SPACE WAR: THE LEGALITY OF TARGETING SATELLITES

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INTRODUCTION

Out of sight, out of mind—but dangerously so. For most of us, outer space is far removed from daily life, only coming up in science fiction novels or movies. Even if we stop and think about how many of our interactions rely on satellites, we are likely to underestimate their impact. Space-based assets now power daily life, as well as modern warfare, and a total space blackout would effectively lurch life back to the 1960s. Communications—including phones, Internet, and news—would suddenly entirely rely on fiber-optic or undersea cabling, overwhelming those capabilities and causing large blackouts. Remote areas would be entirely cut off. GPS would disappear, affecting not only individual travelers but also airplane navigation, certainly causing massive delays and economic losses and likely also plane crashes. "Clock drift," caused by a loss of GPS's precise timing system, would eventually affect both the financial sector and electric power grids. Weather forecasting, including emergency weather warnings, would lose accuracy. ATMs and gas stations could shut down. A study conducted by the United Kingdom's security services nearly a decade ago predicted that within three days, modern societies would be in complete chaos.[1] Whether or not this is true, life as we know it would certainly be over. All because something went terribly wrong somewhere so far away it is easy to ignore.

We ignore the capabilities and vulnerabilities of space at our own peril. Though a complete blackout like the one contemplated above is unlikely to occur in the near future, the denial of space assets will be an attractive option for military commanders in the next war. Modern warfare similarly and completely relies on space-based assets. The capabilities for

[1] Dr. John Sheldon, Visiting Professor, Air University at Maxwell AFB, Address Before the Space Enterprise Council of the U.S. Chamber of Commerce and the George C. Marshall Institute (Oct. 16, 2008), *in* A DAY WITHOUT SPACE: ECONOMIC AND NATIONAL SECURITY RAMIFICATIONS, at 40, http://marshall.org/wp-content/uploads/2013/08/Day-without-Space-Oct-16-2008.pdf.

targeting satellites already exist, and this Essay seeks to answer the question of whether or not using them violates existing international law. Part I provides the minimum background knowledge necessary to a basic understanding of satellite activities. Part II then examines the legal landscape of space, arguing that targeting satellites in wartime is not inherently unlawful, though it often may be. Part III concludes that though perhaps lawful at times, the costs of targeting satellites will almost always outweigh any benefits.

I. A PRIMER ON SPACE

Making sound legal decisions requires a working familiarity with the subject matter involved. Lawyers, policymakers, and interested citizens alike do not require an extensive technical background in order to make informed decisions, but they must learn basic fundamentals about the space environment. This Section provides such an overview, covering the types and uses of satellites, the different orbital regimes, and an introduction to the challenges posed by space debris and anti-satellite weapons (ASATs). All of these are important aspects of the space environment relevant to any decision on whether or not to target a particular satellite.

A. Satellites

Understanding the various uses and types of satellites in modern life is not only relevant background material, but knowing who owns a satellite and what it does is also indispensible to targeting considerations.

1. Uses

Both civilian and military life has become dependent on satellites to operate. Grouped by function, civilian use centers on communications, navigation (GPS), and weather satellites, but

observational and astronomical exploration satellites are also major categories.[2] Communication satellites play a critical role in providing telephone, television, and radio services.[3] In many countries, Internet connection also depends on communication satellites.[4] Navigation satellites provide the Global Positioning System (GPS) used to drive to a friend's house, guide pilots in flight, or plan military operations. GPS's precise timing system is also used to coordinate things as diverse as ATM machines, the financial sector, and electrical power grids.[5] The umbrella term for these types of satellites is GNSS (Global Navigation Satellite System), and the NAVSTAR GPS system is the U.S. run version, comprised of twenty-four satellites and run by the Department of Defense (DOD).[6] Other types of satellites help with earth observation—including weather forecasting and monitoring the environment.[7] Both the European Space Agency (ESA) and the United Nations (UN) now use observational satellites to track humanitarian and other disasters, a rapidly evolving capability with the potential to greatly aid responses to crisis situations.[8]

This is a small sampling of activities that rely on satellites, but a wide range of actors in diverse industries needs this technology to function. Some industries would be completely

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[2] *Satellites*, SPACE SCIENCE AND ENGINEERING CENTER AT THE UNIVERSITY OF WISCONSIN-MADISON (2011), http://www.ssec.wisc.edu/airportexhibit/files/side1.pdf.
[3] *Telecommunications Satellites*, EUROPEAN SPACE AGENCY, Dec. 10, 2012, http://www.esa.int/Our_Activities/Telecommunications_Integrated_Applications/Telecommunications_satellites.
[4] Id.
[5] Ed Morris, Executive Director, Office of Space Commerce, A DAY WITHOUT SPACE: ECONOMIC AND NATIONAL SECURITY RAMIFICATIONS, *supra* note 1, at 2-5.
[6] *The Beginner's Guide to Different Satellite Navigation Systems*, LINX TECHNOLOGIES, https://linxtechnologies.com/wp/beginners-guide-satellite-navigation-systems/. Russia's Aerospace Defense Forces operate its parallel, Soviet-developed Global Satellite Navigation System (GLONASS). As of today, these are the only two completely developed navigation systems with similar levels of precision. However, the European Union and the ESA are developing their own system, Galileo, with an expected completion date of 2019. China is also currently developing its own system called Compass, and additional regional satellite navigation systems either already exist or are underway.
[7] *NOAA Geostationary and Polar-Orbiting Weather Satellites*, NOAA SATELLITE INFORMATION SYSTEM, Mar. 5, 2014, http://noaasis.noaa.gov/NOAASIS/ml/genlsatl.html.
[8] *Satellites Respond to Humanitarian Needs*, EUROPEAN SPACE AGENCY, Nov. 22, 2011, http://www.esa.int/Our_Activities/Observing_the_Earth/Envisat/Satellites_respond_to_humanitarian_needs; Ariel Saber, *The U.N. Uses Satellites to Track Humanitarian Crises Around the* World, SMITHSONIAN MAG., May 2015, http://www.smithsonianmag.com/innovation/united-nations-uses-satellites-track-humanitarian-crisis-180954966/.

unable to function if satellite connection were lost, while others would be able to adjust, but at great cost to the efficiency and accuracy of their endeavors. Either way, all citizens in a modern society directly or indirectly make use of satellite technology every single day.

