CONSIDERATIONS ON THE TARGETING OF SATELLITES

"[T]he prospect of a celestial war can no longer be regarded as mere fantasy."[1]

INTRODUCTION

In the climactic scene of *Star Wars: Episode IV – A New Hope*,[2] the Rebel Alliance attacks the Death Star, a large space station equipped with a powerful weapon, which had been maneuvered into a position threatening the Rebel base.[3] Predicting an imminent and overwhelming attack, the Rebels launch a preemptive strike on the station.[4] The assault succeeds, the Death Star is destroyed, and the audience goes home satisfied. *Star Wars* is science fiction. But that strategic decision faced by the Rebel leadership on Yavin IV parallels decisions that military leaders on our own planet will face in the not-too-distant future.[5] War affects civilians and noncombatants beyond the targets of military commanders, in terrestrial and space warfare alike. Two films later, the Rebel Alliance destroys a second Death Star, again preemptively removing the destructive power of an enemy weapon.[6] However, this second station was under construction when it was destroyed; commentators have theorized that this would mean huge numbers of noncombatant contractors also died onboard.[7] The remains of the station later crashed onto a moon of the planet Endor, scarring the surface.[8] So, while the strategic objective was accomplished, the environment and many noncombatants also suffered harm.

Back home on Earth, we have only just begun to reach beyond our planet's surface. In 1967, a gathering of nations signed the Outer Space

1 Jackson Maogoto & Steven Freeland, *The Final Frontier: The Laws of Armed Conflict and Space Warfare*, 23 CONN. J. INT'L L. 165, 169 (2007).

2 STAR WARS EPISODE IV – A NEW HOPE (Lucasfilm Ltd. 1977).

3 *Id.*

4 *Id*.

5 Yavin IV is the location of the Rebel Alliance's moon-base headquarters. *Id.*

6 STAR WARS: EPISODE VI – RETURN OF THE JEDI (Lucasfilm Ltd. 1983).

7 *See* CLERKS (View Askew Productions 1994) at 30:40 (Two characters discuss the ethics of the destruction of the space station: "My friend here is trying to convince me that any independent contractors who were working on the uncompleted Death Star were innocent victims when it was destroyed by the rebels.").

8 *See* STAR WARS: EPISODE IX – THE RISE OF SKYWALKER (Lucasfilm Ltd. and Bad Robot Productions 2019).

Treaty, the "Magna Carta" of Space Law;[9] a year and a half later, Neil Armstrong took his first small step from the Apollo 11 Lunar Module onto the surface of the Moon.[10] In the fifty-nine years since Yuri Gagarin became the first human in orbit,[11] only a few hundred people have been to space—not quite the thousands that would have crewed the Death Star.[12] Yet, as Air Force Space Command's Michael Hoversten put it, "it is an unfortunate reality that wherever humans have wandered, war has followed."[13] International humanitarian law developed in response to the suffering caused by armed conflict.[14] It "comprises those rules of international law which establish minimum standards of humanity that must be respected in any situation of armed conflict."[15] It "protects not only human beings, but also civilian and cultural property, the environment and, to a certain extent, the continuity of the political order of States."[16]

As humanity moves into the stars, can our laws keep up? One area of particular, pressing concern is the targeting of satellites. Testing of anti-satellite capabilities—which had been on hold since the Cold War—became a renewed area of military interest in the early 2000s. In 2007, China destroyed one of its own weather satellites.[17] In recent years, Russia,[18]

9 Christopher Daniel Johnson, *The Outer Space Treaty* (Jan. 24, 2018), *in* OXFORD RESEARCH ENCYCLOPEDIA OF PLANETARY SCIENCE, https://oxfordre.com/planetaryscience/view/10.1093/acrefore/9780190647926.001.0001/acrefore-9780190647926-e-43 (last visited Mar. 1, 2021).

10 Brian Dunbar, *July 20, 1969: One Giant Leap for Mankind*, NAT'L AERONAUTICS & SPACE ADMIN. (July 15, 2019), https://www.nasa.gov/mission_pages/apollo/apollo11.html.

11 Gagarin orbited Earth on April 12, 1961. Gabrielle Sorto, *Yuri Gagarin Became First Man in Space 55 Years Ago*, CNN (Apr. 12, 2016, 2:40 PM), https://www.cnn.com/2016/04/12/world/yuri-gagarin-55-anniversary-irpt/index.html.

12 According to NASA, 242 individuals have visited the International Space Station. Mark Garcia, *International Space Station Facts and Figures*, NASA (May 13, 2021), https://www.nasa.gov/feature/facts-and-figures. In the United States, spacefaring persons are typically known as astronauts, in Russia as cosmonauts, and in China as taikonauts, and there may be other names used in other nations. These terms sometimes refer exclusively to members of a national spaceflight program. For convenience, this article uses "astronaut" as a general term for "person in space."

13 Michael R. Hoversten, Chief, Space, Cyber, Int'l & Operations L., Air Force Space Command, Remarks on Panel at International Law Weekend: the 98th Annual Meeting of the American Branch of the International Law Association, The Growing Risk of War in Outer Space: What Role Will International Law Play (October 11, 2019).

14 NILS MELZER, INTERNATIONAL HUMANITARIAN LAW: A COMPREHENSIVE INTRODUCTION 12 (2016).

15 *Id.* at 17.

16 *Id.* at 295.

17 Justin Paul George, *History of Anti-Satellite Weapons: US Tested 1st ASAT Missile 60 Years Ago*, WEEK (Mar. 27, 2019, 2:45 PM), https://www.theweek.in/news/sci-tech/2019/03/27/history-anti-satellite-weapon-us-asat-missile.html.

18 Kyle Mizokami, *It Sure Looks Like Russia Just Tested a Space Weapon*, POPULAR MECHANICS (Dec. 17, 2020), https://www.popularmechanics.com/military/weapons/a34992366/russia-test-space-weapon-satellite-killing-missile/.

India,[19] and the United States[20] have conducted tests of their own. Space marines and laser swords are still science fiction, but the targeting and destruction of objects we put in space is in our immediate future. Military strategists and policy makers should consider the potential harm to civilians and noncombatants when planning anti-satellite attacks. International law presents a framework for such considerations.

19 Jeffrey Gettleman & Hari Kumar, *India Shot Down a Satellite, Modi Says, Shifting Balance of Power in Asia*, N.Y. TIMES (Mar. 27, 2019), https://www.nytimes.com/2019/03/27/world/asia/india-weather-satellite-missle.html.

