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All correspondence with reference to this publication should be directed to the JOURNAL OF SPACE LAW, University of Mississippi School of Law, 481 Chucky Mullins Drive, P.O. Box 1848, University, Mississippi 38677; jsl@olemiss.edu; tel: +1.662.915.2688.

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#### FROM THE EDITOR

To say that the world is slowly awakening from a COVID stupor is a misnomer. Those of us engaged in space law certainly did not let the pandemic halt our conversations. We adapted and engaged with each other on various and sundry digital platforms. One undeniable benefit was the ability to reach people that otherwise would not be able to afford to travel to conferences far-flung around the globe. That said, there is no substitute for the conversation borne in a quick cup of coffee or a chance meeting in the elevator. Our goal, as we embrace a return to in-person meetings, must be to assure that we continue to broaden the pool of individuals participating in our conversations about space law and policy. Here at the *Journal of Space Law* we are proud to work with editors, authors, lawyers and policymakers representing a diversity of cultures, geographies, generations and ideas.

This issue of the *Journal* shares research and analysis touching upon the law of neutrality and communications satellites, the characterization of human missions to Mars pursuant to the "harmful contamination" clause of Article IX of the Outer Space Treaty, the space laws of Central Asia, a proposal to form a new United Nations agency and the role of customary law in respect of future lunar activities. Our featured student article addresses cyber intrusions on space-based satellite systems, a topic that is sure to—or at least should—garner considerably more attention in the next few years. The final article builds a policy-based argument advocating for government investment in orbital debris remediation efforts. As always, we distribute this with pride as well as gratitude (and awe) for our authors. We know that decisions we make today will indelibly impact humanity's future and we are humbled to be a trusted platform in which to inform those choices.

> Michelle L.D. Hanlon Editor-in-Chief Oxford, Mississippi June 2022

#### INTERRUPTED BROADCASTS? THE LAW OF NEUTRALITY AND COMMUNICATIONS SATELLITES

Lieutenant Colonel Joshua J. Wolff\*

#### ABSTRACT

The role of private actors in State space activities, including defense applications, is experiencing a period of increasing growth. This marks a boon for space investors but will also bring legal changes to the international security landscape-some obvious and some more nuanced. A subtle but important security matter relates to neutral States, or States that are not parties to an international armed conflict. Neutral State interests (and their nationals' interests) can arise as governments encourage private sector space development or consume such services with contracts fulfilled by a neutral State or its nationals. The increased likelihood of involvement by neutral States and nationals-directly or indirectly-in an armed conflict involving communications satellites raises questions about how States' rights and duties under *neutrality* compare with their relevant counterparts from *international space law*. Neutrality prescribes overlapping but different rights and obligations for neutral States and nationals thereof. Conversely, space law blurs the traditional lines between State responsibility and private action. The proper legal framework to analyze neutral rights and obligations implicated by communications satellites during an international armed conflict is a fact-specific inquiry, assessing each

<sup>\*</sup> Judge Advocate, United States Army. LL.M., 2020, University of Nebraska (Space, Cyber, and Telecommunications Law), LL.M., 2015, The Judge Advocate General's Legal Center and School (Military Law), J.D., 2010, The College of William and Mary Marshall-Wythe School of Law; B.S., 2003, United States Military Academy. This paper was submitted in partial completion of a LL.M. in Space, Cyber, and Telecommunications Law at the University of Nebraska-Lincoln. I am extremely grateful to Professors Frans von der Dunk and Jack Beard for their insightful feedback on earlier drafts. The views in this paper are my own and do not imply endorsement or state policy of the United States Department of Defense or the Department of the Army.

component by the domain it occupies against applicable obligations from both custom and treaty.

#### I. INTRODUCTION

The first human activity in outer space was conducted solely by States and largely for security and research purposes.<sup>1</sup> At the time, only governments possessed the requisite financing to pursue activities in outer space.<sup>2</sup> Many States procured equipment for these endeavors under a system where private companies bid for and developed products to meet requirements specified by the government.<sup>3</sup> This government-led, industry-supported model for space technology development has since inverted. Working from a substantial knowledge base, private industry has surged forward to the role of innovator. From space access<sup>4</sup> to "traditional" space activities like remote sensing<sup>5</sup> and satellite communications,<sup>6</sup> to new inventions to be used in space,<sup>7</sup> private companies are improving

<sup>&</sup>lt;sup>1</sup> Peter Jankowitsch, *The Background and History of Space Law, in* HANDBOOK OF SPACE LAW 1, 3-4 (Frans von der Dunk et al. eds., 2015).

<sup>&</sup>lt;sup>2</sup> Frans von der Dunk, *The Origins of Authorisation: Article VI of the Outer Space Treaty and International Space Law, in 6* STUD. IN SPACE L. 3 (Frans von der Dunk ed., 2011).

<sup>&</sup>lt;sup>3</sup> See Debra Werner, Military Turns to Private Sector for Rapid Space Innovation, SPACENEWS (Oct. 9, 2019), https://spacenews.com/warfare-satellite-innovation-2019/ (citing government and industry officials commenting on transitions in space acquisition policy in the United States). See also Andrew Chuter, Airbus gets \$630 Million Deal Under UK Military's Skynet 6 Push, DEFENSENEWS (Jul. 20, 2020), https://www.defensenews.com/global/europe/2020/07/20/airbus-gets-630-million-deal-under-uk-militarysskynet-6-push (describing the United Kingdom's negotiations with a private sector provider of military satellite communications).

<sup>&</sup>lt;sup>4</sup> Space Exploration Technologies (SpaceX) made tremendous gains in the launch sector, garnering several contracts to resupply the International Space Station (ISS). Mike Wall, *The Private Spaceflight Decade: How Commercial Space Truly Soared in the 2010s*, SPACE.COM (Dec. 20, 2019), https://www.space.com/private-spaceflight-decade-2010s-retrospective.html.

<sup>&</sup>lt;sup>5</sup> Planet Labs operates the largest known privately-owned constellation of remote sensing satellites. Mike Wall, *Earth-Observing Satellite Startup Planet Is Going Public*, SPACE.COM (Jul. 9, 2021), https://www.space.com/planet-earth-observation-startup-go-ing-public. These satellites serve US national security purposes including monitoring Iran and North Korea. Wall, *supra* note 4.

 $<sup>^6\,</sup>$  SpaceX, OneWeb and Amazon are all companies that have announced plans to provide broadband internet via satellite, with some satellites already in operation. Wall, supra note 4.

 $<sup>^7\,</sup>$  Made In Space, Inc., for example, has developed 3-D printers to be used in zero-gravity. Wall, supra note 4.

and inventing space-based and space-related technology at an unprecedented rate. Government agencies find themselves reacting to and incorporating new industry-developed concepts for use in State space activities—including defense applications, rather than contracting for their construction.<sup>8</sup> This change marks a boon for space investors but will also carry legal consequences affecting the international security landscape—some obvious and some more nuanced.<sup>9</sup>

A more obvious consequence is the targetability of space objects<sup>10</sup> (including the terrestrial components of their systems) that are owned and operated by civilians for military use. "Dual use" status makes lawful the targeting of these otherwise protected civilian objects under the law of armed conflict (LOAC).<sup>11</sup> A former United States Secretary of Defense acknowledged this during his 2019 confirmation hearings, stating: "[w]e anticipate that adversary nations are unlikely to discriminate between United States military satellites and commercial satellites providing services to the United States Government, in the event of a conflict."<sup>12</sup>

<sup>&</sup>lt;sup>8</sup> Charles Beames, Why Hybrid Systems Will Enable the United States' Space Future, FORBES (Nov. 29, 2019), https://www.forbes.com/sites/charlesbeames/2019/11/29/why-hybrid-systems-will-enable-the-united-states-space-future/.

 $<sup>^9\;</sup>$  Id. Beames cites reports that the space economy will be a multi-trillion-dollar industry in the next 30 years.

<sup>&</sup>lt;sup>10</sup> The definition of "space object" must be addressed before discussing the complicated tangle of neutrality's application to them. This is undertaken *infra*, at Section II.B.ii.

<sup>&</sup>lt;sup>11</sup> While the law of armed conflict (LOAC) protects civilian objects from direct targeting by belligerents, such objects lose that protection when used in a manner that provides an effective contribution to military action and when destruction or neutralization offers a definite military advantage. Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of International Armed Conflicts art. 52, June 8, 1977, 1125 U.N.T.S. 3 [hereinafter Protocol I]. While many States (including the United States) are not parties to Protocol I, the provision related to defining a military objective as described above is accepted as customary international law. *See* INTERNATIONAL INSTITUTE OF HUMANITARIAN LAW, SAN REMO MANUAL ON INTERNATIONAL LAW APPLICABLE TO ARMED CONFLICTS AT SEA ¶ 67 (Louise Doswald Beck ed., 1995) [hereinafter SAN REMO MANUAL]; OFF. OF GEN. COUNS., DEP'T OF DEF., DEPARTMENT OF DEFENSE LAW OF WAR MANUAL §§ 5.6.3, 19.20.1.1 (2016) [hereinafter DOD LAW OF WAR MANUAL] (citing this definition as an example of a provision from Protocol I that the United States has accepted). *See also* YORAM DINSTEIN, THE CONDUCT OF HOSTILITES AND THE LAW OF INTERNATIONAL ARMED CONFLICT 91 (2d ed. 2010).

<sup>&</sup>lt;sup>12</sup> Theresa Hitchens & Colin Clark, *Commercial Satellites: Will They Be Military Targets?*, BREAKING DEF. (July 16, 2019) *citing* Mark Esper, https://breakingdefense.com/2019/07/commercial-satellites-will-they-be-military-targets/.

The more subtle security matter relates to neutral States, or States that are *not* parties to an international armed conflict. Neutral State interests (and their nationals' interests) can arise as governments encourage private sector space development *or* consume such services with contracts fulfilled by a neutral State or its nationals. Neutral State rights and obligations during an armed conflict involving space objects can be implicated for a variety of reasons including use of its territory (e.g., the location of a satellite control terminal)<sup>13</sup> or by international space law (e.g., by launching a space object from its territory or by registering a space object with the UN).<sup>14</sup>

This increased likelihood of involvement by neutral States and nationals—directly or indirectly—in an armed conflict involving space assets raises an important question: How do States' rights and duties under the law of neutrality<sup>15</sup> interact with their relevant counterparts from international space law?<sup>16</sup> As a body of law, neutrality prescribes overlapping but different rights and obligations for neutral States and nationals thereof. Conversely, space law blurs the traditional lines between State responsibility and private action. Neutrality analysis for space objects thus requires a fact-

<sup>&</sup>lt;sup>13</sup> Maintaining constant contact with any satellite in a non-geosynchronous orbit requires antennae or control stations in multiple locations, inevitably in multiple sovereign States' territories. DAVID WRIGHT ET AL., ACAD. OF ARTS & SCI., THE PHYSICS OF SPACE SECURITY: A REFERENCE MANUAL 114 (2005).

<sup>&</sup>lt;sup>14</sup> Article VI of the Outer Space Treaty requires "authorization and continuing supervision by the appropriate State Party to the Treaty" for non-governmental activities. Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies art. VI, Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205 [hereinafter Outer Space Treaty]. For further discussion regarding State responsibility for space objects, *see* discussion *infra* Section III.

<sup>&</sup>lt;sup>15</sup> The law of neutrality constitutes rights and duties belligerent and neutral States owe and enjoy vis-à-vis one another during an international armed conflict. Generally, the custom requires belligerents to respect the territory of neutral States who, in turn, are obligated to not participate in the conflict. Additionally, neutral States (and their nationals) may generally conduct business *impartially* with the belligerents. *See generally* L. OPPENHEIM, 2 INTERNATIONAL LAW: A TREATISE 653 (H. Lauterpacht ed., 7th ed. 1952).

<sup>&</sup>lt;sup>16</sup> In addition to the Outer Space Treaty, *supra* note 14, two other widely-subscribed treaties are relevant and will be discussed *infra*: Convention on International Liability for Damage Caused by Space Objects, Mar. 29, 1972, 24 U.S.T. 2389, 961 U.N.T.S. 187 [hereinafter Liability Convention]; Convention on Registration of Objects Launched into Outer Space, Jan. 14, 1975, 28 U.S.T. 695, 1023 U.N.T.S. 15 [hereinafter Registration Convention].

specific inquiry, assessing each component by the domain it occupies against applicable obligations from both custom and treaty. In spite of its 20th century skeptics, the law of neutrality survives today and would apply to communications satellites systems used in an international armed conflict, implicating rights and obligations that all States supervising or consuming space-based communications services must consider.

This article analyzes the law of neutrality and its interaction with other bodies of international law applicable to space objects during armed conflict. Beginning with a review of neutrality's historical origins and later multilateral treaties, Section II seeks to identify customary rules that transcend domain. With that foundation, Section III examines the neutrality's applicability and scope vis-à-vis space law and LOAC during an international armed conflict and develops a framework for prospective analysis. The article concludes with brief consideration of practical challenges to this framework and its potential implications for other space services.

#### II. THE LAW OF NEUTRALITY IN SPACE

Assessing the law of neutrality in space is a complicated endeavor for at least three reasons. First, while scholars agree on a few generic customary rules regarding neutrality, specific rules differ depending on the domain in question: rules applicable at sea, generally focus on protecting neutral trade interests; rules for land warfare largely focus on protecting a neutral's territorial integrity.<sup>17</sup> Outer space is neither of those domains, raising genuine questions about the applicability of neutrality treaties (and the principles they represent) to space objects and calling for a more comprehensive understanding of the underlying custom.<sup>18</sup> Second, the rather unusual link between State and private actors in space law imputes international responsibility to a State for activities by

<sup>&</sup>lt;sup>17</sup> See discussion infra Section II.A.i.

<sup>&</sup>lt;sup>18</sup> See Wolff Heintschel von Heinegg, *Neutrality and Outer Space*, 93 INT'L L. STUD. 526, 531 (2017) (concluding that the law of neutrality either "cannot be applied to outer space for practical reasons" or "adds nothing because it would simply be repetitive of the rules and principles of general international law").

non-governmental entities in outer space.<sup>19</sup> This relationship between States and private actors poses unique complications in the neutrality context where rules prohibit certain actions by State actors that would be permissible if conducted by that State's juridical persons.<sup>20</sup> Finally, neutrality in practice is often quite different than theory, increasing uncertainty for how strictly States may observe respective duties and obligations if sought to be enforced in this new domain.<sup>21</sup>

#### A. Overview of Neutrality

#### i. Origins and Evolution of Neutrality

Discussed by scholars and observed (in some capacity) by State and other actors for millennia, the concept of neutrality grew from fanciful hope in antiquity<sup>22</sup> to customary international law backed by multilateral treaties in the twentieth century.<sup>23</sup> Thucydides' 416 B.C. account of Peloponnesian War demonstrates its rather flimsy

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<sup>&</sup>lt;sup>19</sup> Outer Space Treaty, *supra* note 14. *See* discussion *infra* Section II.B.i for more on the unique nature of State responsibility in space law.

<sup>&</sup>lt;sup>20</sup> See, e.g., Convention (XIII) Concerning the Rights and Duties of Neutral Powers in Naval War arts. 6-7, Oct. 18, 1907, 36 Stat. 2415, T.S. No. 545 [hereinafter Hague XIII].

<sup>&</sup>lt;sup>21</sup> ERIK CASTRÈN, THE PRESENT LAW OF WAR AND NEUTRALITY 427 (1954).

<sup>&</sup>lt;sup>22</sup> Alfred Rubin, *The Concept of Neutrality in International Law*, 16 DENV. J. INT'L L. & POL'Y 353, 353-55 (2020). Rubin cites the earliest known discussion of the concept of neutrality as occurring in the 11th century B.C., although the discussion is quite abstract as it deals more with personal property than with State-owned property or territory. *Id.* 

<sup>&</sup>lt;sup>23</sup> Several provisions from—if not the treaties in their entirety—both the Hague Convention V Respecting the Rights of Neutral Powers and Persons in Case of War on Land, Oct. 18, 1907, 36 Stat. 2310, T.S. No. 540 [hereinafter Hague V] and Hague XIII are considered customary international law. See Adam Roberts & Richard Guelff, Prefatory Note to 1907 Hague Convention V Respecting Rights and Duties of Neutral Powers and Persons in Case of War on Land, in DOCUMENTS ON THE LAW OF WAR 85 (3d ed. 2005) [hereinafter Prefatory Note Hague V], Adam Roberts & Richard Guelff Prefatory Note to 1907 Hague Convention XIII Concerning the Rights and Duties of Neutral Powers in Naval War in DOCUMENTS ON THE LAW OF WAR 127 (3d ed. 2005) [hereinafter Prefatory Note Hague XIII] (declaring each Treaty to have representing customary international law when drafted and arguing that the reciprocal participation clauses are no longer necessary). See also YORAM DINSTEIN, WAR, AGGRESSION, AND SELF-DEFENCE 26-27 (2d ed. 1994) (describing certain provisions from Hague V as "concrete rules" of the custom of neutrality); SAN REMO MANUAL, supra note 11 (restating certain principles from Hague XIII); DOD LAW OF WAR MANUAL, supra note 11, § 15.1.4 (noting that principles underlying Hague V and Hague XIII constitute customary international law).

beginnings. There the powerful Athens urged Melos to become an ally in the Delian League's war with the Peloponnesian League.<sup>24</sup> In the infamous Melian Dialogue, Melos pleaded a natural law-themed theory of sovereignty asking Athens to respect its neutrality.<sup>25</sup> The result was an unsettling "might makes right" solution where Athens ultimately responded by killing all grown men and enslaving Melian women and children.<sup>26</sup> This cruel nature of war combined with other factors to limit any discernible custom regarding war and neutrality up through the Middle Ages.<sup>27</sup>

As the Middle Ages gave way to the Renaissance, State power consolidated into fewer monarchs.<sup>28</sup> This change reduced private wars and provided greater uniformity and predictability regarding the bounds of war.<sup>29</sup> Simultaneously, States grew more dependent upon trade.<sup>30</sup> The increased reliance on international commerce in this era became a complicating matter during times of war because belligerents desired to cut off their opponents from trade with *anyone*, including States not involved in the conflict.<sup>31</sup> As a result, States increasingly entered into friendship and commerce treaties designed to protect commercial interests should their neighbors go to war.<sup>32</sup> The law of neutrality thus began a dichotomous development to protect the emerging importance of international trade and sovereignty: rules for neutrality on the sea generally focused on property and were inspired by commerce (prize law); and rules directed at neutrality on land were oriented on territorial integrity.

Prize law was the first branch of neutrality to develop with the earliest known recording in *Consolato del Mare* around 1370.<sup>33</sup> These early rules permitted seizure of enemy goods transported by a neutral shipper but protected that shipper's commercial interest

<sup>&</sup>lt;sup>24</sup> THUCYDIDES, THE HISTORY OF THE PELOPONNESIAN WAR, Chapter XVII (Richard Crawley trans., eBook 2021) https://www.gutenberg.org/files/7142/7142-h/7142-h.htm#link2HCH0001.

 $<sup>^{25}</sup>$  *Id*.

 $<sup>^{26}\;</sup>$  Id. Such a rule seems unlikely to give any State repose should its neighbors go to war.

<sup>&</sup>lt;sup>27</sup> CASTRÈN *supra* note 21, at 12.

 $<sup>^{28}</sup>$  Id.

<sup>&</sup>lt;sup>29</sup> *Id.* at 12-13.

<sup>&</sup>lt;sup>30</sup> NILS ØRVIK, THE DECLINE OF NEUTRALITY 1914-1941 12-13 (1971).

 $<sup>^{31}</sup>$  Id.

<sup>&</sup>lt;sup>32</sup> Id. at 14.

<sup>&</sup>lt;sup>33</sup> CASTRÈN *supra* note 21, at 13.

by compensating the freight for the goods shipment.<sup>34</sup> Later rules developed to further restrict neutral trade with belligerents, prohibiting sale of contraband and transporting goods through a blockade.<sup>35</sup> These rules developed unevenly, with State-established prize courts often reaching different conclusions on similar facts depending upon whether they were a neutral or belligerent.<sup>36</sup> The 1856 Declaration of Paris<sup>37</sup> marked one of the earliest and most significant multilateral attempts to resolve these inconsistencies.<sup>38</sup> Notwithstanding debates regarding the precise definitions of terms like contraband and blockade,<sup>39</sup> the general principles from the treaty remain valid today.<sup>40</sup> Specifically, the treaty established universal protection for non-contraband neutral goods from seizure by belligerents.<sup>41</sup> This agreement represented the widespread desire to promote neutral commercial interests during war, a theme echoed in later neutrality treaties.<sup>42</sup>

For neutrality on land, the work of Hugo Grotius in 1625 marked an early, if small, step in articulating neutral States' rights and obligations.<sup>43</sup> Devoting scarcely one page of a three-volume treatise on international law to the topic, Grotius described neutrality as a duty "to do nothing towards increasing the strength of

<sup>&</sup>lt;sup>34</sup> A TRANSLATION OF THE CHAPTERS OF CCLXXIII AND CCLXXXVIII OF *CONSOLATO DEL MARE*, RELATING TO PRIZE LAW 1-2 (Christopher Robinson trans., 1800).

<sup>&</sup>lt;sup>35</sup> CASTRÈN, *supra* note 21, at 13-14.

<sup>&</sup>lt;sup>36</sup> *Id.* at 16.

<sup>&</sup>lt;sup>37</sup> Declaration Respecting Maritime Law, Apr. 16, 1856, *reprinted in* ADAM ROBERTS AND RICHARD GUELFF, DOCUMENTS ON THE LAW OF WAR 49 3d ed. 2005) [hereinafter Paris Declaration].

<sup>&</sup>lt;sup>38</sup> See Adam Roberts & Richard Guelff, Prefatory Note to 1856 Paris Declaration Respecting Maritime Law, in DOCUMENTS ON THE LAW OF WAR 47-48 (2005).

<sup>&</sup>lt;sup>39</sup> ØRVIK, *supra* note 29, at 40-41.

<sup>&</sup>lt;sup>40</sup> Roberts & Guelff, *supra* note 38. See also SAN REMO MANUAL, *supra* note 11, ¶¶ 146-52 (characterizing the Paris Declaration's rules on neutral goods and contraband as customary international law).

<sup>&</sup>lt;sup>41</sup> Paris Declaration, *supra* note 37, arts. 2-4.

<sup>&</sup>lt;sup>42</sup> See, e.g. Hague V supra note 23, art. 8 and Hague XIII supra note 230, art. 7 (expressly releasing neutral States from any responsibility to preventing commercial activity that would directly assist a belligerent State to with including the export of arms, ammunition, or anything else of military utility).

<sup>&</sup>lt;sup>43</sup> A.C. CAMPBELL, THE RIGHTS OF WAR AND PEACE 7 (1901).

a party maintaining an unjust cause."<sup>44</sup> The prominence of sovereignty following the Peace of Westphalia<sup>45</sup> led to a growing respect for a neutral State's territory in the seventeenth and eighteenth centuries.<sup>46</sup> Emer de Vattel's 1758 writings, for example, described a right of innocent passage for belligerents over neutral territory, albeit subject to receiving permission from the neutral sovereign.<sup>47</sup> Writing in the same period, Cornelius van Bynkershoek described the use of force "in the dominions of another" as proscribed by public law.<sup>48</sup> These developments were somewhat uneven, incremental, and stopped far short of modern standards of respect for territorial integrity.<sup>49</sup> Nonetheless, these works demonstrate a growing respect for neutral territory in public international law.

#### ii. Contemporary Neutrality

Neutrality's legal status grew significantly throughout the eighteenth and nineteenth centuries, heavily influenced by increasing international trade and the developing concept of sovereignty.<sup>50</sup> The evolution yielded a custom that neutral States (and their nationals) incurred one significant, if limited right: to not be adversely

<sup>&</sup>lt;sup>44</sup> *Id.* at 377. The "unjust cause" reference demonstrates the heavy natural law theme in Grotius' views. *Id.* To Grotius, the validity of a belligerent's cause, not sovereignty, defined the rights of neutral States. For example, neutrals were obligated to allow troops to pass through their territory if doubt existed about the invalidity of their cause. *Id.* 

<sup>&</sup>lt;sup>45</sup> "The Peace of Westphalia, signed in 1648, ended the Thirty and Eighty Years Wars and created the framework for modem international relations. The concepts of state sovereignty, mediation between nations, and diplomacy all find their origins in the text of this treaty. . ." Steven Patton, *The Peace of Westphalia and it Affects on International Relations, Diplomacy and Foreign Policy*, 10 THE HISTORIES 1, 91 (2019).

<sup>&</sup>lt;sup>46</sup> Rubin, *supra* note 22, at 16-18.

<sup>&</sup>lt;sup>47</sup> EMER DE VATTEL, THE LAW OF NATIONS, OR THE PRINCIPLES OF NATURAL LAW, APPLIED TO THE CONDUCT AND TO THE AFFAIRS OF NATIONS AND OF SOVEREIGNS (1758) *reprinted in* THE CLASSICS OF INTERNATIONAL LAW VOL. III 274 (James Brown Scott ed., Charles Fenwick trans., 1964). Of note, Vattel's writings specify that a neutral State could only deny request for belligerent passage over neutral territory with good reason. *Id.* at 275.

<sup>&</sup>lt;sup>48</sup> Cornelius van Bynkershoek, On Questions of Public Law (1737) *reprinted in* THE CLASSICS OF INTERNATIONAL LAW VOL. III 54 (James Brown Scott ed., Tenney Frank trans., 1964). Bynkershoek wrote of an exception that allowed belligerents to pursue fleeing foes into neutral ports or land. *Id.* at 57-58.

 $<sup>^{49}\,</sup>$  U.N. Charter art. 2, para. 4 (protecting all States' territorial integrity from the threat or use of force). See also infra note 68 and accompanying text.

<sup>&</sup>lt;sup>50</sup> Prefatory Note to Hague V, *supra* note 23.

affected—commercially or physically—by the belligerents' actions during the war; and two duties: impartial treatment of belligerents and non-participation in the conflict.<sup>51</sup> As consensus developed around the general custom, divergent views arose regarding the details.<sup>52</sup> This dissonance created an incentive for international consensus on the matter, culminating at the Second Hague Conference in 1907, which produced two multilateral agreements codifying rules for neutrality both on land and at sea.53 The 1907 Hague Convention V Respecting the Rights of Neutral Powers and Persons in Case of War on Land (Hague V)<sup>54</sup> and Convention XIII Concerning the Rights and Duties of Neutral Powers in Naval War (Hague XIII) specify duties and rights of neutral States for their respective domains during war.<sup>55</sup> While these are old and limited to their respective domains, they are widely considered customary international law, thus serving as instructive tools to assess the scope of neutral rights and duties.<sup>56</sup>

The consequences of the United Nations (UN) Charter on any earlier treaty relating to security matters cannot be overlooked.<sup>57</sup> Many early commentators posited that the collective security nature of the UN Charter abrogated neutral duties and obligations, arguing that no State is free to remain neutral when the UN Security Council directs action.<sup>58</sup> The narrower view, however, is that such reasoning only applies in instances where the Security Council has directed member State action (or abstinence from action) and

 $<sup>^{51}</sup>$  See DINSTEIN, supra note 23, at 26 (generalizing the rights and duties of neutral States during an armed conflict).

<sup>&</sup>lt;sup>52</sup> Prefatory Note to Hague V, *supra* note 23.

 $<sup>^{53}</sup>$  Id.

<sup>&</sup>lt;sup>54</sup> Hague V, *supra* note 23.

<sup>&</sup>lt;sup>55</sup> Hague XIII, *supra* note 20.

<sup>&</sup>lt;sup>56</sup> Prefatory Note Hague V, *supra* note 23; Prefatory Note Hague XIII, *supra* note 23. Roberts and Guelff note that Hague XIII is also considered customary international law, rendering the general participation clauses of each irrelevant. Prefatory Note Hague XIII, *supra* note 23. Importantly, these rules reflect the particular uses or vulnerabilities of the domain in question to a belligerent, giving caution to directly applying these provisions to space objects.

<sup>&</sup>lt;sup>57</sup> "In the event of a conflict between the obligations of the Members of the United Nations under the present Charter and their obligations under any other international agreement, their obligations under the present Charter shall prevail." U.N. Charter, art. 103.

<sup>&</sup>lt;sup>58</sup> Prefatory Note Hague V, *supra* note 23. *See also* Michael Bothe, *Neutrality, Concept and General Rules, in* THE MAX PLANCK ENCYCLOPEDIA OF PUBLIC INTERNATIONAL LAW VII 619-20 (Rudiger Wolfrum ed., 2012).

only then to the extent of the hypothetical resolution in question.<sup>59</sup> Perhaps reflecting geopolitics and the balance of power structured into it,<sup>60</sup> the Security Council's practice has demonstrated that it is unlikely to direct member State action in the event of an armed conflict.<sup>61</sup>

One other twentieth-century development bears on neutrality's scope today: the emergence of so-called "non-belligerents." Non-belligerents are States that disavow active participation in an armed conflict but nonetheless do not observe all traditional neutral State obligations.<sup>62</sup> The United States' neutrality legislation and policies of the late 1930s are an early and prime example.63 Fueled by skepticism that belligerents would honor the customary protections owed American trade interests as well as a desire to remain out of the brewing conflicts in Europe, Africa and Asia, the United States implemented its neutral policies in a manner that were clearly designed to influence the outcome of the conflict.<sup>64</sup> The legal basis argued in support of non-belligerency is twofold: first, States maintain a moral right to favor a victim of aggression due to the customary prohibition on aggressive war; second, a neutral State perceiving a security risk due to the aggression of a belligerent is not obligated to treat that belligerent impartially.<sup>65</sup> Although the practice has persisted occasionally into the present day,<sup>66</sup> its status is controversial, with many scholars describing it as merely

<sup>&</sup>lt;sup>59</sup> Prefatory Note Hague V, *supra* note 23.

<sup>&</sup>lt;sup>60</sup> RODERICK OGLEY, THE THEORY AND PRACTICE OF NEUTRALITY IN THE TWENTIETH CENTURY 20-21 (1970) (discussing the effects of differing political and security views among Security Council permanent members).

<sup>&</sup>lt;sup>61</sup> Two relatively recent examples of international armed conflict where the UN Security Council did not designate weigh in on the legitimacy of the use of force is the Iran-Iraq War and the NATO intervention in Kosovo.

<sup>&</sup>lt;sup>62</sup> Bothe, *supra* note 58, at VII-618.

<sup>&</sup>lt;sup>63</sup> ØRVIK, *supra* note 29, at 167-71.

 $<sup>^{64}</sup>$  *Id.* at 157-65. As an example, the United States enacted (without any obligation as a neutral State) facially impartial embargoes on Italy and Ethiopia, understanding that the former would suffer much more as a consequence because the latter had hardly any dealings with the United States. *Id.* at 162-63.

 $<sup>^{65}~</sup>See$  DoD LAW OF WAR MANUAL, supra note 11, § 15.2.2 (citing Lass Oppenheim, International Law, Volume II: Disputes, War and Neutrality 22 (§ 61) (Hersch Lauterpacht ed., 7th ed. 1952).

 $<sup>^{66}\,</sup>$  Italy's position regarding the Iraq War in 2003 was that of non-belligerent. Bothe, supra note 58, at VII-618.

a violation of neutrality.<sup>67</sup> Non-belligerency lacks the consistent practice and *opinio juris* to be considered customary international law, but its practice—particularly in the context of its underlying motivations—must be considered when evaluating the application of neutral obligations in a new domain.<sup>68</sup>

While perhaps narrowed by the UN Charter and the victim of at least some departures in State practice, the custom of neutrality and specific rules codified in Hague V and XIII remain viable today. The Four Geneva Protocols of 1949<sup>69</sup> and their Additional Protocol I of 1977 make reference to and provisions for neutral territory.<sup>70</sup> More recently, the International Court of Justice described the principle of neutrality as "of a fundamental character," expressing "no doubt" about its applicability during international armed conflicts.<sup>71</sup> Notwithstanding the questionable legal status of non-belligerency (and its potentially prudent motivations), international rights or obligations may, at times, come into conflict with those arising from neutrality and are the subject of Section III of this article. A brief overview of neutrality's rights, obligations and consequences is in order first to provide a proper framework.

#### iii. Neutrality's Implications - Rights and Obligations

Neutrality imposes several reciprocal duties between belligerent and neutral States, but the key provisions relevant to communications satellite systems are those related to neutral territory and trade. First and foremost, a neutral State's territory is inviolable.<sup>72</sup>

<sup>&</sup>lt;sup>67</sup> *Id. See also* Edwin Borchard, *War, Neutrality and Non-Belligerency*, 35 AM. J. INT'L L. 618 (1941) (describing the United States position as a "unique construction").

 $<sup>^{68}</sup>$  See, e.g., DOD LAW OF WAR MANUAL, supra note 11, § 15.2.2 (recognizing controversy in, but not renouncing the practice).

<sup>&</sup>lt;sup>69</sup> See, e.g., Geneva Convention for the Amelioration of the Condition of the Wounded and Sick in Armed Forces in the Field art. 4, Aug. 12, 1949, 6 U.S.T. 3114, 75 U.N.T.S. 31.

<sup>&</sup>lt;sup>70</sup> See Protocol I, *supra* note 11, art. 19 (directing application of protections for sick and wounded to apply to those interned in neutral territory). See also *id.* at art. 31 (prohibiting medical aircraft from flying over neutral territory absent prior agreement).

 $<sup>^{71}\,</sup>$  Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion, 1996 I.C.J. 226,  $\P$  89 (July 8).

<sup>&</sup>lt;sup>72</sup> Hague V, *supra* note 23, art. 1 (declaring neutral States' territory "inviolable"). *See also* Hague XIII, *supra* note 20, art. 2 (forbidding any "act of hostility" in the territorial waters of a neutral Power).

Although subject to some limitations, this rule is the bedrock of neutrality, securing its purpose: to limit the geographic spread of war and its effects.<sup>73</sup> In exchange, neutrals must not permit certain activities on their territory such as recruitment or the erection of communications equipment by belligerents.<sup>74</sup>

Regarding trade, neutral States and their nationals are permitted to maintain most commercial relationships with belligerents.<sup>75</sup> Critically important for analysis of space-based services, the duty of non-participation limits commercial activities of a neutral *State* more than those conducted by a neutral's national.<sup>76</sup> This distinction imparts two important points. First, some commercial activities (for example, sale of ammunition or other war material) would constitute a violation of the non-participation duty if conducted by a neutral State, but would be permissible if conducted by that same State's *national.*<sup>77</sup> Second, the duty of impartiality is limited in scope to the *policies* of a neutral State, and not all *activity* that is conducted from or on its territory or by its nationals. In other words, neutral State *nationals* are free to engage in commercial activities with belligerents in a discriminatory manner, but the State is prohibited from implementing tariffs, export controls, or any

<sup>&</sup>lt;sup>73</sup> DINSTEIN, *supra* note 23.

<sup>&</sup>lt;sup>74</sup> Hague V, *supra* note 23, arts. 2-4. *See also* Hague XIII, *supra* note 20, art. 8 ("A neutral Government is bound to employ the means at its disposal to prevent the fitting out or arming of any vessel within its jurisdiction which it has reason to believe is intended to...engage in hostile operations[.]").

<sup>&</sup>lt;sup>75</sup> Hague V, *supra* note 23, art. 9; Hague XIII, *supra* note 20, art. 9.

<sup>&</sup>lt;sup>76</sup> Compare Hague XIII, supra note 20, art. 6 (prohibiting neutral States from directly or indirectly providing war material to belligerents), with Hague XIII, supra note 20, art. 7 (explicitly exempting States from preventing the export of war material to belligerents). The only logical conclusion that these articles present is that a neutral State providing war material would violate its duty of non-participation, but that its juridical persons or nationals providing the same material is *not* considered State participation. See also DOD LAW OF WAR MANUAL, supra note 11, § 15.3.2.1 (noting that "[c]ommercial transactions between belligerent States and neutral corporations, companies, citizens, or persons resident in a neutral State are not prohibited").

<sup>&</sup>lt;sup>77</sup> Hague XIII, *supra* note 20, arts. 6-7. While the neutral State does not have an obligation to prohibit its nationals from engaging in such a transaction, the private parties do so at their peril. As an example, assume a private neutral citizen sought to sell a belligerent ammunition, shipping the goods by sea. The neutral citizen may not violate any law, but the goods in question are certainly contraband that another belligerent is permitted, under international law, to seize and condemn under prize law. *See* SAN REMO MANUAL, *supra* note 11, ¶¶ 67, 146-48. Additionally, the actors and equipment used to carry out this object may still be a military target subject to targeting under LOAC under certain circumstances.

other restriction to one, but not all belligerents.<sup>78</sup> In general, these rules represent a compromise: neutral States' territory and commercial interests receive protection from the effects of war in exchange for neutral States refraining from official acts designed to influence the outcome of the war (non-participation and impartiality).

What happens when neutrality is violated? As many answers in law, it depends. If it is the neutral State violating its duties, the belligerent State's options may vary from seizure for adjudication at prize proceedings (as in the matter of shipping contraband)<sup>79</sup> or destroying targets within the neutral State's sovereignty (as in the matter of a ground communications tower used to relay military targeting information).<sup>80</sup> In the case of a neutral State's rights being violated, it is left with the traditional remedies associated with internationally wrongful acts: cessation, reparation, or in some cases, countermeasures.<sup>81</sup> The challenges of enforcing such remedies is beyond the scope of this article, but the considerable selfhelp remedies available to belligerent States as compared to the lack thereof for neutrals bears mentioning.

Chief among a belligerent's self-help options is the use of military force. Neutrality must not be mistaken for a shield against attack if a valid military target is present on neutral territory. An object is a valid military target if, by its nature, location, purpose, or use, it makes an effective contribution to military action and

<sup>&</sup>lt;sup>78</sup> See, e.g., Hague V, supra note 23, art. 9 (requiring "[e]very measure of restriction or prohibition taken by a neutral Power...be impartially applied by it to both belligerents"); Hague XIII, supra note 20, art. 9 (obligating neutral States to impartially apply "the conditions, restrictions or prohibitions" regarding admission to ports and territorial waters). In contrast, Hague V clearly preserves a neutral *person's* right to favor one belligerent in commercial actions. Specifically, Hague V Article 17(b) removes neutral status from a person who "acts in favor of a belligerent[.]" Hague V, supra note 23, art. 17(b). The next article, however, exempts from this rule commercial transactions to furnish supplies or loans (as long as the person does not live in the territory) of a belligerent or its occupied territory and that the supplies do not come from that territory). *Id.* at art. 18. Additionally, States are permitted to continue commercial relations (not involving contraband) with a belligerent that existed prior to hostilities under the concept of *courant normal.* Bothe, supra note 58, at 618.

<sup>&</sup>lt;sup>79</sup> SAN REMO MANUAL, supra note 11, ¶ 116.

<sup>&</sup>lt;sup>80</sup> See discussion *infra* note 83 and accompanying text.

<sup>&</sup>lt;sup>81</sup> Report of the International Law Commission to the General Assembly, U.N. GAOR Supp. No. 10, at 1, 29, art. 43, U.N. Doc. A/56/10 (2001), reprinted in [2001] 2 Y.B. Int'l L. Comm'n 1, 29, art. 43, U.N. Doc. A/CN.4/SER.A/2001/Add.1 (Part 2) [hereinafter ILC Draft Articles on State Responsibility].

whose total or partial destruction offers a definite military advantage.<sup>82</sup> A belligerent can lawfully target an object meeting this definition regardless of its location (i.e., even if on neutral soil).<sup>83</sup> Belligerents possess other self-help remedies for violations of neutrality, but these vary *by domain*. For example, the rights of capture and search pertaining to the potential transfer of contraband is only contemplated in the context of the sea.<sup>84</sup> In contrast, Hague V only addresses material transiting by railway, does not provide for its search, and limits requisition to situations of "absolute necess[ity]."<sup>85</sup> These differences highlight the important role that the domain can play in determining the scope of specific neutral rights and obligations granted by treaty. Accordingly, the provisions of Hague V and Hague XIII must be carefully scrutinized before applying to different domains.

#### B. Applicability

#### i. General

The threshold for neutrality to apply is the existence of an *in*ternational armed conflict.<sup>86</sup> This requirement flows logically from the premise that neutrality defines States' obligations to one another during times of armed conflict. Accordingly, an armed conflict must involve more than one State in an antagonistic belligerent status before any corresponding rights or duties could arise. In the days of declared war, declared neutrality was equally common to

<sup>&</sup>lt;sup>82</sup> See supra note 11 and accompanying text.

<sup>&</sup>lt;sup>83</sup> Protocol I *supra* note 11, art. 52. Neutrals enjoy a corollary right to use force to enforce neutrality. Specifically, neutral States may lawfully use military force to resist threats to or violations of their neutrality. Hague V, *supra* note 23, art. 10. Interestingly, it appears the grant of authority may be somewhat more limited for enforcing neutrality provisions related to the sea domain as Hague XIII does not have a direct parallel provision to Hague V's Article 10. The greatest apparent similarity is Article 8, which obligates a neutral State to "employ the means at its disposal" to prevent fitting out or arming of vessels within its jurisdiction to cruise against one of the belligerents. Hague XIII, *supra* note 20, art. 8.

<sup>&</sup>lt;sup>84</sup> For a discussion of the differences between land and naval warfare as it pertains to capturing private enemy property, *see* CASTRÈN, *supra* note 21, at 318-19.

<sup>&</sup>lt;sup>85</sup> Hague V, *supra* note 23, art. 19.

<sup>&</sup>lt;sup>86</sup> Bothe, *supra* note 58, at 621.

clarify whether a State was an ally of a belligerent or sought protections due it as a neutral party.<sup>87</sup> Any such claim would today be subordinate to a UN Security Council resolution,<sup>88</sup> which could theoretically call upon otherwise neutral States to participate in an armed conflict or proscribe otherwise lawful commercial activities.<sup>89</sup>

A State's neutrality does not depend on perfect observance of its obligations (although abrogation of a neutral State's rights may hasten an end to such status).<sup>90</sup> As already mentioned, breach of neutrality obligations entitles the aggrieved parties to remedies; it does not, without more, terminate neutral *status*. A State's neutrality will end in one of two ways: termination of the armed conflict itself;<sup>91</sup> or when the neutral State enters the fray (either *sua sponte* by unequivocal action or declaration or by operation of treaty should an ally become involved in the conflict).<sup>92</sup> Until such an event terminates neutrality, the rights and duties remain despite any breach.

#### ii. Applicability to Space Objects

The definition of "space objects" must be addressed before discussing the complicated tangle of neutrality's application to them. The term has received much attention in space law literature, primarily as it relates to liability.<sup>93</sup> The widely agreed upon scope includes "any [hu]man-made object which is at least attempted to be physically brought into outer space."<sup>94</sup> This broad definition will be used in this article because it unmistakably includes the principal concern of communications satellite systems relative to neutrality:

<sup>94</sup> Id.

<sup>&</sup>lt;sup>87</sup> Id. at 620.

<sup>&</sup>lt;sup>88</sup> U.N. Charter art. 103.

<sup>&</sup>lt;sup>89</sup> Chapter 7 of the UN Charter gives the Security Council authority to direct members to employ diplomatic, economic, or military measures against another State. Article 25 specifically requires member States to comply with Security Council Directives. U.N. Charter art. 25.

<sup>&</sup>lt;sup>90</sup> Bothe, *supra* note 58, at 623.

 $<sup>^{91}\,</sup>$  Note this is distinct from cessation of hostilities. For example, resuming arms exports during an armistice may reignite an armed conflict. The conflict must be completed—not paused—for neutrality to end. *Id.* at 622.

 $<sup>^{92}</sup>$  Id.

<sup>&</sup>lt;sup>93</sup> Frans von der Dunk, *International Space Law, in* HANDBOOK OF SPACE LAW 29, 86-87 (Frans von der Dunk and Fabio Tronchetti, eds., 2015).

those that could be perceived to be a military target or otherwise violate a neutral's duty of impartiality.<sup>95</sup> In most cases, this will be a functioning satellite.

At first blush, neutrality may appear irrelevant to space objects as defined above. This is because a significant portion of the law of neutrality applies to *territory*. The argument goes that neutrality is moot in space because the Outer Space Treaty prohibits "national appropriation by claim of sovereignty."<sup>96</sup> If a State cannot claim sovereignty over outer space, supporters of this theory posit, then neutrality cannot apply there.<sup>97</sup> But such a view is perhaps a bit oversimplified for practical and legal reasons. On the practical side, satellites are controlled from stations on Earth (i.e., inside a State's sovereign territory or perhaps territorial waters), implicating territory-based neutrality, and potentially including some very specific provisions from Hague V and, again potentially, Hague XIII.<sup>98</sup>

The legal landscape provides several reasons neutrality would apply to space objects. As a threshold matter neutrality (along with all international law including LOAC) applies in outer space by reason of treaty and custom.<sup>99</sup> Space objects can implicate a neutral State's rights and obligations due to the manner in which the relevant space treaties are structured to permit and regulate private space activities. To accomplish this without an international regulatory regime, the treaties provide three obligations on States who are a party. First, they impute responsibility to States for their "national activities in outer space," which includes activities of the State's private actors.<sup>100</sup> Second, they assess liability to "launching states," defined as a State who launches or procures the launch of a space object or a State from whose territory or facility a space object is launched.<sup>101</sup> Finally, they indicate that State parties retain

<sup>&</sup>lt;sup>95</sup> See discussion supra Section II.A.iii.

 $<sup>^{96}~</sup>$  Outer Space Treaty, supra note 14, art. II.

 $<sup>^{97}\,</sup>$  Hentschel von Heinegg, supra note 18, at 531.

<sup>&</sup>lt;sup>98</sup> See Frans von der Dunk, Sovereignty Versus Space – Public Law and Private Launch in the Asian Context, 5 SING. J INT'L & COMP. L. 22, 29 (2001).

<sup>&</sup>lt;sup>99</sup> Outer Space Treaty, *supra* note 14, art. III. *See also* DOD LAW OF WAR MANUAL, *supra*, note 11, § 14.10.2.2 (stating the US position that international law applies in space as a matter of custom as well as treaty).

<sup>&</sup>lt;sup>100</sup> Outer Space Treaty, *supra* note 14, art. VI.

<sup>&</sup>lt;sup>101</sup> Liability Convention, *supra* note 16, art. I.

jurisdiction and control over such space objects on whose registry the object is carried.<sup>102</sup> While successful in aligning incentives for care in conducting space activities (especially launching), this structure blurs (or perhaps erases) the lines between a State and its real and juridical persons for purposes of activities in outer space.

Appreciating neutrality's applicability in outer space is easier than analyzing it for a given space object. The process can raise at least three difficult questions. First, to which States might rights and obligations apply? Evaluating the various State interests in a space object can be a labyrinthine process, dependent upon a variety of factors with potentially varying connection to the neutral State in question. After identifying the neutral State(s) involved, one must assess what, if any, rights and obligations may be implicated by the space object. The challenge in in this endeavor is the lack of specificity. While custom requires neutral States to refrain from participation and enact impartial policies vis-à-vis belligerents, those obligations become difficult to parse when considering contemporary functions of space objects.<sup>103</sup> The third and related question considers the scope of rules in space. Specifically, how do the international space law rules for State responsibility square with neutrality's varying obligations for State and private actors.

#### **III. IMPLICATIONS FOR COMMUNICATIONS SATELLITES**

Communications satellites revolutionized telephony when first developed and are increasingly important today.<sup>104</sup> Proposed as early as 1945 by the famed science fiction writer Arthur C. Clarke, the general architecture of satellite communications begins by transmitting a radio signal between earth-based stations and

<sup>&</sup>lt;sup>102</sup> Outer Space Treaty, *supra* note 14, art. VIII.

<sup>&</sup>lt;sup>103</sup> It is unclear, for example, how to address provision of satellite communications services or remote sensing data—under what circumstances might this constitute participation? In the land or sea domains, Hague V and Hague XIII provide some insight into the scope of neutral obligations. Of course, one must proceed cautiously in applying a provision from these treaties to an object in outer space, ensuring such application is consistent with the general custom of neutrality.

<sup>&</sup>lt;sup>104</sup> See David J. Whalen, Communications Satellites Short History: Making the Global Village Possible, NASA.GOV, https://history.nasa.gov/satcomhistory.html (last visited June 16, 2022).

satellites.<sup>105</sup> The satellite signal is retransmitted back to earth using either a "bent pipe" model, where the same satellite receives and retransmits the signal back to earth or a "cross-linking" model, where signals are relayed among other satellites in orbit before retransmission to improve speed and efficiency.<sup>106</sup> Regardless of structure, the satellite communications concept enables covering much larger areas and facilitating communications between two greatly distant points far better than traditional terrestrial-based relay stations.<sup>107</sup> Looking to capitalize on those advantages, militaries are increasingly reliant on communications satellites. One study showed more than a 300 percent increase in the United States military's use of commercial satellite services from Operation Desert Storm in 1991 to Operation Iraqi Freedom in 2003.<sup>108</sup> More recently, States with large armed forces and significant roles in international security such as the United Kingdom<sup>109</sup> and the United States have sought to augment their communications with commercially operated systems.<sup>110</sup>

In what ways might the law of neutrality affect this increased military consumption of privately provided satellite communications services? Analyzing this question warrants separate analyses for the satellite system's component parts. The terrestrial-based components, whether a terminal for transmitting and receiving signals or for telemetry, tracking and command (TTC), may implicate

<sup>&</sup>lt;sup>105</sup> Arthur C. Clarke, *Extra-Terrestrial Relays: Can Rocket Stations Give World-wide Radio Coverage?*, WIRELESS WORLD, at 305 9Oct. 1945), http://clarkeinstitute.org/wp-content/uploads/2010/04/ClarkeWirelessWorldArticle.pdf.

<sup>&</sup>lt;sup>106</sup> JOHN BLOOM, ECCENTRIC ORBITS: THE IRIDIUM STORY 138 (2016).

<sup>&</sup>lt;sup>107</sup> DENNIS RODDY, SATELLITE COMMUNICATIONS 1 (3d ed. 2001). This broadcast may be to a wide area for receipt by multiple receivers or to a specific point receiver. *Id.* 

<sup>&</sup>lt;sup>108</sup> Jean Francois Bureau, *Telecommunications for Security and Dual Use, in 2* HANDBOOK OF SPACE SECURITY 598, Fig. 34.1 (Kai-Uwe Schrogl et al. eds., 2015).

<sup>&</sup>lt;sup>109</sup> The United Kingdom's military communications are provided by the private company Paradigm, which is wholly owned by the European Aeronautic Defence and Space Company. PARADIGM, MILITARY HARDENED NAVIGATION AND COMMUNICATIONS SATELLITES, Secure Communications Services, https://www.army-technology.com/contractors/satellite/paradigm2/ (last visited Nov. 1, 2021).

<sup>&</sup>lt;sup>110</sup> See Bureau, supra note 108, at 601. See also Sandra Erwin, U.S. Space Force rolls out plan to change how it buys satcom services, SPACENEWS (Feb. 19, 2020), https://spacenews.com/u-s-space-force-rolls-out-plan-to-change-how-it-buys-satcom-services/.

Hague V or Hague XIII for the State where each station is situated.<sup>111</sup> The satellite itself will require a separate analysis of space law examining the various links between States and objects in space. A satellite system thus may implicate neutrality rights and obligations for several States, depending upon myriad variables including its structural design and terrestrial component location(s).

#### A. Terrestrial Components

The most pertinent neutrality rules for the terrestrial components come from Hague V and XIII dealing with wireless communications. Drafted and entered into force decades before satellite communications were discussed, the treaties pay particularly close attention to the specific technology used in radio communications, with several references to "wireless telegraphy stations" located in a neutral State's territory, ports or territorial waters.<sup>112</sup> Perhaps negotiations today would yield more generic language referring to "radio signals," or similar terms broad enough to account for satellite communications more clearly. Nonetheless, the rules were certainly drafted to account for the duties of non-participation and impartiality in the developing field of wireless telecommunications.<sup>113</sup>

The principal provision that addresses the issue is Article 3 of Hague V. This Article contains two prohibitions. First, a belligerent may not "[e]rect on the territory of a neutral Power a wireless telegraphy station or other apparatus for the purpose of communicating with belligerent forces on land or sea."<sup>114</sup> Second, belligerents may not use such a structure established by them on neutral territory before hostilities "for purely military purposes, and which has not been opened for the service of public messages."<sup>115</sup> Hague XIII contains a parallel provision prohibiting belligerents from erecting "any apparatus" in neutral ports or waters for communicating with their armed forces.<sup>116</sup> These provisions spring from the more general obligation of non-participation, in that a neutral State

<sup>&</sup>lt;sup>111</sup> A TTC Telemetry terminal monitors the health of the satellite and ensure it is in a proper orbit. *See* WRIGHT ET AL., *supra* note 13, at 112.

<sup>&</sup>lt;sup>112</sup> See, e.g., Hague V, supra note 23, arts. 3, 8, Hague XIII, supra note 20, art. 5.

<sup>&</sup>lt;sup>113</sup> CASTRÈN, *supra* note 21, at 480.

<sup>&</sup>lt;sup>114</sup> Hague V, *supra* note 23, art. 3.a.

<sup>&</sup>lt;sup>115</sup> *Id.* at art. 3.b.

<sup>&</sup>lt;sup>116</sup> Hague XIII, *supra* note 20, art. 5.

must not assist belligerents in gathering or transmitting military intelligence or otherwise using its territory as a base for military operations.<sup>117</sup>

At first blush, these rules seem relatively straightforward for the terrestrial components of satellite communications systems. The first rule of Hague V, Article 3 is easiest to apply: a belligerent may not construct a facility on a neutral State's territory for purposes of communicating with its armed forces once hostilities have begun.<sup>118</sup> In the context of satellite communications, this provision prohibits a belligerent in an international armed conflict from constructing any ground terminal on neutral territory to operate (or otherwise facilitate operations of) military communications satellites.

If a belligerent built the same ground control terminal before hostilities, its continued use is restricted. Specifically, the belligerent is prohibited from using such an installation "for purely military purposes, and which has not been opened for the service of public messages."<sup>119</sup> This language is at least somewhat ambiguous. Belligerents are clearly permitted to use telecommunications infrastructure owned by a neutral State or its companies or private individuals in *some* manner—Article 8 of Hague V expressly addresses this.<sup>120</sup> Whether that use can include military communications depends on interpretation.

One possible meaning is that such a facility could continue to be used for military purposes during a war as long as it included at least some service of public messages (dual-purpose interpretation).<sup>121</sup> An alternative interpretation is that a facility capable of military use (and indeed, even one used for military purposes prior to the conflict) may continue to be used during the war for *exclu*-

<sup>&</sup>lt;sup>117</sup> CASTRÈN, *supra* note 21, at 480. By this rationale, the treaty provisions extend to communications with all military elements, even though only land and naval forces are specifically mentioned. Id.

<sup>&</sup>lt;sup>118</sup> Hague V, *supra* note 23, art. 3.a.

<sup>&</sup>lt;sup>119</sup> *Id.* at art. 3.b.

 $<sup>^{120}</sup>$  "A neutral Power is not called upon to forbid or restrict the use on behalf of the belligerents of telegraph or telephone cables or of wireless telegraphy apparatus belonging to it or to companies or private individuals." *Id.* at art. 8.

 $<sup>^{121}</sup>$  Castrén, for example, restated this limitation as proscribing use "for purely military purposes *unless* it has been opened for communication service." CASTRÈN, *supra* note 21, at 480.

*sively* non-military purposes (exclusive non-military interpretation). While the dual-purpose interpretation may be plausible—particularly given the technological capabilities of satellite communications<sup>122</sup>—the exclusive non-military interpretation is sounder when conducting a traditional treaty analysis.<sup>123</sup>

Contextually, the dual-purpose interpretation would render the preceding provision in Article 3 (prohibiting constructing new facilities to communicate with belligerent armed forces) illogical.<sup>124</sup> Consider the following example: State A built a communications facility inside State N's territory during peacetime for purpose of A communicating with its armed forces. An international armed conflict then begins between States A and B with N remaining neutral. Under the dual-purpose interpretation, A could use the installation to communicate with armed forces so long as at least a tiny fraction of the transmissions was non-military. This scenario would be severely disadvantageous to B because Article 3 prohibits B from constructing a similar facility on N's (neutral) territory.<sup>125</sup> The result is an interpretation inconsistent with the general custom of nonparticipation and impartiality demanded of neutral States.<sup>126</sup> Therefore, the exclusive non-military interpretation appears more appropriate. Reference to the preparatory works of the Treaty confirm this interpretation.<sup>127</sup> Specifically, the report from the commission responsible for drafting this provision unanimously approved

 $<sup>^{122}</sup>$  A communications satellite will be equipped with multiple transponders, communicating with multiple different ground stations for entirely discrete purposes. WRIGHT ET AL., *supra* note 13, at 114.

<sup>&</sup>lt;sup>123</sup> The Vienna Convention on the Law of Treaties states that terms are to be interpreted with the ordinary meaning "in their context and in light of its object and purpose." Vienna Convention on the Law of Treaties art. 31, May 23, 1969, 1155 U.N.T.S. 331 [hereinafter VCLT].

<sup>&</sup>lt;sup>124</sup> Hague V, *supra* note 23, art. 3.a.

 $<sup>^{125}</sup>$  Id.

<sup>&</sup>lt;sup>126</sup> The context of term in a treaty must be evaluated together with "any relevant rules of international law applicable in the relations between the parties." VCLT, *supra* note 123, art. 31.3.c. In this case, the provision of Hague V is a partial codification of the custom of neutrality. CASTRÈN, *supra* note 21, at 436-37. Custom imputes a duty on neutral States "to refrain from everything connected with war operations and the duty to give equal treatment to both belligerents in those exceptional cases where the support of belligerents in one way or another is not absolutely prohibited." *Id.* at 441.

<sup>&</sup>lt;sup>127</sup> Preparatory works of a treaty can be used as supplementary means of interpretation to confirm a meaning derived from applying the analysis from Article 31 of the VCLT. VCLT, *supra* note 123, art. 32.

a statement that the non-military use of wireless telecommunications contemplated in Article 3 and 8 "does not imply that [the neutral state] has any right to use them or to permit their use in order to render manifest assistance to one of the belligerents."<sup>128</sup>

A slightly different question on the scope of this rule arises from the companion provision in Hague XIII, Article 5. That Article similarly prohibits erecting "any apparatus for the purpose of communicating with the belligerent forces" in neutral ports or waters.<sup>129</sup> The Article does not contain any reference to *existing* infrastructure as seen in Hague V.<sup>130</sup> This raises the question on what is the meaning of the verb "erect?" The ordinary meaning would connote construction.<sup>131</sup> Does that mean belligerents may use seabased components of satellite systems that are assembled in their home ports and later moved into neutral waters? A plausible argument is that the Treaty does not prohibit such action because the same parties drafted and signed both Treaties and chose to limit use of existing stations on land but not at sea. An equally plausible argument is that the prohibition of erecting such stations in Hague XIII is exemplar, not exhaustive, because it appears following an explicit prohibition on use of neutral ports or waters as a base of naval operations and is preceded by the words "in particular."<sup>132</sup> Context indicates that the latter construction is more persuasive. Specifically, this provision frames belligerent military communications from neutral waters as a violation of the general rule against neutral ports and waters serving as a base of military operations.<sup>133</sup>

<sup>&</sup>lt;sup>128</sup> CARNEGIE ENDOWMENT FOR INT'L PEACE, DIVISION OF INT'L L., THE PROCEEDINGS OF THE HAGUE PEACE CONFERENCES 142 (vol. I 1920), https://www.loc.gov/rr/frd/Military\_Law/pdf/Hague-Peace-Conference\_1907-V-1.pdf (emphasis added).

<sup>&</sup>lt;sup>129</sup> Hague XIII, *supra* note 20 art. 5.

<sup>&</sup>lt;sup>30</sup> Hague V, *supra* note 23, art. 3.b.

<sup>&</sup>lt;sup>131</sup> The MacMillan Dictionary lists four meanings for the term: to build something; to put something in an upright position; to put the parts of something together so it stands upright; and to create a system or theory. Erect [Def. 1], MACMILLAN DICTIONARY, https://www.macmillandictionary.com/us/dictionary/american/erect\_1 (last visited Nov. 1, 2021).

<sup>&</sup>lt;sup>132</sup> Hague XIII, *supra* note 20, art. 5.

<sup>&</sup>lt;sup>133</sup> Unfortunately, the preparatory works do not provide any substance to confirm this interpretation. The provision is referenced as similar to the proposed article that ultimately became Article 3 of Hague V, but there is no discussion as to any design to omit reference to existing installations. CARNEGIE ENDOWMENT FOR INT'L PEACE, DIVISION OF INT'L L., THE PROCEEDINGS OF THE HAGUE PEACE CONFERENCES 628-29 (vol. III, 1921), https://www.loc.gov/rr/frd/Military\_Law/pdf/Hague-Peace-Conference\_1907-V-3.pdf.

Moreover, Article 1 prohibits any act by a belligerent in neutral waters that would constitute a violation of neutrality.<sup>134</sup> Moving an operational satellite communications terminal into neutral waters to communicate with a belligerent's armed forces would violate the prohibition of belligerents using neutral waters as a base of naval operations. Accordingly, sea-based terminals communicating with a belligerent's communications satellite must do so from outside neutral States' territorial waters.

In sum, when a terrestrial component of a satellite system is located on neutral territory or in neutral waters, that State's rights and obligations under neutrality would be implicated during an international armed conflict. A belligerent could theoretically use a ground terminal located in a neutral State or its territorial waters during such conflict to support that belligerent's communications satellite(s) without violating neutrality so long as the use does not include any military purpose. Any other use in neutral territory or waters would implicate the neutral State's duties to prevent such violations.<sup>135</sup> But the ground terminals are just one of (at least) two components for a satellite communications system. Do these rules apply to the *extra*terrestrial component? If so, how might they affect operations? Answering these questions requires deconstructing the relationships between space law and public international law.

#### B. Components in Outer Space

#### i. The Quasi-Territory Question

To analyze neutrality's applicability to a communications satellite in outer space requires articulating the means by which the law of neutrality would apply. Most relevant neutral rights and obligations as articulated in Hague V and Hague XIII are linked to territory, but that construct is not directly applicable to outer space. Accordingly, whether the space object constitutes State territory is a critical threshold question. If so, the relevant provisions from

<sup>&</sup>lt;sup>134</sup> Hague XIII, *supra* note 20, art. 1.

 $<sup>^{135}\,</sup>$  Hague V Article 5 and Hague XIII Article 25 impose duties upon neutral States to monitor and prevent violations of their neutrality. Hague V, supra note 23, art. 5, Hague XIII, supra note 20, art. 25.

Hague V and XIII apply.<sup>136</sup> If the space object is not a form of territory, the question remains regarding what of neutrality's customary rights and obligations would apply to it?<sup>137</sup> Moreover, to whom do these apply and under what circumstances? This section addresses each of these questions in turn.

The debate about territorial status of space objects in orbit traditionally follows one of two routes. On the one hand is a *non-territory* view, where supporters note that the Article II of the Outer Space Treaty prohibits national appropriation of outer space, "by claim of sovereignty ... or any other means."<sup>138</sup> The logic proceeds that without territorial sovereignty in space, there can be no national territory.<sup>139</sup> If outer space does not contain any national territory, then the above neutrality provisions pertaining to territory and territorial waters are not applicable.<sup>140</sup>

The popular alternative perspective is more nuanced, concluding that space objects constitute *quasi-territory* based on the relationship between the related—but discrete—concepts of jurisdiction and territory. This version relies principally on Article VIII of the Outer Space Treaty, which declares that the State on whose registry a space object is carried retains "jurisdiction and control over such object" while in outer space.<sup>141</sup> Public international law generally recognizes two categories of jurisdiction relevant to this analysis: prescriptive and enforcement.<sup>142</sup> Prescriptive jurisdiction (sometimes referred to as "jurisfaction" and often couched in moral authority)<sup>143</sup> recognizes States' power to legislate over any conduct occurring within its territory *and* conduct by its nationals located anywhere.<sup>144</sup> Thus, if Article VIII confers upon the registering State

<sup>&</sup>lt;sup>136</sup> Hague V Article 3 restricts erecting and using apparatus to communicate with belligerent armed forces "on the territory" of a neutral power. Hague V, supra note 23, art.3.

<sup>&</sup>lt;sup>137</sup> See Section II.A.iii for a discussion of customary duties and obligations.

<sup>&</sup>lt;sup>138</sup> Outer Space Treaty, *supra* note 14, art. II.

<sup>&</sup>lt;sup>139</sup> See Hentschel von Heinegg, supra note 18, at 531.

<sup>&</sup>lt;sup>140</sup> Id. See also Michel Bourbonniere, The Ambit of the Law of Neutrality and Space Security, 49 PROC. ON L. OUTER SPACE 326 (2006).

<sup>&</sup>lt;sup>141</sup> Outer Space Treaty, *supra* note 14, art. VIII.

<sup>&</sup>lt;sup>142</sup> RESTATEMENT (THIRD) OF THE FOREIGN RELATIONS LAW OF THE UNITED STATES § 401 (AM. L. INST. 1988) [hereinafter RESTATEMENT THIRD]. Jurisdiction to enforce is a third category with its own limitations that is not germane to this discussion. *Id.* 

<sup>&</sup>lt;sup>143</sup> See BIN CHENG, STUDIES IN INTERNATIONAL SPACE LAW 659 (1997).

 $<sup>^{144}\,</sup>$  RESTATEMENT THIRD, supra note 142, § 402. International law recognizes a limited authority for States to prescribe laws regulating conduct of non-nationals occurring

the responsibility to exercise jurisdiction and control over a space object, the space object is either a sort of quasi-territory or a national.

The quasi-territorial solution is attractive because it parallels legal regimes governing other objects located outside any State's territory such as vessels<sup>145</sup> or aircraft.<sup>146</sup> This view is arguably supported by practice, too, as States regularly exercise jurisdiction over space objects, despite them not being present on the ground (or air or territorial waters over) in their sovereign territory with national space legislation and regulation.<sup>147</sup> States impose licensing requirements over their juridical nationals engaged in activities in outer space *anywhere* and foreigners operating in their territory as means to enforce such rules.<sup>148</sup>

The quasi-territorial position gains further appeal over the non-territory view for analytical reasons. First, the non-territory view is built on an intractable reliance on Article II of the Outer Space Treaty. A close reading of the text of that provision in context, however, betrays such an interpretation. Article II refers to "[o]uter space, including the Moon and other celestial bodies" as the locations that are not subject to national appropriation.<sup>149</sup> This Article, unlike several others in the same treaty, does not mention human-made objects in space.<sup>150</sup> Accordingly, the concept of nonappropriation of outer space as articulated in Article II of the Outer Space Treaty does not, in and of itself, foreclose the possibility that a humanmade object could be considered property of a State. The plain text of Article VIII supports this interpretation, stating that

outside its territory directed against the security of the State or against a limited class of other State interests. *Id.* This authority is not implicated in the quasi-territory analysis. Prescriptive jurisdiction is subject to a reasonable connection between the State and various issues implicated by the legislation. *Id.* § 403. States generally have authority to enforce any law properly prescribed. *Id.* § 431.

