Trade-Based Regulation of Space Resources

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This paper addresses the need for a stable legal regime to govern the extraction and utilization of space resources. Historically, the United Nations has provided the primary framework of international law governing space. However, they have yet to deliver an agreement on space resources. In the analogous situation involving intellectual property, the United Nations failed as a venue for a new agreement governing global intellectual property protections, and so the international community turned to the World Trade Organization. Using that regime shift as precedent, this paper analyzes the possibility of regulating the extraction and utilization of space resources under the auspices of the World Trade Organization in the event that an agreement cannot be reached through the United Nations.

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INTRODUCTION

Astronomical bodies, such as planets, moons, and asteroids, are believed to contain vast quantities of platinum group metals, nickel, gold, and other rare earth elements.[1] These elements are essential in the technology, aerospace, and pharmaceutical industries and are believed to be at high risk for terrestrial depletion.[2] However, given the financial risks associated with extraction activities, a robust regime governing activities and rights may be necessary before actors are confident enough to engage in space resource extraction. The United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS) remains the most logical place to pursue the creation of a system governing space resources. However, if UNCOPUOS proves unable to deliver such a system, this paper argues that it may be appropriate to turn to another international body: the World Trade Organization (WTO).

Estimates for the worth of metallic asteroids range from $20 trillion on the smaller end[3] to as much as $10 quintillion,[4] numbers

1. Alexander Lewis, *A Bundle of Sticks in Zero G: Non-State Actor Mining Rights for Celestial Bodies*, 25 SW. J. INT'L L. 393, 408 (2019).

2. Luz Danielle O. Bolong, *Into the Abyss: Rationalizing Commercial Deep Seabed Mining Through Pragmatism and International Law*, 25 TUL. J. INT'L & COMP. L. 127, 132 (2016) ("[T]he British Geological Survey created a supply risk scale of one to ten . . . platinum group elements . . . are at risk, at levels as high as 9.5.").

3. JOHN S. LEWIS, MINING THE SKY: UNTOLD RICHES FROM THE ASTEROIDS, COMETS, AND PLANETS 112 (1996).

4. Jamie Carter, *A Bizarre Trillion-Dollar Asteroid Worth More Than Our Planet*

that are almost meaninglessly large, particularly when compared to the current value of the global economy (recently estimated at around $142 trillion).[5] With stakes this high, it is easy to see why companies and policymakers would be excited about the prospect of tapping into outer space resources. For a while, it looked like the age of space mining might be upon us. Companies like Planetary Resources and Deep Space Industries (DSI) sprang to life with funding from high-profile investors and grand, highly publicized goals of mining the heavens.[6] Venture capital funds appeared with the dedicated mission of investing in space-related companies.[7] Even the U.S. government joined the hype, passing the Commercial Space Launch Competitiveness Act, which established the ability of U.S. companies to claim space resources.[8]

Yet something went wrong. In 2018, Planetary Resources was sold as scrap to a blockchain company.[9] DSI was taken over by another aerospace company called Bradford Space.[10] In the words of Chad Anderson, the founder of space-focused investment firm Space Angels, "[those companies are] gone; they're done. They don't exist."[11] Within a decade of Planetary Resources' founding, supposedly setting the scene for a new era, the bubble burst, taking with it dreams of near-infinite resources.

Industry experts have chalked the failure up to several factors. Some suggest that the leading companies failed to deliver the necessary technology, causing investors to back away.[12] People on the ground in companies like Planetary Resources and DSI, however, blamed investors' aversion to long-term risks.[13] Regardless of what is to blame, in the end, investors walked away, leaving companies

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Is Now Aligned With The Earth And Sun, FORBES (Dec. 5, 2020, 10:00 PM), https://www.forbes.com/sites/jamiecartereurope/2020/12/05/a-bizarre-trillion-dollar-asteroid-worth-more-than-our-planet-is-now-aligned-with-the-earth-and-sun.

5. *Id.*

6. Atossa Araxia Abrahamian, *How the Asteroid-Mining Bubble Burst*, MIT TECH. REV. (June 26, 2019), https://www.technologyreview.com/2019/06/26/134510/asteroid-mining-bubble-burst-history.

7. *Id.* (discussing the investment activities of Space Angels, a venture capital fund focused on investing in space startups).

8. U.S. Commercial Space Launch Competitiveness Act, Pub. L. No. 114-90, 129 Stat. 704, § 401, 402 (2015) (promoting "the right of United States citizens to engage in commercial . . . recovery of space resources).

9. Abrahamian, *supra* note 6 (noting the industry's bafflement with the acquisition).

10. *Id.*

11. *Id.*

12. *Id.* (quoting Chad Anderson, founder of Space Angels).

13. *Id.* (quoting Grant Bonin, former Chief Technology Officer of DSI).

without the resources to fulfill their vision. However, their reticence towards further investment might be prudent. Space is a difficult place, and the massive up-front costs associated with space activities have confined them to national actors for over half a century.[14] Investors faced the risk of technology failing to advance quickly enough to recoup their investments. Perhaps more importantly, they also faced an international legal regime hostile to the extraction and utilization of space resources.

Part I of this paper outlines the current legal debate regarding the status of space resources within the framework of international law. Part II analyzes the effectiveness of WTO agreements in other fields, most notably that of intellectual property. Finally, in Part III, this paper illustrates how a WTO agreement could potentially be used to regulate the extraction and utilization of space resources.

I. IN CONTEXT: SPACE RESOURCE LAW TODAY

The Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (or Outer Space Treaty), adopted in 1967 by the United Nations, forms the basic framework for international space law.[15] The Outer Space Treaty provides that all states shall have "free access to all areas" of outer space.[16] It also established a first step towards the common-heritage principle, as well as the non-appropriation principle for space objects.[17] As of 2023, 112 states have become parties to the Outer Space Treaty.[18]

Following the Outer Space Treaty, UNCOPUOS facilitated negotiation of four other agreements. The Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched in Outer Space (or Rescue Agreement), establishes nations' shared duty to rescue astronauts in distress.[19] The Convention on

14. *Id.* (quoting Henry Hertzfield, director of the Space Policy Institute at George Washington University).

15. *See* 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].

16. *Id.* art. 1.

17. *Id.* art. 2.

18. *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies*, UNITED NATIONS OFFICE FOR DISARMAMENT AFFAIRS, http://disarmament.un.org/treaties/t/outer_space (last visited Jan. 29, 2023).

19. G.A. Res. 22/2345, Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space (Dec. 19, 1967)

International Liability for Damage Caused by Space Objects (or Liability Convention) provides a liability regime that holds launching states liable for damage to another state caused by their launched object.[20] The Convention on Registration of Objects Launched in Outer Space (or Registration Convention) requires states to register their launched object with the United Nations.[21]

One last agreement was established, but its position within international law is less clear. The Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (or Moon Agreement),[22] provides in part a moratorium on space resource appropriation,[23] but as of 2021 has only been adopted by 18 countries.[24] As such, the legal implications of extracting and utilizing space resources remain in limbo. In fact, UNCOPUOS has failed to establish *any* new agreement since the Moon Agreement in 1979. The lack of clear guidance on the subject of space resources has opened the field for debate as to the legality of utilizing space resources.

A. THE DEBATE

When the Outer Space Treaty was adopted in 1967, it brought with it a declaration that outer space was the "province of all mankind."[25] At the time of signing, this was a novel principle, but it was quickly taken up by others in the international community.[26] Arvid Pardo, then the Maltese Delegate to the United Nations, delivered a speech that very same year calling for the application of a similar concept to the seabed.[27] Three years later, the United Nations

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[hereinafter Rescue Agreement].

20. G.A. Res. 26/2777, Convention on International Liability for Damage Caused by Space Objects (Nov. 29, 1971) [hereinafter Liability Convention].

21. G.A. Res. 3235 (XXIX), Convention on Registration of Objects Launched into Outer Space, Art. II (Nov. 12, 1974) [hereinafter Registration Convention].

22. G.A. Res. 34/68, Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (Dec. 5, 1979) [hereinafter Moon Agreement].

23. *See* John G. Wrench, *Non-Appropriation, No Problem: The Outer Space Treaty is Ready for Asteroid Mining*, 51 CASE W. RSRV. J. INT'L L. 437, 441 (2019) (noting that this moratorium was the primary reason that space-faring nations rejected the Moon Agreement).

24. *Agreement Governing the Activities of States on the Moon and Other Celestial Bodies: Status of the treaty*, UNITED NATIONS OFFICE FOR DISARMAMENT AFFAIRS, http://disarmament.un.org/treaties/t/moon (last visited Jan. 20, 2021).

25. Outer Space Treaty, *supra* note 15, art. 1.

26. *See* Scott J. Shackelford, *The Tragedy of the Common Heritage of Mankind*, 28 STAN. ENV'T. L. J. 109, 114 (2009).

27. Arvid Pardo, Maltese Delegate to the United Nations, Speech to the First Committee of the United Nations General Assembly (Nov. 1, 1967), *in* U.N. GAOR,

adopted the Declaration of Principles Governing the Sea-bed and the Ocean Floor, which stated that the deep seabed was the "common heritage of mankind."[28] The common heritage principle grew, expanding beyond the scope of the Outer Space Treaty's "province of all mankind" theory, and developed into Part XI of UNCLOS III, which established the controversial International Seabed Authority.[29] Although it was the controversy attached to the common heritage principle that contributed, at least in part, to the limited acceptance of the Moon Agreement in 1979,[30] the principle continues to form the backdrop of the current debate surrounding the extraction and utilization of space resources.

