetched; an experiment performed in the space environment alone may be sufficient to satisfy the patent requirement of novelty.²³

Patented inventions are not the only form of space-related intellectual property that requires consideration. For decades, remote sensing and satellite technology have created an intellectual property issue.²⁴ The data

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18. Yun Zhao, Protection of Intellectual Property Rights in Outer Space (Paper Presented at the 57th International Astronautical Congress, International Astronautical Congress, Valencia, Spain) at 166, available at <http://www.iislweb.org/docs/Diederiks2006.pdf> (last accessed Feb. 29, 2020) (citing RECHTSANWALT M. SCHMITTMANN & I.L.V. DE VRIES, INTELLECTUAL PROPERTY RIGHTS AND SPACE ACTIVITIES IN EUROPE 4-5 (1997)).
19. Zhao, *supra* note 18, at 166-68.
20. *Id.*
21. Smithsonian National Air and Space Museum, Ask an Explainer, available at <http://howthingsfly.si.edu/ask-an-explainer/do-all-satellites-have-fly-same-speed-so-not-leave-their-orbit> (last accessed Feb. 29, 2020).
22. *Id.*
23. Zhao, *supra* note 18, at 162-64.
24. See, e.g., Julie D. Cromer, *How on Earth Terrestrial Laws Can Protect Geospatial Data*, 32 J. SPACE L. 253, 253-56 (2006) & Catherine Doldirina, *A Rightly Balanced Intellectual Property Rights Regime as a Mechanism to Enhance Commercial Earth Observation Activities*, 67 ACTA ASTRONAUTICA 521, 639-40 (2010).

generated by these satellites have been important not only to governmental activities but also to private ventures.²⁵ “Two-thirds of all earth observation (EO) satellites launched in 2008 were commercial or civilian[,]”²⁶ and telecommunications carriers have partnered with launch vehicles and the ISS to put their private microsatellites into orbit.²⁷

As a result of this activity,

[it is] the terabytes of data streaming to Earth daily from a new generation of smaller, less-expensive satellites — thousands of which are slated to join the roughly 1,500 satellites already in orbit over the next several years — that have piqued investors’ interest in everything from satellites themselves to software used to analyze their data and new rockets designed to loft them into orbit.²⁸

However, private ventures are not limited to the capture of data by satellites. Several corporations, backed by big-name investors, have begun their own endeavors into space travel and exploration. SpaceX, headed by Elon Musk, advertises commercial launch services not only for cargo but also for humans.²⁹ Blue Origin, backed by Amazon’s Jeff Bezos, is developing space flight systems, building a “culture around methodical innovation and exploration.”³⁰ Richard Branson’s Virgin Galactic joins its aerospace counterparts in offering flights to space tourists.³¹

Other companies are more specialized. Planetary Resources is the first commercial venture into deep space exploration, with a goal of mining for

25. Doldirina, *supra* note 24, at 639-40.

26. *Id.* at 639.

27. *See, e.g.*, Pia Ranada, Introducing Diwata, the first Philippine-made satellite, *available at* <https://www.rappler.com/nation/86327-philippine-microsatellite-diwata> (last accessed Feb. 29, 2020).

28. Dillow, *supra* note 12.

29. *See* SpaceX, *supra* note 1.

30. S.A. Applin, *Tech Billionaires Are Building Their Utopias Without Asking Us*, VICE, May 26, 2018, *available at* https://www.vice.com/en_asia/article/3k4bmv/elon-musk-boring-company-spacex-utopia (last accessed Feb. 29, 2020) & Alan Boyle, Life, liberty and the pursuit of spaceflight? Jeff Bezos links Blue Origin to saving Earth, *available at* <https://www.geekwire.com/2017/life-liberty-pursuit-spaceflight-jeff-bezos-links-blue-origin-saving-earth> (last accessed Feb. 29, 2020).

31. *See* Virgin Galactic, Purpose, *available at* <http://www.virgingalactic.com/purpose> (last accessed Feb. 29, 2020).

water after launching to targeted asteroids by 2020.³² Deep Space Industries provides spacecraft components for asteroid mining and also provides updated technology for existing but aging spacecraft.³³

Still other private players focus on providing goods and services ancillary to launch. Sierra Nevada Corporation, founded in 1963, is developing the DreamChaser, a vehicle designed to transport crew to the ISS and other low-orbit destinations.³⁴ Bigelow Aerospace focuses on habitable space structures, and its founder and president Robert Bigelow “holds the exclusive licensing rights to commercialize expandable habitat technology originally conceived but abandoned by NASA in the 1990s.”³⁵

The laws that protect these new commercial ventures is far from uniform. As early as 1997, WIPO had a meeting of consultants for inventions “made or used in outer space” that determined that for the time being, a specialized form of industrial property tailored to outer space was not required, but that eventually, it might need to be.³⁶ Current intellectual property legislation was then sufficient to cover the subject matter of outer

