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Volume 68 | Issue 1

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11-26-2019

## The Cold Vacuum of Arms Control in Outer Space: Can Existing Law Make Some Anti-Satellite Weapons Illegal?

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### Recommended Citation

Jeffrey A. Murphy, *The Cold Vacuum of Arms Control in Outer Space: Can Existing Law Make Some Anti-Satellite Weapons Illegal?*, 68 Clev. St. L. Rev. 125 (2019)  
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# THE COLD VACUUM OF ARMS CONTROL IN OUTER SPACE: CAN EXISTING LAW MAKE SOME ANTI-SATELLITE WEAPONS ILLEGAL?

JEFFREY A. MURPHY\*

## ABSTRACT

The current space law paradigm came into existence when two major national powers were vying for supremacy after a catastrophic world war. The nuclear age had dawned. The United Nations drafted and ratified the Outer Space Treaty under these conditions with limited foresight to the specific nature of future space activities. As more nations and private actors enter the space arena, the nature of the weapons used in space has changed, and the number of targets and opportunities for collateral damage has greatly increased.

This Note looks at the weapons aimed at space and the laws that try to govern them. Between the United Nations Charter, the Law of Armed Conflict, and the Outer Space Treaty, this Note argues that debris-causing, non-nuclear weapons are forbidden by Article IV of the Outer Space Treaty (among others) as weapons of mass destruction. The legality of these weapons is a critical question as more and more of society depends on orbital infrastructure in their daily lives, and the population in orbit, who are directly at risk from space weapons, is only going to increase in the future.

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## I. INTRODUCTION

Imagine waking up one morning to find that cell phones do not work, calls cannot be made or received, the internet is unreachable, financial markets are not operational, payment transactions cannot be processed, and emergency responders cannot find those in need of help. The potential effects of losing the capabilities of satellites would ripple through society from the most sophisticated to the least developed nation. Of the nearly 5,000 satellites in orbit around our planet,<sup>1</sup> there are those for military operations, those for civilian use, and those for both purposes. Mankind’s reliance on the orbiting infrastructure has become so great that losing the functionality of even one satellite to a passing space rock could potentially have far-reaching consequences and would multiply with every disabled satellite.<sup>2</sup> The natural hazards threatening space infrastructure are unpredictable because even small, undetectable objects can unleash critical damage. High energy particles ejected from the sun, known as space weather, have caused havoc for satellites and astronauts, including the complete loss of a Japanese satellite in 2003.<sup>3</sup> The greatest threat to Earth’s orbiting infrastructure, though, is not the harsh space environment but rather man-made orbital debris.

Orbital debris can be created by successful launches in the form of an abandoned rocket stage or discarded bolts and also by unsuccessful missions, resulting in disabled satellites or scrap from a damaged satellite. A satellite or other man-made space object can create (or become) space debris from internal failures or external collisions, accidental or otherwise. There are threats from weapons targeting satellites for intentional collision, but the threat from accidental collisions rise with increased debris.<sup>4</sup>

<sup>1</sup> Space Debris Sensor on Orbit Status, *Orbital Debris Q. News*, May 2018.

<sup>2</sup> See Dr. Lewis Dartnell, *What Would Happen If Satellites Fell from the Sky?*, *THE TELEGRAPH* (Apr. 29, 2014), <https://www.telegraph.co.uk/culture/books/10785683/What-would-happen-if-satellites-fell-from-the-sky.html>; *What Are Satellites Used For?*, *UNION OF CONCERNED SCIENTISTS*, <https://www.ucsusa.org/nuclear-weapons/space-weapons/what-are-satellites-used-for#.W5APGOhKiUk> (last updated Jan. 15, 2015).

<sup>3</sup> David F. Webb & Joe H. Allen, *Spacecraft and Ground Anomalies Related to the October–November 2003 Solar Activity*, 2 *SPACE WEATHER* 3008, 3008 (2004), <https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2004SW000075>.

<sup>4</sup> *About Space Debris*, *EUROPEAN SPACE AGENCY*, [https://www.esa.int/Our\\_Activities/Space\\_Safety/Space\\_Debris/About\\_space\\_debris](https://www.esa.int/Our_Activities/Space_Safety/Space_Debris/About_space_debris) (last visited Oct. 24, 2019).

For as long as satellites have existed, nations have developed anti-satellite weapons (ASATs).<sup>5</sup> Mankind's reach into space was a search for the ultimate high ground.<sup>6</sup> The strategic military advantage gained by intelligence gathered from orbit justifies the strategy of defensive weapons that target satellites. Destroying a satellite could blind a country's military. The use of some ASAT technology could also create a cloud of lethal debris in Earth's orbit that endangers civilian and military assets alike. An estimated 700,000 pieces of debris greater than one centimeter in size are already in orbit now.<sup>7</sup> The likelihood of catastrophic damage from a collision increases non-linearly as the amount of debris rises, even from debris as small as one centimeter.<sup>8</sup> Between the widespread effects on the public of destroying a satellite and the expanded risk of collateral damage to non-targeted satellites and persisting debris, certain ASAT weapons should be recognized as illegal under current international law.

Article IV of the Outer Space Treaty prohibits weapons of mass destruction (WMD) in orbit,<sup>9</sup> but ASAT weapons are not in the category of what is colloquially thought to be a WMD (nuclear, chemical, and biological weapons).<sup>10</sup> Scholars have examined the legality of ASAT weapons under several aspects of international law,

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<sup>5</sup> JAMES CLAY MOLTZ, *THE POLITICS OF SPACE SECURITY* 100 (2d ed. 2011) (stating Operation Bold Orion was the first ASAT test in October 1959).

<sup>6</sup> Former Secretary of Defense Donald Rumsfeld called space the ultimate "high ground." *Department of Defense Authorization for Appropriations for Fiscal Year 2003: Hearings on S. 2225 Before the S. Comm. on Armed Servs.*, 107th Cong. 23 (2002) (statement of Hon. Donald H. Rumsfeld, Sec'y of Def.).

<sup>7</sup> *How Many Space Debris Objects Are Currently in Space*, EUROPEAN SPACE AGENCY, [http://www.esa.int/Our\\_Activities/Space\\_Engineering\\_Technology/Clean\\_Space/How\\_many\\_space\\_debris\\_objects\\_are\\_currently\\_in\\_orbit](http://www.esa.int/Our_Activities/Space_Engineering_Technology/Clean_Space/How_many_space_debris_objects_are_currently_in_orbit) (last visited Sept. 18, 2018).

<sup>8</sup> Alexander William Salter, *Space Debris: A Law and Economics Analysis of the Orbital Commons*, 19 *STAN. TECH. L. REV.* 221, 222–23 (2016). The non-linear increase is not as obvious. As debris collides with debris it causes more debris as a result. This is known as the Kessler Syndrome. Paul B. Larsen, *Solving the Space Debris Crisis*, 83 *J. AIR L. & COM.* 475, 475 (2018).

<sup>9</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 [hereinafter *Outer Space Treaty*].

<sup>10</sup> *HLS 101 – Weapons of Mass Destruction (WMD)*, E. KY. UNIV., <https://ekuonline.edu/homeland-security/hls-101-weapons-mass-destruction-wmd> (last visited Oct. 24, 2019).

including treaties governing weapons and the execution of war.<sup>11</sup> Most of the prior work highlights a failure in space law to properly address the issue of ASATs.<sup>12</sup>

This Note argues that at least some ASAT weapons are illegal under existing law based on the characteristics of the weapons and their effects, especially space debris. A definitive treaty to address the testing and use of ASAT weapons, specifically, would be the best solution.<sup>13</sup> International outlook toward space policy has been shifting from global institutionalism that begat Cold War treaties (including the Outer Space Treaty) toward a more fatalistic nationalism.<sup>14</sup> This shift has been led by the United States, beginning with the second Bush Administration, when neoconservatives who subscribed to an outlook of political realism were setting a policy of space domination.<sup>15</sup> The Obama Administration returned American space policy to global cooperation, only to be reversed by the Trump Administration, which has called for space superiority and even a branch of the military dedicated to the purpose.<sup>16</sup> In light of this shift, new treaties seem ever more difficult.<sup>17</sup>

Part II of this Note examines the background of human activity in outer space and the treaties that resulted from that history. It also discusses the various treaties that

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<sup>11</sup> See generally Bill Boothby, *Space Weapons and the Law*, 93 INT'L L. STUD. 179 (2017); Michel Bourbonnière, *National-Security Law in Outer Space: The Interface of Exploration and Security*, 70 J. AIR L. & COM. 3 (2005); Michel Bourbonnière & Ricky J. Lee, *Legality of the Deployment of Conventional Weapons in Earth Orbit: Balancing Space Law and the Law of Armed Conflict*, 18 EUR. J. INT'L L. 873 (2007); Alex B. Englehart, *Common Ground in the Sky: Extending the 1967 Outer Space Treaty to Reconcile U.S. and Chinese Security Interests*, 17 PAC. RIM L. & POL'Y J. 133 (2008); Ryan Esparza, *Event Horizon: Examining Military and Weaponization Issues in Space by Utilizing the Outer Space Treaty and the Law of Armed Conflict*, 83 J. AIR L. & COM. 333 (2018); Blair Stephenson Kuplic, *The Weaponization of Outer Space: Preventing an Extraterrestrial Arms Race*, 39 N.C. J. INT'L L. & COM. REG. 1123 (2014); Andrew T. Park, *Incremental Steps for Achieving Space Security: The Need for A New Way of Thinking to Enhance the Legal Regime for Space*, 28 HOUS. J. INT'L L. 871 (2006).