<sup>&</sup>lt;sup>145</sup> Convention on the Law of the Sea art. 91-92, Dec 10, 1982, 1833 U.N.T.S. 397.

<sup>&</sup>lt;sup>146</sup> Convention on Civil Aviation art. 17-18, Dec 7, 1944, 15 U.N.T.S. 295.

<sup>&</sup>lt;sup>147</sup> CHENG *supra* note 143, at 658-59.

<sup>&</sup>lt;sup>148</sup> Id.

<sup>&</sup>lt;sup>149</sup> Outer Space Treaty, *supra* note 14, art. II.

<sup>&</sup>lt;sup>150</sup> Articles IV, VII, VIII, X, and XII each make reference to property (in the form of weapons, equipment, or the generic "object") in outer space. Perhaps the most apropos example is Article VIII, whether space objects are specifically treated as distinct from outer space and celestial bodies; the former being located in one of the latter two. *Id. at* art. VIII.

an object's ownership "is not affected by [its] presence in outer space."  $^{151}$ 

The quasi-territory model for space objects is more convincing than its non-territory competitor yet remains somewhat incomplete in a manner particularly relevant to neutrality, at least insofar as it relies strictly upon Article VIII. Article VI of the Outer Space Treaty injects this complexity with its unprecedented step of imputing international responsibility to States for actions by private persons conducted in outer space.<sup>152</sup> This treatment is typically reserved for either an organ of the State<sup>153</sup> or an actor under a State's effective control.<sup>154</sup> Read together, Articles VI, VII and VIII of the Outer Space Treaty can wreak havoc on identifying which State has rights and obligations springing from a given satellite's operations. A privately operated space object can be subject to the national law of multiple State masters, each of whom is obligated to exercise some form of legal control: authorization and continuing supervision from Article VI based on the space object conducting national activities in outer space on behalf of that State or its natural (or juridical) persons;<sup>155</sup> jurisdiction and control under Article VIII based on the State carrying the item on its registry;<sup>156</sup> even financial liability for certain damages under Article VII.<sup>157</sup> Of these, only Article VII references territory, and this provision has

<sup>154</sup> The International Court of Justice described a standard of "effective control" to attribute actions by those without official authority of a State to the said State. Military and Paramilitary Activities in and Against Nicaragua (Nicar. V. U.S.), Judgment, 1986 I.C.J. 14 para. 115 (June 27) [hereinafter Nicaragua Case].

<sup>155</sup> Outer Space Treaty, *supra* note 14, art. VI.

<sup>156</sup> *Id.* at art. VIII. A space object can only be registered to one State, regardless of the number of States participating in the endeavor of launching and operating it. Registration Convention, *supra* note 16, art. II, para. 2.

<sup>157</sup> Based on theories of liability. See Outer Space Treaty, supra note 14, art. VII.

 $<sup>^{151}</sup>$  Id.

 $<sup>^{152}\,</sup>$  Id. at art. VI.

<sup>&</sup>lt;sup>153</sup> Chapter II of the Draft Articles on State Responsibility is titled "Attribution of Conduct to a State" and the commentary notes in its second paragraph that "the general rule is that the only conduct attributed to the State at the international level is that of its organs or government, or of others who have acted under the direction, instigation, or control of those organs, i.e. as agents of the State." DRAFT ARTICLES ON RESPONSIBILITY OF STATES FOR INTERNATIONALLY WRONGFUL ACTS WITH COMMENTARY CH. 2 INT'L LAW COMM'N 2001), https://legal.un.org/ilc/texts/instruments/english/commentaries/9\_6\_2001.pdf (citations omitted)[hereinafter DRAFT ARTICLES ON RESPONSIBILITY].

virtually no obligation of State *control* over activities.<sup>158</sup> The result is a regime where a multiple States' rights and obligations could be implicated for a given space object. Compounding the complexity, national space legislation as to when and how to implement these duties can vary, although this is undergoing increasing convergence for space objects launched over the past decade.<sup>159</sup>

With such a complex regime dependent on several potential variables, identifying the neutral State with rights and obligations pertaining to a space object must be a fact-specific inquiry. The pertinent facts for such an inquiry are rooted in the traditional notions of jurisdiction (prescriptive and enforcement) and State obligations imposed by international space law. The goal of this inquiry is to identify which State has the *ability* to exercise legal control over the private actors operating the satellite (i.e., which State has national legislation to implement its obligations under space law that applies to the subject operators).<sup>160</sup> The questions in the first stage of the checklist below are designed to assist in identifying the appropriate neutral State(s) with rights and obligations applicable to a given space object.<sup>161</sup> These questions address the prescriptive jurisdiction element by identifying both obligations (from international space law) and ability to exercise legal control over a given object.

<sup>&</sup>lt;sup>158</sup> *Id.* This Article and the Liability Convention essentially identify circumstances under which a State is liable for damage caused by space objects. Neither Article VII nor the Liability Convention impose any obligations to exercise control over activities, just a financial incentive to do so. *Id.*, Liability Convention, *supra* note 16.

<sup>&</sup>lt;sup>159</sup> This convergence is supported by the United Nations Committee on the Peaceful Uses of Outer Space which recommends that:

The State, taking into account its obligations as a launching State and as a State responsible for national activities in outer space under the United Nations treaties on outer space, should ascertain national jurisdiction over space activities carried out from territory under its jurisdiction and/or control; likewise, it should issue authorizations for and ensure supervision over space activities carried out elsewhere by its citizens and/or legal persons established, registered or seated in territory under its jurisdiction and/or control, provided, however, that if another State is exercising jurisdiction with respect to such activities, the State should consider forbearing from duplicative requirements and avoid unnecessary burdens

G.A. Res. 68/74, ¶ 2 (Dec. 11, 2013).

<sup>&</sup>lt;sup>160</sup> See von der Dunk *supra* note 2, at 6 (noting that the most logical consequence of Article VI responsibility is "for states to be held legally responsible for those activities in respect of which they had the legal tools available to control them").

<sup>&</sup>lt;sup>161</sup> See discussion infra Section III.C.

#### ii. Article VI Responsibility and Neutral Nationals

Even in a straightforward case of identifying the neutral State, assessing the *scope* of rights and obligations is another challenge posed by Article VI of the Outer Space Treaty. State responsibility for private actions in outer space can make a profound difference in this context because protecting trade interests (both those of the neutral State and its nationals) is one of the two core motivations behind neutrality.<sup>162</sup> Under neutrality, commercial transactions between a belligerent and neutral State or its nationals are protected so long as *States* refrain from those activities that would constitute participation; private actors enjoy greater freedom.<sup>163</sup> Because Article VI erases the distinction between State and private action—at least as far as international responsibility is concerned the additional leeway for private actors to engage in commercial activities involving space objects must be reconsidered. Specifically, inquiry is warranted into whether Article VI responsibility equates to attribution for non-governmental entities' activities in outer space.<sup>164</sup>

One way to view this is to treat Article VI as completely eliminating any difference between private and State actors for activities conducted on or through objects in outer space. Supporters of this view contend that Article VI "transmutes" the traditional rules so that the commercial leeway enjoyed by neutral State nationals on Earth's surface evaporates when one leaves the atmosphere.<sup>165</sup> This reading treats private actors in space as an organ of the State exercising Article VI supervision, apparently enlarging the traditional standard to impute non-governmental actions to a government in the context of armed conflict (effective

<sup>165</sup> Michael Schmitt, *International Law and Military Operations in Space*, in 10 Max Planck Yearbook of United Nations Law 107 (A. von Bogdandy & R. Wolfrum eds., 2006).

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 $<sup>^{162}~</sup>$  Protecting a sovereign State's territorial sovereignty was the other primary goal. See supra notes 30-44 and accompanying text.

<sup>&</sup>lt;sup>163</sup> States—but not private actors—must also treat belligerents impartially. *See supra* notes 76-78 and accompanying text. *See also* DINSTEIN, *supra* note 23 at 28-29 (describing how neutral States may permit its nationals to provide military supplies to belligerents, but noting such permission may not amount to a constructive base of operations for a belligerent).

<sup>&</sup>lt;sup>164</sup> Elina Morozova, *Limits Imposed by Outer Space Law on Military Operations*, Remarks at the 42d Round Table on Current Issues of International Humanitarian Law on the 70th Anniversary of the Geneva Conventions (Sep. 4-6, 2019) http://iihl.org/wp-content/uploads/2019/10/Morozova.pdf.

control).<sup>166</sup> A problem with this interpretation in the context of armed conflict is that it can unnecessarily broaden the circumstances where armed force can be justified. In such arguably this interpretation circumstances. undermines international peace and security, a result squarely in conflict with Article III of the Outer Space Treaty.<sup>167</sup> Consider an example where a private actor purchases a satellite on orbit that is registered to and licensed by State A, then directs the satellite to collide with State B's government owned and operated crewed space station. The above attribution interpretation suggests that a rogue private actor can commit an armed attack against State B on behalf of State A, without the latter exercising any direction or control.<sup>168</sup> Thus, expanding Article VI responsibility to equate attribution in the context of armed conflict can yield manifestly unreasonable results.

These complications could be avoided with a slightly narrower reading. Article VI responsibility in armed conflict could be considered as an extension of the rule described by the International Court of Justice (ICJ) in the *Corfu Channel Case*<sup>169</sup> to outer space. In that case, the ICJ considered whether knowledge of mines in Albanian waters could be imputed to that State solely by means of Albania's control over their location.<sup>170</sup> The court began its analysis with reference to the custom that a State "may be called upon to give an explanation"<sup>171</sup> under such circumstances, but noted that actual knowledge of the wrongful act could not be concluded simply by control over the territory.<sup>172</sup> The court then went on to wrestle with whether indirect evidence provided sufficient reason to presume Albania knew of the mines (and thus

<sup>&</sup>lt;sup>166</sup> See supra notes 153-154 and accompanying text.

<sup>&</sup>lt;sup>167</sup> That provision dictates that activities in outer space be carried on "in accordance with international law, *including the Charter of the United Nations, in the interest of maintaining international peace and security....*" Outer Space Treaty, *supra* note 14, art. III (emphasis added).

<sup>&</sup>lt;sup>168</sup> An armed attack is generally characterized as a use of force in the "most grave form." Nicaragua Case, *supra* note 154, ¶ 191. This article assumes the above example is of the scale and effects to constitute an armed attack. While State B may elect to pursue diplomatic solutions to the matter, the facts support an armed response in self-defense under this interpretation. *See* U.N. Charter art. 51.

<sup>&</sup>lt;sup>169</sup> Corfu Channel (U.K. v. Alb.), 1949 I.C.J. 4 (Apr. 9, 1949) [hereinafter Corfu Channel Case].

 $<sup>^{170}</sup>$  Id. at 17.

<sup>&</sup>lt;sup>171</sup> *Id.* at 18.

 $<sup>^{172}</sup>$  Id.
had violated a duty to warn others about them).<sup>173</sup> In the context of outer space, Article VI could be seen as a restatement of this rule (States are responsible to seek and provide an answer for suspected wrongdoing by and through space objects operated by it or its nationals), but also imposing a duty on States to exercise some form of control over actors in space to facilitate such investigation and oversight.<sup>174</sup>

The narrower interpretation of Article VI in the context of armed conflict avoids the potential unreasonable result described above (a rogue private actor completing an "attributed" armed attack). Moreover, such an interpretation is more consistent with the general concept of responsibility in international law and State practice. Customarily, actions attributed to States are those implemented by its organs, persons or entities exercising government authority, or persons or groups acting under the direction or control.<sup>175</sup> This matches State practice regarding Article VI responsibility. States require licenses to ensure adequate financial capacity to meet remuneration requirements of Article VII and the Liability Convention and to avoid harmful interference.<sup>176</sup> States do not deputize or commission licensees as officers of the

<sup>&</sup>lt;sup>173</sup> *Id.* at 18-19.

<sup>&</sup>lt;sup>174</sup> The details of Corfu Channel are somewhat enlightening here: The ICJ ultimately imputed *knowledge* of the mines to Albania because of that State's discretionary decision to "keep a jealous watch" on the area. *Id.* at 19. Unlike Article VI's obligation to authorize and *continually* supervise, there was no duty to monitor territorial waters; only to warn if aware of their presence. *Id.* at 22.

<sup>&</sup>lt;sup>175</sup> See DRAFT ARTICLES ON RESPONSIBILITY, supra note 153, Ch.II. As noted above, the standard for attributing responsibility for non-governmental actors is "effective control," which is a relatively high bar. See, e.g. Nicaragua Case supra, note 154, ¶ 115 (describing effective control as "direct[ing] or enforce[ing] the perpetration of [violations of international law]. Generally speaking, the standard requires the actor to be an instrument of the State. Cf. Application of the Convention on the Prevention and Punishment of the Crime of Genocide (Bosn. & Herz v. Serb. and Montenegro), 2007 I.C.J. 43, ¶ 398 (Feb. 26, 2007) (citing the ILC Draft Articles of State Responsibility as customary international law, noting that attribution to State—other than that of de jure organs of a State—arises from persons or groups acting on the instructions of, or at the direction of that State).

<sup>&</sup>lt;sup>176</sup> For example, the United States launching permit requirements are largely focused on financial responsibility to cover probable losses. 14 C.F.R. § 440.5 (2022). Similarly, a license application to operate a communications satellite Earth station in the United States requires providing background information on foreign ownership, whether the satellites used are licensed by the United States, and some criminal history. 47 C.F.R. §§ 25.110-25.129 (2022). The result of an approved application is a license to operate, not a commission to act on behalf of the government.

State as part of its authorization or supervision. While it is certainly possible for these actors to take on the role of instruments of the State, reading Article VI to dictate as much—in the context of armed conflict—is not supported by the context of the Outer Space Treaty or State practice.

If the narrower scope of Article VI responsibility prevails, the additional leeway for private actors' commercial activities in outer space will remain. Assessing the scope of neutral obligations under such conditions would require inquiry into several variables: ownership, nationality of owners and operators, and applicable national space legislation among many others. This inquiry ultimately seeks to unwind, where applicable, the relationships between government and non-governmental actors imposed by international space law to assess the varying rights and obligations the law of neutrality bestows upon them. Stage two of the following checklist proposes questions pertinent to the analysis.

### C. Proposed Analytical Framework

Although no substitute for legal analysis, checklists can serve as a useful framework in any fact-intensive inquiry to identify and analyze pertinent factors in complex situations.<sup>177</sup> The following is a two-stage attempt to capture the relevant inquiry for whether and how the law of neutrality may apply to a communications satellite. In the first stage, five lines of inquiry work to identify which neutral State (or States) have rights and obligations implicated by a satellite communications system. The second stage poses questions in three specific areas to identify the scope of those rights and obligations.

Stage One Inquiries:

1. Is there a state of international armed conflict? The custom of neutrality does not apply during non-international armed conflicts.  $^{178}$ 

<sup>&</sup>lt;sup>177</sup> See, e.g., INTERNATIONAL COMMITTEE OF THE RED CROSS, HANDBOOK ON INTERNATIONAL RULES GOVERNING MILITARY OPERATIONS (2013). This handbook provides checklists for lawful means and methods of war, command responsibility and other LOAC issues.

<sup>&</sup>lt;sup>178</sup> See supra note 86 and accompanying text.

2. What State (or States) license any portion of this satellite system? Conduct this inquiry for each component of the system: terrestrial and those in outer space. The State(s) regulating the system are exercising authorization and supervision (and thus acknowledge international responsibility) for the system pursuant to Article VI of the Outer Space Treaty.<sup>179</sup>

3. What State has registered any component in outer space with the United Nations pursuant to the Registration Convention? This State retains jurisdiction and control over the space object(s) portion of the system pursuant to Article VIII of the Outer Space Treaty and is well-positioned to exert legal control over its operators.<sup>180</sup>

4. What State (or States) is a launching State under the Liability Convention (and therefore liable for damages caused by the space object)? What, if anything, in that State's national legislation regarding space launch subjects the space object operator to continuing supervision by the launching State?<sup>181</sup>

5. If the inquiry in questions 2-4 yields more than one State, identify State(s) with direct interests in the current operations of the satellite in question (i.e. the communications service). Which State is regulating that service (either independently or pursuant to international obligations)? Indirect interests, such as tax requirements, are less important in this phase. The State(s) identified here should be considered neutral State(s) for the communications satellite in question.

Stage Two Questions:

6. Is the space object owned by a State or a non-governmental entity? What is the nationality of any non-governmental ownership? Privately-owned companies of neutral nationality generally enjoy complete commercial freedom with belligerents (while assuming risk), although the principle of *courant normal* permit some neutral State commercial activities with

<sup>&</sup>lt;sup>179</sup> See discussion supra Section III.B.ii.

<sup>&</sup>lt;sup>180</sup> See discussion supra Section III.B.i.

<sup>&</sup>lt;sup>181</sup> See supra note 158 and accompanying text.

belligerents to resume.  $^{182}$  Does any evidence suggests a non-governmental operator is under the effective control of a belligerent?  $^{183}$ 

7. Where are the TTC or other terrestrial components of the system located? Provisions of Hague V or Hague XIII will apply to these components of the system.<sup>184</sup>

8. What State (or States) from questions 2-4 have national laws governing satellite system either directly (e.g., a licensing regime) or indirectly (e.g., an export control regime)? Have the relevant laws (or State enforcement thereof) changed since the beginning of hostilities? The duty of impartiality dictates that neutral States apply every measure or restriction on commercial activities impartially among belligerents.<sup>185</sup>

Some space objects may pass through this rubric with clear responses, yielding straightforward answers to questions on neutral rights and obligations. Others, however, may confound those conducting the analysis.<sup>186</sup> Moreover, the information sought may not be readily available or attainable at all.<sup>187</sup> Nonetheless, the answers to these questions will provide substantial material for a State questioning its (or another's) rights and obligations under neutrality to complete its analysis.

<sup>&</sup>lt;sup>182</sup> See supra note 78 and accompanying text for discussion on the differences between neutral nationals' and neutral States' rights to commercial activities with belligerents.

 $<sup>^{183}\</sup> See\ supra$  note 154 and accompanying text for discussion on internationally wrongful act attribution.

<sup>&</sup>lt;sup>184</sup> See discussion supra Section III.A for more on the applicability of Hague V and Hague XIII to terrestrial components of satellite communications systems.

 $<sup>^{185}\;</sup>$  See supra notes 76-78 and accompanying text for discussion on the duty of impartiality.

<sup>&</sup>lt;sup>186</sup> E.g., A satellite produced in and registered by Italy is operated by an Italian university under contract to Iraq. GUNTER'S SPACE PAGE, *TigriSat*, https://space.skyrocket.de/doc\_sdat/tigrisat.htm (last visited Jun. 16, 2022). An even more challenging example is a communications satellite registered by China, owned by company incorporated in Bermuda (with substantial ownership interest by the Chinese government), leased by the Pakistani government and operated by a Pakistani agency? GUNTER'S SPACE PAGE, *AsiaSat 4 – Paksat-MM 1*, https://space.skyrocket.de/doc\_sdat/asiasat-4.htm (last visited June 16, 2022).

<sup>&</sup>lt;sup>187</sup> For example, a government contract for satellite communications services may be classified, masking the operator's true purpose. Identifying where ground terminals may be located could pose similar challenges.

#### IV. CONCLUSION

This article assesses neutrality's application to space objects in general with a focus on issues pertaining to communications satellites. Communication is just one of several space services a belligerent may utilize (and that may be provided by a neutral State or its nationals). Other services will raise the same general questions about identifying which State may have duties and whether the juridical persons operating the space object enjoy any different rights or protections, but would warrant further analysis for the specific subject matter of the commercial relationship. In the case of remote sensing, for example, the legal status of the data must be considered, including whether a neutral State permitting the processing of data<sup>188</sup> in its territory for military use by belligerents would constitute the neutral State becoming a base of operations.<sup>189</sup> Similarly, how might the duty of non-participation affect neutral States scrutiny of payloads to be launched from their territory? These questions are unfortunately, beyond the scope of this work.

A practical question remains as to whether any of this matters in an actual international armed conflict. It is true that aggrieved belligerents possess effective self-help remedies that are more readily accessible than those offered by neutrality, including making (any component of) the satellite system the object of attack.<sup>190</sup> Neutrality remains, nonetheless, a potentially appealing alternative for a variety of reasons. On one level, not all States possess the capabilities to attack a satellite or its terrestrial

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<sup>&</sup>lt;sup>188</sup> Remote sensing data is generally transmitted to terrestrial locations to be processed into more useful products. *See generally* Fabio Tronchetti, *Legal Aspects of Satellite Remote Sensing*, in HANDBOOK OF SPACE LAW 501, 504 (Frans von der Dunk & Fabio Tronchetti, eds., 2015).

<sup>&</sup>lt;sup>189</sup> Generally speaking, the boundary between permitting *private* trade in arms, ammunition and other items of use to a belligerent and the *neutral State's* obligation to not participate is described as a prohibition on becoming "a base of operations" for the enemy. *See* Hague XIII, *supra* note 20, arts. 7 and 8, which articulate that neutral States are not bound to prevent export of arms, ammunition, or other items of use to a belligerent, but *are* obligated to "employ the means at its disposal to prevent the fitting out or arming of any vessel within its jurisdiction." *See also* DINSTEIN, *supra* note 23, at 30 and DOD LAW OF WAR MANUAL, *supra* note 11, § 15.5.1 (describing the base of operations prohibition as an extension of the neutral duty of non-participation).

<sup>&</sup>lt;sup>190</sup> See supra note 11 and accompanying text.

component.<sup>191</sup> Even those who do may not wish to use them for a variety of political or practical reasons. Neutral State obligations offer belligerents a legal alternative to using force to resolve a concern raised by a space object. Observers note that States have historically followed two relevant patterns regarding neutrality: imposing more severe restrictions than obligated to reduce risk of becoming involved;<sup>192</sup> and ignoring the rules in the face of perceived existential threat.<sup>193</sup> With the overwhelming majority of space objects registered or under the jurisdiction of permanent members of the Security Council (and their allies), these outcomes are arguably less likely.<sup>194</sup> Instead, it may be the belligerents of a smaller armed conflict calling upon the major spacefaring States to either adjust a licensing requirement or prohibit a national from providing service based on claims of impartiality and nonparticipation. In this sense, neutrality may be an attractive tool for belligerents to seek relief with lower costs than that of targeting.

The proliferation of private commercial actors in space—and particularly the increasing government reliance upon these services—make a framework to evaluate neutrality vis-à-vis space objects increasingly important. Privately owned commercial satellite systems are *not* protected civilian objects during an armed conflict, but neutrality may offer belligerent States legal options preferable to physical targeting alternatives. Alternatively, neutrality may protect certain trade interests during an armed conflict. Space law's imposition of unique a connection between States and private activities in outer space muddy the waters of assessing the applicability and scope of these rights and obligations. Unfortunately, there is no "silver bullet" to easily analyze all of the pertinent issues. Only a fact-intensive inquiry on

<sup>&</sup>lt;sup>191</sup> As of this writing, the United States, Russia, China and India have demonstrated effective anti-satellite capabilities. Doris Elin Urrutia, *India's Anti-Satellite Missile Test is a Big Deal. Here's Why.* SPACE.COM (Mar. 30, 2019), https://www.space.com/india-anti-satellite-test-significance.html.

<sup>&</sup>lt;sup>192</sup> CASTRÈN *supra* note 21, at 481.

<sup>&</sup>lt;sup>193</sup> ØRVIK *supra* note 29, at 274.

<sup>&</sup>lt;sup>194</sup> A database maintained by Union of Concerned Scientists indicates that as of December 2019, nearly half (1,007) of all known (2,218) satellites in orbit belonged to the United States, with hundreds more belonging to its allies. Russia (164) and China (323) account for nearly one quarter. UNION OF CONCERNED SCIENTISTS, UCS Satellite Database, https://www.ucsusa.org/resources/satellite-database (last visited Apr. 18, 2020).

a case-by-case basis can untangle who has rights and duties and scope of both.

# THE PRINCIPLE OF "HARMFUL CONTAMINATION" APPLIED TO HUMAN MISSIONS TO MARS

Melissa de Zwart,\* Stacey Henderson\*\* and Rachel Neef\*\*\*

## ABSTRACT

This article considers the meaning and application of "harmful contamination" under Article IX of the Outer Space Treaty in the context of the renewed interest in human exploration of the Moon and Mars. It identifies the historical context of the development of the Committee on Space Research Policy on Planetary Protection and considers the legal regime that is applicable to harmful contamination. In particular, it applies the treaty interpretation method set out in the Vienna Convention on the Law of Treaties to understand how Article IX may be interpreted and applied in an era of commercial human habitation in space. This study reflects a unique blend of legal and scientific principles which have evolved side by side since the dawn of space exploration. The article concludes that the principle of harmful contamination remains an appropriate and relevant principle to facilitate the long-term

<sup>\*</sup> Melissa de Zwart is a thought-leader in the area of law and technology and has a strong international profile in the fields of internet law and the regulation of access to and uses of outer space. She is Professor at Jeff Bleich Centre for the US Alliance in Digital Technology, Security & Governance, Flinders University. She previously served as Dean of the Adelaide Law School (2017-2021). She is currently the Deputy Chair of the Space Industry Association of Australia and a Lieutenant in the Royal Australia Navy (Reserve).

<sup>\*</sup> Stacey Henderson is an international law scholar whose research includes the protective capacity of law in the context of sustained human presence in space. She is Senior Lecturer of Law, College of Business, Government & Law, Flinders University. She is currently a Director of the Space Law Council of Australia and New Zealand, and Council Member and Secretary of the Australian and New Zealand Society of International Law.

<sup>\*\*\*</sup> Rachel Neef completed her Bachelor of Laws, awarded First Class Honors in 2021. During her undergraduate studies at the University of Adelaide, she assisted with research projects in space law and plans to begin her PhD in the field in 2023.

habitation of Mars in a manner that reflects the principle of both forward and backward contamination.

#### I. INTRODUCTION

As our closest and apparently most hospitable neighbor, human exploration and even potentially human settlement of Mars has been a long-term goal of space agencies. Once thought of as purely within the realm of science fiction, the first human steps on Mars are closer than ever before.<sup>1</sup> A parallel but distinctly separate goal of space exploration has been the discovery of life outside our own planet.<sup>2</sup> These two goals are inherently at odds with each other and the legal regime that governs them will be tested in the coming decades to reconcile the two missions. At the core of the tension is the need to keep Mars free from life and microorganisms introduced from Earth<sup>3</sup> so that: first, any life that is found on Mars is incontrovertibly Mars life; and second, that Earth life does not out-compete, contaminate and destroy any indigenous Martian species. Humans host a huge range of microorganisms and their presence on Mars would be the quickest way to jeopardize any missions that have been searching for life.<sup>4</sup>

Planetary protection which concerns itself with the protection of both forward (Earth to space) and back (space to Earth) contamination seeks to address the issues that come with exploring outer space. The relevant principle when discussing the human exploration of Mars and the search for alien life is forward contamination.<sup>5</sup> Belief that Earth life may be able to survive on Mars arises from

<sup>&</sup>lt;sup>1</sup> See generally KIM STANLEY ROBINSON, RED MARS (1992); KIM STANLEY ROBINSON, GREEN MARS (1993); KIM STANLEY ROBINSON, BLUE MARS (1996).

<sup>&</sup>lt;sup>2</sup> Jet Propulsion Laboratory, National Aeronautics and Space Administration, Exoplanet Exploration Program Science Development Plan (2018),https://docslib.org/doc/11428193/science-development-plan-2018; European Space Agency, Cosmic Vision: Space Science for Europe 2015 - 2025(2005),https://www.esa.int/esapub/br/br247/br247.pdf.

<sup>&</sup>lt;sup>3</sup> Alberto G. Fairén et al., *Searching for Life on Mars Before It Is Too Late*, 17(10) ASTROBIOLOGY 962 (2017).

 $<sup>^4~</sup>See$  NASA Interim Directive 8715.129, Biological Planetary Protection for Human Missions to Mars,  $\P$  1.2 (July 9, 2020), https://nodis3.gsfc.nasa.gov/OPD\_docs/NID\_8715-129\_.pdf [hereinafter NASA Mars NID].

<sup>&</sup>lt;sup>5</sup> Back contamination would be a concern when humans are returning from Mars. The early Apollo missions quarantined astronauts after their return from the Moon and similar procedures would likely be followed for Mars to Earth returns. *See infra* Part II.

Earth organisms that persist in extreme conditions.<sup>6</sup> There are concerns that these "extremophiles," would survive the trip to and possibly even thrive on Mars.<sup>7</sup> Research has found extremophiles recovered from spacecraft surfaces prior to launch,<sup>8</sup> and it has even been shown to be likely that some species could survive interplanetary transit.<sup>9</sup>

The United States National Aeronautics and Space Administration (NASA), working with the Jet Propulsion Laboratory, monitors the bacteria growth on the International Space Station (ISS).<sup>10</sup> In March 2021, it was reported that three new species of bacteria were found inside the ISS, all being microbes that came from Earth.<sup>11</sup> The researchers found that the "three ISS strains were isolated at different time periods and from various locations, [and that] their persistence in the ISS environment and ecological significance in the closed systems warrant further study."<sup>12</sup> Perhaps even more concerning, is the bacteria found surviving on the *outside* of the ISS by Japanese researchers in 2020. The researchers mounted dried cell pellets of the bacteria *Deinococcus spp*. in exposure panels outside the ISS and found the pellets still alive after three years.<sup>13</sup> They concluded that "cell pellets 1 mm in diameter

<sup>8</sup> Sudeshna Ghosh et al., *Recurrent Isolation of Extremotolerant Bacteria from the Clean Room Where Phoenix Spacecraft Components Were Assembled*, 10(3) ASTROBIOL-OGY 325 (2010); Kasthuri Venkateswaran et al., *Microbial Existence in Controlled Habitats and their Resistance to Space Conditions*, 29(3) MICROBES & ENVIRONMENTS 243 (2014).

<sup>9</sup> Ximena C. Abrevaya et al., Comparative Survival Analysis of Deinococcus radiodurans and the Haloarchaea Natrialba magadii and Haloferax volcanii Exposed to Vacuum Ultraviolet Irradiation, 11(10) ASTROBIOLOGY 1034 (2011).

<sup>&</sup>lt;sup>6</sup> Marta Cortesão et al., *MARSBOx: Fungal and Bacterial Endurance from a Balloon-Flown Analog Mission in the Stratosphere*, FRONTIERS IN MICROBIOLOGY, Feb. 2021, at 1.

<sup>&</sup>lt;sup>7</sup> Tania Fitzgeorge-Balfour et al., *Life from Earth Could Temporarily Survive on Mars*, FRONTIERS SCIENCE NEWS (Feb. 22, 2021), https://blog.frontiersin.org/2021/02/22/frontiers-microbiology-microbes-spores-molds-survival-earth-stratosphere-space-missions-mars-conditions/.

<sup>&</sup>lt;sup>10</sup> Elizabeth Landau, *High-Tech Methods Study Bacteria on the International Space Station*, Jet Propulsion Laboratory (Oct 26, 2015), https://www.jpl.nasa.gov/news/high-tech-methods-study-bacteria-on-the-international-space-station.

<sup>&</sup>lt;sup>11</sup> Chelsea Gohd, *Newly Discovered Bacteria on Space Station Could Help Astronauts Grow Plants on Mars*, SPACE (Mar 23, 2021), https://www.space.com/space-station-bac-teria-discovery-grow-food-on-mars.

<sup>&</sup>lt;sup>12</sup> Swati Bijlani et al., *Methylobacterium ajmalii sp. nov., Isolated From the International Space Station*, FRONTIERS IN MICROBIOLOGY, Mar. 2021, at 1, 7.

<sup>&</sup>lt;sup>13</sup> *Id.* at 1.

have sufficient protection from UV and are estimated to endure the space environment for 2-8 years, extrapolating the survival curve and considering the illumination efficiency of the space experiment."<sup>14</sup> It is clear that there is the possibility for Earth life to survive in the harsh environments of outer space and as such there are concerns that irrevocable damage could be done by Earth life interacting with microbes that may be present on Mars. It is accepted that nothing can ever be 100% sterilized and, obviously, humans are unable to withstand the same level of sterilization procedures that spacecraft and robotic missions undertake.<sup>15</sup> Further, it is acknowledged that "it will not be possible for all human-associated processes and mission operations to be conducted within entirely closed systems."<sup>16</sup> As such it has been accepted that there will be some degree of inevitable forward contamination from human missions.<sup>17</sup>

This article will consider the key legal and scientific principles which regulate space exploration and activity and planetary protection. Article I of the Outer Space Treaty<sup>18</sup> (OST) provides that outer space should be for the free exploration of all countries and Article IX, warns State Parties against "harmful contamination."<sup>19</sup> It remains unclear exactly what amounts to harmful contamination and there is little that States can do to enforce obligations under Article IX. To supplement these legal principles, the Committee on Space Research (COSPAR), a scientific institution, has created the CO-SPAR Policy on Planetary Protection. COSPAR sets out

 $<sup>^{14}</sup>$  Id.

<sup>&</sup>lt;sup>15</sup> Christine Moissl-Eichinger et al., *Venturing into New Realms? Microorganisms in Space*, 40(5) FEMS MICROBIOLOGY REVIEWS 724 (2016).

<sup>&</sup>lt;sup>16</sup> Committee on Space Research, COSPAR Policy on Planetary Protection (2020), https://cosparhq.cnes.fr/assets/uploads/2020/07/PPPolicyJune-2020\_Final\_Web.pdf [hereinafter COSPAR PPP 2020]; See NASA Mars NID, supra note 4.

<sup>&</sup>lt;sup>17</sup> Catharine A. Conley & John D. Rummel, *Planetary Protection for Human Explo*ration of Mars, 66(5) ACTA ASTRONAUTICA 792 (2010); John D. Rummel et al., A New Analysis of Mars "Special Regions": Findings of the Second MEPAG Special Regions Science Analysis Group (SR-SAG2), 14(11) ASTROBIOLOGY 887 (2014). Alberto G. Fairén et al., Planetary Protection and the Astrobiological Exploration of Mars: Proactive Steps in Moving Forward, 63(5) ADVANCES IN SPACE RESEARCH 1491 (2019).

<sup>&</sup>lt;sup>18</sup> Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies art. I, Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S 205 [hereinafter OST].

 $<sup>^{\</sup>rm 19}~$  Id. at art IX.

recommendations that missions should meet in order to avoid forward and back contamination.  $^{\rm 20}$ 

There are concerns that the COSPAR regulations may be too strict and may not allow missions to properly explore the Martian planet.<sup>21</sup> Given there are plans to send humans to Mars in the coming decades, it is imperative that the legal regime is clearly defined and balanced to permit human activities on Mars. It should be recognized that human missions to Mars will greatly differ from previous missions to the Moon. Regardless of expense, orbital mechanics will require that even initial contact with Mars by humans would be for a more extended period of time than for previous Moon missions. The range predicted by NASA is 30 to 550 days.<sup>22</sup> This time frame creates challenges of reducing contamination from basic bodily functions, through human nutrition, respiration and digestive waste.<sup>23</sup> NASA workshops have suggested that this contamination can be reduced by recycling and on-site growth of food, but these processes can only reduce potential contamination.<sup>24</sup> The risk of contamination has been deemed "considerable and unavoidable."25

Robotic precursor missions play a key role in avoiding harmful contamination when humans eventually set foot on Mars, providing

<sup>&</sup>lt;sup>20</sup> Committee on Space Research, COSPAR Policy on Planetary Protection (2021), https://cosparhq.cnes.fr/assets/uploads/2021/07/PPPolicy\_2021\_3-June.pdf [hereinafter COSPAR PPP 2021]. This Policy is frequently updated, with the most recent version being that approved in June 2021; *See infra* Part III C.

<sup>&</sup>lt;sup>21</sup> Alberto G. Fairén et al., *Planetary Protection and the Astrobiological Exploration* of Mars: Proactive Steps in Moving Forward, 63(5) ADVANCES IN SPACE RESEARCH 1491 (2019); NASA Planetary Protection Independent Review Board, NASA Planetary Protection Independent Review Board (PPIRB): Final Report (2019).

<sup>&</sup>lt;sup>22</sup> JET PROPULSION LABORATORY, NATIONAL AERONAUTICS AND SPACE ADMINISTRA-TION, PLANETARY PROTECTION AND CONTAMINATION CONTROL TECHNOLOGIES FOR FU-TURE SPACE SCIENCE MISSIONS 8 (2005), https://solarsystem.nasa.gov/resources/294/planetary-protection-and-contamination-control-technologies-for-futurespace-science-missions/ [hereinafter JPL Control Technologies]. See NATIONAL AERO-NAUTICS AND SPACE ADMINISTRATION, THE MARS SURFACE REFERENCE MISSION: A DE-SCRIPTION OF HUMAN AND ROBOTIC SURFACE ACTIVITIES (Stephen J. Hoffman ed., 2001), https://space.nss.org/wp-content/uploads/2001-NASA-Mars-Surface-Reference-Mission.pdf.

<sup>&</sup>lt;sup>23</sup> JET PROPULSION LABORATORY, NATIONAL AERONAUTICS AND SPACE ADMINISTRA-TION, PLANETARY PROTECTION ISSUES IN THE HUMAN EXPLORATION OF MARS 17 (2005).

<sup>&</sup>lt;sup>24</sup> JPL Control Technologies, *supra* note 22, at 8.

<sup>&</sup>lt;sup>25</sup> Id.

advanced evaluation of a Martian site.<sup>26</sup> It is however noted that "[p]recursor robotic missions may provide only partial answers about possible life on Mars because of limited ability to explore autonomously."27 The locations where life is most likely to exist on Mars are currently inaccessible to spacecraft, robots and rovers, even with the advances of the NASA Perseverance Rover Mission and its helicopter drone.<sup>28</sup> The balance between the value of precursor robotic missions, with their reduced burden of microbial contamination, and the value of the greater extent of information to be gained from human missions must still be explored. It is contested whether the current planetary protection protocols are overly burdensome and impose prohibitively expensive standards for strict sterilization procedures to be undertaken in respect to future missions.<sup>29</sup> Consequently, we ask whether we are risking future and possibly more harmful contamination by not enshrining clear and appropriate protocols in a positive legal obligation before such missions are launched. There is a genuine risk that by imposing overly burdensome standards to which strict adherence is impossible (or next to impossible), missions will simply deem these non-legally binding requirements unattainable and therefore unsustainable. Rather, by establishing clear and realistic threshold obligations which are legally binding, we can provide for a greater expectation of compliance and maximize ongoing benefits for all States.

This article explores the meaning of harmful contamination under the OST and how the law can reconcile the requirement to avoid harmful contamination with plans for human missions. Part II explores the historical context of human space exploration and the creation of COSPAR. Early space missions and the protocols that they employed are also outlined. Part III explores in depth the legal regime that is applicable to harmful contamination. Using the treaty interpretation method set out in the Vienna Convention of

<sup>&</sup>lt;sup>26</sup> COSPAR PPP 2021, *supra* note 20, at 7, § 9.3.

<sup>&</sup>lt;sup>27</sup> JPL Control Technologies, *supra* note 22, at 9.

<sup>&</sup>lt;sup>28</sup> Id. Mars 2020 Mission Perseverance Rover, NASA, https://mars.nasa.gov/mars2020/ (last visited June 21, 2022).

<sup>&</sup>lt;sup>29</sup> Alberto G. Fairén et al., Searching for Life on Mars Before it is Too Late, 17(10) ASTROBIOLOGY 962 (2017); John D. Rummel & Catharine A. Conley, Four Fallacies and an Oversight: Searching for Martian Life, 17(10) ASTROBIOLOGY 971 (2017).

the Law of Treaties<sup>30</sup> (VCLT), the meaning, context and object of the relevant provisions are discussed. The article then looks at the supplementary means of interpretation namely the travaux préparatoires and explores the role of soft law regulations and COSPAR. Further, this part of the article considers general principles of international law such as the principles of transboundary harm and the precautionary principle and how they impact the interpretation of the OST. After this analysis is undertaken, this article concludes that there is scope for human exploration of Mars to occur without violating Article IX or other general principle of international law. This is provided that actors appropriately minimize their risk and conduct their activities in the pursuit of scientific investigation with regard to the need to avoid harmful contamination for the benefit of Mars itself and all visitors, and potential future settlers, on that planet.

#### II. HISTORICAL CONTEXT

Calls for planetary protection predate the OST, with the issue being first raised in 1956 at the Seventh International Astronautical Federation Congress in Rome.<sup>31</sup> In 1958, the International Council of Scientific Unions (ICSU) formed the Committee on Contamination by Extraterrestrial Exploration (CETEX), which recommended that a code of conduct be established for space missions and research.<sup>32</sup> Adopting these recommendations the ICSU established the COSPAR to coordinate space research globally; one of the matters of concern being planetary protection.<sup>33</sup> After the formation of the United Nations Committee on Peaceful Uses of Outer Space (COPUOS) in December 1958,<sup>34</sup> discussions on how to legally regulate outer space activities gained momentum. The OST, now considered the foundational legal instrument that governs the use and

 $<sup>^{30}\,</sup>$  Vienna Convention on the Law of Treaties, May 23, 1969, 1155 U.N.T.S. 331 [here-inafter VCLT].

<sup>&</sup>lt;sup>31</sup> See NATIONAL ACADEMIES, SCIENCE, ENGINEERING AND MEDICINE, THE GOALS, RATIONALES, AND DEFINITION OF PLANETARY PROTECTION: INTERIM REPORT 2 (2017)[hereinafter National Academies Interim Report]; See MICHAEL MELTZER, WHEN BIOSPHERES COLLIDE: A HISTORY OF NASA'S PLANETARY PROTECTION PROGRAMS 15 (2011).

<sup>&</sup>lt;sup>32</sup> National Academies Interim Report, *supra* note 31, at 2.

<sup>&</sup>lt;sup>33</sup> Id.

<sup>&</sup>lt;sup>34</sup> G.A. Res. 1348 (XIII) (Dec. 13, 1958); G.A. Res. 1472 (XIV) (Dec. 12, 1959).

exploration of outer space, came into force in 1967.<sup>35</sup> However, the principles enshrined in the OST were the subject of extensive debate in the decade leading up to its formation.

Despite not being legally required to follow planetary protection protocols, the 1961 Lunar Ranger project lead by NASA was the first mission that followed a sterilization procedure.<sup>36</sup> This was in light of declarations of the ICSU that all countries that were launching space experiments which could have a potential adverse effect on future scientific research should provide the ICSU and CO-SPAR with the relevant information to evaluate the potential contamination.<sup>37</sup> COSPAR formed a Consultative Group on Potentially Harmful Effects of Space Experiments in 1962 to assist with conducting these evaluations.<sup>38</sup> As will be explored below, despite not being a body that can create or enforce binding legal obligations, COSPAR played, and continues to play, a significant role in the development of planetary protection policies.

The Apollo missions also followed planetary protection protocols, the 1969 Apollo 11 mission famously being the first time humans stepped foot on the lunar surface.<sup>39</sup> Planetary protection concerns at this time, however, were largely related to *back* contamination and fears that the astronauts would be bringing back extraterrestrial matter to Earth.<sup>40</sup> The astronauts were subject to a 21day quarantine upon their return to Earth.<sup>41</sup> After the Apollo 14 mission, quarantine for lunar missions was discontinued as unnecessary.<sup>42</sup> It is largely accepted that the Moon does not contain an

 $^{40}$  Id.

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<sup>&</sup>lt;sup>35</sup> OST, *supra* note 18.

<sup>&</sup>lt;sup>36</sup> Jack B. Barengoltz, A Review of the Approach of NASA Projects to Planetary Protection Compliance (2005), https://trs.jpl.nasa.gov/bitstream/handle/2014/40515/04-3484FN.pdf?sequence=3. Note the first two Ranger missions (1961) were test vehicles and not sterilized. Sterilization was implemented beginning with Ranger 3. *See* NA-TIONAL ACADEMIES, SCIENCE, ENGINEERING, MEDICINE, REVIEW AND ASSESSMENT OF PLANETARY PROTECTION POLICY DEVELOPMENT PROCESSES 25 (2018).

<sup>&</sup>lt;sup>37</sup> National Academies Interim Report, *supra* note 31, at 2.

<sup>&</sup>lt;sup>38</sup> Id.

<sup>&</sup>lt;sup>39</sup> See generally, MELTZER, supra, note 31.

<sup>&</sup>lt;sup>41</sup> Barengoltz, *supra* note 36; These protocols were also in place for Apollo 12 and 14 missions; *See* National Academies Interim Report, *supra* note 31, at 27-28. After the Apollo 14 mission, lunar quarantine was discontinued.

<sup>&</sup>lt;sup>42</sup> Meghan Bartels, *Apollo 11 Astronauts Spent 3 Weeks in Quarantine, Just in Case of Moon Plague*, Space (Jul. 24, 2019), https://www.space.com/apollo-11-astronauts-quarantined-after-splashdown.html.

environment that could host life;<sup>43</sup> as such the planetary protection protocols that are recommended are lower.

The Apollo 12 mission highlights the practical difficulties of planetary protection. The Surveyor III probe was brought back from the Moon to Earth as part of the Apollo 12 mission.<sup>44</sup> Upon examination of the probe camera, scientists claim to have isolated a colony of *Streptococcus mitis* bacteria; however, other components did not contain any viable terrestrial bacteria.<sup>45</sup> It was suggested that the bacterium was deposited in the camera prior to its launch and survived its time on the lunar surface.<sup>46</sup> It has been noted that the bacteria found could have been a result of poor contamination protocols within the laboratory upon return and *not* an issue of sterilization prior to launch.<sup>47</sup> Regardless, the situation highlights the confusion that can occur with terrestrial contamination and possible detection of life outside of our planet.<sup>48</sup>

Early Soviet Mars Missions also can inform our understanding of the development of planetary protection policies. Mars 1 (1962), 2 (1971) and 3 (1971) missions—the first a flyby mission and the next two orbital-lander missions—claim to have followed planetary protection protocols equivalent to those set out by COSPAR, but no data was made available at the time of the missions.<sup>49</sup> The Viking projects lead by NASA followed strict planetary protection protocols in their search for life on Mars.<sup>50</sup> In 1976 two orbiters and landers undertook the first in-situ search and experiments for life detection

<sup>&</sup>lt;sup>43</sup> See COSPAR PPP 2021, *supra* note 20, at Category II. A Moon landing is a Category II mission "where there is only a remote chance that contamination carried by a spacecraft could compromise future investigations."

<sup>&</sup>lt;sup>44</sup> Robert Z. Pearlman, 50 Years On, Where Are the Surveyor 3 Moon Probe Parts Retrieved by Apollo 12?, SPACE (Nov. 24, 2019), https://www.space.com/apollo-12-surveyor-3-parts-50-years.html.

<sup>&</sup>lt;sup>45</sup> National Academies Interim Report, *supra* note 31, at 30.

<sup>&</sup>lt;sup>46</sup> F. J. Mitchell & W. L. Ellis, *Surveyor III: Bacterium isolated from lunar-retrieved TV camera*, 3 Proceedings of the Second Lunar Science Conference 2721 (1971).

<sup>&</sup>lt;sup>47</sup> John D. Rummel et al., A Microbe on the Moon? Surveyor III and Lessons Learned for Future Sample Return Missions (2011), https://www.lpi.usra.edu/meetings/sssr2011/pdf/5023.pdf.

<sup>&</sup>lt;sup>48</sup> Daniel P. Glavin et al., *Biological Contamination Studies of Lunar Landing Sites: Implications for Future Planetary Protection and Life Detection on the Moon and Mars*, 3(3) INT'L J. ASTROBIOLOGY 265, 265–271 (2004).

<sup>&</sup>lt;sup>49</sup> National Academies Interim Report, *supra* note 31, at 30.

<sup>&</sup>lt;sup>50</sup> See MELTZER, supra note 31.

on Mars.<sup>51</sup> NASA followed the guidance of COSPAR implementing strict sterilization methods, estimated to be 10% of the budget for the USD 4.4 billion landers.<sup>52</sup>

Since these missions, science and technical standards have continued to develop.<sup>53</sup> Whilst these standards have no bearing on legal obligations, they are relevant to development of State practice. The next part of this article seeks to unpack what exactly the *legal* obligations of States are under the OST and other relevant principles of environmental law.

#### III. LEGAL REGIME

International space law consists primarily of five United Nations treaties: the OST,<sup>54</sup> the Agreement on the Rescue of Astronauts and the Return of Objects Launched in Outer Space (Rescue Agreement),<sup>55</sup> the Convention on International Liability Caused by Space Objects (Liability Convention),<sup>56</sup> the 1975 Convention on Registration of Objects Launched into Outer Space (Registration Convention),<sup>57</sup> and the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (Moon Agreement).<sup>58</sup> The Moon Agreement is considered the most advanced environmentally, but due to its poor uptake by States—it has only 18 State Parties—its force in international law is minimal if anything.<sup>59</sup>

<sup>&</sup>lt;sup>51</sup> NASA Science, Viking 1 & 2, https://mars.nasa.gov/mars-exploration/missions/viking-1-2/ (last visited July 30, 2022).

<sup>&</sup>lt;sup>52</sup> Adjusted for inflation. National Academies Interim Report, *supra* note 31, at 31; David Bearden & Eric Mahr, Aerospace Corporation, Cost of Planetary Protection Implementation (2017), https://sites.nationalacademies.org/cs/groups/ssbsite/documents/webpage/ssb\_180771.pdf.

<sup>&</sup>lt;sup>53</sup> See Leslie I. Tennen, Evolution of the Planetary Protection Policy: Conflict of Science and Jurisprudence?, 34 ADVANCES IN SPACE RESEARCH 2354 (2004).

 $<sup>^{54}</sup>$  OST, supra note 18.

<sup>&</sup>lt;sup>55</sup> Agreement on the Rescue of Astronauts and the Return of Objects Launched in Outer Space, Dec. 19, 1967, 19 U.S.T. 7570, 672 U.N.T.S. 119.

<sup>&</sup>lt;sup>56</sup> Convention on International Liability for Damage Caused by Space Objects, Mar. 29, 1972, 24 U.S.T. 2389, 961 U.N.T.S. 187 [hereinafter Liability Convention].

<sup>&</sup>lt;sup>57</sup> Convention on Registration of Objects Launched into Outer Space, Nov. 12, 1975, 28 U.S.T. 695, 1023 U.N.T.S. 15 [hereinafter Registration Convention].

<sup>&</sup>lt;sup>58</sup> Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, Dec. 18, 1979, 1363 U.N.T.S. 3 [hereinafter Moon Agreement].

<sup>&</sup>lt;sup>59</sup> Lotta Viikari, *Environmental Aspects of Space Activities*, in HANDBOOK OF SPACE LAW 717, 726 (Frans von der Dunk ed., 2015). (purchase)

The OST is the most authoritative document governing State activities in the outer space environment. The core provision that is concerned with biological forward contamination is Article IX, which provides that:

States Parties to the Treaty shall pursue studies of outer space, including the moon and other celestial bodies, and conduct exploration of them so as to avoid their harmful contamination and also adverse changes in the environment of the Earth resulting from the introduction of extraterrestrial matter and, where necessary, shall adopt appropriate measures for this purpose.60

Article IX, which is the longest article in the OST, continues on to outline consultation procedures.<sup>61</sup> It creates a "proscriptive positive legal obligation" for States to avoid harmful contamination.<sup>62</sup> The planetary protection obligations found in Article IX reflect further duties found in the Article that States shall conduct their space activities "with due regard to the corresponding interests of all other States Parties to the Treaty."63

Harmful contamination however, has not been defined within the Treaty. This part of the article uses treaty interpretation methods to better define what is meant by the term. The starting point is the VCLT which requires consideration of the ordinary meaning, context and purpose of an agreement. After this analysis, supplementary means of interpretation namely the travaux préparatoires are looked at to shed light on the meaning of harmful contamination to States at the *time of drafting* the OST. This method provides a holistic approach to the concept of what is harmful contamination per the OST.

<sup>&</sup>lt;sup>60</sup> OST, *supra* note 18, art. IX.

<sup>&</sup>lt;sup>61</sup> Id.

<sup>62</sup> Michael C. Mineiro, FY-1C and USA-193 ASAT Intercepts: An Assessment of Legal Obligations Under Article IX of the OST, 34 J. SPACE L. 321, 333 (2008).

<sup>&</sup>lt;sup>63</sup> OST, supra note 18, art. IX.

## A. Treaty Interpretation: Ordinary Meaning, Context and Purpose

Articles 31 and 32 of the VCLT provide the method for treaty interpretation.<sup>64</sup> These Articles represent customary international law and can therefore be used to interpret the OST,<sup>65</sup> even though it predates the VCLT.<sup>66</sup> First, a "treaty shall be interpreted in good faith in accordance with the ordinary meaning to be given to the terms of the treaty in their context and in the light of its object and purpose."<sup>67</sup> The documents that form part of a treaty include its preambles and annexes,<sup>68</sup> as well as "any agreement relating to the treaty which was made between all the parties in connection with

<sup>&</sup>lt;sup>64</sup> VCLT, *supra* note 30, art. 31 & 32.

<sup>65</sup> Oliver Dörr & Kirsten Schmalenbach, VIENNA CONVENTION ON THE LAW OF TREA-TIES: A COMMENTARY 521-570 (Oliver Dörr & Kirsten Schmalenbach eds., 1st ed. 2012); Santiago Torres-Bernárdez, Interpretation of Treaties by the International Court of Justice Following the Adoption of the 1969 Vienna Convention on the Law of Treaties, in LIBER AMICORUM: PROFESSOR IGNAZ SEIDL-HOHENVELDERN IN HONOUR OF HIS 80TH BIRTHDAY 721 (Gerhard Hafner et al. eds., 1998); See Arbitral Award of 31 July 1989 (Guinea-Bissau v. Sen.), Judgment, 1991 I.C.J. Rep. 53, ¶ 48 (Nov. 12). The Court stated that the pre-existing principles of treaty interpretation "are reflected in Articles 31 and 32 of the Vienna Convention on the Law of Treaties, which may in many respects be considered as a codification of existing customary international law on the point"; See Territorial Dispute (Libya Arab Jamahiriya v. Chad), Judgment, 1994 I.C.J. Rep. 6, ¶ 41 (Feb. 3); Kasikili/Sedudu Island (Bots. v. Namib.), Judgment, 1999 I.C.J. Rep. 1045, ¶ 18 (Dec. 13); LaGrand (Ger. v. U.S.), Judgment, 2001 I.C.J. Rep. 466, ¶ 99 (June 27); Avena and Other Mexican Nationals (Mex. v. U.S.), Judgment, 2004 I.C.J. Rep. 12, ¶ 83 (Mar. 31); Legal Consequences of Construction of a Wall in Occupied Palestinian Territory, Advisory Opinion, 2004 I.C.J. 136, ¶ 94 (July 9); Application of Convention on the Prevention and Punishment of Crime of Genocide (Bos. & Herz. v. Serb. & Montenegro), Judgment, 2007 I.C.J. Rep. 43, ¶ 160 (Feb. 26); Dispute Regarding Navigational and Related Rights (Costa Rica v. Nica.). Judgment, 2009 I.C.J 213, ¶ 47 (July 13); Pulp Mills on the River Uruguay (Arg. v. Uru.), Judgment, 2010 I.C.J. Rep. 14, ¶ 65 (Apr. 20).

<sup>&</sup>lt;sup>66</sup> Cf. Kasikili/Sedudu Island (Bots. v. Namib.), Judgment, 1999 I.C.J. Rep. 1045, ¶ 20 (Dec. 13) (interpretation of treaty of 1890); LaGrand (Ger. v. U.S.), Judgment, 2001 I.C.J. Rep. 466, ¶ 99 (June 27) (ICJ Statute); Avena and Other Mexican Nationals (Mex. v. U.S.), Judgment, 2004 I.C.J. Rep. 12, ¶ 83 (Mar. 31) (Vienna Convention on Consular Relations); Legal Consequences of Construction of a Wall in Occupied Palestinian Territory, Advisory Opinion, 2004 I.C.J. 136, ¶ 95 (July 9) (Geneva Convention IV); Dispute Regarding Navigational and Related Rights (Costa Rica v. Nica.). Judgment, 2009 I.C.J 213, ¶ 47 (July 13) (Treaty of 1885); Pulp Mills on the River Uruguay (Arg. v. Uru.), Judgment, 2010 I.C.J. Rep. 14, ¶ 65 (Apr. 20) (Treaty of 1975); Responsibilities and Obligations of States Sponsoring Persons and Entities with Respect to Activities in the Area, Case No. 17, Advisory Opinion of Feb. 1, 2011, ITLOS Rep. 10, ¶ 57.

<sup>&</sup>lt;sup>67</sup> VCLT, *supra* note 30, art. 31(1).

<sup>&</sup>lt;sup>68</sup> Id. at art. 31(2).

the conclusion of the treaty,"<sup>69</sup> and "any instrument which was made by one or more parties in connection with the conclusion of the treaty and accepted by the other parties as an instrument related to the treaty."<sup>70</sup> Paragraph three of Article 31 provides that subsequent agreements on the interpretation,<sup>71</sup> and "subsequent practice in the application of the treaty,"<sup>72</sup> are also relevant to the interpretation. Article 32 provides for supplementary means of interpretation to confirm the meaning, when the interpretation according to Article 31 "leaves that meaning ambiguous or obscure"<sup>73</sup>; or "leads to a result which is manifestly absurd or unreasonable."<sup>74</sup> Supplementary means of interpretation include "the preparatory work of the treaty and the circumstances of its conclusion."<sup>75</sup>

#### 1. Ordinary Meaning

Article IX stipulates that States "shall" avoid harmful contamination.<sup>76</sup> The use of "shall" indicates that this is a binding legal obligation. It has been interpreted to be "all possible kinds, forms or instances of harmful interference in outer space, deliberate or unintentional alike."<sup>77</sup> Harmful, taken in its ordinary meaning would amount to anything causing harm. This is a wide ambit and does little to guide States on what threshold would need to be exceeded before contamination becomes harmful. Looking at the words of the Article, given that the Article is written by reference to exploration and investigation, it has been argued that the threshold for pollution should be set quite high.<sup>78</sup>

Further, what is and is not harmful will depend on *where* the contamination occurs. For example, in the COSPAR regulations, stricter decontamination procedures are recommended when space objects are exploring regions that have a higher likelihood of

<sup>&</sup>lt;sup>69</sup> Id. at art. 31(2)(a).

<sup>&</sup>lt;sup>70</sup> *Id.* at art. 31(2)(b).

<sup>&</sup>lt;sup>71</sup> *Id.* at art. 31(3)(a).

<sup>&</sup>lt;sup>72</sup> Id. at art. 31(3)(b).

<sup>&</sup>lt;sup>73</sup> VCLT, *supra* note 30, art. 32(a).

<sup>&</sup>lt;sup>74</sup> *Id.* at art. 32(b).

 $<sup>^{75}\,</sup>$  Id. at art. 32.

<sup>&</sup>lt;sup>76</sup> OST, *supra* note 18, art. IX.

<sup>&</sup>lt;sup>77</sup> Sergio Marchisio, *Article IX*, *in* COLOGNE COMMENTARY ON SPACE LAW: OUTER SPACE TREATY, VOLUME 1, 176 (2009).

<sup>&</sup>lt;sup>78</sup> GEORGE T. HACKET, SPACE DEBRIS AND THE CORPUS JURIS SPATIALIS 104 (1994).)

containing organic matter.<sup>79</sup> The Moon for example is subject to relatively few decontamination regulations. Conversely, Mars, particularly regions where water has been found, is subject to extreme decontamination measures.<sup>80</sup> The same contamination could occur on the Moon and on Mars, but only be considered harmful in the latter circumstance.

#### 2. Context

Turning to the context of the OST, the words "harmful contamination" cannot be considered without also understanding the words around it in the rest of the Article. Specific reference is made to "studies" and "exploration,"<sup>81</sup> this is a narrower conception than "use" of outer space which is discussed in Article I of the OST.<sup>82</sup> Article I is however relevant in that it calls on States to ensure that space "shall be free for the exploration and use by all States," which includes "free access to all areas of celestial bodies."<sup>83</sup>

The obligation in Article IX is discretionary in nature, it calls on States to avoid harmful contamination rather than being an obligation of absolute prevention.<sup>84</sup> Article IX provides that States need to "adopt appropriate measures" to avoid harmful contamination, however, provides no guidance as to what constitutes appropriate.<sup>85</sup> The rest of the Article IX does nevertheless reinforce the requirement to have some sort of process in that States Parties "shall be guided by the principle of cooperation and mutual assistance" and further that they "shall undertake appropriate international consultations before proceeding with any such activity or experiment" where the experiment "would cause potentially harmful interference with activities of other States Parties."<sup>86</sup> Although the obligations to avoid harmful contamination and harmful interference are separate, the principles of due regard and consultation can form part of the broader context of the interpretation of what

 $<sup>^{79}\,</sup>$  Comm. on Space Rsch., COSPAR Policy on Planetary Protection (2017), Category IV & V.

<sup>&</sup>lt;sup>80</sup> COSPAR PPP 2021, *supra* note 20, Sec. 9.1.

 $<sup>^{\</sup>rm 81}~$  OST, supra note 18, art. IX.

 $<sup>^{82}</sup>$  Id. at art. I.

<sup>&</sup>lt;sup>83</sup> Id.

<sup>&</sup>lt;sup>84</sup> Mineiro, *supra* note 62, at 340.

<sup>&</sup>lt;sup>85</sup> OST, *supra* note 18, art. IX.

<sup>&</sup>lt;sup>86</sup> Id.

constitutes harmful contamination, in that States must consider the interests of other States Parties. What would be an appropriate standard to avoid harmful contamination can therefore be discussed by reference to having "due regard" for the interests of other State Parties.

This was an early and continuing concern of planetary protection policy. In 1962, Secretary of the Communist Party of the Soviet Union, Nikita Khrushchev raised concerns with President of the United States, John F. Kennedy, that forward contamination by one State could later affect the free exploration<sup>87</sup> by another State, in that any contamination by one State could impact later scientific searches for life by other State Parties.<sup>88</sup> While this document predates the OST, it demonstrates the concerns that were recognized at that time and which are still present to today in the efforts to balance the interests of all States.

Comparing a term in question with analogous wording in a related treaty may assist in the contextual interpretation.<sup>89</sup> The Moon Agreement has a provision similar to Article IX that prohibits harmful contamination.<sup>90</sup> Despite its poor international uptake, it can still provide insight into what States' interests are with regards to harmful contamination. In 1970 Argentina presented their "draft agreement on the principles governing activities in the use of natural resources of the moon and other celestial bodies."<sup>91</sup> This first version did not mention harmful contamination.<sup>92</sup> The Soviet Union also provided a "Draft Treaty Concerning the Moon to the General Assembly in 1971."<sup>93</sup> Article IV of the Soviet draft provided that:

<sup>&</sup>lt;sup>87</sup> See Id. at art. I.

<sup>&</sup>lt;sup>88</sup> Deputy Permanent Rep. of the U.S.S.R., Letter dated Mar. 21, 1962 from the Deputy Permanent Rep. of the U.S.S.R. addressed to the Acting Secretary-General, U.N. Doc. A/AC.105/2 (Mar. 21, 1962) (Letter from Nikita S. Khrushchev, Chairman, U.S.S.R., to John F. Kennedy, President, U.S.).

<sup>&</sup>lt;sup>89</sup> Land, Island and Maritime Frontier Dispute (El Sal./Hond.: Nicar. Intervening), Judgment, 1992 I.C.J. Rep. 351, ¶ 374 (Sept. 11).

<sup>&</sup>lt;sup>90</sup> Moon Agreement, *supra* note 58, art. 7.

<sup>&</sup>lt;sup>91</sup> U.N. GAOR, Argentina Draft Agreement on Principles Governing Activities in the Use of Natural Resources of the Moon and Other Celestial Bodies, U.N. Doc. A/AC.105/C.2/L.71 and Corr.; Comm. on the Peaceful Uses of Outer Space, Rep. of the Legal Subcomm. on the Work of Its Ninth Session, U.N. Doc. A/AC.105/85 (July 3, 1970). <sup>92</sup> Id.

<sup>&</sup>lt;sup>93</sup> U.N. GAOR, Preparation of an International Agreement Concerning the Moon, U.N. Doc. A/C.1/L.568. (Nov. 5, 1971) (USSR: Draft Treaty Concerning the Moon).

1. States parties shall explore and use the Moon by reasonable means avoiding the disruption of the existing balance of the lunar environment.

2. States Parties shall explore and use the Moon in such a way as to prevent adverse changes in the lunar environment and its contamination through the introduction of extralunar matter. Where necessary, consultations shall be held between the States Parties concerned.<sup>94</sup>

Debate continued for some years on whether the subject of the agreement should be solely the Moon or if it should also include celestial bodies generally, ultimately resolving in application to the Moon and other celestial bodies within the solar system, excluding Earth.<sup>95</sup> The final draft agreement as adopted by the General Assembly in 1979 provides at Article 7.1 that "[i]n exploring and using the *moon*, States Parties shall take measures to prevent the disruption of the existing balance of its environment, whether by introducing adverse changes in that environment, by its *harmful contamination through the introduction of extra-environmental matter* or otherwise."<sup>96</sup>

The inclusion of this provision is interesting since at the time of drafting humans had already set foot on the Moon in the Apollo missions and some level of at least regional contamination had been conceded. The Apollo 15, 16, and 17 missions, which concluded in 1972, had discontinued quarantine procedures for astronauts on their return to Earth.<sup>97</sup> This is more relevant to back contamination, but inherently recognizes that there would not be any life on the Moon that could pose a threat to Earth. Notably, contamination procedures did remain in effect so that testing that occurred back on Earth would be uncontaminated.<sup>98</sup>

<sup>&</sup>lt;sup>94</sup> Id.

<sup>&</sup>lt;sup>95</sup> BIN CHENG, STUDIES IN INTERNATIONAL SPACE LAW 359-360 (1997).

<sup>&</sup>lt;sup>96</sup> Moon Agreement, *supra* note 58, art. 7.1.

<sup>&</sup>lt;sup>97</sup> MICHAEL MELTZER, WHEN BIOSPHERES COLLIDE: A HISTORY OF NASA'S PLANE-TARY PROTECTION PROGRAMS 245 (2010).

<sup>&</sup>lt;sup>98</sup> Edward L. Michel et al., *Environmental Factors*, *in* BIOMEDICAL RESULTS OF APOLLO 129 (George G. Armstrong et al. eds., 1975).