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32. See Planetary Resources, Redefining Natural Resources, *available at* <https://www.planetaryresources.com/why-asteroids> (last accessed Feb. 29, 2020) & Planetary Resources, About the Exploration Program, *available at* <https://www.planetaryresources.com/missions/arkyd-301> (last accessed Feb. 29, 2020).
 33. See Deep Space Industries, Who We Are, *available at* <https://www.deepspaceindustries.com> (last accessed Feb. 29, 2020). The company is now owned by Bradford Space. Jeff Foust, Deep Space Industries Acquired by Bradford Space, *available at* <https://www.space.com/42906-deep-space-industries-acquired-by-bradford-space.html> (last accessed Feb. 29, 2020).
 34. See Sierra Nevada Corporation, Space Systems, *available at* <https://www.sncorp.com> (last accessed Feb. 29, 2020); Sierra Nevada Corporation, About Dream Chaser, *available at* <https://www.sncorp.com/what-we-do/dream-chaser-space-vehicle> (last accessed Feb. 29, 2020); & Craft, Profile: Sierra Nevada Corporation, *available at* <https://craft.co/sierra-nevada-corporation> (last accessed Feb. 29, 2020).
 35. See Bigelow Aerospace, Who We Are, *available at* <http://bigelow-aerospace.com/pages/whoweare> (last accessed Feb. 29, 2020).
 36. See World Intellectual Property Organization, Meeting of Consultants on Inventions Made or Used in Outer Space (Discussion Paper Prepared by the International Bureau) *available at* http://www.wipo.int/export/sites/www/patent-law/en/developments/pdf/inventions_space.pdf (last accessed Feb. 29, 2020).

space creations.³⁷ However, the lack of harmonization of national legislation, and the absence of international requirement enforcing its harmonization, almost guaranteed that there would be eventual problems.³⁸ Where there is a bilateral or multilateral agreement among nations with respect to outer space activities, generally, there is a provision dealing with intellectual property.³⁹ However, absent such an agreement, the lack of harmonization, even in light of the applicable intellectual property treaties, becomes problematic.

First, while most ventures into outer space are multinational by nature, joint international ownership of patents and copyrights is largely unaddressed. Second, licensing information and confidentiality necessarily fall within contract provisions, opening up another area of divergent law requiring interpretation. Third, enforcement of intellectual property rights is not uniform; the recent Hague Judgments Convention requiring uniform recognition and enforcement of civil and commercial judgments lists intellectual property as a specific exclusion.⁴⁰ “The only possibility for patent protection in outer space [under the existing legal regime] is to extract some words or provisions in the international agreements and give them a broad explanation.”⁴¹

WIPO has drawn its own analogies in order to assume some regulation of intellectual property in space exists. For example, the office identified article 5ter of the Paris Convention as exempting from infringement “use on board vessels of other countries of the Union of devices”⁴² necessary for the operation of the vessel or its purpose, “when such vessels temporarily or

37. *Id.*

38. *Id.*

39. *Id.*

40. Convention of 2 July 2019 on the Recognition and Enforcement of Foreign Judgments in Civil or Commercial Matters art. 2 (1) (m), *signed* July 2, 2019, *available* at <https://www.hcch.net/en/instruments/conventions/full-text/?cid=137> (last accessed Feb. 29, 2020). *See generally* HAGUE CONFERENCE ON PRIVATE INTERNATIONAL LAW, PRINCIPLES ON CHOICE OF LAW IN INTERNATIONAL COMMERCIAL CONTRACTS (2015).

41. Zhao, *supra* note 18, at 167.

42. Paris Convention for the Protection of Industrial Property of March 20, 1883, as revised at Brussels on December 14, 1900, at Washington on June 2, 1911, at The Hague on November 6, 1925, at London on June 2, 1934, at Lisbon on October 31, 1958, and at Stockholm on July 14, 1967, art. 5ter, ¶ 2, *opened for signature* Mar. 20, 1883, 828 U.N.T.S. 305.

accidentally enter”⁴³ international air or waters.⁴⁴ This interpretation mirrors the language found in some of the international treaties governing outer space activities.

III. OUTER SPACE TREATIES

Activities in outer space are international by nature. While some satellites are geostationary, residing in a fixed place in the atmosphere, the territory that such a satellite can cover on the earth is expansive, without regard to international borders.⁴⁵ The Fédération Aéronautique Internationale recognizes an altitude of 100 kilometers above sea level as the difference between outer space and aerospace.⁴⁶ Above that, a vessel is considered to be in international aerospace.⁴⁷ Since Low Earth Orbit vehicles travel 400 kilometers above sea level,⁴⁸ it is safe to assume that most orbiting machines are in international territory. As such, it is appropriate to first look at the international treaty structure to determine how these vessels are governed.

The Committee on the Peaceful Uses of Outer Space (COPUOS) is the forum for the international development of space law, and it “has concluded five international treaties and five sets of [international] principles on space-related activities.”⁴⁹ Some basic features of international space law were set forth in the United Nations General Assembly Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of

43. *Id.*

44. *Id.*

45. The Editors of Encyclopaedia Britannica, Geostationary orbit, *available at* <https://www.britannica.com/science/geostationary-orbit> (last accessed Feb. 29, 2020).

46. S. Sanz Fernández de Córdoba, 100km Altitude Boundary For Astronautics, *available at* <https://www.fai.org/page/icare-boundary> (last accessed Feb. 29, 2020).

47. See Dennis Jenkins, Schneider walks the Walk, *available at* https://www.nasa.gov/centers/dryden/news/X-Press/stories/2005/102105_Schneider.html (last accessed Feb. 29, 2020).