<sup>12</sup> See Mitchell Ford, *War on the Final Frontier: Can Twentieth-Century Space Law Combat Twenty-First-Century Warfare?*, 39 HOUS. J. INT'L L. 237 (2017); David A. Koplow, *Asat-Isfaction: Customary International Law and the Regulation of Anti-Satellite Weapons*, 30 MICH. J. INT'L L. 1187 (2009); Jesse Oppenheim, *Danger at 700,000 Feet: Why the United States Needs to Develop A Kinetic Anti-Satellite Missile Technology Test-Ban Treaty*, 38 BROOK. J. INT'L L. 761 (2013).

<sup>13</sup> See generally Oppenheim, *supra* note 12.

<sup>14</sup> See MOLTZ, *supra* note 5, at 23–31.

<sup>15</sup> *Id.* at 26.

<sup>16</sup> Ramin Skibba, *How Trump's 'Space Force' Could Set Off a Dangerous Arms Race*, POLITICO (June 28, 2018), <https://www.politico.com/magazine/story/2018/06/22/how-trumps-space-force-could-set-off-a-dangerous-arms-race-218888>.

<sup>17</sup> See MOLTZ, *supra* note 5, at 30 (“Bush administration policies after 2001, inspired by concepts of space nationalism, explicitly rejected new treaty-based approaches.”). Moltz draws out a spectrum of philosophies from conflict to cooperation, space nationalism to global institutionalism, and from the more general extremes to the nuanced center of technological determinism and social interactionism. *Id.* at 23–41.

comprise the Law of Armed Conflict (LOAC),<sup>18</sup> including those addressing environmental concerns in a military context.<sup>19</sup> Part II also examines the various ASAT technologies to better understand the results of their use. Part III discusses why certain kinds of ASAT technology should already be forbidden by existing international law established in the LOAC. Part III also examines the Outer Space Treaty's influence over ASAT law while examining WMD and other ambiguous terms that have prevented straight-forward textual application of the treaty to prohibit ASAT weapons. Finally, Part IV concludes by arguing that the stakes for limiting ASAT weapons are ever-increasing as society's dependence on an orbiting infrastructure grows and private activity in space promises to expand in the future.

## II. JOHNNY, DON'T TAKE YOUR GUNS TO SPACE: WEAPONS OF THE FINAL FRONTIER AND THE LAWS THAT GOVERN THEM

Human endeavors in space intensified at the height of the Cold War.<sup>20</sup> The entire world was justifiably concerned about nuclear weapons and the threat of nuclear war, not just the superpowers with nuclear arsenals.<sup>21</sup> These concerns manifested in technology for surveillance and detection of attacks, but also the weapons to counter the new technology.<sup>22</sup> Any talk of scientific exploration and discovery always took place in the shadow of the Cold War.<sup>23</sup> Humans reaching into outer space was a major step in that war and international law responded.

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<sup>18</sup> Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of International Armed Conflicts (Protocol I), June 8, 1977, 1125 U.N.T.S. 3 [hereinafter PROTOCOL I]; Regulations Respecting the Laws and Customs of War on Land, annexed to Convention No. IV Respecting the Laws and Customs of War on Land, Oct. 18, 1907, 36 Stat. 2227, T.S. No. 539 [hereinafter 1907 Hague Regulations].

<sup>19</sup> Convention on the Prohibition of Military or Any Hostile Use of Environmental Modification Techniques, art. I, May 18, 1977, 31 U.S.T. 333, 1108 U.N.T.S. 151 [hereinafter ENMOD].

<sup>20</sup> The space age is said to start with the development of the V2 rocket in 1942. Colin S. Gray, *Series Editor's Preface* of EVERETT C. DOLMAN, *ASTROPOLITIK: CLASSICAL GEOPOLITICS IN THE SPACE AGE* xi, xi (2002).

<sup>21</sup> The author denies having any WMDs, despite a popular meme. The meme is explained by Josh Dance in a blog post. Josh Dance, *Who Is Jeff and Why Does He Have Nuclear Weapons?*, MEDIUM.COM (Jan. 4, 2017), <https://medium.com/@joshdance/who-is-jeff-and-why-does-he-have-nuclear-weapons-f823de764c5e>.

<sup>22</sup> See generally John Aubrey Douglass, *The Cold War, Technology, and the American University* (UC Berkeley Research and Occasional Paper Series, 1999).

<sup>23</sup> Non-military satellites were also used to set precedent for flyover rights and helped to establish customary international law, which, then applied to military satellites. See DELBERT A. TERRILL, JR., *THE AIR FORCE ROLE IN DEVELOPING INTERNATIONAL OUTER SPACE LAW*, Air University Press (May 1999) 16 n.34 ("Eisenhower's civilian [International Geophysical Year] satellite was a 'stalking horse' to establish the precedent of 'freedom in space' for eventual military reconnaissance satellites and focused attention on the former as a diversion from the latter."); see generally NEIL DEGRASS TYSON & AVIS LANG, *ACCESSORY TO WAR* (2018). Tyson and Lang discuss the long history of scientific advancement depending on military funding and research.

### A. *The Outer Space Treaty*

The USSR launched Sputnik I on October 4, 1957.<sup>24</sup> Sputnik II, with Laika the dog, was launched on November 3 of the same year.<sup>25</sup> On January 31, 1958, the United States launched Explorer I.<sup>26</sup> These first steps in the space race spawned the Committee on the Peaceful Uses of Outer Space (COPUOS) from the United Nations (U.N.) General Assembly in 1959, where proposals for treaties were modeled after the Antarctica Treaty, the Nuclear Test Ban Treaty, and customary international law.<sup>27</sup> A potential treaty that COPUOS would develop was meant to address the use of nuclear weapons, the delineation of airspace from outer space reflecting potential claims of sovereignty that affect flyover rights, and the appropriation of celestial bodies.<sup>28</sup> The U.N. General Assembly unanimously endorsed the Outer Space Treaty in December 1966.<sup>29</sup>

The Outer Space Treaty has been characterized as primarily an arms control treaty, so the application to ASAT weapons is not unfounded.<sup>30</sup> Article IV of the treaty prohibits placing nuclear weapons and other WMDs into orbit and any weapons on celestial bodies:

States Parties to the Treaty undertake not to place in orbit around the Earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons on celestial bodies, or station such weapons in outer space in any other manner.

The Moon and other celestial bodies shall be used by all States Parties to the Treaty exclusively for peaceful purposes. The establishment of military

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<sup>24</sup> *Sputnik and the Dawn of the Space Age*, NASA, <https://history.nasa.gov/sputnik/> (last updated Oct. 10, 2007).

<sup>25</sup> *Id.*

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

<sup>27</sup> Paul G. Dembling & Daniel M. Arons, *Evolution of the Outer Space Treaty*, 33 J. AIR L. & COM. 419, 422–24 (1967) [hereinafter Dembling: *Evolution*] (quoting the COPUOS report from 1959 in regard to the customary international law, “[C]ountries throughout the world proceeded on the premise of the permissibility of . . . flight of the space vehicle . . . regardless of the territory they ‘passed over’ during the course of their flight through outer space.”).

<sup>28</sup> *Id.* The Paris Convention of 1919 and the Chicago Convention of 1944 “recognized the exclusive sovereignty of states to the airspace above their territory” but never resolved how far it extended. The absence of an upper limit meant state sovereignty could potentially extend indefinitely and severely limit the use of outer space. TERRELL *supra* note 23, at 5. The cutoff is still in dispute, though, for regulatory reasons regarding what agencies and laws will apply to suborbital private space flight.

<sup>29</sup> Dembling: *Evolution*, *supra* note 27, at 420.

<sup>30</sup> FRANCIS LYALL & PAUL B. LARSEN, *SPACE LAW* 454 (2d ed. 2018) (quoting L.B. Johnson, ‘Statement by the President Announcing the Reaching of Agreement on an Outer Space Treaty, 8 December 1966’, *Public Papers of the President of the United States*, Johnson 1966-II, Doc. 643, 1441 (U of Michigan Digital Library, <http://quod.lib.umich.edu/p/ppotus/>): *NY Times*, 9 December 1966 at 1 col. 8 (“the most important arms control development since the Limited Test Ban Treaty of 1963”).

bases, installations and fortifications, the testing of any type of weapons and the conduct of military manoeuvres on celestial bodies shall be forbidden. The use of military personnel for scientific research or for any other peaceful purposes shall not be prohibited. The use of any equipment or facility necessary for peaceful exploration of the Moon and other celestial bodies shall also not be prohibited.<sup>31</sup>

The meaning of “weapon of mass destruction” was not defined or otherwise explained in the text, which opens up the possibility of defining WMD in a manner that includes certain ASAT weapons.<sup>32</sup> The term WMD typically evokes nuclear, biological, and chemical (NBC) weapons; however, the term need not be read so narrowly, as discussed below in Section IV.

Note that the second paragraph of Article IV allowing use “exclusively for peaceful purposes” and forbidding the testing of “any type of weapons” or engaging in military maneuvers is limited to activities “on celestial bodies.”<sup>33</sup> As a result, this prohibition of weapons and maneuvers would not apply to ASAT weapons because they are used in orbit and not on a celestial body.

The restriction to “on celestial bodies” of paragraph two is a narrow spatial restriction that would not apply to all current uses and technology of ASAT weapons.<sup>34</sup> However, other articles of the Outer Space Treaty will impact the legality of the use and testing of ASATs. To start, Article I sets out that outer space should be “free for exploration and use by all States” and that there should be “free access to all areas of celestial bodies.”<sup>35</sup> This article is a direct indictment of the debris resulting from the use of a kinetic ASAT, by potentially restricting free access to space. Similarly, if a state were allowed to remove or hinder a satellite belonging to another state, that would interfere with the right of exploration and use. Article VII establishes international liability for a launching State for damage caused by space objects or component parts, which would certainly include debris from ASAT use.<sup>36</sup> Notably, this liability is applied on Earth, in air space, or in outer space.<sup>37</sup> Liability is not prohibition so much as disincentive, though. Article IX creates a duty to act with “due regard” to not interfere with other States’ activities by imploring the State Parties to “conduct exploration . . . so as to avoid . . . harmful contamination.”<sup>38</sup> It seems some nations mistakenly find it legal to create dangerous debris clouds that are certainly contamination.

