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"Using the Force" Against "Rebel Scum": The Application of International Humanitarian Law in Outer Space Against Non-State Actors

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I. INTRODUCTION

As an enormous superweapon known as the "Death Star" orbits the Earth-like planet of Alderaan, the commander gives the order to "fire when ready"; with the press of a button and the pull of a lever, a beam of energy obliterates the planet.[1] Since *Star Wars* was first released in 1977, that scene and others like it have remained fanciful; there has not yet been the kind of military conflict in outer space that is frequently depicted in science fiction. That could change, however. Wars in outer space have only become more likely in the forty-seven years since *Star Wars* was released, and the risk of the use of force in and from outer space is no longer limited to the movies.

Outer space is becoming increasingly militarized. As one of the more prominent examples, the 2021 Department of Defense (DoD) budget proposal called for providing the U.S. Space Force, which will employ approximately 15,000 people by 2025,[2] with $15.4 billion;[3] while the 2024 budget nearly doubles that amount to $30 billion.[4] One senior DoD official justified the Space Force by noting that "space is not just a support function. It's a war-fighting domain. We have to be prepared to fight, deter and win."[5] A senior Russian general responded by warning the United States that the "[Space Force] creates a pretext for militarizing space . . . these actions may lead to an escalation of the military-political situation and emergence of new threats, to which Russia will have to respond with reciprocal and asymmetrical measures."[6] The United States, Russia, China, and India have all tested, or are developing, weapons that can operate in outer space,[7] and have drawn up plans for responding to outer space as a theater of conflict.[8] Further, China, the United

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[1] STAR WARS: EPISODE IV – A NEW HOPE (Lucasfilm Ltd. 1977).

[2] Mike Gruss & Aaron Mehta, *Space Force to Cost $2 Billion, Include 15,000 Personnel in First Five Years*, DEF. NEWS (Mar. 1, 2019), https://www.defensenews.com/space/2019/03/01/space-force-to-cost-2-billion-include-15000-personnel-in-first-five-years/ [https://perma.cc/2DWY-D2N5].

[3] Scott Maucione, *DoD asks for $705B for 2021, Gives Space Force More Than $15B*, FED. NEWS NETWORK (Feb. 10, 2020, 4:16 PM), https://federalnewsnetwork.com/defense-main/2020/02/dod-asks-for-705b-for-2021-gives-space-force-more-than-15b/ [https://perma.cc/XN2Q-RFTN].

[4] Sandra Erwin, *U.S. Space Force Budget Hits $30 Billion in 2024 Proposal*, SPACENEWS (Mar. 13, 2023), https://spacenews.com/u-s-space-force-budget-hits-30-billion-in-2024-funding-proposal/ [https://perma.cc/XN2Q-RFTN].

[5] Gruss & Mehta, *supra* note 2.

[6] Jason Lemon, *Russia Will 'Respond' To 'New Threats' Created By Trump's Space Militarization, Russian Army Official Warns*, NEWSWEEK (Mar. 4, 2019, 9:37 AM), https://www.newsweek.com/russia-respond-threats-trump-space-militarization-1350861 [https://perma.cc/RR3E-HFD2].

[7] *See* Dale Stephens & Cassandra Steer, *Conflicts in Space: International Humanitarian Law and Its Application to Space Warfare*, 40 ANNALS AIR & SPACE L. 71, 73 (2015); Rajat Pandit, *Satellite-Killer Not a One-Off, India Working on Star Wars Armoury*, TIMES OF INDIA (Apr. 7, 2019), https://timesofindia.indiatimes.com/india/satellite-killer-not-a-one-off-india-working-on-star-wars-armoury/articleshow/68758674.cms [https://perma.cc/5ZMG-HG3Q]; Demetri Sevastopulo & Kathrin Hille, *China Tests New Space Capability With Hypersonic Missile*, FIN. TIMES (Oct. 16, 2021), https://www.ft.com/content/ba0a3cde-719b-4040-93cb-a486e1f843fb [https://perma.cc/J5TN-S947]; Guy Faulconbridge, *Is Russia Developing Space-Based Nuclear Weapon? What We Know of US Claim*, REUTERS (Feb. 15, 2024), https://www.reuters.com/world/what-is-space-based-nuclear-weapon-us-says-russia-is-developing-2024-02-15/.

[8] Svea Andersson, Outer Space as a Theatre of War: Legitimate Attacks on Dual-Use Satellites? 1 (2018) (Master's thesis, Uppsala University), https://www.diva-portal.org/smash/get/diva2:1213461/FULLTEXT02 [https://perma.cc/N5XH-87GN]; Vaibhav Agrawal, *India Beyond Earth: India's Status in Space Military Race*, FIN. EXPRESS (July 31, 2022), https://www.financialexpress.com/defence/india-beyond-earth-indias-status-in-space-military-race/2582187/ [https://perma.cc/53Z3-43X5].

States, India, and Russia have demonstrated their anti-satellite (ASAT) capabilities by publicly destroying their own satellites with missiles in 2007, 2008, 2019, and 2021, respectively.[9] Several powerful states thus increasingly view outer space as a sphere for military activity.

States are not alone, however, in viewing outer space as a fertile ground for conducting attacks. The decreasing cost of technology has allowed non-state actors to demonstrate capabilities once reserved for states alone, such as sophisticated cyber operations, and increasing attention has been paid to the risk of terrorist groups using or targeting space assets.[10] Although not the focus of this article, the rise of companies like SpaceX and Blue Origin and the existence of valuable resources in outer space indicate that private-sector actors could be the instigators or targets of outer-space conflicts as well.[11] In short, the chances of a hypothetical conflict in outer space are not limited to hostilities between states.

Where there is a risk of conflict, there is a need for legal analysis. In the United States, for example, each member of the U.S. military has a duty to "comply with the law of war in good faith."[12] As a result, U.S. military commanders must ensure that military actions involving outer space are legal.

This article will analyze whether, and under what circumstances, military actions against terrorist threats involving outer space are permissible. Part II provides an overview of the laws governing the use of force in outer space against non-state actors. Part III then applies those laws to two potential conflict scenarios. The first scenario involves the United States using force from outer space to target non-state actors on Earth. The second scenario involves the United States using force against a satellite controlled by non-state actors. By analyzing these two scenarios, this article will illustrate how a commander might apply space-specific, general international, and U.S. domestic laws governing the use of force to lawfully deal with a threat from non-state actors involving outer space.

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[9] Jeff Foust, *India Tests Anti-Satellite Weapon*, SPACE.COM (Aug. 10, 2022), https://www.space.com/india-tests-anti-satellite-weapon.html [https://perma.cc/5HZX-66PF] (noting China and India's ASAT capabilities); Thom Shanker, *U.S. Missile Strikes Spy Satellite*, N.Y. TIMES (Feb. 21, 2008), https://www.nytimes.com/2008/02/21/world/americas/21iht-satellite.1.10267313.html; Supantha Mukherjee, *Q+A What is Space Debris and How Dangerous is it?*, REUTERS (Nov. 16, 2021), https://www.reuters.com/lifestyle/science/qa-what-is-space-debris-how-dangerous-is-it-2021-11-16/. Further, recent reporting indicates that Russia launched a satellite in 2022, Kosmos 2553, whose purpose may be to test the components of a space-based nuclear weapon system designed to "obliterate hundreds, if not thousands, of critical satellites." W.J. Hennigan, *The Warning*, N.Y. TIMES (Dec. 05, 2024), https://www.nytimes.com/interactive/2024/12/05/opinion/nuclear-weapons-space.html [https://perma.cc/3U62-PAUW].