48. National Aeronautics and Space Administration, Higher Altitude Improves Station’s Fuel Economy, *available at* https://www.nasa.gov/mission_pages/station/expeditions/expedition26/iss_altitude.html (last accessed Feb. 29, 2020).

49. United Nations Office for Outer Space Affairs, Space Law Treaties and Principles, *available at* <http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties.html> (last accessed Feb. 29, 2020).

Outer Space on 13 December 1963.⁵⁰ The first principle is one of cooperation.⁵¹ In the use and exploration of outer space, “States shall be guided by the principles of co-operation and mutual assistance[.]”⁵²

There is also a sentiment against the privatization of outer space. “There are no private rights in outer space ... because outer space is *res communis*, not subject to appropriation, either in public or in private law.”⁵³ It is “not subject to national appropriation by claims of sovereignty, use, exploration, or by any other means. States bear international responsibility for national activities in outer space, whether carried on by governmental agencies or non-governmental entities[.]”⁵⁴

The Treaty on Principles Governing the Activities of Space in the Exploration and Use of Outer Space of 1967, commonly known as the Outer Space Treaty,⁵⁵ embodies these principles.⁵⁶ At the onset it proclaims, “[t]he exploration and use of outer space ... shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind.”⁵⁷ Nongovernmental activities are endorsed only under governmental supervision and the Outer Space Treaty does not regulate economic activities, but it does provide for civil liability in the event of damage.⁵⁸ It anticipates exploration and scientific investigation and prohibits

50. Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space, G.A. Res. 1962 (XVIII), U.N. GAOR, 18th Sess., 1280th Mtg., U.N. Doc. A/RES/18/1962 (1963).

51. *Id.* ¶ 6.

52. *Id.* & PETER P.C. HAANAPPEL, *THE LAW AND POLICY OF AIR SPACE AND OUTER SPACE: A COMPARATIVE APPROACH* 8 (2003) (citing Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space, *supra* note 50, ¶ 6).

53. HAANAPPEL, *supra* note 52, at 10-11.

54. *Id.* at 8.

55. Comm. on the Peaceful Uses of Outer Space Legal Subcomm., *Status of International Agreements relating to activities in outer space as at 1 January 2017*, at 12, U.N. Doc. A/AC.105/C.2/2017/CRP.7 (Mar. 23, 2017). See Outer Space Treaty, *supra* note 8.

56. See Outer Space Treaty, *supra* note 8, pmbl. & art. I.

57. Outer Space Treaty, *supra* note 8, art. I.

58. *Id.* art. VII.

nuclear weapons.⁵⁹ As of this writing, there are 130 signatories to the Outer Space Treaty.⁶⁰

Additional treaties were undertaken to flush out some international legal questions deemed pertinent as time passed and the exploration of space became more experienced. The Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space of 1968 (Rescue Agreement)⁶¹ expanded on Article V of the Outer Space Treaty,⁶² by requiring international cooperation when returning astronauts and vessels to Earth and then home.⁶³ The Convention on International Liability for Damage Caused by Space Objects of 1972 (Liability Convention) contemplates the unexpected return of space objects to Earth and addresses liability that they cause.⁶⁴ The Convention on Registration of Objects Launched into Outer Space of 1975 (Registration Convention)⁶⁵ requires countries launching objects into outer space to register those objects with the United Nations.⁶⁶ On the other hand, the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies of 1979 (Moon Agreement)⁶⁷ was modeled after the United

59. *Id.* arts. I, II, & IV.

60. *See* Outer Space Treaty, *supra* note 8 & Treaty on principles governing the activities of States in the exploration and use of outer space, including the moon and other celestial bodies (Details of the Treaty Published Online by the United Nations Treaty Series), *available at* <https://treaties.un.org/Pages/showDetails.aspx?objid=080000280128cbd> (last accessed Feb. 29, 2020).

61. Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, *opened for signature* Apr. 22, 1968, 672 U.N.T.S. 119 [hereinafter Rescue Agreement].

62. Outer Space Treaty, *supra* note 8, art. V. Article V of the Outer Space Treaty provides in part that, “[w]hen astronauts make such a landing, they shall be safely and promptly returned to the State of registry of their space vehicle.” *Id.*

63. *See* Rescue Agreement, *supra* note 61.

64. Convention on the International Liability for Damage Caused by Space Objects, *opened for signature* Mar. 29, 1972, 961 U.N.T.S. 187.

65. Convention on Registration of Objects Launched into Outer Space, *adopted* Nov. 12, 1974. 1023 U.N.T.S. 15.

66. *Id.* art. II.

67. Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, *opened for signature* Dec. 18, 1979, 1363 U.N.T.S. 21 [hereinafter Moon Agreement].

Nations Convention on the Law of the Sea⁶⁸ and decreed that samples from research must be made available to all organizations that wanted them.⁶⁹

The Outer Space Treaty and its more detailed successors might be very loosely interpreted to contemplate intellectual property. After all, the Outer Space Treaty specifically mentioned scientific investigation,⁷⁰ and one could infer that the drafters knew that patent protection or enforcement could be packaged in with that concept. However, intellectual property is necessarily individual, while the Outer Space Treaty emphasized international harmony.⁷¹ The more probable interpretation is that the drafters did not consider intellectual property in the treaties, each of which addressed very tangible activity.