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<sup>31</sup> Outer Space Treaty, *supra* note 9, art. IV.

<sup>32</sup> See Koplów, *supra* note 12, at 1198 n. 27.

<sup>33</sup> Outer Space Treaty, *supra* note 9, art. IV.

<sup>34</sup> *Id.*

<sup>35</sup> *Id.* art. I.

<sup>36</sup> *Id.* art. VII. See also Convention on International Liability for Damage Caused by Space Objects, Mar. 29, 1972, 961 U.N.T.S. 13810, that elaborated on art. VII [hereinafter Liability Convention].

<sup>37</sup> See Liability Convention, *supra* note 36. Liability for damage brought about by debris from an ASAT weapon may work as a deterrence for collateral damage but does not speak to legality.

<sup>38</sup> Outer Space Treaty, *supra* note 9, art. IX.



The spirit of the Outer Space Treaty can certainly appear to be anti-ASAT. Language such as “for the benefit and in the interests of all countries . . . [outer space] shall be the province of all mankind”<sup>39</sup> and “peaceful purposes”<sup>40</sup> does not invoke weapons or aggressive behavior of any kind. Then again, there are arguments that the Outer Space Treaty is permissive of ASAT weapons.<sup>41</sup> These arguments are based on narrow definitions of WMD and “orbit,” which will be addressed in Section IV. The Outer Space Treaty’s only article to mention weapons of any kind and WMDs, specifically, is Article IV. If the limited discussion of weapons—and only then to prohibit them—does not convince the reader of the peaceful spirit of the treaty or leaves the treatment of weapons ambiguous, the Outer Space Treaty brings reinforcements in Article III.

### B. The Law of Armed Conflict

Article III of the Outer Space Treaty incorporates international law into the realm of outer space.<sup>42</sup> The Law of Armed Conflict (LOAC) is a substantial part of the body of international law, incorporating several treaties and conventions into a comprehensive law of war (sometimes called international humanitarian law) that covers weapons, combatants, and non-combatants. The LOAC does not make war illegal but seeks to limit the damage and suffering.<sup>43</sup>

The general principle of limiting warfare stems from the Regulations Respecting the Laws and Customs of War on Land (1907 Hague Regulations), which state that a warring party’s right “to adopt means of injuring the enemy is not unlimited.”<sup>44</sup> The Geneva Conventions expanded protections for civilians and non-combatants, most importantly for the purposes of this Note in the Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of International Armed Conflicts (Protocol I).<sup>45</sup> These expanded protections start with the basic rule that “the Parties to the conflict shall at all times distinguish between civilian population and combatants and between civilian objects and military objectives and accordingly shall direct their operations only against military objectives.”<sup>46</sup> The satellite infrastructure in orbit is a mix of civilian and military

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

<sup>40</sup> *Id.* Preamble.

<sup>41</sup> See Boothby, *supra* note 11 at 202–03 (discussing Bourbonniere and Lee’s article, *supra* note 11, that distinguishes conventional weapons from weapons of mass destruction).

<sup>42</sup> Outer Space Treaty, *supra* note 9, art. III.

<sup>43</sup> “There are two complementary components of humanitarian law, the *jus ad bellum*, which some view as a separate body of law altogether, and the *jus in bello*. The former sets forth the criteria for the use of force as an instrument of national policy, asking when a State may use force. The *jus in bello*, by contrast, addresses how force may be used in an armed conflict, regardless of the propriety of the decision to resort to it.” Michael N. Schmitt, *The Principle of Discrimination in 21st Century Warfare*, 2 YALE HUM. RTS. & DEV. L.J. 143, 145 (1999).

<sup>44</sup> 1907 Hague Regulations, *supra* note 18, art. 22.

<sup>45</sup> Protocol I, *supra* note 18.

<sup>46</sup> *Id.* art. 48.

objects.<sup>47</sup> The targeting and effects of ASAT weapons, then, would be governed by Protocol I.

Protocol I prohibits indiscriminate attacks where the target is unable to be distinguished as military or civilian or the ability to hit the intended target renders the distinction moot.<sup>48</sup> But indiscriminate is also considered a means or method where the effects cannot be limited to military objectives.<sup>49</sup> Any weapon that may hit its intended target but may also affect civilians or civilian objects could be considered indiscriminate. The prohibition is not barring any collateral damage or effect on civilians and civilian objects; only effects that are “excessive in relation to the concrete and direct military advantage anticipated.”<sup>50</sup> Excessive effect is not defined, nor is direct military advantage, which provides some leeway for judgment.

Allowing reasonable effect to civilian objects is further complicated by the definition of civilian and military objects. Protocol I limits the protections to civilian objects by defining a military object as “objects which by their nature, location, purpose or use make an effective contribution to military action and whose total or partial destruction, capture or neutralization, in the circumstances ruling at the time, offers a definite military advantage.”<sup>51</sup> It is presumed that dual use satellites or even civilian satellites the military utilizes as consumers could be classified as military objects.

An important part of Protocol I in relation to space is a rather weak reference to environmental damage stating that “[c]are shall be taken in warfare to protect the natural environment against widespread, long-term and severe damage.”<sup>52</sup> The environment plays a key role because orbits and outer space are considered part of the environment.<sup>53</sup> Also, by way of customary international law, the environment is considered a civilian object (as opposed to military).<sup>54</sup> Wrecking the environment of earth orbit with persistent debris from ASAT weapons is an excessive effect on a civilian object.

The environment is addressed in other documents as well. The Convention On The Prohibition Of Military Or Any Hostile Use Of Environmental Modification Techniques (ENMOD) from 1977 takes a slightly stronger stance than Protocol I, but not by much.<sup>55</sup> Article I of ENMOD requires parties to “undertake” to not engage in

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<sup>47</sup> TYSON & LANG, *supra* note 23, at 159 (“Most satellites, in fact, are ‘dual use.’ And if, as Joan Johnson-Freese of the US Naval War College points out, dual use covers both civilian/military and defensive/offensive uses, then ‘space technology is at least 95% dual use.’” (citation omitted)).

<sup>48</sup> Protocol I, *supra* note 18, art. 51(4).

<sup>49</sup> Protocol I, *supra* note 18, art. 51(4)(c).

<sup>50</sup> *Id.* art. 51(5)(b).

<sup>51</sup> *Id.* art. 52(2).

<sup>52</sup> *Id.* art 55(1). The U.S. has not accepted this provision, *see* Boothby, *supra* note 11, at 190 n. 37.

<sup>53</sup> Brian D. Green, *Space Situational Awareness Data Sharing: Safety Tool or Security Threat?*, 75 A.F. L. REV. 39, 47 (2016).

<sup>54</sup> Boothby, *supra* note 11, at 190.

<sup>55</sup> ENMOD, *supra* note 19, art. I.

environmental modification techniques that “create widespread, longlasting [sic] or severe effects as the means of destruction, damage or injury to any other State Party.”<sup>56</sup> Protocol I asks to take care to avoid environmental damage as indiscriminate, while ENMOD tries to not have such damage be a deliberate means of injuring the enemy. In addition, the U.N.’s Space Debris Guidelines also speak directly to the space environment, but state explicitly that the Guidelines are not legally binding.<sup>57</sup> Between the LOAC, ENMOD, and the U.N.’s Space Debris Guidelines, the environment of space should be protected against the likes of debris-causing ASAT weapons.

Finally, the U.N. Charter reigns supreme over all other international obligations.<sup>58</sup> It starts with the goal of “international peace and security,”<sup>59</sup> while allowing for the “inherent right of individual or collective self-defense.”<sup>60</sup> Amid the Outer Space Treaty, Protocol I, ENMOD, and the U.N. Charter, there are no definitive or explicit prohibitions on ASAT weapons, or any weapons in space besides WMDs, if used for self-defense with proper proportionality and discrimination. The issues with ASAT weapons are proportionality, discrimination, and, arguably, self-defense, especially when testing such weapons. Live testing of ASAT weapons offers no distinct military advantage because there is no adversary or hostilities, but still affects the civilian object of the space environment.<sup>61</sup>

### C. Anti-Satellite Weapons

Tom Wilson, a member of the Federation of American Scientists’ Space Commission, categorized ASAT weapons in a report for their Space Policy Project.<sup>62</sup> The most obvious category of ASAT weapons are kinetic weapons, also known as intercept weapons.<sup>63</sup> Kinetic weapons propel objects or explosives toward a satellite to destroy or damage it.<sup>64</sup> A kinetic ASAT weapon could be a missile, a swarm of microsattellites, or simply fragments of non-maneuvering objects – essentially, intentional space debris – that can still cause catastrophic damage.<sup>65</sup> The likely result of most of these weapons is destruction of the satellite, which in turn could create

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<sup>56</sup> *Id.*

<sup>57</sup> UNITED NATIONS COMMITTEE ON THE PEACEFUL USES OF OUTER SPACE, SPACE DEBRIS MITIGATION GUIDELINES OF THE COMMITTEE ON THE PEACEFUL USES OF OUTER SPACE 2 (2010), [http://www.unoosa.org/pdf/publications/st\\_space\\_49E.pdf](http://www.unoosa.org/pdf/publications/st_space_49E.pdf).

<sup>58</sup> U.N. Charter art. 103.

<sup>59</sup> *Id.* art. 1, 1.

<sup>60</sup> *Id.* art. 51.