Along with declaring outer space to be the province of all mankind, the Outer Space Treaty states that "[o]uter space, including the moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means."[31] While this principle caused little controversy during the negotiations of the treaty, interpreting it has sparked debates in academia, industry, and policymaking.[32] Many see it as providing protection only against nationalization, thus providing room for private actors to engage in profit-seeking activities.[33] Others argue that it bars all property rights in space.[34]

Some scholars have argued that extraction and utilization of resources cannot be considered appropriation under the Outer Space

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22nd Sess., 1515th mtg. at ¶ 91, U.N. Doc. A/C.1/PV.1515 (Nov. 1, 1967).

28. G.A. Res. 2749 (XXV), ¶ 1, U.N. Doc. A/RES/25/2749 (Dec. 17, 1970).

29. United Nations Convention on the Law of the Sea Part XI, U.N. Doc. A/CONF.62/122 (Oct. 7, 1982) [hereinafter UNCLOS III] (noting that the seabed and ocean floor are "the common heritage of mankind"); *See also* Paul B. Larsen, *Asteroid Legal Regime: Time for a Change?*, 39 J. SPACE L. 275, 292 (2014) (discussing how the United States declined to sign UNCLOS III because of its unfavorable deep seabed regime).

30. The Moon Agreement included the common heritage principle in Article 11, which called for the development of a regime that sounded eerily like the International Seabed Authority to nations unhappy with the seabed regime. As of 2021, only eighteen nations were parties to the Moon Agreement, none of which were space-faring nations. *See* UNITED NATIONS OFFICE FOR DISARMAMENT AFFAIRS, *supra* note 24.

31. Outer Space Treaty, *supra* note 15, art. II.

32. *See* Shackelford, *supra* note 26, at 142 (describing a "trichotomy" of views, in which some believe that private actors have complete freedom in space, others believe that this principle voids property rights, and still others believe that the principle protects private entities while also ensuring economic returns to states in need).

33. *Id.*

34. *Id.*

Treaty.[35] There is precedent for this argument in the removal of extraterrestrial samples for scientific research. In 1969, Apollo 11 carried the first geological samples from the Moon back to Earth.[36] Since then, samples have also been returned by the Soviet Union and China,[37] but in all cases, the international community has never questioned whether this activity violated the Outer Space treaty.[38] Further, even though the Moon Agreement nominally bars all forms of ownership in resources extracted from celestial bodies,[39] scholars have noted that the language of the Agreement itself appears to differentiate between extraction and appropriation.[40]

Even if extraction and utilization can be considered appropriation under the Outer Space Treaty, a minority of scholars argue that such a restriction only applies to state actors or those acting on behalf of a nation and does not bar private appropriation. Some contemporary legal analyses of the language of the Outer Space Treaty questioned its applicability to private actors, with some finding that "the Treaty in its present form appears to contain no prohibition regarding individual appropriation."[41] One modern assessment found similarly, relying on two primary arguments. First, the rules of state responsibility for non-state actors under Article VI only apply when they are acting on behalf of a state.[42] Second, the U.S. is not bound by any treaty to limit the activities of non-state actors, and in the absence of such a requirement, policy does not suggest expanding international law to do so.[43] It is worth noting, however, that today these represent a minority interpretation of the language of the Outer Space Treaty, and most view the Treaty as limiting the activities of even non-state actors.[44]

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35. *See, e.g.*, Wrench, *supra* note 23.

36. LUNAR AND PLANETARY INSTITUTE, https://www.lpi.usra.edu/lunar/missions/apollo/apollo_11/samples (last visited Jan. 8, 2021).

37. *See generally* Cathleen Lewis, *Revisiting the Soviet Lunar Sample Return Missions*, NAT'L AIR AND SPACE MUSEUM (Dec. 16, 2020) https://airandspace.si.edu/stories/editorial/revisiting-soviet-lunar-sample-return-missions.

38. *See* Wrench, *supra* note 23, at 447.

39. *Id.*

40. *See* Frans G. von der Dunk, *Asteroid Mining: International and National Legal Aspects*, 26 MICH. ST. INT'L L. REV. 83, 91 (2017) (noting that the Moon Agreement bars property rights over "natural resources *in place*," thus seemingly allowing property rights over natural resources extracted and removed from the moon).

41. Stephen Gorove, *Interpreting Article II of the Outer Space Treaty*, 37 FORDHAM L. REV. 349, 351 (1969).

42. Lewis, *supra* note 1, at 399.

43. *Id.* at 395.

44. *See, e.g.*, Larsen, *supra* note 29, at 301 (finding "[n]on-governmental entities" bound by space law treaties).

Other scholars have argued for an interpretation of "appropriation" that includes extraction.[45] Given that property rights flow from the governing national authority, it would not be possible for such an authority to grant mining rights without claiming national jurisdiction over the area.[46] Following similar reasoning, some interpret the non-appropriation principle to include activities performed by private actors, regardless of whether or not the act is on behalf of a state.[47] Under this interpretation, the "national activities" language of Article VI of the Outer Space Treaty incorporates any action undertaken by a national of the state party. Notable international groups, such as the International Institute of Space Law (IISL), have adopted this reasoning. In 2004, the IISL issued a statement analyzing the validity of property claims under the Outer Space Treaty, and concluded that non-governmental actors are included in the non-appropriation principle.[48] If this is true, then any attempt to recognize individual property rights to space resources is in direct conflict with the Outer Space Treaty.[49]

It is important to note that multilateral discussions have recently tended toward acceptance of space resource utilization.[50] While some states still rally against the idea, many have shifted their focus toward how to govern such utilization.[51] Some have even taken unilateral steps in doing so, side-stepping the typical multilateral regimes.

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45. GLOBAL SPACE GOVERNANCE: AN INTERNATIONAL STUDY 390 (Ram S. Jakhu & Joseph N. Pelton eds., 2017).

46. *See id.* at 393 ("Since a State itself is unable to assert claims of ownership over outer space, the State has no authority to grant a license to conduct such activity or to supervise such activity.").

47. *See, e.g.*, Larsen, *supra* note 29, at 301 ("Non-governmental entities are subject to [the restrictions of] the space law treaties . . . ").

48. Statement by the Board of Directors Of the International Institute of Space Law (IISL) On Claims to Property Rights Regarding The Moon and Other Celestial Bodies (2004), *archived at* https://perma.cc/32AZ-HS4L. Therefore, according to international law, and pursuant to Article VI, the activities of non-governmental entities (private parties) are national activities. The prohibition of national appropriation by Article II thus includes appropriation by non-governmental entities (i.e. private entities whether individuals or corporations) since that would be a national activity. The prohibition of national appropriation also precludes the application of any national legislation on a territorial basis to validate a 'private claim'.

49. Chad Crowell, *The Final Frontier: Preventing Space from Becoming the Wild West Through the Establishment of Internationally Recognized Property Rights*, 11 GEO. MASON INT'L L.J. 81, 90–91 (2020) (comparing the U.S. Commercial Space Launch Competitiveness Act with the Outer Space Treaty).

50. Ian A. Christensen & Christopher D. Johnson, *Putting the White House Executive Order on Space Resources in an International Context*, THE SPACE REV. (Apr. 27, 2020), https://www.thespacereview.com/article/3932/1.

51. *Id.*

B. NATIONAL ACTION

In the absence of action by the United Nations to settle this debate, some nations have taken matters into their own hands. They have moved to unilaterally establish private property rights over extracted space resources, often by legislatively siding with those who believe that extraction does not equate to appropriation.[52] Even more recently, the U.S. has led a movement to form bilateral agreements affirming this idea.[53]

The U.S. began the trend towards unilateral action in 2015 when Congress passed the Commercial Space Launch Competitiveness Act.[54] Title IV of the Act is perhaps the most controversial, including the proposition that U.S. sovereignty over a particular territory is not a prerequisite to granting property interests in resources extracted from that territory.[55] Scholarly response to the Commercial Space Launch Competitiveness Act has been mixed. Some have argued that the legislative history indicates that the Act subtly sidesteps the actual question of assigning property rights in outer space.[56] However, others have suggested that the Commercial Space Launch Competitiveness Act is in direct contradiction to the international treaties to which the U.S. is a party.[57]

Regardless of the Commercial Space Launch Competitiveness Act's compatibility with the Outer Space Treaty, a handful of other nations have seen the benefit of the U.S. approach and have followed suit. Luxembourg enacted the Law on the Exploration and Use of Space Resources in 2017, breaking from the policies followed by the European Union as a whole, stating explicitly that "space resources are capable of being appropriated."[58] In 2020, Luxembourg expanded protection for private space actors with the Law on Space Activities.[59]

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52. *See, e.g.,* U.S. Commercial Space Launch Competitiveness Act, Pub. L. No. 114–90, 129 Stat. 704, § 401, 402 (2015).

53. *See* The Artemis Accords: Principles for Cooperation in the Civil Exploration and Use of the Moon, Mars, Comets, and Asteroids Sec. 1, Oct. 13, 2020, NASA, https://www.nasa.gov/specials/artemis-accords/img/Artemis-Accords-signed-13Oct2020.pdf [hereinafter Artemis Accords].

54. U.S. Commercial Space Launch Competitiveness Act, Pub. L. No. 114–90, 129 Stat. 704, § 401, 402 (2015).

55. *See* Samuel Roth, *Developing a Law of Asteroids: Constants, Variables, and Alternatives*, 54 COLUM. J. TRANSNAT'L L. 827, 850 (2016).

56. *Id.* at 855 ("... Congress postponed the resolution of the open question of property rights in asteroids in international law.").

57. *See* Crowell, *supra* note 49.