#### 3. Object and Purpose

Article I of the OST clearly expresses that "[t]he exploration and use of outer space, including the Moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries."99 These principles of free use and exploration guide the interpretation of all articles in the OST.<sup>100</sup> Presumably, the primary purpose of the OST was not to preserve outer space in its pristine condition but to govern its sustainable exploration. In regards to Article IX it is clear that harmful contamination is to be avoided not simply to protect general scientific interests but also to protect future interests of other States that want to explore the celestial environment.<sup>101</sup> It can therefore be contended that given the aim of Article IX is not the protection of the space environment per se, but instead to further the exploration and scientific utility of space, the threshold for what amounts to contamination should be set relatively high so as to avoid the creation of an insurmountable burden.<sup>102</sup> Given that the aim of Article IX is to further the continued human exploration of the scientific utility of space, standards for forward contamination should accordingly be calibrated at a relatively low standard to enable States to further this objective whilst complying with their legal obligations.

Ultimately, the three-part test set out in Article 31(1) of the VCLT does little to explain what harmful contamination is in Article IX of the OST. Subsequent State practice may also be considered but this is currently limited. Further, no State has come out with a definition of what is and is not harmful contamination. Rather, States have simply asserted that they are guided by the principles in Article IX of the OST.<sup>103</sup> As such, it is necessary to engage the use of supplementary means of interpretations, in particular the travaux préparatoires of the OST<sup>104</sup> as provided under Article 32

<sup>&</sup>lt;sup>99</sup> OST, *supra* note 18, art. I.

 $<sup>^{100}</sup>$  Id.

<sup>&</sup>lt;sup>101</sup> Federico Bergamasco, Space Mining and the Protection of Extra-Terrestial Environment in the Light of Article IX of the Outer Space Treaty, 60 PROC. INT'L INST. SPACE L. 157, 168 (2017).

<sup>&</sup>lt;sup>102</sup> See HACKET, supra note 78.

<sup>&</sup>lt;sup>103</sup> Bergamasco, *supra* note 101, 1a t 65.

<sup>&</sup>lt;sup>104</sup> See 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 Off.

VCLT. This will assist in understanding what harmful contamination meant at the time of drafting the OST and how States contemplated this Article being interpreted.

### B. Drafting History of the Outer Space Treaty

Soon after the launch of Sputnik in 1957, COPUOS was established and tasked to "study the nature of legal problems which may arise from the exploration of outer space."105 Understanding the diverging interests of COPUOS, the Committee was split into two distinct subcommittees, the Legal Subcommittee and the Scientific and Technical Subcommittee.<sup>106</sup> Precursors to concerns of harmful contamination were concerns of harmful interference with activities of other States.<sup>107</sup> The Friendly Declaration found at paragraph 6 of the 1963 United Nations General Assembly Resolution 1962 XVIII, called for States to undertake appropriate consultations where there was reason to believe that an experiment would cause harmful interference.<sup>108</sup> This was the first agreement on the principles of how to govern activities in outer space, but it of course did not carry any binding legal weight. In COPUOS, whilst the importance of the Declaration was of course noted by many delegations, discussions amongst the States made it clear that the Declaration created only the opening for further formulation of space law. For example, the Polish delegation stated: "This declaration constitutes for the United Nations an important achievement provided that it viewed only as a step toward the establishment of space law."109 The Soviet Union noted that "[t]he Declaration has laid the foundation for further formulation of international legal standards and principles governing activities in outer space. The Declaration,

for Outer Space Affs., https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/travaux-preparatoires/outerspacetreaty.html (last visited June 28, 2022).

<sup>&</sup>lt;sup>105</sup> G.A. Res. 1472 (XIV), ¶ 1(b) (Dec. 12, 1959).

<sup>&</sup>lt;sup>106</sup> Committee on the Peaceful Uses of Outer Space and its Subcommittees, United Nations Off. for Outer Space Affs., https://www.unoosa.org/oosa/en/ourwork/copuos/commsubcomms.html (last visited June 28, 2022).

<sup>&</sup>lt;sup>107</sup> Michelle L. D. Hanlon & Bailey Cunningham, *The Legal Imperative to Mitigate the Plume Effect: An Aggravation and Frustration That Imperils Our History and Our Future*, 43 J. SPACE L. 309, 332 (2019).

<sup>&</sup>lt;sup>108</sup> G.A. Res. 1962 (XVIII), ¶ 6 (Dec. 13 1963).

<sup>&</sup>lt;sup>109</sup> U.N. GAOR, 6th Sess., 29th mtg. at 7, U.N. Doc. A/AC.105/PV.29 (Dec. 8, 1964).

as everyone knows has had a great impact on the formulation of the subsequent agreements."<sup>110</sup>

Interestingly, the Austrian delegation found that:

[I]nternational obligations derived not only from treaties by also — as indicated in Article 38 of the Statute of the International Court of Justice — from custom and the general principles of law recognized by civilized nations. That applied to General Assembly resolution 1962 (XVIII), but [they] nevertheless considered it desirable that treaty should be concluded in order to render the principles stated in that resolution more precise.<sup>111</sup>

Before the drafting process for the OST began, COPUOS had to discuss what needed to be included in the future treaty. While harmful contamination was discussed, and no one disagreed that it should be avoided, what amounted to harmful contamination was not largely elaborated on. In 1964 Mr. Deleau representing the French delegation asked "[w]hat was to be done to prevent the contamination or pollutions of celestial bodies?" at the third session of the Legal Subcommittee of COPUOS.<sup>112</sup> This was a question that largely remained unanswered during the rest of the drafting process. At the same meeting the Indian delegation represented by Mr. Krishna Roa, raised their concerns that "early action should be taken to prevent the use of outer space for experiments which endangered human life or which changed the space environment."<sup>113</sup> The Indian delegation again at the next meeting urged "nations with capability of landing objects on planets should continue to use self-restraint so that the possibility of detecting life on other planets is not jeopardized in any way."114

These complex concerns were somewhat conveniently outsourced to COSPAR and their presence at meetings of COPUOS was recognized and appreciated by States. Mr. Matsch, Chairman

<sup>&</sup>lt;sup>110</sup> U.N. GAOR, 3d Sess., 26th mtg. at 15, U.N. Doc. A/AC.105/PV.26 (Dec 7. 1964).

 $<sup>^{111}\,</sup>$  U.N. GAOR, 5th Sess., 58th mtg. at 2-3, U.N. Doc. A/AC.105/C.2/SR.58 (July 4, 1969).

 $<sup>^{112}\,</sup>$  U.N. GAOR, 3d Sess., 32d mtg. at 47, U.N. Doc. A/AC.105/C.2/SR.29-37 (Aug. 24, 1964).

 $<sup>^{113}\,</sup>$  U.N. GAOR, 3d Sess., 34th mtg. at 80, U.N. Doc. A/AC.105/C.2/SR.29-37 (Aug. 24, 1964).

<sup>&</sup>lt;sup>114</sup> U.N. GAOR, 3d Sess., 30th mtg. at 10, U.N. Doc. A/AC.105/PV.30 (Dec. 8, 1964).

of the 26th meeting of COPUOS urged Member States to rely on the reports of COSPAR stating:

[A]s regards potentially harmful effects of space experiments, on the basis of a COSPAR report Member States proposing to carrying out experiments in outer space should give full consideration to the problem of possible interference with other peaceful uses of outer space as well as of possible harmful changes in the natural space environment caused by space activities and should seek a scientific analysis of those experiments from COSPAR's special Consultative Group or by international consultations.<sup>115</sup>

In the same meeting the Soviet delegation in reviewing the report of the Scientific and Technical Subcommittee included "definite recommendations that take into account the resolution adopted by COSPAR in May 1964 on the basis of a report of the Advisory Group of COSPAR regarding potentially harmful experiments."<sup>116</sup> Further the United States delegation endorsed the COSPAR recommendations and encouraged States to aid in their implementation stating: "My delegation hopes that the recommendations of CO-SPAR on biological sterilization of space probes will be supported by the extensive international exchange of information."<sup>117</sup>

Even States that were not spacefaring commended COSPAR's value to COPUOS. The Hungarian delegation saying: "COSPAR made specific proposals concerning space experiments, which might involve potentially harmful effects. The work done so far along this line by COSPAR is useful and encouraging at the same time."<sup>118</sup> The Polish delegation echoed this sentiment: "We are similarly pleased to stress the great value of the contribution of COSPAR in the field of space research, and we welcome with interest the proposals and recommendations which it has made in connexion with the risks involved in space experiments."<sup>119</sup> The Australian delegation also expressed their "pleasure and relief that the method of dealing with this particular problem has now been settled in a

<sup>&</sup>lt;sup>115</sup> U.N. GAOR, 3d Sess., 26th mtg. at 7, U.N. Doc. A/AC.105/PV.26 (Dec 7. 1964).

<sup>&</sup>lt;sup>116</sup> *Id.* at 14.

 $<sup>^{117}</sup>$  Id. at 21.

<sup>&</sup>lt;sup>118</sup> U.N. GAOR, 3d Sess., 28th mtg. at 8, U.N. Doc. A/AC.105/PV.28 (Dec. 8, 1964).

<sup>&</sup>lt;sup>119</sup> U.N. GAOR, 6th Sess., 29th mtg. at 6, U.N. Doc. A/AC.105/PV.29 (Dec. 8, 1964).

manner satisfactory to all concerned,"<sup>120</sup> the particular problem being the potentially harmful effects of space experiments. This is, however, not directly concerned with the issue of harmful contamination but still tangential to it and the drafting of Article IX.

In 1965 Mr. Abdel-Ghani, then Secretariat expressed his pleasure of being in constant contact with COSPAR, stating: "I should also like to place on record an appreciation of the cooperation we have received from COSPAR, with which we have established close and effective working relationship."<sup>121</sup> It is important to note that the role of COSPAR was not at all limited to investigating harmful contamination. Their role was to advise of issues including the use of weather satellites and launching facilities and they produced technical manuals for Member States on these two issues, but notably not one on harmful contamination.<sup>122</sup> While Member States did appreciate their role in creating guidelines for the scientific discovery of outer space, it was not simply limited to the role of harmful contamination. In fact, this area was spoken about comparatively less than the other works of COSPAR.

The President of COSPAR was present at the 38th meeting of COPUOS and gave a statement saying:

I am happy to tell you, however, that, pursuant to the resolution passed last May by the Assembly at Mar del Pata, this Group has embarked upon the organization of a scientific conference on the sterilization of satellites and probes, which are intended to come near celestial bodies of our system and are capable of contaminating possible life and its environment.<sup>123</sup>

Both the United States and Soviet Union presented draft treaties for the consideration of the Legal Subcommittee. Both drafts contained provisions that States avoid harmful contamination. The United States draft provision read simply "States should pursue studies and take appropriate steps to avoid harmful

<sup>&</sup>lt;sup>120</sup> Id. at 28.

 $<sup>^{121}\,</sup>$  U.N. GAOR, 7th Sess., 37th - 42d mtg. at 16, U.N. Doc. A/AC.105/PV.37 (Feb. 2, 1966).

<sup>&</sup>lt;sup>122</sup> Leslie I. Tennen, *The Role of COSPAR for Space Security and Planetary Protection*, in HANDBOOK OF SPACE SECURITY: POLICIES, APPLICATIONS AND PROGRAMS 1559, 1561 (Kai-Uwe Schrogl et al. eds, 2nd ed., 2020).

<sup>&</sup>lt;sup>123</sup> U.N. GAOR, 7th Sess., 39th mtg. at 77, U.N. Doc. A/AC.105/PV.39 (Oct. 7, 1965).

contamination."<sup>124</sup> The Soviet Union draft provision was lengthy, similar to now Article IX. Regarding harmful contamination, it said "States Parties to the Treaty shall conduct research on celestial bodies in such a manner as to avoid harmful contamination."<sup>125</sup> The debates of these draft articles further explore the reasoning behind the key words "harmful contamination."<sup>126</sup> Whilst it was clear that States wanted to avoid harmful contamination it was anything but clear what was captured by such wording. Each delegate may have had very different ideas about what the term encompassed, whilst appearing to agree on the concept. Ultimately, it remained unclear exactly what harmful contamination was.

In later debates, the Soviet Union, when speaking on the draft provisions, made the link between cooperation among States and the impact of any space experiments, explicitly stating:

The entire draft Treaty was based on the idea of cooperation among all States. That meant, inter alia, that States must refrain from any experiment likely to interfere with the space activities of other States; Article VIII covered that contingency by establishing machinery for consultation, and also provided that States should avoid harmful contamination.<sup>127</sup>

On the issue of international cooperation, the Argentinian delegation found that:

Considering the draft treaty should serve the interests of all [hu]mankind and not those of any one State, his delegation would take its stand on the following ... principles:

<sup>&</sup>lt;sup>124</sup> Permanent Rep. of the U.S. to the Chairman of the Comm. on the Peaceful Uses of Outer Space, Letter dated June 16, 1966 from the Permanent Representative of the United States of America addressed to the Chairman of the Committee on the Peaceful Uses of Outer Space, U.N. Doc. A/AC.105/32 (June 17, 1966) (Draft Treaty Governing the Exploration of the Moon and Other Celestial Bodies); Comm. on the Peaceful Uses of Outer Space, Legal Subcomm., United States of America: Draft Treaty Governing the Exploration of the Moon and Other Celestial Bodies, U.N. Doc. A/AC.105/C.2/L.12 (1966).

<sup>&</sup>lt;sup>125</sup> Rep. of the U.S.S.R to the Chairman of the Comm. on the Peaceful Uses of Outer Space Legal Subcomm., Letter Dated July 11, 1966 Addressed to the Chairman of the Legal Sub-Committee by the Representative of the USSR, at 4, art. VIII, U.N. Doc. A/AC.105/C.2/L.13 (July 11, 1966).

 $<sup>^{126}</sup>$  See generally U.N. GAOR, 5th Sess., 68th mtg., U.N. Doc. A/AC.105/C.2/SR.68 (Oct. 21, 1966).

<sup>&</sup>lt;sup>127</sup> U.N. GAOR, 5th Sess., 57th mtg. at 12, U.N. Doc. A/AC.105/C.2/SR.57 (Oct. 20, 1966).

(2) they should constitute a sphere of international cooperation, not of controversies and conflicts ... In virtue of the second principle, every State should:

•••

(5) seek to prevent any contamination of the earth from space and of space from the Earth.  $^{128}$ 

Further, the United Arab Republic commended the various draft treaties for containing a provision which embraced "the principle of preservation of the spirit of human solidarity which must govern the exploration and use of space," observing:

It was therefore gratifying to note that Article I of the Soviet draft was based on that principle and that both drafts forbade the national appropriate of celestial bodies. A corollary of that principle was the need for international cooperation, which was dealt with in Article 3 and 4 of the United States draft, and the need to ensure that the exploration and use of outer space caused no harm to [hu]mankind or to other States, for which provision was made in both drafts, in the form of a recommendation to avoid contamination.<sup>129</sup>

The Indian delegation commented at length on the issue:

The possibility that the future of [hu]mankind might be jeopardized by a single act of negligence on the part of a State launching an extra-terrestrial probe or orbital vehicle underlined urgent need for the world community to ensure that application of appropriate standards to regulate the activities of individual States in outer space ... the desirability of ensuring that all precautions were taken against the contamination or pollution of not only the earth's environment but also that of the celestial bodies was only too obvious .... [A] provision to prevent contamination of the moon was to be found in operative paragraph 6 of the COSPAR Executive Council's resolution of 20 May 1964 (A/5785 annex 11). In the light of the COSPAR recommendations, he considered that any treaty regarding the

 $<sup>^{128}\,</sup>$  U.N. GAOR, 5th Sess., 60th mtg. at 2-3, U.N. Doc. A/AC.105/C.2/SR.60 (Oct. 20, 1966).

 $<sup>^{129}\,</sup>$  U.N. GAOR, 5th Sess., 62d mtg. at 2-3, U.N. Doc. A/AC.105/C.2/SR.62 (Oct. 24, 1966).

exploration of outer space and celestial bodies should ensure that the necessary precautions, based on appropriate scientific standards, were taken to that there would be no harmful effects on the celestial bodies explored.<sup>130</sup>

Notably here again, there is an explicit nexus created between legal and scientific standards, with little detail provided determining the precise level and nature of precautions.

The French delegation attempted to provide some clearer boundaries, discussing the permanency of an experiment being a relevant factor. It asserted that:

It was generally agreed that freedom of scientific experiment could not be regarded as justifying experiments which would have a semi-permanent or permanent effect on the territory of a State other than the State conducting them. Likewise, freedom of use must not be allowed to have a semi-permanent or permanent effect on the territory of States other than the user State, without their permission.<sup>131</sup>

While all these comments commended the inclusion of the articles preventing contamination, they did very little to assist in the understanding of the scope of such provisions. They asserted that limiting harmful contamination was intricately linked with provisions on international cooperation and free access to space, but they did not explore what would be meant by harmful contamination. The consensus subsisted in the agreement to avoid such harm rather than in any agreement of what such harm would or would not look like. The Japanese delegation observed this and suggested that "the natural environment of celestial bodies should be preserved so far as possible in the condition it was in before the beginning of exploration. The provision designed to prevent contamination of celestial bodies should be expanded and elaborated."<sup>132</sup>

<sup>&</sup>lt;sup>130</sup> U.N. GAOR, 5th Sess., 57th mtg. at 19, U.N. Doc. A/AC.105/C.2/SR.57 (Oct. 20, 1966); The Belgian delegation noted that 'The Indian representative had emphasized the need for precaution to be taken against the contamination of celestial bodies.' U.N. GAOR, 5th Sess., 61st mtg. at 7, U.N. Doc. A/AC.105/C.2/SR.61 (Oct. 20, 1966).

 $<sup>^{131}\,</sup>$  U.N. GAOR, 5th Sess., 69th mtg. at 5-6, U.N. Doc. A/AC.105/C.2/SR.69 (Oct. 21, 1966).

<sup>&</sup>lt;sup>132</sup> U.N. GAOR, 5th Sess., 58th mtg. at 7, U.N. Doc. A/AC.105/C.2/SR.58 (Oct. 20, 1966).

These valid concerns were not addressed at the time and at a later meeting, the Japanese delegation again raised the issue:

[I]n explaining the amendment to Article VIII (Working Paper No. 10), the two drafts under study emphasized the necessity to avoid harmful contamination, and the United States draft provided for steps to avoid adverse changes in the environment of the earth resulting from the return of environment of extraterrestrial matter. However, neither Article VIII of the Soviet draft nor Article 10 of the United States draft seemed sufficient. Celestial bodies, which were of great interest for the scientific study of the universe, were also an invaluable source of knowledge of geophysics, geochemistry, biology, etc., and could provide clues to the origin of the Earth. Great care must therefore be taken to preserve their resources and their natural milieu.<sup>133</sup>

The United States delegation "welcomed the general agreement that the treaty should include a provision designed to avoid contamination of celestial bodies,"<sup>134</sup> and further "fully supported Article VIII of the Soviet draft and considered that some of the amendments put forward by Japan might be included in it."<sup>135</sup> The United States stated in a later meeting that "[a]greement had been reached on the following points ... (8) 'the treaty would contain provisions on liability, jurisdiction, contamination and activities likely to interfere with the activities of other States parties."<sup>136</sup>

While the two drafts did merge, Article IX now looks much more like the draft put forward by the Soviet Union, and the concerns of Japan regarding the sufficiency of the draft articles remained unaddressed. At the 71st meeting of the Legal Subcommittee the Japanese delegation commented that:

As to the article on non-contamination and potentially harmful activities (Working Group L.9), his delegation was not convinced that the text, as adopted covered the substance of the amendment (Working Paper No. 10 paragraph (1)) to the effect

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 $<sup>^{133}\,</sup>$  U.N. GAOR, 5th Sess., 68th mtg. at 5-6, U.N. Doc. A/AC.105/C.2/SR.68 (Oct. 21, 1966).

 $<sup>^{134}</sup>$  Id. at 7.

 $<sup>^{135}</sup>$  Id.

 $<sup>^{136}</sup>$  U.N. GAOR, 5th Sess., 70th mtg. at 4, U.N. Doc. A/AC.105/C.2/SR.70 (Oct. 21, 1966).

that States parties to the treaty should exercise maximum care for the preservation and conservation of the natural resources and environment of celestial bodies. It suspected that the space powers had not accepted its amendment mainly because they feared that it might tie their hands in future activities on celestial bodies. In his delegations' view such fears were groundless, but in a spirit of cooperation it would not press the amendment.<sup>137</sup>

At the same meeting the Brazilian delegation also echoed that "the principle that contamination of outer space and of the Earth's environment should be avoided by appropriate measures and studies undertaken by States engaged in space activities."<sup>138</sup> This however did little to address the substantive concerns raised by the Japanese delegation. Ultimately, despite the calls of many States of the importance of international cooperation to avoid harmful contamination, the concerns of Japan were unsupported.

On December 19, 1966 at the 21st meeting of the General Assembly the draft of the OST was adopted.<sup>139</sup> Before the adoption, comments were made by various delegations on the need for international cooperation and how this was protected under Article IX amongst others.<sup>140</sup> The United States did mention the inclusion of "a specific obligation to avoid harmful contamination of outer space, or of celestial bodies, and also to avoid adverse changes in the terrestrial environment."<sup>141</sup>

Ultimately, concerns of harmful contamination that were raised during the drafting process were largely theoretical. States persistently chose not to engage with the question of what

<sup>141</sup> U.N. GAOR, 21st Sess., 1492d mtg. at 16, U.N. Doc. A/C.1/PV.1492 (Jan. 27, 1967).

 $<sup>^{137}\,</sup>$  U.N. GAOR, 5th Sess., 71st mtg. at 13, U.N. Doc. A/AC.105/C.2/SR.71 and Add.1 (Oct. 21, 1966).

<sup>&</sup>lt;sup>138</sup> Id. at 16-17.

<sup>&</sup>lt;sup>139</sup> G.A. Res. 2222 (XXI) (Dec. 19, 1966).

<sup>&</sup>lt;sup>140</sup> For example: the Italian delegation wrote: "articles V, IX, X, XI and XII represent the measures devised to ensure and promote international cooperation among States for the peaceful exploration and use of outer space." U.N. GAOR, 21st Sess., 1492d mtg. at 16, U.N. Doc. A/C.1/PV.1492 (Jan. 27, 1967); the Swedish delegation noted that Article IX was of special value, since all States had a legitimate interest in keeping the environment free from contamination. U.N. GAOR, 21st Sess., 1493d mtg. at ¶ 14, U.N. Doc. A/C.1/SR.1493 (Dec. 17, 1966); and the Canadian delegation wrote: "The principle of cooperation and mutual assistance was the keystone of the treaty; it was not only mentioned in general terms in the preamble and in the operative part, for example in article IX." *Id.* ¶ 49.

contamination would be considered harmful, instead relying on the overarching principles of the OST—exploration and cooperation. Despite environmental issues not being taken specifically into account, it can be noted that "[a] treaty, as a source of international law, can be used as an instrument of anticipatory legal regulation of future types of activities or future situations which do not exist at the moment of the conclusion of a treaty."<sup>142</sup> International law is not static, and "can shift in content from day to day in order to meet ... the challenge arising from man's venture into new frontiers."<sup>143</sup>

The Japanese delegation advanced the strongest stance for protecting the extra-terrestrial environment, but as seen this did little to affect the wording of Article IX. This lack of detailed discussion therefore remains important. It illustrates that, at the time of drafting of the concept of harmful contamination, States were arguably more concerned with getting into space for exploration and ensuring that such exploration was not impeded than they were with the environmental impact they would have in space (as distinct from the impact of space activities on Earth). These concerns and attitudes may be said to be the very same motivations fueling current plans to get to Mars.

Therefore, at the core of the harmful contamination provision is the consistent desire to ensure that any activity by one State shall not later interfere with the rights of other States. This view is consistent with an argument that space is a global-commons such as the High Seas or Antarctica.<sup>144</sup> However, it should be noted that this is not a universally accepted position and in 2020 a United

<sup>&</sup>lt;sup>142</sup> Vladlen S. Vereshchetin & Gennady M. Danilenko, *Custom as a Source of International Law of Outer Space*, 13(1) J. SPACE L. 22, 23 (1985).

<sup>&</sup>lt;sup>143</sup> BIN CHENG, STUDIES IN INTERNATIONAL SPACE LAW 680 (1997).

<sup>&</sup>lt;sup>144</sup> See Benjamin Silverstein & Ankit Panda, Space Is a Great Commons. It's Time to Treat It as Such, Carnegie Endowment for Int'l Peace (Mar. 9, 2021), https://carnegieendowment.org/2021/03/09/space-is-great-commons.-it-s-time-to-treat-it-as-such-

pub-84018; James Spiller, *Scientific Exploration in Antarctica as an Analogy for American Spaceflight*, 12(2-3) ASTROPOLITICS 180, (2014). Notably, in 1967 several key members of the NASA Apollo team, including Wernher von Braun, spent time at a US Antarctic Base considering what lessons could be learned from one remote, harsh, and confined environment for the upcoming trip to another. *Id.* at 181; *Cf.* Mendenhall who rejects the applicability of these domain analogies. *See* Elizabeth Mendenhall, *Treating Outer Space Like a Place: A Case of Rejecting Other Domain Analogies*, 16(2) ASTROPOL-ITICS 97, (2018).

States Executive Order explicitly rejected the position that space should be viewed as a global commons.  $^{145}$ 

As such, it can be argued that when interpreting what would constitute harmful contamination, the balancing act should be made with reference to the scientific benefit of an activity and whether this offsets any potential contamination to the greater environment thereby preventing access or use by others. In the absence of the more detailed COSPAR guidelines, Article IX itself imposes few key obligations of a binding legal nature upon a State to identify and prohibit any activities on a celestial body which may cause harmful contamination.

#### C. Emerging State Practice and the Role of COSPAR

As discussed above, COSPAR was created to explore concerns that the scientific community had with the use and exploration of space. The organization was involved in the drafting process of the OST attending meetings and creating reports for the COPUOS Legal Subcommittee but could not vote on the articles or sign the treaty document. . . .<sup>146</sup> Despite being a scientific body that cannot create or enforce legal obligations on States, some States have readily taken up COSPAR's planetary protection policies within their own domestic regimes.<sup>147</sup> The following discussion of COSPAR's creation and the development of its policies sets the stage for examining how States have implemented them.

The ISCU, now the International Scientific Council (ISC), created COSPAR in 1958.<sup>148</sup> COSPAR is a scientific international nongovernmental organization whose purpose is to promote research in space on an international level.<sup>149</sup> One of their primary focus areas is planetary protection related to both forward and back

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<sup>&</sup>lt;sup>145</sup> Exec. Order No. 13914, 85 Fed. Reg. 20381 (Apr. 6, 2020).

<sup>&</sup>lt;sup>146</sup> Athena Coustenis et al., *The COSPAR Panel on Planetary Protection Role, Structure and Activities*, 205 SPACE RSCH. TODAY 14, 18 (2019).

<sup>&</sup>lt;sup>147</sup> See National Aeronautics and Space Administration, NASA Policy Directive NPD 8020.76: Biological Contamination Control For Outbound and Inbound Planetary Space Craft (2008); Japan Aerospace Exploration Agency, Planetary Protection Program Standard (2019).

<sup>&</sup>lt;sup>148</sup> About Us, Comm. on Space Rsch., https://cosparhq.cnes.fr/about/.

<sup>&</sup>lt;sup>149</sup> *Id*.

contamination.<sup>150</sup> COSPAR's current planetary protection policy stresses the need to avoid biological contamination of outbound space objects which could impact the search for extra-terrestrial life.<sup>151</sup> The recommendations set forth by COSPAR are in no way binding on States or indicative of their legal obligations under the OST. Nevertheless, they played a significant role in the development of Article IX and the further development of States' subsequent domestic policies.<sup>152</sup> In 1969 COSPAR adopted guidelines, which replaced a previous 1964 interim framework.<sup>153</sup> These guidelines prescribed limits on the probability that a celestial body would be contamination during a mission.<sup>154</sup> These policies have been reviewed over the years, with amendments being released in 1984, 1994, 2002, 2008,<sup>155</sup> 2017,<sup>156</sup> 2020,<sup>157</sup> and 2021.<sup>158</sup> Many of these changes were made in line with NASA policies and recommendations, highlighting the strong relationship between States and CO-SPAR.<sup>159</sup> NASA was a key civil agency in the development of planetary protection policy.<sup>160</sup> Their efforts predated the OST, with an initial planetary protection guideline issued on 15 October 1959.<sup>161</sup>

<sup>&</sup>lt;sup>150</sup> Panel on Planetary Protection (PPP), Comm. on Space Rsch., https://co-sparhq.cnes.fr/scientific-structure/panels/panel-on-planetary-protection-ppp/.

<sup>&</sup>lt;sup>151</sup> COSPAR PPP 2021, *supra* note 20; Gerhard Kminek et al., Comm. on Space Rsch., COSPAR's Planetary Protection Policy (2017), https://cosparhq.cnes.fr/assets/up-loads/2019/12/PPPolicyDecember-2017.pdf.

<sup>&</sup>lt;sup>152</sup> See Omran Sharaf, Mohammed Bin Rashid Space Centre, Planetary Protection inEmiratesMarsMission(2017),http://www.unoosa.org/documents/pdf/copuos/lsc/2017/tech-03.pdf.

<sup>&</sup>lt;sup>153</sup> NATIONAL ACADEMIES, SCIENCE, ENGINEERING AND MEDICINE, REVIEW AND AS-SESSMENT OF PLANETARY PROTECTION DEVELOPMENT PROCESSES 18 (2018).

 $<sup>^{154}</sup>$  Id.

<sup>&</sup>lt;sup>155</sup> For a general description of historic amendments, *see* Patricia M. Sterns & Leslie I. Tennen, *Future of Planetary Protections: Is There Reason for Optimism*, 49 PROC. ON L. OUTER SPACE 391 (2006).

<sup>&</sup>lt;sup>156</sup> Committee on Space Research, COSPAR Policy on Planetary Protection (2017), https://cosparhq.cnes.fr/assets/uploads/2019/12/PPPolicyDecember-2017.pdf.

<sup>&</sup>lt;sup>157</sup> COSPAR PPP 2020, *supra* note 16.

<sup>&</sup>lt;sup>158</sup> COSPAR PPP 2021, supra note 20.

<sup>&</sup>lt;sup>159</sup> National Academies Interim Report, *supra* note 31, at 18.

 $<sup>^{160}\,</sup>$  For an extended discussion on the development of NASA's planetary protection policy and institutions, see National Academies Interim Report, supra note 31, at 25-27.

<sup>&</sup>lt;sup>161</sup> This was at the recommendation from the Space Studies Board (SSB) which is a sub-body of the National Academy of Sciences in the United States. *See Space Studies Board*, National Academies, Science, Engineering, Medicine, https://www.nationalacademies.org/ssb/space-studies-board (last visited Jan. 18, 2022); The SSB recommended that NASA follow the recommendations of the ICSU. *See* Letter from Hugh Odishaw,
The current regulations are split into five categories:

Category I missions are those where the target body is not a direct interest to the study of the evolution of life and no planetary protection is warranted and no requirements are imposed.<sup>162</sup> Category II missions are those where there is a significant interest in the search for life; however, there is only a remote chance<sup>163</sup> that contamination would compromise future investigations. Only documentation requirements are imposed on these missions.<sup>164</sup>

Category III missions are those where there is an interest in the origin of life and there is a consensus that there is a significant chance<sup>165</sup> of contamination that could comprise future investigations.<sup>166</sup> These missions require more extensive documentation and also the implementation of some protection mechanisms such as cleanroom assembly and biological testing.<sup>167</sup>

Category IV missions are largely the same as Category III missions but require sterilization, cleanrooms and other protection mechanisms on a case-by-case basis.  $^{168}$ 

Category V missions are return to Earth missions that require prevention against back contamination.<sup>169</sup>

Missions to Mars in Categories III, IV and V have additional requirements as this is recognized as an environment in which it is possible that life exists or once existed.<sup>170</sup> In particular, COSPAR has demarcated "special regions" on Mars which are "region[s] within which terrestrial organisms are likely to replicate. Any region which is interpreted to have a high potential for the existence

Exec. Dir., Space Sci. Bd., to Thomas K. Glennan, Adm'r, NASA & Roy Johnson, Dir., Advanced Rsch. Projects Agency (Sept. 14, 1959) (on file with the Journal of Space Law).

<sup>&</sup>lt;sup>162</sup> COSPAR PPP 2021, *supra* note 20, Category I.

 $<sup>^{163}\,</sup>$  Implying that there is not an environment where terrestrial organisms could survive or replicate.

<sup>&</sup>lt;sup>164</sup> COSPAR PPP 2021, *supra* note 20, Category II.

 $<sup>^{\</sup>rm 165}$   $\,$  An environment where terrestrial life could survive and replicate.

<sup>&</sup>lt;sup>166</sup> COSPAR PPP 2021, *supra* note 20, Category III.

 $<sup>^{167}</sup>$  Id.

 $<sup>^{168}</sup>$  Id.

 $<sup>^{169}</sup>$  *Id*.

<sup>&</sup>lt;sup>170</sup> *Id.* § 9.

of extended Martian life forms is also defined as a special region."<sup>171</sup> These missions have the highest requirements for sterilization. Despite being the sites where it would be most likely for missions to find life, due to the high cost of sterilization procedures, currently no missions have conducted a search for life in these areas.<sup>172</sup> This is of concern because with human missions beginning to be planned, it will be increasingly difficult to keep Mars free from Earth microorganisms. As such, it is becoming urgent for robotic missions to search for life on Mars, particularly in designated "special regions" before human missions commence.

COSPAR's regulations set out that:

The intent of this planetary protection policy is the same whether a mission to Mars is conducted robotically or with human explorers. Accordingly, planetary protection goals should not be relaxed to accommodate a human mission to Mars. Rather, they become even more directly relevant to such missions—even if specific implementation requirements must differ.<sup>173</sup>

Despite this, COSPAR recognizes that human missions will be carrying microbial populations and that in landed missions it will be not possible for operations to be conducted in entirely closed systems.<sup>174</sup> COSPAR appreciates that there is a "greater capability of human explorers [that] can contribute to the astrobiological exploration of Mars,"<sup>175</sup> with the caveat though only if "human-associated contamination is controlled and understood."<sup>176</sup> COSPAR recommends that a conservative approach be taken for initial human missions and further that any uncharacterized Martian site be evaluated by robotic missions as a precursor to human access.<sup>177</sup>

<sup>&</sup>lt;sup>171</sup> Id. § 9.1.

<sup>&</sup>lt;sup>172</sup> Note the NASA Perseverance mission where, although they did conduct a search for life, its landing site, Jezero Crater, is not considered a special region. *See* Jet Propulsion Laboratory, National Aeronautics and Space Admin., Mars 2020 Perseverance Landing Press Kit (2021), https://mars.nasa.gov/resources/25529/mars-2020-perseverance-landing-press-kit/

<sup>&</sup>lt;sup>173</sup> COSPAR PPP 2021, *supra* note 20, § 9.3.

 $<sup>^{174}</sup>$  *Id*.

 $<sup>^{175}</sup>$  Id.

 $<sup>^{176}</sup>$  Id.

<sup>&</sup>lt;sup>177</sup> Id.

The COSPAR policies are recommendations of a scientific body and not legally binding on States. They are a soft law instrument that does much to address the concerns of astrobiologists but little to consider the rapid development of the space industry, particularly as private industry becomes more and more involved. The legal and scientific positions must be better connected to ensure that the fundamental principle of free exploration and connected idea of preventing harmful contamination is not breached. The soft law nature of the COSPAR principles provides flexibility to adapt to changes and new information about space exploration, as they have done over the decades.

Despite being soft law, NASA, the European Space Agency (ESA) and the Japanese Aerospace Exploration Agency (JAXA) have all adopted COSPAR recommendations as part of their planetary protection policies. <sup>178</sup>

For example, NASA's policy, elaborating on COSPAR's recommendations finds that:

a. Safeguarding the Earth from potential back[ward] contamination is the highest planetary protection priority in Mars exploration.

b. The greater capability that human explorers can contribute to the astrobiological exploration of Mars is only valid if human-associated contamination is controlled and understood.

c. For a landed [human] mission conducting surface operations, it will not be possible for all human-associated processes and mission operations to be conducted within entirely closed systems.

d. [Humans] exploring Mars, and/or their support systems, will inevitably be exposed to Martian materials.<sup>179</sup>

This shows that despite being a soft law instrument, the CO-SPAR policies have played a significant role in shaping the

<sup>&</sup>lt;sup>178</sup> European Space Agency, ESA Planetary Protection Policy (2017); *Planetary Protection*, European Space Agency, https://www.esa.int/Science\_Exploration/Human\_and\_Robotic\_Exploration/Exploration/ExoMars/Planetary\_protection (last visited Jan. 21, 2022); Japan Aerospace Exploration Agency, Planetary Protection Program Standard (2019).

<sup>&</sup>lt;sup>179</sup> NASA Mars NID, *supra* note 4, at 4.

landscape of planetary protection policies. There is however some scope to argue that the policies themselves do not reflect a significant diversity of interests. The policy and thinking behind the principles have been contributed by current spacefaring nations. It might be useful to open-up the policies to greater scrutiny and debate from nations yet to engage in space technology and particularly to those in the private sector who may be involved in implementing such policies.

With this in mind, the divergence over the past decades between regimes of the legal and scientific communities has been of concern.<sup>180</sup> With only limited State practice on the issue, the stricter scientific policies have failed to be clearly integrated into international law and may soon be left aside. This makes it ever more important for a strong clarification of the legal obligations under Article IX so that States can ensure they act in accordance. Given the irreversible effects that contamination could have, States need to be aware of what measures should be adopted to comply with their legal obligations and to ensure future use and access to all the benefits of space exploration, in particular, human missions to Mars. NASA has announced that there will be a "reframing" of the application of the COSPAR Guidelines in the context of the Artemis Accords.<sup>181</sup> It is not clear whether this will reflect a tightening or loosening of current practices. Given the nature of Artemis as an agreement between the NASA and a growing number of international partners, this may not even result in a consistency of approach across all projects.<sup>182</sup>

Under Article VI of the OST States are responsible for the activities of their nationals in outer space.<sup>183</sup> The Registration

<sup>&</sup>lt;sup>180</sup> See Tennen, supra note 53.

<sup>&</sup>lt;sup>181</sup> NASA Updates Planetary Protection Policies for Robotic and Human Missions to Earth's Moon and Future Human Missions to Mars, NASA (July 10, 2020), https://www.nasa.gov/feature/nasa-updates-planetary-protection-policies-for-roboticand-human-missions-to-earth-s-moon; Off. of Safety and Mission Assurance, Nat'l Aeronautics and Space Admin., NASA Interim Directive: Planetary Protection Categorization for Robotic and Crewed Missions to the Earth's Moon (2020), https://nodis3.gsfc.nasa.gov/OPD docs/NID 8715 128 .pdf.

<sup>&</sup>lt;sup>182</sup> Although each partner must adhere to the Artemis Accords themselves, they are free to interpret them with respect to their own international and domestic obligations.

<sup>&</sup>lt;sup>183</sup> OST, *supra* note 18, art. VI.

Convention,<sup>184</sup> and Liability Convention,<sup>185</sup> provide further guidance for establishing jurisdiction and responsibility for activities in outer space. Commercial actors, however, are only required to follow the legal regime applicable to the domestic law they are operating in; they themselves are not bound by either treaty obligations or soft law recommendations.<sup>186</sup> The 2019 crash landing on the Moon by Israeli company Beresheet, with a payload that held tardigrades<sup>187</sup> (a phylum of microscopic organisms) illustrates the difficulty of regulating private actors. As commercial entities increase their access to space it is increasingly important that there is a clear understanding of State obligations under international space law. Other relevant principles of responsibility may be found under the Articles on Responsibility of States for Internationally Wrongful Acts.<sup>188</sup>

There has been limited legal debate on the implementation of Article IX thus far as the key spacefaring States have acted in compliance with strict planetary protection protocols. Despite being subject to supervision under Article VI,<sup>189</sup> unless domestic legislation enforces planetary protection protocols, commercial actors could be subject to lower standards depending on the "correct" legal definition under applicable law. Elon Musk, Chief Executive Officer of SpaceX, a leader in commercial space flight, aims to send humans to Mars by 2026.<sup>190</sup> Musk in 2020 made the following tweet about his thoughts on the possibility of finding alien life: "Doesn't seem to be any life in this solar system. Maybe under the ice of Europe or

<sup>&</sup>lt;sup>184</sup> Registration Convention, *supra* note 57.

<sup>&</sup>lt;sup>185</sup> Liability Convention, *supra* note 56.

<sup>&</sup>lt;sup>186</sup> Christina Isnardi, Problems with Enforcing International Space Law on Private Actors, 58(2) COLUMBIA J. OF TRANSNATIONAL L. 489 (2020).

<sup>&</sup>lt;sup>187</sup> Mindy Weisberger, *Thousands of Tardigrades Stranded on the Moon After Lunar Lander Crash*, SPACE (Aug 6, 2019), https://www.space.com/tardigrades-moon-israeli-lander.html.

<sup>&</sup>lt;sup>188</sup> Draft Articles on Responsibility of States for Internationally Wrongful Acts, G.A. Res. 56/83, annex, U.N. Doc. A/RES/56/83/Annex (Jan. 28, 2002).

<sup>&</sup>lt;sup>189</sup> OST, *supra* note 18, art. VI.

<sup>&</sup>lt;sup>190</sup> Nicolas Vega, *Elon Musk Pledges to Put Humans on Mars by 2026*, N.Y. POST (Dec. 2, 2020), https://nypost.com/2020/12/02/elon-musk-pledges-to-put-humans-on-mars-by-2026/.

extremophile bacteria below the surface of Mars."<sup>191</sup> Despite this the billionaire still has plans to send humans to Mars, with no current publicly available planetary protection policies.<sup>192</sup>

## D. General Principles of International Law

This next section briefly examines two key principles of international environmental law – the transboundary rule and the precautionary principle – and how these apply to the outer space environment. Article III of the OST provides that "States Parties to the Treaty shall carry on activities in the exploration and use of outer space, including the moon and other celestial bodies, in accordance with international law."<sup>193</sup> Thus, principles of environmental law can properly be applied to the outer space environment.<sup>194</sup> As put by Lyall and Larson, "it would be wrong to consider the law of space environment as something separate, distinct and different from the concepts of terrestrial environmental law. … Environmental space law is simply a specialized area of environmental law."<sup>195</sup>

## 1. Transboundary Rule

Within international environmental law there is a general principle that States cannot use their territory in a way that would be contrary to the rights of other States.<sup>196</sup> This is known as the "transboundary rule" or "rule against transboundary harm."<sup>197</sup> This

<sup>&</sup>lt;sup>191</sup> Elon Musk (@elonmusk), Twitter (Oct. 16, 2020, 6:14PM), https://twitter.com/elonmusk/status/1317008535075528704?ref\_src=twsrc%5Etfw%7Ctwcamp%5Etweetembed%7Ctwterm%5E1317008535075528704%7Ctwgr%5E%7Ctwcon%5Es1\_&ref\_url=https%3A%2F%2Fwww.foxbusiness.com%2Ftechnology%2Fspacexs-elon-musk-alien-life-in-these-two-spots.

<sup>&</sup>lt;sup>192</sup> Chelsea Gohd, *Elon Musk Reminds Us All That 'a Bunch of People Will Probably Die' Going to Mars*, SPACE (Apr. 29, 2021), https://www.space.com/elon-musk-mars-spacex-risks-astronauts-die.

<sup>&</sup>lt;sup>193</sup> OST, *supra* note 18, art. Art III.

<sup>&</sup>lt;sup>194</sup> See id.

<sup>&</sup>lt;sup>195</sup> FRANCIS LYALL & PAUL B. LARSEN, SPACE LAW: A TREATISE 243 (2d ed. 2018).

<sup>&</sup>lt;sup>196</sup> Corfu Channel (U.K. v. Alb.), Merits, 1949 I.C.J. Rep. 4, ¶ 22 (Apr. 9); Thomas Merrill, *Golden Rules for Transboundary Pollution* Duke Law Journal 46:5, 931 (1997).

<sup>&</sup>lt;sup>197</sup> David M. Ong, International Environmental Law's "Customary" Dilemma: Betwixt General Principles and Treaty Rules Irish Yearbook of International Law 1:1, 3 (2006).

principle can be expressed by reference to the maxim *sic utere tuo ut alienum non laedas* or "principles of good neighbourliness."<sup>198</sup>

The International Court of Justice (ICJ) recognized this principle as customary international law in the *Trail Smelter Arbitration* in 1935 and articulated the transboundary rule as:

[N]o State has the right to use or permit the use of its territory in such a manner as to cause injury by fumes in or to the territory of another or the properties or persons therein, when the case is of serious consequence and the injury is established by clear and convincing evidence.<sup>199</sup>

This was also echoed in the *Corfu Channel* case where the ICJ found that States are obliged "not to allow knowingly its territory to be used for acts contrary to the rights of other States."<sup>200</sup> It is however noted by Patricia Birnie and Alan Boyle that: "This judgment does not suggest what the environmental rights of other states might be, and its true significance may be confined to a narrower point about warning other states of known dangers."<sup>201</sup>

These principles are also found within the Stockholm Declaration on the Human Environment 1972<sup>202</sup> and the Rio Declaration 1992.<sup>203</sup> Principle 21 of the Stockholm Declaration provides that:

States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies and the responsibility to ensure that activities within their jurisdiction or control do not cause damage

<sup>&</sup>lt;sup>198</sup> PATRICIA W. BIRNIE & ALAN BOYLE, INTERNATIONAL LAW AND THE ENVIRONMENT 104 (2d ed. 2002); DANIEL BODANSKY ET AL., THE OXFORD HANDBOOK OF INTERNATIONAL ENVIRONMENTAL LAW 553 (2012).

<sup>&</sup>lt;sup>199</sup> Trail Smelter (U.S. v. Can.), 11 R.I.A.A. 1905, 1965 (Perm. Ct. Arb. 1941).

<sup>&</sup>lt;sup>200</sup> Corfu Channel (U.K. v. Alb.), Merits, 1949 I.C.J. Rep. 4, ¶ 22 (Apr. 9).

<sup>&</sup>lt;sup>201</sup> BIRNIE & BOYLE, *supra* note 198, at 109.

<sup>&</sup>lt;sup>202</sup> U.N. Conference on the Human Environment, *Report of the United Nations Conference on the Human Environment*, U.N. Doc. A/CONF.48/14/Rev.1 and Corr. 1 (June 16, 1972) [hereinafter Stockholm Declaration].

<sup>&</sup>lt;sup>203</sup> U.N. Conference on Environment and Development, *Rio Declaration on Environment and Development*, U.N. Doc. A/CONF.151/26/Rev.1 (Vol. I), annex I (Aug. 12, 1992) [hereinafter Rio Declaration].

to the environment of other States or of areas beyond the limits of national jurisdiction.  $^{\rm 204}$ 

Article 2 and 3 of the Rio Declaration reproduce these principles.<sup>205</sup> Further, Principle 19 of the Rio Declaration provides that States must notify potentially affected States "on activities that may have a significant adverse transboundary environmental effect and shall consult with those States at an early stage and in good faith."206 This places a consistent obligation on States to not damage environments that are beyond the limits of their national jurisdiction. The ICJ confirmed this in the Advisory Opinion of the Legality of the Threat or Use of Nuclear Weapons, finding that this general obligation forms "part of the corpus of international law relating to the environment."207 Further, States208 and various international treaties<sup>209</sup> consistently refer to the principles within the Rio Declaration related to transboundary harm and its status in international law is well established.<sup>210</sup> The obligation is not just to redress impacts *ex post facto* but "instead obliges states to take adequate measures to control and regulate in advance sources of potential significant transboundary harm."211

Outer space is beyond the national jurisdiction under customary international law,<sup>212</sup> as such the treatment of the outer space

<sup>208</sup> Sumudu Atapattu, International Environmental Law and Soft Law: A New Direction or A Contradiction?, in NON-STATE ACTORS, SOFT LAW AND PROTECTIVE RE-GIMES: FROM THE MARGINS 209 (Cecilia M. Bailliet ed., 2012).

<sup>209</sup> LOTTA VIIKARI, THE ENVIRONMENTAL ELEMENT IN SPACE LAW: ASSESSING THE PRESENT AND CHARTING THE FUTURE 128 (2008).

<sup>210</sup> Gordon Chung, *Emergence of Environmental Protection Clauses in the Outer Space Treaty: A Lesson from the Rio Principles*, in A FRESH VIEW ON THE OUTER SPACE TREATY 1 (Anette Froehlich ed., 2017).

<sup>211</sup> Bodansky et al., supra note 198, at 539; See Draft Principles on the Allocation of Loss in the Case of Transboundary Harm Arising Out of Hazardous Activities with Commentaries, [2006] 2 Y.B. Int'l L. Comm'n 59, U.N. Doc. A/CN.4/SER.A/2006/Add.1 (Part 2).

<sup>212</sup> LYALL & LARSEN, *supra* note 195.

<sup>&</sup>lt;sup>204</sup> Stockholm Declaration, *supra* note 202.

<sup>&</sup>lt;sup>205</sup> Rio Declaration, *supra* note 203, arts. 2 & 3.

 $<sup>^{206}\,</sup>$  Id. at 4, § 19. Cf. the notification requirements contained in the OST. See OST, supra note 18, at art. IX.

<sup>&</sup>lt;sup>207</sup> Legality of Threat or Use of Nuclear Weapons, Advisory Opinion, 1996 I.C.J. 226 (July 8); Draft Articles on Prevention of Transboundary Harm from Hazardous Activities, [2001] 2 Y.B. Int'l L. Comm'n 146, U.N. Doc. A/CN.4/SER.A/2001/Add.1; See Prevention of Transboundary Harm from Hazardous Activities with Commentaries, [2001] 2 Y.B. Int'l L. Comm'n 148, ¶ 3, U.N. Doc. A/CN.4/SER.A/2001/Add.1.

environment is within the ambit of the two declarations.<sup>213</sup> Harmful contamination could be considered within the ambit of damage, and damage is defined by the International Law Commission (ILC) Draft Principles on the Allocation of Loss in the Case of Transboundary Harm Arising Out of Hazardous Activities as "significant damage caused to persons, property or the environment."<sup>214</sup> Again there will be a threshold test of what exactly amounts to harm. The ILC has interpreted "significant" to be something more than "detectable" but need not be at the level of "serious" or "substantial."<sup>215</sup> What this actually amounts to is also subject to some debate; however, the ILC commentary further explains that it requires "a real detrimental effect on matters such as … human health, industry, property, environment or agriculture in other States."<sup>216</sup>

The next consideration is the threshold that States would be required to meet in order to fulfill their obligations under this principle. This comes down to a question of either appropriate measures or an absolute prohibition. Applying this to the question at hand, would a human mission to Mars, which may threaten any existing biodiversity on this planet, risk breaching the principle of transboundary harm? This question not only turns on the harm that could be caused but also the risk of said harm. Daniel Bodansky, Jutta Brunnée and Ellen Hey put forward that "even a low probability event represents a significant risk of harm and, thus, triggers the obligation of prevention, provided that the probability is

<sup>&</sup>lt;sup>213</sup> Chung, *supra* note 210; BIRNIE & BOYLE, *supra* note 198, at 111.

<sup>&</sup>lt;sup>214</sup> Draft Principles on the Allocation of Loss in the Case of Transboundary Harm Arising out of Hazardous Activities with Commentaries, supra note 211.

<sup>&</sup>lt;sup>215</sup> Prevention of Transboundary Harm from Hazardous Activities with commentaries, [2001] 2 Y.B. Int'l L. Comm'n 148, 152 ¶ 4, U.N. Doc. A/CN.4/SER.A/2001/Add.1. Note that in the ILC articles transboundary harm is defined as: "Transboundary harm" means harm caused in the **territory of or in other places under the jurisdiction or control of a State** other than the State of origin, whether or not the States concerned share a common border," (emphasis added) and does not strictly extend to situations beyond the national jurisdiction of *any* states (i.e. land of commons). Jurisdiction under the OST is complex as states cannot claim sovereignty. *See* OST, *supra* note 18, art. II; However, States retain jurisdiction over their national activities. *See* OST, *supra* note 18, art. VI; *See* Frans G. von der Dunk, *The Origins of Authorisation: Article VI of the Outer Space Treaty and International Space Law, in* NATIONAL SPACE LEGISLATION IN EUROPE: IS-SUES OF AUTHORISATION OF PRIVATE SPACE ACTIVITIES IN THE LIGHT OF DEVELOPMENTS IN EUROPEAN SPACE COOPERATION 3 (Frans G. von der Dunk ed., 2011).

<sup>&</sup>lt;sup>216</sup> U.N. GAOR, 53d Sess., Supp. No. 10, at 366-436, U.N. Doc. No. A/56/10 (2001).

coupled with serious consequences."<sup>217</sup> This forces a readdressing of the risk posed by human exploration of Mars.

As mentioned above, it has been deemed "inevitable" that any human exploration of Mars will come with biological contamination.<sup>218</sup> Therefore, the risk that should be considered is narrower and should focus upon whether human exploration will contaminate areas where life may exist. COSPAR reconciles this approach with their designated "special regions" requiring stricter sterilization measures.<sup>219</sup> What is not explicitly considered within this balancing act of risk and harm is the benefit that could be obtained by assuming said risk. By reference to the principles of the OST, the benefit of human missions to Mars is the exploration of outer space.<sup>220</sup> In the same vein, however, the benefit that comes with preserving life on Mars furthers this same purpose.

Strictly construed, it can be argued that human endeavors to Mars will breach the transboundary rule. Before making this conclusion, one consideration must be addressed—Article 3 of the ILC Articles on the Prevention of Transboundary Harm from Hazardous Activities requires that: "[t]he State of origin shall take all appropriate measures to prevent significant transboundary harm or at any event to minimize the risk thereof."221 This creates two distinct situations for States: (1) where States must adopt appropriate measures to prevent significant transboundary harm, and (2) where States must merely minimize the risk thereof. In the first situation States must "prevent" the significant harm and in the latter, they are obliged only to "minimize" risk. The risk involved in the present consideration is dependent on whether or not there is in fact life on Mars. As such, while the transboundary rule is relevant, it yet again does not provide any clear guidance regarding how to assess whether any specific human exploration mission to Mars would fit

<sup>&</sup>lt;sup>217</sup> BODANSKY ET AL., *supra* note 198, at 539; *See* Frederic L. Kirgis, *Technological Challenge to the Shared Environment: United States Practice*, 66 AM. J. OF INT'L L. 290 (1972).

<sup>&</sup>lt;sup>218</sup> Christopher P. McKay & Wanda L. Davis, *Planetary Protection Issues in Advance of Human Exploration of Mars*, 9(6) ADVANCES IN SPACE RSCH. 197 (1989).

 $<sup>^{\</sup>rm 219}~$  COSPAR PPP 2021, supra note 20.

 $<sup>^{220}</sup>$  See generally OST, supra note 18.

<sup>&</sup>lt;sup>221</sup> Prevention of Transboundary Harm from Hazardous Activities with Commentaries, [2001] 2 Y.B. Int'l L. Comm'n 148, ¶ 3, U.N. Doc. A/CN.4/SER.A/2001/Add.1, art 3.

within Article IX of the OST. Instead, we next consider the precautionary principle.

### 2. Precautionary Principle:

A second general principle of environmental law that can be considered is the precautionary principle. The precautionary principle in this context can be described as an obligation to do no harm to the environment. The Rio Declaration also introduced the precautionary principle at Principle 15: "In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."<sup>222</sup> This principle is also established in international treaties,<sup>223</sup> and case law.<sup>224</sup>

The precautionary principle operates to address risk, where the risk of future harm is always uncertain.<sup>225</sup> It aims to "provide guidance in the development and application of international environmental law where there is scientific uncertainty."<sup>226</sup> While the principle has received "widespread support by the international community," there is no uniform understanding of what the principle actually entails.<sup>227</sup> It is argued that if this principle is considered as a general principle of international law under Article 3 of

<sup>&</sup>lt;sup>222</sup> U.N. Conference on Environment and Development, *Rio Declaration on Environment and Development*, 3 § 15, U.N. Doc. A/CONF.151/26/Rev.1 (Vol. I), annex I (Aug. 12, 1992).

<sup>&</sup>lt;sup>223</sup> See United Nations Conference on the Human Environment, Report of the United Nations Conference on the Human Environment, 5, § 21, U.N. Doc. A/CONF.48/14/Rev.1 (1973); United Nations Framework Convention on Climate Change art. 3(3), opened for signature June 4, 1992, 1771 U.N.T.S. 107.

<sup>&</sup>lt;sup>224</sup> Pulp Mills on the River Uruguay (Arg. V. Uru.), Judgment, 2010 I.C.J. Rep. 14, ¶ 205 (Apr. 20).

<sup>&</sup>lt;sup>225</sup> Jonathan B. Wiener, *Precaution, in* THE OXFORD HANDBOOK OF INTERNATIONAL ENVIRONMENTAL LAW 598 (Daniel Bodansky et al. eds., 2008).

<sup>&</sup>lt;sup>226</sup> PHILLIPE SANDS, PRINCIPLES OF INTERNATIONAL ENVIRONMENTAL LAW 267 (2d ed. 2003). See Sonia Boutillon, The Precautionary Principle: Development of an International Standard, 23 MICH. J. INT'L L. 429, 432 (2002); Nuclear Tests (N.Z. v. Fr.), Order, 1995 I.C.J. Rep. 288, 348 (Sept. 22); Southern Bluefin Tuna (N.Z. v. Japan; Austl. v. Japan), Case Nos. 3 & 4, Order of Aug. 27, 1999, ITLOS Rep. 1999 (separate opinion of Judge Laing); MOX Plant Case (Ir. v. U.K.), Case No. 10, Order of Dec. 3, 2001, ITLOS Rep. 95 (separate opinion of Judge Wolfum).

<sup>&</sup>lt;sup>227</sup> SANDS, *supra* note 226, at 272.

the OST, the precautionary principle as it applies to outer space law is consistent with the obligations of due regard espoused in Article IX of the OST. $^{228}$ 

As the name suggests and as put forward in the Rio Declaration, a lack of full scientific certainty "shall not be used" to prevent action to minimize environmental harm.<sup>229</sup> What must then be considered is how much scientific evidence is required to override arguments for applying stricter measures. This operates with a reverse burden of proof, in that States wishing to undertake an activity (e.g., human exploration of Mars) would be required to prove that no harm to the environment would result.<sup>230</sup>

For the precautionary principle to apply the threat must be "serious" or "irreversible."<sup>231</sup> The principle is particularly relevant to fragile environments.<sup>232</sup> Biological contamination of Mars could cause serious damage in the sense that opportunities to find unique life on the planet could be lost irrevocably. There is no way to provide with scientific certainty that there is no life on Mars. With this standard in mind; it is largely impractical for a State to show something is completely safe,<sup>233</sup> particularly in an inherently uncertain environment such as outer space.

Whether or not human exploration of Mars violates the precautionary principle would turn on the harm that would be caused by biological contamination of Mars. A strict approach that any contamination would be harmful is not practical, nor does it fit within current approaches to Article IX that note that "appropriate measures" can be taken to avoid contamination. As such, harm is considered with reference to the consequences of contamination, that it could jeopardize missions that seek to find life on Mars.<sup>234</sup>

Again, we return to the balancing act. The risk of contamination against the utility of the activity. Given that the risk of harm

<sup>&</sup>lt;sup>228</sup> Chung, *supra* note 210, at 2.

<sup>&</sup>lt;sup>229</sup> Rio Declaration, *supra* note 203, principle 15.

 $<sup>^{230}\,</sup>$  SANDS, supra note 226, at 273; Chung, supra note 210, at 11.

<sup>&</sup>lt;sup>231</sup> Rio Declaration, *supra* note 203, principle 15.

<sup>&</sup>lt;sup>232</sup> Kees Bastmeijer & Ricardo Roura, *Regulating Antarctic Tourism and the Precautionary Principle*, 98 AM. J. INT'L L. 763, 772 (2004); Chung, *supra* note 210, at 11.

<sup>&</sup>lt;sup>233</sup> Annecoos Wiersema, *The Precautionary Principle in Environmental Governance, in* RESEARCH HANDBOOK ON FUNDAMENTAL CONCEPTS OF ENVIRONMENTAL LAW 459 (Douglas Fisher ed., 2016).

<sup>&</sup>lt;sup>234</sup> See C.P McKay & W.L. Davis, Planetary Protection Issues in Advance of Human Exploration of Mars, ADV. SPACE RES. 9, 197 (1989).

can be minimized significantly if humans do not venture into the designated "special regions," human exploration of Mars could still fit within the requirements of the precautionary principle.

It can be concluded from that application of these various principles that the concerns which troubled UNCOPUOS in the 1960s remain troubling today. We are on the verge of being able to mount a human mission beyond the Moon and yet, we are still struggling with the balancing act between risks and benefits and between science and the law. As noted at the outset, some clarity of legally binding rules is highly desirable for those planning such missions.

## IV. CONCLUSION

Whether or not human settlement on Mars would violate Article IX of the OST will be determined by how that settlement is manifested, structured and conducted. This article sets out the concerns of the relevant actors during the treaty drafting process. Although the States briefly turned their minds to the issue of harmful contamination, it was never finally determined what would constitute this damage. Further still, what would be appropriate measures to prevent or mitigate such contamination? How far should States be required to implement such measures?

Article I of the OST encourages space to be used for exploration and scientific investigation.<sup>235</sup> Human missions to Mars are closer than ever and without clearer international standards the risk that significant harm could cause irreparable damage and loss of opportunity to study life on Mars is of grave concern. Yet, when we balance this with the immense scientific benefit that would come with sending humans to Mars the answer to what activities could be conducted without violating Article IX is unclear.

Part II showed that planetary protection has long been a concern for missions in outer space. However, it is clear from the analysis in Part III that harmful contamination, as it relates to biological contamination in particular, was not deeply considered during the drafting process of the OST, especially considering the travaux préparatoires. This is not to say that it should not now be included in consideration of mission planning. Yet, it does show that in the changing circumstances of international law, and in the absence of

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 $<sup>^{235}</sup>$  See OST, supra note 18, art. I.

a clear regime, it will be for States to determine what conduct it deemed acceptable. The standard adopted could vary considerably, especially in the context of private actors, considering, for example, the Beresheet mission discussed above.

Interestingly, it is not the laws directly applicable to outer space that provide the most guidance in this context but instead general principles of international law. While there is difficulty in applying the transboundary rule, as the risk of harm is impossible to determine, the precautionary principle can provide further guidance on acceptable conduct, risk and mitigation measures. These principles largely involve balancing a risk or threat of harm with the significance of the harm, but should also consider the benefit of the actions.

By reference to Article I of the OST, human missions to Mars will provide significant scientific and cultural value. As such, it is argued that human missions can fit within the current legal regime, so long as "appropriate measures" and risk minimization strategies are implemented. The United States has begun to consider what measures may be necessary; including sending precursor robotic missions to better understand which areas of the planet are most at risk.<sup>236</sup> The concern for space actors then becomes cost, as the sterilization process, particular to the high standard recommended for life-searching missions, can be probative versus whatever may be necessary to sustain human life on Mars.

With the emergence of private space activities and increased interest in a crewed mission to Mars, the planetary protection regime will be challenged by new dilemmas.<sup>237</sup> This article suggests that the guidance and answers do lie within international law. It may also be advisable for States to consider implementing adherence to the planetary protection principles in their domestic space law licensing regimes to ensure a common standard across multijurisdiction space projects and to prevent a race to the bottom.<sup>238</sup>

<sup>&</sup>lt;sup>236</sup> JPL Control Technologies, *supra* note 22, at 21.

<sup>&</sup>lt;sup>237</sup> See Thomas Cheney et. al., Planetary Protection in the New Space Era: Science and Governance, FRONTIERS IN ASTRONOMY AND SPACE SCIS. (Nov. 13, 2020).

 $<sup>^{238}</sup>$  Id.

# FROM THE STEPPE TO THE STARS: NATIONAL SPACE LEGISLATION IN CENTRAL ASIA IN 2021

Christian A. Packard\*

## ABSTRACT

After the Soviet Union collapsed, it left behind several successor States, each of which inherited a portion of the Soviet legacy of space exploration. Several of these States have implemented national space legislation regimes. After the Russian Federation, the most important of these is probably Kazakhstan, the home of the Baikonur Cosmodrome. In the thirty years since the end of the Soviet Union, Kazakhstan and its neighbor Turkmenistan have taken different paths in many ways, including in their approaches to national space legislation. This article surveys the space legislation of both Kazakhstan and Turkmenistan, as those bodies of law existed in 2020 and 2021, and compares them.<sup>1</sup> This article uses the results to draw out and examine the two States' differing approaches to their obligations under international law, as well as their attitudes toward commercial space activity.

<sup>\*</sup> Christian Arthur Packard is an Attorney-Advisor with the United States Air Force. He holds an LL.M. Space, Cyber, and Telecommunications Law from the University of Nebraska. He also holds an MA in Russian, East European, and Central Asian Studies from Harvard, and a JD from the University of Florida. Any errors on any topic addressed in this article should be ascribed to the author, alone. The views expressed in the article do not necessarily represent the views of the Air Force or the United States.

<sup>&</sup>lt;sup>1</sup> As often happens, events have outpaced scholarship. Because this article was written in 2021, it does not take into account the tumult of 2022. In January 2022, Kazakhstan endured widespread unrest, and in June 2022, Kazakhstan State held a constitutional referendum. Also, in February 2022, Russia dramatically escalated its war in Ukraine. The many consequences of that war impacted Kazakhstan's relationship with Russia and Russia's space industry. This article does not evaluate the effects of these ongoing events on space law in Kazakhstan and Turkmenistan. Further, the author believes that evaluation should, ideally, wait until these events resolve.

## I. INTRODUCTION

The Soviet Union, at the end of its existence, was composed of fifteen "Union Republics." Each of these was centered around a titular nationality.<sup>2</sup> There was one Republic for Estonians; one for Uzbeks; and so on. The largest Union Republic was named for the Russians. In 1991, when the Soviet Union collapsed, the fifteen Republics went their separate ways as independent nation-States.<sup>3</sup> Five of those Republics comprise a region known to many as "Central Asia." The Central Asian States are today usually named, in English, as Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan.<sup>4</sup>

The legislatures of two<sup>5</sup> of those States have enacted statutes addressing human activity related to outer space, specifically Kazakhstan and Turkmenistan.<sup>6</sup> This article explores the space legislation of both of those States, with the intent of showing how they fit in the context of international space law. For Kazakhstan this will mean showing how that State has implemented its treaty obligations under the five outer space treaties.<sup>7</sup> Kazakhstan is a party to each of: the Outer Space Treaty of 1967;<sup>8</sup> the Rescue Agreement

<sup>&</sup>lt;sup>2</sup> How this came to be is a murky, complicated topic with its roots in early Soviet history, before World War II, and steeped in the tragedy and turmoil of that era. For a thorough exploration of Soviet nationalities policy in that era, *see generally* TERRY MARTIN, THE AFFIRMATIVE ACTION EMPIRE: NATIONS AND NATIONALISM IN THE SOVIET UNION, 1923-1939 (2001).

<sup>&</sup>lt;sup>3</sup> See generally Peter Kenez, A History of the Soviet Union from the Beginning to the End 144-48 (1999).