[10] *See, e.g.*, Nina-Louisa Remuss, *The Need to Counter Space Terrorism – A European Perspective*, 17 ESPI PERSPS. 1, 2 (2009).

[11] *See, e.g.*, Martin Elvis, Alanna Krolikowski & Tony Milligan, *Concentrated Lunar Resources: Imminent Implications for Governance and Justice*, 379 PHIL. TRANSACTIONS ROYAL SOC'Y A: MATHEMATICAL, PHYSICAL & ENG'G SCIS. 1, 2 (2020).

[12] OFFICE OF GEN. COUNSEL, DEP'T OF DEF., DEPARTMENT OF DEFENSE LAW OF WAR MANUAL, at 1087 (July 2023) [hereinafter LAW OF WAR MANUAL], https://media.defense.gov/2023/Jul/31/2003271432/-1/-1/0/DOD-LAW-OF-WAR-MANUAL-JUNE-2015-UPDATED-JULY%202023.PDF [https://perma.cc/JC53-VNTF].

II. OVERVIEW OF THE RELEVANT LAWS GOVERNING THE USE OF FORCE IN OUTER SPACE

This section discusses the laws that would apply to any force used in or from outer space. Broadly, they can be divided into three bodies of law: space-specific law as represented by the Outer Space Treaty,[13] general international law, and U.S. domestic law.

A. Applicable Space-Specific Law: The Outer Space Treaty

Any analysis of space-specific law ("space law") should include the Outer Space Treaty, a "constitution of outer space," which lays down fundamental principles relating to the use and exploration of outer space.[14] This sub-section will examine the parts of the OST relevant to the use of force: the Preamble and Articles I, IV, VII, and IX. The OST came into force in 1967 and currently contains 115 parties, including the United States, and another 22 signatories.[15] Although the OST does not directly cover the use of force,[16] it does contain principles germane to the legal analysis of the use of force in outer space. First, the Preamble to the treaty recognizes "the exploration and use of outer space for peaceful purposes."[17] Similarly, Article I of the OST stipulates that "[o]uter space, including the moon and other celestial bodies, shall be free for exploration and use by all States without discrimination of any kind, on a basis of equality and in accordance with international law."[18] Taken together, these provisions permit the free use of outer space by all states, a principle which is now recognized as customary international law.[19] While the phrase "peaceful purposes" is sometimes considered to mean "non-military,"[20] there is a general consensus among scholars and space-capable states that it means "non-aggressive or non-

[13] *See generally* Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, *opened for signature* Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205 (ratified by U.S. on Oct. 10, 1967) [hereinafter Outer Space Treaty or OST].

[14] Christopher M. Petras, *The Use of Force in Response to Cyber-Attack on Commercial Space Systems – Reexamining Self-Defense in Outer Space in Light of the Convergence of U.S. Military and Commercial Space Activities*, 67 J. AIR L. & COM. 1213, 1249 (2002); *see also* David Tan, *Towards a New Regime for the Protection of Outer Space as the "Province of All Mankind*," 25 YALE J. INT'L L. 145, 156 (2000) (describing the Outer Space Treaty as "the 'Magna Charta' of outer space").

[15] Outer Space Treaty, supra note 13.

[16] *See* Stephens & Steer, *supra* note 7, at 79.

[17] Outer Space Treaty, *supra* note 13, annex.

[18] Outer Space Treaty, *supra* note 13, art. I; *see also* art. IV (providing that the "moon and other celestial bodies shall be used by all States Parties to the Treaty exclusively for peaceful purposes").

[19] *See* Michael N. Schmitt, *International Law and Military Operations in Space*, 10 MAX PLANCK Y.B. OF U.N. L. 89, 99 (2006); *see also* MCGILL MANUAL ON INTERNATIONAL LAW APPLICABLE TO MILITARY USES OF OUTER SPACE: VOLUME 1 – RULES 13 r. 118 (Ram S. Jakhu & Steven Freeland eds., Ctr. for Rsch. in Air & Space L., McGill Univ. 2022) [hereinafter MILAMOS].

[20] "Non-military" would mean the non-scientific uses of armed forces in space in this case, as Article IV of the OST specifically states that "[t]he use of military personnel for scientific research or for any other peaceful purposes shall not be prohibited." Outer Space Treaty, *supra* note 13, art. IV; *see also* Stephan Hobe, *The Meaning of Peaceful Purposes in Article IV of the Outer Space Treaty*, 40 ANNALS AIR & SPACE L. 9, 10 (2015) (discussing different interpretations of the phrase); FRANCIS LYALL & PAUL B. LARSEN, SPACE LAW: A TREATISE 469 (2d ed. 2018) (discussing same).

hostile."[21] The United States shares the latter view.[22] Based on this consensus view, the OST only bars the *aggressive* use of force in outer space. Importantly, under this interpretation, the OST does not prohibit the use of force in outer space for self-defense or as sanctioned by the United Nations Security Council, thereby avoiding a potential clash with the United Nations Charter, under which both such uses of force are allowed.[23]

Any use of force analysis involving space law must also consider the arms control provision of Article IV of the OST. The provision describes what kind of weapons are prohibited in space, requiring that "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."[24] Article IV is important not only because of what it explicitly prohibits, but also because of what it does not prohibit. For example, Article IV prohibits nuclear weapons and weapons of mass destruction from being placed in orbit around Earth or stationed elsewhere in space, but Article IV's language does not explicitly ban such weapons from transiting through space after having been fired from Earth.[25] Further, there is no universally accepted definition of a 'weapon of mass destruction,' as referenced in Article IV, and labeling any object as such is as much a political as it is a legal designation.[26] An early United Nations Committee defined weapons of mass destruction as nuclear, radiological, chemical, biological, and "any weapons developed in the future which have characteristics comparable in destructive effect to those of the atomic bomb or other weapons mentioned above."[27] This definition has remained prevalent in international law.[28] Even assuming this broad definition applies to Article IV of the OST, however, not all weapons are weapons of mass destruction. Therefore, Article IV does not explicitly prevent the placement

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[21] *See, e.g.*, Robert A. Ramey, *Armed Conflict on the Final Frontier: The Law of War in Space*, 48 A.F. L. REV. 1, 79 & n.338 (2000) (noting that "the view[,] which today has gained general acceptance, is that non-aggressive military uses are peaceful," and also discussing the problems that would arise if the OST equated peaceful and non-military uses, since "[j]ust about any use of space can support a military purpose.") (internal quotation marks omitted); Schmitt, *supra* note 19, at 101–02 ("Most space-faring nations take the position that 'peaceful' means 'non-aggressive or non-hostile.'"); Hobe, *supra* note 20, at 10. Several commentators have compared the OST with the U.N. Convention on the Law of the Sea, Dec. 10, 1982, 1833 U.N.T.S. 397 [hereinafter UNCLOS], which also states in Article Eighty-Eight that the "high seas shall be reserved for peaceful purposes," UNCLOS, art. 88; those commentators note that UNCLOS does not ban the non-aggressive use of militaries on the high seas, and thus it is unlikely the OST does in outer space either. *See Ramey*, at 108 n.477; Schmitt, *supra* note 19, at 102.

[22] *See* LAW OF WAR MANUAL, *supra* note 12, at 956–57.

[23] *See* Ramey, *supra* note 21, at 62; Ricky J. Lee & Sarah L. Steele, *Military Use of Satellite Communications, Remote Sensing, and Global Positioning Systems in the War on Terror*, 79 J. AIR L. & COM. 69, 93–96 (2014); John E. Parkerson, Jr., *International Legal Implications of the Strategic Defense Initiative*, 116 MIL. L. REV. 67, 82 (1987).