IV. BILATERAL AND MULTILATERAL AGREEMENTS

Fifty years after its ratification, the Outer Space Treaty remains the primary international authority governing the nations with respect to outer space.⁷² However, it does not represent the extent of international cooperation among States who are active in the space industry. Most of the recent international agreements are through bilateral and multinational agreements, and these agreements specifically address commercial activity, including intellectual property.⁷³ These arrangements are generally broken down into two separate agreements: a framework agreement and an implementing agreement.

Framework agreements generally cover the broad legal principles and the specific terms and conditions for future cooperation, meant to provide

68. United Nations Convention on the Law of the Sea, *opened for signature* Dec. 10, 1982, 1833 U.N.T.S. 3 (entered into force Nov. 16, 1994). Receiving only 21 signatories, many of which had no plan to explore outer space, the Moon Agreement is now considered defunct. Comm. on the Peaceful Uses of Outer Space Legal Subcomm., *supra* note 55 & Jenn Tylbon, *Who Owns the Moon?*, WIRED, *available at* <https://www.wired.com/2011/07/who-owns-the-moon/> (last accessed Feb. 29, 2020).

69. Moon Agreement, *supra* note 67, art. 6 (2).

70. Outer Space Treaty, *supra* note 8, art. I.

71. *See, e.g.*, Cromer, *supra* note 24, at 261.

72. *See* Paul Meyer, *The Outer Space Treaty at 50: An enduring basis for cooperative security*, *available at* <https://www.thespacereview.com/article/3335/1> (last accessed Feb. 29, 2020).

73. *See generally* UNITED NATIONS OFFICE FOR OUTER SPACE AFFAIRS, *INTERNATIONAL SPACE LAW: UNITED NATIONS INSTRUMENTS* (2017).

an overview of the arrangement between the countries.⁷⁴ These agreements address intellectual property rights, usually focusing on patent and copyright, but at times also addressing trade secrets and classified information.⁷⁵ The form of the agreements varies. There may be a general provision for intellectual property within the agreement and then an annex specifying the terms of the arrangement.⁷⁶ Conversely, the contracting nations may forego an annex, instead specifying the terms within the framework agreement.⁷⁷ In either of these scenarios, the framework agreement specifies intellectual property working within the strictures of the existing international legal frameworks, such as within WIPO.⁷⁸ The agreements may protect intellectual property in accordance with national intellectual property laws on a reciprocal basis.⁷⁹ They may provide for patent ownership, if they are

74. *See generally* United Nations Economic Convention for Europe: The Committee on Housing and Land Management, Framework Convention Concept (Note by the Secretariat), available at <https://www.unece.org/fileadmin/DAM/hlm/sessions/docs2011/informal.notice.5.pdf> (last accessed Feb. 29, 2020).

75. Comm. on the Peaceful Uses of Outer Space Legal Subcomm., *Report of the Working Group on the Review of International Mechanisms for Cooperation in the Peaceful Exploration and Use of Outer Space on the work conducted under its multi-year workplan*, ¶ 47 (I), U.N. Doc. A/AC.105/C.2/112 (Apr. 13, 2017).

76. United Nations Economic Convention for Europe: The Committee on Housing and Land Management, *supra* note 74.

77. *Id.*

78. WORLD INTELLECTUAL PROPERTY ORGANIZATION, WIPO INTELLECTUAL PROPERTY HANDBOOK 207-08 & 241-363 (2d ed. 2008).

79. *See, e.g.*, Paris Convention for the protection of industrial property of March 20, 1883, as revised at Brussels on December 14, 1900, at Washington on June 2, 1911, at The Hague on November 6, 1925, at London on June 2, 1934, at Lisbon on October 31, 1958, and at Stockholm on July 14, 1967, *opened for signature* Mar. 20, 1883, 828 U.N.T.S. 305. The 1979 amendment is not reported in any official treaty compilation; however, the same is available on the website of the World Intellectual Property Organization. *See* World Intellectual Property Organization, Paris Convention for the Protection of Industrial Property of March 20, 1883, as revised at Brussels on December 14, 1900, at Washington on June 2, 1911, at The Hague on November 6, 1925, at London on June 2, 1934, at Lisbon on October 31, 1958, and at Stockholm on July 14, 1967, and as amended on September 28, 1979, available at www.wipo.int/treaties/en/text.jsp?file_id=288514 (last accessed Feb. 29, 2020).

anticipated;⁸⁰ if not, then the agreement specifies that the parties will work together to own and protect patents in good faith.⁸¹ On the other hand, the agreement may provide for the transfer of technology and the public publication of data, foregoing intellectual property ownership altogether.⁸²

Implementing agreements are agreements that provide the specific details of how the arrangement will work, as opposed to a general framework. If intellectual property is not addressed bilaterally in a framework agreement, the contracting nations will typically spell it out in an implementing agreement.

Multilateral agreements are those agreements that involve more than two contracting nations as parties.⁸³ An example of an outer-space multilateral agreement is the network of agreements concerning the ISS.⁸⁴ The International Space Station Intergovernmental Agreement (IGA) was signed in 1998 by the governments that are a part of the ISS project.⁸⁵ In addition, NASA signed an agreement with each cooperating space agency from the European Union, Russia, Canada, and Japan; and various bilateral

80. *See, e.g.*, Patent Co-operation Treaty, *signed* June 19, 1970, 1160 U.N.T.S. 231. The Patent Co-operation Treaty was amended on September 28, 1979, modified on February 3, 1984, and October 3, 2001. *See* World Intellectual Property Organization, Patent Cooperation Treaty (PCT) Done at Washington on June 19, 1970, amended on September 28, 1979, modified on February 3, 1984, and on October 3, 2001, *available at* www.wipo.int/edocs/lexdocs/treaties/en/pct/trt_pct_001en.pdf (last accessed Feb. 29, 2020).