<sup>&</sup>lt;sup>4</sup> See, e.g., Central Asia, Britannica, https://www.britannica.com/place/Central-Asia (last visited July 31, 2021).

 $<sup>^5~</sup>$  If more have done so, the author is unaware of that, but would welcome correction at: christian.packard@gmail.com

<sup>&</sup>lt;sup>6</sup> NATALIIA R. MALYSHEVA, SPACE LAW AND POLICY IN THE POST-SOVIET STATES 51 (2018).

<sup>&</sup>lt;sup>7</sup> Id. at 16.

<sup>&</sup>lt;sup>8</sup> Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer space, Including the Moon and Other Celestial Bodies, Oct. 10, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205, Art. II [hereinafter Outer Space Treaty].

of 1968;<sup>9</sup> the Liability Convention of 1972;<sup>10</sup> the Registration Convention of 1975;<sup>11</sup> and the Moon Agreement of 1979.<sup>12</sup> Turkmenistan is party to none.<sup>13</sup> So, regarding Turkmenistan this article will still essentially address how Turkmenistan implements the ideas of those treaties, without a documented legal obligation to do so. It is possible that Turkmenistan views the treaty obligations as having passed into customary international law, but this is not yet clear. Either way, however, this article will first provide a bit of background on both Kazakhstan and Turkmenistan, and then consider the broad contours of the relevant treaties.

### II. BACKGROUND

Both Kazakhstan and Turkmenistan are post-Soviet States. That is, both were once part of the Soviet Union, the successor State to the Russian Empire. The history of the Soviet Union was contained entirely within the 20th Century. The first few decades of the Soviet era were largely defined by the aftermath of a bloody civil war, then violence and intrigue between the victorious Communist Party's various factions, and ultimately depravations against millions of Soviet civilians by Nazi Germany.<sup>14</sup> In the wake of that chaos came new challenges, including the Space Race. In 1955, the Soviet Union and its Communist Party identified land in the Kyzyl-Ordinsk region of Kazakhstan to become the Baikonur

<sup>&</sup>lt;sup>9</sup> The Agreement on the Rescue of Astronauts, The Return of Astronauts and The Return of Objects Launched into Outer Space, Apr. 22, 1968, 672 U.N.T.S. 119 (Creates an international obligation to render assistance to astronauts in distress.) [hereinafter Rescue Agreement].

<sup>&</sup>lt;sup>10</sup> The Convention on International Liability for Damage Caused by Space Objects, Mar. 29, 1972, 24 U.S.T. 2389, 961 U.N.T.S. 187 (Covers international liability of States in the launching and attempted launching of space objects.) [hereinafter Liability Convention].

<sup>&</sup>lt;sup>11</sup> The Convention on Registration of Objects Launched into Outer Space, Jan. 14, 1975, 28 U.S.T. 695, 1023 U.N.T.S. 15 (Handles the international obligations of States when launching and procuring launches of space objects) [hereinafter Registration Convention].

<sup>&</sup>lt;sup>12</sup> The Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, Dec. 5, 1979, 1363 U.N.T.S. 3 (Governs the Activities of States and their nongovernmental actors on the Moon and other celestial bodies. This is the least accepted international space law Treaty) [hereinafter Moon Agreement]. *See* MALYSHEVA, *supra* note 6, at 51.

 $<sup>^{13}</sup>$  Id.

<sup>&</sup>lt;sup>14</sup> See generally KENEZ, supra note 3, at 144-48.

Cosmodrome.<sup>15</sup> The Soviet Army was heavily involved, and construction of various facilities, including both the launch complex and a sizable town also called Baikonur, continued through 1957.16 Then, the Soviet Union launched humanity's first satellite from that facility.<sup>17</sup> Myriad other Soviet accomplishments followed from launches out of Baikonur. These included (among many others) the launches of: the first human into space, the Soviet cosmonaut Yuri Gargarin;<sup>18</sup> the first woman into space, the Soviet cosmonaut Valentina Tereshkova;<sup>19</sup> the first probe to softly land on the Moon, Luna 9;<sup>20</sup> and the first probe to land on Venus, Venera-3.<sup>21</sup> At all of these times, and indeed through the Soviet collapse in 1991, Kazakhstan and Turkmenistan were part of the same nation-State. Only one of the two, Kazakhstan, was the physical location of these and other significant space launch events. However, arguably the two share much of the same heritage, under the broad label of Soviet spaceflight. Today, as the reader might expect, things are a bit different.

## A. Kazakhstan Today

To a western observer, Kazakhstan's legal system may seem familiar in some ways, and alien in others. Kazakhstan is generally a civil law country, as distinguished from the English Common Law. Its constitution guarantees a variety of individual rights and requires that the judiciary be independent and nonpartisan.<sup>22</sup> However, the government maintains a Soviet administrative style

<sup>&</sup>lt;sup>15</sup> Страицы Истории [Pages of History], Официальный сайт администрации города Байконур [Official Site of the Administration of the City Baikonur], http://www.baikonuradm.ru/index.php?mod=city\_1 (last visited July 31, 2021).

 $<sup>^{16}</sup>$  Id.

 $<sup>^{17}</sup>$  Id.

<sup>&</sup>lt;sup>18</sup> Космодром Байконур [Baikonur Cosmodrome], Роскосмос [Roscosmos], https://www.roscosmos.ru/479/ (last visited July 31, 2021).

<sup>&</sup>lt;sup>19</sup> Vostok 6, NASA Space Science Data Coordinated Archive,

 $https://nssdc.gsfc.nasa.gov/nmc/spacecraft/display.action?id=1963-023A \ (last \ visited \ July 31, 2021).$ 

<sup>&</sup>lt;sup>20</sup> Luna 9, NASA Space Science Data Coordinated Archive,

https://nssdc.gsfc.nasa.gov/nmc/spacecraft/display.action?id=1966-006A (last visited July 31, 2021).

<sup>&</sup>lt;sup>21</sup> Venera 3, NASA Space Science Data Coordinated Archive,

 $<sup>\</sup>label{eq:https://nssdc.gsfc.nasa.gov/nmc/spacecraft/display.action?id=1965-092A \quad (last ~visited ~July~31,~2021).$ 

 $<sup>^{\</sup>rm 22}$  Zhenis Kembayev, Introduction to the Law of Kazakhstan 24 (2012).

throughout the economy, and the political system is dominated by the President and a one-party Parliament. Moreover, ruling elites believe that "the activities of democratic institutions should support and be fully in line with official State policies."<sup>23</sup>

Kazakhstan's legal system has a strict hierarchy of sources of law. This article will not address every variety of source of law, like the Constitution of Kazakhstan, or acts of local bodies.<sup>24</sup> Out of the sources which will be considered in this article, the hierarchy is from highest to lowest: codes; laws and decrees of the President having the force of law; resolutions of Parliament; and then socalled "sub-law" acts including: decrees of the President; resolutions of the Government; and orders of ministers and other heads of central State organs.<sup>25</sup>

A particular note should be made about treaties in Kazakhstan's legal system. Generally, treaties may be concluded by the President, the Government, State organs under the President, or other central executive bodies in some situations. The President negotiates and signs treaties, and signs ratification instruments.<sup>26</sup> However, treaties must be ratified by Parliament if they require amendment of existing law, adoption of new law, or if they involve (in addition to other categories not relevant to this paper): territorial issues; "principles of interstate relations"; international security; or State loans.<sup>27</sup> Ratified treaties have priority over other laws of the Republic, except when the treaty requires promulgation of new law.<sup>28</sup> Therefore, in Kazakhstan's domestic hierarchy, ratified treaties rank just below the Constitution and laws concerning the Constitution, and above other authorities.<sup>29</sup> If a treaty contradicts the Constitution, it may not be implemented though some amount of severability is apparently allowed. If a treaty is not ratified, it does not have priority over the laws of the Republic.<sup>30</sup>

 $^{30}$  Id.

 $<sup>^{23}</sup>$  Id. at 25.

<sup>&</sup>lt;sup>24</sup> In principle, the acts of local government within the Baikonur region could become relevant for a survey of Kazakh space law. However, this article will not delve into those due to both limitations on resources, and the unlikelihood that they would have major impact.

<sup>&</sup>lt;sup>25</sup> Id. at 26. See generally id. at 26-31 (describing these sources in greater detail).

 $<sup>^{26}\;</sup>$  Kembayev, supra note 22, at 24, 58.

 $<sup>^{27}</sup>$  Id.

 $<sup>^{28}</sup>$  Id. at 31.

<sup>&</sup>lt;sup>29</sup> Id.

## B. Turkmenistan Today

Whatever may be said about the state of democracy or transparent governance in Kazakhstan, Turkmenistan is in a different category. All Central Asian States "have serious problems with the rule of law, control of corruption, and transparency."<sup>31</sup> Yet Turkmenistan's governance appears to be the most opaque of the other Central Asian States. Turkmenistan has been described as "one of the world's most repressive countries," and has been ranked among the ten least transparent States in the world.<sup>32</sup> Even comparatively optimistic observers suggest that Turkmenistan's constitutional order may lead to stagnation "in society, the economy, and other branches of life of the State," and may prevent objective interpretation of the Constitution of Turkmenistan or the legislation of that State.<sup>33</sup>

As such, the author of this article urges caution in assessing the content of Turkmenistani law. As concerns its space legislation, Turkmenistan is apparently in the "habit" of "copying" the legislation of Russia or other post-Soviet States.<sup>34</sup> Moreover, most of Turkmenistan's "rules and regulations in this area remain ... 'paper regulations' . . ."<sup>35</sup>

Nevertheless, one feature of Turkmenistan's legal order likely does have significance for the topic of this article. That is,

<sup>&</sup>lt;sup>31</sup> Farruhbek Muminov, Protection of Foreign Investment in Central Asia, 7 Russ. L.J. 125, 126 (2019).

<sup>&</sup>lt;sup>32</sup> David M. Fuhr, Of Thieves and Repressors: The Interplay between Corruption and Human Rights Violations, 5 Elon L. Rev. 271, 277 (2013) (citations omitted); Kristopher D. White, Reconsideration of the Geography of Economic Development in Central Asia, 3 USAK Yearbook of Int'l Politics and Law 383, 400-01 (2010); See also Emmanuel Decaux, The Moscow Mechanism Revisited, 14 Helsinki Monitor 355, 359 (2003) (noting OSCE's regret of "systematic non-cooperation" by Turkmenistan authorities in human rights fact-finding mission, which "impaired its most basic international obligations"); See generally Charles J. Sullivan, Halk, Watan, Berdymukhammedov! Political Transition and Regime Continuity in Turkmenistan, 5 Region No. 1, 35, 36-38 (2016) (describing excesses of the reigns of post-Soviet Turkmenistan's two presidents).

<sup>&</sup>lt;sup>33</sup> А.В. Kozina & T.B. Smashnikova, Особенности правового положения президента Республики Туркменистана [Features of the Legal Situation of the President of the Republic of Turkmenistan], Актуальные вопросы в науке и практике сборник статей по материалам XII международной научно-практической конференции [Current Issues in Science and Practice – Collection of Materials of the XII International Scientific-Practical Conference] 23-27 (2018).

<sup>&</sup>lt;sup>34</sup> MALYSHEVA, *supra* note 6, at 49.

<sup>&</sup>lt;sup>35</sup> Id.

Turkmenistan is formally neutral in foreign affairs, and fiercely defends its neutrality.<sup>36</sup> This neutrality is guaranteed by the Constitution which directs the President to defend it.<sup>37</sup> Of course, this is not always positive; one observer has indicated that in adopting neutrality, Turkmenistan's first President (now deceased) "effectively sealed the borders and forced his country into isolation."<sup>38</sup> That aside, this neutrality is most likely why Turkmenistan has not signed any of the space treaties. Another plausible explanation, or contributing factor, is that Turkmenistan has only "modest achievements" in outer space affairs.<sup>39</sup> Either way, despite Turkmenistan's formal international neutrality, it has chosen to make a public expression of the rights and duties of its citizens and legal entities in outer space affairs. So, the State's neutrality should be kept in mind when attempting to discern how Turkmenistan views its obligations under international space law.

Speaking of those obligations, this article will now return to the topic of space law. First, the article will briefly address the history of both States' space statutes. Then, the article will work through the obligations enshrined in the outer space treaties, as those are reflected in each States' legislation. Finally, before concluding, the article will address miscellaneous or novel provisions in each States' space legislation, including a discussion of the law relating to the Baikonur Cosmodrome in Kazakhstan.

<sup>&</sup>lt;sup>36</sup> Kozina & Smashnikova, *supra* note 33, at 23-24; Sullivan, *supra* note 32, at 43.

<sup>&</sup>lt;sup>37</sup> Kozina & Smashnikova, *supra* note 33, at 23-24.

<sup>&</sup>lt;sup>38</sup> Sullivan, *supra* note 32, at 43 (discussing Luca Anceshi, *Analyzing Turkmen Foreign Policy in the Berdymuhammedov Era*, 6 China and Eurasia Forum Quarterly no.4, 37-38 (2008).

<sup>&</sup>lt;sup>39</sup> MALYSHEVA, *supra* note 6, at 49.

## C. Sources of Space Legislation in Kazakhstan and Turkmenistan

Kazakhstan adopted its "Law on Space Activity" in early 2012.40 The most recent version was amended in April 2019.41 For most readers of this article, the most accessible version of Kazakhstan's Law on Space Activity will be the English-language translation of the 2017 version of that law by Alexander Ioannidi in Dr. Malysheva's Space Law and Policy in the Post-Soviet States.<sup>42</sup> This article relies largely rely on that translation. However, because the law has been amended since then, and because the author of this article disagrees with a few parts of Mr. Ioannidi's translations,<sup>43</sup> when necessary, this article will cite to the version published on the website online.zakon.kz. Though likely unfamiliar to the Western reader, that website is "the leading commercial database" for legal research in Kazakhstan.<sup>44</sup> In those situations, the author will provide his own translation. William E. Butler, a leading Western scholar of Russian-language law urges caution when relying on the translations of others, and full disclosure about a translator's qualifications when reading someone else's work.<sup>45</sup> In any event, this

<sup>&</sup>lt;sup>40</sup> Закон Республики Казахстан о космической деятельности [Law of the Republic of Kazakhstan on Space Activity] [hereinafter Kazakhstan's Law on Space Activity or, in appropriate context, Law on Space Activity), No. 528-IV (Jan. 6, 2012) (as amended by Law of the Republic of Kazakhstan No. 49-VI, 27 (Feb. 2017)).

<sup>&</sup>lt;sup>41</sup> Закон Республики Казахстан о космической деятельности [Law of the Republic of Kazakhstan on Space Activity], No. 528-IV (Jan. 6, 2012) [hereinafter Kazakhstan's 2019 Law on Space Activity or, in appropriate context, 2019 Law on Space Activity] (as amended by, *e.g.*, Law of the Republic of Kazakhstan, No. 184-VI (Apr. 11, 2019), https://online.zakon.kz/document/?doc\_id=31112199 (last visited July 31, 2021).

<sup>&</sup>lt;sup>42</sup> MALYSHEVA, *supra* note 6, at 421-38.

<sup>&</sup>lt;sup>43</sup> For example, Mr. Ioannidi translates the titles of the major space statutes in the two countries as "Law on Space Activities," in the plural, when the statutes are titled in the singular, as "Law on Space Activity" [Закон о космической деятельности]. See MALYSHEVA, supra note 5, at 470, 561. Of course, this difference is irrelevant for the purposes of this article, but even the smallest changes in wording can cause difficulties later.

<sup>&</sup>lt;sup>44</sup> KEMBAYEV, *supra* note 22, at 34.

<sup>&</sup>lt;sup>45</sup> WILLIAM E. BUTLER, RUSSIAN LAW AND LEGAL INSTITUTIONS 31-36 (2d. ed. 2018). For a discussion of this Author's translation qualifications, his views on how translation should be conducted, and the translation tools on which this author relies, *see* Christian A. Packard, *Falling Back to Earth: The Return of State Predominance in Russian National Space Legislation in the Roscosmos Era*, 44 No. 1 J. SPACE L., 76-145, 85-95 (2020). To supplement that summary: Kazakhstan's legislation is published in the Russian and

article will also consider certain decrees, regulations, and other authorities translated by Ioannidi.  $^{\rm 46}$ 

Turkmenistan adopted its Law on Space Activity in November 2015.<sup>47</sup> It has been amended twice since then, once in 2017 and once in 2018.<sup>48</sup> The 2017 Amendment is available online in Russian, and changes in the 2018 Amendment are available online in a curious mix of the Russian and Turkmen languages on a website called parahat.info.<sup>49</sup> That website publishes online copies of the daily newspaper "Neutral Turkmenistan," which in turn is an official State publication.<sup>50</sup> The author of this article unfortunately has been unable to find a complete Russian-language version of the 2018 Amendment.

The changes to Turkmenistan's law in 2017 and 2018 were minor. In 2017, the new law deleted one mention of the phrase "and administration" in Article 7, and otherwise replaced all mentions of the phrase "State administration" with the phrase "executive

Kazakh languages. Turkmenistan's legislation is published in the Russian and Turkmen languages. The author of this article knows basically nothing about the Kazakh and Turkmen languages. Therefore, this article relies exclusively on the Russian language versions of the relevant authorities, and noted English translations thereof, primarily Mr. Ioannidi's translation in Dr. Malysheva's book. If the Kazakh or Turkmen version of any specific authority is different from the versions discussed herein, the author is unaware of it, and would happily welcome correction.

<sup>&</sup>lt;sup>46</sup> MALYSHEVA, *supra* note 6, at 438-69.

<sup>&</sup>lt;sup>47</sup> Закон Респулики О космической деятельности [Law of the Republic On Space Activity], No. 307-V (Nov. 21, 2015) [hereinafter Turkmenistan's Law on Space Activity or, in appropriate context, Law on Space Activity].

<sup>&</sup>lt;sup>48</sup> See 2017-12-09 ЗАКОН ТУРКМЕНИСТАНА О внесении изменений в Закон Туркменистана «О космической деятельности» [2017-12-09 Law of Turkmenistan on Introduction of Changes to the Law of Turkmenistan 'On Space Activity'] [hereinafter 2017 Amendment], https://www.parahat.info/law/parahat-info-law-02bk (last visited July 31, 2021); See 2018-06-21 ЗАКОН ТУРКМЕНИСТАНА О внесении изменений в Закон Туркменистана «О космической деятельности» [2018-06-21 Law of Turkmenistan on the Introduction of Changes to the Law of Turkmenistan 'On Space Activity'] [hereinafter 2018 Amendment], https://www.parahat.info/law/parahat-info-law-02cu (last visited July 31, 2021).

<sup>&</sup>lt;sup>49</sup> See *id*.

<sup>&</sup>lt;sup>50</sup> See Akhal-Teke, *Turkmenistan: A banana republic for our times*, EURASIANET (Aug. 28, 2018), https://eurasianet.org/turkmenistan-a-banana-republic-for-our-times (last visited July 31, 2021) (noting activities of parahat.info); *Neutral Turkmenistan*, TÜRKMENMETBUGAT, https://www.turkmenmetbugat.gov.tm/en/newspapers/3/articles (last visited July 31, 2021) (government website noting newspaper's founder as "The Cabinet of Ministers of Turkmenistan").

power."<sup>51</sup> The 2018 Amendment affected some sections regarding telecommunications, specifically replacing a word that is apparently translated as "to broadcast" with a word that is apparently translated as "to spread."<sup>52</sup> Whatever the case, the 2017 and 2018 amendments were minor and have little bearing on this article.

This article also assesses a decree establishing Turkmenistan's National Space Agency.<sup>53</sup> As with the 2017 Kazakhstani authorities, both the 2015 version of Turkmenistani law and the space agency decree are available in English translations by Mr. Ioannidi, and Russian originals, in Dr. Malysheva's *Space Law and Policy in the Post-Soviet States*.

#### III. THE OUTER SPACE TREATY

Several obligations under the Outer Space Treaty of 1967 could lead to implementation or interpretation in national legislation. These include obligations: against national appropriation;<sup>54</sup> to regard astronauts (or, in the Russian version, cosmonauts), as "envoys of [hu]mankind";<sup>55</sup> to bear "responsibility for national activities in outer space";<sup>56</sup> to authorize and continuously supervise nongovernmental activities in space;<sup>57</sup> to bear liability for damaged caused by objects launched into space;<sup>58</sup> to retain jurisdiction and control over space objects on a State's registry;<sup>59</sup> and to avoid "harmful contamination" in the exploration of space, and "adverse changes" in the environment of the Earth.<sup>60</sup> The Treaty also leaves undefined certain key terms like "outer space" and "space object," which terms could be elaborated in national space legislation.

- $^{54}$  Outer Space Treaty supra note 8.
- <sup>55</sup> *Id.* at art. V.
- <sup>56</sup> Id. at art. VI.
- <sup>57</sup> Id.

<sup>&</sup>lt;sup>51</sup> See 2017 Amendment, *supra* note 48 (replacing "государственного управления" with "исполнительной власти").

<sup>&</sup>lt;sup>52</sup> See 2018 Amendment, *supra* note 48 (replacing "alyp eşitdirmek" with "ýaýratmak"). As noted above, the author of this article knows nothing of the Turkmen language and, in all candor, resorted to Google Translate to sort this out. See Google Translate, GOOGLE, https://translate.google.com/#view=home&op=translate&sl=tk&tl=en (last visited July 31, 2020).

<sup>&</sup>lt;sup>53</sup> MALYSHEVA, *supra* note 6, at 560.

<sup>&</sup>lt;sup>58</sup> Id. at art. VII.

<sup>&</sup>lt;sup>59</sup> Outer Space Treaty, *supra* note 8, art. VIII.

<sup>&</sup>lt;sup>60</sup> Id. at art. IX.

## A. The Outer Space Treaty in Kazakhstan

Kazakhstan's Law on Space Activity begins with definitions.<sup>61</sup> Outer space is defined simply as "a space which is extending beyond the boundaries of air space."62 A space object is "a spacecraft" (which could be literally translated as a "space apparatus") "and (or) a means of its launch into outer space and their constituent parts."63 A spacecraft is in turn defined as "a technical device intended to be launched into outer space for the purpose of research and (or) use of outer space."64 Next, space activity is activity "directed at research and use of outer space for the achievement of scientific, economic, ecological, defense, informational, and commercial goals."65 Participants in such activity include "physical (or) legal entities" doing those things either in the territory of Kazakhstan or in outer space "in accordance with this Law."66 Cosmonauts, and candidates for that position, are specifically defined as "a citizen of the Republic of Kazakhstan...." 67 One repeatedly used phrase, "authorized body [or empowered organ] in the field [or branch or industry] of space activity" is "the central executive body that exercises leadership in the field of space activities as well as within the limits provided by the legislation of the Republic of Kazakhstan...."68

The equivalent of the "authorized body" has been many entities over the years. In the Soviet era, there was an entity called the Space Research Agency of the Kazakh Soviet Socialist Republic.<sup>69</sup> After the Union collapsed, that entity was renamed the National Aerospace Agency, and over the next twenty years it was shuffled between various cabinet ministries.<sup>70</sup> Between 2007 and 2014, the entity was renamed the National Space Agency of the Republic of

<sup>&</sup>lt;sup>61</sup> Kazakhstan's Law on Space Activity, *supra* note 40, art. 1.

<sup>&</sup>lt;sup>62</sup> Id. at art. 1 § 6 (Author's translation).

<sup>63</sup> Id. at art. 1 § 12.

<sup>&</sup>lt;sup>64</sup> *Id.* at art. 1 § 2. The phrase "космический аппарат" in section 12 which Ioannidi translated as "spacecraft," he here translates as "space vehicle."

 $<sup>^{65}\,</sup>$  Id. at art. 1 § 7 (Author's translation).

<sup>66</sup> Id. at art. 1 § 8.

<sup>67</sup> Id. at art. 1 § § 18, 19.

<sup>&</sup>lt;sup>68</sup> Id. at art. 1 § 11.

<sup>&</sup>lt;sup>69</sup> MALYSHEVA, *supra* note 6, at 46.

 $<sup>^{70}</sup>$  Id.

Kazakhstan (KazCosmos),<sup>71</sup> and it was independent.<sup>72</sup> But in 2014, and again in 2016, it was subsumed into other ministries.<sup>73</sup>

Today, it appears that KazCosmos is synonymous with the Aerospace Committee of the Ministry of Digital Development, Innovation, and Aerospace Industry of the Republic of Kazakhstan (the Ministry).<sup>74</sup> Indeed, the website of the Ministry handles applications for two critical services for entities conducting space activities, including application for license for space activity (both for legal and "physical," that is natural, persons),<sup>75</sup> and State registration of space objects and rights to those objects<sup>76</sup>.

These definitions give rise to several inferences and unanswered questions. The first is that the "boundaries of air space" are left unspecified, within the definition of "outer space." This appears to be a rejection of the use of the "von Karman" line, once supported by the Soviet Union,<sup>77</sup> as a delineation between the air and outer space. However, it is still ambiguous.

The definition of "space object" is quite broad, clearly encompassing anything launched "for the purpose of research and (or) use of outer space," and anything which launched such an object.

<sup>74</sup> See Sara Kabikyzy, Служу казахстанскому космосу! - представителей Казкосмоса наградили медалями к 25-летию Конституции [I serve Kazkhstani Space! – representatives of KazCosmos are awarded medals on the 25th anniversary of the Constitution], KAZINFORM (Aug. 31, 2020, 1:01 PM) (equating KazCosmos with the Aerospace Committee, and enumerating several other entities under its purview), https://www.inform.kz/ru/sluzhu-kazahstanskomu-kosmosu-predstaviteley-kazkosmosa-nagradili-medalyami-k-25-letiyu-konstitucii\_a3689055 (last visited July 31, 2021).

 $<sup>^{71}\,</sup>$  This name mirrors the name of the current "authorized body" in Russia, the State Corporation Roscosmos. See generally Packard, supra note 45, at 97-103.

<sup>&</sup>lt;sup>72</sup> MALYSHEVA, *supra* note 6, at 56.

<sup>&</sup>lt;sup>73</sup> Id. For a history of the development and repeated reorganization of the space institutions within the Kazakh government up to 2017, which appears to include everything before the most recent reshuffle into the Ministry; See also A.A. Kukieva, Этапы институционального развития космической отрасли казахстана [Stages of Institutional Development of Kazakhstan's Space Industry], No. 3-4 (76-77), Право и Государство [Law and State], 197 (2017).

<sup>&</sup>lt;sup>75</sup> Лицензия на осуществление деятельности в сфере использования космического пространства [License for conduct of activity in the sphere of the use of outer space], THE MINISTRY, https://www.gov.kz/services/3663?lang=ru (last visited July 31, 2021).

<sup>&</sup>lt;sup>76</sup> Государственная регистрация космических объектов и прав на них [State registration of space objects and rights to them], THE MINISTRY, https://www.gov.kz/services/3664?lang=ru (last visited July 31, 2021).

<sup>&</sup>lt;sup>77</sup> See generally FRANS VON DER DUNK, HANDBOOK OF SPACE LAW 29, 65-69 (Frans von der Dunk & Fabio Tronchetti eds., 2015).

Perhaps, however, if something makes it to space accidentally, without the requisite purpose, then this would not be a "space object" for the purposes of domestic law, even if other States sought to hold Kazakhstan accountable internationally.

The list of purposes encompassed under the definition of "space activity" is also far-reaching. However, it leaves out a few possibilities. Suppose, for example, someone placed an object into space purely for their own amusement, or for a strictly religious purpose. Would that be an "informational" goal? Would it be a "scientific" goal? Perhaps, but perhaps also this attempt to craft a broad definition is not yet broad enough to encompass all "national activities" in outer space. At the least, the definition of "participants" is broad enough to encompass anyone engaged in space activities in or from the territory of Kazakhstan.

The definition of "cosmonaut" presents a curious situation. That term is identical to the word used in the Russian version of the Outer Space Treaty,<sup>78</sup> which word is "astronaut" in the English versions of that Treaty. However, the statute unambiguously limits the definition of that term to citizens of Kazakhstan.<sup>79</sup> This is sensible to the extent that the law provides State subsidy for certain facets of a cosmonaut's life.<sup>80</sup> and likely no State in the world would extend those benefits to just anyone from any other country who happened to go into space. However, are cosmonauts really "envoys of [hu]mankind" if they are limited to being only from one State? The principle of sovereign equality<sup>81</sup> may suggest otherwise. Still, Kazakhstan is not alone in its assessment; Russia views the definition of "cosmonaut" as similarly limited to Russian citizens for the purposes of at least its domestic laws.<sup>82</sup> So, perhaps this is a trend. Alternatively, perhaps these States simply want one definition for domestic purposes, and another for international purposes.

<sup>&</sup>lt;sup>78</sup> Договор о принципах деятельности государств по исследованию и использованию космического пространства, включая Луну и другие небесные тела [Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer space, Including the Moon and Other Celestial Bodies], Oct. 10, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205, Статьи V, http://www.un.org/ru/documents/decl\_conv/conventions/outer\_space\_governing.shtml (last visited January 11, 2020) (using "космонавт").

<sup>&</sup>lt;sup>79</sup> *Id.* at art. 1 § 18, 19.

<sup>&</sup>lt;sup>80</sup> Kazakhstan's Law on Space Activity, *supra* note 40, art. 31-35.

 $<sup>^{\</sup>rm 81}$  See generally IAN BROWNLIE, PRINCIPLES OF PUBLIC INTERNATIONAL LAW 289-98 (7th ed. 2008).

<sup>&</sup>lt;sup>82</sup> See Packard, supra note 45, at 121-22.

However, if that is the case, then they should clarify their statements in their laws. As things stand, even though this may not violate the Outer Space Treaty or the Rescue Agreement, the use of the same term to mean one thing abroad and another at home is confusing, and may lead to confusion among or Kazakhstani institutions responsible for the State's outer space affairs.

Concerning the intertwined obligations of responsibility, authorization, continuing supervision, and maintaining jurisdiction and control, Kazakhstan's Law on Space Activity has several relevant provisions. The law directs the authorized body to carry out licensing and State control, to create a procedure for registration and then to carry out registration, to keep the register, to approve certain regulations, develop standards, and so on.<sup>83</sup> This is in addition to "industry expert examination," with the goals of assessing "advisability,"<sup>84</sup> technical feasibility, "economic efficiency" and compliance with law and regulations.<sup>85</sup> The authorized body must also ensure the safety (or security—the word can be translated either way) of space activities.<sup>86</sup>

Rocket launches from facilities in Kazakhstan may only happen "in the presence of a positive decision of the Government of the Republic of Kazakhstan...."<sup>87</sup> Moreover, launches "beyond

<sup>&</sup>lt;sup>83</sup> Kazakhstan's Law on Space Activity, *supra* note 40, art. 9; *See also id.* at art. 12; *See* MALYSHEVA, *supra* note 6, at 429 (directing the reader to other authorities for "State control").

<sup>&</sup>lt;sup>84</sup> Kazakhstan's Law on Space Activity, *supra* note 40, art. 10 (using the word "целесообразность"). Mr. Ioannidi translated this word as "feasibility," *see* MALYSHEVA, *supra* note 6, at 477, but also translated another word the same way, which masks the fact that different terms were used in the original. The translation "advisability" is recommended by the RUSSIAN-ENGLISH LEGAL DICTIONARY (William E. Butler, ed., 1995) at 282. The Oxford dictionary recommends "expediency," but this is even more ambiguous in context.

<sup>&</sup>lt;sup>85</sup> Kazakhstan's Law on Space Activity, *supra* note 40, art. 10 (using the phrase "отраслевая экспертиза"). Mr. Ioannidi translates this phrase variously as "branch expertise," "industry expertise," and "sectoral expertise." MALYSHEVA, *supra* note 6, at 427. However, the author of this article believes it unwise to translate the same phrase in a statute in different ways in different places, absent some compelling reason, which does not appear here. In reaching his own opinion, the author relied on the OXFORD RUSSIAN DICTIONARY (Marcus Wheeler et al. eds., 4th ed. 2007), and the fact that expertise cannot be "carried out," in English, as described in Kazakhstan's Law on Space Activity, *supra* note 40, art. 10 § 2, as well as the fact that Mr. Ioannidi translates the word "экспертиза" as "examination" in *id.* at art. 10 § 3.

<sup>&</sup>lt;sup>86</sup> Kazakhstan's Law on Space Activity, *supra* note 40, art. 27.

<sup>&</sup>lt;sup>87</sup> Id. at art. 19 § 2.

[Kazakhstan's] boundaries" require the same, if they are conducted "by Kazakhstan[i] participants in space activities."<sup>88</sup> It therefore appears that, in addition to any other requirement pronounced in this law, launches from within Kazakhstan, or anywhere else in the world by Kazakh citizens or legal entities, must be expressly approved by the government.

The details of registration will be assessed in greater detail in the portions of this article discussing obligations under the Registration Convention, below. However, "industry expert examination" appears to be a separate requirement, beyond licensing or registration. That is, whether or not those other obligations are fulfilled, "implementation of projects in the field of space activities" is forbidden without a positive examination result. One pair of scholars has observed that ecological expert examination in particular takes a particularly important role.<sup>89</sup> Unfortunately, the terms "advisability," "technical feasibility," and "economic efficiency" are not defined in the statute, leaving ambiguity as to what is meant. In any event, it appears that Kazakhstan has extended its treaty obligation to "authorize" space activities to requiring expert opinions at least about whether a given project will actually work, and whether it is "advisable," in addition to whether it is lawful under Kazakh law. This is, in other words, a new barrier to space activity not clearly required by international law, however advisable it may be.

Concerning licensing procedure, individuals and legal entities seeking a space activity license must fill out certain forms which ask for a great deal of information about the space object to be launched, its purposes, who built it and their qualifications, and the people and organizations launching it or giving or receiving services in use of the object.<sup>90</sup> Anyone engaged in activities described in Articles 1 through 5 of Kazakhstan's Law on Space Activity must do

<sup>&</sup>lt;sup>88</sup> *Id. See also id.* (using word "казахстанскими," which indicates being of or belonging to the Kazakh State, rather than people of the Kazakh ethnicity who might be citizens of Russia, Mongolia, China, or so on).

<sup>&</sup>lt;sup>89</sup> Andrey Dmitrievich Kondratev & Tatyana Vitalyevna Koroleva, Регулирование воздействия ракетно-космической деятельности на окружающую среду в рамках природоохранного законодательство Российской Федерации и Республики Казахстана [Regulation of the Environmental Impact of Rocket and Space Activities within the Environmental Legislation of the Russian Federation and the Republic of Kazakhstan], No. 7 (104) Актуальные проблемы российского право [Current Issues of Russian Law] 154, 157 (July 2019).

<sup>&</sup>lt;sup>90</sup> MALYSHEVA, *supra* note 6, at 450-56.

so "on the basis of a license...."<sup>91</sup> Those articles appear to contemplate activities carried out within Kazakhstan or "in outer space in accordance with this law."<sup>92</sup> So, it is not clear on the face of the law that Kazakhstani entities must obtain a license from their home State if they engage in activities elsewhere.

Moving on, Kazakhstan's law on space activity expressly forbids several activities. These include the following:

1.1 Creation of an immediate threat to life and health of people;

1.2 Launching into orbit, deployment in outer space of weapons of mass destruction;

1.3 Use of space technology and (or) celestial bodies for negative impact on the environment;

1.4 Violation of international norms and standards for the pollution of outer space.  $^{93}$ 

Also forbidden is causing material loss or damage to the environment, as proscribed by "the environmental legislation of the Republic of Kazakhstan."<sup>94</sup> The statute does not proscribe a penalty for breaking any of these rules. Moreover, the rules in subsections 1.3 and 1.4 are quite vague. Ideally, the author supposes, the "expert examination" system would screen out projects that could break these rules before they start. Also, the author wonders whether a participant in space activity who had a "positive" expert examination, and then accidentally breaks these rules, could blame the experts for missing a possibility or minimizing the risk, and thus avoid responsibility themselves. Unfortunately, none of these questions are answered by the authorities consulted for this article.

Turning to the obligations to avoid "harmful contamination" in the exploration of space, and "adverse changes" in the environment of the Earth,<sup>95</sup> Kazakhstan's Law on Space Activity does address those. It appears that under Kazakhstan's Law on Space Activity,

<sup>&</sup>lt;sup>91</sup> Kazakhstan's Law on Space Activity, *supra* note 40, art. 13.

 $<sup>^{92}</sup>$   $\,$  Id. at art. 1 § 8.

 $<sup>^{93}~</sup>$  Id. at art. 30 § 1.

<sup>&</sup>lt;sup>94</sup> Id. at art. 30 § 2.

<sup>&</sup>lt;sup>95</sup> Outer Space Treaty, *supra* note 8, art. IX.

the authorized body does not conduct environmental monitoring. That task is assigned to "authorized State bodies in the field of environmental protection," and land management, as well as "specifically authorized State bodies."96 Participants in space activities must carry out "industrial ecological control of the surrounding environment" as required by Kazakhstan's environmental legislation.<sup>97</sup> If public health is implicated, that control or monitoring is delegated to "authorized bodies in the field of environmental protection and public health."98 Certain emergency information about environmental issues is required to be disseminated through the media.<sup>99</sup> In practice, one scholar has observed, Kazakhstan's norms governing the environmental impact of space activity have proven inadequate.<sup>100</sup> This is perhaps unsurprising, as the statute delegates authority to entities without clear expertise in space activities, and makes vague reference to other legislation without spelling out obligations or penalties for noncompliance. Moreover, the joint practice of launches by Russia from within Kazakhstan, at Baikonur, has left many unanswered questions about whose law applies to which parts of a launch.<sup>101</sup> In any event, Kazakhstan has not overlooked its environmental obligations under the Outer Space Treaty, but it appears to have delegated many of them away from the parts of the government that specifically focus on space activity.

## B. The Outer Space Treaty in Turkmenistan

Turkmenistan's Law on Space Activity addresses many of the same issues that Kazakhstan's does. Turkmenistan defines space activity as activity directed at exploration and use of outer space for "scientific, economic, environmental, information[al] and commercial purposes," as well as national defense and security.<sup>102</sup> This is

<sup>&</sup>lt;sup>96</sup> Kazakhstan's Law on Space Activity, *supra* note 40, art. 29 § 1.

<sup>&</sup>lt;sup>97</sup> Id. at art. 29 § 2 (Author's translation of Russian phrasing).

 $<sup>^{98}~</sup>$  Id. at art. 29 § 3.

<sup>&</sup>lt;sup>99</sup> Id. § 4.

<sup>&</sup>lt;sup>100</sup> Dilara Zhantasovna Smagulova, Международно-правовя ответственность за загрянение космической окружающией среды (опыт Республики Казахстана) [International-legal responsibility for pollution of the space environment (experience of the Republic of Kazakhstan)], No. 1 (37) Вестник института законодательства Республики Казахстана [Bulletin of the Institute of Legislation of the Republic of Kazakhstan] 158, 160-61 (2015).

 $<sup>^{\</sup>rm 101}\,$  Kondratev & Koroleva, supra note 89, at 158.

<sup>&</sup>lt;sup>102</sup> Turkmenistan's Law on Space Activity, *supra* note 47, art. 1 § 1.

broad, but with the same potential gaps as in Kazakhstan's definition discussed above. "Subjects of space activities" include legal entities and individuals, wherever they are from, and international organizations, carrying out space activities on the territory of Turkmenistan.<sup>103</sup> Taking the breadth of these two provisions together, it seems reasonably clear that even the management of a satellite's ground-station within Turkmenistan would qualify as engaged in a space activity. "Objects of space activity" include a wide range of man-made objects, located both on the ground and in space, whose sole unifying feature appears to be that they are intended "for the purpose of exploring and using outer space."<sup>104</sup> However, this is distinct from a "space object," the definition of which is verbatim identical to Kazakhstan's, described above, being "a spacecraft and(or) a means of its launch into outer space and their constituent parts."<sup>105</sup> The definition of spacecraft is also the same.<sup>106</sup>

Perhaps surprisingly, Turkmenistan defines outer space as extending "beyond the airspace at a height of more than one hundred kilometers above sea level."<sup>107</sup> It appears that Turkmenistan has never launched a satellite into orbit on its own. Yet it also appears that Turkmenistan has chosen a bright-line rule to divide outer space from air space. Turkmenistan's motivations on this point are opaque, as this subject does not clearly come up again in the statute in question.

Concerning oversight of space activity, the President and the Cabinet of Ministers take a primary role. The former sets the "general direction" of space activity, and the latter carries out "State regulation." The Cabinet shares its authority with the "authorized government body."<sup>108</sup> This entity is apparently the "National Space Agency under the President of Turkmenistan."<sup>109</sup> That agency was established by Presidential decree in 2011.<sup>110</sup> This entity exercises

<sup>&</sup>lt;sup>103</sup> *Id.* at art. 1 § 3.

<sup>&</sup>lt;sup>104</sup> *Id.* at art. 1 §§ 4, 5, 6.

<sup>&</sup>lt;sup>105</sup> Id. at art. 1 § 7.

<sup>&</sup>lt;sup>106</sup> *Id.* at art. 1 § 8.

<sup>&</sup>lt;sup>107</sup> Id. at art. 1 § 2.

<sup>&</sup>lt;sup>108</sup> *Id.* at art. 7.

<sup>&</sup>lt;sup>109</sup> MALYSHEVA, *supra* note 6, at 49. Unfortunately, this entity's website is only accessible in the Turkmen language. https://www.turkmencosmos.gov.tm/ (last visited July 31, 2020).

<sup>&</sup>lt;sup>110</sup> MALYSHEVA, *supra* note 6, at 560 (presenting translation of decree).

"State control in the field of space activities...."<sup>111</sup> The President defines the authorized body, and handles conceptual or policy issues.<sup>112</sup> The Cabinet's obligations are also spelled out in the statute, and they are too many to list here. It is worth mentioning that the Cabinet "approves within its powers legal regulatory acts" on space activity, and approves certain other regulations including, e.g., technical regulations and procedures for disposal of space objects.<sup>113</sup> The authorized body's responsibilities are more numerous, drawn out over three pages.<sup>114</sup> Noteworthy entries in the list include creating the space industry of Turkmenistan,<sup>115</sup> determining procedure for expert examinations,<sup>116</sup> organizing and coordinating work on commercial projects,<sup>117</sup> carrying out licensing,<sup>118</sup> and certifying space technology.<sup>119</sup>

As in Kazakhstan, State expert examination is required for space activity, with the same set of traits to be evaluated.<sup>120</sup> Licensing and certification are expressly made contingent on this process, and without "positive" examination results, space activity is forbidden.<sup>121</sup> The Cabinet of Ministers determines the "composition of expert commissions" that engage in this process.<sup>122</sup> Licensing is conducted "in accordance with the legislation of Turkmenistan on licensing."<sup>123</sup> It is unfortunately not clear on the face of the statute whether this means a single law or a more general genre of law. Nevertheless, the "subjects of space activities," as noted above, are defined as entities, domestic or foreign, carrying out space activities within Turkmenistan.<sup>124</sup> So, it is not perfectly clear on the face of Turkmenistan's Law on Space Activity that Turkmenistani entities acting abroad must obtain licensing from their home State.

<sup>120</sup> Turkmenistan's Law on Space Activity, *supra* note 47, art. 19 § 1.

<sup>&</sup>lt;sup>111</sup> Turkmenistan's Law on Space Activity, *supra* note 47, art. 40.

<sup>&</sup>lt;sup>112</sup> *Id.* at art. 8.

<sup>&</sup>lt;sup>113</sup> Id. at art. 40.

<sup>&</sup>lt;sup>114</sup> *Id.* at art. 40, art. 10.

<sup>&</sup>lt;sup>115</sup> Id. at art. 40, art. 2.

<sup>&</sup>lt;sup>116</sup> Turkmenistan's Law on Space Activity, *supra* note 47, art. 9.

<sup>&</sup>lt;sup>117</sup> Id. at art. 16.

<sup>&</sup>lt;sup>118</sup> Id. at art. 17.

<sup>&</sup>lt;sup>119</sup> Id. at art. 24.

<sup>&</sup>lt;sup>121</sup> *Id.* at art. 19 §§ 2, 4.

<sup>&</sup>lt;sup>122</sup> Id. at art 19 § 3.

<sup>&</sup>lt;sup>123</sup> Id. at art. 17.

 $<sup>^{124}</sup>$   $\,$  Id. at art. 1 § 3.

"Management of space objects registered in Turkmenistan" is carried out by the authorized body, and "organizations responsible for the use" of certain facilities, from launch to completion of flight.<sup>125</sup> It is not clear that independent private operation of space objects registered in Turkmenistan is possible under this phrasing. Still, foreign legal entities and individuals carrying out space activities "under the jurisdiction of Turkmenistan," receive the same legal protections and rights as Turkmen entities do, to the extent that such Turkmen entities would be extended those legal traits "by the State concerned."126 However, disputes arising from "international cooperation" in space activities either in Turkmenistan or outside the nation but within its jurisdiction must be litigated in Turkmenistani courts, unless otherwise specified by a treaty.<sup>127</sup> Also, violations of the Law on Space activity incur responsibility under Turkmen law.<sup>128</sup> So, even if private operation of space objects registered in Turkmenistan is possible, foreign legal entities probably would wish to avoid doing so, lest they be haled into court in a deeply problematic State.

Environmental issues are not extensively addressed in Turkmenistan's Law on Space Activity, though they are not entirely ignored. When a Space object registered in Turkmenistan will no longer be used, it is "subject to disposal in the manner determined by" the authorized body, "and international treaties of Turkmenistan."<sup>129</sup> It is not clear that Turkmenistan's authorized body has identified a preferred manner of disposal. Also, because Turkmenistan is not party to any of the outer space treaties, it is not clear what treaties are meant here.

Like Kazakhstan, Turkmenistan delegates other environmental authority to bodies outside the space sector. The "authorized State bod[ies]" in "environmental protection" and "meteorology" are responsible for monitoring "the environment and natural resources" in carrying out space activities. Participants must also monitor the environment as required by other legislation, and "State control" over environment and public health is handled by

<sup>&</sup>lt;sup>125</sup> Turkmenistan's Law on Space Activity, *supra* note 47, art. 24 § 1.

<sup>126</sup> Id. at art. 38 § 1.

<sup>&</sup>lt;sup>127</sup> Id. at art. 39.

<sup>&</sup>lt;sup>128</sup> Id. at art. 41.

<sup>&</sup>lt;sup>129</sup> Turkmenistan's Law on Space Activity, *supra* note 47, art. 25.

authorized bodies in environmental protection and public health administration.  $^{\rm 130}$ 

Turkmenistan's Law on Space Activity does not define "cosmonaut." Therefore, that law avoids the complication raised in Kazakhstan's law. It appears that only one person from Turkmenistan has ever been to space: Oleg Kononenko. Turkmenistani State-controlled media has stated that he went to space as a "Russian cosmonaut" in 2008, well after the end of the USSR.<sup>131</sup>

## IV. THE RESCUE AGREEMENT

The Rescue Agreement is primarily concerned with the retrieval and return of distressed human spacefarers and humanmade space objects.<sup>132</sup> The space legislation of neither Kazakhstan nor Turkmenistan has much to say about such people or objects when they are distressed outside of the respective States. However, both do go into a little detail about State intentions and obligations concerning such people or objects within the respective States.

#### A. The Rescue Agreement in Kazakhstan

In Kazakhstan, the law directs the authorized body over space activities to participate "within its competence in the organization of search [and] rescue operations, as well as in the investigation of accidents in the implementation of space activities."<sup>133</sup> Also, cosmonauts and cosmonaut-candidates who suffer harm, up to and including, in the course of their official duties, or their heirs, are guaranteed to receive specified amounts of financial compensation.<sup>134</sup> In addition, the State guarantees most, if not all, medical expenses for cosmonauts and cosmonaut-candidates who live permanently in Kazakhstan, and for "jointly residing members" of their family, but not for cosmonauts and candidates who have lost their Kazakhstani

<sup>&</sup>lt;sup>130</sup> Id. at art. 33.

<sup>&</sup>lt;sup>131</sup> Космонавту Олегу Кононенко присвоено звание Героя Туркменистана [To Cosmonaut Oleg Kononenko is Given the Title of Hero of Turkmenistan],TURKEMNPORTAL https://turkmenportal.com/blog/21898/kosmonavtu-olegu-kononenko-prisvoeno-zvanie-geroya-turkmenistana (last visited Jan. 12, 2022).

 $<sup>^{132}\,</sup>$  Rescue Agreement, supra note 8. See generally Von der Dunk, supra note 77, at 78-81.

<sup>&</sup>lt;sup>133</sup> Kazakhstan's Law on Space Activity, *supra* note 40, art. 9 § 1.26.

<sup>&</sup>lt;sup>134</sup> *Id.* at art. 32 §§ 1-4.

citizenship.<sup>135</sup> The heirs of the deceased will receive free State-sponsored housing, if they do not already have their own housing within Kazakhstan.<sup>136</sup> Burial and funerary expenses are also covered.<sup>137</sup> In sum, Kazakhstan's cosmonauts are well looked-after on Earth. However, no reference in Kazakh law appears to be made to the "personnel of a spacecraft" mentioned in Article 3 of the Rescue Agreement, or other possible participants in spaceflight. Moreover, given that "cosmonaut" is limited to Kazakhstani citizens, as discussed above, it appears to the author that Kazakhstan's domestic space legislation does not clearly compel its space-related government entities to rescue the citizens of other States. Instead, it appears that the State must choose to fulfill its international obligations on that front.

Moreover, a foreign space object

may conduct a safe flight through the air space of the Republic of Kazakhstan in the process of its launch into outer space or its return to Earth, under the condition of [prior agreement or advance coordination] with the Ministry of Defense of the Republic of Kazakhstan, and the authorized organs in the security of the environment and in the sphere of civil defense.<sup>138</sup>

The reader has likely noted the author's mark of the ambiguous bracketed phrase. Mr. Ioannidi translates the relevant phrase as "prior agreement," which is not at all wrong.<sup>139</sup> However, while the second word in that phrase can mean agreement, it can also be translated as "coordination."<sup>140</sup> Given the national security sensitivities involved here, it is probably best to translate the word as "agreement," and await express permission. However, the word is a little ambiguous. Either way, this provision should not be mistaken for a right of innocent passage,<sup>141</sup> or the comparatively more permissive arrangement under the law of the Russian Federation

 $<sup>^{135}</sup>$  Id. at art. 34.

<sup>&</sup>lt;sup>136</sup> *Id.* at art. 32 §§ 5-6.

<sup>&</sup>lt;sup>137</sup> Kazakhstan's Law on Space Activity, *supra* note 40, art. 33.

 $<sup>^{\</sup>rm 138}~$  Id. at art. 27 § 5 (Russian version, author's translation).

 $<sup>^{\</sup>rm 139}~$  Kazakhstan's Law on Space Activity, supra note 40.

<sup>&</sup>lt;sup>140</sup> OXFORD RUSSIAN DICTIONARY at 471 (translating "согласование"). *But see* RUSSIAN-ENGLISH LEGAL DICTIONARY at 239 (translating word as "agreement, brought into").

<sup>&</sup>lt;sup>141</sup> See generally von der Dunk supra note 77, at 72-79.
which just requires advance notice to Russian authorities.<sup>142</sup> Instead, a space object seeking to pass through Kazakhstani airspace, apparently without exception for ones in distress, must at least communicate responsively with the Kazakhstani military before doing so.

# B. The Rescue Agreement in Turkmenistan

Turkmenistan has less to say on this topic—its Law on Space Activity merely requires that "[i]ncidents, including accidents and catastrophes, in the conduct of space activit[y] are subject to investigation," with further details determined by other "normative legal acts...."<sup>143</sup> The passive construction used here does not even identify who should investigate, so it is hard to say that this is responsibility is taken seriously. Certainly, nothing in Turkmenistan's Law on Space Activity compels particular actions be taken toward cosmonauts or astronauts, wherever they are from.

#### V. THE LIABILITY CONVENTION

The 1972 Liability Convention<sup>144</sup> expanded on certain provisions contained in the Outer Space Treaty. The Convention defines damage broadly.<sup>145</sup> It defines "launching State" as one of four things, a State: which launches a space object; which procures the launch of a space object; from whose territory a space object is launched; or from whose facility a space object is launched.<sup>146</sup> Under the Liability Convention, if a launching State's space object causes damage "elsewhere than on the surface of the Earth," to another State's space object, or the people or things therein, liability is fault based.<sup>147</sup> However, if damage is caused on the surface of the Earth, or to aircraft in flight, the "launching State" is "absolutely liable…"<sup>148</sup> The Liability Convention does not prescribe rules for

 $<sup>^{\</sup>rm 142}~$  Packard, supra note 45, at 119-20.

 $<sup>^{\</sup>rm 143}$  Turkmenistan's Law on Space Activity, supra note 47, art. 34.

 $<sup>^{144}\,</sup>$  Liability Convention, supra note 10. See generally von der Dunk, supra note 77, at 82-94.

 $<sup>^{145}</sup>$  *Id.* at art. I(a) ("The term 'damage' means loss of life, personal injury or other impairment of health; or loss of or damage to property of States or of persons, natural or juridical, or property of international intergovernmental organizations".)

<sup>&</sup>lt;sup>146</sup> Id. at art I(c).

 $<sup>^{147}\,</sup>$  Id. at art III.

 $<sup>^{148}\,</sup>$  Id. at art. II.

damage to the launching State's nationals, or foreign nationals participating in the launch.<sup>149</sup> Also, States which "jointly launch a space object" are jointly and severally liable, and can seek indemnification from other participants.<sup>150</sup> In particular, a "State from whose territory or facility a space object is launched shall be regarded as a participant in a joint launching."<sup>151</sup>

# A. The Liability Convention in Kazakhstan

As one might imagine, the provisions of the Liability Convention are complicated by Baikonur's presence in Kazakhstan. This article will first address provisions of Kazakhstan's space legislation related to the Liability Convention in general, and then specific variations related to Baikonur.

# i. Generally

Given the Liability Convention's express avoidance of intranational liability issues, Kazakhstan's Law on Space Activity fills that gap in Article 27:

2. Compensation for harm to the health of individuals, damage to the environment, property of individuals and legal entities[,or] the State[,] that arose as a result of space activities is carried out voluntarily or by a court decision in accordance with the laws of the Republic of Kazakhstan

Harm is subject to compensation in full, taking into account the degree of loss of ability to work of the victim, the cost of his treatment, and restoring health, [and] costs of caring for the patient.<sup>152</sup>

So, it appears that in most cases, the victim must actively pursue a claim for suffered harm, and either negotiate a settlement or secure a court judgment. However, "[i]n case of death of people or animals, as well as causing damage to citizens and the environment as the *result of the launch of a space object*, the participants in space activities must compensate for the damage caused in accordance

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<sup>&</sup>lt;sup>149</sup> *Id.* at art. VII

<sup>&</sup>lt;sup>150</sup> Id. at art. V § 1-2.

<sup>&</sup>lt;sup>151</sup> Liability Convention *supra* note 10, art. V § 3.

<sup>&</sup>lt;sup>152</sup> MALYSHEVA, *supra* note 6, at 434.

with paragraph 2 of this article."<sup>153</sup> So, at least these enumerated harms following specifically from a *launch*, compensation is required automatically.

Prior to a scheduled launch, participants in space activities must disclose to the authorized body for environmental protection the coordinates of the "areas of fall of the separated parts of the launch vehicle" within Kazakhstan.<sup>154</sup> This is sensible, beyond the obvious reason that some warning of falling space objects is always for the best, given that Kazakhstan has no ocean shoreline (aside from the crowded Caspian Sea) in which to conveniently dump space debris. Curiously, this provision does not require disclosure of exactly what will be falling. The reader might anticipate different precautions should be taken for an empty aluminum tube than for a tube full of hydrazine.

# ii. Liability Concerning Baikonur

Under a treaty signed in 1994, often called the "Lease Agreement," the Russian Federation rents Baikonur from Kazakhstan.<sup>155</sup> Under this agreement, if the Russian space program causes harm, then the Russian Federation takes responsibility under the 1972 Liability Convention.<sup>156</sup> In that situation, under the Lease Agreement, Kazakhstan is *not* automatically viewed as a joint participant or launching State for Russian launches.<sup>157</sup> If the two launch a space object jointly, then liability follows under Article V of the Liability Convention.<sup>158</sup> However, if Russia launches a space object

<sup>&</sup>lt;sup>153</sup> Kazakhstan's Law on Space Activity, *supra* note 40, art. 27 § 4 (emphasis added). The word which Mr. Ioannidi here translated as "must," is должны, which is often appropriately translated as "should." Naturally, in English, these mean entirely different things, and the latter carries little to no legal mandate. However, in context, "must" is almost certainly the better translation, as "should" would render this provision entirely superfluous.

<sup>&</sup>lt;sup>154</sup> *Id.* § 3.

<sup>&</sup>lt;sup>155</sup> Mira Zh. Kulikpayeva, Нормы об Ответсвтенности в Международном Космическом Праве и их Имплементация в Национальное Законодательство Республики Казахстан [Norms on Responsibility in International Space Law and their Implementation in the National Legislation of the Republic of Kazakhstan], No. 5 (54) Вестник Института Законодательства РК [Bulletin of the Institute of Legislation of the Republic of Kazakhstan], 97, 101 (2018).

<sup>&</sup>lt;sup>156</sup> *Id.* at 102.

<sup>&</sup>lt;sup>157</sup> Id. (quoting 1994 Lease Agreement, Art. 8.4(r)).

 $<sup>^{158}</sup>$  Id.

jointly with other States, then those States (apparently meaning Russia and the other States) will bear the liability between them, and not regard Kazakhstan as a launching State.<sup>159</sup>

For the purposes of their own relations, it appears that Russia and Kazakhstan have chosen to waive certain provisions of the Liability Convention. Of course, this treaty is only binding as between the Russian Federation and the Republic of Kazakhstan.<sup>160</sup> Yet the fact remains that the two parties to the 1994 Lease Agreement have chosen to deviate from the 1972 Liability Convention's definition of "launching State."<sup>161</sup> In practice, when a Russian launch causes harm in Kazakhstan, the two States resolve the situation through intergovernmental commissions.<sup>162</sup> However, at least one scholar believes that Kazakhstan's implementation of its obligations under the Liability Convention is inadequate, given that Kazakhstan's Constitution makes international "norms" into domestic law, giving ratified treaties higher priority, and Kazakhstan has ratified potentially conflicting treaties.<sup>163</sup> It is not clear that any third State has attempted to hold Russia and Kazakhstan jointly liable for a Russian space launch from Baikonur, which would not, as between Russia and Kazakhstan, trigger Kazakhstan's liability. Nevertheless, if this does someday happen, the situation would be complicated.

# B. The Liability Convention in Turkmenistan

Turkmenistan's Law on Space Activity does not have much to say about any possible obligations inferred from the existence of the 1972 Liability Convention. However, it does require entities and people "who use space technology or commissioned for the creation and use of space technology" to acquire insurance "for employees of ground-based space infrastructure facilities, as well as liability insurance for harm caused to the life, health, or property of others, in the order and under the conditions established" in other Turkmen law.<sup>164</sup> However, insurance to protect a piece of space technology,

 $<sup>^{159}</sup>$  Id.

<sup>&</sup>lt;sup>160</sup> Vienna Convention on the Law of Treaties, Art. 34.1, 1155 U.N.T.S. 331 ("A treaty does not create either obligations or rights for a third State without its consent.").

<sup>&</sup>lt;sup>161</sup> Kulikpayeva, *supra* note 155, at 102.

 $<sup>^{162}</sup>$  *Id*.

<sup>&</sup>lt;sup>163</sup> Id. at 103.

<sup>&</sup>lt;sup>164</sup> Turkmenistan's Law on Space Activity, *supra* note 47, art. 35 § 1.

as opposed to human beings, is merely voluntary.<sup>165</sup> Curiously, a similar provision is absent from Kazakhstan's statute, and Turkmenistan objectively has far less space activity to worry about. Also, this is not, on the face of Turkmenistan's statute, an advance requirement for space activity or licensing. So, it is not clear at what point this obligation would need to be fulfilled. Still, the provision exists, and should not be overlooked.

# VI. THE REGISTRATION CONVENTION

The last of the four major space treaties is the Registration Convention of 1975.<sup>166</sup> Under that Convention, launching States, defined as in the Liability Convention, must register a launched space object in its own registry. When there is more than one launching State, the two must jointly determine which shall register.<sup>167</sup>

#### A. The Registration Convention in Kazakhstan

Kazakhstan's Law on Space Activity speaks of registration of space objects, as well as registration of rights to those objects.<sup>168</sup> Space objects are subject to registration in Kazakhstan if they: belong to Kazakhstani individuals or legal entities; or are launched into space from Kazakhstan.<sup>169</sup> Rights to space objects arise from the moment of their registration, and are "confirmed" by a State certificate from the authorized body.<sup>170</sup> The State may refuse registration of a space object, or rights to it, if documents do not meet the State's requirements, or if rights are in some way encumbered such that they are not transferrable.<sup>171</sup> The list of necessary documents was elaborated in a 2015 order of the Minister for Investment and Development.<sup>172</sup> However, refusal of registration appears

<sup>172</sup> "On Approval of Rules of State Registration of Space Objects, Rights to them and Forms of the Register of Space Objects," Order of the Minister for Investment and

<sup>&</sup>lt;sup>165</sup> Id. § 2.

<sup>&</sup>lt;sup>166</sup> Registration Convention, *supra* note 11.

<sup>&</sup>lt;sup>167</sup> Id. at art. II § 1-2.

<sup>&</sup>lt;sup>168</sup> See, e.g., Kazakhstan's Law on Space Activity, *supra* note 40, art. 11.

<sup>&</sup>lt;sup>169</sup> *Id.* § 1.

<sup>&</sup>lt;sup>170</sup> Id. § 4.

<sup>&</sup>lt;sup>171</sup> *Id.* § 7 (forbidding registration if encumbrance "exclude[s] the disposal of a space object" or is "restricting or excluding the right to dispose of a space object").

to be without prejudice to try again if conditions change, and either way it is subject to judicial review.<sup>173</sup> Once the State registers a space object, and confirms its "destruction or utilization," the authorized body will update "the register of space objects."<sup>174</sup> Once a space object is included in the register, it is assigned a State registration number.<sup>175</sup>

Markings are typically required for space objects. Such markings are "determined by the authorized body in accordance with international standards" and Kazakhstani legislation.<sup>176</sup> A 2012<sup>177</sup> decree by the chair of the Kazakhstan Space Agency elaborated on the requirements for markings. The marking must include (under nuanced requirements for arrangement and font size and coloring): the registration number; the word "Kazakhstan" in Latin letters (not the Cyrillic alphabet used in the Kazakh and Russian languages); and the State Flag of Kazakhstan "by a scale, which is corresponding to the scale of the text of the marking."<sup>178</sup> This must be repeated on each stage of a launch vehicle.<sup>179</sup> It is also permissible to include the name of the object in a State language; and the emblem of a participant in space activity which is launching the object.<sup>180</sup>

#### B. The Registration Convention in Turkmenistan

Turkmenistan's Law on Space Activity makes national registration of "objects of [a] space activit[y]" mandatory.<sup>181</sup> Objects belonging to Turkmenistani legal entities or individuals must be

Development of the Republic of Kazakhstan of 24 April 2015 No. 484," Annex 1, in MALYSHEVA, *supra* note 6, at 458-59.

<sup>&</sup>lt;sup>173</sup> Kazakhstan's Law on Space Activity, *supra* note 40, art. 11, § 9-10.

<sup>&</sup>lt;sup>174</sup> Id. § 11.

<sup>&</sup>lt;sup>175</sup> Order of 24 April 2015, No. 484, Annex 1, in MALYSHEVA, *supra* note 6, at 461.

<sup>&</sup>lt;sup>176</sup> Kazakhstan's Law on Space Activity, *supra* note 40, art. 24.

 $<sup>^{177}\;</sup>$  If a superseding or amended decree exists, the author of this paper was unable to locate it.

<sup>&</sup>lt;sup>178</sup> В Казахстане утверждена маркировка космических объектов [In Kazakhstan marking of space objects is confirmed], *Казахстанская Права* [KAZAKHSTAN PRAVDA], No. 209-210, July 3, 2012, available at: https://online.zakon.kz/Document/?doc\_id=31217108#pos=3;-80 (last visited Jan. 12, 2022) (quoting Decree of the Chairman of the National Space Agency of the Republic of Kazakhstan from 14 May 2012. No. 61/OД).

<sup>&</sup>lt;sup>179</sup> Id.

<sup>&</sup>lt;sup>180</sup> Id.

<sup>&</sup>lt;sup>181</sup> Turkmenistan's Law on Space Activity, *supra* note 47, art. 20 § 1.

registered in accordance with a procedure approved by the Cabinet of Ministers.<sup>182</sup> Objects "created jointly with legal entities of foreign States or international organizations are registered in accordance with" Turkmenistan's treaties.<sup>183</sup> It is not clear which treaties this refers to; as noted above, Turkmenistan is not party to any of the outer space treaties. So, it must refer either to bilateral treaties between Turkmenistan and particular other States or future treaties. Also, the law does not specify what happens if an object is "created jointly" in the absence of a relevant treaty. In any event, objects are removed from the registry when they are destroyed or transferred "to a foreign State or an international organization."<sup>184</sup>

#### VII. THE MOON AGREEMENT IN KAZAKHSTAN

Kazakhstan is a party to the 1979 Moon Agreement.<sup>185</sup> The Moon Agreement elaborated on the obligations of States specifically toward celestial bodies, rather than empty space.<sup>186</sup> For better or for worse, very few States ratified that agreement.<sup>187</sup> The consensus appears to be that many States viewed certain provisions as restricting their ability to engage in resource extraction on the Moon, on asteroids, or elsewhere.<sup>188</sup>

Beyond the environmental responsibility provisions mentioned above, it does not appear that any specific portion of the Moon Agreement has been implemented or expanded upon in Kazakhstan's Law on Space Activity. At least one Kazakhstani scholar, Smagulova, has noted that part of the Agreement may be too vague in that it insists on preventing the disruption of the "existing balance" of the environment.<sup>189</sup> That is, that term is never defined, and the Agreement does not specify what measures should be taken to protect that balance, or how quickly, and so on.<sup>190</sup> In other words, it may be that Kazakhstan has not imposed any

 $<sup>^{182}</sup>$   $\,$  Id. § 2. The author of this article was unable to locate that procedure.

<sup>&</sup>lt;sup>183</sup> Id. § 3.

<sup>&</sup>lt;sup>184</sup> Id. § 6.

<sup>&</sup>lt;sup>185</sup> Moon Agreement, *supra* note 12.

<sup>&</sup>lt;sup>186</sup> See VON DER DUNK, supra note 77, at 40-41.

<sup>&</sup>lt;sup>187</sup> See id. at 41.

<sup>&</sup>lt;sup>188</sup> *Id.* at 99-103; Fabio Tronchetti, *Legal Aspects of Space Resource Utilization*, in VON DER DUNK, *supra* note 77, at 782-88.