<sup>61</sup> DEFENSE INTELLIGENCE AGENCY, CHALLENGES TO SECURITY IN SPACE 35 (2019) (stating one-third of all orbital debris is attributed to a satellite collision and a disastrous ASAT weapon test by China in 2007).

<sup>62</sup> TOM WILSON, THREATS TO UNITED STATES SPACE CAPABILITIES sec. IV (2001), <https://fas.org/spp/eprint/article05.html>.

<sup>63</sup> *Id.*

<sup>64</sup> *Id.*

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

more debris.<sup>66</sup> From the aggressor's perspective, the good news is that the satellite is no longer a threat or helpful to an adversary. The bad news is that the effects of that victory can linger indefinitely and continue to cause damage indiscriminately to assets in orbit, some of which, ironically, may belong to the aggressor.

Wilson categorizes some types of ASAT as "stand-off" weapons, meaning they maintain a further distance than the intercept weapons.<sup>67</sup> These types of weapons are usually transmitting energy to the target to either dazzle the sensors temporarily or damage the electronics of the target to some degree.<sup>68</sup> Stand-off ASAT weapons would not produce as much space debris, beyond perhaps rendering the target satellite unresponsive and out of control.

Another type of ASAT weapon does not need to interact with the satellite in a physical way. Jamming or spoofing the signals travelling to or from the satellite or hacking the earth-bound computer systems running the satellite would be effective in disabling the satellite.<sup>69</sup> In the vast majority of circumstances where this kind of attack would be used, the effects could be temporary and leave the satellite undisturbed in its orbit.<sup>70</sup>

The effects of ASAT weapons can vary depending on where one looks. When looking in orbit, the biggest effect is debris and the growing danger of space junk. Looking at the receiving end of a signal, the loss of the satellites' functionality will be felt by militaries and civilians alike that depend on the lost functions. Computer systems control much of our infrastructure and economy.<sup>71</sup> Those systems rely on space assets, like the precision timing and location functions of global positioning systems (GPS).<sup>72</sup> The chain reaction of systems failing to function properly would be widespread and persistent. For instance, if communication infrastructure is reduced, other emergencies become more difficult to manage and could threaten lives. Emergencies could arise from components of utility infrastructure losing contact or the timing of events and systems failing from a GPS constellation reduction. There is also a high probability of political action if foul play is suspected. If a satellite is destroyed, redundancy is limited and the time to build and launch a replacement can stretch into years or decades.<sup>73</sup> There is little doubt that such failure would result in a

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<sup>66</sup> See Larsen, *supra* note 8.

<sup>67</sup> WILSON, *supra* note 62, sec. IV.

<sup>68</sup> *Id.*

<sup>69</sup> *Id.*

<sup>70</sup> There is the potential, theoretically, to maneuver the satellite via system hacking, and likewise to inhibit the maneuvering control via interference or jamming which could lead to collisions, turning the satellite itself into uncontrolled debris.

<sup>71</sup> See generally FED. COMM'N COMM'N, CRITICAL INFRASTRUCTURE AND COMMUNICATIONS SECURITY, <https://www.fcc.gov/general/critical-infrastructure-and-communications-security>.

<sup>72</sup> Richard Hollingham, *What Would Happen If All Satellites Stopped Working?*, BBC FUTURE (June 9, 2013), <http://www.bbc.com/future/story/20130609-the-day-without-satellites>; Dartnell, *supra* note 2.

<sup>73</sup> George Dvorsky, *What Would Happen If All Our Satellites Were Suddenly Destroyed*, GIZMODO (June 4, 2015), <https://io9.gizmodo.com/what-would-happen-if-all-our-satellites-were-suddenly-d-1709006681>. Dvorsky points out that not only does it take time and money to rebuild and relaunch a satellite, but the orbit it needs to be placed in is now full of a debris field.

death toll from food shortages stemming from reduced agricultural production, accidents, or reduced capacity to predict and manage natural disasters.<sup>74</sup> The societal tolls could ripple outward from failing transportation to devastating hits to global economies and massive power outages. If satellites were destroyed or impaired purposefully, the diplomatic repercussions and retaliations may be much more devastating than the loss of the satellites' utility.<sup>75</sup>

### III. THE DISCRIMINATING LAWS OF WAR EXTEND TO OUTER SPACE

When China used an ASAT weapon to destroy a defunct satellite in 2007, followed by the United States doing the same in 2008,<sup>76</sup> attempts to formalize agreements pertaining to ASAT weapons had been hindered for a decade by the United States.<sup>77</sup> In light of the lack of willingness to discuss restricting ASAT weapons, examining their legality under current law may help to move parties closer to restricting uses of weapons in outer space more formally. The following analysis will look at the indiscriminate nature and the environmental effects of kinetic ASAT weapons in relation to current international law, including the LOAC and the U.N. Charter.

#### A. ASATs Are Indiscriminate Weapons

The Geneva Convention Additional Protocol I deems a weapon to be “indiscriminate,” and therefore prohibited, in two situations.<sup>78</sup> First, a weapon is indiscriminate if the weapon is unable to discriminate between targets, especially between civilian and military targets.<sup>79</sup> This means the weapon is not able to be aimed precisely enough to distinguish targets if civilian and military objects are in close proximity. Second, a weapon is deemed indiscriminate if the secondary effects of the weapon having hit the intended target, such as gas clouds or shrapnel after the initial impact, can harm civilian as well as military objects or personnel.<sup>80</sup> When a kinetic ASAT weapon is used, the effects of the weapons are three-fold: the destruction of the target satellite, the consequential damage potentially caused by the debris cloud, and

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<sup>74</sup> *Id.*

<sup>75</sup> See FORREST E. MORGAN, DETERRENCE AND FIRST-STRIKE STABILITY IN SPACE (2010).

<sup>76</sup> Spacesecurity.org, Space Security 2008, at 29–30 (2008), available at <http://spacesecurityindex.org/wp-content/uploads/2014/10/SSI2008.pdf>.

<sup>77</sup> U.N.-affiliated Conference on Disarmament (CD) participants refer to “PAROS” (or Prevention of an Arms Race in Outer Space) which the U.N. General Assembly passes a resolution from annually. “U.S. opposition has effectively spiked all meaningful consideration of the subject.” Koplów, *supra* note 12, at 1216–19. See also TERRILL, *supra* note 23, at 19 (describing generally the U.S. Air Force resistance to the development of international conventions).

<sup>78</sup> Schmitt, *supra* note 43, at 147 (“such weapons are incapable of afflicting only combatants and difficult to control”); Protocol I, *supra* note 18, art. 51.4(b-c).

<sup>79</sup> Schmitt, *supra* note 43, at 147. See also Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-Personnel Mines and on their Destruction (Ottawa Treaty), Sept. 18, 1997, 2056 U.N.T.S. 211.

<sup>80</sup> Schmitt, *supra* note 43, at 147.

the effect on the users of the target or collaterally damaged satellites. The nature of these effects renders the use of kinetic ASAT weapons illegal under Protocol I.

### 1. Indiscriminate Effect on the Environment

The state of the technology of ASAT targeting makes the actual target discernable. In outer space, there are not enough objects in close proximity to risk missing the target only to hit something unintended.<sup>81</sup> Rather, indiscrimination falls under the second situation discussed above, when the targeting is successful and results in the compromise of structural integrity of the satellite (it blows apart).<sup>82</sup> Pieces of a satellite that has been successfully targeted by a kinetic ASAT weapon will travel in all directions at hyper-velocities. It is the nature of this debris and the inability to control its effects that are the indiscriminate nature of an ASAT weapon.<sup>83</sup>

One can recall from basic physics that even a tiny mass can carry tremendous force when traveling at extremely high speeds.<sup>84</sup> If flecks of dried paint can cause damage when travelling at hyper-velocities,<sup>85</sup> larger pieces of debris from a destroyed satellite would be fatal to other space objects. While missing the original target is unlikely to result in the accidental destruction of a civilian satellite, the successful destruction of a satellite could indiscriminately threaten civilian satellites with the resultant debris.

The environment itself is a civilian object under international law,<sup>86</sup> and has become a sort of global commons in recent decades.<sup>87</sup> Extending the environment to include outer space was a natural next step.<sup>88</sup> The consequences of this designation are

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<sup>81</sup> See *id.* at 148 (discussing SCUD missile use in the open desert compared with use in Israeli cities).

<sup>82</sup> Kinetic ASAT weapons would obviously result in blowing up the target satellite but directed energy ASAT weapons could also affect the integrity of the target satellite resulting in the explosion-like effect of blowing apart. See Laura Grego, Union of Concerned Scientists, *A History of Anti-Satellite Programs* (Jan. 2012).

<sup>83</sup> A debris cloud from an exploded satellite could be compared to a cloud of gas from a chemical or biological weapon. See Koplów, *supra* note 12, at 1245.

<sup>84</sup> Where force is equal to the mass of the object multiplied by the acceleration (the acceleration from a collision would be the rapid slowing of the object from impact). Even a small mass has a large force when the acceleration is so high. To understand the force of debris, compare the velocity of one of the fastest bullets on the market, which moves at the speed of 4,145 feet per second, with the speed of a piece of space debris traveling faster than 25,666 feet per second. Chris Bond, *Modern Rifle Cartridges Keep Getting Faster and Faster, But Which Are the Fastest?*, WIDESPACES (Nov. 29, 2014), <https://www.wideopenspaces.com/8-cartridges-highest-fps-speed-pics/>; *Space Debris and Human Spacecraft*, NASA (Sept. 26, 2013), [https://www.nasa.gov/mission\\_pages/station/news/orbital\\_debris.html](https://www.nasa.gov/mission_pages/station/news/orbital_debris.html).