20 James Oberg, *U.S. Satellite Shootdown: The Inside Story*, IEEE SPECTRUM (Aug. 1, 2008, 4:00 AM), https://spectrum.ieee.org/aerospace/satellites/us-satellite-shootdown-the-inside-story.

II. THE MILITARIZATION OF SPACE AND ANTI-SATELLITE ACTIVITY

Satellites are used by civilian, military, and commercial actors.[21] Many satellites are used for more than one purpose, with multiple onboard transponders communicating for different missions.[22] "[A]n important group of space assets used for military purposes are 'dual-use' satellites – which also provide 'civilian' communications, remote sensing, and GPS services."[23] Some other civilian uses for space include scientific research in physics and biology,[24] tracking the weather,[25] commercial technological development,[26] and the International Space Station (ISS), a multinational research laboratory.[27]

A. Military Use of Space

Space is also increasingly used by terrestrial armed forces around the world. The first Gulf War (1990-1991) could be called the first space war, because allied forces relied "heavily upon space-based assets to facilitate coalition fighting within the terrestrial environment."[28] Space is the sixth domain of warfare, complementing operations on land, sea, air, sub-surface, and cyberspace.[29] As Maogoto and Freeland put it: "outer space is increasingly being used as part of active engagement in the conduct of

21 PATRICIA MALONEY FIGLIOLA, CARL E. BEHRENS & DANIEL MORGAN, CONG. RSCH. SERV., IB92011, U.S. SPACE PROGRAMS: CIVILIAN, MILITARY, AND COMMERCIAL (2006).

22 Abdul Rehman Khan, Note, *Space Wars: Dual-Use Satellites*, 14 Rutgers J.L. & PUB. POL'Y 314 (2017).

23 Maogoto & Freeland, *supra* note 1, at 183 ("Inevitably, one is drawn to the question of whether, and in what circumstances, such a satellite might now be regarded as [a] legitimate target of war.").

24 FIGLIOLA ET AL., *supra* note 21.

25 *Id.*

26 Kenneth Chang, *SpaceX Lifts NASA Astronauts to Orbit, Launching New Era of Spaceflight*, N.Y. TIMES (Feb. 2, 2021), https://www.nytimes.com/2020/05/30/science/spacex-nasa-astronauts.html; Carmel Wroth, *Elon Musk Unveils SpaceX's New Starship, Designed to Fly to the Moon, Mars and Beyond,* NPR (Sept. 29, 2019, 2:26 PM), https://www.npr.org/2019/09/29/765526405/elon-musk-unveils-spacexs-new-starship-designed-to-fly-to-the-moon-mars-and-beyo.

27 *About Research in Space*, EUR. SPACE AGENCY, https://www.esa.int/Science_Exploration/Human_and_Robotic_Exploration/Research/About_research_in_space (last visited Mar. 1, 2021). Kristine Rainey, *15 Ways the International Space Station is Benefiting Earth*, NAT'L AERONAUTICS & SPACE ADMIN. (Aug. 6, 2017), https://www.nasa.gov/mission_pages/station/research/news/15_ways_iss_benefits_earth.

28 Dale Stephens & Cassandra Steer, *Conflicts in Space: International Humanitarian Law and Its Application to Space Warfare*, 40 ANNALS AIR & SPACE L. 71, 73 (2015).

29 Jared Donnelly & Jon Farley, *Defining the "Domain" in Multi-Domain*, OVER HORIZON (Sept. 17, 2018), https://othjournal.com/2018/09/17/defining-the-domain-in-multi-domain. Other non-physical domains, as understood in military theory, may include cyberspace, information, and the electromagnetic spectrum. *Id.*

armed conflict . . . . It is now within the realms of reality to imagine outer space as an emerging theatre of warfare."[30]

In modern armed conflicts, militaries rarely plan an operation without first considering space capabilities, "using satellites for such ends as weather tracking, unit positioning, timing, communications, and missile warning."[31] Satellites provide support to terrestrial forces in three ways: allowing information gathering,[32] directing troop and missile movements,[33] and providing communications networks.[34]

In December 2019, the United States created the Space Force, separating the command from the Air Force and the other services.[35] The United States Space Force joins other national military space services,[36]

30 Maogoto & Freeland, *supra* note 1, at 169 ("Not only is information gathered from outer space—through, for example, the use of remote satellite technology and communications satellites—used to plan military engagement on earth, space assets are now used to direct military activity and represent an integral part of the military hardware of the major powers."). *See generally* Thomas Ricks, *Space Is Playing Field for Newest War Game*, WASH. POST (Jan. 29, 2001), https://www.washingtonpost.com/archive/politics/2001/01/29/space-is-playing-fieldfor-newest-war-game/938e9674-0c3b-4d66-b67b-e3195b1275fd/ .

31 Joshua Handelman, *To Boldly Go: ILW 2019 Panels on Space Law*, LEX LATA, LEX FERENDA (Nov. 6, 2019), http://sites.law.wustl.edu/WashULaw/harris-lexlata/to-boldly-go-ilw-2019-panels-on-space-law/.

32 *Using the Force: Attacking Satellites Is Increasingly Attractive—and Dangerous*, ECONOMIST (July 18, 2019), https://www.economist.com/briefing/2019/07/18/attacking-satellites-is-increasingly-attractive-and-dangerous. An example of information gathering is by observing foreign forces and spying on communications. *Id.*

33 *Id.* The United States operates the Global Positioning System (GPS), which has at least twenty-four satellites, and which allows the direction of troop and missile movements. GPS also provides location services for civilian and commercial navigation. *Id.* Other positioning constellations include China's BeiDou, Europe's Galileo, India's NAVIC, Japan's QVSS, and Russia's GLONASS. *Id.* In a change of strategy from thirty years ago, the United States now employs precision guided missiles using satellite positioning with increasing regularity. *Id.*

34 *Id.* "America outspends the rest of the world on military space capabilities by a ratio of three to one. This makes its satellites attractive targets. Knocking some of them out is the surest way to blind, deafen and disorient America's armed forces when they are far from home." *Id.*

35 Merrit Kennedy, *Trump Created the Space Force. Here's What It Will Actually Do*, NPR (Dec. 21, 2019, 6:19 PM), https://www.npr.org/2019/12/21/790492010/trump-created-the-space-force-heres-what-it-will-do. The United States Space Force became the sixth branch of the United States military. *Id.*