<sup>&</sup>lt;sup>189</sup> Moon Agreement, *supra* note 12. art. 7.

<sup>&</sup>lt;sup>190</sup> Smagulova *supra* note 100, at 161.

requirements of the Moon Agreement in its domestic legislation because that agreement is too vague to effectively implement.

#### VIII. MISCELLANEOUS PROVISIONS

Of course, the space law sources in both Kazakhstan and Turkmenistan contain myriad other provisions which are not clearly related to any of the obligations in the space treaties. A few of these will be of interest to the student of space law for their novelty or relevance to frequently asked questions. This section of addresses such provisions first in Kazakhstan's law, with a special subsection for the administration of Baikonur, and then the provisions in Turkmenistan's law.

#### A. Miscellaneous Provisions in Kazakhstan

# i. Generally

Initially Kazakhstan's Law on Space Activity requires that if a treaty which Kazakhstan ratifies "establishes other rules than those contained in this Law, the rules of the international treaty will apply."<sup>191</sup> It is not clear that any of the rules in the major space treaties do contradict that statute, but it may be possible that a bilateral treaty would, as between two States, such as, for example, the 1994 Lease Agreement concerning Baikonur. In such a situation, simple ratification by the President would be enough to override the statute. However, it is not clear on the face of the law that a treaty like the 1994 Lease Agreement would undo the statute's requirements as they might apply to interested parties from third States not party to the relevant treaty.

Private financing of space activity is not always permitted in every country.<sup>192</sup> However, Kazakhstan permits financing of space activities both "at the expense of budgetary funds and other sources not prohibited by" Kazakhstani law.<sup>193</sup>

<sup>&</sup>lt;sup>191</sup> Kazakhstan's Law on Space Activity, *supra* note 40, art. 2 § 2.

 $<sup>^{192}\;</sup>$  See Packard, supra note 45, at 129-33 (discussing financing of space activity under Russian law).

<sup>&</sup>lt;sup>193</sup> Kazakhstan's Law on Space Activity, *supra* note 40, art. 7.

# ii. Administration of Baikonur

Kazakhstan formally leased Baikonur to Russia in 1994. Kazakhstan's Law on Space Activity does not have much to say about the city, settlements, launch complex and other facilities bundled up under that name. That statute notes that the "Baikonur cosmodrome is an integral part of the space infrastructure and includes technical, launching, landing complexes, [and] land areas intended for the preparation and launch of space objects."<sup>194</sup> The statute also forbids privatization of the cosmodrome.<sup>195</sup>

However, the authorities governing the cosmodrome go far beyond that. The 1994 treaty was the result of long, tense negotiations.<sup>196</sup> In 2001, acting on a petition from local authorities, Kazakhstan's Constitutional Council determined that the 1994 Lease Agreement was partially unconstitutional. That is, assigning Russian jurisdiction over Kazakhstan's territory and citizens violated the constitution.<sup>197</sup> So, the 1994 Lease Agreement had to be amended.<sup>198</sup> In practice, there have been several agreements, memoranda and amendments between 1994 and the present day, and it is easy to get them confused. <sup>199</sup>

By 2010, Kazakhstan had jurisdiction in situations: implicating the constitutional rights (including those endangered in criminal prosecutions) of Kazakhstani citizens; land relations; banking; ecological and environmental matters; and protection of "social

<sup>&</sup>lt;sup>194</sup> Id. at art. 23 § 1.

<sup>&</sup>lt;sup>195</sup> Id. § 2.

<sup>&</sup>lt;sup>196</sup> Mira Zh. Kulikpayeva, Возвращаяь к Научной Публикации К.Ю.Н. Доцента Ж.О. Кулжабаевой "Международно-Правовое Обеспечение Космодрома 'Байконур" [Returning to the Scientific Publication of the Candidate of Juridical Sciences, Docent Zh. O. Kulzhabayeva, "International-Legal Support of the Baikonur Cosmodrome"], No. 3 (57) Вестник Института Законодательства и Правовой Информации РК [Bulletin of the Institute of Legislation and Legal Information of the Republic of Kazakhstan], 191, 192 (2019).

<sup>&</sup>lt;sup>197</sup> Id. at 193.

 $<sup>^{198}</sup>$  Id

<sup>&</sup>lt;sup>199</sup> See generally V.V. Timofeev, Характеристика проблемных вопросов взаймодействая органов исполнительной власти Российской Федерации и государствнных органов Руспублики Казахстан, функционирующих на территории г. Байконура [The characteristic[s] of Problem Questions of Interaction of Enforcement Authorities of the Russian Federation and the State Structures of the Republic of Kazakhstan Functioning on the Territory of the City of Baikonur], Вестник Владимирского Юридического Института No. 1 (14) 147-152 (2010).

guarantees" of Kazakhstani citizens.<sup>200</sup> In all other situations, Russian legislation applies.<sup>201</sup> In particular, Russian military and civilian personnel, and their families are under Russian jurisdiction.<sup>202</sup> If and when a Russian prosecuting agency investigates a crime implicating the constitutional rights of Kazakhstani citizens, it must (after the preliminary investigation and inquiries) turn transfer the case to the Kazakhstani authorities.<sup>203</sup> However, if a citizen of one State commits a crime "against the bases of the constitutional order and security of the other State," then the competent organs of the other State may act.<sup>204</sup>

The population of the Baikonur area is mostly Russian citizens.<sup>205</sup> In theory, the population can self-govern through referendums, though none had occurred at least up to 2010.<sup>206</sup> Also, typically the Russian government picks the city administration with input from the Kazakhstani head of the administration.<sup>207</sup> In addition to that pervasive level of control, the Russian government played a primary role in the operation of some, if not most, schools and all of the hospitals in Baikonur.<sup>208</sup> Active Kazakhstani State organs in Baikonur, specifically contemplated by the governing international agreements, include: courts; prosecutors; the national aerospace agency; a special representative of the President of Kazakhstan; a committee on State property; a branch of the Kazakhstani State bank; a military komissariat;209 and a representative of the Kazakhstani Ministry of Internal Affairs.<sup>210</sup> Other active Kazakhstani State organs, not expressly mentioned in a treaty, include a customs committee, and a State pension agency.<sup>211</sup>

 $^{211}$  Id.

<sup>&</sup>lt;sup>200</sup> Id. at 147.

 $<sup>^{201}</sup>$  *Id*.

<sup>&</sup>lt;sup>202</sup> Id. at 148.

<sup>&</sup>lt;sup>203</sup> *Id.* at 149.

 $<sup>^{204}</sup>$  Id.

<sup>&</sup>lt;sup>205</sup> Т. Zh. Imash, Комплекс "Байконура"- Главная Платформа Казахстанско-Российского Сотрудничества в Освоении Космоса [The Baikonur Complex – The Main Platform for Kazakh-Russian Cooperation in the Exploration of Space], Постсоветские Исследование [Post-Soviet Research], Т.2, No. 3, 1085, 1087 (2019).

<sup>&</sup>lt;sup>206</sup> Timofeev, *supra* note 199, at 149.

<sup>&</sup>lt;sup>207</sup> Id. at 148-49.

 $<sup>^{\</sup>scriptscriptstyle 208}\,$  Imash, supra note 205, at 1088.

 $<sup>^{\</sup>rm 209}\,$  This is not to be confused with a "commissary." This is a military administrative committee.

<sup>&</sup>lt;sup>210</sup> Imash, *supra* note 205, at 150.

Over the years, Kazakhstan has pushed for an expanded role for its agencies in Baikonur, rejecting a Russian interpretation of the relevant treaties that limited that role.<sup>212</sup> The current result is a unique situation with several unresolved questions.<sup>213</sup>

The two States have extended the term of the lease to 2050, but Russia is building other facilities elsewhere that may render further extensions pointless.<sup>214</sup> Still, Russia has publicly asserted that it intends to use Baikonur through at least 2030, and to conduct launches at least through 2023.<sup>215</sup>

#### B. Miscellaneous Provisions in Turkmenistan

As in Kazakhstan, Turkmenistan's Law on Space Activity provides that if an international treaty "establishes other rules than those provided for by this Law, the rules of the international treaty shall apply."<sup>216</sup> Financing of space activity happens "on the basis of the National Space Program of Turkmenistan, by forming a State order...."<sup>217</sup> However, "extrabudgetary sources of financing, including own funds and foreign investment" are permissible "if this does not contradict the objects of the project in the field of space activit[y]."<sup>218</sup> Also, in case this was not automatically clear under other Turkmenistani law, legal protection of the results of "intellectual activity" obtained from the development or use of space technology and objects is protected by other Turkmenistani law.<sup>219</sup>

#### IX. CONCLUSION

The foregoing is the State of national space legislation in Central Asia as of 2021. Turkmenistan's legislation is a first step toward regulating and encouraging a domestic space industry. However, that legislation is written in broad strokes, and leaves many details vague. Kazakhstan appears to have taken a more deliberate approach, filling in far more detail with respect to space activities,

<sup>&</sup>lt;sup>212</sup> See id. at 150-52.

<sup>&</sup>lt;sup>213</sup> Timofeev, *supra* note 199, at 152.

<sup>&</sup>lt;sup>214</sup> Kulikpayeva, *supra* note 155, at 181.

 $<sup>^{\</sup>scriptscriptstyle 215}\,$  Imash, supra note 205, at 1091.

<sup>&</sup>lt;sup>216</sup> Turkmenistan's Law on Space Activity, *supra* note 47.

<sup>&</sup>lt;sup>217</sup> Id. at art. 29, § 1.

 $<sup>^{218}</sup>$  Id. at art. 29 § 2.

<sup>&</sup>lt;sup>219</sup> *Id.* at art. 31.

likely drawing on its experiences related to Baikonur. The future is likely to bring change to both nations' laws, if Russia eventually departs Baikonur and Kazakhstan seeks new customers for the services that facility will still offer, and if Turkmenistan becomes more seriously engaged in space activity.

In one other Central Asian State, Uzbekistan (located between the two States discussed in this article), the Legislature discussed two competing drafts of its own Law on Space Activity in late 2019.<sup>220</sup> Neither had been adopted by the end of 2021, but, also in late 2019, the President of Uzbekistan did establish a Space Research and Technology Agency (in English named "Uzbekspace," and in Russian "Узбеккосмос") under the authority of the Cabinet of Ministers.<sup>221</sup> So, the region's interest in space law is only growing.<sup>222</sup>

A positive sign for the region is that both Kazakhstan and Turkmenistan more or less acknowledge that private funding (if not always operation) of space activity is possible, though neither appears to encourage private space activity in any clear way on the face of their laws. Also, it appears that both States have fully implemented their obligations under the Liability and Registration Conventions. Kazakhstan has also taken legal steps to fulfil its environmental and responsibility obligations under the Outer Space Treaty. However, both States restrict the notion of "cosmonaut" to only their own citizens, which leads the author to question their interpretations of their obligations under the Rescue Agreement and the relevant portions of the Outer Space Treaty. Also, both States leave many questions unanswered or vague in the realm of

<sup>&</sup>lt;sup>220</sup> See Проект – Закон Республики Узбекистан О Космической Деятельности [Bill – Law of the Republic of Uzbekistan on Space Activity], September 25, 2019, https://regulation.gov.uz/ru/document/7664 (last visited July 31, 2021); Проект – Закон Республики Узбекистан О Космической Деятельности [Bill – Law of the Republic of Uzbekistan On Space Activity], March 15, 2019, https://regulation.gov.uz/ru/document/2583 (last visited July 31, 2021). Since that law has not clearly been finalized, it was not considered for this article. However, the reader may wish to note that both versions define outer space as beginning being above 100 kilometers above sea level. *Id.* at art. 3 (in both versions).

<sup>&</sup>lt;sup>221</sup> Overview, The Space Research and Technology Agency under the Cabinet of Ministers of the Republic of Uzbekistan, https://uzspace.uz/en/page/overview (last visited July 31, 2021).

<sup>&</sup>lt;sup>222</sup> The author did investigate whether Tajikistan or Kyrgyzstan has adopted a law on space activity in recent years, but it appears that neither has done so, at least not in a form discoverable in the English or Russian languages.

responsibility. Either way, it is encouraging to see both States step out of the shadow of their Soviet past and take their own approaches to regulating humanity's future in space.

# FROM EUSPA TO A NEW UNITED NATIONS AGENCY TO COORDINATE GNSS-EO-TELECOMMUNICATION SYSTEMS

# Ivan Fino\*

# ABSTRACT

Global navigation satellite, Earth observation and telecommunication systems (GNSS-EO-Telecommunication) have created new possibilities for the economic development and political-strategic use of outer space. This has led several spacefaring nations and international organizations to redefine their space strategies. Europe in particular decided to reduce the European Space Agency's (ESA) responsibilities in the field of GNSS-EO-Telecommunication and entrust these activities to the European Union Agency for the Space Programme (EUSPA), established by EU Regulation 2021/696.1 Doubts immediately arose about the mutual relationship and the international roles of ESA and EUSPA with regard to GNSS-EO-Telecommunication systems and the duty and responsibility to comply with obligations arising from the legal regime of outer space. In particular, this division of space responsibilities presented new questions about the role of the European Union (EU) as an international entity engaged in space activities. To formally

<sup>\*</sup> Ivan Fino has been conducting research in the field of space law for several years and has produced several leading scientific publications and articles. He has worked and researched space mining, participated in the debates surrounding the creation of a new legal regime for exploiting space resources, and proposed a system based on a legal trust model. He is an SGAC mentor and organizer of the First SGAC x ECSL Model UN COPUOS. He will be a rapporteur at the artificial intelligence session of the IISL Colloquium at the 73rd International Astronautical Congress

<sup>&</sup>lt;sup>1</sup> Comm'n Reg. Regulation 2021/696 of the European Parliament and of the Council of 28 April 2021 establishing the Union Space Programme and the European Union Agency for the Space Programme and repealing Regulations (EU) No 912/2010, (EU) No 1285/2013 and (EU) No 377/2014 and Decision No 541/2014/EU O.J. (L170) 69 [here-inafter Regulation 2021/696].

enjoy this status, the EU should, above all, obligate itself through the international space treaties; however, doubts arise about the legal legitimacy of EU accession to these treaties. This article analyzes the relationship among the EU, ESA and EUSPA in the field of GNSS-EO-Telecommunication systems and the implications of this relationship as viewed through the lens of international space law.

# I. INTRODUCTION

As the role of the European Union Agency for the Space Programme (EUSPA or Agency) in European space activities increases, the opportunity and legal feasibility of European Union (EU) accession to the international treaties governing the activities of States in outer space<sup>2</sup> (International Space Treaties) arises. In fact, some of the International Space Treaties have assimilability clauses that allow intergovernmental organizations to enter into them. This article will investigate which provisions of the international law of outer space, including customary international law and treaty law as ratified by EU Member States, are applicable to satellite navigation, Earth observation and telecommunication systems (GNSS-EO-Telecommunication Systems). Part II provides an introduction to EUSPA. Part III delves into some issues relating to the formation and existence of EUSPA. Part IV looks at how the EU might adapt its role on the international stage and specifically in respect of the

<sup>&</sup>lt;sup>2</sup> For purposes of this article, reference to the international space treaties includes: the 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]; the Agreement on the Rescue of Astronauts, The Return of Astronauts and The Return of Objects Launched into Outer Space, Apr. 22, 1968, 672 U.N.T.S. 119 (Creates an international obligation to render assistance to astronauts in distress.) [hereinafter Rescue Agreement]; the Convention on International Liability for Damage Caused by Space Objects, Mar. 29, 1972, 24 U.S.T. 2389, 961 U.N.T.S. 187 (Covers international liability of States in the launching and attempted launching of space objects.) [hereinafter Liability Convention]; the Convention on Registration of Objects Launched into Outer Space, Jan. 14, 1975, 28 U.S.T. 695, 1023 U.N.T.S. 15 (Handles the international obligations of States when launching and procuring launches of space objects) [hereinafter Registration Convention]; and the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, Dec. 5, 1979, 1363 U.N.T.S. 3 (Governs the Activities of States and their non-governmental actors on the Moon and other celestial bodies. This is the least accepted international space law Treaty) [hereinafter Moon Agreement].

International Space Treaties in light of the EUSPA. Part V lays out the legal obligations that are imposed by customary international law and by virtue of the fact that most EU Member States have acceded to many of the International Space Treaties. Part VI concludes with the suggestion that the EU and EUSPA integration model, with some proposed improvements, could lay the foundations for an international organization to govern and coordinate all GNSS-EO-Telecommunications systems.

Finally, in Part VII the creation of a United Nations (UN) Agency for the Coordination of GNSS-EO-Telecommunication Systems is proposed. The Agency's goal will be to facilitate the twin objectives of: 1) democratization of space for the benefit of all humanity; and 2) reduction of space pollution.

#### II. REGULATION (EU) 2021/696: INTRODUCING EUSPA

For decades, EU space policy has supported the economic, scientific, environmental strategies and interests of individual countries with the European Space Agency (ESA) as the main actor.<sup>3</sup> However, in recent years space has undergone a general transformation: on the economic side there is increased talk of a "new space economy"; and on the political side we have witnessed the creation of various space forces, with the rank of autonomous armed forces.<sup>4</sup>

The European use of space has faced several challenges, including, uniquely, the so-called Brexit and the subsequent exclusion of the United Kingdom from the Galileo and European Geostationary Navigation Overlay Service (EGNOS) systems.<sup>5</sup> From the technological side, the EU recently began to reveal the immense potential for development of space integrated applications to benefit the space value chain, especially regarding downstream

<sup>&</sup>lt;sup>3</sup> Anna Veclani et al., *The Challenges for European Policy on Access to Space*, 11 INSTITUTO AFFARI INTERNATIONALI WORKING PAPERS 22, 2 (July 2011).

<sup>&</sup>lt;sup>4</sup> Matthew Weinzierl, Space, the Final Economic Frontier, 32.2 J. ECON. PERSPECTIVES 173, 174 (Spring 2018).

<sup>&</sup>lt;sup>5</sup> The word 'Brexit' is derived from 'British' and 'exit' and refers to the United Kingdom's decision to leave the European Union (EU), following the referendum on 23 June 2016. Brexit took place on 31 January 2020. Lesley Jane Smith, *The Impact of the United Kingdom Withdrawal from the European Union on Space Law and Activities*, 46 AIR & SPACE L., 289 (2021).

components.<sup>6</sup> Similarly, urgent needs for telecommunications and satellite systems security are emerging.<sup>7</sup>

These economic and strategic factors, along with the need to provide the EU with greater independence in accessing space, prompted the European Commission to adopt a proposal for a regulation on June 6, 2018.8 Following the procedure from Article 289.1 of the Treaty on the Functioning of the EU<sup>9</sup> (TFEU), the proposal had the dual objectives of: 1) establishing the EU's space program; and 2) transforming the European Global Navigation Satellite System Agency (GSA) into the EUSPA.<sup>10</sup> Political agreement between the European Council and the European Parliament on the details of the space program was reached only a year and a half later, on December 16, 2020.<sup>11</sup> In April 2021, the European Council adopted the final text of the space program, which was then approved by the Committee on Industry, Research and Energy (ITRE) and the European Parliament in plenary session.<sup>12</sup> The final act was signed on April 28, 2021, and entered into force on May 12, 2021 as Regulation (EU) 2021/696, which applies retroactively to January 1, 2021.13

Recital 45 of Regulation (EU) 2021/696 states that the main objective of EUSPA is to contribute to the implementation of the EU's space program.<sup>14</sup> The components of the EU space program are delineated in Article 3 of the Regulation and are described as:<sup>15</sup>

<sup>&</sup>lt;sup>6</sup> Among the main initiatives is the "ARTES (Advanced Research in Telecommunications Systems) - IAP (Integrated Applications Promotion) programme", which is dedicated to the development and implementation of integrated applications (*Overview of Integrated Applications Promotion (IAP)*, EU SPACE AGENCY, (2021), https://artes.esa.int/integrated-applications-promotion-iap-overview).

<sup>&</sup>lt;sup>7</sup> Space: EU initiates a satellite-based connectivity system and boosts action on management of space traffic for a more digital and resilient Europe, EU COMMISSION - PRESS RELEASE, (2022), https://ec.europa.eu/commission/presscorner/detail/en/IP\_22\_921.

<sup>&</sup>lt;sup>8</sup> Comm'n Proposal for a Reg. Parliament & Council Establishing Space Programme & Repealing Reg. (EU) No. 912/2010I, (EU) No. 1285/2013, (EU) 377/2014 and Decision 541/2014/EU, 447 FINAL EU COM (June 6, 2018).

<sup>&</sup>lt;sup>9</sup> Consolidated Version of the Treaty on the Functioning of the European Union art. 289.1, 2012 O.J. (C326) 171 [hereinafter TFEU].

<sup>&</sup>lt;sup>10</sup> *Id. See also* TFEU, art. 4.

<sup>&</sup>lt;sup>11</sup> TFEU, *supra* note 9.

 $<sup>^{12}</sup>$  Id.

<sup>&</sup>lt;sup>13</sup> Regulation 2021/696, *supra* note 1.

<sup>&</sup>lt;sup>14</sup> Id. at 76.

 $<sup>^{15}</sup>$  Id. at 92.

1. Galileo, "an autonomous civil global navigation satellite system . . . under civil control, which consists of a constellation of satellites, centres and a global network of stations on the ground, offering positioning, navigation and timing services and integrating the needs and requirements of security;"<sup>16</sup>

2. EGNOS, a "civil regional satellite navigation system . . . which augments and corrects the open signals emitted by Galileo and other GNSS";<sup>17</sup>

3. Copernicus, an Earth Observation (EO) system that provides geoinformation data and services;<sup>18</sup>

4. Space Situational Awareness (SSA) which consists of three sub-components: a space surveillance system (SST), an observational system related to the observation of space weather events (SWE); and the risk monitoring of near-Earth objects NEO;<sup>19</sup> and

5. GOVSATCOM a satellite communications service tasked with providing EU Member States with secure access to satellite communications.<sup>20</sup>

From the list of components of the European Space Program it is clear that EUSPA, unlike the GSA which it succeeded, has the task of "governing" not only the satellite navigation programs of the European Union, but also the activities related to Earth observation and telecommunications activities.<sup>21</sup> The objective of the centralization at EUSPA of the GNSS-EO Telecommunications Systems is to exploit their infrastructural synergies and to better integrate satellite services to the benefit of the market monitoring sectors for the support of new business strategies of research and development (R&D).<sup>22</sup> An additional impetus for the creation of the

 $<sup>^{16}</sup>$  Id.

 $<sup>^{17}</sup>$  Id.

<sup>&</sup>lt;sup>18</sup> *Id.* 

<sup>&</sup>lt;sup>19</sup> See *Id*.

 $<sup>^{\</sup>rm 20}~$  Regulation 2021/696, supra note 1, at 92.

 $<sup>^{21}</sup>$  Id.

 $<sup>^{22}</sup>$  Id. at 92-3 (explaining that the integration of EO-GNSS-Telecommunication systems has applications in precision agriculture, weather forecasting, civil engineering, and, in addition, makes it possible to expand the use of new technologies, such as all digital tachograph, traffic supervision, autonomous driving, and drones, and to ensure secure and seamless connectivity).

EUSPA was the need to ensure the security of these important systems. <sup>23</sup> However, there are still issues to be cleared; principally, there are no clear indications as to how the EU, ESA and EUSPA should relate to each other, and it is therefore uncertain how their relationship will unfold in the coming years. It seems equally likely that in the absence of a straightforward definition of competences, unnecessary overlaps or even "gaps" in competences could emerge.

# III. EUSPA, ESA AND EU: FRAGILE CO-EXISTENCE

#### A. Problems with Integration

Economic, political and, in general, strategic factors, as well as the recent creation of EUSPA, are redefining and fine-tuning the multipolar European space policy.<sup>24</sup> The mutual competencies and challenges with integration of ESA and EUSPA will need to be driven by the need to promote the role of the EU as a protagonist of space activities, are just some of the issues to be addressed.<sup>25</sup>

The relationship between the ESA and EUSPA can be finessed in different and almost opposite ways. Scholars suggest some solutions, including that of having the European Union adhere to the 1975 Paris Convention establishing the ESA.<sup>26</sup> Conversely, it has been proposed, as envisaged in the White Paper of November 1,

<sup>&</sup>lt;sup>23</sup> See generally, Regulation 2021/696, *supra* note 1 (noting that the security of the components of the European space program is one of the primary objectives of Regulation (EU) 696/2021, as reflected in Articles 3-5, 14, 24, 29, and Chapter I of Title V).

<sup>&</sup>lt;sup>24</sup> Ugo Draetta et al., 'Scritti in Onore di Ugo Draetta (2011) 388 (noting that the evolution of European space policy has been defined as "bicephalous" by Sergio Marchisio, Professor of International Law at the Sapienza University of Rome).

<sup>&</sup>lt;sup>25</sup> Regulation 2021/696, *supra* note 1, at 92 (listing the objectives of the European Space Program and stressing the importance of "promoting the role of the Union as a global player in space... and enhancing its role in addressing global challenges...").Jeff Frost, *EU and ESA Proclaim "Fresh Start" in Space Cooperation*, SPACE NEWS (June 23, 2021), https://spacenews.com/eu-and-esa-proclaim-fresh-start-in-space-cooperation/ (noting that the Financial Framework Partnership Agreement (FFPA) of June 22, 2021 between ESA and the EU occurred just over a month after the creation of EUSPA and intended to clarify a number of knots that are not yet fully unraveled between ESA, the EU, and EUSPA. To date, the contents of this FFPA have not been made public).

<sup>&</sup>lt;sup>26</sup> See Draetta et al, *supra* note 24. Not all EU Member States are members of the Space Agency and vice versa. The European Space Agency is a completely independent organization although it maintains close links with the EU, with which it shares a common strategy in the field of space-related activities. The analysis of the consequences of the possible accession of the EU to the 1975 Paris Convention establishing ESA will be developed later.

2003<sup>27</sup> and the Agenda 2011,<sup>28</sup> to integrate ESA more fully into the EU by transforming it into an operational EU agency.

There are several asymmetries between the ESA and the EU that would make this integration path difficult.<sup>29</sup> Although the ESA is primarily funded by the EU and its Member States, it is not an agency of the EU, but an independent international organization.<sup>30</sup> Furthermore, the ESA Convention, which entered into force on October 30, 1980, includes 22 States parties, three of which are not EU members: the United Kingdom, Norway and Switzerland.<sup>31</sup> On the other hand, not all EU Member States have joined the ESA Convention, including Bulgaria, Cyprus, Croatia, Latvia, Lithuania, Malta and Slovakia.<sup>32</sup> This asymmetry between EU Member States and ESA State Parties, which is more pronounced after Brexit, may call into question the reliability of the security components of GNSS-EO-Telecommunication Systems, which are aimed at ensuring the strategic autonomy of the EU and are fundamental to its defense.<sup>33</sup>

The integration of the ESA into the EU could be made even more hostile due to the discordance of the financial rules, especially the irreconcilability of the mechanisms of the ESA's geographic fair return and the EU's most economically advantageous offer.<sup>34</sup>

<sup>&</sup>lt;sup>27</sup> Commission White Paper on Space: A New European Frontier for an Expanding Union - An Action Plan for Implementing the European Space Policy, 673 Final EU COMM'N (Nov. 11, 2003)[hereinafter Commission White Paper].

 $<sup>^{28}\,</sup>$  ESA Director General and the ESA Directors, ESA AGENDA 2011 (Dorothea Danesy ed., 2007).

<sup>&</sup>lt;sup>29</sup> Andrew Drwiega, *EU Looks to Optimise for Greater Strategic Autonomy*, ARMADA INT'L, (Apr. 29, 2021), https://www.armadainternational.com/2021/04/eu-looks-to-optimise-for-greater-strategic-autonomy/.

 $<sup>^{30}</sup>$  Id.

<sup>&</sup>lt;sup>31</sup> European Space Agency, CONVENTION FOR ESTABLISHMENT EUR. SPACE AGENCY, May 30, 1975, 1297 U.N.T.S. 161.

 $<sup>^{32}</sup>$  Id.

 $<sup>^{33}</sup>$  Id.

<sup>&</sup>lt;sup>34</sup> In contrast to the European Union, the principle of 'fair return' (sometimes also called the geographical return principle or 'juste retour') applies within the ESA. The current rules are based on what was established in the Council at Ministerial level in 1997, and according to which the ratio between a country's share in the weighted value of contracts and its share in the contribution paid to the Agency must be equal to X per cent by the end of a given period. This ratio is called the industrial performance coefficient. In the Communication from the Commission to the Council and the European Parliament entitled "Establishment of appropriate relations between the European Union and the European Space Agency" (COM/2012/0671 final), under point 2.1, entitled "Discordance of financial rules", it is stated that "The management of EU funding

Moreover, the ESA would have no financial and political accountability to the EU, as no formal link between the ESA and the European Parliament is envisaged by any proposals<sup>35</sup>

As the process of integrating ESA into the EU proves too difficult to achieve, it would be desirable to at least consider a different configuration of relations between ESA and EUSPA in order to improve mutual integration.<sup>36</sup> Starting from the components of the European space program (Galileo, Copernicus, EGNOS and GOVSATCOM),<sup>37</sup> there is a real risk that the unclear definition of management, control and evaluation competencies between ESA and EUSPA could hinder the efficient integration between the components of the European space program, to the detriment of operability, the commercialization of services and the objective analysis and study of costs and benefits.<sup>38</sup>

According to some, a redefinition of ESA as a future agency for scientific collaboration is in the making, with EUSPA instead covering all tasks related to security and defense.<sup>39</sup> In fact, the lack of scrutiny of the EU's contribution to ESA by the European Parliament, and the asymmetry in the formation of the ESA and EU will make it increasingly difficult to support the need for Member States to invest in ESA to support security policies.<sup>40</sup>

by ESA is too complex given the fact that the European Union and ESA have different rules which must co-exist within ESA. ESA's largest programmes are funded primarily through Member States' subscriptions. The industrial procurement for those programmes follows the objective of geographical return and ESA financial procedures are primarily designed to fit this rule. For the implementation of EU programmes ESA is obliged to follow EU rules and the strict principle of best value embodied in the EU Financial Regulation3. This has given rise to difficulties, particularly whenever programmes are funded through mixed ESA and EU appropriations."

<sup>&</sup>lt;sup>35</sup>Earth From Space: United Europe, EUR. SPACE AGENCY, (Dec. 6, 2009), https://www.esa.int/Applications/Observ-

ing\_the\_Earth/Earth\_from\_Space\_United\_Europe#:~:text=Alt-

hough % 20 ESA % 20 and % 20 the % 20 EU % 20 have % 20 no % 20 formal, aim % 20 to % 20 streng then % 20 Europe % 20 and % 20 benefit % 20 its % 20 citizens.

<sup>&</sup>lt;sup>36</sup> Commission White Paper, *supra* note 27, at 11.

<sup>&</sup>lt;sup>37</sup> EU SPACE Programme Overview Factsheet, EUR. COMM'N, https://ec.europa.eu/defence-industry-space/eu-space-policy/eu-space-programme\_en., (last visited Nov. 2, 2021).

<sup>&</sup>lt;sup>38</sup> Id.

<sup>&</sup>lt;sup>39</sup> See Nina K. Witjes, Shifting Articulations of Space and Security: Boundary Work in European Space Policy Making, 30 EUR. SEC. 526, 538 (2021).

 $<sup>^{40}</sup>$  Id. at 539.

#### B. An Institutional Solution

Considering the many difficulties that would arise from the integration of ESA into the EU, both political, financial and institutional, a solution could be to assign EUSPA greater management and control powers over the EO-GNSS and telecommunications components.<sup>41</sup> Only an agency under the direct control of the EU would be able to achieve the political, economic and strategic objectives of the European Space Program, dealing exclusively with the design and development of the security and defense components.<sup>42</sup> On the other hand, the use of ESA know-how would remain a mandatory choice for space exploration activities.<sup>43</sup> Moreover, it is possible that EUSPA will receive additional mandates and in any case, continuous supervision by the Commission, as well as a quadrennial evaluation of costs and benefits, would ensure effective control on all EUSPA activities.<sup>44</sup> Last but not least, while the ESA would maintain its nature as an independent organization, it could also act on a contractual basis as a mere implementing body of the EU for space.<sup>45</sup> Finally, this proposal would also offer the advantage of anticipating future developments and facilitating EU participation in the International Space Treaties.

This proposed institutional model can be more succinctly described as one in which: 1) EUSPA would be able to obtain total control and management of the components of the European space program and exclusive control of the research and development of the security components (entrusting this last task to a group of European companies<sup>46</sup>); 2) ESA would limit itself to pursue the objectives of research, design and development in relation to the activities of peaceful use and exploration of outer space and celestial bodies.

 $<sup>^{\</sup>rm 41}$   $\,$  Id. at 16.

 $<sup>^{42}</sup>$  Id.

<sup>&</sup>lt;sup>43</sup> See Witjes, supra note 39.

 $<sup>^{44}</sup>$  Id. at 541.

 $<sup>^{45}</sup>$  *Id*.

<sup>&</sup>lt;sup>46</sup> Thierry Breton, Speech by Comm'r Thierry Breton 13<sup>th</sup> Eur. Space Conf. (Jan. 12, 2021) (transcript available online at https://ec.europa.eu/commission/commission-ers/2019-024/breton/announcements/speech-commissioner-thierry-breton-13th-euro-pean-space-conference\_en.) (laying out the idea of forming a "European Launcher Alliance").

# IV. THE INSTITUTIONAL SOLUTION AND EU ADAPTATION

#### A. EU and Treaty Participation

An unprecedented scenario would open up for European space policy if the institutional model proposed above were to be implemented.<sup>47</sup> The European Union would need to redefine its role as an international organization directly implementing and executing space activities. Even after the Lisbon Treaty,<sup>48</sup> it is doubtful that the EU has this mandate or ability. Under the proposed institutional model, in which the EU assumes a greater commitment in carrying out space activities, it would be desirable that the organization also take responsibility and obligate itself internationally by acceding to the International Space Treaties. In order to understand the legal feasibility of the aforesaid option, as well as the one outlined above regarding the accession to the Paris Convention of 1975 establishing the ESA,<sup>49</sup> it is necessary to mention some preliminary considerations on the legitimacy of the EU to conclude international agreements.<sup>50</sup>

First, Title VI, Article 47 of the Treaty on European Union, expressly recognizes the legal personality of the EU, formally confirming its international subjectivity.<sup>51</sup> Therefore, the EU has the power to act "externally" not only through agreements, but also

<sup>&</sup>lt;sup>47</sup> See *id*.

<sup>&</sup>lt;sup>48</sup> Treaty of Lisbon Amending the Treaty on European Union and the Treaty Establishing the European Community, Dec. 13, 2007, 2007 O.J. (C306) 1 (hereinafter Treaty of Lisbon). The Lisbon Treaty clarifies the division of competences between the EU and the Member States. These competences are divided into three main categories: exclusive EU competences, shared competences and supporting competences.

Another novelty concerns the power of initiative: the Commission can submit proposals to regulate or supplement space activities.

The entry into force of the Lisbon Treaty has enshrined the EU's competence in space matters, without prejudice to that of the Member States. This point will be discussed in the following paragraphs.

<sup>&</sup>lt;sup>49</sup> Convention for the Establishment of a European Space Agency, May 30, 1975, 1297 U.N.T.S 186 (hereinafter Paris Convention).

<sup>&</sup>lt;sup>50</sup> The Role of the Council in International Agreements, COUNCIL EUR. UNION, https://www.consilium.europa.eu/en/council-eu/international-agreements/# (last visited Nov. 3, 2021).

 $<sup>^{51}</sup>$  Consolidated Version of the Treaty on European Union and the Treaty on the Functioning of the European Union art. 47, 2016 O.J. (C202) 41.

through other forms provided by international law.<sup>52</sup> The EU can also enter into non-binding acts, such as Memoranda of Understanding, and can adopt any kind of political position on the international stage. It can also be a party to international litigation.<sup>53</sup>

In general, agreements with third countries or international organizations are the instrument through which the EUs policies can be fully expressed, contributing to the concrete affirmation of the EU's international subjectivity.<sup>54</sup> The power to enter into agreements with third countries or international organizations, as an instrument of expression of EU policies, was formally recognized by the Treaty of Lisbon in Article 216 of the TFEU<sup>55</sup>. The provision of the Article broadens the treaty-making powers of the European Community,<sup>56</sup> although it must also be considered that the provision of Article 216 constitutes a consolidation of previous case law.<sup>57</sup>

Article 216.1 of the TFEU enumerates four cases in which the Union may conclude international agreements:

1. when the Treaties so provide;

2. when the conclusion of an agreement is necessary to attain, within the framework of the Union's policies, one of the objectives of the Treaties;

3. if the conclusion of an agreement is provided for in a legally binding act of the Union; and

4. if the conclusion of an agreement may affect common rules or alter their scope.  $^{58}$ 

<sup>&</sup>lt;sup>52</sup> FAQ EU Competences and Commission Powers, EUR. UNION, https://europa.eu/citizens-initiative/faq-eu-competences-and-commission-powers\_en#EU-competences, (last visited Nov. 3, 2021).

<sup>&</sup>lt;sup>53</sup> Id.

<sup>&</sup>lt;sup>54</sup> ROBERTO ADAM & ANTONIO TIZZANO, LINEAMENTI DI DIRITTO DELL'UNIONE EUROPEA 383-387 (2019).

<sup>&</sup>lt;sup>55</sup> TFEU, *supra* note 9, art. 216.

<sup>&</sup>lt;sup>56</sup> Marise Cremona, OXFORD GUIDE TO TREATIES 119 (Duncan B. Hollis ed., 2nd ed. 2020).

<sup>&</sup>lt;sup>57</sup> According to the Court of Justice of the European Union, the provision of Article 216 constitutes a consolidation of previous case law (Opinion 1/13, 1980 Hague Convention, EU:C:2014:2303, par. 67)

<sup>&</sup>lt;sup>58</sup> TFEU, *supra* note 9, art. 216.1.

Despite its wording, Article 216.1 does not constitute an attribution of competence. According to Article 5.2 of the TFEU, the EU can only act on competences that have been conferred upon it by Member States;<sup>59</sup> therefore, the competence to conclude an international agreement and the scope of this competence must be derived from the provisions relating to the EU's' policies in conjunction with the specific provisions contained in Articles 2, 3 and 4 of the TFEU.<sup>60</sup>

Moreover, Article 216.1 states that the EU may conclude international agreements not only when the Treaties explicitly provide for it, but the EU has the power to exercise its competence by entering into international commitments in matters where it has exclusive and shared competence.<sup>61</sup> This orientation has been confirmed by the Court of Justice of the European Union, when it clarified that exclusive competence is only one of the situations in which the Union can exercise its ability to conclude international treaties.<sup>62</sup> In principle, it can be said that there is real parallelism between internal and external competencies since whenever the EU's institutions have internal competence, they also have a specular external competence, irrespective of the existence of provisions to establish external competence.<sup>63</sup>

The question remains about the abstract ability of the EU to participate in the International Space Treaties and other international agreements on space matters. First of all, there is no provision in the Treaties of the EU which gives its institutions the power to enter into international agreements on space matters (unlike in some areas, i.e., the common commercial policy (TFEU Article 207.3) or the implementation of the cooperation and development

<sup>&</sup>lt;sup>59</sup> *Id.* at art. 5.2.

<sup>&</sup>lt;sup>60</sup> *Id.* at arts. 2-4.

<sup>&</sup>lt;sup>61</sup> *Id.* at art. 216.1. *See* Manuel Kellerbauer et al., The EU TREATIES AND THE CHARTER OF FUNDAMENTAL RIGHTS: A COMMENTARY 1646 (2019).

<sup>&</sup>lt;sup>62</sup> Case C-600/14, Germany v. Council, ECLI:EU:C:2017:935, ¶¶ 50-51 (Dec. 5, 2017).

<sup>&</sup>lt;sup>63</sup> ADAM & TIZZANO, *supra* note 54 at 395. *See EU Powers and Competences*, EUR-LEX GLOSSARY OF SUMMARIES, https://eur-lex.europa.eu/summary/glossary/community\_powers.html (last visited Nov. 1, 2021, 12:30 PM) (explaining that where Treaties assign explicit powers to the EU in a particular area, it must also have similar powers to conclude agreements with non-EU countries in the same field).

policy (TFEU Article 209)).<sup>64</sup> Since EU institutions can sign international agreements on a given matter, not only when expressly provided for by specific provisions, but also as a consequence of an internal competence, it must be verified both whether such internal competence in space matters actually exists and how it is formulated.<sup>65</sup>

Space is mentioned in Article 4 of the TFEU, which deals with competing or shared competences, in respect of which both the Union and the Member States may legislate.<sup>66</sup> Space is not included in the list from Article 4.2 of the TFEU, where matters of shared competence are listed; but is instead mentioned in the following paragraph:<sup>67</sup> "in the fields of research, technological development and space, the Union shall have the competence to carry out actions, in particular, to define and implement programs, and the exercise of this competence shall not have the effect of preventing Member States from exercising theirs."<sup>68</sup> This provision also excludes a priori the principle of pre-emption, which usually applies in matters of shared competence.<sup>69</sup>

The construction of the provision in Article 4.3 of the TFEU is taken to further consequences by the provision in Article 189.2 of the TFEU, which prevents any form of harmonization of the laws and regulations of Member States.<sup>70</sup> The competence of the EU in space matters can therefore be defined as *sui generis* or "parallel".<sup>71</sup>

The competence of the EU in space matters, being parallel, and therefore in some ways falling within the category of competing competences,<sup>72</sup> would allow the signing of international

<sup>&</sup>lt;sup>64</sup> See Dimitris Liakopoulos, The Future of the European Space Agency-EU relationship: Critical Aspects and Perspectives, 25 no. 2 EUR. J. CURRENT LEGAL ISSUES (2019), http://webjcli.org/index.php/webjcli/article/view/649/919.

<sup>&</sup>lt;sup>65</sup> See EU Powers and Competences, supra note 63.

<sup>&</sup>lt;sup>66</sup> TFEU, *supra* note 9, art. 4.

<sup>&</sup>lt;sup>67</sup> See id.

 $<sup>^{68}\;</sup>$  TFEU, supra note 9, art. 4.3.

 $<sup>^{69}</sup>$  Id. According to the principle of pre-emption, as per Article 2.2 of the TFEU, the exercise by the Union of shared competence prejudices this possibility for the Member States; the competence of the EU on that matter therefore becomes exclusive. TFEU, supra note 9, art. 2.2.

<sup>&</sup>lt;sup>70</sup> TFEU, *supra* note 9, art. 189.

<sup>&</sup>lt;sup>71</sup> Frans G Von der Dunk, *The European Union and the Outer Space Treaty: Will Twain Ever Meet?*, *in* 50 YEARS OF THE OUTER SPACE TREATY: TRACING THE JOURNEY 75, 82 (Ajey Lele ed., 2017).

<sup>&</sup>lt;sup>72</sup> See *id*.

agreements, international conventions and various non-binding agreements, such as memoranda of understanding. However, the provision of Article 3.2 of the TFEU is considered not applicable, since it is aimed at ensuring the exclusive competence of the Union at the international level when it "is necessary to enable [it] to exercise its internal competence, or in so far as its conclusion may affect common rules or alter their scope."<sup>73</sup> The exercise of an exclusive competence by the EU in the sector of outer space, by virtue of the principle of parallelism between internal and external action, would in fact be contrary to Articles 4.3 and 189.2 of the TFEU.<sup>74</sup>

In general, the accession of the EU alone to an international agreement is allowed in areas of exclusive competence;<sup>75</sup> in the event that the treaty concerns areas of shared competence, States are normally called upon to negotiate and ratify agreements jointly with European institutions.<sup>76</sup> This is the case with the so-called "mixed agreements", which have also been endorsed by case law.<sup>77</sup>

Since space competence, although parallel, is nevertheless under the "umbrella" of Article 4 of the TFEU of concurrent competences,<sup>78</sup> it is not entirely certain whether EU Member States should participate in the negotiations and accede to space treaties together with the EU, even when considering that most EU Member States are already parties to almost all the International Space Treaties elaborated by the UN, with the exception of the Moon Agreement of 1979.<sup>79</sup>

 $<sup>^{73}\;</sup>$  TFEU, supra note 9, art. 3.

 $<sup>^{74}~</sup>$  See Von der Dunk, supra note 71.

 $<sup>^{75}</sup>$  See TFEU, supra note 9, art. 3.

<sup>&</sup>lt;sup>76</sup> International Agreements and the EU's External Competences, EUR-LEX, https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=legissum:ai0034 (Apr. 8, 2020).

<sup>&</sup>lt;sup>77</sup> See Case C-246/07, Comm'n v. Sweden, ECLI:EU:C:2010:203, ¶ 73 (Apr. 20, 2010). Mixed agreements may also require the adoption of an internal EU act to allocate obligations between member countries and the EU. In this regard, it should be noted that the EU is also a member of several international organizations including the FAO, WTO and EBRD where there is often a so-called "mixed" situation based on the fact that many competencies are shared between the EU and its Member States [hereinafter OST Parties].

<sup>&</sup>lt;sup>78</sup> See TFEU, supra note 9, art. 4.

<sup>&</sup>lt;sup>79</sup> See Comm. on the Peaceful Uses of Outer Space, Rep. of the Legal Subcommittee on its Sixtieth Session, *Status of International Agreements relating to Activities in outer space as at 1 Jan 2021*, U.N. Doc. A/AC.105/C.2/L.317 (2021) [hereinafter Status of International Space Agreements].

By virtue of the *sui generis* competence of the EU in space matters, which has been defined as "parallel" to that of the Member States, the possibility for the EU to adhere to the International Space Treaties should be considered fully accepted, regardless of the participation of the Member States.<sup>80</sup>

#### B. EU and the International Space Treaties

Having ascertained the legal legitimacy of the EU to accede to the International Space Treaties, it is worth discussing the possible EU accession to the primary International Space Treaty, the 1967 Outer Space Treaty (OST).<sup>81</sup> Although the OST does not express the possibility for intergovernmental organizations to adhere to it, it does contain a number of provisions that should be respected by the EU.<sup>82</sup> Starting from the international subjectivity of the EU, which would require it to comply with the various obligations of customary international law embodied in the OST, it should also be considered that almost all EU Member States are part of the OST, except Croatia and Latvia.<sup>83</sup>

As far as the 1972 Liability Convention and the 1975 Registration Convention are concerned, both contain an assimilation clause.<sup>84</sup> In particular, the first paragraph of Article XXII of the Liability Convention declares:

In this Convention, with the exception of Articles XXIV to Articles XXVII, references to States shall be deemed to apply to any international intergovernmental organization which conducts space activities if the organization declares its acceptance of the rights and obligations provided for in this Convention and if a majority of the States members of the organization are States Parties to this Convention and to the Treaty on Principles Governing the Activities of States in

<sup>&</sup>lt;sup>80</sup> See Von der Dunk, supra note 71.

<sup>&</sup>lt;sup>81</sup> Outer Space Treaty, *supra* note 2.

<sup>&</sup>lt;sup>82</sup> See Von der Dunk, supra note 71, at 85.

<sup>&</sup>lt;sup>83</sup> See OST Parties, supra note 77.

<sup>&</sup>lt;sup>84</sup> Liability Convention, *supra* note 2, art. XXII. Registration Convention, *supra* note 2, art. VII.

the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies.  $^{85}$ 

Similarly, the Registration Convention, in Article VII.1 expresses the following:

In this Convention, with the exception of articles VIII to XII inclusive, references to States shall be deemed to apply to any international intergovernmental organization which conducts space activities if the organization declares its acceptance of the rights and obligations provided for in this Convention and if a majority of the States members of the organization are States Parties to this Convention and to the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies.<sup>86</sup>

The third and fourth paragraphs of Article XXII of the Liability Convention go further, foreseeing the hypothesis in which the international organization is responsible for damage within the meaning of the Convention, establishing the joint and several liability of the organization and those of its Members which are also States parties to the Convention.<sup>87</sup> Any claim for compensation must be forwarded in advance to the organization and, only in the event that the organization is in default, can the injured party invoke the liability of the members which are parties to the Convention.<sup>88</sup>

To summarize and conclude the discussion, the possible accession of the EU to the International Space Treaties finds general legitimacy in the systematic interpretation of various provisions from the TFEU, and particular legitimacy in the treaties that provide for an assimilation clause, such as the Liability Convention and the Registration Convention. If the EU becomes a full-fledged international organization dedicated to the conduct of space activities, it will have the choice to accede to such treaties, the provisions of

<sup>&</sup>lt;sup>85</sup> Liability Convention, *supra* note 2, art. XXII.1.

<sup>&</sup>lt;sup>86</sup> Registration Convention, *supra* note 2, art. VII.

<sup>&</sup>lt;sup>87</sup> Liability Convention, *supra* note 2, art. XXII.3.

<sup>&</sup>lt;sup>88</sup> Id.

which will nevertheless be binding to the extent that they reflect principles of customary international law.<sup>89</sup>

Moreover, regardless of whether the EU chooses to accede to a given International Space Treaty to which its Member States are also parties, the rules of a treaty would still apply indirectly if the Member States conduct space activities within the context of the EU.<sup>90</sup>

Another possible avenue that Europe could pursue to reinforce its role as an international organization dedicated to conducting space activities could be its membership in the UN. Currently, the EU has held permanent observer status at the UN since 1974.<sup>91</sup> Thus, the EU has no voting rights *per se* but is nevertheless represented by its 27 members, with France representing as a member of the Security Council.<sup>92</sup> In this regard, there has been some discussion of proposing that France cede its seat to the EU.<sup>93</sup> This would allow the EU to have more political clout in space matters, as well as strengthen its role as an international organization dedicated to conducting space activities.

# V. INTERNATIONAL OBLIGATIONS ON GNSS-EO-TELECOMMUNICATION SYSTEMS

In the previous section, it was explained that some rules bind the space activities of the EU either because they may reflect principles of customary international law or because they are contained in international treaties to which EU Member States are parties. Therefore, all components of GNSS-EO-Telecommunication systems are subject to customary international law and international treaties that EU States have ratified. Some of the GNSS-EO-Telecommunication systems infrastructures are located on the

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<sup>&</sup>lt;sup>89</sup> See id.

<sup>&</sup>lt;sup>90</sup> See Von der Dunk, supra note 71, at 83.

<sup>&</sup>lt;sup>91</sup> Leigh Phillips, *EU Wins New Powers at UN, Transforming Global Body*, EU Observer (May 3, 2011). While normal observers are not allowed to speak before Member States at the UN General Assembly, the EU was granted the right to speak among representatives of major groups on 3 May 2011.

<sup>&</sup>lt;sup>92</sup> United Nations Security Council, Current Members, https://www.un.org/securitycouncil/content/current-members.

<sup>&</sup>lt;sup>93</sup> E.g., Hajnalka Vincze, One voice, but Whose Voice? Should France Cede Its UN Security Council Seat to the EU?, FOREIGN POLICY RESEARCH INSTITUTE, https://www.fpri.org/article/2019/03/one-voice-but-whose-voice-should-france-cede-itsun-security-council-seat-to-the-eu/ (Oct. 29, 2021, 5:30 PM).

earth's surface, others in space, and others, in the future, may involve facilities between outer space and airspace. However, it is uncertain where the rules on space begin to apply, as no international instrument has, at least until the present time, established the boundary between airspace and outer space.<sup>94</sup> A further element to consider that could result in disharmony in the laws to be applied is the fact that terrestrial infrastructures must be subject to the laws of the nations in which they are located.

# A. Obligations of Customary International Law

The most important principles of customary international law that have direct applicability to the activities of GNSS-EO-Telecommunication systems are codified in Articles I and II of the OST.<sup>95</sup> More specifically, the satellite components of these systems, which are essential to all, are subject to the four basic freedoms set forth in Article I of the OST when conducting on-orbit operations.<sup>96</sup> These are: the freedom of exploration, freedom of use and freedom of scientific investigation.<sup>97</sup>

To say that orbiting satellites of GNSS systems are "subject" to the fundamental freedoms of Article I might seem ambiguous. *Prima facie*, this semantic choice does not clarify whether the freedoms of access, exploration and scientific research are for the benefit of satellite activities, or on the contrary, whether they embody obligations. Indeed, these freedoms both benefit and directly constrain Earth-orbiting satellites. To better understand this, consider the first paragraph of Article I of the OST, which states that the activities of exploration and use are provinces of humankind, i.e., they belong to all humankind without discrimination and on a basis of mutual equality.<sup>98</sup> Admitting that terrestrial orbits are freely usable and accessible both for economic reasons and for scientific research does not intend to exclude any possible limit for these activities. The ancient Roman brocardo "*sic utere tuo ut alienum non* 

<sup>&</sup>lt;sup>94</sup> For a discussion of where space begins *see* Stanley B. Rosenfield, *Where Air Space Ends and Outer Space Begins*, 7 J. SPACE L. 137 (1979). Most of the scholars consider that space begins at an altitude conventionally set at 100 kilometers, beyond which aeronautical flight is theoretically impossible (*See id.* at 138-39).

 $<sup>^{95}</sup>$  Outer Space Treaty, supra note 2, arts I and II.

<sup>&</sup>lt;sup>96</sup> Id. at art. I.

<sup>97</sup> Id.

<sup>&</sup>lt;sup>98</sup> Id.

*laedas*,"<sup>99</sup> further elaborated by various authors, e.g., Kant<sup>100</sup>, finds full application in the earth's orbits and thus to all satellite systems. Therefore, the activities of use, research and exploration that take place in outer space must not interfere with, or hinder the same activities carried out by others. In Earth orbits, then, it can be maintained that any constellation of GNSS satellites is required to not hinder the free use of a given orbital area to the detriment of other users.

The content of the provision of Article I is reinforced and, in a sense, is taken to further consequences by the non-appropriation principle of Article II: "Outer 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."<sup>101</sup> The prohibition also includes the extra-atmospheric space itself, such as the vacuum or ether between celestial bodies.<sup>102</sup> The principle of non-appropriation from Article II would therefore be substantiated in a prohibition to exercise any form of exclusive control over space, celestial bodies or portions thereof. Therefore, it excludes both forms of formal claims to sovereignty typical of international law and all other modes of exclusive control, formal or substantive, that are closer to civil law institutions (appropriation and use) or somewhere between civil and international law (occupation).

The question of the prohibition of appropriation arises especially for those orbits where the positioning of satellites is more convenient from a functional point of view.<sup>103</sup> It may be considered, for example, that the massive, indiscriminate and harmful positioning of Earth observation satellites to the detriment of third parties

<sup>&</sup>lt;sup>99</sup> See Overview: sic utere tuo ut alienum non laedas, OXFORD DICTIONARY, https://www.oxfordreference.com/view/10.1093/oi/authority.20110803100504563 (last visited Nov. 3, 2021).

<sup>&</sup>lt;sup>100</sup> "There is only one innate right. Freedom (independence from being constrained by another's choice), insofar as it can coexist with the freedom of every other in accordance with a universal law, is the only original right belonging to every man by virtue of his humanity" (Immanuel Kant, *The Metaphysics of Morals*, ed. Mary Gregor (Cambridge University Press, 2015), 30.

 $<sup>^{\</sup>rm 101}~$  Outer Space Treaty, supra note 2, art. II.

<sup>&</sup>lt;sup>102</sup> Zachos Paliouras, "The Non-Appropriation Principle: The Grundnorm of International Space Law," *Leiden Journal of International Law* 27, no. 1 (2014): 42.

<sup>&</sup>lt;sup>103</sup> See Kelly M. Zullo, *The Need to Clarify the Status of Property Rights in International Space Law*, 90 GEO. L.J. 2413, 2421 (2002).

could constitute an illegitimate occupation of that area as contrary to Article II of the OST.

The obligations arising from the provisions of Articles I and II of the OST are even more relevant if one considers that Earth's orbit is becoming increasingly congested. Some authors have compared Earth orbits to Common Pool Resources (CPR), not subject to the jurisdiction of any State.<sup>104</sup> Concerning the common areas, where everyone has unrestricted access, Garrett Hardin explained that users acting in their own exclusive interests will tend to exploit as many units of a resource as possible, leading to overuse or destruction of that common resource.<sup>105</sup> This, in turn will lead to the destruction of the resource which is well expressed as "the tragedy of the commons."<sup>106</sup> This concept is can also be formalized in terms of game theory, and the concept of Nash equilibrium "where, in general, resources are over-exploited at the Nash equilibria of the CPR dilemma games."<sup>107</sup> At this point, it is necessary to limit the users who have access and keep exploitation within a sustainable limit. This consideration can be applied to the regulation of Earth orbits in general and thus also to satellites that are a component of GNSS-EO-Telecommunications Systems.

In addition to Articles I and II of the OST, GNSS-EO-Telecommunication System satellites, in whatever orbit they operate, are required to: 1) comply with applicable general international

<sup>&</sup>lt;sup>104</sup> Joan Johnson-Freese and Brian Weeden, "Application of Ostrom's Principles for Sustainable Governance of Common-Pool Resources to Near-Earth Orbit," *Global Policy* 3 (2012). For a more in-depth discussion of the Common-Pool Resource concept, see: Ostrom Elinor, *Governing the Commons: The Evolution of Institutions for Collective Action* (Cambridge: Cambridge University press, 1990, 1990); Elinor Ostrom, *The Future of the Commons: Beyond Market Failure and Government Regulations: Beyond Market Failure & Government Regulation* (The Institute of Economic Affairs, 2012).

<sup>&</sup>lt;sup>105</sup> Garrett Hardin, "The Tragedy of the Commons," *Nature* 162 (1968).

<sup>&</sup>lt;sup>106</sup> Daniel Little, *Ostrom's Central Idea*, UNDERSTANDING SOCIETY (JUNE 12, 2012). Ostrom used the term common resource to refer to "a system of natural or manmade resources that is large enough to make it costly (but not impossible) to exclude potential beneficiaries from obtaining benefits from its use."

<sup>&</sup>lt;sup>107</sup> *Id.* It has been emphasized that an efficient allocation of common resources cannot be achieved when the players present act for their own self-interest and are therefore selfish. Over-exploitation of common resources is often associated with open access regimes in which each user of the resource operates independently of all others. The result is a Nash equilibrium of the prisoner's dilemma (Robert Mamada and Charles Perrings, "Entanglement" and the Exploitation of Common Pool Resources: A Quantum Solution to the Prisoner's Dilemma," *International Game Theory Review* 24, no. 1 (2022).

law (Article III of the OST specifically refers to the United Nations Charter);<sup>108</sup> 2) make every effort to avoid harmful interference with other legitimate space activities (Article IX);<sup>109</sup> and 3) share with the international community any relevant scientific information gathered in the context of operations (Article XI).<sup>110</sup>

Other obligations under customary international law to which GNSS-EO-Telecommunication Systems are bound are those arising from the indirect application of Article III. Chief among these is the prohibition again using such systems to exercise the use of force for purposes other than the exercise of the right of self-defense under Article 51 of the United Nations Charter.<sup>111</sup>

Other obligations that bind these satellite systems relate to information and cooperation obligations concerning, for example, the obligation to report any situation about natural disasters or other things observed with GNSS systems. These obligations emerge from a comparative analysis between several treaties and UN resolutions on outer space and various international law sources which address the environmental damage on Earth. In particular:

- Article XI of the OST provides the duty of parties who launch objects into outer space to inform the Secretary-General of the United Nations as well as the public and the international scientific community on the nature, conduct, locations, and results of such objects;<sup>112</sup>
- Article IV of the Convention on Registration of Objects Launched into Outer Space requires that each State of registry shall furnish to the Secretary-General of the U.N. a list of information on registered space object.<sup>113</sup>
- Article 198 of the Montego Bay Convention affirms that when a State becomes aware of cases where the marine

<sup>&</sup>lt;sup>108</sup> Space Treaty, *supra* note 2, art. III.

<sup>&</sup>lt;sup>109</sup> *Id.* at art. IX.

<sup>&</sup>lt;sup>110</sup> *Id.* at art. XI.

<sup>&</sup>lt;sup>111</sup> Id. at art. III. U.N. Charter art. 51.

<sup>&</sup>lt;sup>112</sup> Outer Space Treaty, *supra* note 2, art. XI.

<sup>&</sup>lt;sup>113</sup> Registration Convention, *supra* note 2, art. IV. The information to be provided by the State of Registration is as follows: name of launching State or States; an appropriate designator of the space object or its registration number; date and territory or location of launch; basic orbital parameters; general function of the space object.

environment is likely to be damaged or has been damaged by pollution, it must notify other States that it believes may be affected by such damage, as well as relevant international organizations;<sup>114</sup>

- The Principle 18 of Rio Declaration establishes that States must immediately notify the concerned States of any natural disasters or other emergencies that may produce sudden harmful effects on the environment;<sup>115</sup>
- Article 17 of the International Law Commission draft text of 2001 on the Prevention of Transboundary Harm from Hazardous Activities declares: "The State of origin shall, without delay and by the most expeditious means, at its disposal, notify the State likely to be affected of an emergency concerning an activity within the scope of the present articles and provide it with all relevant and available information".<sup>116</sup>
- The 1986 Convention on Early Notification of a Nuclear Accident (AIEA) provides a notification system for nuclear accidents that may affect another State. In fact, the AIEA area of application includes outer space activities since Article 1 refers to any nuclear reactor wherever located and the use of radioisotopes for power generation in space objects;<sup>117</sup>

On the whole, the customary law of the duties of information and collaboration are confirmed by the International Tribunal for the Law of the Sea in the Mox Plant Case of 2001 (Ireland vs U.K.),<sup>118</sup> and also in the North Sea Continental Shelf Cases in which it is stated that the parties "are under an obligation so to conduct themselves that the negotiations are meaningful, which

<sup>&</sup>lt;sup>114</sup> Convention on the Law of the Sea, Dec. 10, 1982, 1833 U.N.T.S. 397.

<sup>&</sup>lt;sup>115</sup> Rio Declaration on Environment and Development, UN Doc. A/CONF. 151/26 (vol. I), 31 ILM 874 (1992).

<sup>&</sup>lt;sup>116</sup> 2001 Draft Articles on Prevention of Transboundary Harm from Hazardous Activities, UN Doc. A/RES/56/82 (2001), UN Doc A/56/10.

<sup>&</sup>lt;sup>117</sup> 1986 Convention on Early Notification of a Nuclear Accident, 1439 U.N.T.S. 275.

<sup>&</sup>lt;sup>118</sup> The Mox Plant Case (Ireland v United Kingdom), Case No. 10, Order of Dec. 3, 2001, https://www.itlos.org/fileadmin/itlos/documents/cases/case\_no\_10/published/C10-O-3\_dec\_01.pdf.

will not be the case when either of them insists upon its own position without contemplating any modification of it.<sup>119</sup>

# B. Obligations Stemming from the Accession of EU Member States to the International Space Treaties

Since nearly all EU Member States have acceded to the OST, its provisions are also relevant for space activities that are carried out in the context of the EU.

#### i. Outer Space Treaty Article VI

The control of Galileo and EGNOS operations is attributed by Regulation 2021/696 to EUSPA.<sup>120</sup> A few preliminary remarks must be made in this regard. On the one hand, Article VI of the OST affirms that the "appropriate state" is required to authorize and continuously supervise the activities of non-governmental entities in space.<sup>121</sup> EUSPA is a government entity so the statement about supervision and authorization does not apply. On the other hand, Article VI explicitly states that when activities are carried out by an international organization, the responsibility for compliance with OST lies with that organization and the States Parties to the OST that are members of that organization. EUSPA is an agency of the EU and, generally, agencies of the European Union are set up to perform specific tasks under EU law, the work of EUSPA shall be considered the responsibility of the EU. EUSPA and, still less, the EU do not possess all the technologies necessary to ensure that the OST is respected. As mentioned above, the EU is not yet, with all intents and purposes, an intergovernmental body carrying out space activities that in essence lacks concrete tools. EU Member States that are part of the OST would then be indirectly obliged to verify that such activities are carried out in compliance with both the rules of international space law of customary law as well as treaties to which they are signatories (including the OST). Should a private operator one day take over the operation of satellite systems, EU members would be bound to intervene, directly or indirectly through ESA itself or through EU institutions such as

<sup>&</sup>lt;sup>119</sup> Federal Republic of Germany vs. Denmark/ Federal Republic of Germany vs. Netherlands Judgement of 20 February 1969 (ICJ Reports, 1969, par. 85).

<sup>&</sup>lt;sup>120</sup> Regulation 2021/696, *supra* note 1.

<sup>&</sup>lt;sup>121</sup> Outer Space Treaty, *supra* note 2, art. VI.
EUSPA to ensure compliance with the provisions of the OST and customary international space law.

#### ii. Outer Space Treaty Articles VI and VII

Articles VI and VII of the OST address respectively, the international responsibility of States with respect to their registered space objects and the liability of States performing or commissioning space launches.<sup>122</sup> Dwelling on the issue of liability, while Article VII provides for a *sui generis* liability for States, irrespective of any attribution of the tort to the State, Article II of the Liability Convention,<sup>123</sup> obliges launching States to indemnify damages caused on Earth under any circumstances.<sup>124</sup> In both cases, a sort of absolute responsibility is configured. In case of damage caused by a space object on the Earth's surface, to an aircraft in flight, or to space infrastructures, liability arises regardless the damage is a consequence of an action or omission of a State. In other words, the act which caused the damage does not require a showing of malice or even negligence.

## iii. Registration of Space Objects by States Involved in Their Launching.

States are also obliged to register objects that are launched into space, for which they qualified as "launching State(s)."<sup>125</sup> Article VIII contains the principle of jurisdiction, as an expression of the power of the State to enforce national and international law, and the principle of control, as a factual element of State power, over objects launched into space.<sup>126</sup> Finally, the provisions of Article VIII provide clarification to the question of ownership of objects launched into space.<sup>127</sup> This principle is confirmed by the 1975 Registration Convention.<sup>128</sup>

 <sup>&</sup>lt;sup>122</sup> Outer Space Treaty, *supra* note 2, arts. VII and VIII.
<sup>123</sup> See Liability Convention, *supra* note 2, art. II.

<sup>&</sup>lt;sup>124</sup> According to the Liability Convention, Article I, the term "launching State" means: (a) A State which launches or procures the launching of a space object; (b) A State from whose territory or facility a space object is launched.

<sup>&</sup>lt;sup>125</sup> Registration Convention, *supra* note 2, art. IV.

<sup>&</sup>lt;sup>126</sup> Outer Space Treaty, *supra* note 2, art. VIII.

 $<sup>^{127}</sup>$  Id.