58. JOURNAL OFFICIEL DU GRAND-DUCHÉ DE LUXEMBOURG ART. I, No. 674 (Jul. 20, 2017) [hereinafter Law on the Exploration and Use of Space Resources].

59. JOURNAL OFFICIEL DU GRAND-DUCHÉ DE LUXEMBOURG, No. 1086 (Dec. 28, 2020)

The United Arab Emirates, hoping to develop a robust space economy of their own, enacted the Law on the Regulation of the Space Sector in 2019.[60] Japan also took legislative action to protect access to space resources when it passed a bill in 2021 allowing Japanese companies to seek a permit from the government to prospect for and extract space resources.[61]

Capitalizing on the growing international interest in the free extraction and utilization of space resources, the U.S. drafted the Artemis Accords in 2020.[62] The Artemis Accords were a series of bilateral agreements that reiterated many of the ideals of the Outer Space Treaty, Rescue and Return Agreement, Liability Convention, and Registration Convention, with an important addition: an affirmation that the extraction of space resources does not inherently constitute national appropriation under Article II of the Outer Space Treaty.[63] As of the beginning of 2023, twenty-two other nations have signed onto the Artemis Accords,[64] and while the Accords did not establish an international system of regulating space resource utilization, they solidified the proposition that utilization does not

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[hereinafter Law on Space Activities].

60. FEDERAL LAW NO. (12) OF 2019 ON THE REGULATION OF THE SPACE SECTOR (United Arab Emirates) [hereinafter Law on the Regulation of the Space Sector].

61. Uchū shigen no tansa oyobi kaihatsu ni kansuru jigyō katsudō no sokushin ni kansuru hōritsu, [Act on Promotion of Business Activities Related to the Exploration and Development of Space Resources], Law No. 83 of 2021, (Japan) [hereinafter Act on Promotion of Business Activities Related to the Exploration and Development of Space Resources]; *See* Sayuri Umeda, *Japan: Space Resources Act Enacted*, LIBRARY OF CONGRESS (Sept. 15, 2021), https://www.loc.gov/item/global-legal-monitor/2021-09-15/japan-space-resources-act-enacted ("The act defines "space resources" as water, minerals, and other natural resources that exist in outer space, including on the moon and other celestial bodies. (Art. 2, item 1.) Under the act, a person needs to obtain a permit in order to pursue space resources extraction activities. The application for the permit is combined with a permit for launching an artificial satellite. (Act on the Launching of Artificial Satellites and Management of Artificial Satellites, Act No. 76 of 2016 (Space Activity Act), art. 3.) In addition to items required for the permit under the Space Activities Act (including, among other things, the satellite launch-rocket design and the flight path of the satellite), an applicant for the space resources extraction permit must attach a business activity plan to the application. The activity plan must include the purpose of the proposed space resources exploration and exploitation activity; the term, location, method, and other details of the activity; and other matters specified by a Cabinet ordinance. (Art. 3, para. 1.)").

62. *See* Artemis Accords, *supra* note 53.

63. *Id.* §10, ¶2.

64. *See* Robert Lea, *What are the Artemis Accords*, SPACE.COM (Jan. 22, 2023), https://www.space.com/artemis-accords-explained ("NASA says that 23 countries have signed the Artemis Accords including the U.S., the U.K., Japan, Italy, Canada, and Brazil. On December 13 2022 at the U.S./Africa Space Forum held in Washington D.C., Nigeria and Rwanda became the first African countries to sign the accords.").

equal appropriation in the international consciousness.

While some nations have viewed the American approach with favor, it has not received universal acceptance. The European Union has remained frigid to the idea, while Russia and Brazil have both expressly condemned the unilateral approach.[65] Russia objected for a number of reasons, most notably stating that the Commercial Space Launch Competitiveness Act was an attempt at national domination in disregard of discussions in the context of the Moon Agreement.[66] Brazil, on the other hand, has focused their critique on the idea that multilateral interests and instruments should take precedence over unilateral interests and domestic legislation.[67]

C. PROPOSALS FOR REGULATING SPACE RESOURCES

Since the Moon Agreement in 1979, the United Nations has not successfully brokered a substantive treaty on the subject of outer space. In the years since then, academics and policymakers have filled their time by offering suggestions that, for one reason or another, have not been adopted, but are worthy of consideration. While these proposals vary dramatically in their approach to space resources, they share a United Nations-centric approach and generally find their legal basis in agreements under the umbrella of the United Nations. As such, if the United Nations remains the venue for international negotiations on space resources, a variant of one of the following proposals (or a combination thereof) would likely prove to be the most effective.

1. An International Regime Under the Moon Agreement

Because the Moon Agreement already calls for the establishment of an international regime to manage the exploitation of space resources, many have logically suggested that the simplest solution is to simply establish such a regime.[68] In considering how to structure a

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65. *See* von der Dunk, *supra* note 40 at 96–99.

66. Comm. on the Peaceful Uses of Outer Space, Sci. & Tech. Subcomm., Reviewing Opportunities for Achieving the Vienna Consensus on Space Security Encompassing Several Regulatory Domains: Working Paper Submitted by the Russian Federation, ¶¶ 5–7, U.N. Doc. A/AC.105/C.1/2016/CRP.15 (Feb. 16, 2016).

67. *See* von der Dunk, *supra* note 40 at 98–99. One interesting note is that, in spite of its criticism regarding the U.S. Commercial Space Launch Competitiveness Act, Brazil has signed a letter of intent to join the Artemis Accords. *See NASA Administrator Signs Statement of Intent with Brazil on Artemis Cooperation*, NASA, https://www.nasa.gov/feature/nasa-administrator-signs-statement-of-intent-with-brazil-on-artemis-cooperation (Dec. 18, 2020).

68. *See, e.g.*, Sarah Coffey, *Establishing a Legal Framework for Property Rights to*

new space resource regime under the Moon Agreement, two existing international bodies have received the most analysis as potential models.

Perhaps the most widely suggested model has been the International Seabed Authority (ISA), which was established under Article XI of UNCLOS III.[69] The similarities between the law and policy governing the deep seabed and that governing outer space are readily apparent. In both situations, large amounts of resources remain untapped, made obtainable only through recent technological developments.[70] Yet at the same time, nations have expressed fears that uncontrolled resource extraction would lead to a tragedy of the commons by the nations that develop those technological capabilities first.[71] This fear has led to the proliferation of the common heritage principle in both UNCLOS III and the Moon Agreement, as applied to extra-territorial resources.[72] These similarities suggest that, if the ISA has successfully enforced the common heritage principle in the deep seabed, then a similar authority might prove effective at controlling the extraction of space resources while protecting the rights of non-space faring nations.

In practice, the ISA issues rules and regulations governing the mining of the deep seabed, evaluates and approves plans for the exploitation of seabed resources, and controls the distribution of mining revenues.[73] Nations seeking to obtain exclusive rights to the exploitation of resources must first obtain the permission of the ISA.[74] In the case of multiple nations seeking to exploit the same resources, the ISA evaluates the requests based off of the nations' financial resources and technical capabilities, giving priority to the nation that gives a better assurance of performance.[75] In exchange for the grant of exclusive rights, and to protect the rights of nations unable to exploit seabed resources, the ISA levies a fee of either a production charge, or a production charge plus a share of net proceeds.[76] In the realm of space resources, such an authority could govern claims to mine celestial bodies in a similar manner, granting exclusive rights if the requesting nation abides by procedural rules and pays a

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Natural Resources in Outer Space, 41 CASE W. RSRV. J. INT'L L. 119, 133 (2009).

69. *See* UNCLOS III, *supra* note 29.

70. Shackelford, *supra* note 26, at 123 (describing how technological progress caused a change in common perceptions of the high seas).

71. *See* Pardo, *supra* note 27.

72. *See* UNCLOS III, *supra* note 29; Moon Agreement, *supra* note 22.

73. *See* UNCLOS III, *supra* note 29, arts. 160, 162.

74. *Id.* at Annex III, arts. 2–3.

75. *See id.* at Annex III, art. 7.

76. *See id.* at Annex III, art. 13.

redistributive fee.

However, there are issues in a potential application of an ISA-type authority to space resources. Besides the fact that such a body may administratively consume funds that are nominally reserved for distribution to developing nations,[77] there is one major hurdle that it would be unlikely to overcome: the United States. Even to this day, the U.S. has declined to sign UNCLOS III, primarily because it viewed the ISA regime as unfavorable.[78] Further, it was the Moon Agreement's restriction of resource appropriation that led to its ultimate rejection by the vast majority of the international community.[79] So, international acceptance of an ISA-type authority for space resources is unlikely to occur.

Given the international hesitancy with an ISA-type authority, some scholars have suggested instead looking to the International Telecommunication Union (ITU) as a model.[80] The ITU operates under the United Nations, providing guidance and regulation of satellite orbits.[81] Compared to the more rigid structure of the ISA, the ITU process has been compared to that of domain-name registration.[82] The international community has readily accepted the more lax framework of the ITU,[83] and so it has been offered as a model for an international space resources regime.

However, even with its benefits, the ITU is not a perfect model either. Most notably, the ITU has no means of sanctioning violators.[84] This means that the ITU relies on the good will and cooperation of its member nations.[85] In a high risk, high reward ecosystem such as space mining, there may potentially be great incentive to break such an

77. Coffey, *supra* note 68, at 136 (noting that there is "questionable value in creating a structure which is supposed to allocate profits and benefits to developing countries but which consumes funds that might have otherwise been put toward helping those nations directly").

78. Larsen, *supra* note 30, at 292.

79. *See* Wrench, *supra* note 23, at 441.