36 Matthew Bodner, *As Trump Pushes for Separate Space Force, Russia Moves Fast the Other Way*, DEFENSE NEWS (June 21, 2018), https://www.defensenews.com/global/europe/2018/06/21/as-trump-pushes-for-separate-space-force-russia-moves-fast-the-other-way. The United States may be the only nation with an independent space branch, separate from other commands. *Id.*

including the Chinese People's Liberation Army Strategic Support Force,[37] and the Russian Aerospace Defence Forces.[38]

B. History of Anti-Satellite Targeting

Satellites are high-value military targets for two reasons: they support missions in a number of crucial ways[39] and they are vulnerable to attack.[40] Satellites "are relatively few in number, not generally hardened against attack, not usually equipped to 'fight back', normally follow predictable orbit patterns, tend to be unable to take evasive action, are often not equipped with sensors to give situational awareness, and may even not register that an attack is happening . . . ."[41] There has never been a recorded attack on one state's satellite by a different state,[42] but in recent years several states have demonstrated anti-satellite capabilities through tests against their own spacecrafts.[43] Hostile anti-satellite attacks may be inevitable. Strategists should prepare to make decisions that involve targeting objects in orbit, and the international community should prepare to observe that existing international standards in the conduct of warfare are maintained in celestial combat.[44]

History shows as much. During the Cold War, anti-satellite research by the Soviet Union and the United States focused on kinetic interceptors, such as missiles that could be used to physically destroy satellites.[45] The United

37 Adam Ni & Bates Gill, *The People's Liberation Army Strategic Support Force: Update 2019*, 19 CHINA BRIEF (May 29, 2019, 5:57 PM), https://jamestown.org/program/the-peoples-liberation-army-strategic-support-force-update-2019. The People's Liberation Army Strategic Support Force is a unified support command for a number of operations, including space, cyber, electronic, and psychological warfare. *Id.*

38 *Aerospace Defence Forces*, MINISTRY DEF. RUSSIAN FED'N, http://eng.mil.ru/en/structure/forces/cosmic.htm (last visited Mar. 1, 2021).

39 *See supra* notes 28–34 and accompanying text.

40 WILLIAM H. BOOTHBY, THE LAW OF TARGETING 371 (2012).

41 *Id.*

42 Laura Grego, *Why We Need to Avoid More Anti-Satellite Tests*, SPACE NEWS (Apr. 16, 2019), https://spacenews.com/why-we-need-to-avoid-more-anti-satellite-tests.

43 *See infra* notes 51–59 and accompanying text.

44 "[International Humanitarian Law] applies not only in the territories of the belligerent States, but essentially wherever their armed forces meet, including the territory of third States, international airspace, the high seas, and even cyberspace." MELZER, *supra* note 14, at 28; *see* BOOTHBY, *supra* note 40, at 360–62 (discussing the application of targeting law to outer space by considering the interpretation of several treaties and customs of international law, and concluding that terrestrial targeting law does apply to outer space).

45 *See A History of Anti-Satellite Programs*, UNION CONCERNED SCIENTISTS (Mar. 1, 2012), https://www.ucsusa.org/nuclear-weapons/space-security/a-history-of-anti-satellite-programs; David Koplow, *ASAT-isfaction: Customary International Law and the Regulation of Anti-Satellite Weapons*, 30 MICH. J. INT'L L. 1187, 1208 (2009).

States began to develop anti-satellite methods soon after the Soviet satellite Sputnik was put into orbit,[46] conducting the first known anti-satellite test in 1959.[47] Most of the first interceptors were designed to be launched from Earth, although an early Russian system was designed to be placed in orbit.[48] The United States also developed systems intended to be launched from aircraft,[49] testing its last attempt, the ASM-135, by destroying an American satellite in 1985.[50] The Soviet Union dissolved six years later, and with the end of the Cold War there were no anti-satellite tests for over two decades.[51]

In 2007, China returned the world to anti-satellite testing when it destroyed one of its own defunct weather satellites,[52] and thus ended the "de facto moratorium" on anti-satellite tests.[53] One year later, in 2008, the United States destroyed a U.S. reconnaissance satellite that was leaking dangerous fuel.[54] Commentators wrote that the strike likely served three policy goals: to "save the world from [the dangerous fuel], test a missile-defense rocket as an antisatellite weapon, and put the Chinese on notice that we can kill satellites."[55] "[T]he U.S. shootdown may have marked the opening of a new arms race in space . . . it looks to have been part of a larger U.S. effort, mostly out of public view, to develop antisatellite weapons and to militarize space, with potentially catastrophic consequences."[56] In 2013, China returned the effort by launching a rocket into space to study the Earth's magnetosphere.[57] According to the United States, the launch was in fact a test of a kinetic interceptor intended to target satellites.[58] Russia has since begun tests of its own anti-satellite kinetic interceptor, a missile

46 Koplow, *supra* note 45, at 1201.

47 Gerry Doyle, *Factbox: Anti-Satellite Weapons: Rare, High-Tech, and Risky to Test*, REUTERS (Mar. 27, 2019, 4:40 AM), https://www.reuters.com/article/us-india-satellite-tests-factbox/factbox-anti-satellite-weapons-rare-high-tech-and-risky-to-test-idUSKCN1R80UW.

48 *A History of Anti-Satellite Programs*, *supra* note 45.

49 *Id.*

50 *Id.*

51 *Id.*

52 George, *supra* note 17; *see* Carin Zissis, *China's Anti-Satellite Test*, COUNCIL ON FOREIGN RELS. (Feb. 3, 2010, 7:00 AM), https://www.cfr.org/backgrounder/chinas-anti-satellite-test. The Chinese Test created the "largest debris cloud in history" at the time. Doyle, *supra* note 46.

53 Guy Gugliotta, *Space Invaders: How Preparations for Tomorrow's Satellite Wars Could Ruin Life as We Know It Today*, ATLANTIC (2008), https://www.theatlantic.com/magazine/archive/2008/09/space-invaders/306927/.

54 Oberg, *supra* note 20.

55 Gugliotta, *supra* note 53.

56 *Id.*

57 Andrea Shalal-Esa, *U.S. Sees China Launch as Test of Anti-Satellite Muscle: Source*, REUTERS (May 15, 2013, 12:35 AM), https://www.reuters.com/article/us-china-launch/u-s-sees-china-launch-as-test-of-anti-satellite-muscle-source-idUSBRE94E07D20130515.