<sup>&</sup>lt;sup>128</sup> Registration Convention, *supra* note 2, art.II.2. It expressly confirms the content of Article VIII of the OST by stating that when there are two or more launching

From the interpretation of Article VIII and from the Registration Convention, it is clear that States have two obligations: on one hand, they have to register space objects in a national registry, and on the other hand, they have to provide the UN with a specific set of data for inclusion in an international registry.<sup>129</sup> The GNSS-EO-Telecommunication Systems satellites have been registered by ESA and not by the EU, although the Registration Convention was also open to intergovernmental agencies. However, double registration is not possible.<sup>130</sup>

#### iv. Use of Force

Article IV of the OST expands the prohibition of the use of force contained in Article 2, paragraph 4, of the UN Charter,<sup>131</sup> which is considered by some authors as customary international law.<sup>132</sup> Article IV contains a dual provision on military uses of space. The treaty makes a distinction between the denuclearization of space (contained in Art IV.1 OST), and that of celestial bodies (as regulated by paragraph 2 in Article IV).<sup>133</sup>

As far as GNSS-EO-Telecommunication systems are concerned, Article IV has relevance mainly for the first part. Satellite

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States for a single space object, these States must together determine which of them will register the object in accordance with paragraph 1 of this Article, bearing in mind the provisions of Article VIII of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space.

<sup>&</sup>lt;sup>129</sup> *Id.* at arts. III-V. For the information to be provided by the State of registry to the Secretary-General of the United Nations, see footnote 113.

 $<sup>^{\</sup>rm 130}~$  Id. at art. II.

<sup>&</sup>lt;sup>131</sup> "Members shall refrain in their international relations from the threat or use of force, whether against the territorial integrity or political independence of any State, or in any other manner inconsistent with the purposes of the United Nations." U.N. Charter art. 2(4).

<sup>&</sup>lt;sup>132</sup> Władysław Czapliński, "Customary International Law on the Use of Force," Wroclaw Review of Law, Administration & Economics 8, no. 2 (2018): 97–111. For further comments on this issue, see Micheal Wood, "International Law and the Use of Force: What Happens in Practice," Indian Journal of International Law 53 (2013): 345–67.

<sup>&</sup>lt;sup>133</sup> Outer Space Treaty, *supra* note 2, art. IV. This provision establishes a differentiated regime for earth's orbits from the rest of outer space and celestial bodies. On the one hand, it allows States Parties to the Treaty to undertake not to place in orbit around the earth any objects carrying nuclear weapons or other weapons of mass destruction. The placement of conventional weapons in earth orbits is thus permitted. On the other hand, no weapons of any kind may be placed or used on celestial bodies, not even for maneuvers or demonstration purposes.

systems are therefore prohibited from supporting nuclear weapons or weapons of mass destruction.

## v. Environmental Protections

Article IX of the OST contains an initial attempt to provide for the protection of the environment in space.<sup>134</sup> This provision contains two duties: the principle of diligence and the principle of prevention of harmful contamination. These general duties are implemented by some procedural obligations, including a duty to conduct international consultations prior to conducting potentially harmful activities in space. There also exists a corresponding right granted to States to request international consultations in case they learn of a potentially harmful experiment carried out during exploration or other activity by a third State.

Article IX is particularly relevant with to GNSS-EO-Telecommunication Systems activities as regards to orbit clogging and interference with other satellites in observation, navigation and telecommunication operations. To this end, it would be necessary to better integrate the GNSS-EO-Telecommunication Systems of different nations and international organizations (which are progressively increasing in the last two decades) both in order to reduce the amount of space debris and to reduce the same interference between systems.

# VI. TOWARDS THE ESTABLISHMENT OF A NEW INTERNATIONAL AGENCY?

The article will conclude with some final summary considerations and a proposal. Firstly, it would be appropriate for EUSPA, ESA and the EU to better clarify their mutual positions and especially their competences. More direct and efficient control of space operations by the EU would be possible if the latter adhered to international space treaties. In the previous paragraphs it was mentioned that the principles of customary law on outer space and the rules laid down in treaties to which the EU Member States are parties shall be binding with regard to the GNSS-EO-Telecommunication systems components (namely Galileo, EGNOS, Copernicus, GOVSATCOM). Therefore, if the EU acceded to the

 $<sup>^{134}</sup>$  Id. at art. IX.

space treaties, there would be more clarity at the international level about the law applicable to the GNSS-EO-Telecommunication systems components.

In the end, it can be assumed that Earth observation, satellite navigation and telecommunication systems, both taken individually and as a unicum, are capable of performing functions relevant to the economic and social development of human civilization; it would therefore be desirable for GNSS-EO-Telecommunication systems to be more integrated not only at the European level. Generally, GNSS-EO-Telecommunication Systems are managed by national governments and/or regional organizations to which they belong. Only the free use of these systems by the entire human race could effectively realize the clauses of province of humankind, equality and non-discrimination expressed in Article I of the OST, if not, more generally, mostly of the goals of sustainable development established by the United Nations.<sup>135</sup> The EU and EUSPA integration model, with some proposed refinements, could lay the foundations for an international organization to govern and coordinate all GNSS-EO-Telecommunications systems.

The first step of a mutual integration of the different GNSS-EO-Telecommunication systems could be the establishment of an international authority in charge of coordinating the use of these systems. Governments and international organizations that have invested in such systems would not even be forced to relinquish total control of these systems, but only a minor part of their control of them. Another advantage arising from the integration of these systems would be the saving of resources that would result because, very often, some satellites of these systems are able to "cover" the same geographical area. In addition to savings in economic terms, there would be a real saving on orbital slots occupied by these satellites, also in light of the fact that more and more nations are equipping themselves with these systems. Although there is already an authority responsible for the assignment of satellite orbits, the International Telecommunications Union, this organization does not have the structural requirements to coordinate the use of GNSS-EO-Telecommunication Systems. A new international agency under the auspices of the United Nations should be

<sup>135</sup> Id.

established to ensure that GNSS-EO-Telecommunication Systems are used and coordinated for the benefit of humankind.

To ensure that there are no nations or organizations interested in benefiting from such systems without contributing in any way to their management, such an international agency for GNSS-EO-Telecommunication Systems could provide for the payment of fees for access to the network, perhaps based on the actual economic capabilities of the user concerned.

Some problems might arise from the establishment of such an international agency for the coordination of GNSS-EO-Telecommunication Systems, such as the need for some nations or international organizations to use such systems exclusively, due to the danger of possible information theft by enemy powers. Since it would be necessary that the integrated use of GNSS-EO-Telecommunication Systems would take place for the sole purpose of betterment of humankind, it would be essential to create such an intergovernmental agency on the assumptions of internationality of its delegates and that the actual use of the different GNSS-EO-Telecommunication systems would also be controlled by the nations or organizations that own them.

The structure of the international agency for the coordination of GNSS-EO-Telecommunication Systems should first of all consist of:

(a) an assembly to adopt guidelines and procedures for the coordination of operations, to establish the cost of entry into the international GNSS-EO-Telecommunication network or choose which nations to exempt from the payment due to their economic conditions. Decisions on any matter for which the council has competence shall be based on the recommendations of the Council. All States Parties are ipso facto members of the Assembly.

(b) a Council, the executive branch, will oversee the correct functioning of the system and should verify that there is no use of the worldwide GNSS-EO-Telecommunication network for non-peaceful purposes. The Council shall consist of 25 members, elected by the Assembly in the following order: 5 among the 10 States which have the largest investment in the space economy, 10 elected according to the principle of ensuring an equitable geographical distribution of seats, 5 among the developing countries, 5 among the 10 states at the top in the global achievement of the United Nations Goals (which will be fixed every 15 years by United Nations).

Finally, the establishment of an international agency for the coordination of GNSS-EO-Telecommunication Systems would have significant benefits not only for the democratization of outer space but also for the strengthening of international cooperation, in addition to the overall decrease in costs for the implementation of such systems and the reduction of space debris pollution that would result from the multiplication of GNSS-EO-Telecommunication systems by more and more nations and international organizations. As an added benefit, harmful interference between different systems would be reduced.

# THE ROLE OF CUSTOMARY INTERNATIONAL LAW IN FUTURE LUNAR ACTIVITIES

Nivedita Raju and Héloïse Vertadier\*

# ABSTRACT

Once humans have a regular presence on the Moon, numerous legal questions will arise. Some we can predict now, while others we cannot anticipate. Adopting multilateral treaties to address each issue arising from the development of lunar communities entails consensus-based State-oriented decision-making. As this form of law-making appears increasingly unlikely for the future of lunar and space governance, this article considers how stakeholder behavior could eventually form new laws through the creation of what is called a customary international norm. This article explores what international customs are, where they take their binding force from and why they would be an interesting way to regulate future human communities in space. We will present examples of the use of international customs in lunar-related activities and review whether we can consider as custom: (1) the Artemis Accords, and (2) the purchase of lunar regolith by the National Aeronautics and Space Administration (NASA).

<sup>\*</sup> Nivedita Raju is a Researcher at Stockholm International Peace Research Institute (SIPRI). She specializes in space security and also conducts outreach on disarmament education. In addition, she is Director of Legal Affairs and Research at Space Court Foundation. Previously, she was a Research Fellow at Open Lunar Foundation. Héloïse Vertadier is the project coordinator of the Breaking Ground Lunar Resources Trust created by the Open Lunar Foundation. She is also a member of the Dubai Courts of Space working group. After training in cyber and aviation law in France, Héloïse completed the MSS program at the International Space University and is currently doing a Ph.D. at Otago University in New Zealand. Her thesis is focusing on the future of the law and governance for lunar settlements and is supported via a grant by the Luxembourg Space Agency.

## I. INTRODUCTION TO SOURCES OF LAW UNDER THE ARTICLE 38 OF THE INTERNATIONAL COURT OF JUSTICE

There is no code of public international law and, as such, no formal hierarchy between different sources of such law whether written or otherwise.<sup>1</sup> The various sources of international law are mentioned in Article 38 (Article 38) of the Statute of the International Court of Justice<sup>2</sup> (ICJ) which provides:

1. The Court, whose function is to decide in accordance with international law such disputes as are submitted to it, shall apply:

a. international conventions, whether general or particular, establishing rules expressly recognized by the contesting states;

b. international custom, as evidence of a general practice accepted as law;

c. the general principles of law recognized by civilized nations;

d. subject to the provisions of Article 59, judicial decisions and the teachings of the most highly qualified publicists of the various nations, as subsidiary means for the determination of rules of law.

2. This provision shall not prejudice the power of the Court to decide a case *ex aequo et bono*, if the parties agree thereto. <sup>3</sup>

From this Article, two different types of sources can be identified: traditional sources including treaties between States or international organizations; and sources such as custom and general principles of law and equity.

<sup>&</sup>lt;sup>1</sup> BIN CHENG, GENERAL PRINCIPLES OF LAW AS APPLIED BY INTERNATIONAL COURTS AND TRIBUNALS 23 (1953); MALCOLM SHAW, INTERNATIONAL LAW 67 (2003).

 $<sup>^{\</sup>rm 2}\,$  Statute of the International Court of Justice art. 38, June 26, 1945, 6 L.N.T.S. 391-413 [hereinafter ICJ Statute].

<sup>&</sup>lt;sup>3</sup> Id.

# A. International Conventions

International conventions are agreements between two or more States, or international organizations, which grant reciprocal rights and obligations between the parties.<sup>4</sup> These agreements must be ratified by each State in order to become enforceable.<sup>5</sup> An agreement between entities that are not recognized as States at the international level does not constitute an international convention, nor do contracts between individuals, or between States and individuals.<sup>6</sup>

Various terminologies are used in international practice to designate international conventions including: treaty, agreement, pact, charter, protocol and concordat.<sup>7</sup> The usage lacks consistency. Despite some of these terms being used in comparable contexts, no general rule can be formulated.

The most used terminology to describe international conventions is the treaty.<sup>8</sup> The official definition of a treaty can be found in Article 2, paragraph 1, of the 1969 Vienna Convention on the Laws of Treaties:<sup>9</sup>

[f]or the purposes of the present Convention: (a) 'treaty' means an international agreement concluded between States in written form and governed by international law, whether embodied in a single instrument or in two or more related instruments and whatever its particular designation.<sup>10</sup>

Thus, treaties are written agreements between subjects of international law that are legally binding.<sup>11</sup> They can be bilateral, multilateral or universal.

As for the other terminologies aforementioned, an international convention will be described as a charter when it establishes an organization; a pact when it creates a military alliance; a

<sup>&</sup>lt;sup>4</sup> Vienna Convention on the Law of Treaties, art. 1, May 23, 1969, 1155 U.N.T.S. 331 [hereinafter VCLT].

<sup>&</sup>lt;sup>5</sup> Id. at art. 14.

<sup>&</sup>lt;sup>6</sup> Id. at art. 3.

 $<sup>^7\,</sup>$  Denys P. Myers, The Names and Scope of Treaties, 51 Am. J. Int'l L. 574, 576 (1957).

<sup>&</sup>lt;sup>8</sup> *Id*.

<sup>&</sup>lt;sup>9</sup> VCLT, *supra* note 4.

 $<sup>^{10}</sup>$  Id. at art. 2.

 $<sup>^{11}</sup>$  Id.

protocol for an additional or amended treaty; and a concordat for a treaty concluded between a State and the Holy Seat.<sup>12</sup> For the purpose of this article, only the terminology "treaty" will be used as they typically constitute the foundations of international space law. Interestingly, treaties themselves may also contain provisions that reflect a customary norm.<sup>13</sup> The Vienna Convention is one such instrument, as it has been relied upon consistently as an aid of treaty interpretation.

#### B. International Customs

An international custom is a general practice accepted as a law.<sup>14</sup> A notable point of distinction between treaties and custom lies in their applicability, as only parties to the treaty can be bound by it, while a norm of custom applies to all States, subject to exceptions (see thresholds below). The constitutive elements of a custom are:

- The *consuetudo*: the objective element which is defined by the repeated and uniform practice of a rule by the members of international society;  $^{15}$  and

- The *opinio juris*: the subjective element, which involves having the conviction to respect a binding rule of law.<sup>16</sup>

In other words, a legal custom can be considered as such in international relations when States behave in a certain way, having the conviction that they are obligatorily bound to do so. One interesting principle, recognized by the ICJ in its 1959 *Interhandel* Judgment is the fact that if the *consuetudo*, or the material element, is established, it can naturally lead to the *opinio juris*, or the psychological element.<sup>17</sup>

<sup>&</sup>lt;sup>12</sup> Tim McCormack, An Introduction to Treaties: What They Are and Where to Find Them, 4 Austl. L. Libr. 265, 268-9 (1996).

<sup>&</sup>lt;sup>13</sup> United Nations Treaty Collection, UNITED NATIONS, https://treaties.un.org/pages/overview.aspx?path=overview/glossary/page1\_en.xml (last visited June 12, 2022).

<sup>&</sup>lt;sup>14</sup> ICJ Statue, *supra* note 2, art. 38.

<sup>&</sup>lt;sup>15</sup> Identification of Customary International Law, Second Rep. of the International Law Commission on Identification of Customary International Law, Ch. IV, UN Doc. A/CN.4/672 (May 22, 2014)[hereinafter Second Report].

<sup>&</sup>lt;sup>16</sup> Id. at Ch. V.

<sup>&</sup>lt;sup>17</sup> Interhandel (Switz. v. U.S.), Judgment, 1959 I.C.J. Rep. 6, 27-28 (Mar. 21).

Worthy of highlight is the fact that an international custom as a source of unwritten law raises the question of its enforceability. In other words, how does one prove that a custom does exist? In the 1969 judgment regarding the North Sea Continental Shelf,<sup>18</sup> the ICJ opined that it is possible for principles stated in bilateral conventions to become part of the *corpus* of international customary laws if the material and subjective requirements are met. However, the principle of equidistance, at issue in the North Sea case, did not attain those conditions. The tests for demonstrating custom are discussed further in Section II.B below.

When it comes to international customary law, the burden of proof lies with the plaintiff.<sup>19</sup> However in the 1950 Asylum case,<sup>20</sup> the ICJ recognized that the scope of Article 38 encompassed general customary norms and regional international norms in the same way it encompasses international treaties.<sup>21</sup> As such, it may be unnecessary to demonstrate to a custom if it has already been established.

#### C. General Principles of Law

The general principles of law refer to principles that are common to different national legal systems.<sup>22</sup> Amongst the most known are the principles of fairness, free consent, good faith and the prohibition of abuse of right or undue enrichment.<sup>23</sup>

The general principles of law are rules of law that the international judge or arbitrator applies without having the ability of creating them.<sup>24</sup> A key distinguishing feature of this source therefore lies in its pre-existing character, when certain legal principles have been recognized and applied in national legal systems.<sup>25</sup> These

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 $<sup>^{18}\,</sup>$  North Sea Continental Shelf (Ger. v. Den./Neth.), Judgment, 1969 I.C.J. Rep. 3,  $\P\,$  64 (Feb. 20).

<sup>&</sup>lt;sup>19</sup> Second Report, *supra* note 15, at Ch. V.

<sup>&</sup>lt;sup>20</sup> Asylum (Colom. v. Peru), Judgment, 1950 I.C.J. Rep. 266, 276-77 (Nov. 20).

 $<sup>^{21}</sup>$  Id.

 $<sup>^{22}~</sup>$  ICJ Statute, supra note 2, art. 38.

 $<sup>^{23}~</sup>See$  Robert Kolb, Principles as Sources of International Law (With Special Reference to Good Faith), 53 NETHERLANDS INT'L L. REV. 1 (2006).

 $<sup>^{24}~</sup>See$  Wolfgang Friedmann, The Uses of "General Principles" in the Development of International Law, 57 AM. J. INT'L L., 279 (1963).

<sup>&</sup>lt;sup>25</sup> See generally M. Cherif Bassiouni, A Functional Approach to 'General Principles of International Law, 11 MICH. J. INT'L L. 768 (1990).

principles can then be invoked at the international level, to fill lacunae in international law.

There are two kinds of general principles of law. On one hand, there are principles which are drawn from national laws and which touch upon judicial procedures such as the abuse of rights, the equality of the parties or the authority of the res judicata.<sup>26</sup> These general principles can be derived from a single legal system, culminating in the answer to the notion of estoppel. Estoppel expresses that a State party to a trial cannot contradict a position it has previously taken regarding a precise matter and in which other States or international organizations have placed their legitimate confidence.<sup>27</sup> Furthermore, the judgement of the ICJ in the 1962 Temple of Preah Vihear case highlights that a party may raise a plea of inadmissibility to the allegation of a party as soon as it is contrary to an attitude previously adopted by the other party.<sup>28</sup> On the other hand, general principles of law specific to public international law encompass the principle of pacta sunt servanda (requiring treaties be adhered to by the parties in good faith).<sup>29</sup> The notion includes underlying principles of international conventions which must be respected: the principle of State sovereignty and the principle of equality between States, for instance.

#### II. THRESHOLDS FOR INTERNATIONAL CUSTOM

Determining whether a particular law or policy position qualifies as a source of law requires an inquiry into the tests for international custom. Custom is described as "evidence of a general practice accepted as law" under Article 38.<sup>30</sup> As stated above, custom therefore consists of two elements: "a general practice," i.e., the practice of States; and "acceptance as law," which is the State's belief in a legal obligation tied to said practice. This requires a study of evidence that exhibits how States respond to a point of law. Both elements are crucial for the practice to be declared as custom.

<sup>&</sup>lt;sup>26</sup> See Friedmann, supra note 24.

<sup>&</sup>lt;sup>27</sup> *Estoppel*, THE LAW DICTIONARY, https://thelawdictionary.org/estoppel/ (last visited Mar. 3, 2021).

 $<sup>^{28}\,</sup>$  Temple of Preah Vihear (Cambodia v. Thai.), Judgment, 1962 I.C.J. Rep. 4, 32-33 (June 15).

<sup>&</sup>lt;sup>29</sup> VCLT, *supra* note 4, art. 26.

<sup>&</sup>lt;sup>30</sup> ICJ Statute, *supra* note 2, art. 38(1)(b).

As custom does not stem from a traditional source (unlike treaties), discerning whether a legal position has crystallized into custom is challenging. To aid this assessment, the International Law Commission (ILC) adopted Draft Conclusions on identification of customary international law in 2018.<sup>31</sup> The ILC's findings hold significant weight in interpreting international law, as the texts of these experts, particularly the Articles on State Responsibility, have been cited by the ICJ in past cases.<sup>32</sup> The ILC can therefore be viewed as "highly qualified publicists" and their works can form subsidiary means of determining the law under Article 38.<sup>33</sup>

Each of the two elements have to be determined separately, although the same material may be used to ascertain practice and acceptance as law.<sup>34</sup> For example, National Space Policy Directives issued by the United States can be studied both for evidence of its practice, as well as its normative perceptions. The ILC has also specified that there is no universal rule, as custom has to be determined on a case-by-case basis and with regard to the overall context in each case.<sup>35</sup>

#### A. General Practice

#### i. Which Actors?

According to the ILC, it is "primarily the practice of States" that should be considered, in addition to the practice of international organizations in "certain cases."<sup>36</sup> Evidence for State practice can stem from any acting branch of the State.<sup>37</sup>

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<sup>&</sup>lt;sup>31</sup> Draft Conclusions on Identification of Customary International Law with Commentaries, [2018] 2 Y.B. Int'l L. Comm. 122, U.N. Doc. A/73/10 [hereinafter ILC Draft Conclusions].

<sup>&</sup>lt;sup>32</sup> See, e.g., Gabčíkovo-Nagymaros Project (Hung. v. Slovk.), Judgment, 1997 I.C.J. Rep. 7 (Sept. 25).

<sup>&</sup>lt;sup>33</sup> See, e.g., Military and Paramilitary Activities in and Against Nicaragua (Nicar. v. U.S.), Judgment, 1986 I.C.J. Rep. 14, 89-90 (June 27); Legal Consequences of the Construction of a Wall in the Occupied Palestinian Territory, Advisory Opinion, 2004 I.C.J. Rep. 38, 63 (July 9); Land, Island and Maritime Frontier Dispute (El Sal. v. Hond.), Judgment, 1992 I.C.J. Rep. 351, ¶ 394 (Sept. 11).

 $<sup>^{\</sup>rm 34}~$  ILC Draft Conclusions, supra note 31, at 126-29.

<sup>&</sup>lt;sup>35</sup> *Id*.

<sup>&</sup>lt;sup>36</sup> *Id.* at 129-32.

 $<sup>^{37}</sup>$  Id. at 132 ("State practice consists of conduct of the State, whether in the exercise of its executive, legislative, judicial or other functions.").

This reflects the positivist approach to States being the subjects of international law. However, with the boom in commercialization, stakeholders in outer space are no longer restricted to States. Indeed, any assessment of custom will require a study of the behavior of non-State actors, such as the private entities driving commercial ventures and the civil society organizations (CSOs) striving for shared use of space. However, according to the ILC, the behavior of such actors cannot directly be considered as contributing to custom.<sup>38</sup> The conduct of these actors can only be considered to the extent that States have endorsed or reacted to them.<sup>39</sup> This thinking is also reflected to some extent in Article VI of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and other Celestial Bodies (Outer Space Treaty) which imposes responsibility on States for the acts of their non-governmental entities.<sup>40</sup>

While the scope of Article VI continues to be questioned,<sup>41</sup> it is contended here that non-State actors in the space sector nonetheless hold considerable capacity for norm-building. Consider a hypothetical scenario where a space start-up company partners with global aerospace manufacturers to collaborate on tracking services for collision avoidance in cislunar space. This practice in and of itself cannot be considered as evidence for custom. However, if States respond to this practice, either by endorsing the action or adopting this particular collision avoidance mechanism into their regulatory system, there is scope for the practice to eventually crystallize into custom as a legal source.

Similarly, international organizations are recognized as separate entities with their own rights and obligations. The conduct of

<sup>&</sup>lt;sup>38</sup> ILC Draft Conclusions, *supra* note 31, at 132-33.

 $<sup>^{39}</sup>$  Id.

<sup>&</sup>lt;sup>40</sup> Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and other Celestial Bodies art. VI, Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S 205 [hereinafter Outer Space Treaty]. *See also* Judge Manfred Lachs' views on Article VI in MANFRED LACHS, THE INTERNATIONAL LAW OF OUTER SPACE: AN EXPERIENCE IN CONTEMPORARY LAW-MAKING 114 (2010).

<sup>&</sup>lt;sup>41</sup> For example, the United States Federal Communications Commission imposed a penalty against Swarm Technologies for their unauthorized launch of SwarmBees in 2018. *In re* Swarm Technologies, Inc., F.C.C. 18-184, Consent Decree 2 (Dec. 20, 2018), https://docs.fcc.gov/public/attachments/FCC-18-184A1.pdf. *See also* Laura Montgomery, *US Regulators May Not Prevent Private Space Activity on the Basis of Article VI of the Outer Space Treaty* (Mercatus Working Paper, George Mason University, 2018).

an international organization can be considered in determining general practice, if the subject matter falls within the mandate of the organizations, and/or in cases whether the practice is addressed specifically to them, such as a situation where the international organization is party to a treaty.<sup>42</sup> A prime example of the role of international organizations in this regard is the International Committee of the Red Cross (ICRC), whose reports have played a key role in the interpretation of international humanitarian law.<sup>43</sup>

#### ii. Which States?

The question of which States is particularly relevant in the space context, given that there are categories of spacefaring nations and non-spacefaring nations in addition to "middle" space powers.<sup>44</sup> Since State practice is required to be "general," this raises the question of what constitutes fair and adequate representation. In the North Sea Continental Shelf case the ICJ considered the requirement of State practice as being "both extensive and virtually uniform."<sup>45</sup> There are no further specifications on a precise number of States or how to ensure that the practice is fairly representative, which means that "universal participation" is not a requirement.<sup>46</sup> However, the ICJ did specify that participation should include "States whose interests are specially affected," which would encompass States who either participate or would be impacted by the practice in question.<sup>47</sup>

Applying this to the space context is complicated, since, arguably, all States could be impacted by the actions of one actor in space, and, further, since Article I of the Outer Space Treaty,<sup>48</sup>

<sup>&</sup>lt;sup>42</sup> ILC Draft Conclusions, *supra* note 31, at 131.

<sup>&</sup>lt;sup>43</sup> See The International Committee of the Red Cross, *International Humanitarian Law, Answers to Your Questions*, (Oct. 2002), https://www.icrc.org/en/doc/assets/files/other/icrc\_002\_0703.pdf.

<sup>&</sup>lt;sup>44</sup> See Daniel Golston & Ben Baseley-Walker, *The Realities of Middle Power Space Reliance*, UNIDIR (2015), https://www.unidir.org/files/publications/pdfs/the-realities-of-middle-power-space-reliance-en-633.pdf.

 $<sup>^{45}\,</sup>$  North Sea Continental Shelf (Ger. v. Den./Neth.), Judgment, 1969 I.C.J. Rep. 3, ¶ 74 (Feb. 20).

<sup>&</sup>lt;sup>46</sup> See ILC Draft Conclusions, supra note 31, at 136-38.

 $<sup>^{47}</sup>$  Id. at 136.

<sup>&</sup>lt;sup>48</sup> Article I of the Outer Space Treaty states that the activities carried in outer space including the Moon and other celestial bodies must be carried for the benefit and in the interests of all countries. See Outer Space Treaty, *supra* note 40, art. I. From the wording

along with the Benefits Declaration,<sup>49</sup> explicitly recognize the significance of the shared benefits of space.

#### iii. What Forms?

State practice can be determined through physical acts, diplomatic conduct, written or verbal statements, and, in some cases, can also be deduced from inaction.<sup>50</sup> Since forms of State practice can range from domestic judicial decisions to diplomatic correspondence, each of these forms of practice are given equal weight, and no one form takes precedence over another.<sup>51</sup> In addition, account is to be taken of *all* available practice of a particular State, which is to be assessed as a whole.<sup>52</sup> Applying this test to State practice in space is extremely useful, as it can reflect how different organs of the same State, such as the executive and judiciary branches, address the same subject.<sup>53</sup>

#### B. Opinio Juris

Labelled the "subjective element," *opinio juris* requires evidence that the State has acted with the belief that there was a legal obligation to do so.<sup>54</sup> Without this belief, a State may otherwise be conducting itself out of sheer habit or convenience. In the Asylum case, the ICJ distinguished between the latter and a State acting with *opinio juris* holding that "considerations of convenience or simple political expediency seem to have led the territorial State to recognize asylum without that decision being dictated by any feeling

of this provision, it can be concluded that the benefits of outer space should not be denied to other states, especially those that may be precluded from conducting these activities due to a lack of technological or financial means.

<sup>&</sup>lt;sup>49</sup> G.A. Res. 51/122, Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking into Particular Account the Needs of Developing Countries (Feb. 4, 1997).

<sup>&</sup>lt;sup>50</sup> ILC Draft Conclusions, *supra* note 31, at 133.

<sup>&</sup>lt;sup>51</sup> *Id.* at Draft Conclusion 6, page 12.

 $<sup>^{52}</sup>$  Id. at 134. See also Jurisdictional Immunities of the State (Ger. v. It.), Judgment, 2012 I.C.J. Rep. 99, ¶ 76 (Feb. 3) (where the Court considered "Greek State practice taken as a whole").

<sup>&</sup>lt;sup>53</sup> See Nivedita Raju, Are We There Yet: Identifying the Crystallisation of Custom Through a Case Study on the Exploitation of Resources in Outer Space, 43 ANNALS OF AIR & SPACE L. 273 (2018). For example, there is no crystallization of custom as regards the legality of space resource utilization since State practice is inconsistent at present.

<sup>&</sup>lt;sup>54</sup> ILC Draft Conclusions, *supra* note 31, at 138.

of legal obligation."<sup>55</sup> A similar distinction arose in the Right of Passage case, where the ICJ considered the right of passage of Portuguese armed forces in India, and concluded that there was "nothing in the record to show that grant of permission was incumbent on the British or on India as an obligation."<sup>56</sup>

#### i. Which States?

According to the ILC, *opinio juris* is to be sought with respect to both the States engaging in the relevant practice and those in a position to react to it.<sup>57</sup> Similar to the absence of any specifications for general practice, no critical mass or bare minimum of States is specified, which, once again, raises the question of what the standard is for a legal view that represents the position of *all* States. If the matter under consideration is controversial, meaning the international community is "profoundly divided,"<sup>58</sup> then there is no clear evidence of *opinio juris*, as the ICJ found in its Advisory Opinion on the Threat or Use of Nuclear Weapons.<sup>59</sup>

#### Persistent objector

The ICJ has acknowledged the ability of one or more States to object to the formation of a new rule of custom in both Fisheries<sup>60</sup> and North Sea Continental Shelf<sup>61</sup> cases. Still, the standards for a successful persistent objector are high, as the objector may adopt one or both of two stances: First, the objector may seek to prevent the rule from coming into being; or, second, the objector may aim to ensure that, if the rule does emerge, the rule will not be applicable to it.<sup>62</sup> As the timeline for formation of custom is key, the role of a persistent objector is significant to forming new laws in space. Since we are studying fairly recent practices, and considering how States

<sup>&</sup>lt;sup>55</sup> Asylum (Colom. v. Peru), Judgment, 1950 I.C.J. Rep. 266, 286 (Nov. 20).

<sup>&</sup>lt;sup>56</sup> Right of Passage Over Indian Territory (Port. v. India), Judgment, 1960, I.C.J. Rep. 6, 42-43 (Apr. 12).

<sup>&</sup>lt;sup>57</sup> ILC Draft Conclusions, *supra* note 31, at 138.

<sup>&</sup>lt;sup>58</sup> *Id.* at 139.

<sup>&</sup>lt;sup>59</sup> Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion, 1996 I.C.J. Rep. 226, 254 (July 8).

<sup>60</sup> Fisheries (U.K. v. Nor.), Judgment, 1951 I.C.J. Rep. 116, 131 (Dec. 18).

 $<sup>^{61}\,</sup>$ North Sea Continental Shelf (Ger. v. Den./Neth.), Judgment, 1969 I.C.J. Rep. 3, ¶63 (Feb. 20).

 $<sup>^{\</sup>rm 62}~$  ILC Draft Conclusions, supra note 31, at 152.

will interpret laws in the future, we are looking at a time when the objections of States could eventually fall within this category.

#### ii. What Forms?

Several types of materials can be analyzed for evidence of *opinio juris*. These include statements made on behalf of States, diplomatic correspondence, decisions of national courts and conduct in connection with resolutions adopted by an international organization or at an intergovernmental conference.<sup>63</sup> This is significant, as it indicates that even United Nations Assembly resolutions can hold normative value. Indeed, these resolutions represent acceptance of specific legal views by a majority vote of governments in the widest forum (at present) for the expression of such opinion.<sup>64</sup> Similar to United Nations resolutions, a State's legal perceptions could also be exhibited in their national military manuals or doctrines, as these materials dictate State conduct in conflict.<sup>65</sup>

#### Silence

Under international law, a State's silence or failure to react in some circumstances may qualify as consenting to a practice. In the Territorial and Maritime Dispute between Nicaragua and Honduras case, the ICJ acknowledged that acquiescence from silence is possible but that "evidence of a tacit legal agreement must be compelling."<sup>66</sup> Ascertaining whether a State's failure to react amounts to *opinio juris* requires that the State in question should have been aware of the situation and had the opportunity to respond.<sup>67</sup> Therefore, a State's silence on a particular point of space law, or more specifically, new lunar activities, cannot automatically be interpreted as acquiescence.

<sup>63</sup> Id. at 140

<sup>&</sup>lt;sup>64</sup> IAN BROWNLIE, PRINCIPLES OF PUBLIC INTERNATIONAL LAW 15 (2008).

<sup>&</sup>lt;sup>65</sup> ILC Draft Conclusions, *supra* note 31, at 141.

 $<sup>^{66}\,</sup>$  Territorial and Maritime Dispute Between Nicaragua and Honduras in the Caribbean Sea (Nicar. v. Hond.), Judgment, 2007 I.C.J. Rep. 659,  $\P$  253 (Oct. 8).

<sup>&</sup>lt;sup>67</sup> ILC Draft Conclusions, *supra* note 31, at 140.

## iii. What Time?

There is no predetermined time period for a practice to be considered "general" and "accepted as law." Thus, it is possible for custom to develop in a small time period.<sup>68</sup> In North Sea Continental Shelf case, the ICJ held that "the passage of only a short period of time is not necessarily, or of itself, a bar to the formation of a new rule of customary international law."<sup>69</sup> In fact, the ILC acknowledges that in international space law, custom has sometimes developed rapidly, but, at the same time, rejects the notion of "instant custom"<sup>70</sup> that was proposed by Bin Cheng.<sup>71</sup>

In conclusion, the tests for each of these elements requires careful analysis, as each element has several more subsidiary thresholds to meet. Furthermore, while examining evidence for either State practice or *opinio juris*, the background and setting may be more relevant than the wording present in the material itself. This was considered in *United States v. Morocco*, where the ICJ held:

There are isolated expressions to be found in the diplomatic correspondence which, if considered without regard to their context, might be regarded as acknowledgments of United States claims to exercise consular jurisdiction and other capitulatory rights. On the other hand, the Court can not ignore the general tenor of the correspondence, which indicates that at all times France and the United States were looking for a solution based upon mutual agreement and that neither Party intended to concede its legal position.<sup>72</sup>

#### C. Subsequent Practice of States under the Vienna Convention

Article 31(3) of the Vienna Convention on the Law of Treaties (Vienna Convention) provides rules for treaty interpretation states

<sup>&</sup>lt;sup>68</sup> Second Report, *supra* note 15, ¶ 58.

 $<sup>^{69}\,</sup>$  North Sea Continental Shelf (Ger. v. Den./Neth.), Judgment, 1969 I.C.J. Rep. 3,  $\P$  74 (Feb. 20).

<sup>&</sup>lt;sup>70</sup> ILC Draft Conclusions, *supra* note 31, at 138.

<sup>&</sup>lt;sup>71</sup> Bin Cheng contends that U.N. resolutions regarding space reflect the possibility for *opinio juris* to grow "overnight." BIN CHENG, STUDIES IN INTERNATIONAL SPACE LAW 147 (1997).

<sup>&</sup>lt;sup>72</sup> Rights of Nationals of the United States of America in Morocco (Fr. v. U.S.), Judgment, 1952 I.C.J. Rep. 176, 200 (Aug. 27).

that "[t]here shall be taken into account, together with the context ... any subsequent practice in the application of the treaty which establishes the agreement of the parties regarding its interpretation."<sup>73</sup> Used as an aid to interpretation, this provision puts great weight on relevant State practice to evidence the details of the agreement between the parties in question.

Naturally, there is a distinction between Article 38 and Article 31 of the Vienna Convention, as the former provision stipulates sources of international law, while the latter is merely meant to guide treaty interpretation. In the context of space, subsequent State practice can be illuminating. For example, it could assist in the interpretation of Article II of the Outer Space Treaty<sup>74</sup> and clarifying the legality of resource exploitation. While analysis of subsequent practice under the Vienna Convention is beyond the scope of this article, there is nevertheless potential for further research on defining thresholds for State practice as an aid to interpret ambiguities in the space treaties.

# III. HISTORICAL IMPORTANCE OF CUSTOMS FOR INTERNATIONAL SPACE LAW

Historically, international custom has been the first major source of international space law, preceding conventional sources. Prior to the adoption of the Outer Space Treaty, several fundamental principles of international space law emerged as customary international law.<sup>75</sup> Indeed, the freedom of access and use of outer space, the prohibition of all sovereignty and national appropriation

<sup>&</sup>lt;sup>73</sup> VCLT, *supra* note 4, art. 31(3).

<sup>&</sup>lt;sup>74</sup> Article II of the Outer Space Treaty provides that outer 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. This principle is also known as the non-appropriation principle. Outer Space Treaty, *supra* note 40, art. II.

<sup>&</sup>lt;sup>75</sup> The 1963 Declaration of Legal Principles Governing the Activities of States in the Exploration and the Uses of Outer Space developed nine principles governing space activities: (1) exploration and use of outer space for the benefit of all [hu]mankind; (2) freedom of use and exploration of outer space; (3) non-appropriation principle; (4) the exploration and use of outer space must be done in accordance to the international law; (5) responsibility of States for their national activities; (6) cooperation and mutual assistance; (7) national jurisdiction and control over space objects; (8) State liability for damages; and (9) "envoy of [hu]mankind" status for astronauts. G.A. Res. 1962 (XVIII) (Dec. 13, 1963). This Declaration is the main source of the principles recognized a few years later by international treaties known as the *Corpus Juris Spatialis*.

and the control and jurisdiction of States over launched space objects are amongst the principles that were respected even before any international treaty in force.<sup>76</sup>

The reason why these principles were agreed upon as customary law comes from the fact that non-spacefaring nations were concerned by the absence of dispute resolution in case of any claim of sovereignty raised against the rapid increase of space launches operated in the decade following Sputnik 1.77 These practices were tacitly accepted by all and even welcomed positively, which allowed the development of proper principles regulating space.<sup>78</sup> A prominent example of the impact of custom on space law lies in the right of overflight of space objects.<sup>79</sup> Indeed, there was no objection to the launch of space objects into outer space, and overflight over countries. Although States were aware of the presence of satellites in the area beyond their national airspace, they did not protest or reject these activities. On the contrary, they acclaimed the successes of Soviet and American spaceflights, which demonstrated that States unanimously agreed that such conduct did not consist of an incursion of territory and that outer space constituted a unique domain incapable of sovereign claim.<sup>80</sup>

As such activities multiplied and became more complex, proving the test to create customary law became difficult due to the inherent lack of precision and detailed rights and obligations of such rules.<sup>81</sup> This need to have precise and binding rules for outer space activities paved the way for the creation of the Outer Space Treaty in 1967.

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<sup>&</sup>lt;sup>76</sup> See MICHAEL P. SCHARF, OUTER SPACE LAW: CUSTOMARY INTERNATIONAL LAW IN TIMES OF FUNDAMENTAL CHANGE 123-38 (2013).

<sup>77</sup> Id.

<sup>&</sup>lt;sup>78</sup> Id.

<sup>&</sup>lt;sup>79</sup> Id.

 $<sup>^{80}</sup>$  *Id*.

<sup>&</sup>lt;sup>81</sup> Ambiguous provisions which are not defined in the space treaties have since been questioned at international fora with no consensus achieved. For example, even to date, there is no acceptable definition for what constitutes a "weapon in outer space." See discussions surrounding the Draft Treaty on Prevention of the Placement of Weapons in Outer Space and of the Threat or Use of Force Against Outer Space Objects, PPWT CD/1985 (June 12, 2014).

# IV. TRACING THE DEVELOPMENT OF CUSTOM IN RESPECT OF FUTURE LUNAR ACTIVITIES

#### A. Purchase of Regolith

In 2020, NASA declared that it would solicit invitations for the collection of lunar regolith from commercial entities.<sup>82</sup> The organization aims to purchase small amounts of lunar regolith from the commercial entity who would be treated as a contractor in this arrangement.<sup>83</sup> As of January 2021, four companies have been awarded these contracts.<sup>84</sup> Notably, two of these companies, ispace Europe and ispace Japan, are foreign entities.

# i. Arguments in Favor of Custom Formation

From a domestic perspective, within the United States (US), there are numerous pieces of evidence to consider. NASA itself is a US federal entity, which makes it a central actor representing US views. Prior to the regolith announcement, NASA introduced the Artemis Accords, a series of principles governing bilateral arrangements between the US and other States in future missions.<sup>85</sup> Section 10 of the Accords supports the commercial recovery of space resources, and thus indicates the US view that the extraction and sale of lunar regolith is legally permissible.<sup>86</sup>

In 2015, the US legislature passed the Commercial Space Launch Competitiveness Act<sup>87</sup> (CSLCA) which officially granted every US citizen the right to possess, own, transport or use any "space resource obtained" by the citizen.<sup>88</sup> In 2020, former President Trump signed an Executive Order on Encouraging

<sup>&</sup>lt;sup>82</sup> NASA Selects Companies to Collect Lunar Resources for Artemis Demonstrations, NASA (Dec. 3, 2020), https://www.nasa.gov/press-release/nasa-selects-companies-to-collect-lunar-resources-for-artemis-demonstrations.

<sup>&</sup>lt;sup>83</sup> Id.

<sup>&</sup>lt;sup>84</sup> Id.

<sup>&</sup>lt;sup>85</sup> The Artemis Accords: Principles for Cooperation in the Civil Exploration and Use of the Moon, Mars, Comets, and Asteroids for Peaceful Purposes, NASA, https://www.nasa.gov/specials/artemis-accords/img/Artemis-Accords-signed-13Oct2020.pdf [hereinafter Artemis Accords].

 $<sup>^{86}</sup>$  Id.

<sup>87 51</sup> U.S.C. §§ 51301-03.

<sup>&</sup>lt;sup>88</sup> Id. § 51303.

International Support for the Recovery and Use of Space Resources<sup>89</sup> which states that "Americans should have the right to engage in commercial exploration, recovery and use of resources in outer space, consistent with applicable law" and further that "the United States does not view [space] as a global commons."<sup>90</sup> In each of these materials, the US has stated that it will continue to comply with international law. From this conduct, it can be concluded that the US is aiming to normalize the commercial recovery of resources, beginning with lunar regolith.

On an international level, the US would obviously be the key State leading the development of this norm. However, ispace Europe is a foreign entity based in Luxembourg and ispace Japan is a foreign entity based in Japan. These companies will therefore have to seek authorization from their domestic regulators. In granting national approvals to these missions, the conduct of Luxembourg and Japan would also be considered relevant to the space activity of purchasing regolith. After the US enacted the CSLCA in 2015, Luxembourg adopted its own legislation that granted ownership over space resources to its citizens.<sup>91</sup> This law, and the subsequent incorporation of companies for the purposes of space mining in Luxembourg, implies that Luxembourg accepts the US position on utilization of space resources.<sup>92</sup> With Luxembourg and Japan each having signed the Artemis Accords, it appears that their interpretation of Article II of the Outer Space Treaty regarding the legality of space resource extraction and utilization conforms to the US view that it is permissible to extract and own lunar regolith. In granting approvals for these ispace missions, Japan and Luxembourg could possibly be demonstrating their "acceptance of law" as regards the extraction and sale of regolith.

While custom may not have crystallized yet, these materials nonetheless demonstrate that the US is advancing the crystallization of custom on legalizing space resource extraction and ownership by encouraging other States to follow suit.

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<sup>&</sup>lt;sup>89</sup> Exec. Order No. 13914, 85 Fed. Reg. 20,381 (Apr. 6, 2020).

<sup>&</sup>lt;sup>90</sup> Id. § 1.

<sup>&</sup>lt;sup>91</sup> Loi 674 du 20 juillet 2017 sur l'exploration et l'utilisation des ressources de l'espace [Law 674 of July 20, 2017 on the Exploration and Use of Space Resources], JOURNAL OFFICIEL DU GRAND-DUCHE DE LUX., July 28, 2017, http://legilux.public.lu/eli/etat/leg/loi/2017/07/20/a674/jo.

 $<sup>^{92}\,</sup>$  Id. at art. 1.

#### ii. Arguments Against Custom Formation

In considering evidence for custom, it is relevant to consider the conduct of all States in a position to react to the issue to assess "general" practice. In this regard, it is significant to note that other spacefaring nations, particularly Russia and China, are yet to express a favorable response to the regolith announcement.<sup>93</sup> Accordingly, these reactions may indicate that these States oppose the US approach to extracting and utilizing space resources, although it is presently too early to tell. Since these two States possess significant spacefaring capabilities, their reactions cannot be disregarded in assessing the development of custom.

Other States' responses at the multilateral level were also far from unanimous. At the 58th meeting of COPUOS in 2019,<sup>94</sup> delegations from different States, primarily Greece and Belgium, criticized national movements towards legalizing space resource exploitation and claimed that international guidance was imperative to avoid conflict.<sup>95</sup> These two delegations have adopted an approach that considers Article 11 of the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (Moon Agreement)<sup>96</sup> as a starting point to building an international framework for the utilization of space resources.<sup>97</sup> At the time of this writing, the COPUOS meetings of 2021 culminated in the establishment of

<sup>&</sup>lt;sup>93</sup> See Elliot Ji, Michael B. Cerny & Raphael J. Piliero, What Does China Think About NASA's Artemis Accords?, THE DIPLOMAT (Sept. 17, 2020), https://thediplomat.com/2020/09/what-does-china-think-about-nasas-artemis-accords/. See also Andrew Jones, Russian Space Chief Disses NASA's Artemis Moon Landing Plans, SPACE.COM (Nov. 4, 2020), https://www.space.com/russia-space-agency-chief-criticizes-nasa-moonplans#:~:text=The%20head%20of%20Russia's%20space,the%2071st%20Interna-

tional%20 Astronautical%20<br/>Congress (Russian official decrying NASA's plans as too "US-centric").

<sup>&</sup>lt;sup>94</sup> The 2020 session was cancelled due to the Covid-19 pandemic and the 2021 sessions are yet to be conducted. *See Legal Subcommittee: 2020*, U.N. OFFICE OUTER SPACE AFF., https://www.unoosa.org/oosa/en/ourwork/copuos/lsc/2020/index.html (last visited Mar. 23, 2021).

<sup>&</sup>lt;sup>95</sup> Comm. on the Peaceful Uses of Outer Space, *Proposal for the Establishment of a Working Group for the Development of an International Regime for the Utilization and Exploitation of Space Resources*, ¶ 16, U.N. Doc A/AC.105/C.2/L.311 (Mar. 4, 2019).

<sup>&</sup>lt;sup>96</sup> Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, Dec. 18, 1979, 1363 U.N.T.S. 3 [hereinafter Moon Agreement].

<sup>&</sup>lt;sup>97</sup> Id. at art. 11.

a Working Group on Space Resources.<sup>98</sup> The mandate of this Working Group includes the study of the existing legal framework and identifies scope for further development.<sup>99</sup> However, the Moon Agreement is not explicitly mentioned in the mandate, terms of reference or method of the Working Group. Given that the US has consistently rejected the Moon Agreement, including in the afore-mentioned Executive Order in 2020, a favorable response from the US to this particular approach is doubtful.

Since the ICJ has required, as part of custom formation, the inclusion of conduct of States "specially affected," this also raises the question of non-spacefaring States which presently lack the capacity to engage in the recovery and sale of lunar regolith. Although none of these nations have reacted to the regolith purchase announcement yet, NASA's aim of normalizing the extraction and purchase of regolith will require a positive response from these nations for the development of a customary norm.

As the degree of State practice required to qualify as custom must be "extensive and virtually uniform,"<sup>100</sup> these differing positions demonstrate an approach that lacks the requirements of "general" State practice. Regarding the *opinio juris* element, the NASA announcement by itself does not hold legal value and requires other States to respond to the extraction and sale of regolith out of a sense of legal duty. While the conduct of Japan and Luxembourg indicates an acceptance of custom, the lack of a favorable response from other States does not support this conclusion.

In the absence of general State practice and clear "acceptance of law," NASA's regolith proposal cannot be regarded as moving toward the crystallization of custom.

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<sup>&</sup>lt;sup>98</sup> Comm. on the Peaceful Uses of Outer Space, Proposal on the Mandate, Terms of Reference and Method of Work of the Working Group Established Under the Legal Subcommittee Agenda Item Entitled "General Exchange of Views on Potential Legal Models for Activities in the Exploration, Exploitation and Utilization of Space Resources, UN Doc. A/AC.105/L.326 (2021).

<sup>&</sup>lt;sup>99</sup> Id. at 2.

 $<sup>^{100}\,</sup>$  North Sea Continental Shelf (Ger. v. Den./Neth.), Judgment, 1969 I.C.J. Rep. 3, ¶ 74 (Feb. 20).

## B. Ratifying the Moon Agreement and the Artemis Accords: The Case of Australia

The Moon Agreement<sup>101</sup> may arguably be the most controversial document of the Corpus Juris Spatialis. Unlike the Outer Space Treaty, this international Agreement has not been ratified by the main space powers of the time and only eighteen States are parties to it.<sup>102</sup> The Moon Agreement contains clauses that the spacefaring nations were not ready to accept at the time.<sup>103</sup> In particular, the principle which considers the Moon and its natural resources as the "common heritage of [hu]mankind" (Article 11)104 was the most questioned clause because it prevented any sort of commercialization of lunar resources until an internationally agreed-upon framework was introduced.<sup>105</sup> On the other hand, Section 10 of the Artemis Accords allows for resource utilization and extraction, while noting that extraction does not necessarily constitute national appropriation as stated by Article II of the Outer Space Treaty. Due to the fundamental difference in approaches between the Artemis Accords and the Moon Agreement, the question of use and eventually commercialization of lunar resources is becoming central.

This is particularly important from the perspective of sources of international law, as the publication and signature of the Artemis Accords by thirteen States can possibly codify and organize the future behavior of actors in space, including how these States will commercialize outer space resources. It is important to note, however, that these Accords do not have a binding force on the international law level. But could they be a first step to create a customary behavior? And, if so, what would it mean for countries who have ratified both the Moon Agreement and the Artemis Accords?

<sup>&</sup>lt;sup>101</sup> Moon Agreement, *supra* note 96.

<sup>&</sup>lt;sup>102</sup> See Comm. on the Peaceful Uses of Outer Space, Status of International Agreements Relating to Activities in Outer Space as at 1 January 2019, U.N. Doc. A/AC.105/C.2/2019/CRP.3 (Apr. 1, 2019).

<sup>&</sup>lt;sup>103</sup> Michael Listner, *The Moon Treaty: Failed International Law or Waiting in the Shadows?*, THE SPACE REVIEW (Oct. 24, 2011), https://www.thespacereview.com/article/1954/1

<sup>&</sup>lt;sup>104</sup> Moon Agreement, *supra* note 96, art. 11.

 $<sup>^{105}</sup>$  Id.

Australia ratified the Moon Agreement in 1986 and signed the Artemis Accords in 2020.<sup>106</sup> However, the goal of both instruments is quite contradictory. The Moon Agreement mandates commercialization of space resources from a multilateral and internationally agreed on standpoint, while the Artemis Accords adopts a unilateral approach to this issue through a select group of States. The Moon Agreement considers the need to develop a new multilateral framework when exploitation of resources becomes feasible, yet the Artemis Accords are based on the assumption that the existing principles of international space law suffice.<sup>107</sup> In joining the Artemis Accords, participating States imply that they consent and agree to the US interpretation and approach to resource utilization. These States include Australia, who is a party to the Moon Agreement and a member of the Artemis Accords, which indirectly endorses the US view of the Moon Agreement.

The question becomes: Is Australia contradicting itself from an international law perspective?

#### i. Arguments in Favor

By using the Artemis Accords to standardize a new type of behavior in space, the United States appears to be creating an innovative way of thinking about governance in space. Indeed, the norms resulting from the Artemis Accords are presumably meant to set standards to be followed by other countries, whether they sign the Accords or not. In that scenario, the US is positioning itself as the international standard maker regarding behavior in space and the Artemis Accords can be considered international custom.

With that in mind, and considering that the Moon Agreement is a binding document from an international law perspective, it can be argued that countries party to both are contradicting themselves, putting themselves in a position that could raise questions. In fact, if the Artemis Accords are set to become a custom, then

<sup>&</sup>lt;sup>106</sup> Australia Signs NASA's Artemis Accords, AUSTRALIAN GOV'T: DEP'T OF INDUSTRY, SCI., ENERGY & RESOURCES (Oct. 14, 2020), https://www.industry.gov.au/news/australia-signs-nasas-artemis-accords#:~:text=Australia%20is%20among%20the%20first,space%20exploration%20coopera-

tion%20 among%20 nations.

<sup>&</sup>lt;sup>107</sup> Fabio Tronchetti & Hao Liu, Australia's Signing of the Artemis Accords: A Positive Development or a Controversial Choice?, 75 AUSTL J. INT'L AFF. 243 (2021).

which document would prevail? The principle of *lex posterior derogat priori* says that in case of a conflicting rule, the younger legal rule will override the older legal rule.<sup>108</sup> In that scenario, the Artemis Accords would eventually prevail over the Moon Agreement. However, this is still theoretical and remains an open question; but it is interesting to keep it in mind, especially for countries who are party to both documents.

#### ii. Arguments Against

Another way to approach that question is to take the opposite perspective, where the Artemis Accords would remain a simple political statement with no binding power on the international legal stage. Arguably, the Artemis Accords are yet to be signed by a consequent number of States, which undermines its international influence. As expressed in the previous paragraph, neither China, nor Russia-two of the current major space powers-have recognized the power of these Accords, let alone envisioned signing them.<sup>109</sup> At the time of this writing. India too, has remained silent on the Accords. Considering the resistance of a number of space actors and the lack of signatory parties as of now, it is possible to question whether any of the ideas expressed in the Artemis Accords will ever achieve the requirements to become an international custom. In addition, it is worth noting that the Accords themselves are meant to be a political commitment as expressed in the Section 1 of the document. Therefore, by definition the opinio juris would be difficult, if not impossible, to prove since the very nature of these Accords is to not be legally binding.

Hence, it is perfectly possible for a State to be party to both the Artemis Accords and the Moon Agreement, since only the latter has a binding effect on the international level. In that case, Australia is not contradicting itself by being part of both instruments.

<sup>&</sup>lt;sup>108</sup> AARON X. FELLMETH & MAURICE HOROWITZ, GUIDE TO LATIN IN INTERNATIONAL LAW (2011), https://www.oxfordreference.com/view/10.1093/acref/9780195369380.001.0001/acref-9780195369380-e-1282

<sup>&</sup>lt;sup>109</sup> Christopher Newman, Artemis Accords: Why Many Countries Are Refusing to Sign Moon Exploration Agreement, THE CONVERSATION (Oct. 19, 2020), https://theconversation.com/artemis-accords-why-many-countries-are-refusing-to-sign-moon-explorationagreement-148134.

#### VI. CONCLUSION

Customary international law has played a key role in defining the legality of space activities since the beginning of the space age. This article has identified the elements and corresponding tests to establish international custom, in addition to providing case studies where custom may shape legality in the future. In both NASA's regolith announcement and the Artemis Accords examples, it is too early to discern a customary norm, as there is insufficient State conduct to evidence concrete State practice and *opinio juris* on either matter. This is a testament to the rigorous tests required to establish custom.

However, both case studies give examples of contemporary situations that might use different regulatory methods in the future, instead of States achieving express consensus through traditional multilateral treaty-making processes. Despite the foreseeable surge in commercial lunar activities, States appear reluctant to engage in discussions for a new multilateral treaty, and, therefore, require new approaches to lunar regulation and governance.

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# FROM GOLDENEYE TO LANDSAT-7: COMBATTING CYBER INTRUSIONS TO SPACE-BASED SATELLITE SYSTEMS UTILIZING INTERNATIONAL LAW

### Andrew Fois\*

# ABSTRACT

This Note examines how States can utilize international law to mitigate risk and provide redress for damage to Internet-powered, space-based satellite systems by State or non-State sponsored hackers. In recent years, land-based cyber intrusions, hacks and data breaches, including ones against Equifax, Sony, the Democratic National Committee and the Office of Personnel Management, exposed masses of consumer data and compromised the networks of various private companies and governmental organizations. These significant events caused great harm to the organizations, the economy and the public. Cybersecurity has become a crucial concern for public and private organizations in recent years. However, the issue has not been meaningfully addressed among the international legal community, particularly within the space sector. If a hostile actor were to successfully infiltrate the networks of major satellite systems that orbit the Earth, which the world relies on for, among other things, communication, navigation, weather monitoring, national security and military operations, the consequences could be catastrophic. This Note addresses what sorts of cyber-attacks or intrusions to a satellite system would constitute a violation of international law and to what degree a State can respond and receive reparation for damage, either physical or otherwise, caused. It concludes that the application of currently accepted legal

<sup>\*</sup> Andrew Fois is a recent graduate of Georgetown University Law Center. He graduated cum laude in 2021 and served as an executive editor on the Georgetown Law Journal. Currently, Andrew works as an Associate Attorney at Lawler, Metzger, Keeney & Logan, a media, communications and technology firm in Washington, D.C.

conventions do not sufficiently address new and evolving threats that have become possible due to advancing technologies. The Note applies the UN Charter's prohibition against the use of force, the law of State responsibility, sovereignty and other principles of international law to hypothesize how the current international regime could address such a scenario. It concludes with the suggestion that: 1) the international space law community adopt cooperative and streamlined norms, standards and initiatives that are adaptable to constantly evolving technologies, including the formation of an international body dedicated to cyber issues in outer space that would bring all relevant parties together; and 2) within that framework consider implementing amendments to the space law treaties as a long-term goal.

#### I. INTRODUCTION

When a powerful Soviet satellite armed with electromagnetic pulse weaponry falls into the wrong hands, British intelligence agents had to risk their lives to prevent the space-based weapon from incapacitating electricity-powered technologies on Earth in a destructive blast.<sup>1</sup> While this is the somewhat far-fetched plot of the 1995 James Bond film *Goldeneye*, the film illustrates the importance of artificial space-based satellites and the potential disaster that could result if a hostile actor gained control of one. Although no satellite capable of such mass destruction orbits the Earth currently, various military and civilian observation, communication, weather and navigational satellites, if compromised, could have similarly drastic consequences, particularly as satellite technologies advance and hostile intruders become more sophisticated, especially by utilizing Internet-based attacks.<sup>2</sup>

The problem of an artificial satellite becoming compromised due to a cyber intrusion of its network is not completely theoretical. In 2007 and 2008, several United States (US) military satellites were hacked through a ground station in Norway—the Chinese

<sup>&</sup>lt;sup>1</sup> See GOLDENEYE (United Artists 1995).

<sup>&</sup>lt;sup>2</sup> See William Akoto, What Happens When All the Tiny Satellites We're Shooting Into Space Get Hacked?, FAST COMPANY (Feb. 15, 2020), https://www.fastcompany.com/90464666/what-happens-when-all-the-tiny-satellites-were-shooting-intospace-get-hacked.

military is the prime suspect.<sup>3</sup> A Landsat-7 and Terra AM-1 satellite, which are used for climate and terrain monitoring by the National Aeronautics and Space Administration (NASA) and the US Geological Survey (USGS), each experienced several minutes of interference.<sup>4</sup> Luckily, no commands were successfully sent to the satellite and no data was captured by the hackers.<sup>5</sup> However, it is concerning that these adversary possibly State hackers managed to infiltrate a highly sensitive network and gain access to the satellites' controls.<sup>6</sup> Attempts did not end there. Another hacking campaign, allegedly by the Chinese again, occurred in 2018 when hackers intruded into the networks of satellite operators of private defense contractors and telecommunications companies.7 Although the international space community is beginning to consider the consequences of a successful hacking campaign on space technologies,8 it is only a matter of time before a State, one of its agents, or even an unidentifiable non-State actor successfully infiltrates a crucial commercial or government-owned satellite system and damages, destroys, steals sensitive data or manipulates its transmission.

Satellites today are capable of a variety of functionality and have highly advanced technological capability. Satellites are relay stations in space that receive voice, data, and video communications signals from multiple military, government, and commercial ground stations across Earth,<sup>9</sup> and are thus vulnerable to internet-

<sup>&</sup>lt;sup>3</sup> Jim Wolf, China Key Suspect in U.S. Satellite Hacks: Commission, REUTERS (Oct. 28, 2011), https://www.reuters.com/article/us-china-usa-satellite-idUSTRE79R4O320111028.

 $<sup>^{4}</sup>$  Id.

<sup>&</sup>lt;sup>5</sup> Id.

<sup>&</sup>lt;sup>6</sup> See U.S.-CHINA ECONOMIC AND SECURITY REVIEW COMMISSION, 2011 REPORT TO CONGRESS (2011).

<sup>&</sup>lt;sup>7</sup> Reuters, *China-Based Hacking Campaign Is Said to Have Breached Satellite, Defense Companies*, CNBC (June 19, 2018), https://www.cnbc.com/2018/06/19/china-basedhacking-breached-satellite-defense-companies-symantec.html.

<sup>&</sup>lt;sup>8</sup> NASA's chief information security officer has stated that preventing hacking of its systems is a top priority for the agency. See Nafeesa Syeed, Outer-Space Hacking a Top Concern for NASA's Cybersecurity Chief, BLOOMBERG (Apr. 12, 2017), https://www.bloomberg.com/news/articles/2017-04-12/outer-space-hacking-a-top-concern-for-nasa-s-cybersecurity-chief.

<sup>&</sup>lt;sup>9</sup> Satellite communication involves four steps: (1) an Earth ground station transmits the desired signal to the satellite; (2) the satellite amplifies the incoming signal and changes the frequency; (3) the satellite transmits the signal back to Earth; and (4) the ground equipment receives the signal. Intelsat, *Satellite Basics*, INTELSAT.COM (last visited on September 5, 2022), https://www.intelsat.com/resources/tools/satellite-101/. For

based cyber-attacks.<sup>10</sup> A successfully implemented system breach could result in satellite collisions, signal jams, transmission distortion or morphing, or, worst case scenario, complete loss of control of the satellite's functions.<sup>11</sup> Satellites carry an immense amount of sensitive data and capabilities that affect the entire world. They provide Global Positioning System (GPS) signals, which the world relies on for navigation, communication, banking, agriculture, travel and the Internet.<sup>12</sup> They also transmit broadcast and terrestrial signals for radio and television, which are the only sources of communication people have in parts of the world that lack wi-fi.<sup>13</sup>

If a State military had more hostile intentions, it could disrupt the entire weather monitoring ability of the US, among other consequences.<sup>14</sup> Hacking a GPS satellite, for instance, could seriously compromise worldwide travel and communication. Of particular note, cyber-attacks became more prevalent during the COVID-19 pandemic, leaving networks more vulnerable due to the disrupted economy and rise of teleworking.<sup>15</sup> For instance, China may have attempted to hack American vaccine data.<sup>16</sup> Networks can be infiltrated more easily when employees work from home, often from their own personal devices. While health data may be an obvious

detailed information regarding the technical aspects of satellite operations, see Satellite Communications Systems by Gerard Maral. *See* GERARD MARAL ET AL., SATELLITE COMMUNICATIONS SYSTEMS: SYSTEMS, TECHNIQUES AND TECHNOLOGY (6th ed. 2020).

<sup>&</sup>lt;sup>10</sup> See U.S.-CHINA ECONOMIC AND SECURITY REVIEW COMMISSION, *supra* note 6 (reporting that two US satellites were compromised in 2007 and 2008 from an attack carried out via the internet).

<sup>&</sup>lt;sup>11</sup> Deborah Housen-Couriel, *Cybersecurity and Anti-Satellite Capabilities (ASAT): New Threats and New Legal Responses*, J. OF L. & CYBER WARFARE 116, 119 (2015).

<sup>&</sup>lt;sup>12</sup> Dale Stephens & Duncan Blake, *The U.S. Military is Preparing for War in Space: We're Drafting Laws to be Ready For It*, NEWSWEEK (Nov. 22, 2017), https://www.newsweek.com/us-preparing-war-space-laws-drafted-719438.

<sup>&</sup>lt;sup>13</sup> See id.

<sup>&</sup>lt;sup>14</sup> Although it cannot be conclusively proven, China is the prime suspect for interfering with the Landsat-7 and Terra AM-1 satellites in 2007 and 2008. Such interferences are disturbing because, while the hackers did not actually exercise control of the satellites in these instances, they achieved all steps required for command and could access satellites with more sensitive functions in the future. *See supra* note 3.

<sup>&</sup>lt;sup>15</sup> Zachary Cohen, State-Backed Hackers Behind Wave of Cyberattacks Targeting Coronavirus Response, US and UK Warn, CNN (May 5, 2020), https://www.cnn.com/2020/05/05/politics/us-uk-cyberattack-warning-coronavirus/index.html.

<sup>&</sup>lt;sup>16</sup> David E. Sanger & Nicole Perlroth, U.S. to Accuse China of Trying to Hack Vaccine Data, as Virus Redirects Cyberattacks, N.Y. TIMES (May 11, 2020), https://www.ny-times.com/2020/05/10/us/politics/coronavirus-china-cyber-hacking.html.

target, hackers could use this pandemic as an opportunity to infiltrate the networks of businesses and governmental organizations while they are particularly vulnerable. Now more than ever is the time to start taking cybersecurity more seriously.

A major breach of certain satellite networks by sophisticated actors could have drastic effects, depending on the intentions of the intruder. For instance, the US military uses the USA 224 satellite for detailed spying all around the Earth for military activities.<sup>17</sup> If that satellite were compromised, hackers could acquire invaluable and classified US intelligence, threaten US military operations and perhaps even manipulate the satellite's transmission to complete military objectives adverse to the interests of the US. Similarly, a hacker could also disrupt a geostationary weather satellite, such as the GOES series,<sup>18</sup> causing weather prediction to be disrupted, or one of the many commercial telecommunications satellites that power critical infrastructure. Other disruptions could affect air traffic controls, cable and network television broadcasts, cell-phone communications, military intelligence and environmental monitoring.<sup>19</sup> Current space law would likely never allow the launching of a satellite like Goldeneye with nuclear capabilities specifically designed as an electromagnetic weapon.<sup>20</sup> But satellites launched in the next several decades, especially as the private sector develops its space industry, may have capabilities that seem unimaginable today. It is crucial that the law can account for hackers' ability to use sophisticated and constantly advancing technologies to access

<sup>&</sup>lt;sup>17</sup> Geoff Brumfiel, Amateurs Identify U.S. Spy Satellite Behind President Trump's Tweet, NPR (Sept. 2, 2019), https://www.npr.org/2019/09/02/756673481/amateurs-identify-u-s-spy-satellite-behind-president-trumps-tweet.