81. *Id.*

82. *Id.*

83. JOAQUIN G. BERNAS, S.J., *INTRODUCTION TO PUBLIC INTERNATIONAL LAW* 27 (2009 ed.).

84. European Space Agency, International Space Station legal framework, *available at* http://m.esa.int/Our_Activities/Human_Spaceflight/International_Space_Station/International_Space_Station_legal_framework (last accessed Feb. 29, 2020).

85. *Id.* As of this writing, the parties to the International Space Station Intergovernmental Agreement are “the United States of America, Canada, Japan, the Russian Federation, and 10 Member States of the European Space Agency (Belgium, Denmark, France, Germany, Italy, The Netherlands, Norway, Spain, Sweden and Switzerland ...).” *Id.*

agreements were executed to outline the specific duties and management structure of the project.⁸⁶

The ISS contains several separate modules, or elements, many of which were contributed by a specific country to the space station.⁸⁷

This extension of national jurisdiction determines what laws are applicable for activities occurring on a Partner's Space Station elements (e.g. European law in the European Columbus Laboratory). This legal regime [recognizes] the jurisdiction of the Partner States' [] courts and allows the application of national laws in such areas as criminal matters, liability issues, and protection of intellectual property rights.⁸⁸

In other words, if an invention or other work meriting intellectual property is developed in or is using an ISS physical element, then the intellectual property is governed by the laws of that element's contributing nation and will be on that nation's intellectual property registry. This understanding does not impact ownership or the right to file for patent.⁸⁹ Also, if the element at issue is European by nature, a second level of consideration must be undertaken to invoke the laws of each individual nation under the umbrella of the European Space Agency.⁹⁰

The ISS partner States are less concerned about the creation of intellectual property and more concerned about its infringement. "The main objective of the Space Station Partners concerning property rights is to avoid the infringement of rights owned by another Partner and their entities (e.g.[,] contractors, subcontractors, users)."⁹¹ Each space agency, its affiliates, and any third party have specific marking requirements for technical and/or proprietary data to protect the States and their customers' data and goods.⁹² Procedures regarding use of intellectual property extend to all ground and ISS crew in the Crew Code of Conduct.⁹³ If infringement occurs despite

86. *Id.*

87. *Id.*

88. *Id.*

89. European Space Agency, *supra* note 84.

90. *Id.*

91. *Id.*

92. *Id.*

93. *Id.*

the precautions taken, “claims would be made according to the parties’ respective national legal regimes for intellectual property.”⁹⁴

V. NATIONAL LEGISLATION GOVERNING OUTER SPACE

Bilateral and multilateral agreements provide strong deference to national legislation governing intellectual property in matters of both ownership and disputes. However, since the governing outer space laws are still the treaties that emphasize cooperation, private actors that are ratcheting up activities in outer space may seek more protection of intellectual property from their governments. In an effort to keep in step with their commercial players, governments worldwide have recently enacted space laws and created space agencies to regulate the industry. Depending on their respective histories with space exploration and travel, their focuses differ.

A. Veteran Player: United States

The U.S. has been in the forefront of outer space exploration since the Space Race of the 1950s and 1960s,⁹⁵ making it one of the first to address specific issues in its legislation. In 2015, the U.S. Congress enacted the Spurring Private Aerospace Competitiveness and Entrepreneurship Act (SPACE Act).⁹⁶ The purpose of the SPACE Act was “to facilitate a pro-growth environment for the developing commercial space industry by encouraging private sector investment and creating more stable and predictable regulatory conditions, and for other purposes.”⁹⁷ The SPACE Act is clearly aimed at promoting the private interests in the outer space industry, as its provisions demonstrate.

94. *Id.* Claims involving European countries are subject to specific provisions provided in the Intergovernmental Agreement to prevent simultaneous claims in multiple countries. European Space Agency, *supra* note 84.

95. LINDA DAWSON, THE POLITICS AND PERILS OF SPACE EXPLORATION: WHO WILL COMPETE, WHO WILL DOMINATE? 107-26 (2016).

96. An Act to Facilitate a Pro-growth Environment for the Developing Commercial Space Industry by Encouraging Private Sector Investment and Creating More Stable and Predictable Regulatory Conditions, and for Other Purposes [U.S. Commercial Space Launch Competitiveness Act], Pub. L. No. Law 114-90 (2015) (U.S.) (also known as the Spurring Private Aerospace Competitiveness and Entrepreneurship Act of 2015 or SPACE Act of 2015).

97. *Id.* pmbl.