58 *Id.*

known as the Nudol.[59] In 2019, India became the fourth country to demonstrate anti-satellite capabilities by successfully shooting down one of its own satellites.[60]

C. Anti-Satellite Attack Methods

Anti-satellite attacks can be grouped into four broad categories. Kinetic physical weapons are designed to collide with or explode alongside a satellite, physically damaging or forcing it out of orbit.[61] Non-kinetic physical weapons damage the satellite without requiring a physical interceptor and include electromagnetic energy weapons such as lasers, high powered microwaves, and electromagnetic pulses.[62] Electronic attacks target the satellite's sensors and antennae, jam radio frequencies, or send fake commands to the satellite.[63] Finally, cyberattacks target the data and data systems on the satellite, and include attempts to commandeer the satellite's computers.[64]

The harm to noncombatant populations from an anti-satellite attack could be minor, if, for instance, the satellite is moved to a harmless orbit, or if the satellite is disabled without causing physical damage. On the other hand, certain attacks, especially those using kinetic anti-satellite weapons, could have a significant impact on civilians, non-combatants, and the environment. A kinetic strike typically creates space debris.[65] Space debris presents a serious problem for the future of safe space operations for all actors.[66] There are currently more than 500,000 pieces of space debris in orbit[67] and the physical destruction of a satellite would add thousands

59 Mizokami, *supra* note 18.

60 Gettleman & Kumar, *supra* note 19. The Indian test escalated geopolitical tensions with China and Pakistan and threatened the International Space Station with debris. *Nasa: India's Satellite Destruction Could Endanger ISS*, BBC (Apr. 2, 2019), https://www.bbc.com/news/world-asia-india-47783137; TODD HARRISON, KAITLYN JOHNSON, THOMAS G. ROBERTS, TYLER WAY & MAKENA YOUNG, CTR. FOR STRATEGIC & INT'L STUD., SPACE THREAT ASSESSMENT 2020, at 44–45 (2020), https://aerospace.csis.org/wp-content/uploads/2020/03/Harrison_SpaceThreatAssessment20_WEB_FINAL-min.pdf; SECURE WORLD FOUND., GLOBAL COUNTERSPACE CAPABILITIES: AN OPEN SOURCE ASSESSMENT, at xvi, chs. 5-2, 18 (Brian Weeden & Victoria Samson eds., 2020), https://swfound.org/media/206970/swf_counterspace2020_electronic_final.pdf.

61 Koplow, *supra* note 45, at 1201; *see also* TODD HARRISON ET AL., *supra* note 60, at 3.

62 *See* TODD HARRISON ET AL., *supra* note 60, at 3.

63 *Id.* at 4.

64 Koplow, *supra* note 45, at 1201; *see also* TODD HARRISON ET AL., *supra* note 60, at 4–5.

65 Koplow, *supra* note 45, at 1202.

66 *Id.*

67 Mark Garcia, *Space Debris and Human Spacecraft*, NAT'L AERONAUTICS & SPACE ADMIN. (Aug. 7, 2017), https://www.nasa.gov/mission_pages/station/news/orbital_debris.html.

more.[68] A collision with even a small piece of debris could be disastrous[69]—tiny chunks can harm or destroy other satellites,[70] and can endanger astronauts.[71] Additionally, the disabling of a satellite—whether through a direct attack or through debris from an unrelated strike—could have derivative effects for noncombatants on Earth. Satellites host important weather, communications, and navigations systems,[72] used by civilian populations as well as military forces. An anti-satellite strike to deny military capabilities could disconnect these vital civilian services.

68 Koplow, *supra* note 45, at 1202. China's 2007 test created 2,600 sizeable chunks of debris and potentially as many as 150,000 smaller, non-trackable pieces. *Id.*

69 Garcia, *supra* note 67.

70 Koplow, *supra* note 45, at 1202.

71 *Id.* Astronauts on the International Space Station have had to prepare to evacuate when debris passed near the station. Kenneth Chang, *Debris Gives Space Station Crew Members a 29,000-M.P.H. Close Call*, N.Y. TIMES (June 28, 2011), https://www.nytimes.com/2011/06/29/science/space/29junk.html. This has happened at least four times in the history of the ISS. Katie M. Palmer, *ISS Crew Prepares to Evacuate in Real-Life* Gravity *Scare*, WIRED (July 16, 2015, 2:46 PM), https://www.wired.com/2015/07/iss-crew-prepares-evacuate-real-life-gravity-scare/.

72 Handelman, *supra* note 31.

III. THE LAWS OF SPACE

Space Law is the collection of domestic laws and international agreements which govern outer space activities.[73] Space Law covers a variety of legal topics, including contract law, conflict of laws, administrative law, intellectual property law, arms control law, environmental law, and criminal law.[74] The sources of Space Law are a patchwork of international and domestic laws, including municipal law; memoranda of understanding; nonbinding soft laws like working arrangements, informal standards, recommendations, resolutions, and procedures; public international law including U.N. treaties and customary international law; and private international law.[75] There are five major international agreements that cover outer space: the Outer Space Treaty (1967), which is considered the "Magna Carta"[76] of space law and establishes "general principles for the use and exploration of Outer Space";[77] the Rescue and Return Agreement (1968), which covers astronaut safety; the Liability Convention (1972), which covers damage caused by space objects;[78] the Registration Convention (1975), which covers registries of objects launched into space;[79] and the Moon Agreement (1984), which covers the Moon and other celestial bodies in the Milky Way.[80] There are also several U.N. General Assembly resolutions and other international agreements addressing Outer Space,[81] covering such topics as satellite

73 Skip Smith, *A Space Law Primer for Colorado Lawyers: Part 1: International Space Law*, COLO. LAW., Mar. 2018, at 48–49, https://www.cobar.org/Portals/COBAR/Repository/TCL/March2018/FEATURES_SPACE_LAW.pdf. Space law is a young area of law, still early in its development. *See generally* Ma Xinmin, Deputy Director-General, Dep't Treaty & L., Ministry Foreign Affs., China, Speech at the United Nations/China/APSCO Workshop on Space Law, The Development of Space Law: Framework, Objectives and Orientations, (Nov. 17, 2014), https://www.unoosa.org/documents/pdf/spacelaw/activities/2014/splaw2014-keynote.pdf.

74 Emily Albrecht, *To Infinity and Beyond: Space Law 101*, AM. BAR ASS'N, https://www.americanbar.org/groups/young_lawyers/publications/tyl/topics/space-law/to-infinity-and-beyond-space-law-101/ (last visited Mar. 1, 2021).

75 FRANCIS LYALL & PAUL B. LARSEN, SPACE LAW: A TREATISE 31–52 (2009).

76 Johnson, *supra* note 9.

77 Smith, *supra* note 73, at 48, 50.

78 Convention on International Liability for Damage Caused by Space Objects, Mar. 29, 1972, 961 U.N.T.S. 187 [hereinafter Liability Convention].