<sup>85</sup> Koplów, *supra* note 12, at 1202 (“[T]he windows of the Space Shuttle, designed to withstand the enormous pressures of re-entry into the earth’s atmosphere, have repeatedly been pockmarked by collisions with tiny flecks of dried paint and other minor objects, traveling at ten times the speed of a high-powered bullet.”).

<sup>86</sup> See Boothby, *supra* note 11, at 190.

<sup>87</sup> “The notion that the entire globe should be common and within the domain of politics has been uncritically adopted by the international environmental community.” David A. Westbrook, *Liberal Environmental Jurisprudence*, 27 U.C. DAVIS L. REV. 619, 655 (1994).

<sup>88</sup> Alexander William Salter, *Space Debris: A Law and Economics Analysis of the Orbital*

two-fold: the effect of indiscriminate weapons on the environment as a civilian rather than a military object and the obligations under non-weapon treaties to protect the environment all extend into outer space where ASAT technologies would be used.<sup>89</sup>

As discussed above, the concept of discrimination in targeting and use of weapons includes the initial intended target and the aftermath of the use of the weapon. If a precise hit to a military satellite creates a dangerous debris field, the orbits the debris occupies are inherently civilian objects that are damaged by the use of the weapon. Like radioactivity from fallout of a nuclear weapon, the debris will linger for years turning that particular orbit into an unusable casualty of “scorched earth.” The debris aftermath would render the proportionality calculation heavily away from legality under Protocol I, the sort of indiscriminate collateral damage to civilian objects – as outer space is considered – that Protocol I was trying to prevent.

Article I of The Convention On The Prohibition Of Military Or Any Hostile Use Of Environmental Modification Techniques (ENMOD) reinforces the illegality of the creation of debris fields in orbit because Article II explicitly extends the environment not to be altered to outer space.<sup>90</sup> The littering of orbits in outer space alters the ability to occupy and use the orbits. A debris-strewn orbit would be a modification of the utility of that orbit and thus a modification of the natural environment that ENMOD prohibits. Modification of that orbit also hinders the free access guaranteed by the Outer Space Treaty as discussed below in Section IV.

The space environment was a factor in the Limited Nuclear Test Ban Treaty of 1963 (LTBT) that stopped the testing of nuclear weapons in the high atmosphere and space.<sup>91</sup> It can be argued that nuclear arms control benefitted from space technology by providing means of verifying compliance as much as space technology benefitted from not having space be a nuclear wasteland.<sup>92</sup> Nuclear tests in the upper atmosphere and in space<sup>93</sup> were endangering other missions and could hinder the use of reconnaissance satellites, manned space flight, and other technologies, like GPS, from being developed.<sup>94</sup> What James Clay Moltz argues in *The Politics of Space Security* is that the LTBT was essentially an environmental treaty.<sup>95</sup> This is reflected in the

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*Commons*, 19 STAN. TECH. L. REV. 221, 227 (2016) (“[T]he problems associated with space debris arise because access to orbit--getting a spacecraft from launch to its intended orbit--and the orbits themselves are public goods.”).

<sup>89</sup> See generally Kristina Schiavone, *The Adaptation of the Precautionary Principle of Environmental Law to Outer Space: The Mitigation of Space Debris* (Feb. 12, 2019) (unpublished manuscript) (on file with author).

<sup>90</sup> ENMOD, *supra* note 19, art. I–II.

<sup>91</sup> Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space & Under Water, Oct. 10, 1963, T.I.A.S. No. 5433 [hereinafter Limited Test Ban Treaty].

<sup>92</sup> MOLTZ, *supra* note 5, at 45. Space technology also helps with many treaties by using reconnaissance satellites to verify compliance.

<sup>93</sup> *Id.* at 47 (“[L]ess than a year passed between *Sputnik*’s orbit in 1957 and the U.S. testing of three nuclear weapons in space in the summer 1958.”).

<sup>94</sup> *Id.* at 46.

<sup>95</sup> *Id.* at 62. This leaves us with a treaty limiting arms as an environmental treaty and a treaty establishing laws for an environment – outer space in the Outer Space Treaty – being considered

preamble and Article I of the treaty, “to achieve the discontinuance of all test explosions of nuclear weapons for all time . . . and desiring to put an end to the contamination of mans [sic] environment by radioactive substances . . . the Parties to this Treaty undertake to prohibit, to prevent, and not to carry out any nuclear weapon test explosion, or any other nuclear explosion, at any place under its jurisdiction or control . . . in the atmosphere; beyond its limits, including outer space; or under water, including territorial waters or high seas.”<sup>96</sup>

## 2. Indiscriminate Effects of Collateral Damage

When a piece of the orbiting infrastructure is targeted by an ASAT weapon, the destruction of the targeted satellite will certainly affect a military’s ability to function, potentially making it legal under Protocol I. But there is a remaining question of possible effects on civilian uses of destroyed space infrastructure. Destruction of civilian infrastructure will come about in two ways: (1) the initial destruction of a dedicated civilian satellite or a dual-use satellite by an ASAT weapon and (2) the subsequent damage to a dedicated civilian satellite, or a dual-use satellite, by the debris created by the destruction of the initially targeted satellite.<sup>97</sup>

Protocol I leaves room for a balancing of proportionality of military advantage to potential civilian harm.<sup>98</sup> Civilians and civilian targets can be liberally interpreted as military targets if contributing to the war effort in any way.<sup>99</sup> If the military contracts commercial communication bandwidths or other uses, the line blurs between military and civilian objects in outer space, skewing the proportionality balancing.<sup>100</sup> Directly targeting a commercial satellite being used by the military could potentially be justified if the effects are deemed proportionate and reasonable.

For a target to be deemed proportional, one cannot ignore the effect on civilian populations. Any calculation of proportionality must look beyond the hardware of the satellite destroyed to the rippling effects on the civilians reliant on the hardware. For instance, if a missile destroys a dam, the loss of the structure would factor, but so too should harm that results from any flooding or lost power as a result of the loss of the dam. Similarly, the actual results of the destruction of a satellite, in its immediate environment, are a factor, but so too should be the effects of its lost utility downstream in the data flow. Like modern militaries, society has integrated space technology into the infrastructure to such a degree that it has become quite reliant.<sup>101</sup> The disappearance of that infrastructure would be devastating and long-lasting. The

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an arms control treaty.

<sup>96</sup> Limited Test Ban Treaty, *supra* note 91, at Preamble & art. I.

<sup>97</sup> See Allen Thomson, *Civil Satellite Vulnerability*, SPACE NEWS (Feb. 20–26, 1995), <https://fas.org/spp/eprint/civilsat.htm>.

<sup>98</sup> Protocol I, *supra* note 18, art. 51(5)(b).

<sup>99</sup> Schmitt, *supra* note 43, at 149–50.

<sup>100</sup> Koplow, *supra* note 12, at 1245 n.189.

<sup>101</sup> See *Satellite Outage Felt by Millions*, CHICAGO TRIBUNE (May 21, 1998), <https://www.chicagotribune.com/news/ct-xpm-1998-05-21-9805210138-story.html> (citing the many issues from the temporary outage of a single communications satellite with technology that is now 20 years old. Technological dependence has grown exponentially in the past 20 years.).



destruction of a single satellite in an array or system of satellites may not always reach the level of catastrophic, but even a single military satellite's debris could indiscriminately collide with one or more civilian satellites that would affect millions of end-users.

The determination of proportionality required to make the weapon legal under Protocol I should be a difficult one to reach, otherwise the purpose of Protocol I to protect civilians would be compromised. Article 51, paragraph 5, section (b) describes the cutoff as "excessive in relation to the concrete and direct military advantage anticipated."<sup>102</sup> This subsection is referring to effects on civilians as a result of the direct targeting. Paragraph 4, section (c), though, addresses the post-targeting effects on civilians, stating that indiscriminate attacks are "[t]hose which employ a method or means of combat the effects of which cannot be limited as required by this Protocol."<sup>103</sup> Both provisions implicate kinetic, debris-causing ASAT weapons.

If the case against kinetic ASAT weapons being legal seems iron-clad based on collateral damage, the integration of civilian and military uses in single satellites and military use of civilian satellites rusts the iron into potential ineffectiveness. Arguments exist that dual-use satellites are using the civilians as a shield,<sup>104</sup> which is illegal under Protocol I.<sup>105</sup> When taken together, the two arguments – proportional or illegal – result in the need for a more definitive international understanding on the use of ASAT weapons if the international community wants to safeguard access to space for expanding commercial and scientific endeavors. While solid arguments can be made for illegality, they still might be too precarious to stake the future of human space activity on.

### 3. The Outer Space Treaty Is a Lever in Search of a Fulcrum.<sup>106</sup>

The strongest argument against ASAT weapons is found in the Outer Space Treaty. A vast majority of States have signed the Outer Space Treaty, unlike many of the treaties relating to the LOAC or the environment.<sup>107</sup> David A. Koplou, Professor of National Security Law at Georgetown University, makes a strong case for customary international law in his paper "Asat-Isfaction: Customary International Law and the Regulation of Anti-Satellite Weapons,"<sup>108</sup> but he also points out that the United States has consistently objected to many of the resolutions proposed, in order to preserve the U.S. status as a persistent objector outside of the customary international law where a failure to object can mean consent.<sup>109</sup> The wide acceptance and focus on the interests

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<sup>102</sup> Protocol I, *supra* note 18, art. 51(5)(b).

<sup>103</sup> *Id.* art. 51(4)(c).

<sup>104</sup> Abdul Rehman Khan, *Space Wars: Dual Use Satellites*, 14 RUTGERS J. L. & PUB. POL'Y. 314, 334–35 (2017).

<sup>105</sup> Protocol I, *supra* note 18, art. 51(7).

<sup>106</sup> "Give me a lever long enough and a fulcrum on which to place it, and I shall move the world." Archimedes

<sup>107</sup> See Koplou, *supra* note 12, at 1199.