[24] Outer Space Treaty, *supra* note 13, art. IV.

[25] *See* Jackson Nyamuya Maogoto & Steven Freeland, *Space Weaponization and the United Nations Charter Regime on Force: A Thick Legal Fog or a Receding Mist?*, 41 INT'L LAW. 1091, 1105 (2007).

[26] *See* Susan D. Moeller, *Media Coverage of Weapons of Mass Destruction*, Ctr. for Int'l & Sec. Studies at Md. 28 (2004), https://www.files.ethz.ch/isn/122334/2004-03_wmdstudy_full.pdf [https://perma.cc/87QN-E9A5].

[27] Comm'n for Conventional Armaments, Res. adopted by the Comm'n at its 13th meeting, 12 August 1948, and a 2nd Progress Report of the Comm'n, U.N. Doc. S.C. Res. S/C.3/32/Rev.1, at 2 (Aug. 18, 1948) [hereinafter CCA Res.].

[28] *See* W. SETH CARUS, CTR. FOR THE STUDY OF WEAPONS OF MASS DESTRUCTION, DEFINING "WEAPONS OF MASS DESTRUCTION" 5 (2012).

and use of non-weapons of mass destruction in outer space or the transport of weapons of mass destruction through outer space.[29]

Turning to Article VII, the OST also addresses liability for damages caused by state actions in outer space. Article VII provides that:

> [e]ach State Party to the Treaty that launches . . . an object into outer space . . . and each State Party from whose territory or facility an object is launched, is internationally liable for damage to another State Party to the Treaty or to its natural or juridical persons by such object or its component parts on the Earth, in air space or in outer space.[30]

Article VII therefore imposes liability on states for damage caused by objects launched into outer space. Although some commentators have viewed Article VII's liability provision as requiring states to compensate injured parties for any damage caused during an outer-space conflict,[31] this provision probably would not apply to the use of force during an armed conflict involving outer space.[32] As discussed below, in an armed conflict international humanitarian law governs, and a state is not liable for damage caused by a lawful attack on a military objective.[33] A state would also not be liable for damage incurred if it invoked other commonly recognized international law justifications for using force, such as self-defense or consent.[34] Absent a violation of the laws of armed conflict, a state is unlikely to face liability for any damage caused by its operations in an armed conflict.

Finally, Article IX of the OST merits a brief discussion. Under Article IX, when a State Party engages in an activity that "would cause potentially harmful interference with activities of other State Parties . . . it shall undertake appropriate international consultations before proceeding with any such activity."[35] This requirement may obligate an attacking state to warn civilians and neutral states of "attacks or other 'potentially harmful interference' with their activities or assets" during an armed conflict.[36] However, this provision has only been cited twice (by a small minority of State Parties) following the destruction by China and the United States of their own satellites, leading commentators to conclude that the state conduct must reach a high threshold before the provision would be triggered.[37]

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[29] *See* David A. Koplow, *ASAT-isfaction: Customary International Law and the Regulation of Anti-Satellite Weapons*, 30 MICH. J. INT'L L. 1187, 1198 (2009) ("This provision does not impede the stationing of non-nuclear weapons (including conventional ASAT weapons) in space").
[30] Outer Space Treaty, *supra* note 13, art. VII.
[31] *See, e.g.*, Ramey, *supra* note 21, at 90.
[32] *See* Frans G. von der Dunk, *Armed Conflicts in Outer Space: Which Law Applies?*, 97 INT'L L. STUD. 188, 211–12 (2021); MILAMOS, *supra* note 19, at 16 r. 134.
[33] *See* Von der Dunk, *supra* note 32, at 211–12.
[34] *See* Michael Bourbonnière, *National-Security Law in Outer Space: The Interface of Exploration and Security*, 70 J. AIR L. & COM. 3, 22 (2005).
[35] Outer Space Treaty, *supra* note 13, art. IX.
[36] Dale Stephens, *The International Legal Implications of Military Space Operations: Examining the Interplay Between International Humanitarian Law and the Outer Space Legal Regime*, 94 INT'L L. STUD. 75, 87 (2018).
[37] *See id.* at 87–88.

Thus, considering the relevant OST Articles described above, the OST broadly allows states to use force for non-aggressive purposes with weapons in outer space that are not weapons of mass destruction, and need only notify other states if the use of force is expected to be highly destructive.

B. Applicable General International Law

International law not specific to space, including the UN Charter and international humanitarian law (IHL), also applies to the use of force in outer space. OST Article III declares that "States Parties to the Treaty shall carry on activities in the exploration and use of outer space . . . in accordance with international law, including the Charter of the United Nations, in the interest of maintaining international peace and security."[38] By requiring that states' activities in outer space conform to international law and the UN Charter, Article III indicates that IHL and the Charter's restrictions on the use of force are also applicable in outer space.

The UN Charter generally prohibits the use of force. Article 2(4) of the Charter requires states to "refrain in their international relations from the threat or use of force against the territorial integrity or political independence of any state."[39] UN Member States can, however, use force in self-defense under Article 51 or when authorized by the UN Security Council under Article 42.[40]

Beyond the broad mandates of the UN Charter, IHL controls the use of force during war.[41] IHL applies in situations of armed conflict,[42] whether international or non-international, and is intended to protect individuals who are not taking an active part in the hostilities.[43] The main

[38] Outer Space Treaty, *supra* note 13, art. III; *see also* MILAMOS, *supra* note 19, at 11 r. 109.
[39] U.N. Charter art. 2, ¶ 4; *see also* MILAMOS, *supra* note 19, at 22 r. 151.
[40] *See* U.N. Charter art. 51; *id.* art. 42.
[41] *See* GARY D. SOLIS, THE LAW OF ARMED CONFLICT: INTERNATIONAL HUMANITARIAN LAW IN WAR 26–27 (2010).
[42] A widely accepted definition of "armed conflict" comes from the Tadić Appeals Chamber in the International Criminal Tribunal for the former Yugoslavia (ICTY). There, the Chamber held that "an armed conflict exists whenever there is a resort to armed force between States or protracted armed violence between governmental authorities and organized armed groups or between such groups within a State." Prosecutor v. Tadić, Case No. IT-94-1-I, Decision on Defense Motion for Interlocutory Appeal on Jurisdiction, ¶ 70 (Int'l Crim. Trib. for the Former Yugoslavia Oct. 2, 1995); *see also* Anthony Cullen, *The Parameters of Internal Armed Conflict in International Humanitarian Law*, 12 U. MIAMI INT'L & COMPAR. L. REV. 189, 228 (2004) (noting the *Tadić* test is included in the Rome Statute and applied by the ICTR and the U.N. Commission on Human Rights "as a standard for determining the existence of armed conflict").
[43] Solis, *supra* note 41, at 23; *see also* Geneva Convention (III) Relative to the Treatment of Prisoners of War art. 2, Aug. 12, 1949, 6 U.S.T. 3316, 75 U.N.T.S. 135 [hereinafter Geneva Convention III].

instruments of IHL applicable to armed conflicts are the 1907 Hague Convention IV,[44] the four Geneva Conventions from 1949,[45] and the 1977 Additional Protocols to the Geneva Conventions.[46]