Among other topics, the SPACE Act addresses orbital traffic management, space surveillance and situational awareness data,⁹⁸ streamlined commercial space launch activities,⁹⁹ and asteroid resource and space resource rights.¹⁰⁰ It is in the last area that property rights are addressed outright —

A [U.S.] citizen engaged in commercial recovery of an asteroid resource or a space resource under this chapter shall be entitled to any asteroid resource or space resource obtained, including to possess, own, transport, use, and sell the asteroid resource or space resource obtained in accordance with applicable law, including the international obligations of the [U.S.].¹⁰¹

Intellectual property is not specifically mentioned in the SPACE Act, but the legislation provides for the possession of resources,¹⁰² for which, of course, the Outer Space Treaty and its counterparts do not provide. It is not a stretch to interpret space resources to include intellectual property, including data, patents, and confidential information or secrets. While the SPACE Act “entitles” the citizen to the resource’s possession and use, its availability for the common good is what is paramount to the treaty structure and therefore directly at odds with market rights.

B. Repeat Player: United Kingdom

Other nations are looking to enact similar legislation but differ in legislative agenda and national goals. In the United Kingdom (U.K.), the skeletal U.K. Space Industry Bill¹⁰³ creates a regulatory scheme to provide for launching from private airports,¹⁰⁴ addresses sanctions for noncompliance,¹⁰⁵ civil liability and criminal activity,¹⁰⁶ and regulates the transfer of licenses.¹⁰⁷

98. *Id.* §§ 109–110.

99. *Id.* § 113.

100. *Id.* § 402 (a).

101. *Id.*

102. U.S. Commercial Space Launch Competitiveness Act, § 402 (a).

103. A Bill to Make Provision About Space Activities and Sub-orbital Activities, and for Connected Purposes [Space Industry Bill [HL]], Bill 155 2017–19 (2017) (U.K.).

104. *Id.* ¶¶ 8–14 & schedule 12 (7).

105. *Id.* ¶¶ 50–54.

106. *Id.* ¶¶ 50–58.

107. *Id.* ¶ 14.

The [U.K.] Space Industry Bill seeks to create the rare situation where law is ahead of technological advances and has been drafted to significantly accommodate the emerging private commercial space market. It is therefore unsurprising that the Bill has garnered wide support within the industry. If enacted, it is likely to achieve its target of boosting the employment rate and cementing the [U.K.'s] position as a leader in the NewSpace sector.¹⁰⁸

Interestingly, the U.K. Space Industry Bill fails to mention intellectual property in any respect. Although the bill addresses the protection of and liability for property in several places,¹⁰⁹ from its context it is clear that the contemplated property is tangible in nature and not easily extended to intellectual property rights — “interests in property carried by spacecraft;”¹¹⁰ “safety of members ... of the public and the safety of their property;”¹¹¹ “preserving order within the spaceport and preventing damage to property within it;”¹¹² and “the protection of ... persons and property on board spacecraft and at space sites, against acts of violence[,]”¹¹³ as examples. Without much reference to invention or data protection,¹¹⁴ it seems that if the target is cementing a leadership position in the NewSpace sector, the legislation may have missed the mark.

C. New Player: The Philippines

States that were not considered central to the space industry are also recognizing the importance of outer space in their development. With the importance of cellphone technology to these economies, private ventures worldwide have been manufacturing satellites and finding ways to put these into outer space. These collaborations have been solidified through

108. Julia Selman Ayetey, *Black Holes in the Proposed UK Space Legislation*, available at <http://www.jurist.org/forum/2017/12/Selman-Ayetey-uk-space-legislation.php> (last accessed Feb. 29, 2020).

109. Space Industry Bill [HL], ¶ 2 (2) (d).

110. *Id.*

111. *Id.* ¶ 2 (6) (defining “public safety” for purpose of the bill).

112. *Id.* ¶ 24 (2) (c).

113. *Id.* ¶ 28 (6) (a) (defining “spaceflight security”).

114. *Id.* schedule 1 (25). Schedule 1 of the U.K. Space Industry Bill does authorize licenses to spell out “conditions relating to the use, processing, communication, and distribution of data obtained in the course of spaceflight activities[,]” though it does not address data ownership, even in light of the property interest available through the EU Database Directive. Space Industry Bill [HL], schedule 1 (25). *See generally* Cromer, *supra* note 24.

appropriate contracts and bilateral agreements, but governments new to the industry are introducing national legislation to regulate any future industry involvement.

As an example, to date, the Philippines has not had a large part of the outer space sector, but in the last five years, it has become a new player. In 2016, the Philippines launched its first microsatellite, beginning with Diwata-1, which was created to capture satellite images of the country.¹¹⁵ In 2017, President Rodrigo Duterte approved a proposal for a Space Development program with funding of ₱24 billion (more than U.S.\$467 million) over the next 10 years.¹¹⁶ In June 2018, the Philippines launched nanosatellite Maya-1;¹¹⁷ Diwata-2, the Philippines' third satellite, launched in October 2018.¹¹⁸

Before the launch of these satellites, administration of space activities in the Philippines was distributed among various agencies of the Philippine Department of Science and Technology. On 8 August 2019, President Duterte signed into law the Philippine Space Act¹¹⁹ creating the Philippine Space Agency (PhilSA) and defining the six Key Development Areas of the Philippine Space Policy: (1) national security and development, (2) hazard management and climate studies, (3) space research and development, (4) space industry capacity building, (5) space education and awareness, and (6) international cooperation.¹²⁰

115. Edd K. Usman, How Diwata-2 is better than PH's first satellite, Diwata-1, *available at* <https://www.rappler.com/technology/features/171988-diwata-1-diwata-2-improvements-up-tech-fair> (last accessed Feb. 29, 2020).