<sup>108</sup> See *id.* at 1265–66.

<sup>109</sup> *Id.* at 1269.

of all nations in the Outer Space Treaty make it the strongest argument for the limitation of ASAT weapons.

Article IX of the Outer Space Treaty tells States to use space with “due regard for the corresponding interests of other States” that are parties to the Treaty.<sup>110</sup> Such “corresponding interests” include access to space as stated in Article I: “Outer Space . . . shall be free for exploration and use by all States.”<sup>111</sup> Space debris can effectively limit access to space by preventing a space object from achieving orbit lest it risk destruction by passing debris. It can also damage or destroy objects already in space by colliding with them. Any of these collisions, in turn, will likely cause more debris that further inhibit access to space. Article IX also tells States to avoid contamination of space.<sup>112</sup> Any use of space that indiscriminately creates debris, especially the amount of debris resulting from the use of an ASAT weapon, runs afoul of this article of the Outer Space Treaty.

The Outer Space Treaty has, thus far, not prevented the development or testing of ASAT weapons, nor has other international law, in spite of statements against the weapons’ legality from other space-faring nations.<sup>113</sup> The spirit of the Outer Space Treaty makes the best lever for moving legal opinion into the realm of sensible restriction. What is missing is a fulcrum on which to place this lever in order to ease the work of effectively addressing ASAT weapons and avoiding an outer space arms race.<sup>114</sup> Until another agreement or treaty is made, the most applicable fulcrum is found in the specific language of the Outer Space Treaty itself.

#### B. WMD, Definitely a Definition Problem

The strongest argument for the illegality of ASAT weapons is based on the plain language of the Outer Space Treaty and leveraging the language of Article IV. Article IV states:

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<sup>110</sup>Outer Space Treaty, *supra* note 9, art. IX. Article IX was spawned from Project West Ford wherein the United States deployed tons of metal strips to orbit in an attempt to bounce communication signals off of them. The project was opposed stridently by astronomers and other scientists from all over the world, prompting the agreement to consult and share data from the experiment to determine the effect on other nations and their scientific endeavors. TERRILL, *supra* note 23, at 67.

<sup>111</sup> Outer Space Treaty, *supra* note 9, art. I.

<sup>112</sup> Outer Space Treaty, *supra* note 9, art. IX.

<sup>113</sup> In response to China’s January 2007 ASAT weapon test, many nations condemned the act. Japan accused China of violating the Outer Space Treaty, and India, supposedly, had previously refrained from testing ASAT weapons of its own for legal reasons. Carin Zissis, *China’s Anti-Satellite Test*, COUNCIL ON FOREIGN RELATIONS, BACKGROUND (Feb. 22, 2007), <https://www.cfr.org/backgrounder/chinas-anti-satellite-test>.

<sup>114</sup>See Michael Sheetz & Amanda Macias, *China and Russia Are Militarizing Space With ‘Energy Weapons’ and Anti-Satellite Missiles: Pentagon*, CNBC (Feb. 13, 2019), <https://www.cnbc.com/2019/02/13/pentagon-warns-of-weaponization-of-space-by-china-russia-report.html> (reporting that the arms race is likely already in progress); see also Amitabh Sinha & Johnson T.A., *Shooting Down Live Satellite, India Enters Strategic Space*, INDIAEXPRESS (Mar. 28, 2019), <https://indianexpress.com/article/india/shooting-down-live-satellite-india-enters-strategic-space-5646177/> (reporting a recent test of a kinetic ASAT weapon by India on March 27, 2019 signaling a potential arms race aimed at space resources).

States Parties to the Treaty undertake not to place in orbit around the Earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons on celestial bodies, or station such weapons in outer space in any other manner.<sup>115</sup>

Illegality through Article IV hinges on ASAT weapons being considered weapons of mass destruction, as well as defining “place in orbit.” Some argue that “weapon of mass destruction” is not a defined term, but rather an idea.<sup>116</sup> The phrase had grown and evolved over time before it was drilled into the world’s psyche in the runup to the invasion of Iraq by President George W. Bush. The ambiguous claim that Iraq had and used WMDs was used as a justification for the invasion and was carpeting the news reports and briefings.<sup>117</sup> The use of the term was meant as a metonym<sup>118</sup> to stand in for nuclear and other highly destructive weapons without having to identify them specifically. For this reason, the definition of WMD is clouded with a lack of specifics in order to enable the term to be effectively used with the preferred connotation of the user.<sup>119</sup> Today, the term is synonymous with nuclear, biological, and chemical (NBC) weapons, but that was not always the case.

### 1. Bringing “Weapons of Mass Destruction” into Existence

The term “weapons of mass destruction” is considered to have been coined in 1937 by the Archbishop of Canterbury.<sup>120</sup> At that time, he was not referring to nuclear or chemical or even biological weapons. Rather, he was referring to the aerial bombardment, with conventional bombs, of population centers by the Spanish Fascists and Japanese.<sup>121</sup> The phrase was first used in the diplomatic arena in November 1945 in a declaration from the U.S., Canada, and Britain, though not in its final form; it took

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<sup>115</sup> Outer Space Treaty, *supra* note 9, art. IV.

<sup>116</sup> Ido Oren & Ty Solomon, *WMD: The Career of a Concept*, *NEW POLITICAL SCIENCE*, 35:1, 109, 111 (2013) (dispelling “the illusion that ‘WMD’ has a stable, unambiguous, essential meaning”).

<sup>117</sup> *Id.* at 109.

<sup>118</sup> *Id.* at 111 n.11 (“[A] figure of speech that involves using one signified to stand for another signified which is . . . closely associated with it in some way, notably the substitution of effect [purported mass destruction] for cause [e.g., nuclear explosion; chemical reaction].”).

<sup>119</sup> *Id.* at 126 (citing President Clinton’s use of rhetoric to classify semi-automatic rifles as WMD for the assault weapons ban).

<sup>120</sup> *Id.* at 112; W. Seth Carus, *Defining “Weapons of Mass Destruction,”* Occasional Paper, No. 8, CTR. FOR THE STUDY OF WEAPONS OF MASS DESTRUCTION 6–7 (2012) (quoting “the December 1937 Christmas address on ‘Christian Responsibility’ delivered by the Archbishop of Canterbury, William Cosmo Gordon Lang: ‘Take, for example, the question of peace. Who can think without dismay of the fears, jealousies, and suspicions which have compelled nations, our own among them, to pile up their armaments? Who can think at this present time without a sickening of the heart of the appalling slaughter, the suffering, the manifold misery brought by war to Spain and to China? Who can think without horror of what another widespread war would mean, waged as it would be with all the new weapons of mass destruction?’”).

<sup>121</sup> Carus argues he was referencing, at least in part, chemical weapons, but Carus does not imply he was referring solely to chemical weapons. Carus, *supra* note 120, at 7.

the New York Times' translation and commentary to put it together.<sup>122</sup> The declaration was the precursor to a U.N. resolution regarding arms control, which also established the Atomic Energy Commission (AEC). When negotiating the resolution, discussion of atomic weapon controls was obvious, but arguments over "other weapons of mass destruction" language were strongly debated.<sup>123</sup> Over the years, various negotiations proposed classifying conventional weapons such as jets, bombers, and battleships as WMDs, as well as any weapon in-between up to nuclear weapons.<sup>124</sup>

Around the time of the Outer Space Treaty's drafting, the phrase "weapons of mass destruction," in the context of Article IV, saw various iterations.<sup>125</sup> The negotiations settled on specifically naming nuclear weapons and including other weapons of mass destruction.<sup>126</sup> A broader conception of WMD, beyond nuclear weapons, is reflected in a statement by Deputy Secretary of Defense, Cyrus Vance, during the Senate ratification hearing for the Outer Space Treaty, in which he defined WMD as, "chemical and biological weapons . . . or any weapon which might be developed in the future which would have the capability of mass destruction such as that which would be wreaked by nuclear weapons."<sup>127</sup> With the exception of referring to future weapons with destructive effects similar to chemical and biological as well as nuclear, this is, incidentally, the definition espoused by the Commission on Conventional Armaments, a U.N. commission created to act alongside the Atomic Energy Commission.<sup>128</sup>

In order to evaluate other weapons' destructive effects, compared to NBC weapons, it is required to evaluate the effects of the NBC weapons, not the means of destruction. Is the destructive effect that qualifies a weapon as a WMD the physical damage to infrastructure, the lasting effects to the environment, or simply the toll in human lives? Chemical and biological weapons affect living things like humans and animals, but also the vegetation and other environmental components.<sup>129</sup> They are not known for the plain destructive effect of a large blast, though. Simply looking at lives

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<sup>122</sup> Oren & Solomon, *supra* note 116, at 113 (explaining N.Y. Times reporter Arthur Krock's report translated "atomic weapons and all other major weapons adaptable to mass destruction" into weapons of mass destruction).

<sup>123</sup> *Id.* at 115–16.

<sup>124</sup> *Id.* at 114–17. More recently, domestic U.S. law has defined a WMD very broadly in 18 U.S.C. § 2332a in conjunction with the definition of a destructive device in 18 U.S.C. § 921. There are many examples of suspects being charged under this section, most notably the Boston Marathon Bomber, Dzhokhar A. Tsarnaev, for detonating a pressure cooker filled with shrapnel. *United States v. Tsarnaev*, 951 F. Supp. 2d 209, 210 (D. Mass. 2013).

<sup>125</sup> Carus, *supra* note 120, at 21–24.

<sup>126</sup> *Id.* at 21, 23–24.

<sup>127</sup> *Id.* at 24.

<sup>128</sup> *Id.* at 20.