79 Convention on Registration of Objects Launched into Outer Space, Nov. 12, 1974, 1023 U.N.T.S. 15 [hereinafter Registration Convention].

80 Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, Dec. 5, 1979, 1363 U.N.T.S. 3 [hereinafter Moon Agreement]; *see* Smith, *supra* note 73, at 48, 50.

81 Koplow, *supra* note 45, at 1199 n.34. As an example of other treaties that contribute to the laws of outer space, Professor Koplow notes the 1963 Limited Test Ban Treaty, which "prohibits nuclear explosions in outer space" as well as "several arms control treaties [that] ban interference with satellites employed to help parties monitor compliance with the agreements' terms." *Id.*

orbits[82] and regional Space agencies.[83] There are several regional and international agencies that administer space agreements and set regulations. Many states also have domestic laws that address or affect the use of outer space.[84] Finally, there are principles of customary international law which may apply to space.[85]

A. Treaty Law

The Outer Space Treaty (1967)[86] established the foundational principles for international agreements on outer space, including that "the exploration and use of outer space . . . shall be carried out for the benefit and in the interests of all countries . . . and shall be the province of all mankind."[87] The treaty affirms that outer space "is not subject to national appropriation by claim of sovereignty,"[88] that states parties "shall carry on activities in the exploration and use of outer space . . . in accordance with international law,"[89] and that states parties shall not place into orbit "nuclear weapons or any other kinds of weapons of mass destruction."[90] The Outer Space Treaty broadly affirms that space is the province of all mankind and that it should be explored peacefully. The only restriction on state action in the Outer Space Treaty is the limitation against placing weapons of mass destruction in space; non-nuclear attacks in space are not precluded.[91] One hundred and nine states have ratified the Outer Space Treaty,[92] including all of the major spacefaring nations.[93]

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82 *See, e.g.*, The International Telecommunication Union Constitution, Convention, and Radio Regulations in Collection of the Basic Texts of the International Telecommunication Union adopted by the Plenipotentiary Conference (2015), www.itu.int/pub/S-CONF-PLEN-2015.

83 *See, e.g.*, Convention for the Establishment of a European Space Agency, *entered into force* Oct. 30, 1980, 1297 U.N.T.S.

84 *See* LYALL & LARSEN, *supra* note 75, at 32–37.

85 Koplow, *supra* note 45, at 1187.

86 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, 610 U.N.T.S. 205 [hereinafter Outer Space Treaty].

87 *Id.* art. 1.

88 *Id.* art. 2.

89 *Id.* art. 3.

90 *Id.* art. 4.

91 *Id.*

92 Status of Outer Space Treaty, UNITED NATIONS OFF. FOR DISARM. AFFS., http://disarmament.un.org/treaties/t/outer_space (last visited Mar. 1, 2021).

93 *The 10 Countries Most Active in Space*, AEROSPACE TECH. (Dec. 21, 2015), https://www.aerospace-technology.com/features/featurethe-10-countries-most-active-in-space-4744018/. The ten countries most active in space are: the United States, China, Russia, Japan, the United Kingdom, India, Canada, Germany, France, and Luxembourg. *Id.*

The Rescue and Return Agreement (1968) expanded on some of the responsibilities of states parties outlined in the Outer Space Treaty.[94] In particular, the Rescue and Return Agreement clarified that states parties should provide assistance to "the personnel of a spacecraft" that are in distress within the territory of that state, as might occur after a crash landing.[95] The Rescue and Return Agreement also addressed the recovery of space objects belonging to one state landing in another state's territory.[96] The Agreement does not address conflict in space.[97] Ninety-eight states have ratified the Rescue and Return Agreement.[98]

The Liability Convention expanded on the liability requirements of the Outer Space Treaty.[99] The Convention clarified that the state from which a space object is launched is responsible for harm caused by that object,[100] even if that state did not intend or cause the harm.[101] The Liability Convention focused on restitution for damages,[102] and does not directly limit action in space. Ninety-eight states have ratified the Liability Convention.[103]

The Registration Convention made it easier to track ownership of space objects.[104] It obligates states to establish national registries of space launches and to share information from those registries with the United Nations Office for Outer Space Affairs, which records them in the United Nations Register of Objects Launched into Outer Space.[105] The Office for

94 Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, Apr. 22, 1968, 672 U.N.T.S. 119.

95 *Id.* art. 1.

96 The Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, Apr. 22, 1968, 19 U.S.T. 7570, 672 U.N.T.S. 119.

97 *Id.*

98 Louis de Gouyon Matignon, *The Rescue Agreement of 1968*, SPACE LEGAL ISSUES (Apr. 6, 2019), https://www.spacelegalissues.com/space-law-the-rescue-agreement-of-1968/.

99 Liability Convention, *supra* note 78.

100 *Id.*

101 Trevor Kehrer, Note, *Closing the Liability Loophole: The Liability Convention and the Future of Conflict in Space*, 20 CHI. J. INT'L L. 178, 180 (2019).

102 Liability Convention, *supra* note 78.

103 Status of Liability Convention, UNITED NATIONS TREATY COLLECTION, https://treaties.un.org/pages/showDetails.aspx?objid=08000002801098c7 (last visited Mar. 1, 2021); Status of International Agreement Relating to Activities in Outer Space as at 1 January 2020, UNITED NATIONS OFF. FOR OUTER SPACE AFFS., https://www.unoosa.org/documents/pdf/spacelaw/treatystatus/TreatiesStatus-2020E.pdf.

104 Registration Convention, *supra* note 79.

105 *United Nations Register of Objects Launched into Outer Space*, UNITED NATIONS OFF. FOR OUTER SPACE AFFS., https://www.unoosa.org/oosa/en/spaceobjectregister/index.html (last visited Mar. 1, 2021).

Outer Space Affairs publishes the Register through its website.[106] Sixty-nine states have ratified the Registration Convention.[107]

The last of the major treaties, the Moon Agreement,[108] established foundational principles for the use and exploration of the Moon and other celestial bodies.[109] However, the Moon Agreement has not been widely accepted.[110] The Agreement has 18 states parties and has not been signed or ratified by most spacefaring nations, including the U.S. and Russia.[111]

There are other treaties that contribute to the laws of space.[112] Arms control and test ban treaties further limit the use of certain weapons in space, including nuclear weapons.[113] The Environmental Modification Convention[114] prohibits the hostile use of environmental modification techniques, and clarifies that "environmental modification" includes the deliberate manipulation of outer space.[115]

B. Customary Law

Customary international law is difficult to apply to newer fields like space law. Customary law rests on consistent practice and necessarily focuses on patterns of historical activity; a history of anti-satellite methods

106 *Id.*

107 Status of Registration Convention, UNITED NATIONS TREATY COLLECTION, https://treaties.un.org/Pages/ViewDetailsIII.aspx?src=TREATY&mtdsg_no=XXIV-1&chapter=24 (last visited Mar. 1, 2021).