Given that none of these treaties reference warfare in outer space, however, does IHL apply beyond Earth? The answer is yes. Because every state has ratified the four Geneva Conventions, those treaties apply in all armed conflicts; large portions of the other treaties are also customary international law and thus binding on all states.[47] Article I of each of the four Geneva Conventions declares that "[t]he High Contracting Parties undertake to respect and to ensure respect for the present Convention in *all* circumstances."[48] This language is broad on its face and has been interpreted as such.[49] Further, the International Court of Justice (ICJ) has opined that IHL "applies to all forms of warfare and to all kinds of weapons, those of the past, those of the present and those of the future."[50] Finally, Manfred Lachs, a former judge of the ICJ and an early expert on outer-space law, wrote in 2010 that "outer space has never been a lawless area, but rather has always been subject to international law, though the matter could never have been put to the test before."[51] Viewed together, these persuasive authorities indicate that despite a lack of specific references to outer space in the foundational IHL treaties, IHL nonetheless governs the use of force during an armed conflict in outer space.[52]

The IHL rules governing any use of force during an armed conflict can be broken down into four 'principles': distinction, military necessity, proportionality, and preventing unnecessary suffering. All four principles must be met for an action to be lawful, since they are customary international law and are therefore binding on all armed forces.[53]

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[44] Hague Convention (IV) respecting the Laws and Customs of War on Land: Regulations concerning the Laws and Customs of War on Land, Oct. 18, 1907, 36 Stat. 2277 [hereinafter Hague Convention IV].
[45] Geneva Convention (I) for the Amelioration of the Condition of the Wounded and Sick in Armed Forces in the Field, Aug. 12, 1949, 6 U.S.T. 3114, 75 U.N.T.S. 31 [hereinafter Geneva Convention I]; Geneva Convention (II) for the Amelioration of the Condition of Wounded, Sick and Shipwrecked Members of Armed Forces at Sea, Aug. 12, 1949, 6 U.S.T. 3217, 75 U.N.T.S. 85 [hereinafter Geneva Convention II]; Geneva Convention III; Geneva Convention (IV) Relative to the Protection of Civilian Persons in Times of War, Aug. 12, 1949, 6 U.S.T. 3517, 75 U.N.T.S. 287 [hereinafter Geneva Convention IV].
[46] 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]; Protocol Additional to the Geneva Conventions of 12 August 1949 and Relating to the Protection of Victims of Non-International Armed Conflicts, Dec. 12, 1977, 1125 U.N.T.S. 609 [hereinafter Protocol II].
[47] Solis, *supra* note 41, at 81–82.
[48] Geneva Convention III, *supra* note 43, art. 1 (emphasis added); *see also* Geneva Convention I, *supra* note 45, art. 1; Geneva Convention II, *supra* note 45, art. 1; Geneva Convention IV, *supra* note 45, art. 1.
[49] Stephens & Steer, *supra* note 7, at 81.
[50] Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion, 1996 I.C.J. 95, at 259 (July 8), https://www.icj-cij.org/sites/default/files/case-related/95/095-19960708-ADV-01-00-EN.pdf.
[51] MANFRED LACHS, THE LAW OF OUTER SPACE: AN EXPERIENCE IN CONTEMPORARY LAW-MAKING, REISSUED ON THE OCCASION OF THE 50TH ANNIVERSARY OF THE INTERNATIONAL INSTITUTE OF SPACE LAW 125 (2010).
[52] *See* LAW OF WAR MANUAL, *supra* note 12, at 955 ("[L]aw of war treaties and the customary law of war are understood to regulate the conduct of hostilities, regardless of where they are conducted, which would include the conduct of hostilities in outer space."); Kubo Mačák, *Silent War: Applicability of the* Jus in Bello *to Military Space Operations*, 94 INT'L L. STUD. 1, 37 (2018); Michael Bourbonnière, *supra* note 34, at 47.
[53] Solis, *supra* note 41, at 250; *see also* Stephens & Steer, *supra* note 7, at 83.

i. Distinction

The principle of distinction is codified in Article 48 of Additional Protocol I to the Geneva Conventions.[54] It requires that only military objectives, and not civilians or civilian objects, be targeted in or from outer space.[55] Military objectives are those that "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."[56] An object used for both civilian and military purposes is a military objective and may be lawfully targeted under distinction, although the attack is still subject to the other three IHL principles.[57] As will be seen below, this rule is particularly relevant to dual-use satellites. Finally, a use of force does not violate the principle of distinction merely because civilians are killed in the course of an attack on a military objective; however, operations that target civilians or civilian objects or that fail to discriminate between military and civilian targets would violate distinction.[58]

ii. Necessity

The principle of military necessity is not defined in the Geneva Conventions or the Additional Protocols. However, it is a customary rule of IHL famously expressed in an early military code as "the necessity of those measures which are indispensable for securing the ends of the war . . . ."[59] Thus, the principle of military necessity requires that an attack only use the minimum level of force or violence necessary to carry out the operation and advance the goal of defeating the enemy as quickly and efficiently as possible.[60] Importantly, military necessity cannot be used as a defense to justify actions that are otherwise unlawful.[61]

iii. Proportionality

Another principle of IHL is proportionality. An attack fails the principle of proportionality if the harm to civilians and civilian objects "would be excessive in relation to the concrete and direct military advantage anticipated."[62] There is no formula for determining precisely when

[54] "Parties to [a] conflict shall at all times distinguish between the civilian population and combatants and between civilian objects and military objectives" and may "direct their operations only against military objectives." Protocol I, *supra* note 46, art. 48.
[55] Stephens & Steer, *supra* note 7, at 85.
[56] Protocol I, *supra* note 46, art. 52(2).
[57] Stephens & Steer, *supra* note 7, at 88–89.
[58] *See* Prosecutor v. Galić, Case No. IT-98-29-T, Judgment and Opinion, ¶ 54 (Int'l Crim. Trib. for the Former Yugoslavia Dec. 5, 2003).
[59] Solis, *supra* note 41, at 258 (quoting General Orders No. 100: Instructions for the Government of Armies of the United States in the Field (Apr. 24, 1863) [hereinafter Lieber Code]).
[60] *See* Solis, *supra* note 41, at 258; LAW OF WAR MANUAL, *supra* note 12, at 57.
[61] *See* Solis, *supra* note 41, at 269.
[62] Protocol I, *supra* note 46, art. 51(5)(b), 57(2)(iii). This definition combines two Articles of Additional Protocol I, and reflects the customary rule that combatants must take into account civilians and their objects during an attack. *See* Stephens & Steer, *supra* note 7, at 93–94.

civilian casualties or civilian object damage is "excessive"; rather, military actors must weigh the costs and benefits on a case-by-case basis.[63]

iv. Unnecessary Suffering

The last main principle of IHL is preventing unnecessary suffering. Even if an attack targets a military objective, is militarily necessary, and does not cause excessive civilian harm, the "material and methods" used in the attack must not "cause superfluous injury or unnecessary suffering."[64] The principle is meant to apply only to combatants, since non-combatants are protected by the other three principles.[65] Thus, a commander ordering the attack must ensure that the weapons and tactics used do not cause unnecessary suffering for enemy combatants.[66]

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Combining the applicable general international law means that a commander who wants to use force in outer space would have to first ensure that the attack complies with the UN Charter, either because it is in self-defense[67] and not aggressive, or because it has UN Security Council authorization. Assuming an armed conflict exists, the commander would then have to ensure the use of force complies with the four principles of IHL: distinction, necessity, proportionality, and preventing unnecessary suffering.