<sup>129</sup> See David Biggs, Opinion, *Vietnam: The Chemical War*, N.Y. TIMES (Nov. 24, 2017), <https://www.nytimes.com/2017/11/24/opinion/vietnam-the-chemical-war.html> (discussing Agent Orange as a chemical weapon, although only thought of as a defoliant at the time. The devastating effects on human life at the time, and into future generations, would be discovered later).

lost and lasting environmental damage would be enough to compare other weapons against.

Nuclear weapons combine the effects of chemical and biological weapons and add the physical power of an immense blast of heat and pressure.<sup>130</sup> Only comparing the physical blast of a nuclear warhead will not define many other weapons as massively destructive. But nuclear weapons also act like a chemical or a biological weapon in their aftermath due to radioactive fallout.<sup>131</sup> Radioactivity is a poison that continues to kill long after the blast is gone.<sup>132</sup> Radioactive material also travels with the wind and can spread over large areas in an environmental disaster that pollutes water and soil for decades.<sup>133</sup> Without accounting for lives lost, the devastation of a nuclear weapon, like chemical and biological weapons, has the longest effect by poisoning the environment.<sup>134</sup>

The scale of lethality of a weapon is a concrete way to easily classify it as a weapon of mass destruction, but it should not be the only criteria. Environmental effects last much longer and can be just as lethal and costly for a time beyond the initial impact. Like radioactive fallout or the environmental devastation of Agent Orange, a weapon that has such widespread and long-lasting effect on an environment can be considered a weapon of mass destruction.

## 2. Plain Meaning Is the Correct Meaning

The Vienna Convention emphasizes plain meaning of the final text and limits the use of legislative history, or *travaux préparatoires*, leading to the drafting of the treaty.<sup>135</sup> When interpreting “weapons of mass destruction,” the plain meaning of the term should look beyond the means of the destruction and look at the scale of the destruction, as is suggested by the use of the qualifier “mass” in “mass destruction”.

## 3. What Is a Weapon of Mass Destruction?

The plain meaning of weapons of mass destruction starts with a weapon. Even the obvious missile can look like common transportation in the outer space environment. Is anything that can be used aggressively against another a weapon, or does a weapon have to have the explicit purpose of being a weapon? In previous efforts to create an ASAT weapon treaty, negotiations broke down over defining the space shuttle as an ASAT weapon.<sup>136</sup> The primary purpose of the space shuttle was not to be a weapon, but it easily could snatch a satellite out of orbit, as it did with the Hubble Space

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<sup>130</sup> *The Effects of Nuclear War*, OFFICE OF TECHNOLOGY ASSESSMENT, 15–24 (1979).

<sup>131</sup> *Id.*

<sup>132</sup> *Id.* at 23.

<sup>133</sup> *Id.*

<sup>134</sup> See generally Int’l Atomic Energy Agency [IAEA], *Environmental Consequences of The Chernobyl Accident and Their Remediation: Twenty Years of Experience* (Apr. 2006).

<sup>135</sup> Stephan Hobe, *Historical Background*, in Vol. I COLOGNE COMMENTARY ON SPACE LAW 1, 14 (Stephan Hobe et.al. eds., 2009).

<sup>136</sup> See Koplou, *supra* note 12, at 1216.

Telescope.<sup>137</sup> Performing sophisticated on-orbit activities with benign satellites can draw suspicion of ASAT testing and development.<sup>138</sup> Even future technologies such as those developed to mitigate the current debris crisis or servicing satellites can draw suspicion.<sup>139</sup> In the interest of not classifying every space object as a weapon, the plain meaning of a weapon would lean toward only objects that were designed with that specific intent and objective.

Furthermore, what is a space weapon? A common definition has three categories: (1) a weapon that starts in space to target a space object; (2) a weapon that starts in space to target a ground object; and (3) a weapon that starts on the ground (or in the air) and targets a space object.<sup>140</sup> Attempting to define a space weapon more narrowly collides quickly with trying to define where space starts. For ASAT weapons, the object is pretty clearly in outer space, but where is the ASAT launched from? If there were to be an anti-ASAT treaty or agreement, this question may be critical. For the purposes of this Note, it is not, as this Note looks at the effects of the weapon on the target in outer space beyond any reasonable delineation, not the origin of the weapon.

Oxford English Dictionary defines “mass” used as an adjective as “[i]nvolving or affecting large numbers of people or things.”<sup>141</sup> Therefore, mass destruction plainly means destruction or damaging effects that are widespread, affecting large numbers. The mass of mass destruction would not likely mean simply the gravity or the degree of the destruction – if a single object is completely destroyed or only partially, for instance. A definition that could be so limited in scope could easily include handguns or even knives capable of taking a life, arguably a complete destruction in terms of gravity of damage. By interpreting the phrase as being wide in scope and extent, the definition would fall into line with past uses, such as massive aerial bombings or NBC weapons.<sup>142</sup>

Lastly, what is destruction referring to? A loss of human life? Property damage? Loss of critical infrastructure? Nuclear weapons bring all the destruction. The damage from chemical weapons can be limited to the environment and property. For example, Agent Orange was meant to kill vegetation.<sup>143</sup> The crippling of infrastructure may not take human lives immediately, but can become deadlier the longer and more far-reaching the damage. Likewise, radiological weapons could potentially not take a single life when detonated, but could contaminate the environment and eventually take lives after some time. For a weapon to be considered a WMD, the destruction does not

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

<sup>138</sup> *Competing in Space*, NAT’L AIR & SPACE INTELLIGENCE CTR. 15 (Dec. 2018), <https://media.defense.gov/2019/Jan/16/2002080386/-1/-1/1/190115-F-NV711-0002.PDF>.

<sup>139</sup> *Id.* at 25.

<sup>140</sup> Caesar Voute, *Boundaries in Space*, in PEACEFUL AND NON-PEACEFUL USES OF SPACE 19, 22 (Bhupendra Jasani ed., 1991).

<sup>141</sup> *Mass*, LEXICO POWERED BY OXFORD, <https://www.lexico.com/en/definition/mass> (last visited July 15, 2019).

<sup>142</sup> This would also align with more recent rhetorical uses of WMD in relation to global warming. See Arshad Mohammed, *Kerry Calls Climate Change ‘Weapon of Mass Destruction*, REUTERS (Feb. 16, 2014), <https://www.reuters.com/article/us-kerry-climate-idUSBREA1F0BP20140216>.

<sup>143</sup> See generally Biggs, *supra* note 129.

have to be only in human lives, but could be property, infrastructure, or environment which could harm or end human lives in the long-term.<sup>144</sup>

#### 4. ASATs Are Massively Destructive Weapons

The majority of ASAT technology would easily qualify as a weapon, being made for the purpose of being a weapon. In some instances, a particularly maneuverable satellite with some other primary purpose could potentially be used as a kinetic kill ASAT weapon when placed on a collision course, but the kind of investment needed to place useful satellites in orbit would likely prevent such use. There should be no good arguments for classifying a dual-use satellite as a weapon.

ASAT weapons are massively destructive. The immediate results of a successful ASAT deployment are not likely to cost any human lives. Though, as more humans begin to enter space in a private capacity, the likelihood of casualties will go up.<sup>145</sup> In the longer run, the environmental effects of an ASAT are more devastating than environmental effects on Earth. The environment of outer space is dangerous without contamination from successfully deployed ASAT weapons; when fields of high-speed debris are added, the danger is multiplied many-fold.

The environmental effects of an ASAT weapon rival – and perhaps outrange – the effects of a nuclear weapon. Unless the debris is in a low enough orbit where it will eventually slow and reenter the atmosphere, there is little hope of mitigation.<sup>146</sup> Inert debris does not have a half-life. So long as the debris is present, it can continue to cause damage, some catastrophic, for decades and perhaps indefinitely.

#### C. Just Passing Through or Staying in Orbit?

The final piece of text remaining in Article IV that could prevent application to ASAT weapons is distinguishing what “placing in orbit” means. Article IV prohibits “plac[ing] in orbit around the Earth any object carrying nuclear weapons or any other kind of weapons of mass destruction.”<sup>147</sup> Like defining where space starts, one can take a positional or functional approach to defining orbit. Functionally, this can be read to mean placed on a trajectory to orbit the earth at least temporarily, which would preclude a direct intercept with no intention of orbit. The spatial approach would look at the position in outer space more than intention of completing revolutions. Article IV also prohibits, “station[ing] such weapons in outer space in any other manner.” This clause implies a functional approach that would be redundant with a functional

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<sup>144</sup>See *id.*

<sup>145</sup>See Amitabh Sinha, *India's ASAT Test Created Debris, Raised Risk for International Space Station: NASA*, INDIANEXPRESS (Apr. 3, 2019), <https://indianexpress.com/article/india/nasa-says-400-pieces-of-debris-in-orbit-indias-asat-test-increased-risk-to-iss-by-44-5653898/> (citing NASA Administrator Jim Bridenstine stating the risk to astronauts on the International Space Station (ISS) increased 44 percent due to India's ASAT test in March of 2019. Bridenstine also said in 16 years, the ISS has had to maneuver about 25 times to avoid collisions with debris).

<sup>146</sup>See DEFENSE INTELLIGENCE AGENCY, *supra* note 61 (stating that one-third of all debris is from two events from 2007 or before).

<sup>147</sup>Outer Space Treaty, *supra* note 9, art IV.

approach to “plac[ing] in orbit.” To avoid redundancy, we should interpret orbit spatially.

The spatial approach is also more consistent with current practice. Everett C. Dolman defines orbit in his book *Astropolitik: Classical Geopolitics in the Space Age* as “the path of a spacecraft or satellite caught in the grip of gravity.”<sup>148</sup> The path Dolman describes could be seen as simply an altitude where the object orbits, like a road with a particular location. One need not travel the road to be on or in the road. If the possibility of revolutions was required to define an orbit, then geosynchronous satellites that don’t change their position over the earth could arguably not be in orbit.