116. Sara Soliven De Guzman, *An ambitious plan for a space agency*, PHIL. STAR, Mar. 27, 2017, *available at* <https://www.philstar.com/opinion/2017/03/27/1682358/ambitious-plan-space-agency> (last accessed Feb. 29, 2020).

117. Kristine Sabillo, SpaceX brings Philippines' Maya-1 cube satellite to ISS, *available at* <https://news.abs-cbn.com/news/06/29/18/spacex-brings-philippines-maya-1-cube-satellite-to-iss> (last accessed Feb. 29, 2020) [hereinafter Maya-1].

118. Kristine Sabillo, PH's 2nd microsatellite marks 1st year in space, shows Manila Bay improvement, *available at* <https://news.abs-cbn.com/news/10/29/19/phs-2nd-microsatellite-marks-1st-year-in-space-shows-manila-bay-improvement> (last accessed Feb. 29, 2020).

119. An Act Establishing the Philippine Space Development and Utilization Policy and Creating the Philippine Space Agency, and for Other Purposes [Philippine Space Act], Republic Act No. 11363 (2019).

120. *Id.* §§ 5 & 6.

With respect to intellectual property, the Philippine Space Act provides the direction that one could expect from a framework act. The Philippine Space Act anticipates owning intellectual property by giving PhilSA the authority to “[l]icense, sell[,] or otherwise make available any patent, copyright, industrial design, trademark, trade secret[,] or like property controlled[.]”¹²¹ However, it does not make the affirmative move to grant the Agency through its employees and contractors the right to own the intellectual property in the first place.¹²² This is true even though intellectual property exists in several of the works created in space by its satellites. For example, on the Diwata-1, a high-precision telescope provides surface reflectance data, “used mostly for damage extent determination during disasters and calamities” and also “imaging natural and cultural heritage sites.”¹²³ In addition, Diwata-1 can “potentially image cloud formations and typhoons.”¹²⁴

Although it is expending many resources in the administration, research, and development of space activities, the Philippines still relies upon other nations to bring its visions to reality.¹²⁵ The PHL Microsat Program, responsible for the launch of the Diwata-1 microsatellite and the Diwata-2 nanosatellite, is a collaboration between the “Philippines’ Department of Science and Technology, University of the Philippines [] and Japan’s Hokkaido University”¹²⁶ The Maya-1 nanosatellite was a product of the Joint Global Multination Birds Project, initiated by Kyushu University in Japan and managed by a team of graduate students from Bhutan, Japan, Malaysia, and the Philippines.¹²⁷ It was launched from Cape Canaveral in the US, aboard a SpaceX resupply mission to the ISS.¹²⁸ While built by

121. *Id.* § 8 (V) (d).

122. *See* Philippine Space Act.

123. PHL Microsat, Diwata-1, *available at* <http://phl-microsat.upd.edu.ph/diwata1> (last accessed Feb. 29, 2020).

124. *Id.*

125. *See* PHL Microsat, About the PHL Microsat Program, *available at* <http://phl-microsat.upd.edu.ph/about> (last accessed Feb. 29, 2020).

126. PHL Microsat, *supra* note 125.

127. Maya-1, *supra* note 117.

128. *Id.*

Filipinos, *Maya-1* is jointly controlled and operated by the Philippines, Bhutan, and Malaysia.¹²⁹

As noted by Dr. Joel Joseph Marciano, Jr., Director General of PhilSA, multinational partnerships such as these are the natural trajectory for a newly developing space program. He stated that

[w]e can send Filipinos to study there and because they are breaking new grounds, we can be right in the middle of it through our people studying in the universities, to international cooperation projects, that's how we can keep pace with them. Being pragmatic in the beginning, we probably start off on continuing what we are doing, momentum on building small satellites. But [we are] not precluding the possibility that later on, the Filipinos will be in space[.]¹³⁰

With multinational partnerships, however, come several different versions of intellectual property and opinions about whose law should control. While in theory the solution is fairly straightforward — as posited, “a State on whose registry an object launched into outer space is carried shall retain jurisdiction and control thereof”¹³¹ — the reality may be more complex. The more seasoned players may be in a better position to impose their will upon the partners who are more reliant on them for technology, data, and transport to and from space. This possibility has already been acknowledged by Director General Marciano, to wit —

If we [do not] [] start something like this [] satellite program [], [we will] forever be consumers of data provided by other countries. What if geopolitical situations change that we are not able to take advantage of other countries' help[?]¹³²

PhilSA, still in its beginning months, is in a strong position to make a policy stand about the creation, ownership, and protection of its intellectual property interests in outer space, both by its employees and contractors and also among its multinational partners. The Agency has been tasked with creating regulations governing its various functions.¹³³ Although it does not

129. Dexter Cabalza, *Maya-1: Cube satellite latest Pinoy venture into space*, PHIL. DAILY INQ., July 1, 2018, available at <https://technology.inquirer.net/77081/maya-1-cube-satellite-latest-pinoy-venture-space> (last accessed Feb. 29, 2020).

130. Neyzielle Ronnicque, Philippine Space Agency signed into law, available at <https://asti.dost.gov.ph/communications/news-articles/philippine-space-agency-signed-into-law> (last accessed Feb. 29, 2020).