80. *See, e.g.*, Craig Foster, *Excuse Me, You're Mining My Asteroid: Space Property Rights and the U.S. Space Resource Exploration and Utilization Act of 2015*, 2016 U. ILL. J.L. TECH. & POL'Y 407, 429 (2016).

81. *About International Telecommunication Union (ITU)*, INT'L TELECOMM. UNION, https://www.itu.int/en/about/Pages/default.aspx (last visited Jan. 13, 2021).

82. Clive Thompson, *Space Mining Could Set Off a Star War*, WIRED (Jan. 14, 2016, 7:00 AM), http://www.wired.com/2016/01/clive-thompson-11/.

83. *See* Foster, *supra* note 80, at 429 (noting that 193 countries follow the ITU regulations and utilize its services).

84. Sam Gallicchio, *What is an Ideal Framework to Regulate Exploration in Space?*, CHI. POL'Y REV. (Apr. 21, 2018), https://chicagopolicyreview.org/2018/04/21/what-is-an-ideal-framework-to-regulate-exploration-in-space/.

85. *Id.*

agreement if it means getting an early claim to expansive resources. As such, an international regime based on the ITU may not satisfactorily regulate the extraction and utilization of space resources in a manner that effectively protects the rights of developing nations.

2. A Credit Trading System

Rather than a rigid international regime involving applications and approval, some have advocated for a more flexible approach involving a credit trading system.[86] The Montreal Protocol involves an early application of such a system.[87] Under the Protocol, emissions are controlled by allowing each party a certain amount of emissions in a given time frame.[88] Parties may then purchase these emission "credits" from each other, allowing the credits to be efficiently allocated to the party whose technology has not yet caught up to emission standards.[89] This system has provided a free-market method of regulating emissions, giving financial benefit to those who do not use their credits, while essentially fining those who pollute by requiring them to purchase more credits.

This system has proven successful for regulating emissions, and has thus seen suggestions for adaption to extraction as well.[90] In the context of space resource extraction, nations could be allotted a certain number of space mining credits, entitling them to extract a certain tonnage of space resources.[91] The credits could be specific to a certain celestial body identified by the extracting nation, for example the Moon, an asteroid, or Mars, or they could be generally applied to any resource retrieved from space. Such a credit would ostensibly incentivize developed countries to invest heavily in the extraction of space resources, since the pay-for-play credit system would give them

86. *See, e.g.*, Edwin W. Paxson III, Note, *Sharing the Benefits of Outer Space Exploration: Space Law and Economic Development*, 14 MICH. J. INT'L L. 487, 514–517 (1993).

87. Montreal Protocol on Substances that Deplete the Ozone Layer, Jan. 1, 1989, 26 I.L.M. 1550 [hereinafter Montreal Protocol].

88. *See id.* art. 2.5.

89. *See id.*

90. *See, e.g.*, Tom Tietenberg, *The Tradable Permits Approach to Protecting the Commons: What Have We Learned?*, at 1, presented at the Conference of the International Association for the Study of Common Property, Constituting the Commons: Crafting Sustainable Commons in the New Millennium, 2000, https://dlc.dlib.indiana.edu/dlc/bitstream/handle/10535/119/tietenbergt040800.pdf?sequence=1&isAllowed=y.

91. *See* Coffey, *supra* note 68 at 138.

a large first-movers advantage. At the same time, because their credits would have to be purchased from other nations, developing nations would still be able to receive a benefit from the extraction activities.

However, because an international authority would be required to allocate the mining credits and ensure nations do not exceed their credits, this system, on its own, runs into many of the same problems as the international regime described above.[92] Further, national systems may have to be established for the domestic allocation of credits to the private space actors seeking to mine in space.[93]

3. The International Space Station Model

Rather than an authoritarian structure, or tradable credits, some have suggested that extraction of space resources could be managed by bilateral intergovernmental agreements (IGAs) – a system modeled after the operation of the International Space Station (ISS).[94] In general, legal jurisdiction of the ISS is divided among the member states, with each maintaining jurisdiction of the components it provides.[95] To facilitate the joint use of all components, parties enter into IGAs, which set out rules for parties' conduct in outer space and establish principles for carrying out joint efforts.[96] Once IGAs have been established, the corresponding space agencies establish memoranda of understanding (MOUs) that iron out the details regarding the operation of the ISS.[97]

Applying this system to space resources, governments could agree to work together on a space mining project, each contributing financial and technological resources.[98] In a way, this system would simply be a more robust variant of the Artemis Accords (which is also structured as a bilateral framework, and which has already gained some international acceptance), adding more detailed substantive requirements of partner nations. Because such a system does not require full international buy-in, it has the benefit of allowing nations to create such partnerships as soon as the requisite technology becomes available.[99] The lack of international buy-in, however, means

92. *Id.*
93. *Id.*
94. *See, e.g.*, Rosanna Sattler, *Transporting a Legal System for Property Rights: From the Earth to the Stars*, 6 CHI. J. INT'L L. 23, 37–38 (2005).
95. *See* Coffey, *supra* note 68 at 142.
96. *Id.*
97. *Id.* at 143–44.
98. *Id.*
99. *Id.* at 142.

that this system likely contravenes the common heritage principle, and could lead to tensions between nations that agree to the IGAs and those that refuse, particularly if both have significant presences in space on celestial bodies where the mining is to occur.[100]

4. Full Personal Property Rights

Some scholars have argued that the "most efficient solution to the space resource debate would simply be to allow comprehensive property rights, including real estate ownership, in space."[101] While there may be persuasive utilitarian and desert-for-labor arguments for such a system, there are several reasons why it would be difficult to implement in the current international legal regime. As an initial matter, the Outer Space Treaty declares space to be the province of all mankind, and even if extraction of resources is allowed as argued by some, the treaty's freedom of access requirement bars a right to exclude typical of modern real property rights.[102]

Further, U.S. federal courts have already engaged with the question of real property rights in space in the infamous *Nemitz* case.[103] The plaintiff, George Nemitz, had claimed ownership to the asteroid "Eros," by registering with the Archimedes Institute.[104] In 2001, when the National Aeronautics and Space Administration (NASA) landed a spacecraft on Eros, Nemitz alleged that they infringed his property rights, and claimed "parking" fees of twenty cents per year.[105] NASA alleged that Nemitz's claim had no foundation in law, and the Nevada district court agreed, dismissing the case on the grounds that Nemitz had no property interest in the asteroid, and thus had no cognizable cause of action against NASA.[106] If the U.S., which is arguably the most space resource-friendly nation currently, found such property treatment unreasonable, other nations are likely to do the same.

Finally, the common heritage principle, central to the

100. *Id.* at 143–44.

101. *Id.* at 139.

102. *See id.* (citing Outer Space Treaty art. 1).

103. *See* Nemitz v. United States, No. CV-N030599-HDM (RAM), 2004 WL 3167042 (D. Nev. Apr. 26, 2004), *aff'd sub nom.* Nemitz v. NASA, 126 F. App'x 343 (9th Cir. 2005).

104. *Id.* at *1. For many years, the Archimedes Institute operated an online registry where individuals could register private claims to space resources, until it was abandoned in 2001-02. *The Archimedes Institute*, PERMANENT, https://www.spacesettlement.com/archimedes-institute.html, (last visited Jan. 30, 2023).

105. *See Nemitz*, 2004 WL 3167042, at *1.

106. *Id.* at *2.

development of international space law thus far, would have to be disregarded.[107] Unfettered property rights in space would likely lead to a rush on space resources by technologically capable nations, leaving developed nations in the dust. This situation may still provide a net global benefit in trade of new or cheaper resources but undermines the common heritage principle's attempt to stymie a growing wealth gap between nations.[108]

Four possible solutions to the space resource debate have been outlined above: an international regime, a credit-trading system, an ISS-model governed by IGAs, and full property rights. Each of these models has clear benefits as an inspiration for a new system governing space resources. However, each also has potentially fatal flaws, and so another option should be considered.

II. THE WORLD TRADE ORGANIZATION AND THE AGREEMENT ON TRADE-RELATED ASPECTS OF INTELLECTUAL PROPERTY RIGHTS

The World Trade Organization (WTO) had a long journey to becoming the expansive organization we know today. In the years trailing the Second World War, members of the newly formed United Nations hoped to form an organization that would reduce tariffs and eliminate other barriers to trade.[109] The United States led the proposal, fashioning the Havana Charter for what was to be dubbed the International Trade Organization (ITO).[110] While negotiations continued, states adopted the General Agreement on Tariffs and Trade (GATT) as a stopgap measure until the ITO could be formed.[111] While the GATT initially succeeded in obtaining tariff concessions affecting $10 billion in trade, it was not intended to be an institution, and was considered provisional even as an agreement.[112] However, the Havana Charter failed to be adopted by the U.S. Congress, so the ITO never came to be, leaving the supposedly temporary GATT standing in its

107. *See* Coffey, *supra* note 68, at 141 ("The proposition of full ownership rights further violates the OST by disregarding the concerns of developing nations.").

108. *Id.* (noting that this system "could perpetuate current disparities of wealth and resources on Earth to the Moon and outer space").

109. CRAIG VANGRASSTEK, THE HISTORY AND FUTURE OF THE WORLD TRADE ORGANIZATION 43 (2013).

110. *Id.* at 43–44.