<sup>&</sup>lt;sup>18</sup> See NOAA GEOSTATIONARY SATELLITE SERVER (last visited on May 11, 2020), https://www.goes.noaa.gov/.

<sup>&</sup>lt;sup>19</sup> What Are Satellites Used For?, UNION OF CONCERNED SCIENTISTS (Feb. 13, 2014), https://www.ucsusa.org/resources/what-are-satellites-used#:~:text=Satellites%20can%20detect%20underground%20water,erosion%20of%20topsoil%20from%20land.

<sup>&</sup>lt;sup>20</sup> The Outer Space Treaty, which will be discussed in more detail in later sections, prohibits any nuclear weapons from being placed in Earth's orbit, and, although it does not explicitly prohibit other non-nuclear weapons, a device capable of such destruction would violate the treaty's notional requirement that outer space be used for peaceful purposes. *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, arts. II, IV [hereinafter Outer Space Treaty].

satellite networks as well as the fact that more advanced satellites, if breached, could result in severe consequences.

The US and the international community at large are not sufficiently prepared to protect against or provide adequate recourse for a larger-scale cyber-attack against the networks of highly valued space satellites on the scope of the alleged Chinese hacks on Equifax and the Office of Personnel Management (OPM).<sup>21</sup> In particular, it is unclear exactly how current international law, which is still evolving in both the cyber and space realms, could disincentivize hackers and provide States with sufficient response options or remedies. This question is particularly difficult to answer since there is no clear international framework governing cybersecurity on its own let alone cybersecurity in space.<sup>22</sup> Additionally, the distinctive physical nature of both cyberspace and outer space presents challenges as to how these laws apply.<sup>23</sup> Although the 1967 Outer Space Treaty prohibits the use of nuclear weapons in outer space,<sup>24</sup> other means of destroying or interfering with a satellite are not directly prohibited by any of the five main treaties governing outer space.<sup>25</sup> However, the major principles drawn from those

<sup>&</sup>lt;sup>21</sup> See Brian Barrett, *How 4 Chinese Hackers Allegedly Took Down Equifax*, WIRED (Feb. 10, 2020), https://www.wired.com/story/equifax-hack-china/.

<sup>&</sup>lt;sup>22</sup> Although many States have enacted their own domestic cybersecurity laws, there is not much governing such activities on the international plane. See Pavan Duggal, Chairman, Int'l Comm'n on Cyber Security Law, UNOOSA Presentation: Cyber Security Law, It's Regulation and Relevance for Outer Space, https://www.unoosa.org/documents/pdf/hlf/HLF2017/presentations/Day2/Session\_7b/Presentation5.pdf.

<sup>&</sup>lt;sup>23</sup> See generally, ACQNOTES, https://acqnotes.com/acqnote/careerfields/cyberspace (last visited Jan. 3, 2022).

<sup>&</sup>lt;sup>24</sup> Outer Space Treaty, *supra* note 20, art. IV.

<sup>&</sup>lt;sup>25</sup> See Stephens & Blake, *supra* note 12. In addition to the Outer Space Treaty mentioned previously, there are four other relevant treaties for a total of five space law treaties. The Rescue Agreement elaborates on elements of articles V and VIII of the Outer Space Treaty, providing that States take all possible steps to rescue and assist astronauts in distress and promptly return them to the launching State and that States, upon request, assist launching states in recovering space objects outside the launching State's territory. Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, Apr. 22, 1968, 19 U.S.T. 7570.

The Liability Convention elaborates on article VII of the Outer Space Treaty, providing that a launching State should be absolutely liable to pay compensation for damage caused by its space objects on the surface of Earth or to aircraft and due to activities in space. It also provides procedures for settling claims for damages. Convention on International Liability for Damage Caused by Space Objects, Mar. 29, 1972, 24 U.S.T. 2389 [hereinafter Liability Convention].

treaties, along with other areas of international law, such as the law of State responsibility,<sup>26</sup> the United Nations (UN) prohibition against the use of force<sup>27</sup> and principles of sovereignty,<sup>28</sup> may offer some guidance. Despite the recognition of cybersecurity's importance on outer space technologies by many in the international space community,<sup>29</sup> the current legal framework warrants improvement. A streamlined, cooperative legal approach at the international, domestic and market levels is still needed.<sup>30</sup>

Part II of this Note discusses the background and history of the space race alongside the emergence of the Internet and how space and nuclear-capable States have developed into major cybersecurity threats against one another. Part III outlines the current international space law and general international law, most relevant to the issue of cyber intrusions against satellites. Part IV addresses specifically how current law can prevent and mitigate the risk of cyber-security breaches of artificial satellites and discusses what international recourses and remedies are available if such an event were to occur. It posits that the current international legal framework is insufficient and suggests possible reforms to the law and other cooperative actions that the international space law community should take, including the formation of new UN body

The Registration Convention builds upon the Outer Space Treaty, Rescue Agreement, and Liability Convention creates a mechanism to help States identify space objects by expanding the scope of the UN Register of Objects Launched into Outer Space and addressed issues relating to State parties' responsibilities concerning space objects. Convention on Registration of Objects Launched into Outer Space, Jan. 14, 1975, 28 U.S.T. 695.

The Moon Agreement reaffirms and elaborates on many elements of the Outer Space Treaty as applied to the moon and other celestial bodies, providing that those bodies should be used only for peaceful purposes, their environments not disrupted, that the UN should be informed of the location and purpose of any station on those bodies. Additionally, and that that the Moon and its natural resources are the common heritage of mankind and that an international regime should be established to govern the exploitation of such resources if exploitation becomes feasible. Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, Dec. 18, 1979, 1363 U.N.T.S. 15.

<sup>&</sup>lt;sup>26</sup> See infra note 103.

<sup>&</sup>lt;sup>27</sup> See infra note 85.

 $<sup>^{28}</sup>$  See infra note 100.

<sup>&</sup>lt;sup>29</sup> See e.g., Syeed, supra note 8.

<sup>&</sup>lt;sup>30</sup> See Helena C. Mendoça, Cyberspace in Outer Space: New Challenges, New Responses, VIA SATELLITE DIGITAL, (Jan. 2017), http://interactive.satellitetoday.com/via/january-2017/new-space-spotlight-on-some-of-the-next-big-things/.
dedicated to cyber issues, similar to the Committee on the Peaceful Uses of Outer Space (COPUOS).

#### II. BACKGROUND

# A. The Cold War's Significance on the Space Race Alongside the Internet's Development

The Cold War solidified the status of Russia, at that time the Soviet Union, and the US as the two primary players in both the space race and the nuclear arms race.<sup>31</sup> Space was linked to nuclear disarmament during this period.<sup>32</sup> After the 1967 launch of Sputnik, the world's first artificial satellite, into orbit by the Soviet Union, the US and the Soviet Union competed in their space capabilities with various launches and experiments. The US capabilities demonstrably surpassed the Soviets with Apollo 8 orbiting the Moon and Apollo 11 putting humans on the Moon at the end of the decade.<sup>33</sup> In fact, the Moon landing may even have been a catalyst to the end of the Cold War and the cementing of the US's advantage over the Soviets in the nuclear arms and space races.<sup>34</sup> Notably, the same technology used to launch Sputnik into space was intended by the Soviets as a way to deliver intercontinental ballistic missiles (IBMs).<sup>35</sup>

At the same time, the Internet was developed largely as a reaction to the events of the Cold War.<sup>36</sup> The US military created

<sup>&</sup>lt;sup>31</sup> See Bradley G. Shreve, *The US, the USSR, and Space Exploration, 1957-1963,* 20 INT'L J. ON WORLD PEACE 67 (2003).

 $<sup>^{32}</sup>$  Id. at 77.

<sup>&</sup>lt;sup>33</sup> See Roald Sagdeev, United States-Soviet Space Cooperation During the Cold War, NASA 50TH MAGAZINE (May 28, 2008), https://www.nasa.gov/50th/50th\_magazine/coldWarCoOp.html.

<sup>&</sup>lt;sup>34</sup> After losing the race to the Moon, the Soviets put an enormous amount of money toward space-based weapons, which led to the collapse of the Soviet Union's economy. Mark R. Whittington, *How the Flight of Apollo 11 Won the Cold War*, THE HILL (July 21, 2018, 9:30 AM), https://thehill.com/opinion/international/398164-how-the-flight-of-apollo-11-won-the-cold-war.

<sup>&</sup>lt;sup>35</sup> Russia Tests and Intercontinental Ballistic Missile, HISTORY (Nov. 13, 2009), https://www.history.com/this-day-in-history/russia-tests-an-intercontinental-ballisticmissile.

<sup>&</sup>lt;sup>36</sup> Spencer Bruttig & Matt Gregory, *Here's How the Cold War Helped Create the Internet We Know and Love Today*, WUSA9 (Dec. 6, 2019), https://www.wusa9.com/article/news/nation-world/this-week-in-history-how-the-internet-was-created-during-the-cold-war/507-41b19bed-f500-4d66-a565-c72de578a7d0.

ARPANET, an early version of the Internet, as a military venture to bring computing to the front lines.<sup>37</sup> During the height of the Cold War, the US military further developed this network to communicate faster in the event of a nuclear attack.<sup>38</sup> Eventually, this technology evolved into the Internet the world knows today.

Before long, the Internet was subject to various vulnerabilities in its network. The first computer virus was discovered in 1971 during the ARPANET age.<sup>39</sup> By 1983, the US filed its first patent for cybersecurity protection to prevent these intrusions.<sup>40</sup> Beginning in the early 2000s, State and non-State hackers became more organized and sophisticated. For instance, Anonymous, the first major hacker group, committed various attacks against governmental organizations and corporations, mainly in the name of privacy.<sup>41</sup> By the 2010s, the US began to identify even more sophisticated security breaches committed by State-sponsored intelligence operatives for the first time.<sup>42</sup> Today, cybersecurity is a major concern for individuals, governments and corporations as organizations rely almost exclusively on Internet-capable technologies. Most organizations today have information technology departments, a chief information officer (CIO), specific policies and technical measures to prevent and respond to cyber incidents or attacks and even a team of employees dedicated to cybersecurity prevention and response.<sup>43</sup>

<sup>&</sup>lt;sup>37</sup> Ben Tarnoff, *How the Internet Was Invented*, THE GUARDIAN (July 15, 2016), https://www.theguardian.com/technology/2016/jul/15/how-the-internet-was-invented-1976-arpa-kahn-cerf.

<sup>&</sup>lt;sup>38</sup> Spencer Bruttig & Matt Gregory, *Here's How the Cold War Helped Create the Internet We Know and Love Today*, WUSA9 (Dec. 6, 2019), https://www.wusa9.com/article/news/nation-world/this-week-in-history-how-the-internet-was-created-during-thecold-war/507-41b19bed-f500-4d66-a565-c72de578a7d0.

<sup>&</sup>lt;sup>39</sup> Tim Matthew, *A Brief History of Cybersecurity*, CYBERSECURITY INSIDERS (last visited March 2, 2020), https://www.cybersecurity-insiders.com/a-brief-history-of-cybersecurity/.

 $<sup>^{40}</sup>$  Id.

<sup>&</sup>lt;sup>41</sup> *Id*.

<sup>&</sup>lt;sup>42</sup> *Id.* In 2010, Google announced that Chinese intelligence agents breached its infrastructure in "Operation Aurora" in what was considered an ultra-sophisticated attack that utilized encryption, stealth programming, and the exploitation of a vulnerability in Internet Explorer. *See* Kim Zetter, *Google Hack Attack Was Ultra Sophisticated, New Data Shows*, WIRED (Jan. 14, 2010), https://www.wired.com/2010/01/operation-aurora/.

<sup>&</sup>lt;sup>43</sup> For instance, the Cybersecurity & Infrastructure Security Agency (CISA) maintains guidance on how organizations can strengthen the security, resilience, and workforce of the cyber ecosystem. *Cybersecurity*, CISA (last visited Sept. 5, 2022), https://www.cisa.gov/cybersecurity. Additionally, CIO.gov maintains OMB guidance

States as a whole have also developed their own cybersecurity safeguards and attack methods as well as legal protections. In the US, for instance, the Cybersecurity Infrastructure Security Agency (CISA), a component of the Department of Homeland Security (DHS), is the main entity in charge of ensuring that government agencies have adequate standards and security policies in place and follow the government-sponsored guidance<sup>44</sup> while the National Security Agency (NSA) has developed its own cyber-attack methods for responding to and hacking into the networks of adversary States.<sup>45</sup> Certain States are notorious for cyber-attacks, whether government-sponsored or not, including Russia, China, North Korea, Iran, Israel, the United Kingdom and even the United States.<sup>46</sup> China, in particular, is responsible for 29.56% of denial of service attacks.<sup>47</sup>

#### B. Major International Players in the Space and Cyber Realms

The players in the space race have increased massively since the Cold War when the US and Soviet Union dominated. Nine countries and the European Space Agency have the independent capacity to launch into outer space.<sup>48</sup> The countries with the most objects launched into space include first the US, followed by China, Russia

describing the responsibility of government agency CIOs with regard to information security and privacy. and how to best prepare for and respond to cyber incidents. *1.6.2 CIO Responsibilities* – *OMB Guidance*, CIO (last visited Sept. 5, 2022), https://www.cio.gov/handbook/cio-responsibilities/information-security-and-privacy/cioresponsibilities-omb-guidance/.

<sup>&</sup>lt;sup>44</sup> See CISA, Cybersecurity Framework (last visited Mar. 2, 2020), https://www.uscert.gov/resources/cybersecurity-framework. The National Institute of Standards and Technology (NIST), an agency of the Department of Commerce, publishes the Cybersecurity Framework, guidelines for organizations to manage cybersecurity risks. See NIST, Cybersecurity Framework, (last visited May 23, 2020), https://www.nist.gov/cyberframework. The framework says organizations should identify the risk, protect the network, detect the problem, respond swiftly and recover from any damage caused. See id.

<sup>&</sup>lt;sup>45</sup> For more information on how the NSA protects US cyberspace, *see* NSA, *Cyberse-curity* (last visited Mar. 2, 2020), https://www.nsa.gov/what-we-do/cybersecurity/.

<sup>&</sup>lt;sup>46</sup> AllinAllSpace, Cyber Warfare – The Leading Countries, ALLINALLSPACE (Jan. 20, 2019), https://www.allinallspace.com/cyber-warfare-the-leading-countries/.

<sup>&</sup>lt;sup>47</sup> Naveen Goud, List of Countries Which Are Most Vulnerable to Cyber Attacks, CYBERSECURITY INSIDERS (last visited Mar. 2, 2020), https://www.cybersecurity-insiders.com/list-of-countries-which-are-most-vulnerable-to-cyber-attacks/.

<sup>&</sup>lt;sup>48</sup> NATIONAL AIR AND SPACE INTELLIGENCE CENTER, COMPETING IN SPACE (2018).

and Japan.<sup>49</sup> Even North Korea placed a satellite into orbit in 2012.<sup>50</sup> In addition, various private companies have placed satellites into orbit as well. SpaceX, for instance, plans to launch 12,000 small satellites into space to as part of the Starlink Internet project.<sup>51</sup> Today there are more than 2,000 satellites in orbit, a number which will only increase in the future.<sup>52</sup> All of them serve as potential targets for cyberattack by State militaries or other hacker groups.

States known to have developed cyber capabilities that have attacked the US in the past, such as Russia, China, North Korea and Iran, or sophisticated non-State cyber hackers, pose significant threats to these space assets. For instance, in 2011, Sony Pictures was victim to a brutal cyber-attack by a North Korean national suspected to have ties with the government that brought the company to its knees to prevent the release of *The Interview*, a film that depicted the assassination of Kim Jong-Un, the country's dictator.<sup>53</sup> Russian hackers also allegedly infiltrated the network of the Democratic National Committee (DNC) and are suspected of having influenced the US 2016 Presidential Election by compromising the American election infrastructure.<sup>54</sup> The Chinese are arguably the most notorious cyber hackers and are, or are suspected of having been, behind some of the largest cyber-attacks in the past decade, such as the Equifax and OPM breaches.<sup>55</sup> They also allegedly have

<sup>&</sup>lt;sup>49</sup> Johnny Wood, *The Countries with the Most Satellites in Space*, WORLD ECONOMIC FORUM (Mar. 4, 2019), https://www.weforum.org/agenda/2019/03/chart-of-the-day-the-countries-with-the-most-satellites-in-space/.

<sup>&</sup>lt;sup>50</sup> Space.com Staff, North Korea Successfully Launches Satellite: Reports, SPACE.COM (Dec. 12, 2012), https://www.space.com/18867-north-korea-rocket-launch-satellite.html.

<sup>&</sup>lt;sup>51</sup> Starlink is a satellite network that SpaceX plans to develop into a mega-constellation to provide low-cost Internet to remote locations. *See* Adam Mann, *Starlink: SpaceX's* Satellite Internet Project, SPACE.COM (Jan. 17, 2020), https://www.space.com/spacex-starlink-satellites.html.

<sup>&</sup>lt;sup>52</sup> See *id*.

<sup>&</sup>lt;sup>53</sup> This attack on an American subsidiary of a Japanese company caused unprecedented damage to the economy in the US and around the globe. *See* Tim Starks, *U.S. Indicts North Korean National for Sony Hack, Massive Cyberattacks*, POLITICO (Sept. 6, 2018), https://www.politico.com/story/2018/09/06/justice-department-north-korea-sonyhack-771212.

<sup>&</sup>lt;sup>54</sup> See CNN Library, 2016 Presidential Campaign Hacking Fast Facts, CNN (Oct. 31, 2019), https://www.cnn.com/2016/12/26/us/2016-presidential-campaign-hacking-fast-facts/index.html.

<sup>&</sup>lt;sup>55</sup> In 2017, four members of China's military were charged by the US Department of Justice for hacking into Equifax, one of the nation's largest credit reporting agencies,

infiltrated US satellites at least twice<sup>56</sup> and could execute actual commands if that happened again. If State and non-State actors<sup>57</sup> are capable of such major hacks on Earth-based systems, there is little stopping them from targeting satellites in space via the Internet.

Current space law does not allow the placement of nuclear weapons or a weapon of mass destruction such as Goldeneye into orbit.<sup>58</sup> But satellites launched in the next several decades, especially as the private sector develops its space industry, may have capabilities that seem unimaginable today, so it is crucial that space law can account for the fact that evolving technologies create new ways for hackers to access these systems. Today, most devices, including satellites, rely on the Internet, and with the emergence of the Internet of Things (IoT), that will only increase.

History shows that satellites are vulnerable to cyber attacks, which scholar P. J. Blount argues are merely one form of IoT,<sup>59</sup> and given the rise of military activities in outer space<sup>60</sup> and military cyber espionage and attacks,<sup>61</sup> there is no reason to doubt that a State or nonaligned hacker group may attempt to infiltrate and

<sup>56</sup> See Wolf, supra note 3.

and stealing trade secrets and highly personal data from millions of Americans. See Katie Benner, U.S. Charges Chinese Military Officers in 2017 Equifax Hacking, N.Y. TIMES (Feb. 10, 2020), https://www.nytimes.com/2020/02/10/us/politics/equifax-hack-china.html. Although there is not conclusive proof, the indictment suggests the hack was part of a series of major data thefts organized by the People's Liberation Army and Chinese intelligence agencies. See id.

Another such major data theft suspected to have been organized by China was the 2015 data breach against OPM, which resulted in the arrest of a Chinese national by the FBI in 2017. Evan Perez, *FBI Arrests Chinese National Connected to Malware Used in OPM Data Breach*, CNN (Aug. 24, 2017), https://www.cnn.com/2017/08/24/politics/fbi-arrests-chinese-national-in-opm-data-breach.

<sup>&</sup>lt;sup>57</sup> Although many hackers are non-State actors suspected of being tied with a State, it often is not known who the perpetrator is and if that person or entity is associated with the State or not. For instance, the North Korea example was a North Korean national who likely had ties or was directed by the government, but there is not conclusive proof of that. *See supra* note 53.

<sup>&</sup>lt;sup>58</sup> See Outer Space Treaty, supra note 20, art. IV.

<sup>&</sup>lt;sup>59</sup> See generally P. J. Blount, Satellites Are Just the Internet of Things, 42 AIR & SPACE L. 3, 273 (2017).

<sup>&</sup>lt;sup>60</sup> Jun Nagishima, *The Militarization of Space and its Transformation Into a Warfighting Domain*, SPF, https://www.spf.org/iina/en/articles/nagashima\_02.html.

<sup>&</sup>lt;sup>61</sup> David Vergun, DOD Works to Increase Cybersecurity for U.S., Allies, DEFENSE.GOV, https://www.defense.gov/News/News-Stories/Article/Article/2351916/dod-works-to-increase-cybersecurity-for-us-allies/.

manipulate adversary satellites. The Chinese have already been suspected of successfully gained access to the Landsat-7 and Terra AM-1.<sup>62</sup> The Pentagon has also reported that both the Chinese and Russians are developing lasers and a host of other anti-satellite (ASAT) weapons, which could track, study, or even target adversary satellites through physical, kinetic, microwave and cyber technologies.<sup>63</sup> This Pentagon report also apparently indicated that the Chinese and Russians are preparing to employ offensive and defensive ASAT technology, which could extend to cyber infiltration of satellites as well.<sup>64</sup>

Blount argues that it is only a matter of time before military conflict occurs in outer space.<sup>65</sup> He notes that although China and the US have developed ASAT technologies, no legal instrument has been adopted to regulate them.<sup>66</sup> Blount goes on to suggest that the rules of armed conflict from international humanitarian law should extend to military activities in space.<sup>67</sup> Blount's ideas serve as a useful starting point in examining what sorts of international rules could be adopted to effectively regulate and prevent cyber attacks against satellites.

#### II. CURRENT INTERNATIONAL LEGAL REGIME

Both international law in general and international space law in particular provide legal protections to both States and private satellite operators to ensure the security of their satellites in space. Because there are only five treaties<sup>68</sup> governing space activities specifically, much of the law applicable to cybersecurity of satellites comes from general public international law, which the Outer Space Treaty says governs outer space activities as well.<sup>69</sup>

<sup>&</sup>lt;sup>62</sup> See Wolf, supra note 3.

<sup>&</sup>lt;sup>63</sup> These ASATs may employ microwave, radiofrequency jamming, laser, chemical spraying, kinetic kill and robotic technologies to attack satellites. *See* Patrick Tucker, *China, Russia Building Attack Satellites and Space Lasers: Pentagon Report*, DEFENSE ONE (Feb. 12, 2019), https://www.defenseone.com/technology/2019/02/china-russia-building-attack-satellites-and-space-lasers-pentagon-report/154819/.

<sup>&</sup>lt;sup>64</sup> See id.

<sup>&</sup>lt;sup>65</sup> P.J. Blount, Targeting in Outer Space: Legal Aspects of Operational Military Actions in Space, HARV. NAT'L SEC. J. 1, 1 (2012).

 $<sup>^{66}</sup>$  Id. at 2.

<sup>&</sup>lt;sup>67</sup> Id. at 22.

<sup>&</sup>lt;sup>68</sup> See supra note 25.

<sup>&</sup>lt;sup>69</sup> Outer Space Treaty, *supra* note 20, art. III.

Additionally, the nature of cyberspace, because it is intangible, presents many challenges that traditional international law does not address. Due to its infancy, even more so than space exploration, there is no clear standard of international legal norms in the area of cybersecurity.<sup>70</sup> Rather, there are mostly theories and suggestions as to how the traditional rules and principles apply in this new domain.

According to Article 38 of the Statute governing the International Court of Justice (ICJ), public international law consists of three primary sources: (1) international conventions, (2) international custom, as evidence of general practice accepted as law and (3) the general principles of law recognized by civilized nations.<sup>71</sup> In addition, judicial decisions and the "teachings of the most highly qualified publicists of the various nations" may serve as subsidiary sources.<sup>72</sup> Finally, there are various other sources of soft law, such as memoranda of understanding, recommendations, principles and resolutions, which lack the same enforcement measures of "hard law" but serve as useful persuasive authority.<sup>73</sup> These subsidiary sources are particularly useful in space law considering the field's infancy, even more so compared to space law due to the recent advance of computer technology, and lack of internationally binding legal instruments.

# A. Treaties

## i. The Outer Space Treaty

The foundational international convention governing space activities is the 1967 Outer Space Treaty.<sup>74</sup> According to the Treaty, all space activities should be carried out in accordance with international law, including the UN Charter, in the interest of maintaining peace, security, cooperation and understanding, and States should act with "due regard" to the interests of all other parties to

<sup>&</sup>lt;sup>70</sup> See Duggal, supra note 22.

 $<sup>^{71}\,</sup>$  Statute of the International Court of Justice Art. 38 June 26 1945, 6 L.N.T.S. 391-413.

 $<sup>^{72}</sup>$  Id. at art. 38.4

<sup>&</sup>lt;sup>73</sup> See Francis Lyall & Paul B. Larsen, Space Law: A Treatise 47-48 (Routledge ed., 2d ed. 2018).

<sup>&</sup>lt;sup>74</sup> Outer Space Treaty, *supra* note 20.

the treaty.<sup>75</sup> Thus, treaties, custom and other sources of general international law also govern outer space activities.

Additionally, the placement of nuclear weapons or other weapons of mass destruction in space is prohibited.<sup>76</sup> However, nothing in the treaty addresses non-nuclear space weapons explicitly, though Article IV says that the Moon and other celestial bodies shall be used only for peaceful purposes, but launching other types of weapons into space, depending on the purpose and capability of destruction, could go against the Treaty's overall object and purpose of maintaining peace and security.<sup>77</sup> Nevertheless, the Treaty does not explicitly prohibit non-physical threats, such as cyber intrusions.

The Outer Space Treaty provides for some redress for violations of international law. States who conduct national activities in outer space bear "international responsibility" for such activities but are only "liable" for physical damage caused by space objects they launch into outer space whereas the Liability Convention expands in more detail on when a State actually must pay for damages.<sup>78</sup>

#### ii. The Liability Convention

The Liability Convention provides that States should pay for damage caused by objects the State launches into outer space.<sup>79</sup> Liability should be distinguished from "international responsibility."<sup>80</sup> Specifically, it states that "[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 in flight."<sup>81</sup> If damage is caused elsewhere, the launching State "shall be liable only if the damage is due to its fault or the fault of persons for whom it is responsible."<sup>82</sup> But the Convention defines "damage" as death,

 $<sup>^{75}\,</sup>$  Id. at arts. III, IX.

<sup>&</sup>lt;sup>76</sup> *Id.* at art. IV.

 $<sup>^{77}\,</sup>$  Id. at arts. I, IV.

<sup>&</sup>lt;sup>78</sup> Outer Space Treaty, *supra* note 20, arts. VI, VII.

<sup>&</sup>lt;sup>79</sup> Liability Convention, *supra* note 25.

 $<sup>^{80}~</sup>$  The Outer Space Treaty on its own does not say that a State deemed "internationally responsible" must pay compensatory damages to the injured State. See Outer Space Treaty, supra note 20, art. VI.

<sup>&</sup>lt;sup>81</sup> Liability Convention, *supra* note 25, art. II.

<sup>&</sup>lt;sup>82</sup> Id. at art. III.

physical injury or loss or damage to property; "launching state" as a State that launches or from whose territory a space object is launched; and a "space object" as components and parts of the space object itself and the launching vehicle.<sup>83</sup> So, although a cyber-attack could cause physical as well as intangible damage to a satellite, under this treaty, it is unlikely that the drafters of this Convention anticipated non-physical threats by other actors in outer space, so hackers will likely not to be considered a State that launches an object into space.

## iii. The United Nations Charter

The UN Charter, the foundational treaty of the United Nations (UN), governs outer space activities per Article III of the Outer Space Treaty.<sup>84</sup> The Charter, among many other things, prohibits the use of force and requires States to resolve disputes by peaceful means unless the UN approves the use of force by resolution or the State uses force in self-defense.<sup>85</sup> These principles raise the question of whether hacking, jamming or interfering with satellites through cyberspace constitutes a use of force because it is not necessarily an "armed" attack in the traditional sense.<sup>86</sup>

#### iv. Budapest Convention on Cybercrime

Although many US states have domestic privacy and data security laws,<sup>87</sup> there is no real international standard regarding how

<sup>&</sup>lt;sup>83</sup> *Id.* at art. I.

<sup>&</sup>lt;sup>84</sup> See Outer Space Treaty, supra note 20, art. III.

<sup>&</sup>lt;sup>85</sup> U.N. Charter arts. 2(4), 39-51. For an interesting discussion on the U.N. Charter's prohibition against the use of force, see Professor Claus Kress's essay examining the international framework governing the use of force. *See* Claus Kress, *On the Principles of Non-Use of Force in Current International Law*, JUST SECURITY (Sept. 30, 2019), https://www.justsecurity.org/66372/on-the-principle-of-non-use-of-force-in-current-international-law/. Interestingly, Professor Kress notes that the question of whether harmful cyber operations violate this prohibition is uncertain because while cyber operations can cause massive damage to critical national infrastructure, the harms would be mainly economic in nature.

<sup>&</sup>lt;sup>86</sup> *Id.* at art. 2(4).

<sup>&</sup>lt;sup>87</sup> Many recent state laws in the US provide stronger protection to individuals' personally identifiable information (PII) and say what businesses can and cannot do with such information that they collect from consumers. For instance, the California Consumer Privacy Act (CCPA) gives more rights to consumers and control over their information. *See* Cal. Civ. Code 1.81 § 1798.100-1798.199 (West 2018). For an in-depth analysis on the CCPA, the nation's first major comprehensive consumer privacy law, see

nation-States should handle cyber-security attacks.<sup>88</sup> The Budapest Convention on Cybercrime is the first and only international convention that specifically seeks to address Internet crime.<sup>89</sup> The treaty attempts to harmonize the laws addressing copyright infringement, computer fraud, child pornography and violations of network security.<sup>90</sup> However, it only has sixty-seven signatories, and its scope is narrow.<sup>91</sup> Despite the original intention that the Convention apply globally, the US only ratified it in 2006,<sup>92</sup> while various States that hold strong nationalism and sovereignty views, such as Russia, unsurprisingly, oppose it.<sup>93</sup> It has garnered little recognition and significance since its adoption.

#### B. Custom

## i. The Use of Outer Space for Peaceful Purposes

Although the idea that space should be used only for peaceful purposes is enshrined in the Outer Space Treaty and the UN resolution on the legal principles applicable to outer space,<sup>94</sup> it has

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Nicholas Palmieri's article evaluating the CCPA and its potential implications on other data protection laws nationwide. See Nicholas F. Palmieri III, Who Should Regulate Data?: An Analysis of the California Consumer Protection Act and its Effects on Nationwide Data Protection Laws, 11 UC HASTINGS SCI. & TECH. L.J. 37 (2020), https://repository.uchastings.edu/cgi/viewcontent.cgi?article=1092&context=hastings\_science\_technology\_law\_journal.

<sup>&</sup>lt;sup>88</sup> See generally TALLINN MANUAL 2.0 ON THE INTERNATIONAL LAW APPLICABLE TO CYBER OPERATIONS (Michael N. Schmitt & Liis Vihul eds., 2017) [hereinafter TALLINN MANUAL 2.0].

<sup>&</sup>lt;sup>89</sup> Convention on Cybercrime, Nov. 23, 2001, E.T.S. No. 185.

<sup>&</sup>lt;sup>90</sup> See id. arts. 2-10, 16-17, 20-21.

<sup>&</sup>lt;sup>91</sup> Details of Treaty No. 185, COUNCIL OF EUROPE (last visited Jan. 3, 2022), https://www.coe.int/en/web/conventions/full-list/-/conventions/treaty/185.

<sup>&</sup>lt;sup>92</sup> Chart of Signatories and Ratifications of Treaty 185, COUNCIL OF EUROPE (last visited Jan. 3, 2022), https://www.coe.int/en/web/conventions/full-list/-/conventions/treaty/185/signatures?p\_auth=UJtzQGCt.

<sup>&</sup>lt;sup>93</sup> Communist and authoritarian countries, such as Russia, opposed this convention because allowing parties to access computer data of other parties "might damage the sovereignty and security of member countries and their citizens' rights." *See* Jonathan Clough, *A World of Difference: The Budapest* Convention on Cybercrime *and the Challenges of Harmonisation*, 40(3) MONASH U. L. REV. 698, 724-25 (2014).

<sup>&</sup>lt;sup>94</sup> Outer Space Treaty *supra* note 20; Declaration of Legal Principles Governing the Activities of States in the Exploration of and Use of Outer Space, Dec. 13, 1963, https://www.unoosa.org/oosa/en/ourwork/spacelaw/principles/legal-principles.html#:~:text=1.,in%20accordance%20with%20international%20law.

likely solidified as part of customary international law.<sup>95</sup> State practice on this principle can be seen in various treaties, statements, principles and policies from space-capable nations.<sup>96</sup> There is even a body in the UN dedicated to maintaining peace, security and development in outer space—the Committee on the Peaceful Uses of Outer Space (COPOUS)—as well as a legal subcommittee.<sup>97</sup> However, defining what "peaceful purposes" actually means can be difficult,<sup>98</sup> especially when considering the intangible nature of cyberspace.

#### ii. Violating Another State's Sovereignty

States can violate international law by interfering with another State's sovereignty or territorial integrity.<sup>99</sup> Territorial sovereignty means that a State exercises complete and exclusive jurisdiction over its physical territory.<sup>100</sup> The ICJ has stressed that "respect for territorial sovereignty is an essential foundation of international relations."<sup>101</sup> Traditionally, whether a State violated another State's sovereignty could easily be determined because it was dependent on physical borders.<sup>102</sup> However, determining what constitutes a sovereignty violation can be difficult in the space and cyber context due to its cross-border nature and the fact that a hack might not actually occur in outer space but rather through servers on Earth.

## iii. The Law of State Responsibility and Attribution

The law of State responsibility imposes several international rights and duties on States in the event of a violation of

<sup>&</sup>lt;sup>95</sup> See Blount, supra note 59, at 2.

 $<sup>^{96}</sup>$  Id.

<sup>&</sup>lt;sup>97</sup> See Committee on the Peaceful Uses of Outer Space, U.N. OFF. FOR OUTER SPACE AFF. (last visited Jan. 3, 2022), https://www.unoosa.org/oosa/en/ourwork/copuos/index.html.

<sup>&</sup>lt;sup>98</sup> Blount, *supra* note 59, at 2.

<sup>&</sup>lt;sup>99</sup> Benedikt Pirker, *Territorial Sovereignty and Integrity and the Challenges of Cyberspace, in* PEACETIME REGIME FOR STATE ACTIVITIES IN CYBERSPACE 192 (Katharina Ziolkowski ed., 2013).

<sup>&</sup>lt;sup>100</sup> Wolff Heintschel von Heinegg, *Legal Implications of Territorial Sovereignty in Cyberspace*, NATO CCD COE 8 (2012).

 <sup>&</sup>lt;sup>101</sup> See Corfu Channel Case (U.K. v. Alb.), Judgment, 1949 I.C.J. 4, 35 (Apr. 9).
<sup>102</sup> Id.

international law.<sup>103</sup> States who commit an internationally wrongful act, either through a State organ or by an entity under the instruction or control of the State, owe reparations to the injured party.<sup>104</sup> An injured State may also respond with countermeasures that are proportional to the original violation and are necessary to stop, prevent, or remedy the violation, subject to the limitations of the UN Charter.<sup>105</sup> However, the perpetrators of many cyber-attacks cannot even be identified, let alone officially attributed to a State, and thus a State cannot be held internationally responsible. While there is little authority on State attribution in the cyber context, the *Tallinn Manual 2.0 on the International Law Applicable to Cyber Operations* serves as a useful reference guide on the current State of customary international law, particularly on this topic.<sup>106</sup>

## C. Subsidiary Sources and Soft Law

In addition to treaties and customary international law, subsidiary sources can be a useful, additional authority. These could include opinions from the ICJ on general subjects of international law. Given the novelty of cyberattacks on space assets, scholarly commentary are also useful sources, especially considering the lack of established binding legal authority in this area. Additionally, Unite Nations principles, declarations and resolutions serve as useful "soft law" that do not have the same binding effect as treaties and other primary sources of international law. They are indicative, however, of State practice and international consensus.

<sup>&</sup>lt;sup>103</sup> See DRAFT ARTICLES ON RESPONSIBILITY OF STATES FOR INTERNATIONALLY WRONGFUL ACTS WITH COMMENTARY ARTS. 2, 4, 8, INT'L LAW COMM'N 2001), https://legal.un.org/ilc/texts/instruments/english/commentaries/9\_6\_2001.pdf ([hereinafter DRAFT ARTICLES].

 $<sup>^{104}</sup>$  *Id*.

<sup>&</sup>lt;sup>105</sup> See id. § 905.

<sup>&</sup>lt;sup>106</sup> See generally TALLINN MANUAL 2.0 supra note 88.

# III. HOW INTERNATIONAL LAW CAN PREVENT AND PROVIDE REDRESS FOR A MAJOR CYBER-ATTACK ON A SATELLITE SYSTEM

A successful cyber-attack on a satellite could interfere with the space object's flight control, payload control or transmission.<sup>107</sup> Because the Outer Space Treaty says that space activities are governed by international law,<sup>108</sup> if such an attack were to occur, the State or private company whose satellite was compromised would turn to international law to evaluate its response options and any potential recourse the attacker owes. The injured satellite operator will want assurances and effective enforcement measures from the law that discourage and disincentivize hostile actors from committing attacks.

# A. Prevention and Risk Mitigation: How Hacking Satellites Violates International Law

The space law treaties say little specifically about how States can prevent against possible cyber military or terrorist attacks in space but are more concerned with the peaceful use and exploration of outer space for the "province of all [hu]mankind."<sup>109</sup> However, there are various ways that general international law can be violated when a hacker invades a government or private satellite's network.

First, a cyber-attack, depending on its nature and scope, could qualify as a violation of international law because it is a prohibited "use of force" under Article 2(4) of the UN Charter.<sup>110</sup> Second, a cyber-attack may constitute a violation of a State's territorial

<sup>&</sup>lt;sup>107</sup> See Elizabeth Howell, What Is A Satellite?, SPACE.COM (Oct. 27, 2017), https://www.space.com/24839-satellites.html.

<sup>&</sup>lt;sup>108</sup> Outer Space Treaty, *supra* note 20, art. III.

<sup>&</sup>lt;sup>109</sup> *Id.* at art. I.

<sup>&</sup>lt;sup>110</sup> See UN Charter art. 2(4). For instance, a hacker State could use prohibited force against another State directly by interfering with its weather or Internet communications, causing technology failures, transportation shutdowns, or emergency responses that would likely cause significant physical damage. This type of hack would more clearly qualify as a use of force because it resulted in physical damage, even if the hacker was not using armed force in the traditional sense. Alternatively, a more indirect use of force could be economic in nature, such as collapsing a State's stock exchange system or financial institutions, which would be more difficult to show as a violation of the UN Charter.

sovereignty.<sup>111</sup> But whether a violation of international law actually occurs will be highly context specific.

# i. Cyber-Attacks Against a Space-Based Satellite's Network As a "Use of Force" Prohibited by the United Nations Charter

Whether the UN's prohibition against the use of force, and exception for self-defense measures, applies to cyberspace is generally unresolved by international law and highly dependent on each State's particular interpretation of the Charter. Article 2(4) of the Charter says that States may use force in self-defense or in anticipation of an impending attack "if an armed attack occurs."<sup>112</sup> Although cyber activities are not "armed" in the traditional sense,<sup>113</sup> a successful cyber operation against a satellite system could qualify as an armed attack under international law depending on the circumstances of the attack.<sup>114</sup> The theory accepted by most States on Article 2(4)'s applicability in cyberspace argues that an attack may be deemed "armed" if its scope and effect are equivalent to that of a

<sup>&</sup>lt;sup>111</sup> A cyber-attack that crosses State borders, unlike traditional violations of territorial sovereignty, is more difficult to determine because of the intangible nature of cyberspace. If a hacker caused massive amounts of damage to another State across the globe, without ever actually setting foot in that State, it would be difficult to argue that the hacker violated traditional principles of sovereignty, which focuses on a State's exclusive jurisdiction over physical territory. *See supra* note 100.

 $<sup>^{112}\,</sup>$  UN Charter arts. 2(4); see also art. 51 (permitting States to use force in self defense against an armed attack).

<sup>&</sup>lt;sup>113</sup> See Benedikt Pirker, supra note 99.

<sup>&</sup>lt;sup>114</sup> *Id.* Depending on the target, extent of damage, intentions of the attacker, and a variety of other factual circumstances, a cyber attack may or may not qualify as a "use of force" under the UN Charter. While hackers generally are not "armed" in the traditional sense of having physical weapons, they could cause massive damage to variety of information and communications systems through malware, phishing, man-in-the-middle attacks, denial-of-service (DOS) attacks, structured query language (SQL) injections, zero-day exploits, or domain name system (DNS) tunnelling. See *What is a Cyberattack?* CISCO (last visited Sept. 6, 2022), https://www.cisco.com/c/en/us/products/security/common-cyberattacks.html#~types-of-cyber-attacks.

For instance, a malware attack, commonly understood as a cyber-attack using malicious software to breach a network vulnerability and block access, install harmful software, steal data, or render the system inoperable, that shut down aviation systems could qualify as a prohibited use of force because it would cause massive damage to a State's transportation infrastructure and was clearly intended to disrupt those communication systems. *See id.* By contrast, a man-in-the middle attack that merely eavesdrops and obtains information from an important government transaction may be damaging and potentially illegal, but would be less likely to qualify as a use of force under the UN Charter. *See id.*; UN Charter art. 2(4).

physical attack.<sup>115</sup> Other theories take a more holistic view and consider various factors such as severity, immediacy, directness, invasiveness, measurability and presumptive legality.<sup>116</sup> This section focuses on the "effects" test, as it is the test followed by most States and the US.<sup>117</sup>

Under the "effects" test, a hacker that intentionally causes physical damage to a satellite will have violated the UN's prohibition on force and thus committed an internationally wrongful act.<sup>118</sup> The US in particular considers "clandestine" military operations conducted in cyberspace to be traditional military activity.<sup>119</sup> For instance, if Chinese military operatives were to intentionally invade a US military satellite network to destroy it or cause it to collide into another satellite in space, this conduct would violate the UN Charter's prohibition under the US interpretation because the operatives have caused clear tangible damage to US military assets.

However, if the cyber intrusion causes more of an economic or dignitary harm, such as information theft, that does not have a direct physical effect, delineating between permissible and prohibited acts under international law becomes less clear. The ICJ has ruled on drawing this line in *Nicaragua v. United States* when it found that the US merely funding Nicaraguan guerillas who opposed their government did not use prohibited force against the State.<sup>120</sup> The US did use force, however, when it armed and trained those forces, even without any immediate physical effects.<sup>121</sup> This case suggests that some additional, and intentional, steps must be taken by hackers beyond mere access for an intrusion to constitute a prohibited use of force under the effects test. So, if Chinese military operatives only gained access to a satellite communications system merely to infiltrate the system, as they allegedly did in 2007 and

 $<sup>^{115}\,</sup>$  This theory is referred to as the "effects" test. See Housen-Couriel, supra note 11, at 135.

<sup>&</sup>lt;sup>116</sup> See Matthew C. Waxman, Cyber-Attacks and the Use of Force: Back to the Future of Article 2(4), 36 YALE J. INT'L L. 421, 432 (2011).

<sup>&</sup>lt;sup>117</sup> See id. at 434.

<sup>&</sup>lt;sup>118</sup> See generally Housen-Couriel, supra note 11.

 $<sup>^{119}~</sup>$  See John S. McCain National Defense Authorization Act for Fiscal Year 2019, Pub. L. No. 115-232, § 1632.

<sup>&</sup>lt;sup>120</sup> Military and Paramilitary Activities in and Against Nicaragua (Nicar. v. U.S.), Judgment, 1986 I.C.J. Rep. 14, ¶136-37 (June 27).

 $<sup>^{121}</sup>$  Id.

2008,<sup>122</sup> that may not qualify as a use of force under the effects test; however, taking data, manipulating the satellite's transmission to make it do something significant, or causing some other additional harm would likely provide the additional element required by *Nicaragua*.<sup>123</sup>

# ii. Cyber Attacks Against a Space-Based Satellite's Network as a Violation of a State's Territorial Sovereignty

A State can also violate international law with a cyber intrusion if it interferes with another State's sovereignty or territorial integrity.<sup>124</sup> Like with the UN prohibition against the use of force, drawing the line between legal conduct and an illegal violation of State sovereignty can be murky.<sup>125</sup> In the Corfu Channel Case, for instance, the ICJ found that the United Kingdom (UK) did not violate Albania's sovereignty when its warships passed through Albanian waters during World War II without permission from the government but did when it went back into the waters to conduct minesweeping operations later on.<sup>126</sup> While some amount of coercion will not amount to a violation of a State's sovereignty, when an interference crosses the line to become a prohibited intervention, this will violate international law.<sup>127</sup> In the cyber context, a minor interference, such as the alleged Chinese interference in 2007 and 2008,<sup>128</sup> that causes little or no disturbance or damage, would likely not qualify as a violation of territorial sovereignty because it is more akin to "passing through."129 But, at certain point, a cyber interference could become a sovereignty violation when it rises to the level of the minesweeping activity in the Corfu Channel Case.<sup>130</sup> Following the reasoning of this case, a State who infiltrates a satellite system merely to "pass through" would likely not violate international law. But taking data, damaging the satellite, or manipulating its transmission would be more akin to "minesweeping" and thus a

<sup>&</sup>lt;sup>122</sup> See Wolf, supra note 3.

 $<sup>^{123}</sup>$  Id.

<sup>&</sup>lt;sup>124</sup> See Pirker, supra note 99, at 192.

 $<sup>^{125}</sup>$  Id.

<sup>&</sup>lt;sup>126</sup> U.K. v. Alb., 1949 I.C.J. at 35-36.

<sup>&</sup>lt;sup>127</sup> Nicar. V. U.S. 1986 I.C.J at 108, 124.

<sup>&</sup>lt;sup>128</sup> See U.S.-CHINA ECONOMIC AND SECURITY REVIEW COMMISSION supra note 6.

<sup>&</sup>lt;sup>129</sup> U.K. v. Alb., 1949 I.C.J. at 35-36.

 $<sup>^{130}</sup>$  Id.

sovereignty violation because this conduct was planned and deliberate rather than necessary or happenstance.<sup>131</sup> This case also suggests that there are limits to what constitutes a violation of a State's sovereignty.<sup>132</sup> International law seeks to encourage some amount of cooperation and open borders between States in times of crisis or when the State had no ill intent.<sup>133</sup> There is no reason why this idea should not extend to cyberspace, although it becomes much more complex.

The unique physical nature of cyberspace suggests that it may not be subject to the traditional principles of territorial sovereignty. Unlike a channel of water that clearly sits within a State's physical borders, cyberspace, like outer space, has been argued to be a "global commons."<sup>134</sup> A global commons is an area located outside the sovereign jurisdiction of any particular State to which all nations have access.<sup>135</sup> The Outer Space Treaty suggests that outer space is a global commons when it calls it the province of all of humankind.<sup>136</sup> However, cyberspace, unlike outer space, more suitably falls under the sovereign jurisdiction of individual States. For one, cyberspace is run by physical servers and modems, and when a virus is transmitted to a network, it can be traced to a physical source.<sup>137</sup> Additionally, States can prevent others from accessing their content outside of the country because they have their own Internet regulators, filters and IP addresses. By contrast, outer space still exists within physical space and is not subject to the same constraints and regulation as the Internet. But any State is free to explore outer space without permission from another State.<sup>138</sup> It has no physical territory of origin because it exists all

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 $<sup>^{131}</sup>$  Id.

 $<sup>^{132}</sup>$  Id.

<sup>&</sup>lt;sup>133</sup> U.K v.Alb., 1949 I.C.J. at 35-36.

<sup>&</sup>lt;sup>134</sup> See Pirker, supra note 99, at 195.

<sup>&</sup>lt;sup>135</sup> See OFF. OF THE U.N. HIGH COMM'R FOR HUMAN RIGHTS ET AL., UN SYSTEM TASK TEAM ON THE POST-2015 UN DEVELOPMENT AGENDA 5 (2013) [hereinafter UN TASK TEAM AGENDA].

<sup>&</sup>lt;sup>136</sup> See Outer Space Treaty, *supra* note 20, art. I. Although the US has not officially recognized outer space as a global commons, there is an argument for deeming it one due to the language in the treaty. The four universally recognized global commons include Antarctica, the atmosphere, the oceans and seas and outer space. See UN TASK TEAM AGENDA, *supra* note 135.

<sup>&</sup>lt;sup>137</sup> See generally Pirker, supra note 99.

<sup>&</sup>lt;sup>138</sup> Outer Space Treaty, *supra* note 20, arts. I, II (explaining that outer space and celestial bodies are not subject to national appropriation by claim of sovereignty).

around the Earth, more akin to the sea, rather than cyberspace, and is thus appropriately considered, in the author's view, a global common.

One could possibly interpret the Outer Space Treaty as suggesting that, if outer space is deemed a global common, so are the objects placed into outer space.<sup>139</sup> Satellites, however, are still owned and operated by States and private companies that own and operate facilities on Earth. Hackers will generally invade the physical server located on Earth that will then send signals and commands to the space-based object. So, even if satellites were not subject to national appropriation once launched into outer space, most hacking occurs on the Earth. Additionally, even if a hacker attacked a satellite in space directly, such as through an ASAT weapon,<sup>140</sup> the satellite is the property of the State or private company. While space and celestial bodies are not subject to national appropriation,<sup>141</sup> property launched into space is.<sup>142</sup> Thus, a major cyber-attack against a State or privately-owned satellite would likely be deemed a violation of State sovereignty, presuming it qualifies as more than just "passing through."<sup>143</sup>

#### B. State Response and Redress

The Outer Space Treaty provides that States should bear international responsibility, distinguished from liability, for national activities in outer space.<sup>144</sup> The law of State responsibility governs how States may respond to acts of aggression under international law.<sup>145</sup> However, there are often rogue hackers whose actions cannot be attributable to a State government. Likewise, the Liability Convention expands on the Outer Space Treaty, providing a special framework for State liability for damage that a State causes object.<sup>146</sup> Because this Convention was adopted before the existence of the Internet and when only a few States conducted activities in

<sup>&</sup>lt;sup>139</sup> Outer Space Treaty, *supra* note 20, art. VIII (explaining that space objects retain the jurisdiction of the launching State and/or the State of Registry).

<sup>&</sup>lt;sup>140</sup> See e.g., Tucker, supra note 63.

<sup>&</sup>lt;sup>141</sup> See Outer Space Treaty, supra note 20, art. II.

<sup>&</sup>lt;sup>142</sup> Outer Space Treaty, *supra* note 20, art. VI.

<sup>&</sup>lt;sup>143</sup> U.K. v. Alb., 1949 I.C.J. at 35-36.

<sup>&</sup>lt;sup>144</sup> Outer Space Treaty, *supra* note 20, arts. VI, VII.

<sup>&</sup>lt;sup>145</sup> See DRAFT ARTICLES supra note 103, arts. 2, 4, 8.

<sup>&</sup>lt;sup>146</sup> Liability Convention, *supra* note 25, arts. I, II.

outer space, it only applies in a narrow set of circumstances and assumes that the "launching State" has control over space objects and will be the party responsible for clearly physical damage.<sup>147</sup> However, a hostile actor who damages a satellite system through cyberspace, even if associated with the State itself, will rarely be launching anything, and even if it were, it is not a space object causing damage but a computer virus or malware.

# i. Determining International Responsibility and Response Options

If a State violates international law, either directly or through its organs or agents,<sup>148</sup> it generally must make reparation through restitution for the loss or injury and may be responded against by the injured State.<sup>149</sup> Even if the source of a virus or malware can be traced to the territory of a particular State, the hack could have been orchestrated by a rogue actor unassociated with the government. If so, public international law provides little recourse, and the affected party must seek alternative relief. Often, a State is only suspected of sponsoring a cyberattack or is not even involved at all. For instance, in the OPM hack, the US government traced the source of the data breach to Chinese nationals but could not formally link them to the government, at least at first.<sup>150</sup> In this particular case, the Federal Bureau of Investigation (FBI) later charged four members of the Chinese military with the hack and explicitly tied the attack to Beijing.<sup>151</sup> This case is an outlier because the US was very close to eventually being able to attribute the hackers to the Chinese government, though could not do so definitively, but in many cases, attribution to the State or even

<sup>&</sup>lt;sup>147</sup> See Stefan A. Kaiser & Martha Mejía-Kaiser, Cyber Security in Air and Space Law, 64 Z.L.W. 396, 406-07 (2015).

 $<sup>^{148}\,</sup>$  A State may still be internationally responsible if it does not act directly but directs or controls other actors. See DRAFT ARTICLES, supra note 103, arts. 2, 4, 8.

<sup>&</sup>lt;sup>149</sup> See Restatement (Third) of Foreign Relations §§ 901, 905.

<sup>&</sup>lt;sup>150</sup> "While no 'smoking gun' was found linking the attack to a specific perpetrator, the overwhelming consensus is that OPM was hacked by State-sponsored attackers working for the Chinese government. *See* Josh Fruhlinger, *The OPM Hack Explained: Bad Security Practices Meet China's Captain America*, CSO (Feb. 12, 2020), https://www.csoon-line.com/article/3318238/the-opm-hack-explained-bad-security-practices-meet-chinas-captain-america.html.

 $<sup>^{151}\,</sup>$  But the US rarely files criminal charges against foreign intelligence officers for fear of retaliation. Id.

suspected attribution cannot be determined at all because the hackers cannot be found or have no provable links to the government.  $^{152}$ 

Attributing a cyberattack to a State can be a difficult process. First, identifying hackers can be technically challenging because they use third-party proxies and other concealment tools to mask their activities.<sup>153</sup> Additionally, international law lacks streamlined norms regarding cyberactivity, which makes formal attribution impractical.<sup>154</sup> According to *Tallinn 2.0*, "[c]yber operations conducted by organs of a State, or by persons or entities empowered by domestic law to exercise elements of governmental authority, are attributable to the State."155 In addition, a State is responsible for intentionally aiding or assisting, directing or controlling, or coercing another State to violate international law.<sup>156</sup> But this has proved difficult to show. For instance, officials suspected that those responsible for hacking the Democratic National Committee in 2016 were linked to the Russian government, but it was not until the end of the year, after the election of President Trump, that the US Federal Bureau of Investigation and the Central Intelligence Agency formally declared that the Russian government interfered with the election, after almost a year of research, intelligence gathering and reporting.<sup>157</sup> Presumably, hackers who could infiltrate a highly secure satellite network will have to be pretty sophisticated, making it easier to hide their tracks. Thus, the rise of unidentifiable hackers or those with weak ties to State governments makes attribution less likely.

Assuming that a cyberattack can be attributed to a State, and that that attack was a violation of international law, the Outer Space Treaty provides guidance as to what recourse and remedies are available to States after an attack has occurred.<sup>158</sup> In certain

 $<sup>^{152}</sup>$  Id.

<sup>&</sup>lt;sup>153</sup> See William Banks, State Attribution of Cyber Intrusions After Tallinn 2.0, 95 TEX. L. REV. 1487, 1493 (2017).

<sup>&</sup>lt;sup>154</sup> See generally TALLINN MANUAL 2.0, supra note 88.

<sup>&</sup>lt;sup>155</sup> TALLINN MANUAL 2.0, *supra* note 88, at 87.

<sup>&</sup>lt;sup>156</sup> Id. at 100.

 $<sup>^{157}</sup>$  The report linking the cyber-attack on the DNC to the highest levels of the Russian government did not reach President Obama's desk until many months after the discovery of the breach. *See* Banks, *supra* note 153, at 1487-89, 1497.

<sup>&</sup>lt;sup>158</sup> Parties to the Outer Space Treaty "shall bear international responsibility for national activities in outer space . . . whether such activities are carried out in conformity

instances, the State may respond with countermeasures.<sup>159</sup> In the cyber context, this could include a retaliatory cyberattack, economic sanctions, or, if serious enough, the use of physical force.<sup>160</sup> The US policy, for instance, under the Trump administration, was to meet any harmful interference of space assets in cyberspace "with a de-liberate response at a time, place, manner, and domain of our choosing."<sup>161</sup> International law will permit such a response if it is proportional to the initial hostile act.<sup>162</sup>

#### ii. State Liability for Damage Caused by a Cyber Attack

A cyberattack could compromise a satellite by causing clear physical damage or indirect damage to the satellite operator's economic, informational, or intellectual property assets. It is much easier for a State to recover for physical damage because it can simply sue for damage to property.<sup>163</sup> The Liability Convention, however, only provides recourse for damage caused by space objects by the "launching State."<sup>164</sup> A State whose agents attack another State's satellite networks via the Internet is not necessarily launching a space object as the Convention requires.<sup>165</sup> The Convention provides liability in a narrow set of circumstances.<sup>166</sup> An intrusion may be just as damaging but only cause intellectual property or economic damage, such as when the hacker takes military intelligence stored in the satellite's network or disrupts satellite navigational or communication signals, without directly causing any physical damage. But when it was adopted in the 1970s, the drafters of the

with the provisions set forth in the present [t]reaty." Outer Space Treaty, *supra* note 20, art. VI.

<sup>&</sup>lt;sup>159</sup> See Restatement (Third) of Foreign Relations § 905.

<sup>&</sup>lt;sup>160</sup> See TALLINN MANUAL 2.0, supra note 88; see also Eric Talbot Jensen, Talinn Manual 2.0: Highlights and Insights, 48 GEO. J. INT'L L. 736 (2018), https://www.law.georgetown.edu/international-law-journal/wp-content/up-loads/sites/21/2018/05/48-3-The-Tallinn-Manual-2.0.pdf.

<sup>&</sup>lt;sup>161</sup> NATIONAL SECURITY STRATEGY OF THE UNITED STATES OF AMERICA 31 (Dec. 2017).

<sup>&</sup>lt;sup>162</sup> See UN Charter art. 51. Customary international law says that clearly excessive or punitive force violates the requirement of proportionality. See Proportionality, WEAPONS LAW ENCYCLOPEDIA (Nov. 30, 2013), http://www.weaponslaw.org/glossary/proportionality-definition-under-international-law.

 $<sup>^{163}\;</sup>$  See Liability Convention, supra note 79, art. II.

 $<sup>^{164}\,</sup>$  Id. at arts. I, II.

 $<sup>^{165}</sup>$  *Id*.

<sup>&</sup>lt;sup>166</sup> See generally id.

Convention really only anticipated physical threats caused by objects by other State actors. Interpreting the Convention's language as applying to more intangible aggression in space goes directly against the treaty's plain text. Thus, the Liability Convention would not provide a remedy unless interpreted very broadly since any State or non-State actor that hacks a satellite network will almost certainly not be physically launching an object into space. However, the State could still take the responsible party to the ICJ or domestic courts because domestic law is really where most of the regulation on data security and violations of intellectual property exist, subject to the sovereign immunity exceptions, and could succeed in such a claim depending on the nature of the attack and amount of damage caused.

#### **IV. SUGGESTIONS FOR REFORM**

#### A. Adopting New Treaties or Amending the Current Rules

In theory, States could convene to create a new treaty or, at the very least, amend the current treaties to create broader language that is more suitable to addressing intangible cyber threats to satellite systems. For instance, the Liability Convention's requirement of a "launching State" does not account for anything other than physical damage caused by another State's launch.<sup>167</sup> However, this seemingly most obvious solution is probably the most unrealistic. First, completing this goal would be a long, arduous process with every State having different interests. Even if it succeeded, by the time a new treaty was adopted, the technology will no doubt out pace any agreement.<sup>168</sup> Additionally, there have been attempts to adopt new space-related treaties that have failed.<sup>169</sup> Amended treaties and additional international legal instruments that provide stronger cybersecurity protections may work temporarily but not long-term and would be met with much resistance.

<sup>&</sup>lt;sup>167</sup> See Liability Convention, supra note 79, arts. I, II.

<sup>&</sup>lt;sup>168</sup> See generally Blount, supra note 65.

<sup>&</sup>lt;sup>169</sup> See e.g., Jeff Foust, U.S. Dismisses Space Weapons Treaty Proposal As "Fundamentally Flawed", SPACE NEWS (Sept. 11, 2014), https://spacenews.com/41842us-dismisses-space-weapons-treaty-proposal-as-fundamentally-flawed/.

# B. International Cooperation and Implementing More Adaptive Standards

Because of the inherently global nature of both cyberspace and satellites, international cooperation among States is crucial to set a baseline of international legal norms that protect satellites and satellite communications from cyber interferences. According to Blount, the primary sources that govern space law lack sufficient enforcement mechanisms.<sup>170</sup> Cybersecurity laws are a scattered and inconsistent collection of domestic laws and international norms that States have been slow to adopt.<sup>171</sup> Implementing specific cybersecurity laws at the international level, particularly ones directly aimed at or capable of protecting space assets, could create a false sense of security for a time, until technology changes again, and complying with the law no longer mitigates risk.<sup>172</sup> Although satellite operators will feel pressure to establish cybersecurity practices and standards within international space law, to maximize the Internet security of these satellites, cooperative efforts among States is necessary to protect the networks and avoid potential conflict in outer space.<sup>173</sup>

Perhaps there is a way to follow Blount's approach of focusing on international cooperation and implementing adaptable standards in addition to adopting some rigid international legal instruments, or amendments to the current ones, as a long-term goal. The combination of hard legal rules with malleable standards and international cooperation could account both for the need for stricter enforcement and clearer legal rules and address Blount's concern that technology will outpace the law. If adopting or amending a treaty is currently infeasible, perhaps the UN could impose declarations, principles, or even resolutions that reinterpret the UN Charter's provisions to account for these new threats that the original drafters did not anticipate. Adopting an international body dedicated to cybersecurity in outer space, similar to COPUOS, could also be a potential solution, simply to bring all the relevant parties to the table to address this vexing problem.

<sup>&</sup>lt;sup>170</sup> Blount, *supra* note 65, at 273.

<sup>&</sup>lt;sup>171</sup> Id. at 293.

 $<sup>^{172}</sup>$  *Id*.

<sup>&</sup>lt;sup>173</sup> *Id*.

#### V. CONCLUSION

The convergence of cyberspace and outer space presents novel questions within space law and international law in general. Both space law and cybersecurity law are new areas, and cybersecurity law has continued to evolve and change with technology while space law has remained relatively stagnant. The novelty of these areas of the law, along with the unique physical nature of space and the intangibility of cyberspace, makes it difficult to determine what sorts of cyber intrusions to space satellite systems violate international law. While there is no clear answer as to how exactly the international legal community should deal with this problem, plenty of authority stemming from traditional international law can be utilized. Additionally, States have several options moving forward to ensure the protection of these highly sensitive space-based systems and provide relief to victims of hacks. Although adopting new international legal instruments, or modifying the current ones, would be the ideal solution, it would be unlikely to garner much support considering the various interests of the various nations. Perhaps this can remain a long-term goal, but in the meantime, States should work cooperatively, with strong support from the private sector, to adopt international legal norms and practices in the form of declarations, principles, resolutions, State practice, and perhaps even the creation of an international body dedicated to the protection of satellite systems, and other Internet-powered space technologies, in outer space.

# THE TIME IS NOW: HOW THE UNITED STATES CAN LEAD ACTIVE DEBRIS REMOVAL EFFORTS

Denton Hunter and Quinn McKemey\*

# ABSTRACT

Satellites form an indispensable arm of critical infrastructure in the United States (US). Unfortunately, they face increased collision risk due to the increase in the debris population in low Earth orbit (LEO). The US must support and develop active debris removal (ADR) measures in order to assure the safety of satellites and continued access to orbit and beyond. Large debris objects, such as rocket boosters and dead satellites, should be prioritized for ADR efforts to stabilize the debris environment. The US must work with the international community on a multilateral agreement for ADR as a long-term solution. In the meantime, it must recognize that ADR is urgently needed to address the existing threat debris poses to critical space assets and focus on immediate and attainable solutions. The US can accomplish this by implementing an "inverted" approach by executing a domestic, commercially-developed ADR demonstration that subsequently grows to involve international allies who share concerns about the debris population in LEO. Employing contractual agreements and Memorandums of

<sup>\*</sup> Denton Hunter holds a B.A. in International Business from Mississippi State University and is a 2022 Juris Doctor candidate at the University of Mississippi School of Law. She would like to thank her family for their support as she closes out her life as a student. Quinn McKemey is a Graduate Certificate candidate at the University of Mississippi School of Law (2022) and Legal Fellow for the National Space Society. In 2020, he co-founded Clean Orbit, an advocacy non-profit focused on active debris removal. Quinn earned a Master in Business Administration from the University of Mississippi in 2019 preceded by a B.A. in Political Science in 2018 and would like to thank his family for your ceaseless support. Both authors would like to thank Professor Michelle Hanlon for the opportunity to write for the Journal of Space Law and continuing to push young people to use their voice on space issues, and Christiana Paissios for being instrumental in the editing process.

Understanding (MOU's) among involved parties can remove legal ambiguity regarding ownership and liability and will inform precedent for necessary international ADR efforts in the future. This model offers an immediate solution to an immediate problem that can enhance efforts to incentivize the growth of ADR investment.

#### I. INTRODUCTION

The National Aeronautics and Space Administration (NASA) defines orbital debris "as human-made objects in space that no longer serve a useful purpose, such as decommissioned satellites and parts of spacecraft."1 This debris can remain in orbit for decades until it "decays, deorbits, explodes, or collides with another object thus creating more debris."2 In fact, millions of orbital debris fragments orbit the Earth at high velocity due to both decades of launch activity and collisions among objects.<sup>3</sup> These fragments pose a mission-critical threat to space activities in low Earth orbit (LEO).<sup>4</sup> The United States (US) operates approximately half of the functioning spacecraft in LEO, and as a result the nation bears the greatest risk of sustaining major losses from satellite collisions with orbital debris.<sup>5</sup> In January 2021, an internal report from NASA's Office of the Inspector General (OIG) found that mitigation-only measures are no longer effective in stabilizing the debris environment in space.<sup>6</sup> Large debris objects, such as defunct rocket boosters and dead satellites, have the highest collision probability and should be prioritized for active debris removal (ADR) efforts in

<sup>&</sup>lt;sup>1</sup> Office of Inspector General, NASA's Efforts to Mitigate the Risks Posed by Orbital Debris, NASA 1 (Jan. 27, 2021), https://oig.nasa.gov/docs/IG-21-011.pdf [hereinafter NASA's Efforts].

 $<sup>^{2}</sup>$  Id.

<sup>&</sup>lt;sup>3</sup> Paul M. Sutter, *Who's Going to Fix the Space Junk Problem?*, SPACE.COM (July 31, 2021), https://www.space.com/space-junk-growing-problem-complicated-solution. ("In Earth orbit, there are more than 23,000 objects larger than about 4 inches (10 centimeters), another half a million objects larger than about 0.4 inch (1 cm) and possibly 100 million more smaller than that . . .").