C. International and Domestic Law that Applies to the Use of Force Against Non-State Actors

Since this article focuses on the use of force against non-state actors, including terrorist groups such as al-Qa'ida, this sub-section will discuss the international and U.S. domestic laws that would apply to the use of force in outer space against such actors. The international law governing the use of force against non-state actors is complicated and unsettled, even for attacks that do not involve outer space.[68] However, many states and commentators support the idea that a state may lawfully use force for self-defense against non-state actors, such as when an armed

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[63] *See* Stephens & Steer, *supra* note 7, at 94–95. A factor in the proportionality test is also whether a reasonable person ordering an attack using the information reasonably available to them could have expected excessive civilian casualties to result. Prosecutor v. Galić, Case No. IT-98-29-T, Judgment and Opinion, ¶ 58 (Int'l Crim. Trib. for the Former Yugoslavia Dec. 5, 2003).

[64] Protocol I, *supra* note 46, art. 35(2).

[65] Int'l Comm. of the Red Cross, *Rule 70: Weapons of a Nature to Cause Superfluous Injury or Unnecessary Suffering*, https://ihl-databases.icrc.org/customary-ihl/eng/docs/v1_rul_rule70 [https://perma.cc/U9MT-F2TM] (last visited Mar. 11, 2024) [hereinafter ICRC].

[66] *See* Legality of the Threat or Use of Nuclear Weapons, Opinion, 1996 I.C.J. 95, at 257 (July 8), https://www.icj-cij.org/sites/default/files/case-related/95/095-19960708-ADV-01-00-EN.pdf ; Solis, *supra* note 41, at 272.

[67] As a reminder, a state may exercise the right of self-defense in outer space. *See* TALLINN MANUAL 2.0 ON THE INTERNATIONAL LAW APPLICABLE TO CYBER OPERATIONS 173 r. 58(b) (Michael N. Schmitt ed., 2017) [hereinafter TALLINN MANUAL].

[68] *See* Waseem Ahmad Qureshi, *The Use of Force Against Perpetrators of International Terrorism*, SANTA CLARA J. INT'L L. 1, 3 (2018).

conflict exists and the host state is "unable or unwilling" to effectively deal with the threat.[69] The use of force against non-state actors must, of course, comply with IHL – even if the targeted groups themselves do not follow IHL.[70]

U.S. law is more developed regarding the use of force against non-state actors. U.S. law defines non-state groups which practice "premeditated, politically motivated violence perpetrated against noncombatant targets" as terrorist groups.[71] The principal statutory authority for the use of force by the United States against terrorist groups comes from the *Authorization for Use of Military Force* (AUMF).[72] Under the Obama Administration, the use of force authorized by the AUMF was clarified to mean al-Qa'ida, the Taliban, and "associated forces" engaged in hostilities against the United States,[73] and the Trump and Biden Administrations maintained that definition while conducting strikes on the leaders of non-state groups.[74] Relatedly, in 2010, the Office of Legal Counsel (OLC) in the Department of Justice determined that the targeted killing of an American-born terrorist was lawful under the AUMF, given that he was fighting for an associated force of al-Qa'ida.[75] Thus, under U.S. law, the United States can use force against statutorily defined terrorist groups engaged in hostilities against the United States.

To summarize, there are three sets of laws that generally apply to the use of force in or from outer space. First, the OST and the UN Charter require that the use of force not be aggressive,

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[69] *See* Adil Ahmad Haque, *Self-Defense Against Non-State Actors: All Over the Map*, JUST SECURITY (Mar. 24, 2021), https://www.justsecurity.org/75487/self-defense-against-non-state-actors-all-over-the-map/ [https://perma.cc/JFY8-6DFC] (collecting state positions on the issue); *see also* Michael Schmitt, *Counter-Terrorism and the Use of Force in International Law*, 79 INT'L L. STUD. 7, 33, 36 (2002); Ashley Deeks, "*Unwilling or Unable": Toward a Normative Framework for Extraterritorial Self-Defense*, 52 VA. J. INT'L L. 483, 491 (2012).

[70] *See* Solis, *supra* note 41, at 216 ("Al Qaeda do not observe LOAC/IHL. Are they protected by it? If nonstate actors do not observe LOAC, may their enemies disregard LOAC in their armed conflicts against them, as well? Of course not."); Derek Jinks, *The Applicability of the Geneva Conventions to the "Global War on Terrorism,"* 46 VA. J. INT'L L. 165, 173 (2006) ("The [Geneva] Conventions . . . establish minimum rules that apply even when arguably no other law does, shining the light of law, however dim, into the darkness of war. Given these limited ambitions, the Conventions should apply whenever fighting erupts between organized enemies.") (emphasis omitted).

[71] 22 U.S.C. § 2656f(d)(1)–(3).

[72] Authorization for Use of Military Force, Pub. L. No. 107-40, 115 Stat. 224 (2001). The AUMF allows the United States to "use all necessary and appropriate force against those nations, organizations, or persons [who] planned, authorized, committed, or aided the terrorist attacks that occurred on September 11, 2001 . . . in order to prevent any future acts of international terrorism against the United States by such nations, organizations or persons." *Id.* § 2(a).

[73] WHITE HOUSE, REPORT ON THE LEGAL AND POLICY FRAMEWORKS GUIDING THE UNITED STATES' USE OF MILITARY FORCE AND RELATED NATIONAL SECURITY OPERATIONS 4–5 (2016), https://obamawhitehouse.archives.gov/sites/whitehouse.gov/files/documents/Legal_Policy_Report.pdf [https://perma.cc/YA67-F8NM].

[74] *See, e.g.*, President Trump's strike on Islamic State leader Abu Bakr al-Baghdadi and President Biden's use of force against Baghdadi's successor, Abu Ibrahim al-Hashimi al-Qurayshi; Miriam Berger, *Biden's Legal Justification for Striking ISIS Leader in Syria — and why not Everyone Agrees*, Wash. Post (Feb. 4, 2022) https://www.washingtonpost.com/world/2022/02/04/biden-aumf-legal-justification/.

[75] *See* Memorandum from David J. Barron, Acting Assistant Att'y Gen., Office of Legal Counsel, U.S. Dep't of Justice, to the Att'y Gen., *Applicability of Federal Criminal Laws and the Constitution to Contemplated Lethal Operations Against Shaykh Anwar al-Aulaqi* 24–30 (July 16, 2010). The OLC also determined that the attack would be lawful under IHL as long as the military followed the four IHL principles during the operation. While not binding, OLC legal guidance is considered an authoritative restatement of the law, and its opinions are given deference among the other government departments and agencies. Daniel Klaidman, *Palace Revolt*, NEWSWEEK (Feb. 5, 2006), https://www.newsweek.com/palace-revolt-113407 [https://perma.cc/GQN8-NCNE].

and the OST only permits weapons in outer space that are not considered weapons of mass destruction. Next, the use of force must comply with the four IHL principles of distinction, necessity, proportionality, and preventing unnecessary suffering to be valid. Finally, in the case of a U.S. operation against non-state actors or objects under their control, those non-state actors would likely need to meet the statutory definition of a terrorist group, and any action would have to comply with U.S. law.

III. CASE STUDIES

Having discussed the relevant law in Part II, this section considers two hypothetical situations, plausible in the not-too-distant future, to further explore how international law applies to the use of force in outer space. In the first scenario, the United States uses force from a weapon in outer space, such as a laser, to target non-state actors on Earth; in the second, the United States uses force against a satellite controlled by non-state actors. I will assume that both situations involve an ongoing non-international armed conflict and that force is being used in self-defense against non-state actors that fall under the statutory definition of a terrorist group subject to attack under the AUMF.[76] Thus, a commander will be authorized to use force under the UN Charter and U.S. law against these non-state actors, but will still be required to comply with the space-specific and IHL laws that may apply.