111. *Id.*

112. *The GATT years: from Havana to Marrakesh*, THE WORLD TRADE ORG., https://www.wto.org/English/thewto_e/whatis_e/tif_e/fact4_e.htm (last visited Jan. 14, 2021).

place.[113]

Over the years, the GATT grew and developed through six more negotiations, called "rounds," each lowering tariffs or adding agreements aimed at facilitating international trades.[114] The Annecy Round of 1949, which took place in Annecy, France, introduced around 5,000 tariff reductions.[115] In 1951, the Torquay Round brought almost 9,000 more reductions, and signified the first round after the failure of the Havana Charter led to the GATT's permanent establishment.[116] The Geneva Round and Dillon Round in 1956 and 1960-61, respectively, both contributed to the lowering of tariffs.[117] In 1964-67, the Kennedy Round led to anti-dumping provisions along with tariff reductions.[118] The Tokyo Round of 1973-79 established regulations controlling non-tariff barriers and voluntary export restrictions.[119]

Then, in 1986, the Uruguay Round was launched.[120] This round was the most ambitious yet, lasting for over seven years, and culminating in new agreements on trade in services, agriculture, and intellectual property.[121] Perhaps most importantly, the Uruguay Round established the WTO, which succeeded where the ITO had failed, surviving the scrutiny of Congress and passing by a margin that surprised the world even at the time.[122]

For the most part, the agreements covered by the WTO imposed requirements directly relating to international trade.[123] Generally, this means binding parties to low tariffs[124] and restricting import quotas or other procedural barriers to trade.[125] For example, the

113. VANGRASSTEK, *supra* note 109, at 44.

114. *Id.*

115. Press Release, Fiftieth Anniversary of the Multilateral Trading System, WTO (1998) (on file with author); *see also History of the multilateral trading system,* WTO, https://www.wto.org/english/thewto_e/history_e/history_e.htm (last visited Feb. 2, 2023).

116. *Id.*

117. *Id.*

118. *Id.*

119. *Id.*

120. VANGRASSTEK, *supra* note 109, at 44.

121. *Id.* at 47–48.

122. *Id.* at 64 ("[T]he final vote in favour of the Uruguay Round Agreements Act of 1994 was wider than feared. It passed by 288 to 146 in the House of Representatives and 76 to 24 in the Senate . . . .").

123. *See, e.g.*, *Understanding the WTO*, *supra* note 112.

124. *Understanding the WTO: The Agreements*, WORLD TRADE ORG., https://www.wto.org/english/thewto_e/whatis_e/tif_e/agrm2_e.htm (last visited Feb. 8, 2023) (noting that a goal of the WTO is to make tariffs more binding and closer to zero).

125. *See* Agreement on Agriculture, Apr. 15, 1994, Marrakesh Agreement

Agriculture Agreement requires that a party apply a tariffs-only approach to regulating agricultural imports, thus barring import quotas for agriculture.[126] Meanwhile, the Technical Barriers to Trade Agreement (TBT) imposes restrictions on regulations, standards, and testing and certification procedures that create unnecessary obstacles to the importation of products.[127] The General Agreement on Trade in Services (GATS) extended the most-favored-nation treatment of the GATT to services, putting all parties on an equal footing in providing services across borders.[128]

One agreement, however, went substantially beyond the scope of the others. The Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPs),[129] also adopted during the Uruguay Round, was nominally suggested to limit or enforce intellectual property measures to ensure they did not become barriers to legitimate trade.[130] At the beginning of the negotiations, some nations believed they would be able to limit talks primarily to trade in counterfeit goods and other topics directly trade-related.[131] Led by India and Brazil, they argued that substantive intellectual property issues could be negotiated only under the World Intellectual Property Organization (WIPO), and that the GATT did not have the institutional competence to discuss the issues.[132]

Yet discuss them they did, and when the Uruguay Round closed in 1994, it brought with them all the substantive requirements that India and Brazil feared.[133] Article 27 imposed a general mandate of patentability for all new, inventive, and useful inventions, regardless

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Establishing the World Trade Organization, Annex 1A, 1867 U.N.T.S. 410 [hereinafter Agriculture Agreement]; Agreement on Technical Barriers to Trade, Apr. 12, 1979, 1186 U.N.T.S. 276 [hereinafter TBT Agreement].

126. Agriculture Agreement, *supra* note 125, art. 4.2.

127. *Technical Barriers to Trade*, WORLD TRADE ORG., https://www.wto.org/english/tratop_e/tbt_e/tbt_e.htm#:~:text=The%20Technical%20Barriers%20to%20Trade,create%20unnecessary%20obstacles%20to%20trade (last visited Feb. 8, 2023).

128. *The General Agreement on Trade in Services (GATS): Objectives, Coverage and Disciplines*, WORLD TRADE ORG., https://www.wto.org/english/tratop_e/serv_e/gatsqa_e.htm (last visited Feb. 8, 2023).

129. Agreement on Trade-Related Aspects of Intellectual Property Rights, Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1C, 1869 U.N.T.S. 299, 33 I.L.M. 1197 (1994) [hereinafter TRIPs Agreement].

130. General Agreement on Tariffs and Trade, Ministerial Declaration on the Uruguay Round of Multilateral Trade Negotiations, pt. I.D, Sept. 20, 1986, 25 I.L.M. 1623, 1626 (1986).

131. Peter K. Yu, *The Objectives and Principles of the TRIPS Agreement*, 46 HOUS. L. REV. 979, 983–84 (2009).

132. *Id.* at 984.

133. *See* TRIPs Agreement, *supra* note 129.

of field of technology.[134] Prior to TRIPs, patentability requirements varied greatly between nations, most notably for pharmaceuticals.[135] TRIPs standardized these requirements, forcing parties to add protections where they lacked them previously.[136] TRIPs also harmonized the rights of patent holders, providing that they may prevent infringers from "making, using, offering for sale, selling, or importing" the patented product or process.[137]

TRIPs is not without its flexibilities, however. There are several categories of inventions which members may exclude from patentability.[138] These include inventions injurious to the public health or environment.[139] Parties may also exclude patents on medical procedures, and patents covering plants or animals, other than micro-organisms.[140] Thus TRIPs seeks to harmonize patent rights while leaving intact a portion of nations' sovereign ability to determine policy.

In analyzing how and why the international community adopted a substantive intellectual property regime through an organization ostensibly focused on trade, rather than WIPO, it helps to review the history leading up to the introduction of TRIPs at the Uruguay Round. In the 1970s, both developing nations and industry leaders in developed nations became increasingly vocal in their criticisms of the international patent system at the time.[141] The former believed that the system favored developed nations, and that they should be given preferential treatment to balance out its impact among states.[142] Intellectual property industries believed that their rights were not sufficiently protected in developing nations, and that standards of protection should be raised to combat widespread infringement.[143] In response, a WIPO diplomatic conference was convened in 1980 with the purpose of addressing these concerns.[144]

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134. *Id.* art. 27.1.

135. Amy Kapczynski, *Harmonization and Its Discontents: A Case Study on TRIPS Implementation in India's Pharmaceutical Sector*, 97 CALIF. L. REV. 1571, 1576 (2009) (noting that for the three decades prior to TRIPs, India had forbidden patents on pharmaceuticals).

136. *Id.*

137. TRIPs Agreement, *supra* note 129, art. 28.

138. *Id.* art. 27.2, 27.3.

139. *Id.* art. 27.2.

140. *Id.* art. 27.3.

141. Laurence R. Helfer, *Regime Shifting: The TRIPs Agreement and New Dynamics of International Intellectual Property Lawmaking*, 29 YALE J. INT'L L. 1, 20 (2004).

142. *Id.*

143. *Id.*

144. *Id.*

The conference continued for five years, kept alive by a deepening conflict between the U.S. and developing countries.[145] Finally, in 1985, the conference ended without adopting any treaty revisions.[146] This deadlock loomed large in the international community, and was perceived by some as a failure by WIPO.[147]

At the same time that negotiations fizzled within WIPO, the U.S. successfully negotiated a series of bilateral consultations that strengthened intellectual property protections by linking them with trade.[148] Having lost faith in WIPO, the U.S. decided to expand this linking strategy into a multilateral approach.[149] After evaluating the international landscape, they set their eyes on the GATT as the venue for doing so, and urged the inclusion of intellectual property issues in the Uruguay Round.[150]

The nature of the Uruguay Round as a "package deal" may have ultimately led to TRIPs' success. By linking intellectual property to trade, the Round forced nations to accept the provisions if they also wanted to secure access to the broader international market.[151] Further, the Uruguay Round provided a mechanism of actually enforcing the substantive requirements by restructuring the dispute settlement rules to make decisions binding on all states and to authorize the use of retaliatory sanctions by prevailing states.[152] These new rules were viewed as a massive improvement over those utilized by WIPO, which were so cumbersome they were never utilized.[153]

So, when WIPO failed to bring international harmony to the global patent system, the WTO proved effective. The WTO's ability to link substantive reform to trade issues that all nations have a stake in has made it a powerful tool in incentivizing progress. It is possible that, in the future, it could be seen as an alternative venue for solving many of our global issues.

III. A WTO AGREEMENT ON SPACE RESOURCES

Hot on the heels of the Outer Space Treaty, the international

145. *Id.*
146. *Id.*
147. *Id.*
148. *Id.* at 20–21.
149. *Id.* at 21.
150. *Id.*
151. *Id.* at 22.
152. *Id.*
153. *Id.*

community convened the United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE) in 1968 to create a framework to govern utilization of space resources.[154] At the time, many believed that this technology lay right around the corner.[155] The Moon Agreement took a decade to complete and called for the establishment of an international regime to govern the exploitation of the natural resources of the moon.[156] The international response to the agreement was lackluster, however, and no substantive steps were taken to create the envisioned regime.[157] In spite of this lack of a solution from the United Nations, countries still seek an answer to the space resource utilization debate.[158]

The current situation could be considered analogous to that preceding the regime shift in intellectual property from WIPO to the WTO. In both situations, negotiations took place within the framework of the United Nations,[159] and both times, the negotiations failed to implement a substantive reform. Similarly, in both instances, the United States began employing bilateral agreements as a work-around of the United Nations.[160] For intellectual property, it was not until the international community turned to the WTO that a comprehensive agreement was finally reached.[161] With a multilateral agreement on space resources also in limbo, a similar approach may be appropriate here. With a regime shift from UNCOPUOS to the WTO,

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154. Dennis C. O'Brien, *Beyond UNISPACE: It's time for the Moon Treaty*, SPACE REV. (Jan. 21, 2019), https://www.thespacereview.com/article/3642/1.