<sup>&</sup>lt;sup>4</sup> See NASA Efforts, supra note 1, at 2.

<sup>&</sup>lt;sup>5</sup> Space Debris from Anti-Satellite Weapons, UNION OF CONCERNED SCIENTISTS, https://www.ucsusa.org/sites/default/files/2019-09/debris-in-brief-factsheet.pdf.

<sup>&</sup>lt;sup>6</sup> NASA's Efforts, *supra* note 1, at 14.

order to stabilize the debris environment as soon as possible.<sup>7</sup> However, legal uncertainty regarding ownership and liability in ADR activity under existing treaties such as the Outer Space Treaty<sup>8</sup> (OST) and Liability Convention<sup>9</sup> are often cited as prohibitively complicating rapid development of a market-ready solution for this pressing problem.<sup>10</sup>

The National Space Society (NSS) recommends the implementation of actions that can incentivize State parties and private entities to collaborate on rapidly developing ADR methods and use economic means to enable the creation of a new market for debris removal.<sup>11</sup> NASA's OIG report also recommends the NASA Administrator lead national and international efforts to mitigate debris by encouraging ADR through investment in relevant methodologies.<sup>12</sup> Given that the US considers continued access to space a vital interest of economic prosperity and national security,<sup>13</sup> the US—as the leading nation in space activity<sup>14</sup>—must not wait for lengthy negotiation for international agreements to clarify legal questions regarding the practice. The nation must, instead, focus on solutions that are achievable *now*.

Part II of this article provides an overview of the development of and challenges posed by orbital debris in LEO. Part III describes

<sup>&</sup>lt;sup>7</sup> Tyler A. Way & Josef S. Koller, *Active Debris Removal: Policy and Legal Feasibility*, AEROSPACE CORP. (Apr. 2021), https://csps.aerospace.org/sites/default/files/2021-08/Way\_Koller\_ADR\_20210422.pdf.

<sup>&</sup>lt;sup>8</sup> 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 https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspacetreaty.html [hereinafter Outer Space Treaty].

<sup>&</sup>lt;sup>9</sup> Convention on the International Liability for Damage Caused by Space Objects, Mar. 29, 1972, 961 UNTS 187 https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/liability-convention.html [hereinafter Liability Convention].

<sup>&</sup>lt;sup>10</sup> US Space Policy Directive-3, Nat'l Space Traffic Mgmt. Pol'y, 83 FED. REG. 28969 PRESIDENTIAL MEMORANDUM, (June 18, 2018) [hereinafter SPD-3].

<sup>&</sup>lt;sup>11</sup> See Space Debris Removal, Salvage, and Use: Maritime Lessons, NAT'L SPACE SOC'Y (Oct. 2009), https://space.nss.org/wp-content/uploads/NSS-Position-Paper-Space-Debris-Removal-2019.pdf.

<sup>&</sup>lt;sup>12</sup> NASA's Efforts, *supra* note 1, at 4.

<sup>&</sup>lt;sup>13</sup> SPD-3, *supra* note 10, at 28970.

<sup>&</sup>lt;sup>14</sup> Nicolas Rapp & Brian O'Keefe, *50 Years After the Moon Landing, Money Races into Space*, FORTUNE (July 22, 2019), https://fortune.com/longform/space-program-spending-by-country/. In 2018, the US spent approximately \$41 billion on space programs. This is more than 8 times the amount of the second highest-paying State (China, \$5.8 billion).

existing ADR efforts and Part IV reviews relevant international law governing those efforts and how US domestic law fits in the international framework. Finally, in Part V we argue that the US must immediately initiate a domestic ADR demonstration with the ultimate goal of supporting collaboration with international allies – both from a legal and engineering standpoint – before offering some concluding thoughts in Part VI.

## II. OVERVIEW OF THE ORBITAL DEBRIS CHALLENGE

#### A. How It Started

On October 4, 1957, Sputnik 1 became the first human-made object to launch into space and successfully orbit the Earth.<sup>15</sup> This launch also produced the first pieces of human-generated orbital debris—a nose cone and an empty rocket core stage.<sup>16</sup> While many space objects, including Sputnik 1, naturally disintegrate in the Earth's atmosphere in a relatively short time period, many do not. Vanguard I, launched only one year later, has remained in orbit for more than sixty years and continues to be the oldest human-made object in space.<sup>17</sup> Human activity in space has markedly increased in scope and frequency over the last seven decades, yet debris mitigation and remediation efforts remain limited at both national and international levels.<sup>18</sup> As a result, orbital debris, has also grown exponentially since the launch of Sputnik, a result of both "accumulating and increasing amounts of" space objects and "intentional and accidental collisions."<sup>19</sup>

The current debris population is generally broken down into three categories based on size.<sup>20</sup> Objects roughly ten centimeters (cm) and larger—ranging from softball-sized fragments to dead satellites as large as a school bus –number at least 26,000 in LEO

<sup>&</sup>lt;sup>15</sup> Elizabeth Howell, *Sputnik: The Space Race's Opening Shot*, SPACE.COM (Sept. 29, 2020) https://www.space.com/17563-sputnik.html.

<sup>&</sup>lt;sup>16</sup> NASA Video, Space Policy and History Forum: The History and Politics of Space Junk, YOUTUBE.COM (July 7, 2021), https://www.youtube.com/watch?v=yve597kNKbg.

<sup>&</sup>lt;sup>17</sup> Alice Gorman, 60 Years in Orbit for 'Grapefruit Satellite'- The Oldest Human Object in Space, THE CONVERSATION (Mar. 21, 2018), https://theconversation.com/60-yearsin-orbit-for-grapefruit-satellite-the-oldest-human-object-in-space-93640.

<sup>&</sup>lt;sup>18</sup> NASA's Efforts, *supra* note 1, at 14.

<sup>&</sup>lt;sup>19</sup> *Id.* at 1.

 $<sup>^{20}\;</sup>$  NASA's Efforts, supra note 1, at 3.

2021]

alone and pose a catastrophic threat to current space operations.<sup>21</sup> A 2020 survey by Darren McKnight of Centauri catalogued a top-50 list of "statistically most concerning" debris objects in LEO.<sup>22</sup> "The top 20 objects in that master list are all a single class of upper stages known as SL-16, from the Zenit family of rockets."<sup>23</sup> These objects are considered to be the most pressing debris threat due to their size and the likelihood that they will create additional debris through collisions with other operational or defunct space objects.<sup>24</sup> There are at least another 500,000 objects that are between one and ten centimeters (marble-sized) which could result in mission-critical damage to space operations upon impact.<sup>25</sup> Debris fragments one millimeter and smaller number in the hundreds of millions and are too small and numerous to be tracked.<sup>26</sup> In fact, precise measurements of the debris population three millimeters and smaller in LEO are based solely on statistical probability.<sup>27</sup>

## B. How It Grows

The character of space activity today is markedly different from the early 1960s. Space activities, once solely the purview of dual superpowers, are now executed by the more than 45 countries and international organizations that own or operate space assets.<sup>28</sup> Indeed, while governments may remain power players in the space industry, the current advancement of space technology is being driven by the private sector.<sup>29</sup> More actors, national and private, means more activities and while these activities provide

 $<sup>^{21}</sup>$  Id.

<sup>&</sup>lt;sup>22</sup> Jeff Foust, Upper Stages Top List of Most Dangerous Space Debris, SPACENEWS (Oct. 13, 2020), https://spacenews.com/upper-stages-top-list-of-most-dangerous-space-debris/; See also, Matthew Stevenson et al., Identifying the Statistically-Most-Concerning Conjunctions in LEO, AMOSTECH (2021), https://amostech.com/TechnicalPapers/2021/Poster/Stevenson.pdf.

<sup>&</sup>lt;sup>23</sup> Jeff Foust, Upper Stages Top List of Most Dangerous Space Debris, SPACENEWS (Oct. 13, 2020) https://spacenews.com/upper-stages-top-list-of-most-dangerous-space-debris/.

 $<sup>^{24}</sup>$  Id.

<sup>&</sup>lt;sup>25</sup> NASA's Efforts, *supra* note 1, at 8.

 $<sup>^{26}</sup>$  Mark Garcia, Space Debris and Human Spacecraft, NASA (May 27, 2021), https://www.nasa.gov/mission\_pages/station/news/orbital\_debris.html.

<sup>&</sup>lt;sup>27</sup> NASA's Efforts, *supra* note 1, at 12.

 $<sup>^{28}</sup>$  NASIC Public Affairs Office, Competing in Space, NASIC (Dec. 2018), https://media.defense.gov/2019/Jan/16/2002080386/-1/-1/1/190115-F-NV711-0002.PDF.

 $<sup>^{29}</sup>$  *Id*.

innumerable benefits to humanity, they all have the potential to contribute, whether purposefully or inadvertently, to potentially catastrophic orbital debris scenarios.

#### i. Collisions

Collisions of larger debris objects create numerous smaller fragments and contribute significantly to the debris population when they occur.<sup>30</sup> The impact of Russia's Cosmos 2251 with the Iridium 33, a satellite regulated by the United States, exemplifies the danger of debris production from a singular event involving large objects.<sup>31</sup> On February 10, 2009, the two objects crashed into each other, resulting in over 2,000 fragments of debris.<sup>32</sup> Only 89 of these fragments have vaporized upon atmospheric reentry<sup>33</sup> and NASA estimates that more than half of the debris from the collision will remain in orbit for at least another century.<sup>34</sup> Successful ADR combined with accurate tracking mechanisms could prevent any future large collisions. Quick deployment of such technology could remove inoperable spacecraft before any incidents occur.

## ii. Anti-Satellite (ASAT) Weapon Testing

Debris congestion in LEO is also the result of deliberate actions by spacefaring nations.<sup>35</sup> While some objects—such as rocket boosters—are intentionally left behind after fulfilling their purpose, these detachments are planned and currently a necessary part of take-off operations within the constraints of current

<sup>&</sup>lt;sup>30</sup> A.B. Kiselev & V.A. Yarunichev, A Study on the Fragmentation of Space Debris Particles at High-Speed Collision, 2 UNIV. SER. 1. MAT. MEKH. 25 (2009), http://www.mathnet.ru/php/archive.phtml?wshow=paper&jrnid=vmumm&paperid=856&option lang=eng.

<sup>&</sup>lt;sup>31</sup> Brian Weeden, 2009 Iridium-Cosmos Collision Fact Sheet, SECURE WORLD FOUND. (Nov. 10, 2010), https://swfound.org/media/6575/swf\_iridium\_cosmos\_collision\_fact\_sheet\_updated\_2012.pdf.

<sup>&</sup>lt;sup>32</sup> Guy Faulconbridge, U.S. and Russia track satellite crash debris, REUTERS, (Feb. 12, 2009).

<sup>&</sup>lt;sup>33</sup> China Debris Reaches New Milestone, 14 ORBITAL DEBRIS QUARTERLY NEWS 4, (Oct. 2010).

<sup>&</sup>lt;sup>34</sup> TS, Kelso, Analysis of the Iridium 33 and Cosmos 2251 Collision, Advanced Maui Optical and Space Surveillance Conference (Sep. 2009), http://www.centerforspace.com/downloads/files/pubs/AMOS2009.pdf.

<sup>&</sup>lt;sup>35</sup> Space Debris and Human Spacecraft, NASA (May 26, 2021), https://www.nasa.gov/mission\_pages/station/news/orbital\_debris.html.

technology.<sup>36</sup> Moreover, these boosters were predominantly launched before 2000, when countries began adopting international orbital debris mitigation guidelines.<sup>37</sup> Anti-Satellite (ASAT) testing, however, is conducted intentionally by nations using groundbased, missile–intercept technology and is a major contributor to the debris population in LEO.<sup>38</sup> Only four countries—the US, Russia, China and India—have performed ASAT operations.<sup>39</sup> Initial ASAT testing began in the early 1960's by the US and former USSR before being largely phased out by April 1975.<sup>40</sup> Due to the financial burdens and ineffectiveness, many programs slowed after the Cold War, but did not halt the development of ASAT capability altogether.<sup>41</sup>

More recent ASAT tests conducted by China and India have drawn concern from the international community regarding their contribution to the debris environment.<sup>42</sup> During a singular test in 2007, China purposely destroyed the Fengyun-1C weather satellite and created 3,400 pieces of debris—one-sixth of all current trackable debris in orbit.<sup>43</sup> While the nation has stated it may move to debris-free" tests due to the resulting international outrage, more than half of the debris stemming from this single action will remain in orbit through 2027.<sup>44</sup>

India also recently joined the short list of countries to test an ASAT weapon.<sup>45</sup> However, their 2019 test seemed to indicate an effort to mitigate debris generation. For this demonstration, India

 $<sup>^{36}</sup>$  Id.

<sup>&</sup>lt;sup>37</sup> Foust, *supra* note 22.

<sup>&</sup>lt;sup>38</sup> Milton Leitenberg, *Studies of Military R&D and Weapons Development*, SCH. PUB. POL'Y (Jan. 1, 1984), https://fas.org/man/eprint/leitenberg/asat.pdf.

<sup>&</sup>lt;sup>39</sup> Justin George, *History of Anti-Satellite Weapons: US Tested 1st ASAT Missile 60 Years Ago*, THE WEEK (Mar. 27, 2019), https://www.theweek.in/news/scitech/2019/03/27/history-anti-satellite-weapon-us-asat-missile.html.

<sup>&</sup>lt;sup>40</sup> *Id. See also*, Laura Grego, *A History of Anti-Satellite Programs*, UNION OF CONCERNED SCIENTISTS, 2 (Jan. 2012), https://www.ucsusa.org/sites/default/files/2019-09/a-history-of-ASAT-programs\_lo-res.pdf.

 $<sup>^{41}</sup>$  Id.

<sup>&</sup>lt;sup>42</sup> Mike Gruss, US Official: China Turned to Debris-free ASAT Tests Following 2007 Outcry, SPACENEWS (Jan. 11, 2016), https://spacenews.com/u-s-official-china-turned-todebris-free-asat-tests-following-2007-outcry/.

 $<sup>^{43}</sup>$  Id.  $^{44}$  Id.

<sup>44</sup> Id.

<sup>&</sup>lt;sup>45</sup> Ashley Tellis, *India's ASAT Test: An Incomplete Success*, CARNEGIE ENDOWMENT FOR INT'L PEACE (Apr. 15, 2019), https://carnegieendowment.org/2019/04/15/india-s-asat-test-incomplete-success-pub-78884.

chose to launch a small satellite into a low altitude orbit specifically for this test.<sup>46</sup> The ASAT missile intercepted it in a downward trajectory back towards the Earth's atmosphere, allowing most of the debris to burn up shortly thereafter.<sup>47</sup> While increased mitigation measures were undertaken compared to previous ASAT tests, the impact still created over 60 pieces of trackable debris, half of which reached altitudes higher than that of the International Space Station (ISS).<sup>48</sup>

The most recent ASAT test, conducted by Russia on November 15, 2021, saw pushback and condemnation from around the international community.<sup>49</sup> In taking down a defunct satellite, the projectile debris threatened numerous other spacecraft, including the ISS, forcing all seven residing astronauts to take cover – two of which were Russian nationals.<sup>50</sup> In response, many countries and private companies reiterated calls for a halt to international ASAT tests<sup>51</sup> The repeated practice of such tests further inhibits the ability to stabilize the debris environment, and international consensus regarding their discontinuation will be a critical part of debris remediation.

#### iii. Satellite Breakups and Explosions

Satellites occasionally break up due to design malfunctions or explosions.<sup>52</sup> ADR could prevent these break-ups and the large amounts of debris they create by removing them from orbit when they show signs of deterioration.<sup>53</sup> In March 2021, a polar-orbiting

 $<sup>^{46}</sup>$  *Id*.

<sup>&</sup>lt;sup>47</sup> Id.

<sup>&</sup>lt;sup>48</sup> Sarah Lewin, *India's Anti-Satellite Test Created Dangerous Debris*, NASA Chief Says, Space.com (Apr. 1, 2019), https://www.space.com/nasa-chief-condemns-india-anti-satellite-test.html

<sup>&</sup>lt;sup>49</sup> Chelsea Gohd, Russian Anti-Satellite Missile Test Draws Condemnation from Space Companies and Countries, SPACE.COM (Nov. 22, 2021), https://www.space.com/crussian-anti-satellite-missile-test-world-condemnation.

 $<sup>^{50}</sup>$  *Id*.

<sup>&</sup>lt;sup>51</sup> Nivedita Raju, *Russia's anti-satellite test should lead to a multilateral ban*, SIPRI.COM (Dec. 7, 2021), https://www.sipri.org/commentary/essay/2021/russias-anti-sat-ellite-test-should-lead-multilateral-ban.

 <sup>&</sup>lt;sup>52</sup> V. Braun et al., Analysis of Breakup Events, ESA SPACE DEBRIS OFF. (Apr. 18, 2017), https://conference.sdo.esoc.esa.int/proceedings/sdc7/paper/1005/SDC7-paper1005.pdf.

<sup>&</sup>lt;sup>53</sup> NASA's Efforts, *supra* note 1, at 17.

weather satellite NOAA-17 broke up for reasons unknown.<sup>54</sup> Two years prior, several of the US Air Forces' weather satellites broke up due to a battery malfunction, creating at least 147 pieces of large debris.<sup>55</sup> These satellites were allowed to remain in orbit even after there were known technical issues that could lead to potential break-ups.<sup>56</sup> This is further complicated as many satellites have leftover, pressurized propellant that could explode due to increase in pressure over time or impact with pieces of debris.<sup>57</sup>

## iv. Satellite Constellations

The number of satellites occupying LEO is about to exponentially increase without any developed ADR methodology for effectively removing the existing craft congesting the orbital zone.<sup>58</sup> Driven by the push to bring global populations high-speed broadband internet at affordable prices, several companies are planning to launch artificial constellations of satellites.<sup>59</sup> These are groups of small satellites working together as a unified system to provide global internet coverage to remote places on Earth.<sup>60</sup> While satellites are not the sole cause of orbital debris, satellite constellations are relevant to the debris environment due to the unprecedented number of satellites planning to be launched in the coming decade.<sup>61</sup> SpaceX's Starlink program received approval from the FCC in 2018 to launch 11,943 satellites, 4,500 of which are expected to be in orbit by 2024.<sup>62</sup> Similarly, Blue Origin and OneWeb are two

<sup>&</sup>lt;sup>54</sup> Jeff Foust, *Decommissioned NOAA Weather Satellite Breaks Up*, SPACENEWS (Mar. 20, 2021), https://spacenews.com/decommissioned-noaa-weather-satellite-breaks-up/.

<sup>&</sup>lt;sup>55</sup> Mike Wall, To Control Space Junk, Remove 5 Pieces a Year, Experts Say, NBCNEWS (Feb. 27, 2012), https://www.nbcnews.com/id/wbna46542521.

 $<sup>^{56}</sup>$  Id.

<sup>&</sup>lt;sup>57</sup> NASA's Efforts, *supra* note 1. See also, Foust, *supra* note 22.

<sup>&</sup>lt;sup>58</sup> Foust, *supra* note 22.

<sup>&</sup>lt;sup>59</sup> David Jarvis, *The Satellite Broadband Industry is Moving at Hyperspeed*, DELOITTE.COM (Feb. 19, 2020), https://www2.deloitte.com/us/en/insights/industry/tech-nology/future-of-satellite-internet.html.

<sup>&</sup>lt;sup>60</sup> STARLINK.COM, https://www.starlink.com/ (last visited Sept. 18, 2021).

<sup>&</sup>lt;sup>61</sup> NASA's Efforts, *supra* note 1, at 38.

<sup>&</sup>lt;sup>62</sup> Michael Sheetz, SpaceX Looks to Build Next-Generation Starlink Internet Satellites after Launching 1,000 So Far, CNBC (Jan. 29, 2021), https://www.cnbc.com/2021/01/28/spacex-plans-next-generation-starlink-satelliteswith-1000-launched.html.

of the many competitors poised to occupy this coveted space in orbit as well.  $^{\rm 63}$ 

Initial independent studies find that the likelihood of collisions will rise in correlation to the number of objects occupying LEO.<sup>64</sup> This is after SpaceX has placed only 1,500 of its Starlink satellites in orbit, a meager figure compared to the company's total goal.<sup>65</sup> By the time Starlink completes its project in 2027, it will have launched up to 42,000 satellites, 20 times the current number of operational objects in orbit.<sup>66</sup> This figure is dwarfed by the filings made for other satellite constellations, including 115,000 satellites for Canadian company Kepler and another 327,000 satellites proposed by the Rwandan government.<sup>67</sup> ADR technologies would enable these entities to better service their multitude of satellites, preventing malfunction and subsequent damage to nearby objects from large pieces created by occasional impact or breakup.<sup>68</sup> This is critical in the absence of an international enforcement framework for regulating orbital congestion.<sup>69</sup> Thus, time is an essential variable if the US wants to develop a domestic ADR technology that matches

<sup>&</sup>lt;sup>63</sup> Kellen Beck, *SpaceX vs. Amazon: Where We're at In the Internet Space Race*, MASHABLE INDIA (Mar. 2021), https://in.mashable.com/science/20837/spacex-vs-amazon-where-were-at-in-the-internet-space-race.

<sup>&</sup>lt;sup>64</sup> Morgan McFall-Johnsen, SpaceX's Starlink Internet Satellites Could Make Astronomy on Earth 'Impossible' and Create a Space-junk Nightmare, Some Scientists Warn, INSIDER (Nov. 15, 2019), https://www.businessinsider.com/spacex-starlink-satellitesrisks-astronomy-space-junk-2019-11.

<sup>&</sup>lt;sup>65</sup> Jeff Foust, SpaceX Continues Starlink Deployment with Latest Launch, SPACENEWS (May 4, 2021), https://spacenews.com/spacex-continues-starlink-deployment-with-latest-launch/#:~:text=Nearly%201%2C500%20Starlink%20satellites%20are,license%20modification%20sought%20by%20SpaceX.

<sup>&</sup>lt;sup>66</sup> Morgan McFall-Johnsen, SpaceX's License to Launch Hundreds of Internet Satellites May Have Violated the Law, Experts Say. Astronomers Could Sue the FCC, INSIDER (Jan. 22, 2020), https://www.businessinsider.com/spacex-starlink-satellite-license-fccenvironmental-law-2020-1.

<sup>&</sup>lt;sup>67</sup> Jeff Foust, Satellite Operators Criticize "Extreme" Megaconstellation Filings, SPACENEWS (Dec. 14, 2021), https://spacenews.com/satellite-operators-criticize-extreme-megaconstellation-filings.

<sup>&</sup>lt;sup>68</sup> Harriet Brettle et al., Assessing Debris Removal Services for Large Constellations, ESA SPACE DEBRIS OFF. (2021), https://conference.sdo.esoc.esa.int/proceedings/sdc8/paper/74.

<sup>&</sup>lt;sup>69</sup> Foust, *supra* note 67.

pace with innovative private enterprise and the increasing threat of spacecraft collisions.  $^{70}\,$ 

## v. Kessler Syndrome

All of these concerns are compounded by the Kessler Syndrome, a theory proposed in 1978 by NASA scientist Donald J. Kessler upon his observation of spent Delta rockets creating clouds of shrapnel upon exploding in the upper atmosphere.<sup>71</sup> Kessler identified the risk of a self-sustaining, exponential increase in space debris stemming from collisions, and theorized a resulting "self-sustaining cascade of collisions."<sup>72</sup> This cascade can create a field of debris so thick that space activity in LEO and beyond would be rendered impossible or economically infeasible.<sup>73</sup> Also known as collisional cascading, Kessler hypothesized that this process would begin to occur gradually once orbital debris concentration reaches critical mass, a point where derelict objects could begin colliding with one another unprompted by the introduction of additional debris.<sup>74</sup> The debris would eventually form a belt of these fragmented objects, making access to Earth's orbit and outer space impossible.<sup>75</sup>

While Kessler initially estimated that it would take thirty to forty years to reach such a threshold,<sup>76</sup> NASA has reported that

<sup>&</sup>lt;sup>70</sup> Harriet Brettle et al., Assessing Debris Removal Services for Large Constellations, ESA SPACE DEBRIS OFF. (2021), https://conference.sdo.esoc.esa.int/proceedings/sdc8/paper/74.

<sup>&</sup>lt;sup>71</sup> Judy Corbett, *Micrometeoroids and Orbital Debris (MMOD)*, NASA (June 14, 2016), https://www.nasa.gov/centers/wstf/site\_tour/remote\_hypervelocity\_test\_laboratory/micrometeoroid\_and\_orbital\_debris.html. *See* Donald J. Kessler & Burton G. Cour-Palais, *Collision Frequency of Artificial Satellites: The Creation of a Debris Belt, 83* J. OF GEOPHYSICAL RSCH.: SPACEPHYSICS, 2637 (1978), https://agupubs.onlinelibrary.wiley.com/doi/abs/10.1029/JA083iA06p02637; *See also,* Donald J. Kessler et al., *The Kessler Syndrome: Implications to Future Space Operations,* AM. AUSTRONAUTICAL SOCY (*Feb. 10, 2010*), https://www.threecountrytrustedbroker.com/media/kesseler\_syndrome.pdf.

<sup>&</sup>lt;sup>72</sup> Kelly Kizer Whitt, Kessler Syndrome of Colliding Satellites Could Make Low-Earth Orbit Unusable, EARTHSKY (Nov. 15, 2021), https://earthsky.org/humanworld/kessler-syndrome-colliding-satellites/#:~:text=Kessler%20syn-

drome % 3A% 20A% 20 scenario% 20 in, the % 20 likelihood% 20 of% 20 further% 20 collisions.

<sup>&</sup>lt;sup>73</sup> See Nodir Adilov et al., *Economic Dynamics of Orbital Debris: Theory and Application*, FIRST INT'L ORBITAL DEBRIS CONF. (2019) https://www.hou.usra.edu/meetings/orbitaldebris2019/orbital2019paper/pdf/6072.pdf.

 $<sup>^{74}</sup>$  Id.

<sup>&</sup>lt;sup>75</sup> Id.

<sup>&</sup>lt;sup>76</sup> Corbett, *supra* note 71.

LEO might be already at critical mass, suggesting the conditions for a disastrous collisional cascade are already present.<sup>77</sup> The need for action is therefore immediate to urgently combat the unfolding effects before they become too costly to fix.

## B. The Role of Satellites in the US

The US relies heavily on satellites and their ability to augment daily life through military, civilian, and dual-use applications.<sup>78</sup> This reliance on space capability will increase as in-space manufacturing, satellite servicing, space tourism and satellite constellations emerge over the next decade.<sup>79</sup> The way space technology has enabled multiple aspects of America's modern society underscores the immediate need for domestic ADR efforts in light of the growing debris problem.<sup>80</sup>

Among other things, satellites are utilized to direct and inform military efforts on the ground.<sup>81</sup> Roughly 13% of the satellites in orbit are owned and operated by militaries worldwide and provide services such as communication, navigation and remote sensing.<sup>82</sup> One-tenth of these military satellites are operated by the US Department of Defense, and the country accounts for 49% of all active space objects as of April 2020.<sup>83</sup> While the US military seeks to protect its space assets, these activities consist of mitigation measures via tracking and collisional avoidance maneuvers and do not include any ADR concepts for debris remediation.<sup>84</sup>

<sup>&</sup>lt;sup>77</sup> Id.; Paul Ratner, *How the Kessler Syndrome Can End All Space Exploration and Destroy Modern Life*, BIG THINK (Aug. 29, 2018), https://bigthink.com/paul-ratner/how-the-kessler-syndrome-can-end-all-space-exploration-and-destroy-modern-life.

<sup>&</sup>lt;sup>78</sup> Linda Haller and Melvin Sakazaki, *Commercial Space and United States National Security*, FAS, https://spp.fas.org/eprint/article06.html.

<sup>&</sup>lt;sup>79</sup> SPD-3, *supra* note 10.

<sup>&</sup>lt;sup>80</sup> *Id.* These efforts can be multilateral through regulation, the creation of more robust legal frameworks and the creation of incentives for the private sector to participate. <sup>81</sup> Outer Space Treaty, *supra* note 8.

<sup>&</sup>lt;sup>82</sup> Therese Wood, Who Owns Our Orbit: Just How Many Satellites are There in Space?, WORLD ECON. F. (Oct. 23, 2020), https://www.weforum.org/agenda/2020/10/visu-alizing-easrth-satellites-sapce-

 $spacex/\#:\sim:text=Right\%20now\%2C\%20there\%20are\%20nearly, globe\%20in\%20April\%20of\%202020.$ 

<sup>&</sup>lt;sup>83</sup> Therese Wood, *Visualizing All of Earth's Satellites: Who Owns Our Orbit?*, VISUAL CAPITALIST (Oct. 20, 2020), https://www.visualcapitalist.com/visualizing-all-of-earths-satellites/.

<sup>&</sup>lt;sup>84</sup> NASA's Efforts, *supra* note 1.
Sixty-one percent of Earth's operational satellites are owned by the private sector and play an essential role in administering many of the comforts of the modern world.<sup>85</sup> These assets provide communications necessary for network and cable television, in addition to the mobile phones that are now ubiquitous in day-to-day life.86 Another twenty-seven percent of active satellites are for Earth Observation, such as monitoring extreme weather systems and long-term climate trends.<sup>87</sup> The US benefits tremendously from these services as it operates half of these satellites while the next closest competitors, China and Russia, operate 13% and 6% of satellites, respectively.<sup>88</sup>Dual-use examples include satellite capabilities such as navigation and remote sensing, which have significant use in both civilian and military applications.<sup>89</sup> The future operating environment in LEO will be defined by the increase in volume of these activities along with those specific to military and commercial capability for the benefit of public life.<sup>90</sup> This will only be possible, however, if we stabilize the debris population in LEO such that the risk of collision continues to pass basic cost-benefit analysis.

Imagine the economic implications if major businesses suddenly lost access to the internet or Zoom during the COVID-19 pandemic. In the case of singular failure, other satellites could provide the necessary signals to maintain services; however, if multiple satellites went offline simultaneously the result would be catastrophic. To protect its significant stake and interest in space assets, the US should focus efforts toward immediately collaborating on a domestic, commercially-developed ADR demonstration that can lay the groundwork for future collaboration at the international level. There is clearly an immediate need for ADR technology and models from NASA's Orbital Debris Program Office suggest we can stabilize the debris environment in space by removing just five large objects from LEO each year.<sup>91</sup>

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<sup>&</sup>lt;sup>85</sup> Wood, supra note 82; See also, The Impact of Space Activities Upon Society, ESA, 2-3 (Feb. 2005), http://www.esa.int/esapub/br/br237/br237/br237.pdf.

<sup>&</sup>lt;sup>86</sup> The Impact of Space Activities Upon Society, *supra* note 85.

 $<sup>^{\</sup>rm 87}\,$  Wood, supra note 82.

<sup>&</sup>lt;sup>88</sup> Wood, *supra* note 83.

<sup>&</sup>lt;sup>89</sup> Id.

<sup>&</sup>lt;sup>90</sup> SPD-3, *supra* note 10.

<sup>&</sup>lt;sup>91</sup> Debris Remediation, NASA, https://orbitaldebris.jsc.nasa.gov/remediation/.

## III. EFFORTS IN PLACE

According to the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) Space Debris Mitigation Guidelines, solutions to the orbital debris problem exist in two categories: mitigation and remediation efforts.<sup>92</sup> Mitigation methods are attempts to reduce the creation of additional debris to the fullest extent possible by tracking debris objects, enhanced craft design and post-mission disposal.<sup>93</sup> While mitigation is centered around limiting the risk and creation of additional debris, remediation is equally important and involves removing space objects using ADR.<sup>94</sup>

There are various potential ADR remediation concepts currently in development.<sup>95</sup> The tested capabilities are diverse, ranging from electrodynamic tethers, lasers and nets, to attaching deorbit kits to existing crafts and utilizing nets and other grappling objects.<sup>96</sup> There are also multiple nations working on these solutions such as the European Space Agency's (ESA) ClearSpace<sup>97</sup> to the Japan Aerospace Exploration Agency's (JAXA) collaboration with Astroscale on ELSA-d.<sup>98</sup> Aside from end-of-life disposal, all remediation projects currently being developed are in the early stages of testing and demonstration, meaning that a market-ready solution for this immediate problem does not exist.<sup>99</sup> Although the US Space Force's Orbital Prime program has recently signaled aggressive plans to collaborate with private companies on an ADR

<sup>&</sup>lt;sup>92</sup> UN Off. for Outer Space Aff., Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space (Vienna; United Nations 2010), https://www.unoosa.org/pdf/publications/st\_space\_49E.pdf.

 $<sup>^{93}</sup>$  Id.

<sup>&</sup>lt;sup>94</sup> SPD-3, *supra* note 10.

<sup>&</sup>lt;sup>95</sup> C. R. Phipps et al., *Removing Orbital Debris with Lasers*, SCIENCEDIRECT.COM (Oct. 2011), https://www.researchgate.net/publication/51946228\_Removing\_Orbital\_Debris\_with\_Lasers.

 $<sup>^{96}</sup>$  Id.

<sup>&</sup>lt;sup>97</sup> ESA Commissions World's First Space Debris Removal, ESA (Sept. 12, 2019), https://www.esa.int/Safety\_Secu-

 $rity/Clean\_Space/ESA\_commissions\_world\_s\_first\_space\_debris\_removal.$ 

<sup>&</sup>lt;sup>98</sup> Elsa-d (End-of-Life Service by Astroscale)-d (Demonstration), Sharing Earth Observation Res., https://directory.eoportal.org/web/eoportal/satellite-missions/content//article/elsa-d#launch (last visited Sept. 23, 2021).

<sup>&</sup>lt;sup>99</sup> Id.

demonstration within three years,<sup>100</sup> the US is otherwise falling behind its allies in developing ADR commensurate with its dependence on space technology for its services.<sup>101</sup>

#### IV. THE LAW

# A. Current International Legal Regulation

The current international legal regime inhibits collaboration among States on ADR efforts by complicating ownership and liability assessment of space objects.<sup>102</sup> The following sections analyze existing legal obligations through the lens of our suggested inverted approach, starting with a domestic ADR perspective that grows to encompass a close international ally with a shared interest in the debris problem.

## i. The Outer Space Treaty

The OST was adopted by the United Nations and entered into force in October 1967.<sup>103</sup> The treaty serves as the basic framework for international space law. This Cold War-era agreement seeks to bar the militarization of space and encourage peaceful purposes in the uses of space and celestial bodies but does little to provide guidance on the debris problem.<sup>104</sup>

The sections of the OST most applicable to ADR are Articles VI, VII, VIII. Article VI outlines international responsibility for national activities in outer space, holding government agencies and non-governmental entities of State Parties accountable for actions taken in space.<sup>105</sup> In the case of a domestic ADR effort consisting entirely of US-based entities, the commercial entity performing the mission and the US would clearly bear responsibility for any actions taken at the international level. The same would apply under

<sup>&</sup>lt;sup>100</sup> Sandra Erwin, Space Force wants to Help Fund Technologies to Recycle, Reuse or Remove Space Debris, SPACENEWS (Jan.5, 2022), https://spacenews.com/space-forcewants-to-help-fund-technologies-to-recycle-reuse-or-remove-space-debris/.

<sup>&</sup>lt;sup>101</sup> Sandra Erwin, Space debris expert warns U.S. 'woefully behind' in efforts to clean up junk in orbit, SPACENEWS (Jan. 6, 2022), https://spacenews.com/space-debris-expert-warns-u-s-woefully-behind-in-efforts-to-clean-up-junk-in-orbit/.

 $<sup>^{102}</sup>$  Id.

<sup>&</sup>lt;sup>103</sup> Outer Space Treaty, *supra* note 8.

<sup>&</sup>lt;sup>104</sup> Id. at annex.

 $<sup>^{\</sup>rm 105}~$  Id. at art. VI, VII, and VIII.

Article VII which holds the launching State accountable for any damage inflicted upon another State or its assets.<sup>106</sup> An entirely domestic project would not implicate the OST provisions and thus, the US can enter into contractual arrangements outlining liability obligations among the parties. However, care will have to be taken to ascertain liability should the ADR platform itself cause damage to another State whether on-orbit or on Earth as the US would be liable to another country in that event. We recommend that such liability be addressed through a risk sharing mechanism much like those set forth in launch licensing procedures.<sup>107</sup>

The UN 1971 Convention on International Liability for Damage Caused by Space Objects (Liability Convention)<sup>108</sup> extrapolated from Articles VI and VII of the OST in terms of liability assessment. Article II of the Convention in particular holds launching States "absolutely liable" for any damage caused by a space object and Article IV extends that liability to persons of the State or a jointlaunching State.<sup>109</sup> Liability assessment is of critical importance especially when considering the recent uncontrolled re-entry of a Russian rocket stage in January 2022 that failed to burn up in the atmosphere and ultimately crashed in the Pacific Ocean.<sup>110</sup> Considering the vast majority of large space objects are owned by governments,<sup>111</sup> the launching States themselves could assume liability for the actions of the commercial ADR service provider, offering liability protection up to a government-determined amount and minimizing the legal risk profile for the operator.<sup>112</sup> Taken as a whole, relevant articles from the OST and Liability Convention combined with a detailed contractual agreement or Memorandum of Understanding (MOU) that addresses remaining questions regarding liability and ownership could pave the way for international cooperation on remediation of large debris objects.<sup>113</sup> This would be

<sup>&</sup>lt;sup>106</sup> *Id.* at art. VII.

<sup>&</sup>lt;sup>107</sup> 14 CFR Ch. III, Subch. C, Pt. 413.

<sup>&</sup>lt;sup>108</sup> Outer Space Treaty, *supra* note 8, at art. VI-VIII. *See also*, Liability Convention, *supra* note 9.

<sup>&</sup>lt;sup>109</sup> Outer Space Treaty, *supra* note 8, art. IV.

<sup>&</sup>lt;sup>110</sup> Kate Hunt et al, *Russian rocket stage makes uncontrolled entry into Earth's atmosphere*, CNN (Jan. 5, 2022), https://www.cnn.com/2022/01/05/world/russia-rocket-uncontrolled-reentry-scn/index.html.

<sup>&</sup>lt;sup>111</sup> Foust, *supra* note 22.

<sup>&</sup>lt;sup>112</sup> Way & Koller, *supra* note 7.

<sup>&</sup>lt;sup>113</sup> Id.

especially true if the US could partner with a close ally that has shown express interest in ADR, such as JAXA and the ESA (both of which own boosters listed in the aforementioned top-50 "most statistically concerning" space objects).<sup>114</sup>

Article VIII of the OST also has applications to ADR as it states any launched object registered to a State Party will remain under the jurisdiction and ownership of that State.<sup>115</sup> There are countless examples of commercial launch companies providing services, such as payload delivery, without assuming ownership of that payload itself.<sup>116</sup> This indicates that ownership transfer is not necessary to provide services in space and could theoretically permit an ADR service provider to remove a given object, especially if a contractual agreement between the two offered express consent for the service.<sup>117</sup>

While it has been proven that removing a defunct object from orbit does not necessarily require a change in ownership, in the same sense that a tow truck does not assume ownership of an automobile using its services or a tug boat doing the same for an ocean freight liner, the transfer of liability remains a point of contention.<sup>118</sup> A domestic ADR initiative between a service provider and the federal government can assess the extent of liability for all parties involved in a contractual agreement.<sup>119</sup> If the debris object scheduled for removal is a rocket booster owned by the US government, the US could assume international liability as the launching State to diminish the liability and financial risk for the ADR provider. In turn, the State is entitled to rigorous technical inspection of the ADR service provider's technology.<sup>120</sup> A system in which the launching State provides liability coverage in exchange for government inspection would promote commercial development and minimize risk exposure for all parties.

<sup>&</sup>lt;sup>114</sup> Foust, *supra* note 22.

<sup>&</sup>lt;sup>115</sup> Liability Convention, *supra* note 9.

 $<sup>^{116}</sup>$  Id.

<sup>&</sup>lt;sup>117</sup> Id.

<sup>&</sup>lt;sup>118</sup> Way & Koller, *supra* note 7.

<sup>&</sup>lt;sup>119</sup> *Id*.

 $<sup>^{120}</sup>$  Id.

#### ii. Artemis Accords

While not international law, the Artemis Accords expand on several concepts posited in the OST and offer principles and guidelines to provide a framework for future international agreements.<sup>121</sup> Section 12 of the Artemis Accords addresses debris and commits Signatories to plan for mitigation efforts through post-mission disposal, explicitly assigning primary responsibility for disposal in the event of cooperative missions.<sup>122</sup>

Noticeably absent, however, are any measures encouraging ADR efforts by any State party or international coalition,<sup>123</sup> which underscores the need for urgent action in this area if we are to ensure the continued safety and reliability of space assets. Subsequent international policies governing ADR should be pursued but only in the interest of facilitating a long-term solution as the time required for such an effort does nothing to address the immediate problem.<sup>124</sup> These authors argue the focus should be on establishing a rough baseline for best practices through a domestic-led demonstration until international consensus can become law.

# B. United States Law and Regulation

As signatories of international treaties, the US follows and implements international law into its own regulations. Article VI of the OST requires State Parties to provide "continuous supervision" over the entities operating within the State.<sup>125</sup> This provision is enforced by domestic policy initiatives as well as federal agencies. No federal agency specifically governs ADR but all have authority over certain aspects of the practice. While international treaties serve as

<sup>&</sup>lt;sup>121</sup> Chelsea Gohd, Brazil Makes History in Signing the Artemis Accords for Moon Exploration, SPACE.COM (June 15, 2021), https://www.space.com/brazil-signs-artemis-accords-moon-exploration; see also, National Space Society, ISDC 2021 Sunday Session 1: Perspectives on the Artemis Accords, YOUTUBE.COM (June 27, 2021), https://youtu.be/k4FpFZWJsGY [hereinafter 2021 NSS ISDC].

<sup>&</sup>lt;sup>122</sup> The Artemis Accords: Principles for Cooperation in the Civil Exploration and Use of the Moon, Mars, Comets, and Asteroids for Peaceful Purposes, NASA, https://www.nasa.gov/specials/artemis-accords/img/Artemis-Accords-signed-13Oct2020.pdf [hereinafter Artemis Accords].

 $<sup>^{123}</sup>$  Id.

<sup>&</sup>lt;sup>124</sup> Way & Koller, *supra* note 7.

 $<sup>^{125}~</sup>$  Outer Space Treaty, supra note 8.

the foundation of US obligations, these internal regulations hold the US space industry to a higher standard.  $^{126}$ 

## i. US SPD-3

On June 18, 2018, SPD-3 was announced outlining a new national STM policy to build on the ODMSP.<sup>127</sup> Presidential Directives, which are not law, are considered policies regarding national security and "carry the force and effect of the law."<sup>128</sup> The directive outlined and is notable for explicitly addressing the need for ADR efforts as a matter of national interest.<sup>129</sup> "The United States should pursue active debris removal as a necessary long-term approach to ensure the safety of flight operations in key orbital regimes. This effort should not detract from continuing to advance international protocols for debris mitigation associated with current programs."<sup>130</sup> This is a clear call by the administration to engage the international community in implementing debris remediation measures that incentivize ADR. Unfortunately, SDP-3 has done little to move the conversation forward regarding ADR methods in the years since both at domestic and international levels.<sup>131</sup>

### ii. US ODMSP

In November 2019, the United States updated its ODMSP through the National Space Council.<sup>132</sup> Much of these updates fell in line with other international standards, such as the 25-year post-

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 $<sup>^{126}\,</sup>$  NASA's Efforts, supra note 1 (NASA has a 96% compliance rate for post-mission disposal within 25 years compared to a global compliance rate between 20-30%).

<sup>&</sup>lt;sup>127</sup> SPD-3, *supra* note 10.

<sup>&</sup>lt;sup>128</sup> Presidential Directives, SCI. SAFETY SEC., https://www.phe.gov/s3/law/Pages/Directives.aspx#:~:text=Presidential%20Directives%20are%20a%20specific,requirements%20for%20the%20Executive%20Branch (last visited Sept. 8, 2021).

<sup>&</sup>lt;sup>129</sup> Id. § 5(a)(iii).

<sup>&</sup>lt;sup>130</sup> Id. §§5(a)(iii) & 5(b).

<sup>&</sup>lt;sup>131</sup> Caleb Henry, FCC Punts Controversial Space Debris Rules for Extra Study, SPACENEWS (Apr. 23, 2020), https://spacenews.com/fcc-punts-controversial-space-de-bris-rules-for-extra-study/.

<sup>&</sup>lt;sup>132</sup> See US Government Orbital Debris Mitigation Standard Practices, NASA (2019), https://orbitaldebris.jsc.nasa.gov/library/usg\_orbital\_debris\_mitigation\_standard\_practices\_november\_2019.pdf. See also J.C. Liou, The 2019 US Government Orbital Debris Mitigation Standard Practices, NASA (Feb. 14, 2020), https://www.unoosa.org/documents/pdf/copuos/stsc/2020/tech-24E.pdf. The ODMSP is created and pushed through by the National Space Council and the Office of Space Commerce.

mission deorbit requirement.<sup>133</sup> Objective 5-4: Safety of Active Debris Removal Operations requires that any ADR effort should limit the risk of additional debris creation through fragmentation, collision, or explosion resulting from operations.<sup>134</sup> Outside of this singular section, the ODMSP offers little insight on incentivizing ADR and is considered inadequate for largely focusing on mitigation activities alone.<sup>135</sup>

While the updated ODMSP seeks to mitigate the risk of explosion by mandating depletion of propellant and batteries as part of post-mission disposal, many satellites made before mitigation guidelines remain in orbit.<sup>136</sup> Moreover, compliance with the guidelines remains a challenge considering only 70% of rocket stages adhered to the NASA Orbital Debris Mitigation Standard Practices (ODMSP) standards as of 2019 (that number was 20% in 2000).<sup>137</sup> This indicates a need to incentivize compliance with mitigation practices to limit the creation of additional debris as much as possible before ADR has a chance to fully develop.<sup>138</sup>

## iii. Federal Agencies

The US enforces provisions of the OST relating to ADR through various federal agencies including the Federal Aviation Administration (FAA), Federal Communications Commission (FCC) and the National Oceanic and Atmospheric Association (NOAA). The FAA has authority over launches and re-entry which will cover the launch of an ADR service provider.<sup>139</sup> l The FCC plays a larger role by comparison as it pertains to communications and spectrum.<sup>140</sup> As most satellites require spectrum to operate, the FCC has become the de facto regulator where there is jurisdictional ambiguity.<sup>141</sup> The agency requires those obtaining a launch license to show proof of compliance with international and national

 $<sup>^{133}</sup>$  *Id*.

 $<sup>^{134}</sup>$  *Id*.

<sup>&</sup>lt;sup>135</sup> SPD-3, *supra* note 10.

<sup>&</sup>lt;sup>136</sup> *Id*.

 $<sup>^{137}</sup>$  Id.

 $<sup>^{\</sup>rm 138}\,$  NASA's Efforts, supra note 1.

<sup>&</sup>lt;sup>139</sup> Way & Koller, *supra* note 7.

 $<sup>^{140}</sup>$  *Id*.

 $<sup>^{141}</sup>$  *Id*.

regulations.<sup>142</sup> These requirements encompass disclosure of probability of successful craft disposal, collision risk,<sup>143</sup> adherence to the ODMSP, and having indemnity insurance to protect the US from liability.<sup>144</sup> In April 2020, the FCC began accepting feedback from the industry on the proposed new rules for the *Mitigation of Orbital Debris in the New Space Age*, which became effective by September.<sup>145</sup> In these new rules, the FCC failed to implement more strict regulations such as shortening the 25-year post-mission disposal timeline, which leaves countless of defunct spacecraft congesting Earth orbits long after their useful life.<sup>146</sup>. Additionally, while the new rule discussed ADR methods, it postponed creating specific regulations so early in development.

In order to address a severe deficiency in legal guidance on ADR activities at both the domestic and international level, the US needs to initiate cooperation with congress, federal agencies and State parties to the UN to update legal regimes so they may incentivize debris removal methods.<sup>147</sup> The production of such guidelines will take time but should serve as a parallel effort to a domestic ADR initiative that can begin laying the groundwork on best practices immediately.

#### V. SOLUTIONS

Despite the lack of legal regimes at the international level governing space debris and its removal, there is consensus among States that debris poses a threat to space activity as a whole.<sup>148</sup> Given the urgency of the problem, the following section will outline solutions and frameworks for combating the problem immediately.

The most immediate solution would be a domestic ADR initiative consisting of government and private sector partners. As

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 $<sup>^{142}</sup>$  Id.

<sup>&</sup>lt;sup>143</sup> Henry, *supra* note 131.

<sup>&</sup>lt;sup>144</sup> Outer Space Treaty, *supra* note 8, art. VII. The requirement for insurance is only up to certain point, and the US would be liable for paying the remainder.

<sup>&</sup>lt;sup>145</sup> Mitigation of Orbital Debris in the New Space Age: Final Rule, 85 FR 52422, (2020), https://www.federalregister.gov/documents/2020/08/25/2020-13185/mitigation-of-orbital-debris-in-the-new-space-age.

<sup>&</sup>lt;sup>146</sup> Theresa Hitchens, *FCC Reconsiders Tightening 25-year Deadline for Space Junk Disposal*, BREAKINGDEFENSE (Apr. 23, 2020), https://breakingdefense.com/2020/04/fcc-reconsiders-tightening-25-year-deadline-for-space-junk-disposal/

<sup>&</sup>lt;sup>147</sup> NASA's Efforts, *supra* note 1.

<sup>&</sup>lt;sup>148</sup> 2021 NSS ISDC, *supra* note 121.

discussed previously, if Articles VI, VII and VIII from the OST and Articles II and IV of the Liability Convention are observed, combined with a detailed contractual agreement or MOU that addresses remaining questions regarding liability and ownership, such demonstration would be permissible under present legal regimes.<sup>149</sup> The only burden at which point would be development time and cost.

To set precedent of future ADR practice and international cooperation, the US would be best served targeting a close ally with a mutual interest in the debris population for collaborative efforts.<sup>150</sup> Multiple signatories to the Artemis Accords (a US-led initiative) have ADR concepts currently in development and would be prime candidates for international cooperation.<sup>151</sup>

One obstacle frequently cited as a hindrance to this type of collaboration is the dual use of ADR as a potential ASAT weapon or device capable of extracting privileged information. While a valid concern, a contract based on mutual consent between two State parties would clearly delineate prohibited and authorized actions while provisions of the OST would determine liability.<sup>152</sup> An important counter to this notion is an expressed emphasis on transparency and accountability, such that one day even Russia and China would be willing to collaborate on ADR efforts in the longer term.<sup>153</sup>

In October, 2019, the National Space Society (NSS) recommended actions that would incentivize State parties and private entities to collaborate on rapidly developing ADR methods and using economic means to enable the creation of a new market for in-orbit servicing of satellites and debris removal.<sup>154</sup> The NSS suggests decision-makers could look to maritime law when considering space debris regulations.<sup>155</sup> While not a definitive one-to-one comparison, maritime and space operations share enough similarities that

<sup>&</sup>lt;sup>149</sup> Way & Koller, *supra* note 7.

 $<sup>^{150}</sup>$  Id.

<sup>&</sup>lt;sup>151</sup> ESA Commissions World's First Space Debris Removal, *supra* note 87.

 $<sup>^{\</sup>rm 152}~$  Way & Koller, supra note 7.

<sup>&</sup>lt;sup>153</sup> Id.

<sup>&</sup>lt;sup>154</sup> Space Debris Removal, Salvage, and Use: Maritime Lessons, *supra* note 11.

 $<sup>^{155}</sup>$  Id.

maritime law can be used to inform decisions regarding space debris.<sup>156</sup> Orbital debris is not confined to a singular location, which is analogous to debris caused by ocean failures such as sunken vessels, downed planes, and oil spills.<sup>157</sup> As space activities progress, they will somewhat resemble current maritime operations where human-made structures (think oil rigs versus space stations) are built and serviced by mobile vessels.<sup>158</sup> The space tourism industry could also echo maritime tourism through spacewalks in lieu of deep-sea diving, or weeklong orbital flights instead of cruising on an ocean liner.<sup>159</sup> The commercialization of LEO and the development of a large space economy requires assurances of safety and risk mitigation for investors.<sup>160</sup> Keeping orbital zones free of debris obstruction will encourage private investment and public support.<sup>161</sup>

Using maritime salvage law to inform orbital debris regulations could also aid in assigning liability assessment by interpreting defunct objects and other debris as salvage.<sup>162</sup> Drawing from historical practices dating back to ancient Phoenicians, Romans and Greeks, this tradition rewarded commercial salvors special compensation for clearing wrecks or other environmental hazards from shipping lanes and rescuing imperiled or damaged vessels.<sup>163</sup> Salvors would assume the liability in so-called "liability salvage" for compensation in return.<sup>164</sup> In 1972, the London Convention barred dumping, or deliberately disposing of refuse and waste, into the open ocean by boats and aircraft.<sup>165</sup> The ancient tradition of maritime salvage and the London Convention were officially adopted as international law by the International Convention on Salvage in

<sup>&</sup>lt;sup>156</sup> Rachel Rogers, The Sea of the Universe: How Maritime Law's Limitation on Liability Gets it Right, and Why Space Law Should Follow by Example, 26 Ind. J. Glob. Legal Stud. 741 (2019), https://www.repository.law.indiana.edu/ijgls/vol26/iss2/10.

<sup>&</sup>lt;sup>157</sup> Id.

 $<sup>^{158}</sup>$  Id.

 $<sup>^{159}</sup>$  Id.

<sup>&</sup>lt;sup>160</sup> LEO Commercialization: The Pathway to Earth's Trillion Dollar Space Economy Webinar, Nat'l Space Soc'y (Sept. 25, 2020), https://space.nss.org/leo-commercializationthe-pathway-to-earths-trillion-dollar-space-economy-webinar/.

 $<sup>^{161}</sup>$  *Id*.

<sup>&</sup>lt;sup>162</sup> Space Debris Removal, Salvage, and Use: Maritime Lessons, *supra* note 11.

 $<sup>^{163}</sup>$  Id.

 $<sup>^{164}</sup>$  Id.

<sup>&</sup>lt;sup>165</sup> Convention on the International Regulations for Preventing Collisions at Sea, Oct. 20, 1972, 33 UST 1602.

1989.<sup>166</sup> Article 14 of the International Convention on Salvage emphasizes protecting the environment and considers all debris as salvage and redeemable for a reward if the salvor prevented contamination.<sup>167</sup> Applying maritime guidance for debris liability assumption further develops the assumption of "international responsibility" mentioned in OST Article VI.<sup>168</sup>

Additionally, maritime risk mitigation structures could be adapted to launch the creation of new space industries.<sup>169</sup> Spacefaring nations could look to Marine Protection and Indemnity (P&I) Insurance as blueprints for methodologies that pool risk and yield lower costs.<sup>170</sup> Premiums are paid by members based on measurable risks and costs regarding machinery, the hull, or the entire vessel.<sup>171</sup> According to Peter Garretson in *The Space Review*,

If carried out proactively involving multiple launch and satellite companies internationally, such a pool could accrue multiple billions of dollars simply by charging a penny per dollar to satellite service end users. Moreover, an international trust fund could be accessed by multiple P&I space clubs worldwide as a major resource for their funding pools.<sup>172</sup>

This insurance would have the added benefit of making LEO safer and more accessible to all actors,<sup>173</sup> allow for the growth of existing industries and lower the barrier to entry for developing nations seeking to engage in space activity.<sup>174</sup>

The US can incentivize the removal of existing debris threats through active debris removal (ADR) both domestically and internationally through economic channels.<sup>175</sup> Launch costs to orbit

<sup>&</sup>lt;sup>166</sup> International Convention on Salvage, Apr. 28, 1989, S. Treaty Doc. No. 102-12, 1953 U.N.T.S. 193.

 $<sup>^{167}</sup>$  Id.

<sup>&</sup>lt;sup>168</sup> Outer Space Treaty, *supra* note 8, art. VI.

<sup>&</sup>lt;sup>169</sup> Space Debris Removal, Salvage, and Use: Maritime Lessons, *supra* note 11.

<sup>&</sup>lt;sup>170</sup> Peter Garretson et al., Catalyzing Space Debris Removal, Salvage, and Use, SPACE REV. (Dec. 9, 2019), https://www.thespacereview.com/article/3847/1.

 $<sup>^{171}</sup>$  Id.

 $<sup>^{172}</sup>$  Id.

 <sup>&</sup>lt;sup>173</sup> Id.; Space Debris Removal, Salvage, and Use: Maritime Lessons, *supra* note 11.
<sup>174</sup> Id.

<sup>&</sup>lt;sup>175</sup> Aaron Carroll, *Preventative Care Saves Money? Sorry, It's Too Good to be True*, NEW YORK TIMES (Jan. 29, 2018), https://www.nytimes.com/2018/01/29/upshot/preventive-health-care-costs.html. Similar to preventative medicines and practices preventing

average \$2,200 per pound, with launch and maintenance costs continually increasing due to the growing population of space debris.<sup>176</sup> Mitigating those costs would save money for government and private sector operators in the long term.<sup>177</sup> While initially expensive, spread over several years, the result will be comparably economic, especially considering the growing market demand from military and commercial operators for orbital zones free of congestion.<sup>178</sup> We estimate it would cost \$100 million over seven to eight years for a proof of concept capable of ADR.<sup>179</sup> This is not an unreasonable amount, and the long term impact on increasing the feasibility of a commercial economy in LEO would be a net positive.<sup>180</sup> Additionally, regulations and other measures can be put in place to subsidize the initial cost of remediation.<sup>181</sup>

Debris is raising the cost of building, launching, and maintaining satellites every year.<sup>182</sup> As the debris problem grows, satellites and spacecraft hulls must be engineered to be more durable, thus increasing the cost of materials, amount of propulsion to take off, and increasing the cost of the launch.<sup>183</sup> By focusing resources to remediating the debris problem and clearing up LEO and GEO, the

long term expensive medical conditions, removing dangerous objects in space will prevent potential expenses in the future.

<sup>&</sup>lt;sup>176</sup> Megan Ansdell, Active Space Debris Removal: Needs, Implications, and Recommendations for Today's Geopolitical Environment, J. PUB. & INT'L AFFS. 21 (2010), https://ciaotest.cc.columbia.edu/journals/jpia/v21i0/f\_0022076\_18192.pdf. See generally Will Ailor et al., Effects of Space Debris on the Cost of Space Operations, AEROSPACE (Sept. 28, 2010), https://vesta.astro.amu.edu.pl/Staff/Iwona/CostofSpaceDebris.pdf.

<sup>&</sup>lt;sup>177</sup> Torrey Kim, *Home Maintenance Tasks That Cost More Later*, THE BALANCE (Feb. 18, 2021), https://www.thebalance.com/home-maintenance-tasks-that-cost-more-later-4684185.

 $<sup>^{178}</sup>$  Id.

<sup>&</sup>lt;sup>179</sup> Determined after discussion with several industry representatives.

 $<sup>^{180}</sup>$  Id.

<sup>&</sup>lt;sup>181</sup> The Balance Between Taxes, BRITANNICA.COM, https://www.britannica.com/topic/government-budget/The-balance-between-taxes (lasty visited Sept. 16, 2021).

<sup>&</sup>lt;sup>182</sup> Ailor et al., *supra* note 176. *Generally*, Hanspeter Schaub, *Cost and Risk Assessment for Spacecraft Operation Decisions Caused by the Space Debris Environment*, 113 ACTA ASTRONAUTICA 66 (Aug. – Sept. 2015), https://www.sciencedirect.com/science/article/abs/pii/S0094576515001289?via%3Dihub.

<sup>&</sup>lt;sup>183</sup> See generally Sylvestre Habimana & Ramakrishna V.R. Parama, Space Debris: Reasons, Types, Impacts, and Management, 46 INDIAN J. RADIO & SPACE PHYSICS 1, 24-25 (2017), http://op.niscair.res.in/index.php/IJRSP/article/view/15316. To protect the craft additional layers of protection are built, thus increasing the weight, and thus increasing the amount of propulsion needed to launch.

cost of building and launching rockets will decrease.<sup>184</sup> Similarly, the risk of damage or collision will also decrease so satellites will be safer.<sup>185</sup> Doing so will make for more accessible and less expensive launches.<sup>186</sup>

There are also ways to fund a remediation program without strict government funding. The FAA, through the Department of Transportation, could be reimbursed the funding costs by the final users through several means.<sup>187</sup> First, if the FAA is funded via government programming, an increase to taxes (American end users) should be enough to fund it.<sup>188</sup> The FAA could disperse this fee to companies and satellite owners directly through an additional or increased fee to all new satellite licenses.<sup>189</sup> Those companies could redirect that cost to their consumers, with a \$1 increase for all consumers using a satellite would fund most program estimates.<sup>190</sup> A slight increase in the internet bill throughout the population could raise the money needed, the increase to the final consumer would

<sup>&</sup>lt;sup>184</sup> What Determines the Price of an Auto Insurance Policy?, INS. INFO. INST., https://www.iii.org/article/what-determines-price-my-auto-insurance-policy (last visited Sept. 16, 2021) (Just like with car and homeowner insurance, reducing risks will make risk prevention cheaper).; *Homeowners Insurance Guide*, TEX. DEP'T INS., https://www.tdi.texas.gov/pubs/consumer/cb025.html (IE insurance drops when risks reduce. The additional protection/coverage of the craft can be reduced).

<sup>&</sup>lt;sup>185</sup> Kessler et al., *supra* note 71.

<sup>&</sup>lt;sup>186</sup> By reducing the cost of production, the total launch cost reduces. This would make launching satellites cheaper and more accessible.

<sup>&</sup>lt;sup>187</sup> The US government (Congress) could increase taxes to all citizens by a marginal amount and put that toward the FAA and its funding of remediation programs.

<sup>&</sup>lt;sup>188</sup> Internet/Broadband Fact Sheet, PEW RSCH. CTR. (Apr. 7, 2021), www.pewresearch.org/internet/fact-sheet/internet-broadband.; Andrew Perrin & Sara Atske, 7% of Americans Don't Use the Internet. Who are They?, PEW RSCH. CTR. (Apr. 2, 2021), https://www.pewresearch.org/fact-tank/2021/04/02/7-of-americans-dont-use-the-internet-who-are-they/.

<sup>&</sup>lt;sup>189</sup> Regulatory Fees Fact Sheet, What You Owe-International and Satellite Services Licensees for FY 2007, FCC (2007), docs.fcc.gov/public/attachments/DOC-275938A6.pdf (breakdown of FCC fees).; FCC Proposes Cost-based Application Fee Schedule; Satellite Application Fees Greatly Reduced, HOGAN LOVELLS (Sept. 18, 2020), https://www.engage.hoganlovells.com/knowledgeservices/news/fcc-proposes-cost-based-application-feeschedule-satellite-application-fees-greatly-reduced.

<sup>&</sup>lt;sup>190</sup> Internet/Broadband Fact Sheet, supra note 188; Andrew Perrin & Sara Atske, supra note 188. The US currently has a population of 328.2 million. This population, reduced by 7% who are not using the internet (46885714), comes out to 281,314,286 people. At \$1 per internet bill, and a minimum of \$280 million, the funds would be well within reach.

be negligible, and the cost to the satellite owner almost non-existent.

Currently, the FCC is considering enforcing satellite owners to pay a bond for successful post-mission disposal.<sup>191</sup> If the owner fails to dispose of the satellite in the permitted 25 years, the bond is forfeited.<sup>192</sup> The FCC could increase the bond to the amount estimated for the cost of the remediation effort for that size satellite. This could be similar to a temporary 'parking fee' for all newly launched satellites.<sup>193</sup> All companies would be charged a small 'parking fee' upon gaining a license.<sup>194</sup> Upon deorbit, rehabilitation, or placement into secure salvage orbits, the fee, or a portion of it, would be returned.<sup>195</sup> If the owner fails to deorbit, the fee would be forfeited.<sup>196</sup> The FAA, working with the Department of Commerce and other entities such as the Satellite Industry Association (SIA) or Space Data Association (SDA), could consult for an ideally assessed fee. This calculation could be based on the debris threat created with each launch and then scaled back modestly. Alternatively, the FCC could have an opt-in program with a discounted amount if the satellite owner 'donates' that money into the remediation initiative, regardless of deorbit.

#### VI. CONCLUSION

The US can immediately address the threat of orbital debris to its space assets by implementing a domestic, commercially-developed ADR demonstration that satisfies existing ADR legal frameworks and subsequently grows to involve international allies who share concern and interest in the debris population in LEO. While the US works with the international community on a multilateral agreement for ADR as a long-term solution, it must recognize that ADR is urgently needed to address the existing threat debris poses to critical space assets and focus on immediate and attainable

<sup>&</sup>lt;sup>191</sup> FCC Fact Sheet: Mitigation of Orbital Debris in the New Space Age, REP. & ORD. & FURTHER NOTICE OF PROPOSED RULEMAKING, IB Docket No. 18-313 FCC (Apr. 2, 2020), https://docs.fcc.gov/public/attachments/DOC-363486A1.pdf.

 $<sup>^{192}</sup>$  Id.

<sup>&</sup>lt;sup>193</sup> Orbital Debris: Overcoming Challenges, NAT'L SPACE SOC'Y 1, 16 (May 2016), https://space.nss.org/wp-content/uploads/NSS-Position-Paper-Orbital-Debris-2016.pdf.

<sup>&</sup>lt;sup>194</sup> *Id.* at 16.

 $<sup>^{195}</sup>$  *Id*.

 $<sup>^{196}</sup>$  Id.

solutions. Employing contractual agreements MOUs among involved parties removes legal ambiguity regarding ownership and liability and will inform precedent for necessary international ADR efforts in the future. On an issue with ranging geopolitical implications, several States and private entities have already begun taking the lead on remediation technology showing they will step into the role as international leaders in the absence of a multilateral approach.<sup>197</sup> If we have learned anything from the year 2020, it is that unforeseen events with global impact are real and have lasting effects.<sup>198</sup> Space debris has a global impact capable of doing great harm to essential US interests and to all of humanity.<sup>199</sup> Every space-based operator and entity requires a safe space environment to launch as desired and to utilize the benefits of Earth orbits, and as such has a stake in the success of effectively removing hazardous debris. Provided that the US considers these interests vital to the economic prosperity and security of the nation, we urgently recommend that the US initiate a domestic ADR program, through NASA, appropriate federal agencies and congressional action, to prevent the degradation of LEO to the extent future operating costs overwhelm our burgeoning orbital economy.

<sup>&</sup>lt;sup>197</sup> NASA's Efforts, *supra* note 1.

<sup>&</sup>lt;sup>198</sup> Patrick Van Kessel et al., In Their Own Words, Americans Describe the Struggles and Silver Linings of the COVID-19 Pandemic, PEW RSCH. CTR. (Mar. 5, 2021), https://www.pewresearch.org/2021/03/05/in-their-own-words-americans-describe-thestruggles-and-silver-linings-of-the-covid-19-pandemic/.

<sup>&</sup>lt;sup>199</sup> NASA's Efforts, *supra* note 1.