A. Targeting Non-State Actors on Earth from Outer Space

In this scenario, if the United States targets non-state actors on Earth from outer space, the type of weapon used partly determines the legal analysis required. If the weapon is a nuclear, radiological, chemical, or biological weapon, there will be a relatively clear violation of OST Article IV, since the weapon will be classified as a weapon of mass destruction and likely orbiting or otherwise "station[ed]" in outer space to target combatants on Earth.[77]

A weapon that is not nuclear, radiological, chemical, or biological may still qualify as a weapon of mass destruction if its "characteristics [are] comparable in destructive effect to those of the atomic bomb" and similarly recognized weapons of mass destruction.[78] This may include both exotic weapons like lasers and more conventional munitions.[79] Thus even weapons not traditionally recognized as weapons of mass destruction will violate OST Article IV if they are stationed in outer space and their effects approximate those of weapons of mass destruction.

Even if the weapon is not a weapon of mass destruction, the principles of IHL must be applied to ensure the use of force is legal. The principles of distinction and necessity will not be affected by the outer space environment; a commander must still ensure the use of force is directed

[76] Making these assumptions focuses the legal analysis on the outer space context rather than on other potential legal questions such as whether an armed conflict exists or whether the United States is an aggressor.
[77] *See* Outer Space Treaty, *supra* note 13, art. IV.
[78] CCA Res., *supra* note 27, at 2. For example, if the weapon used a beam of energy to destroy a planet, it would qualify as a weapon of mass destruction under this definition.
[79] A laser that causes permanent blindness may violate Protocol IV of the Convention on Certain Conventional Weapons, Oct. 10, 1980, 1342 U.N.T.S. 137. But not all lasers necessarily would violate Article IV. *See* Maogoto & Freeland, *supra* note 25 (describing lasers being researched by the U.S. military that would deliver a high-impulse shock or burn a hole through a target that likely would not violate Article IV).

at military objectives rather than civilian objects[80] and is intended to "secur[e] the ends of the war."[81] In this case, I assume both principles will be met.

The principles of proportionality and preventing unnecessary suffering are closer questions. An attack that produces little to no collateral damage or needless suffering will likely meet both principles if used against the non-state actors. However, attacks can cause "excessive" loss of life or "superfluous injury" even if they do not involve weapons of mass destruction.[82] The outer space environment may in fact add to an attack's destructive effects. For example, near-Earth space contains almost no friction, and states have already attempted to develop weapons that make use of such an environment, such as "Hypervelocity Rod Bundles" that "launch rods of depleted uranium or tungsten weighing up to 100 kilos from outer space against terrestrial targets."[83] An attack using such weapons could be incredibly destructive, given the weapons' ability to gain high closing velocities due to low air resistance, and thus the attack would violate both of these IHL principles. Ultimately, the chosen weapon's inherent capabilities and the impact the outer space environment would have on its destructive effects potentially complicate the analysis, and a commander must consider both factors to ensure any use of force from outer space is not disproportionate or causes unnecessary suffering.

B. The Use of Force Against a Satellite

In this scenario, non-state actors use a satellite to coordinate armed attacks against the United States. The state that owns the satellite is unable or unwilling to block its use by the group. As a result, the United States can lawfully target the satellite in self-defense. This section's analysis considers both whether the United States can use kinetic force, such as an ASAT missile, to destroy the satellite, and whether it can use a cyber attack to disable it. Applying the laws governing the use of force in outer space to both attacks suggests that a kinetic attack that destroys the satellite would not be legal, while a cyber attack would be.

i. Using a Kinetic Attack Against the Satellite

It is unlikely that the United States could lawfully destroy the satellite with a kinetic attack. While space law would likely allow such an attack, IHL would likely not.

A kinetic attack, such as a missile strike, will not violate space law as long as the United States notifies states potentially harmed by the satellite's destruction. Because the attack will be defensive rather than aggressive, OST Article I will not be violated.[84] Likewise, the attack will not violate Article IV as long as the United States does not use a weapon of mass destruction for the operation. Even if the United States chose to employ a weapon of mass destruction like a nuclear

[80] Protocol I, *supra* note 46, art. 48.
[81] Solis, *supra* note 41, at 258 (quoting Lieber Code).
[82] Protocol I, *supra* note 46, art. 35(2), 51(5)(b), 57(2)(iii).
[83] *See* Schmitt, *supra* note 19, at 98.
[84] *See id.* at 101.

warhead, it is possible that there will not be a *per se* violation of Article IV because such a maneuver will not "place in orbit" or "station" the nuclear weapon in space.[85]

However, under Article IX, the United States will likely be required to notify affected states of the attack before acting. This is especially true if the satellite performs a vital global function, for example, as part of the Global Positioning System (GPS). GPS is a U.S.-owned system of satellites that operate as a global navigation system.[86] Given that 6% to 7% of the GDP of Western states depends on GPS, if GPS fails or is destroyed, the results will be "catastrophic."[87] Article IX would require notification before an attack of that magnitude. If an attack creates a large debris field, it will also trigger Article IX. As discussed below, China arguably violated OST Article IX's affirmative reporting obligations by not informing other states of its 2007 ASAT test because it should have known the test would create long-lasting and threatening debris.[88] If the United States targets an important satellite like one used in the GPS system or creates a large debris field with the satellite's destruction, the use of force will likely be considered "harmful interference with activities of other States Parties"[89] and trigger OST Article IX's reporting obligations.[90] Any failure to consult with potentially harmed states would therefore be a violation of the OST.

Even if in compliance with the OST, however, the use of a kinetic attack to destroy the satellite would likely violate IHL. The principle of distinction will be met if the satellite is used in part for military purposes by the non-state actors, because dual-use objects may be lawfully targeted as military objects.[91] The principle of preventing unnecessary suffering will also be met, as that principle is meant to protect combatants rather than inanimate objects.[92] The necessity analysis, however, is more complicated. Although destroying the satellite would advance the goal of defeating the enemy,[93] it is not clear that a kinetic attack on the satellite is "the minimum level of force or violence necessary to carry out the operation."[94]

Even assuming that the attack would meet the principle of necessity, the principle of proportionality poses a larger hurdle to a legal kinetic attack. During China's 2007 ASAT test, the destruction of a satellite created a debris field of "more than two million pieces up to 10 cm in size."[95] These "objects pose a significant safety danger . . . [because], depending on their altitude, they can travel in orbit at speeds of between 3,000 to 7,600 metres per second (approximately 27,000 kilometres per hour)."[96] At such velocities, these objects are capable of destroying anything

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[85] *See, e.g.*, Koplow, *supra* note 29, at 1198 ("This provision does not . . . affect a nuclear weapon that makes only a temporary *transit* of outer space, as when propelled by an intercontinental ballistic missile (ICBM) toward its target, rather than being 'stationed' in space.").
[86] *What is GPS*, https://www.gps.gov/systems/gps/ [https://perma.cc/YJ6V-B4WC] (last visited Mar. 11, 2024).
[87] *See* Stephens & Steer, *supra* note 7, at 90–91, 95–96.
[88] *See* Michael C. Mineiro, FY-1C *and* USA-193 *ASAT Intercepts: An Assessment of Legal Obligations under Article IX of the Outer Space Treaty*, 34 J. SPACE L. 321, 343 (2008).
[89] Outer Space Treaty, *supra* note 13, art. IX.
[90] *See* Mineiro, *supra* note 88, at 334, 337–38.
[91] *See* Stephens & Steer, *supra* note 7, at 89–90.
[92] *See* ICRC, *supra* note 65.
[93] *See* Solis, *supra* note 41, at 258; LAW OF WAR MANUAL, *supra* note 12, at 57.
[94] Solis, *supra* note 41, at 258.
[95] Stephens & Steer, *supra* note 7, at 75.
[96] *Id.* at 76.