131. HAANAPPEL, *supra* note 52, at 8.

132. Sabillo, *supra* note 118.

133. See Philippine Space Act, § 8 (I).

have much guidance from the Philippine Space Act itself, its primary advisory body, the Philippine Space Council, includes among its members the Secretaries of Trade and Industry and Information Communications and Technology. PhilSA should look to this experience in regulating intellectual property in the public and private industries to guide the development of Agency practice in light of international obligations and competition.

VI. PROTECTING INTELLECTUAL PROPERTY IN THE SPACE INDUSTRY: NEXT STEPS

It is generally recognized that “[t]he protection and enforcement of intellectual property rights should be considered together with the international legal principles developed by the United Nations in the form of treaties and declarations, such as those relating to the principle of non-appropriation of outer space[.]”¹³⁴ The need to address intellectual property rights in outer space is not a new concern. In 2000, Brazil urged COPUOS to address outer space activities’ commercial aspects, including intellectual property.¹³⁵ Brazil viewed the principles of progress to be threefold: “[1] to provide developing countries with reasonable access to data resulting from cooperation; [(2)] to foster spin-off benefits; and [(3)] to provide the transfer of technology [to the developing countries].”¹³⁶ COPUOS has considered intellectual property, enlisting the assistance of the WIPO to determine what additional steps may be necessary. In 2007, a WIPO expert opined that existing intellectual property laws could handle issues in the outer space industry but with limitations.¹³⁷

134. International Bureau of the World Intellectual Property Organization, Intellectual Property and Space Activities (Issue Paper) at 9, *available at* http://www.wipo.int/export/sites/www/patent-law/en/developments/pdf/ip_space.pdf (last accessed Feb. 29, 2020).

135. United Nations Committee on the Peaceful Uses of Outer Space Legal Subcommittee (Unedited Transcript of the 633d meeting, Vienna, Apr. 3, 2000) at 6, *available at* http://www.unoosa.org/pdf/reports/transcripts/legal/LEGALT_633E.pdf (last accessed Feb. 29, 2020).

136. *Id.*

137. Miyamoto, *supra* note 17.

In 1997, WIPO had a meeting of consultants for inventions “made or used in outer space”¹³⁸ which determined that for the time being, a specialized form of industrial property tailored to outer space was not required, but that eventually, it might need to be.¹³⁹ Current intellectual property legislation is said to be sufficient to cover the subject matter of outer space creations. However, lack of harmonization of national legislation, coupled with the absence of international requirement of enforcement, all but guaranteed that there would be eventual problems. As noted above, bilateral and multilateral agreements generally address intellectual property. However, absent a specific agreement, the lack of harmonization becomes problematic, even in light of applicable international intellectual property treaties.

The problems created are threefold. *First*, while most ventures into outer space are multinational by nature, joint international ownership of patents and copyrights is largely unaddressed. *Second*, licensing information and confidentiality necessarily fall within contract provisions, opening up another area of divergent law requiring interpretation.¹⁴⁰ *Third*, enforcement of intellectual property rights is not uniform, and the Judgments Convention excluded intellectual property from the uniform recognition and enforcement of judgments.¹⁴¹

These problems are not insurmountable. As demonstrated by the international response to the COVID-19 pandemic in spring 2020, governments do have the capability of working together yet separately to achieve a common worldwide goal. And, when the stakes are high enough, the private sector is capable of being a collaborator, as opposed to a hindrance, to cooperative effort. The question that remains, then, is whether the furtherance of efforts in outer space are more appropriately labeled an opportunity or an objective.

138. World Intellectual Property Office, *supra* note 36, at Annex III, 2-4, available at http://www.wipo.int/export/sites/www/patent-law/en/developments/pdf/inventions_space.pdf (last accessed Feb. 29, 2020).

139. *Id.*

140. *Id.* at Annex III, 11-14. WIPO notes that even if all intellectual property differences were resolved in the treaties and agreements between countries, purely commercial disputes would still exist. *Id.* at Annex III, 13.

141. *See generally* HAGUE CONFERENCE ON PRIVATE INTERNATIONAL LAW, *supra* note 40.

VII. CONCLUSION

It has been suggested that “[t]he only possibility for patent protection in outer space [under the existing legal regime] is to extract some words or provisions in the international agreements and give them a broad explanation.”¹⁴² Granted, existing regimes may be adequate, as long as single nations are the creators and protectors of the intellectual property. That does not, however, address the inequity that the international space treaties try to avoid. As the Philippines has learned, eventually, nations without space programs are going to have to develop them in case the veteran space actors decide that cooperation is no longer in their best interest — or if private actors make licensing technology and data financially unattainable.

In the future, nations and private entities alike will inevitably look towards the privatization of outer space. Hence, problems are bound to occur due to the absence of national and international legislation as well as the lack of harmonization between the two bodies of law with regard to property rights, and in particular, intellectual property rights. It is high time that nations enact appropriate legislation to deal with the impending privatization of outer space so that they may protect their own interests as well as their citizens’ rights. This is crucial in order to avoid the problems that may arise with regard to conflicts in the ownership and protection of intellectual property. Through proper legislation and enforcement, state interest, corporate profit, and global benefit can co-exist peacefully in the arena of outer space industry.

142. Zhao, *supra* note 18, at 167. Dr. Yun Zhao has suggested a *quasi-sui generis* regime to govern patents in outer space. *Id.* at 165-66.