These satellites reach their altitude and maintain a horizontal velocity to match the rotation velocity of the earth, but do not complete a revolution from the point of view of the earth.<sup>149</sup> An ASAT launched to an altitude of an orbiting satellite has achieved the positioning the same as a geosynchronous satellite, but would stay in that position a significantly shorter time. Would the ASAT be required to achieve some horizontal velocity to be considered in orbit? That would be counter to the definition just defined.

The treaty language reflects the desire to not ensnare intercontinental ballistic missiles (ICBM) that would pass through space for a short period before descending to its target.<sup>150</sup> But the altitude some ICBMs reach is higher than some satellites around 1000 km.<sup>151</sup> Furthermore, the idea of an arms control treaty, as the Outer Space Treaty has been called, allowing ICBMs carrying nuclear warheads under Article IV, when Article III imports the U.N. Charter and other international law that make nuclear warheads illegal, is disingenuous.<sup>152</sup>

#### D. Peacefully Blowing Up Satellites

In the preamble to the Outer Space Treaty “peaceful purposes” is mentioned twice in the first four paragraphs.<sup>153</sup> The preamble of a treaty is the “primary source of interpretation” for a treaty.<sup>154</sup> The preamble cannot create any legal commitments, but it does spell out the intent of the operative clauses that follow in the treaty.<sup>155</sup> “Peaceful uses” is a complex phrase to define, though. As Bin Cheng astutely pointed out in his paper *The Legal Status of Outer Space*, the phrase “peaceful purposes” was en vogue around the time of drafting the Outer Space Treaty.<sup>156</sup> Several U.N. Resolutions,

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<sup>148</sup> DOLMAN, *supra* note 20, at 61.

<sup>149</sup> *Id.* at 66.

<sup>150</sup> Koplw, *supra* note 12, at 1198.

<sup>151</sup> Hubertus M. Feigl, *Problems of Distinguishing ATBM/Air Defense Systems From Space Weapons*, in PEACEFUL AND NON-PEACEFUL USES OF OUTER SPACE 129, 135 (Bhupendra Jasani ed., 1991); Bhupendra Jasani, *Introduction*, in PEACEFUL AND NON-PEACEFUL USES OF OUTER SPACE 1, 2 (Bhupendra Jasani ed., 1991).

<sup>152</sup> Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion, 1996 I.C.J. Rep. 226, 266 (July 8).

<sup>153</sup> Outer Space Treaty, *supra* note 9, preamble.

<sup>154</sup> Stephan Hobe & Niklas Hedman, *Preamble*, in Vol. I COLOGNE COMMENTARY ON SPACE LAW, 19, 20 (Stephan Hobe et. al. eds., 2009).

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

<sup>156</sup> Bin Cheng, *The Legal Status of Outer Space*, 11 J. AIR & SPACE L. 89, 98–99 (1983).



including the formation of the Committee on the *Peaceful* Uses of Outer Space, the main body for outer space law and policy, as well as national policies of the United States and the Soviet Union all referred to peace and peacefulness.<sup>157</sup> Cheng finishes the thought with “[t]he old adage, *Si vis pacem, para bellum* (If you desire peace, prepare for war) was given a new twist.”<sup>158</sup>

Two predominant definitions are espoused by various nations to describe “peaceful uses.” The first is advocacy of peaceful meaning non-military; the second defines peaceful as non-aggressive.<sup>159</sup> The Vienna Convention also prescribes using the actions of the state parties to a treaty as a means of interpretation. Since the inception of outer space resolutions and declarations, nearly all of them mention “peaceful” in some manner, yet the uses of space have always been predominantly for military uses more than scientific or commercial.<sup>160</sup>

Based on the continued uses for military purposes before and after the Outer Space Treaty, one would almost be forced to define peaceful as non-aggressive as a matter of customary international law. Even if accepting this view of the meaning of peaceful, one would then have to define aggressive. The United States, in its justifications for the non-aggressive reading, cites the U.N. Charter that allows for self-defense.<sup>161</sup> Does that mean preemptive strikes on critical military space assets for an earth-based action? The difficulty with the definition of “peaceful uses” leaves defining an ASAT weapon as a WMD as the most expedient and clear way to their illegality.

#### IV. CONCLUSION: THE STAKES ARE SKYROCKETING

The legality of ASAT weapons is looming ever larger today.<sup>162</sup> The trend in international schools of thought regarding outer space has shifted from global institutionalism (emphasizing cooperation) toward space nationalism (focusing on conflict) in recent decades.<sup>163</sup> The shift began when the United States pulled out of the Anti-Ballistic Missile Treaty (ABM) in 2001.<sup>164</sup> The ABM was one of the treaties that could prevent further development of kinetic ASAT weapons because of their nature of often being a ballistic missile intercept weapon.<sup>165</sup> Recently, the Trump administration reiterated the space superiority outlook of the nationalists and announced the policy goal of establishing a branch of the armed forces dedicated to

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<sup>157</sup> *Id.*

<sup>158</sup> *Id.* at 99.

<sup>159</sup> Jasani, *supra* note 151, at 7; *see also* TYSON & LANG, *supra* note 23.

<sup>160</sup> *See generally* TYSON & LANG, *supra* note 23.

<sup>161</sup> U.N. Charter art. 51, ¶ 1.

<sup>162</sup> *See* Sheetz & Macias, *supra* note 114.

<sup>163</sup> MOLTZ, *supra* note 5, at 23–31.

<sup>164</sup> Terence Neilan, *Bush Pulls Out of ABM Treaty; Putin Calls Move a Mistake*, N.Y. TIMES (Dec. 13, 2001), <https://www.nytimes.com/2001/12/13/international/bush-pulls-out-of-abm-treaty-putin-calls-move-a-mistake.html>.

<sup>165</sup> *See* the ASAT tests by China and the United States referenced in Koplow, *supra* note 12, at 1235.

outer space.<sup>166</sup> Globally, China is now a major space-faring nation that has tested ASAT weapons in orbit, and Russia is purported to have developed a new ASAT weapon as recently as October of 2018.<sup>167</sup> India became the newest entrant in the space arms race when it successfully tested a kinetic ASAT weapon in March of 2019.<sup>168</sup> At the same time, the space industry is exploding with new national and private interests investing billions of dollars in technology and research.<sup>169</sup> The escalation of potential hostilities that could extend into outer space is counter to the mission of the U.N. and the Outer Space Treaty: reserving outer space for the peaceful uses of all.

As space becomes more populated with private assets, an increasing amount of economic activity relies on space infrastructure. Economic activities themselves are moving to outer space. Private companies are launching plans to try to harvest resources from space,<sup>170</sup> carrying military hardware into space,<sup>171</sup> and planning to send tourists into space.<sup>172</sup> The threat to civilians in an outer space battlefield only increases as civilians move into space in greater numbers. It is that high likelihood of civilians suffering the ill effects of destroyed space infrastructure, or being denied access to space, as a result of debris or direct targeting, that makes the use of debris-causing ASAT weapons illegal.

Still, there is too much room for argument. In what would seem like a tremendous change in outlook for several current national governments, efforts should focus on ensuring peace outside our atmosphere and protecting our space infrastructure. Non-binding resolutions and codes-of-conduct are attempting to fill gaps in international law,<sup>173</sup> but recommitment to the spirit of the Outer Space Treaty would be a strong start. Talks to create more concrete international law to specifically ban weapons of

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<sup>166</sup> Skibba, *supra* note 16; DEPARTMENT OF DEFENSE, 2019 MISSILE DEFENSE REVIEW iv–v (2019).

<sup>167</sup> Amanda Macias, *A Never-Before-Seen Russian Missile Is Identified as an Anti-Satellite Weapon and Will Be Ready for Warfare by 2022*, CNBC (Oct. 25, 2018), <https://www.cnbc.com/2018/10/25/russian-missile-identified-as-anti-satellite-weapon-ready-by-2022.html>.

<sup>168</sup> Sinha & Johnson, *supra* note 114.

<sup>169</sup> Loren Grush, *Commercial Space Companies Have Received \$7.2 Billion in Government Investment Since 2000*, THE VERGE (June 18, 2019),

<https://www.theverge.com/2019/6/18/18683455/nasa-space-angels-contracts-government-investment-spacex-air-force>.

<sup>170</sup> Clive Cookson, *Asteroid Mining Takes Giant Leap from Sci-Fi to Reality*, FINANCIAL TIMES, SPECIAL REPORT: SPACE MINING (Oct. 19, 2017), <https://www.ft.com/content/78e8cc84-7076-11e7-93ff-99f383b09ff9>.

<sup>171</sup> Sandra Erwin, *SpaceX Wins \$130 Million Military Launch Contract for Falcon Heavy*, SPACENEWS (June 21, 2018), <https://spacenews.com/spacex-wins-130-million-military-launch-contract-for-falcon-heavy/>.

<sup>172</sup> Joe Svetlik, *Space Tourism – What You Need to Know About Taking a Trip into Space*, BRITISH TELECOMMUNICATIONS (June 21, 2018), <http://home.bt.com/tech-gadgets/internet/what-is-space-tourism-space-flight-cost-spacex-virgin-galactic-blue-origin-11364163509098>.

<sup>173</sup> Jameson Rohrer, *Deciphering and Defending the European Union's Non-Binding Code of Conduct for Outer Space Activities*, 23 DUKE J. COMP. & INT'L L. 187 (2012).

all kinds from outer space, including ASAT weapons, should be the goal. In the meantime, a strong argument can be made that current international law prohibits the use of kinetic and other debris-causing ASAT weapons due to their indiscriminate and massively destructive effects on the space environment and the critical reliance of civilian infrastructure upon it.