108 Moon Agreement, *supra* note 80.

109 *Id.*

110 Jourdan Rasmussen, Not Going Gently, or Alone, into that Good Night: Why Nations Should Enter into an International Space Convention for the Furthering of Cooperation in Space Exploration, at 6 (2015) (submitted in relation to King Scholar Program, Michigan State University College of Law), https://www.law.msu.edu/king/2014-2015/Rasmussen.pdf .

111 Status of Moon Agreement, UNITED NATIONS TREATY COLLECTION, https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXIV-2&chapter=24&clang=_en (last visited Mar. 1, 2021).

112 Koplow, *supra* note 45, at 1199.

113 *Id*. The 1963 Limited Test Ban Treaty "prohibits nuclear explosions in outer space." *Id.*; Treaty Banning Nuclear Weapons Tests in the Atmosphere, in Outer Space and Under Water art. I(l)(a), Aug. 5, 1963, 480 U.N.T.S. 43. The Limited Test Ban Treaty has 108 parties, including the United States, Russia, and China. Status of Limited Test Ban Treaty, UNITED NATIONS TREATY COLLECTION, https://treaties.un.org/pages/showDetails.aspx?objid=08000002801313d9 (last visited Mar. 1, 2021). Other relevant treaties include the Treaty on the Limitation of Anti-Ballistic Missile Systems (no longer in force), the Treaty on the Elimination of Their Intermediate-Range and Shorter-Range Missiles, and the Treaty on Conventional Armed Forces in Europe. Koplow, *supra* note 45, at 1199 n.34.

114 Convention on the Prohibition of Military or Any Hostile Use of Environmental Modification Techniques, May 18, 1977, 1108 U.N.T.S. 151.

115 Bill Boothby, *Space Weapons and the Law*, 93 INT'L L. STUD. 179, 191 (2017).

has at most 60 years to draw on.[116] Even where customary rules exist, "it can be difficult to ascertain the precise content of a putative . . . rule, to determine that it has actually achieved the status of [Customary International Law], and to know on which states it is binding."[117] Customary international law represents widespread and consistent state practice done out of a sense of legal obligation (*opinio juris*).[118] In the realm of anti-satellite activity, there is little observable state practice.[119] There have been few anti-satellite tests,[120] and "no State has ever *used* its [anti-satellite] system in hostilities or in a time of crisis against the spacecraft of another country."[121] Furthermore, there is little evidence that states have been refraining from conducting anti-satellite tests strictly out of a sense of legal obligation, rather than mere technical or political limitations.[122] It is therefore unlikely that a body of customary international law addressing anti-satellite targeting exists.[123] As more states develop spacefaring and anti-satellite capabilities, national actions in the field will add to evidence for customary international legal norms[124]—observers should 'watch this space'[125] for ongoing development. In our current era, "custom can coalesce into customary principle and develop into codified law within a relatively short period of time."[126]

116 "Historically, crystallization of new rules of customary international law was viewed as a protracted process that took decades, if not centuries, to complete." Michael P. Scharf, *Accelerated Formation of Customary International Law*, 20 ILSA J. INT'L & COMPAR. L. 305, 306 (2014).

117 Koplow, *supra* note 45, at 1223.

118 RESTATEMENT (THIRD) OF FOREIGN RELS. L. § 102 cmts. (b)–(c) (AM. L. INST. 1987). *See generally* Paquete Habana, 175 U.S. 677 (1900); Statute of the International Court of Justice art. 38(1)(b), June 26, 1945, 33 U.N.T.S. 993.

119 Koplow, *supra* note 45, at 1235.

120 *Id.*

121 *Id.*

122 *Id.*

123 *Id.* at 1241–42. General international principles on armed conflict likely do apply, however. BOOTHBY, *supra* note 40, at 360–61; *see infra* Section IV.C.

124 Without customary law or other prohibitions on action, under the *Lotus* principle, states may be able to act without limit. *See generally* George Wendell Berge, *The Case of the S.S. "Lotus"*, 26 MICH. L. REV. 361 (1928).

125 *See generally* Orin S. Kerr, *A Theory of Law*, 16 GREEN BAG 2D 111 (2012).

126 Maogoto & Freeland, *supra* note 1, at 194; *see also* Tullio Treves, *Customary International Law*, *in* MAX PLANCK ENCYCLOPEDIA OF PUBLIC INTERNATIONAL LAW ¶ 24 (2006) (examples of rapidly coalescing customary rules include "drilling technology as regards the rules on the continental shelf," "space technology as regards the rule on the freedom of extra-atmospheric space," and "widespread sentiments of moral outrage regarding crimes committed in conflicts, such as those in Rwanda and Yugoslavia").

C. International and Municipal Space Law Regimes

Many international organizations exist to coordinate space activities. The primary United Nations office for this area is the United Nations Office for Outer Space Affairs (UNOOSA). UNOOSA is the secretariat for the United Nations General Assembly's Committee on the Peaceful Uses of Outer Space.[127] UNOOSA promotes international cooperation, oversees a number of space science reports, and maintains the Register of Objects Launched into Outer Space.[128] Another prominent United Nations body which affects space activity is the International Telecommunications Union.[129] The International Telecommunications Union consists of 193 member states as well as hundreds of private companies and educational institutions, and coordinates the allocation of radio frequency spectrum channels and satellite orbits.[130] There are also several regional intergovernmental organizations that coordinate space activities. One prominent example is the European Space Agency, which coordinates civilian activities among 20 European member states.[131]

The United States is a major producer of and participant in space activities, so it is worth paying extra attention to the U.S. domestic space law regime. There are several major components to the U.S. space law regime. These include the Federal Aviation Administration (FAA),[132] the Federal Communications Commission (FCC),[133] the National Oceanic and Atmospheric Administration (NOAA),[134] export control regulators (including offices in the U.S. Department of State and U.S. Department of

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127 *Roles and Responsibilities*, UNITED NATIONS OFF. FOR OUTER SPACE AFFS., https://www.unoosa.org/oosa/en/aboutus/roles-responsibilities.html (last visited Mar. 1, 2021).