155. von der Dunk, *supra* note 40, at 88–89 n.28 (citing the Moon Agreement's language that it was enacted because "such exploitation is about to become feasible").

156. Moon Agreement, *supra* note 22, art. 11.5.

157. *See* Roth, *supra* note 55, at 843–44 ("The Moon Treaty, however, has been ratified or acceded to by fewer than twenty countries, none of them major space powers. As one noted space-law scholar remarks, '[T]he Moon Treaty . . . is a treaty that is already obsolete.'").

158. The unilateral responses discussed in Part I of this paper evidence a continued desire by the U.S. and others to create a solution in spite of the silence of UNCOPUOS.

159. Negotiations occurred within WIPO in the context of intellectual property, and UNCOPUOS in the context of space resources. *See Inside WIPO*, WIPO, https://www.wipo.int/about-wipo/en/ (last visited Mar. 16, 2023) (noting that WIPO is an agency of the United Nations); Helfer, *supra* note 140, at 23 (detailing the regime shift in intellectual property from WIPO to the WTO); *Space Law Treaties and Principles*, United Nations Off. for Outer Space Affs., https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties.html (last visited Mar. 16, 2023) (explaining the role of UNCOPUOS in forming international space law treaties that deal with a variety of issues, including "the exploitation of natural resources in outer space").

160. *Compare* Helfer, *supra* note 141, at 20–21 *with* Artemis Accords, *supra* note 53. For both intellectual property and space resources, it was the lack of movement within the United Nations that led to the United States seeking other options.

161. *See supra* Part II.

the incentives associated with access to international markets could prove sufficient to finally bring nations to the table.

The following sections will first outline the structural components that a potential WTO agreement on space resources should provide. They will then analyze the potential benefits of the system. Finally, they will present potential issues with this use of the WTO, along with solutions to these issues.

A. CONTENTS OF THE AGREEMENT

In imagining the contents of a potential WTO agreement on space resources, it may be helpful to examine the structure of our model, TRIPs. TRIPs begins with a statement of its basic principles, including a renewed commitment to the multilateral agreements concluded under the auspices of WIPO.[162] It then lays out the substantive standards concerning copyrights, trademarks, industrial designs, patents, and other types of intellectual property, including requirements as to the scope of inventions protected.[163] Next, TRIPs outlines the obligations of member states regarding enforcement of the harmonized intellectual property rights.[164] Finally it outlines dispute resolution measures and other administrative details.[165]

Using TRIPs as an outline, a potential WTO agreement on space resources should begin with a statement of its basic governing principles. As nations have recognized in previous agreements, any new agreement on space resources should include an affirmation of duties under the Outer Space Treaty, Rescue Agreement, Liability Convention, and Registration Convention, as well as of the continuing authority of UNCOPUOS.[166]

Next, any effective agreement on space resources should aim to harmonize acceptance of space resource utilization activities. As discussed in Part I, some nations have attempted to act unilaterally or through small bilateral groups. However, these actions will likely have limited success in promoting the extraction and utilization of space

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162. *See* TRIPs Agreement, *supra* note 129, art. 5.

163. *See id.*, pt. II.

164. *See id.*, pt. III.

165. *See id.*, pts. IV–VII.

166. *See* Artemis Accords, *supra* note 53, pmbl. ("Affirming the importance of compliance with the . . . Outer Space Treaty . . . as well as the . . . Rescue and Return Agreement . . . , Liability Convention . . . , [and] Registration Convention . . . ; as well as the benefits of coordination via multilateral forums, such as the United Nations Committee on the Peaceful Uses of Outer Space ('COPUOS'), to further efforts toward a global consensus on critical issues regarding space exploration and use . . . .").

resources for a number of reasons. Perhaps most importantly, neither public nor private actors are likely to invest the necessary resources to establish an extraterrestrial mining operation without significant assurance of a stable legal claim to extracted resources.[167] The lack of international buy-in with unilateral legislation or with the Artemis Accords will likely lead to conflicting claims and challenges from other nations.[168] The only way to ensure the predictability required is to act with the cooperation of the greater international community, as outlined in the Outer Space Treaty.[169]

Just as TRIPs provided for the global patentability of a wide range of technologies,[170] a WTO agreement on space resources should provide for the global acceptance of the retrieval and trade in space resources. The agreement could do so without impinging on the authority of UNCOPUOS or the Outer Space Treaty, by simply affirming that "the extraction of space resources does not inherently constitute national appropriation under Article II of the Outer Space Treaty."[171] An agreement could then mandate acceptance of importation of space resources and products made using space resources.

In outlining such a mandate, inspiration could be taken from the general principles governing the GATT, WTO, and the other WTO agreements. This includes the principle of non-discrimination, which requires all WTO members to give each other "most favored nation" (MFN) status[172] and "[n]ational [t]reatment" regarding taxation of

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167. *See* Richard B. Bilder, *A Legal Regime for the Mining of Helium-3 on the Moon: U.S. Policy Options*, 33 FORDHAM INT'L L.J. 243, 274 (2010) (reasoning that actors will only risk the very substantial investment and long-term effort necessarily involved in seeking to develop helium-3 based fusion energy if they are assured that the requisite supply of lunar helium-3 can continue to be obtained without encountering significant legal or political difficulties).

168. *Id.*

169. Outer Space Treaty, *supra* note 15, pmbl. ("Reaffirming the importance of international cooperation in the field of activities in the peaceful exploration and use of outer space, including the Moon and other celestial bodies, and the importance of developing the rule of law in this new area of human endeavour").

170. *See* TRIPs Agreement, *supra* note 129, art. 27.

171. Artemis Accords, *supra* note 53, § 10, ¶ 2 ("The Signatories emphasize that the extraction and utilization of space resources, including any recovery from the surface or subsurface of the Moon, Mars, comets, or asteroids, should be executed in a manner that complies with the Outer Space Treaty and in support of safe and sustainable space activities. The Signatories affirm that the extraction of space resources does not inherently constitute national appropriation under Article II of the Outer Space Treaty, and that contracts and other legal instruments relating to space resources should be consistent with that Treaty.").

172. General Agreement on Tariffs and Trade 1994 art. 1, Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1A, 1867

imported products.[173] Because many of the resources extracted from outer space also occur naturally on Earth, and are already found in many WTO member states, they would likely be "like product[s]" under Article I of the GATT, and thus entitled to free trade under the non-discrimination principle.[174] Such a mandate is also consistent with Article XI of the GATT, which eliminates quantitative restrictions such as quotas or bans.[175] In the context of space resources, Article XI would bar member states from unilaterally punishing extracting states by refusing trade in the extracted resources.

Besides harmonizing acceptance of space resources, an effective agreement should also provide measures to govern resource extraction activities in space. Without regulation, states might engage in conflicting activities, incidentally damaging each other's operations. Without standardized operational parameters and efficient conflict resolution measures, these off-planet encounters bear the risk of escalating into international hostilities, in a situation scholars have compared to the lawlessness emblematic of the "Wild West."[176] This procedural standardization is not without precedent in the WTO; for instance, Article 29 of TRIPs includes procedural requirements (e.g., regarding disclosure) for the filing of patents.[177]

Although the Artemis Accords have attracted much controversy,[178] they could provide a template for these operational requirements. Section 11 of the Accords addresses the deconfliction

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U.N.T.S. 187 [hereinafter GATT 1994].

173. *Id.* art. 3.

174. *See* von der Dunk, *supra* note 40, at 96; *see also* GATT 1994, *supra* note 171, art. 1 ("With respect to customs duties and charges of any kind imposed on or in connection with importation or exportation or imposed on the international transfer of payments for imports or exports, and with respect to the method of levying such duties and charges, and with respect to all rules and formalities in connection with importation and exportation, and with respect to all matters referred to in paragraphs 2 and 4 of Article III,* any advantage, favour, privilege or immunity granted by any contracting party to any product originating in or destined for any other country shall be accorded immediately and unconditionally to the like product originating in or destined for the territories of all other contracting parties.").

175. GATT 1994, *supra* note 172, art. 11 ("No prohibitions or restrictions other than duties, taxes or other charges, whether made effective through quotas, import or export licenses or other measures, shall be instituted or maintained by any contracting party on the importation of any product of the territory of any other contracting party or on the exportation or sale for export of any product destined for the territory of any other contracting party.").

176. *See* Crowell, *supra* note 49, at 102.