in their path.[97] Further, there is a risk that increasing the debris orbiting the Earth will lead to the "Kessler syndrome," where debris colliding at hyper velocities will multiply until eventually there could be an impenetrable debris field around Earth.[98] Because destroying a satellite through a kinetic attack will add significantly to the existing debris field orbiting Earth and thus threaten all states, the use of force in this situation is likely disproportionate and a violation of IHL.

ii. Using a Cyber Attack on the Satellite

A cyber operation could be a legal alternative to a kinetic attack. In this scenario, the United States would seek to disable the satellite through a cyber attack. Before answering the question of legality, it is worth briefly clarifying a few points regarding the law of cyberwarfare as applied in outer space. For the analysis in this section, I rely primarily on the International Group of Experts' *Tallinn Manual*.[99] While non-binding, the Manual is an authoritative restatement of the international law currently applicable to cyber operations.[100]

1. Overview of Cyberlaw Applied in Outer Space

"Cyber attack" is legally defined as an offensive or defensive cyber operation that is not carried out for direct financial gain or information gathering and is "reasonably expected to cause injury or death to persons or damage or destruction to objects."[101] The term applies in non-international armed conflicts.[102] Second, cyber operations on Earth are governed by space law when they "involve activities, or otherwise achieve effects, in outer space, such as the control of space objects."[103] Finally, like the use of force in outer space, the principal provisions of IHL were developed before any state had the ability to conduct cyber attacks. While not all states agree, there is a consensus that IHL applies to cyber attacks.[104] As stated in the *Tallinn Manual*, "cyber operations in outer space are subject to international law limitations on the use of force."[105] Thus, if the United States conducts a cyber attack to disable a satellite in outer space, analysis of the four principles of IHL will still be required.

2. Application of Cyberlaw to a Cyberattack on the Satellite

A cyber operation is not likely to violate space law. Under Article IX of the OST, a cyber attack that disables a satellite does not necessarily rise to the level of interference that would require the United States to notify potentially affected states. A cyber attack could be designed to disable the satellite only temporarily, and such a shortened time during which other states may be

[97] *Id.* at 100.
[98] *See id.*
[99] TALLINN MANUAL, *supra* note 67.
[100] *Id.* at 1–2.
[101] *Id.* at 415 r. 92(1).
[102] *Id.*
[103] *Id.* at 272; *see also* MILAMOS, *supra* note 19, at 11 r. 112.
[104] *See* TALLINN MANUAL, *supra* note 67, at 223 r. 80(1); Harold Hongju Koh, Legal Advisor, U.S. Dep't of State, International Law in Cyberspace: Remarks as Prepared for Delivery to the USCYBERCOM Inter-Agency Legal Conference (Sept. 18, 2012), *reprinted in* 54 HARV. INT'L L.J. ONLINE 1, 3 (Dec. 2012); Kristen E. Eichensehr, *The Cyber-Law of Nations*, 103 GEO. L.J. 317, 374 (2015).
[105] TALLINN MANUAL, *supra* note 67, Rule 58(b).

affected might not reach the high interference threshold that permanent destruction would.[106] Further, a cyber attack can potentially distinguish between components of the satellite used for military, rather than civilian purposes. Such an attack will probably not require notice under Article IX, since, under this hypothetical, disabling only military components used by non-state actors would not affect civilian components used by other states. Ultimately, a cyber attack will probably amount to "harmful interference" serious enough to warrant notice only if it permanently disables the satellite.[107]

A cyber attack on the satellite will likely comply with all four IHL principles as well. The attack targeting the satellite in this scenario will not cause 'superfluous' injury to any of the non-state actors, because it is not physically attacking them, so the principle of preventing unnecessary suffering is likely met. Necessity is also likely met – a cyber weapon can be programmed to be less forceful or violent than a kinetic attack would be, making the cyber attack probably the minimum level of force that can be used in the operation,[108] while still disabling the satellite and advancing the military goal of defeating the non-state actors. Moreover, if the satellite in question is either a purely military satellite or dual-use, it can be lawfully targeted under the principle of distinction. In fact, a cyber attack that can discretely nullify the military component of a dual-use satellite would be far less provocative under distinction than a missile strike against the satellite. Under these three principles, there is little controversy regarding the cyber attack.

As above, the analysis turns on the principle of proportionality. Compared to destroying the satellite with a missile, and potentially creating a catastrophic debris field, a cyber attack seems much less likely to cause disproportionate damage. In fact, in one real-world analogue, U.S. government lawyers described how the United States has "gone to extraordinary lengths to narrowly limit cyberattacks to highly precise operations with as little collateral damage as possible"[109] during cyber operations against the Islamic State. If the United States proceeds similarly while disabling, or not excessively damaging, the satellite in this scenario, the action probably will not violate proportionality.[110]

If the cyber attack permanently disables the satellite, however, the effects can be very large if the satellite was significant, and such an attack may not be proportional. For example, it will probably be unlawful to permanently disable a satellite that provides vital communication information to civilians, such as one that is part of the GPS. In one comparable example, Russian hackers disabled a Ukrainian power grid in December 2015, leaving 230,000 people without power for several hours in the middle of the Ukrainian winter.[111] Had the Russian government conducted the same attack during an armed conflict, and had civilians been injured or killed by the power outage, it would have been difficult to show that the attack was proportional to the anticipated military advantage. A cyber attack that permanently disables a satellite with significant effects on

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[106] *See generally* Mineiro, *supra* note 88, at 334, 337–38.
[107] Outer Space Treaty, *supra* note 13, art. IX.
[108] *See* Solis, *supra* note 41, at 258.
[109] David E. Sanger, *U.S. Cyberattacks Target ISIS in a New Line of Combat*, N.Y. TIMES (Apr. 24, 2016), https://www.nytimes.com/2016/04/25/us/politics/us-directs-cyberweapons-at-isis-for-first-time.html?_r=1.
[110] Protocol I, *supra* note 46, art. 51(5)(b), 57(2)(a)(ii).
[111] Kim Zetter, *Inside the Cunning, Unprecedented Hack of Ukraine's Power Grid*, WIRED (Mar. 3, 2016), https://www.wired.com/2016/03/inside-cunning-unprecedented-hack-ukraines-power-grid/ [https://perma.cc/Y2G5-Z7C6].

civilians will need to meet a similarly high bar to satisfy the principle of proportionality. However, because it will not create a debris field, a cyber attack is still more likely to be proportional and legal under IHL than a kinetic attack.