128 *Id.*

129 *About International Telecommunication Union (ITU)*, INT'L TELECOMM. UNION, https://www.itu.int/en/about/Pages/default.aspx (last visited Mar. 1, 2021).

130 *What Does ITU Do?*, INT'L TELECOMM. UNION, https://www.itu.int/en/about/Pages/whatwedo.aspx (last visited Mar. 1, 2021).

131 Elizabeth Howell, *European Space Agency: Facts & Information*, SPACE.COM (May 24, 2016), https://www.space.com/22562-european-space-agency.html. *See generally* EUR. SPACE AGENCY, http://www.esa.int/ (last visited Mar. 1, 2021).

132 *See* FED. AVIATION ADMIN., https://www.faa.gov/ (last visited Mar. 1, 2021). The Federal Aviation Administration deals with licensing for U.S. space ports and for objects launched from and landing in U.S. territory. *Licenses & Permits: Commercial Space Transportation*, FED. AVIATION ADMIN. (Mar. 16, 2020, 3:13 PM), https://www.faa.gov/licenses_certificates/commercial_space_transportation/.

133 *See* FED. COMMC'NS COMM'N, https://www.fcc.gov/ (last visited Mar. 1, 2021). The Federal Communications Commission deals with commercial licensing for satellites. *What We Do*, FED. COMMC'NS COMM'N , https://www.fcc.gov/about-fcc/what-we-do (last visited Mar. 13, 2020).

134 *See* NAT'L OCEANIC & ATMOSPHERIC ADMIN., https://www.noaa.gov/ (last visited Mar. 1, 2021). The National Oceanic and Atmospheric Administration maintains a weather satellite system of "short-range warning" and "longer-term forecasting" satellites. *National Weather Service Satellite Products*, NAT'L WEATHER SERV., https://www.weather.gov/marine/wxsat (last visited Mar. 1, 2021).

Commerce),[135] the National Aeronautics and Space Administration (NASA),[136] and the United States Military, including the Air Force and the newly formed Space Force.[137]

Other states have significant space law regimes. Luxembourg recently became "the first European country to adopt legislation regulating the ownership of resources acquired in space by commercial countries."[138] Several states have their own administrative space agencies, although only a few of these oversee programs with full spaceflight capabilities.[139] Several states also maintain global navigation satellite constellations.[140]

135 *See generally* DEP'T COM. OFF. SPACE COM. & FED. AVIATION ADMIN. OFF. COM. SPACE TRANSP., INTRODUCTION TO U.S. EXPORT CONTROLS FOR THE COMMERCIAL SPACE INDUSTRY (2d ed. 2017), https://www.space.commerce.gov/wp-content/uploads/2017-export-controls-guidebook.pdf.

136 *See* NAT'L AERONAUTICS & SPACE ADMIN., https://www.nasa.gov/ (last visited Mar. 1, 2021). The National Aeronautics and Space Administration oversees the United States civilian space program and space scientific research. *About NASA*, NAT'L AERONAUTICS & SPACE ADMIN., https://www.nasa.gov/about/index.html (last visited Mar. 1, 2021).

137 *See* Colin Dwyer, *White House Hopes Revived Space Command Is One Giant Leap Toward Proposed Space Force*, NPR (Aug. 29, 2019, 1:22 PM), https://www.npr.org/2019/08/29/755383671/white-house-hopes-revived-space-command-is-one-giant-leap-toward-proposed-space-. The Air Force still oversees most of the United States' current military space program, including the United States' Global Positioning System. *See What Is GPS?*, GPS.GOV (Feb. 22, 2021), https://www.gps.gov/systems/gps/.

138 Laurent Thailly & Fiona Schnieder, *Luxembourg Set to Become Europe's Commercial Space Exploration Hub with New Space Law*, OGIER (Aug. 1, 2017), https://www.ogier.com/news/the-luxembourg-space-law.

139 These include NASA in the United States, the European Space Agency in Europe, the Russian Federal Space Agency, the Indian Space Research Organization, and the Japan Aerospace Exploration Agency.

140 Russia has the Global Navigation Satellite System (GLONASS), Europe has the Galileo constellation, China has the BeiDou system, and India has the Indian Regional Navigation System.

IV. INTERNATIONAL HUMANITARIAN LAW IN SPACE

A. International Humanitarian Law

Laws about the use of military force which "constrain the waging of war"[141] are classically divided into two categories: *jus ad bellum*, or "laws about when it is legal to resort to force,"[142] and *jus in bello*, or regulations on the conduct of actors engaging in armed conflict once the conflict has begun.[143] *Jus in bello* is also known as "international humanitarian law" and "the law of armed conflict."[144] The International Court of Justice has identified two "cardinal principles" of international humanitarian law.[145] First, civilians should be protected from the effects of hostilities.[146] Second, combatants should be protected from unnecessary suffering.[147] Similarly, there are three classical fundamental maxims of just warfare: (1) "the only legitimate object which States should endeavour to accomplish during war is to weaken the military forces of the enemy";[148] (2) in pursuing this aim, "the right of the Parties to the conflict to choose methods or means of warfare is not unlimited";[149] and (3) "[t]he civilian population and individual civilians shall enjoy general protection against dangers arising from military operations."[150]

B. The Law of Targeting

Laws on targeting are a subset of international humanitarian law. "Targeting law is . . . about the requirement to distinguish between combatants and civilians who do not participate in the hostilities, and between objects that can lawfully be made the object of attack and civilian

141 FRITS KALSHOVEN & LIESBETH ZEGVELD, CONSTRAINTS ON THE WAGING OF WAR 1 (4th ed. 2011).

142 MARK WESTON JANIS & JOHN E. NOYES, INTERNATIONAL LAW AND INTERNATIONAL RELATIONS 443 (2018).

143 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).

144 JANIS & NOYES, *supra* note 142, at 531.

145 Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion, 1996 I.C.J. 226, 257 (July 7) [hereinafter Nuclear Weapons Advisory Opinion].

146 *Id.*

147 *Id.*

148 MELZER, *supra* note 14, at 79.

149 *Id.*; *see* Declaration of St. Petersburg Renouncing the Use, in Time of War, of Explosive Projectiles Under 400 Grammes Weight, Dec. 11, 1868, 138 Consol. T.S. 297; Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of International Armed Conflicts (Protocol I) art. 35(1), June 8, 1977, 1125 U.N.T.S. 3; *see* Hague Convention (IV) Respecting the Laws and Customs of War on Land, annex art. 22, Oct. 18, 1907, 36 Stat. 2277 ("The right of belligerents to adopt means of injuring the enemy is not unlimited.").