177. TRIPs Agreement, *supra* note 129, art. 29.

178. *See, e.g.*, Comm. on the Peaceful Uses of Outer Space, Reviewing Opportunities for Achieving the Vienna Consensus on Space Security Encompassing Several Regulatory Domains: Working Paper Submitted by the Russian Federation, ¶¶ 5–7, U.N. Doc. A/AC.105/C.1/2016/CRP.15 (Feb. 16, 2016).

of space activities, and outlines principles of non-interference.[179] Most notably, the Accords call for the definition of "safety zones" around a nation's space-based activities.[180] The size and scope of these zones would vary with the nature of the operations being conducted, based on commonly accepted scientific and engineering principles.[181] Within these zones, other signatories commit to avoiding harmful interference with activities, and to provide notification before conducting any operations nearby.[182] Beyond non-interference and notification, the safety zones do not infringe on the general freedom of access outlined in the Outer Space Treaty.[183]

The Artemis Accords give other protections that could benefit a future multilateral agreement on space resources as well. Section 12 requires signatories to plan for the mitigation of any potential orbital debris caused by their space activities.[184] Section 9 calls for the preservation of outer space heritage, such as the Apollo 11 landing site.[185] Signatories also commit to the open sharing of scientific data and information on space activities.[186] Each of these provisions acts to protect the rights and safety of the international community, while allowing for the efficient extraction of space resources. As such, they are deserving of consideration during the drafting of a new space resources agreement.

An agreement on space resources should also provide for the handling of disputes within the WTO. It should incorporate Articles XXII and XXIII of the GATT, as applied by the Dispute Settlement Understanding (DSU), such that disputes are to preferably be settled through consultation before being heard by a dispute panel.[187] Consultation allows states in dispute to attempt to find a solution before appealing to a higher authority.[188] The incorporation of consultation into the GATT (and subsequently WTO) dispute resolution system has helped incentivize cooperative solutions, since the alternative involves steps that are often complex and costly.[189] However, if consultations fail, the parties may turn to the Dispute

179. *See* Artemis Accords, *supra* note 53, § 11.
180. *Id.* ¶¶ 6–11.
181. *Id.* ¶ 7.
182. *Id.* ¶ 10.
183. *Id.* ¶ 11.
184. *Id.* § 12.
185. *Id.* § 9.
186. *Id.* § 8.
187. *See* GATT 1994, *supra* note 172, art. 22–23.
188. *Id.* art. 22.1.
189. *See* Joost Pauwelyn, *The Dog That Barked but Didn't Bite: 15 Years of Intellectual Property Disputes at the WTO*, J. INT'L DISP. SETTLEMENT 389, 422 (2010).

Settlement Body (DSB), which has the power to impose sanctions on treaty violators.[190] It is this threat of sanctions that has proven the WTO so effective, and so should be incorporated in an agreement on space resources as well.

Finally, because space mining operations will likely be complex, and the actors numerous, it may be helpful to incorporate a body to monitor the ongoing operation of the governing agreement. The TRIPs agreement established the Council for TRIPs and tasked it with similar authority.[191] The Council for TRIPs regularly conducts transparent reviews of state conduct and serves as a forum for consultations.[192] Similarly, a "Council for Space Resources" could monitor ongoing space mining operations and serve as an intermediary for receiving notice of new operations and disseminating scientific data. Further, the council could consult with UNCOPUOS to ensure cooperation among international space activities.[193]

B. BENEFITS OF A REGIME SHIFT

The WTO carries several benefits over the United Nations as a venue for an agreement on space resources. The DSB offers a more effective method of resolving disputes than the International Court of Justice (ICJ). In addition, tying space resources to trade may provide the most efficient method of regulating its extraction within the current international legal system. Finally, some nations have already begun a regime shift away from UNCOPUOS, and directing that shift towards the WTO could protect the multilateral order that has thus far governed space activities.

Compared to the United Nations, the WTO provides a more stringent and effective dispute resolution system.[194] During the Uruguay Round, the dispute settlement rules were restructured to make decisions binding on all states.[195] Further, while the WTO supports consultations as a primary method of dispute resolution, in the case of continued non-compliance, the DSB may authorize the

190. Helfer, *supra* note 141, at 23.

191. TRIPs Agreement, *supra* note 129, art. 68.

192. Helfer, *supra* note 141, at 23.

193. TRIPs carried a similar mandate, requiring that "[i]n consultation with WIPO, the Council shall seek to establish . . . appropriate arrangements for cooperation with bodies of that Organization." TRIPs, *supra* note 129, art. 68.

194. *See* Helfer, *supra* note 141, at 2 ("Unlike prior international intellectual property agreements negotiated under the auspices of [WIPO], TRIPs has teeth.").

195. *Id.* at 22.

prevailing state to impose retaliatory sanctions.[196] The real threat of economic sanctions has proven to be one of the most effective aspects of the WTO dispute resolution system.[197]

In contrast, the ICJ, which acts as the judicial arm of the United Nations, has proven far less effectual for a very powerful reason: the states party to a dispute must agree to appear before the court and to be bound by its decisions.[198] The obvious flaw in this system is that there is no enforceable accountability mechanism. The U.S. has taken advantage of this loophole in the past, most notably in the notorious *Nicaragua* case,[199] where the ICJ delivered a judgement against the U.S., and in response, the U.S. simply ignored it.[200] Without a strong method of holding parties accountable, the ICJ would not have the power to effectively administer an agreement on space resources.

The United Nations in general has had limited success at brokering solutions to space-based disputes. In 1978, the U.S.S.R.'s nuclear powered satellite, Kosmos 954, broke up upon reentry and scattered radioactive debris across Canada, including portions of the Northwest Territories, Alberta, and Saskatchewan.[201] The Liability Convention, brokered under UNCOPUOS, ostensibly imposes strict liability for damages caused by space objects.[202] However, in the international uproar following the crash of Kosmos 954, authorities could not even agree whether the spread of radioactive debris across Canada entitled them to recover the six million Canadian dollars

196. *Id.*

197. *See* Laurence R. Helfer, *Adjudicating Copyright Claims Under the TRIPs Agreement: The Case for a European Human Rights Analogy*, 39 HARV. INT'L L.J. 357, 385–86 (1998) (noting that authorities have largely attributed the success of the WTO dispute resolution system to the prevailing state's ability to impose trade sanctions on the losing state). *But see* Ruth L. Okediji, *Rules of Power in an Age of Law: Process Opportunism and TRIPs Dispute Settlement, in* 2 HANDBOOK OF INTERNATIONAL TRADE LAW 42, 46 (E. Kwan Choi & James C. Hartigan eds. 2004) (arguing that the WTO dispute settlement system serves primarily to encourage the parties to "opt out of the formal process and settle the dispute informally").

198. Marcell Berlins, *The ICJ is the UN's Least Effective Body*, THE GUARDIAN (July 12, 2004), https://www.theguardian.com/world/2004/jul/13/law.features11.

199. *See* Military and Paramilitary Activities in and against Nicaragua (Nicar. v. U.S.), Jurisdiction of the Court and Admissibility of the Application, 1984 I.C.J. 392 (Nov. 26).

200. Berlins, *supra* note 200 (noting that the U.S. did not even show up to court in order to deliver their arguments).

201. Alexander F. Cohen, *Cosmos 954 and the International Law of Satellite Accidents*, 10 YALE J. INT'L L. 78, 79.

202. *See* Liability Convention, *supra* note 20, art. 2 ("A launching State shall be absolutely liable to pay compensation for damage caused by its space object on the surface of the earth or to aircraft flight.").

expended on clean up during Operation Morning Light.[203] In the end, the U.S.S.R. contributed three million Canadian dollars, and Canada decided not to push the issue in view of the uncertainty surrounding the international regime's ability to resolve the dispute.[204] In light of the costs associated with this uncertainty, any new agreement on space resources should include a robust system for resolving the inevitable disputes between space-faring nations. The WTO's DSB is a pre-built example of such a system.

Tying space resources to trade may also provide the most economically and procedurally efficient method of regulating space resource utilization within the current international legal regime. Besides the incentives associated with the threat of sanctions, using trade as the basis for regulation also ensures a minimum level of freedom within the marketplace for the exchange of space resources. This is a quality that United Nations-led regimes have thus far failed to replicate. For example, the most commonly cited United Nations model for regulating space resource extraction, the ISA,[205] has been criticized for lacking economic incentives for compliance.[206] A trade-based regime would provide not only the requisite regulation, but would also provide an ecosystem for efficient distribution that would incentivize compliance.

Further, tying regulations to trade may provide inherent enforcement of the freedom of scientific investigation provision within the Outer Space Treaty. Rather than a presumption of regulation for all space activities, the enforcement mechanism of sanctions could only be utilized for economic space activities; a WTO agreement would focus on trade, and any breach would necessarily involve such trade. This would leave states free to pursue extraction of resources for scientific or research purposes. At the same time, celestial bodies are saved from strip-mining, because economic resource extraction would theoretically lead to trade, and violations could then be sanctioned. Thus a trade-based regime may self-enforce the freedom of scientific investigation without affecting its ability to

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203. *See, e.g.*, Haanappel, *Some Observations on the Crash of Cosmos 954,* 6 J. SPACE L. 147, 147–48 (1978). Operation Morning Light was a joint Canadian-American operation to recover the nuclear wreckage for which the U.S. paid approximately two and a half million U.S. dollars. *See* Cohen, *supra* note 203 at 80.

204. *See* Cohen, *supra* note 203, at 89, n.72 ("Canadian elites were relieved that the U.S.S.R. chose not to avoid payment on [grounds of the uncertainty surrounding the Liability Convention's definition of injury].").

205. *See, e.g.*, Coffey, *supra* note 68.

206. Jason C. Nelson, *The Contemporary Seabed Mining Regime: A Critical Analysis of the Mining Regulations Promulgated by the International Seabed Authority*, 16 COLO. J. INT'L ENVTL. L. & POL'Y 27, 43 (2005).

effectively regulate economic activity.