Even if the use of force is proportional on its face, however, it is important to consider the likelihood that the unintended consequences of a cyber attack are even less predictable than those of a physical attack. Cyber attacks are viewed as more unpredictable than physical attacks, both because of the global interconnectedness of cyberspace and because intelligence surrounding that interconnectedness before an attack is launched is often incomplete.[112] For example, the United States might plan to deliver a virus against a contained aspect of the satellite merely to disable it, but the virus could malfunction and instead permanently destroy the satellite.[113] If the satellite system is as vital as the GPS is, indicating a violation of proportionality, mistake will not be a defense if a reasonably well-informed person ordering the attack using the information reasonably available could have expected excessive casualties or harm to result.[114] This may be the case with cyber weapons in outer space because a satellite is more likely to be connected to a global network, allowing a cyber tool like the famous Stuxnet worm to spread quickly around the world.[115]

The 2017 "WannaCry" malware attack is one illustrative example of a devastating global cyber attack. WannaCry spread through more than 300,000 computers in 150 countries and caused billions of dollars in damage before being stopped.[116] While the attack caused problems worldwide, it was especially damaging in the United Kingdom, where WannaCry infected thousands of National Health Service (NHS) computers and medical equipment and forced dozens of NHS hospitals to turn away patients.[117] There were no reported injuries or deaths directly related

[112] Marcus Fowler, *When Cyber-Attacks Become Ransomware-as-a-Service*, DARKTRACE (June 7, 2021), https://www.darktrace.com/en/blog/unintended-consequences-when-cyber-attacks-go-wild/ [https://perma.cc/N3UL-AEL3].

[113] A recent example of the unpredictable nature of cyber tools comes from Russia's 2022 invasion of Ukraine, where Russia allegedly used a cyber attack against communications company Viasat to impact Ukrainian military targets, but also disrupted wind farms in central Europe and personal and commercial internet users. NAT'L CYBER SEC. CTR., *Russia Behind Cyber Attack with Europe-Wide Impact an Hour Before Ukraine Invasion* (May 10, 2022), https://www.ncsc.gov.uk/news/russia-behind-cyber-attack-with-europe-wide-impact-hour-before-ukraine-invasion [https://perma.cc/C6K3-DQ8E].

[114] *See* Prosecutor v. Galić, Case No. IT-98-29-T, Judgment and Opinion, ¶ 58 (Int'l Crim. Trib. for the Former Yugoslavia Dec. 5, 2003).

[115] David Kushner, *The Real Story of Stuxnet*, IEEE SPECTRUM (Feb. 26, 2013), https://spectrum.ieee.org/telecom/security/the-real-story-of-stuxnet [https://perma.cc/FN6H-FVG6].

[116] Dustin Volz, *U.S. Blames North Korea for 'WannaCry' Cyber Attack*, REUTERS (Dec. 19, 2017), https://www.reuters.com/article/us-usa-cyber-northkorea/u-s-blames-north-korea-for-wannacry-cyber-attack-idUSKBN1ED00Q.

[117] Jon Ungoed-Thomas, Robin Henry & Dipesh Gadher, *Cyber-Attack Guides Promoted on YouTube*, THE TIMES (May 14, 2017), https://www.thetimes.co.uk/article/cyber-attack-guides-promoted-on-youtube-972s0hh2c [https://perma.cc/R542-VS33]. According to news reports, the malware caused several emergency rooms to shut down, chemotherapy patients to be sent home, and surgical operations to be stopped mid-surgery or cancelled. *Id.*; *see also Global Cyberattack Strikes Dozens of Countries, Cripples U.K. Hospitals*, CBS NEWS (May 12, 2017), https://www.cbsnews.com/news/hospitals-across-britain-hit-by-ransomware-cyberattack [https://perma.cc/849N-CUZC].

to the cyber attack,[118] but its effects could nevertheless have been deadly.[119] Given the interconnectedness of the digital world, a cyber attack with a high risk of causing a global outcome like WannaCry probably will not be proportionate.

Despite these concerns, the U.S. has some of the best offensive cyber capabilities in the world,[120] and a cyber attack that disables a satellite without creating "excessive" consequences will be proportional and thus a lawful use of force under IHL. However, the possible negative outcomes described above demonstrate that an IHL analysis is rarely straightforward. Moreover, the uniqueness of outer space as a theater of war – a theater where war has never been fought by humankind, where the technologies employed are new and constantly evolving, where territory is a nebulous concept, and where assets and consequences are shared by many if not all nations – only intensifies the difficulty of those calculations.

IV. CONCLUSION

We are a long way from Death Stars and prolonged firefights in outer space. And yet, as IHL expert and General Editor of the *Tallinn Manual* Michael N. Schmitt noted, "it is inevitable that war will migrate to space."[121] Since the inception of the OST, there have been incredible and concerning technological developments related to military activities in outer space,[122] and states are beginning to embrace the idea of combatting terrorism through outer space.[123] It is clear that the United States cannot wait until such a conflict begins to prepare and train for the legal implications of using force in outer space.

IHL is designed to ensure that civilians and civilian objects are protected from the destruction of armed conflict whenever possible. Applying IHL to the use of force in outer space

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[118] Justine Alford, *NHS cyber-attacks could delay life-saving care and cost millions*, IMPERIAL COLL. LONDON (Oct. 2, 2019), https://www.imperial.ac.uk/news/193151/nhs-cyber-attacks-could-delay-life-saving-care/ [https://perma.cc/3HJH-DVRT].

[119] Bruce Y. Lee, *Friday's Events Showed How Cyber Attacks May Hurt and Kill People*, FORBES (May 15, 2017), https://www.forbes.com/sites/brucelee/2017/05/15/fridays-events-showed-how-cyber-attack-may-hurt-and-kill-people/#37a4c4815206 [https://perma.cc/84JX-D8D9]. In fact, a ransomware attack on a hospital in Germany may have directly led to a woman's death in 2020, illustrating the seriousness of cyber attacks on health infrastructure. Nicole Wetsman, *Woman Dies During a Ransomware Attack on a German Hospital*, THE VERGE (Sept. 17, 2020), https://www.theverge.com/2020/9/17/21443851/death-ransomware-attack-hospital-germany-cybersecurity [https://perma.cc/W7KY-4TBX].

[120] *See* Bob Mason, *So Who Has the Most Advanced Cyber Warfare Technology?*, FX EMPIRE (Mar. 8, 2020), https://www.fxempire.com/education/article/so-who-has-the-most-advanced-cyber-warfare-technology-444874 [https://perma.cc/F8YE-7X3N] ("Unsurprisingly, the U.S. sits as the nation [that] has the best offensive cyber capabilities . . . ."); Keith Breene, *Who Are the Cyber Superpowers?*, WORLD ECON. F. (May 4, 2016), https://www.weforum.org/agenda/2016/05/who-are-the-cyberwar-superpowers/ ("The countries which are believed to have the most developed cyber warfare capabilities are the United States, China, Russia, Israel and the United Kingdom.").

[121] Schmitt, *supra* note 19, at 125.

[122] DANIEL PORRAS, SHARED RISKS: AN EXAMINATION OF UNIVERSAL SPACE SECURITY CHALLENGES, at 7 (UNIDIR 2019), http://www.unidir.org/files/publications/pdfs/shared-risks-an-examination-of-universal-space-security-challenges-en-775.pdf [https://perma.cc/6NJC-67GQ] ("States are strengthening their military presence in outer space.").

[123] *See* Comm. on the Peaceful Uses of Outer Space, Sci. & Tech. Subcomm., Combatting Terrorism Using Space Technology: Proposal to Add a New Agenda Item in the Year 2017, U.N. Doc. A/AC.105/2016/CPR.18 (2016).

protects civilians and civilian objects from the harmful effects of outer space conflict and ensures that core humanitarian values will remain at the center of outer space military planning.

While existing legal frameworks such as the OST, IHL, and U.S. domestic law are instructive, this article has shown that applying space law and international legal protections to outer space can be difficult. As Professors Stephens and Steer argue, the novel issues posed by wars in outer space "require deft navigation of the legal framework . . . and the exercise of careful discretion."[124] This essay provides material that future military commanders, and their lawyers, can look to when doing so.

[124] Stephens & Steer, *supra* note 7, at 74.