150 MELZER, *supra* note 14, at 79.

objects."[151] Principles of targeting law include the principle of military necessity,[152] distinction "between civilians and combatants, and between civilian objects and military objectives,"[153] and proportionality in the use of force.[154]

"Military necessity is a fundamental principle of the [Law of Armed Conflict] circumscribing the use of force, by establishing a reasonable connection between destruction and the overcoming of an enemy force."[155] There must be a justifiably significant military reason to attack a particular target. Many satellites are likely to meet this requirement. As discussed earlier, satellites are used by military actors for weather tracking, unit positioning, timing, communications, and missile warning. [156] Indeed, the United States military often will not consider an operation without using space capabilities.[157] Satellites that serve a significant strategic purpose are likely to meet the necessity standard.

"Distinction is a general principle of the [Law of Armed Conflict] that requires an attacker to distinguish between civilians and civilian objects on the one hand and military objectives (combatants or objects) on the other, and to use weapons capable of distinction between them."[158] Distinguishing targets in space is similar to the task in terrestrial combat.[159] A space targeteer should "review all available information . . . including registration data, observation data, data from sensors, human intelligence, and so on in order to determine the identity, location, and status as a military objective of any object he intends to target."[160]

Even when striking an otherwise legitimate military target, "the extent of military force used and any injury and damage inflicted upon civilians and civilian property should not be disproportionate to any expected military advantage."[161] Proportionality is of particular concern when targeting dual-use satellites. "While civilian and military uses are combined

151 BOOTHBY, *supra* note 40, at 6.

152 *What Are the Rules of War and Why Do They Matter?*, INT'L COMM. RED CROSS (Oct. 19, 2016), https://www.icrc.org/en/document/what-are-rules-of-war-Geneva-Conventions.

153 *Id.*

154 *Id.*

155 Maogoto & Freeland, *supra* note 1, at 176.

156 *See supra* Section II.A.

157 Peter Hays, Senior Space Pol'y Analyst, Falcon Rsch., Remarks on Panel at International Law Weekend: The 98th Annual Meeting of the American Branch of the International Law Association, The Growing Risk of War in Outer Space: What Role Will International Law Play, (Oct. 11, 2019).

158 Maogoto & Freeland, *supra* note 1, at 177.

159 BOOTHBY, *supra* note 40, at 369.

160 *Id.*

161 Maogoto & Freeland, *supra* note 1, at 178.

on a single satellite or transponder, the damage caused to the civilian uses as a result of an attack on the military uses must be considered in the proportionality assessment undertaken in advance of the attack."[162] Additionally, kinetic attacks on satellites may cause significant space debris, threatening other space objects.[163] Directed energy attacks, such as lasers, radiofrequency jamming, or cyberattacks, may be better able to achieve a strategic goal without causing additional harm.

C. Applying International Humanitarian Law in Outer Space

It is worth pausing to consider whether these rules of international law travel to space. "The Geneva Conventions establish that States shall comply and ensure compliance with the convention in all circumstances,"[164] and furthermore, "the International Court of Justice (ICJ) determined in an advisory opinion that the Law of Armed Conflict applied to 'all forms of warfare and to all kinds of weapons, those of the past, those of the present and those of the future.'"[165] The Law of Armed Conflict is generally understood to apply wherever armed conflict occurs.[166] Additionally, a review of the conventional law tends toward an understanding that relevant treaties would apply in the case of an anti-satellite attack.[167]

D. Rules of Engagement

A review of international law on the use of force in any domain would be incomplete without a discussion of how those laws are put into actual practice. The primary tool used by armed forces to "operationalize governing legal precepts" is the set of commands known as "rules of engagement."[168] Rules of engagement were originally developed in the United States, and the United States' standing rules are most well-known, but similar rulesets are used by militaries around the world.[169] Rules of engagement constrain and direct commanders and soldiers in the field, and

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162 BOOTHBY, *supra* note 40, at 370.

163 *Id.* at 372.

164 Esparza, *supra* note 143, at 342.

165 *Id.*; *see* Nuclear Weapons Advisory Opinion, *supra* note 145, at 86.

166 "[The Law of Armed Conflict] applies not only in the territories of the belligerent States, but essentially wherever their armed forces meet, including the territory of third States, international airspace, the high seas, and even cyberspace." MELZER, *supra* note 14, at 28.

167 BOOTHBY, *supra* note 40, at 360–62 (discussing the application of targeting law to outer space by considering the interpretation of several treaties and customs of international law and concluding that terrestrial targeting law does apply to outer space).

168 U.S. MILITARY OPERATIONS: LAW, POLICY, AND PRACTICE 211 (Geoffrey S. Corn, Rachel E. VanLandingham, & Shane R. Reeves eds., 2016).

169 *Id.* at 212–19.

ensure that the use of force complies with rules of law.[170] A well-defined set of rules applies policy, legal, and strategic considerations.[171]

Military strategists and policy makers should prepare model rules of engagement that anticipate potential anti-satellite actions. Of the four types of anti-satellite attacks—kinetic physical weapons, non-kinetic physical weapons, electronic attacks, and cyberattacks—cyberattacks and electronic attacks should be given preference, and kinetic physical weapons should be avoided or used as a last resort. Non-destructive means can best achieve law of targeting principles of proportionality and distinction. A sophisticated cyberattack, for instance, could restrict the military capabilities of a dual-use satellite while permitting civilian functions to continue. Additionally, a non-destructive attack can be turned off once military action is no longer necessary. However, in order to achieve the military targeting objective, a kinetic weapon is likely to also destroy civilian functions of satellites, endanger other satellites and persons in space, and may even directly threaten those on the ground if sizeable pieces are pushed into a crashing trajectory.

170 *Id.*
171 *Id.*

VI. CONCLUSION

Satellites present valuable military targets, and several states have shown significant development in anti-satellite technology. States are likely to include satellite-strikes in their military and hard-power strategies within the near future, yet it is important that policy makers consider the implications of such a strike before such plans are operationalized. Principles of international law, including international humanitarian law, likely still apply in outer space. Considerations on terrestrial targeting, including rules of military necessity, distinction, and proportionality, should apply as well to the targeting of satellites. Militaries around the world should effectuate these requirements by incorporating them into rules of engagement for outer space. Much of what is publicly demonstrated in the anti-satellite space are kinetic attacks—China, India, and the United States have all shown they can destroy their own satellites. However, at the same time, these states should look to develop non-physical alternative attack capabilities, and should prepare for restrained strikes that respect existing international law. We may have to carry our wars out beyond our planet, but we should aim to bring our laws with us as well.

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