Finally, as discussed in Part I, many nations are already engaging in a subtle regime shift away from UNCOPUOS. Nations like the U.S.,[207] Luxembourg,[208] and U.A.E.[209] have enacted unilateral legislation granting certain rights over space resources. The U.S. has also brokered the Artemis Accords with fourteen other nations, which affirms that extraction does not equal appropriation.[210] In the absence of a solution from UNCOPUOS, these states have already seen the benefit of shifting the regulation of space resource extraction away from the United Nations. However, their piecemeal activities have led to an international regime of questionable integrity. Obtaining broader international support will likely be necessary for an enduring, long-term solution. The WTO, by tying a space resource regime to trade, could likely broker the type of multilateral agreement necessary to establish such a workable solution. In other words, perhaps the regime-shifting experiment of the Artemis Accords is not a warning of fragmentation in the international system,[211] but a sign that a more concrete shift should be undertaken. Doing so could protect the multilateral approach thus far taken towards space, while still acknowledging the concerns expressed by the states that initiated the regime shift.

C. POTENTIAL ISSUES

There are a few potential critiques of using the WTO to regulate space resources that deserve some consideration. First, it could be argued that space resources do not fall into the purview of the WTO. There could also be concerns that a WTO agreement as described could lead to over-utilization by developed nations at the expense of developing ones. In addition, perhaps such a WTO agreement could supplant the authority of UNCOPUOS. Finally, there may not be enough international buy-in for a multilateral agreement on space resources. In the end, however, each of these issues are surmountable through relatively simple mechanisms.

Some might view using the WTO to regulate the extraction and

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207. U.S. Commercial Space Launch Competitiveness Act, *supra* note 8.

208. Law on the Exploration and Use of Space Resources, *supra* note 58; Law on Space Activities, *supra* note 59.

209. Law on the Regulation of the Space Sector, *supra* note 60.

210. Artemis Accords, *supra* note 53, at §10, ¶2.

211. Jack Wright Nelson, *The Artemis Accords and the Future of International Space Law,* 24 INSIGHTS 31 (American Society of International Law, Dec. 10, 2020) ("[T]he Accords may mark the end of multilateralism in space lawmaking.").

utilization of space resources as an improper use of the organization. After all, the GATT, and subsequently the WTO, was founded with the goal of limiting tariffs and other barriers to trade.[212] Regulating space resource extraction would appear to be outside of this general purview. However, the entire purpose of obtaining space resources is for the value they provide in trade or manufacturing.[213] In fact, it could be argued that space resources could be more easily tied to trade than intellectual property, because nations will actually trade in the resources themselves, rather than simply using the intellectual property rights to protect their products. Because the international community accepted the WTO as a forum for imposing requirements in the somewhat nebulous field of intellectual property, they would likely also accept its use for the regulation of the more down-to-earth trade in space resources.[214]

Further, the WTO already provides some regulation in the burgeoning space economy. The Agreement on Trade of Information Technology Products (ITA) and its follow-up, ITA 2, cover many of the technologies involved in satellites.[215] The TBT further improves global free market access to space-related technologies by limiting standards-based impediments to trade.[216] In 1997, the Agreement on Telecommunication was adopted as a part of the GATS framework, and includes satellite telecommunications.[217] Even the TRIPs Agreement influences the space economy, insofar as it imposes substantive requirements regarding the intellectual property protections of space technologies.[218]

A second critique of this use of the WTO might revolve around the common-heritage principle. If the WTO's general purpose is to reward open trade and avoid impediments to such, then perhaps it would reward the extraction of resources by space-faring nations, while stripping the ability of developing nations, that lack the technology to compete, of their ability to protect their own rights. This could lead to over-utilization by developed nations, and a potential tragedy of the commons at the expense of developing nations.

A simple response to this critique would be to implement a form of quantitative regulation within an agreement on space resources.

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212. *Understanding the WTO*, *supra* note 112, at 25.

213. *See* Carter, *supra* note 4.

214. *See* TRIPs Agreement, *supra* note 129.

215. Domenico Giorgi, *WTO and Space Activities in* INTERNATIONAL ORGANIZATIONS AND SPACE LAW: THEIR ROLE AND CONTRIBUTIONS 403, 405 (R.A. Harris ed., 1999).

216. *Id.* at 406.

217. *Id.* at 407.

218. *Id.* at 410.

This could be in the form of allowable quotas as an exception to GATT Article XI, or perhaps a credit-trading system. The former would give developing nations direct economic leverage over space-faring nations, while the latter would incentivize action by space-faring states while distributing the gained wealth to developing nations.[219] A credit-trading system would give space-faring nations the ability to purchase enough credits to ensure that they will be able to extract sufficient resources to recoup their sizable investment.[220] At the same time, developing nations can sell their credits to obtain a piece of the pie.[221]

It could be also argued that using the WTO to regulate space activities would supplant the authority of UNCOPUOS. Similar concerns were raised during the negotiations of TRIPs with regard to the already-established WIPO.[222] TRIPs navigated these concerns by including an acknowledgement of the continuing importance of WIPO as a forum for negotiating treaties regarding the protection of intellectual property rights.[223] In addition, shortly after TRIPs' adoption, an agreement was reached between WIPO and the WTO that delegated certain functions between the two organizations in administering TRIPs.[224] Similar measures could be adopted here by accepting the continued authority of UNCOPUOS and delegating certain continued powers to the United Nations. For example, if a credit-distributing body is required to govern a credit-trading system, this could be delegated to UNCOPUOS.

Finally, a more pragmatic critique of a shift towards the WTO may center on its workability in the current international environment. Part of the reason that the Uruguay Round succeeded in establishing the TRIPs Agreement was the combined advocacy of the U.S. and European Union.[225] In contrast to the field of intellectual property, where many of the more developed economies shared interests in more stringent protections, the topic of space resources has proven far more divisive among the space powers. While Japan and the United Kingdom established support for the U.S. position by joining in the Artemis Accords, Russia and China have advocated against it.[226] This

219. *See* Coffey, *supra* note 68, at 138.

220. *See id.*

221. *See id.*

222. *See* Helfer, *supra* note 141, at 25.

223. *Id.*

224. Agreement Between the World Intellectual Property Organization and the World Trade Organization art. 2–4, Dec. 22, 1995, 35 I.L.M. 754–59.

225. *See* Helfer, *supra* note 141, at 19.

226. *See* Morgan McFall-Johnsen, *China and Russia haven't signed on to NASA's new plan to unify how humanity explores space*, BUS. INSIDER (Oct. 13, 2020, 11:52 AM),

divide splitting the space-faring nations may bring any future multilateral negotiations on the subject into gridlock.

However, this outcome is far from certain. In particular, by focusing on the divide among space-faring nations, one ignores the fact that the *global* divide on the issue of space resources looks far different from the one on intellectual property. During the TRIPs negotiations, the split was primarily between economically developed states that advocated for increased protections and less developed countries that feared the protections would stifle their own growth.[227] The topic of space resources, however, does not appear to divide along strictly economic lines. Instead, the U.S. has found itself joined by new actors hoping to establish themselves as new leaders in space, such as Luxembourg, the United Arab Emirates, and Brazil.[228] Instead of the debate falling to purely economic lines, other interests appear to be controlling, such as national entrepreneurialism and protection of old-guard institutions.[229] As such, the mere fact that the current space-faring nations cannot appear to agree on the subject does not mean that the rest of the international community would not welcome a more aggressive agreement on space resources.

CONCLUSION

As technology progresses, the need for an agreement on space resources becomes increasingly pressing. While the United Nations is the most logical venue to pursue such an agreement, it has thus far failed to provide an agreement that could gain the support of the international community.[230] Other scholars have suggested various solutions, from an ISA-type authority to the establishment of real property rights in space.[231] However, each of these runs into issues with either international law or policy concerns.

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https://www.businessinsider.com/nasa-artemis-accords-deep-space-exploration-moon-mars-asteroids-comets-2020-10.

227. *See* Helfer, *supra* note 141, at 20.

228. *See* Grush, *supra* note 64; *see also NASA Administrator Signs Statement of Intent with Brazil on Artemis Cooperation*, *supra* note 67.

229. The actions of Luxembourg and the United Arab Emirates stem from a plan to break into the relatively small club of space-faring nations. In contrast, Russia and the European Union's reticence towards more liberal space resource agreements appears to reflect their desire to protect their own statuses and that of the United Nations. An interesting case is that of Australia, which adopted the Moon Agreement only to then join the Artemis Accords, putting them in a precarious position regarding their international legal responsibilities. *See* Nelson, *supra* note 210, at 4.

230. *See* Roth, *supra* note 55, at 844 (suggesting that, because of its lack of support, "[t]he Moon Treaty . . . is a treaty that is already obsolete.").

231. *See* Coffey, *supra* note 68, at 133–44.

The WTO, although primarily focused on issues directly affecting trade such as tariffs or import quotas, has proven successful in harmonizing substantive intellectual property regimes through the TRIPs agreement. A similar model could be applied to space resources, with a potential agreement geared towards standardizing acceptance of the extraction of resources from celestial bodies. Such an application of the WTO may not be an issue-free solution, however, and future research should focus on how such an agreement could be specifically structured so as to navigate the varied policy concerns of the international community.

Only once a stable, international legal regime covering space resources is achieved will there likely be any sizable investment in the industry again. Dreamers of the last decade, including Planetary Resources and DSI, failed to make traction, in part, because of the heightened risk associated with investing in a field hallmarked by legal ambiguity. Once companies and investors can be certain that their lofty research and development costs are not being thrown into a legal black hole, and that their efforts will be rewarded by stable legal claims, we will likely see a resurgence in space mining interest. Companies may compete to be the first to mine the heavens, but we as legal thinkers should strive to arrive before them, so that they can succeed in our footsteps.