2. Ownership

Most of these capabilities benefit civilians as well as the military, and space contains both commercial and government-owned satellites. Of known U.S. satellites currently in orbit, there are more commercial satellites (297) than government and military satellites combined (286),[9] but military commanders and intelligence analysts have perhaps an even greater need to communicate and plan operations, observe areas of interest, predict the weather, and navigate to a particular location. Over twenty-five percent of U.S. satellites are military satellites.[10] GPS, for example, originated from a DOD program, and its initial intended use was for the military.[11] Today, the U.S. military and its allies rely on the parallel Precise Positioning Service.[12] Military communications satellites have also "become essential to help the warfighter."[13] As the use of satellites has expanded, so has the need for more capabilities and bandwidth, and the United States military has turned to the commercial sector to help meet its needs. It is estimated that

[9] *UCS Satellite Database*, UNION OF CONCERNED SCIENTISTS, http://www.ucsusa.org/nuclear-weapons/space-weapons/satellite-database#.WPFMEhLyugQ.
[10] *What Are Satellites Used For?*, UNION OF CONCERNED SCIENTISTS, http://www.ucsusa.org/nuclear-weapons/space-weapons/satellite-database#.WPFK6BlyvUo.
[11] Until May 1, 2000 GPS operated with selective availability, meaning a code of error was intentionally introduced in order to protect foreign or enemy forces from using the system. *Frequently Asked Questions About Selective* Availability, GPS.GOV, Oct. 2001, http://www.gps.gov/systems/gps/modernization/sa/faq/.
[12] PPS theoretically operates with the same level of precision as GPS, but affords other benefits to its users. Global Positioning System (GPS) 2008, DEPARTMENT OF DEFENSE, Oct. 31, 2008, http://www.dod.mil/pubs/foi/Reading_Room/Other/15-F-0403_GPS_2008_Report_to_Congress.pdf.
[13] Mak King & Michael J. Riccio, *Military Satellite Communications: Then and Now*, AEROSPACE, Apr. 1, 2010, http://www.aerospace.org/crosslinkmag/spring-2010/military-satellite-communications-then-and-now/.

almost ninety percent of military satellite communications in Central Command are hosted by commercial satellite owner-operators, such as Intelsat or Inmarsat.[14]

The United States government has recognized the benefits that can be gained through increased reliance on the commercial sector to meet military needs. Both the *National Space Policy* articulated by President Obama in 2010, and the subsequent *National Security Space Strategy* by the Director of National Intelligence Jim Clapper stated as one of their goals greater cooperation with the commercial sector to meet space needs.[15] So-called dual use satellites can—and do—take a variety of forms. One option is to employ a commercial owner-operator of the satellite, as the military already does. Another option is using commercially hosted military payloads (CHMP), which have sparked interest since the United States Air Force's first CHMP and its announcement that it will work with more companies in the future.[16] CHMP's partner with an existing commercial satellite and attach a military payload that will operate simultaneously with the satellite's intended use. Though not without its challenges, both the private sector and voices within the military have called for increased CHMP use.[17] Finally, the commercial sector can also provide additional bandwidth when required through agreements that allow the government to buy additional capabilities as needed. Lawmakers have been working on

[14] Peter A. Cunningham, *Military Payloads Hosted on Commercial Satellites*, AIR COMMAND AND STAFF COLLEGE: WRIGHT FLYER PAPER NO. 53 (2015).
[15] NATIONAL SPACE POLICY OF THE UNITED STATES OF AMERICA (June 28, 2010), 13-14; U.S. DEP'T OF DEF. & OFFICE OF THE DIR. OF NAT'L INTELLIGENCE, NATIONAL SECURITY SPACE STRATEGY: UNCLASSIFIED SUMMARY (2011), 5.
[16] Mike Gruss, *U.S. Air Force Picks 14 Companies To Support Hosted Payload Efforts*, SPACE NEWS, July 11, 2004, http://spacenews.com/41223us-air-force-picks-14-companies-to-support-hosted-payload-efforts/.
[17] Kay Sears, *Hosted Payload Concept Now Being Taken Seriously*, SATCOM FRONTIER, June 7, 2011, http://www.intelsatgeneral.com/blog/hosted-payload-concept-now-being-taken-seriously/.

such agreements, which may be similar in nature to the Civil Reserve Aircraft Fleet (CRAF) agreements already in place with certain major civilian airlines.[18]

Dual-use capabilities like CHMPs raise challenges of their own. Though launch happens quicker and costs less, the potential for rapid escalation of an armed conflict is also introduced. If the United States military hosts capabilities on a French satellite, an attack on that satellite will not only be an attack on the United States, but an attack on a member of the North Atlantic Treaty Alliance (NATO) as well.[19] For international legal experts who worry about the dangers that such interconnectivity may pose in the form of unintentional escalation, this is worrying. Certain members of the military, however, are already considering the beneficial deterrent effects of that same interconnectivity.[20]

Satellites have clearly become a major part of both civilian and military infrastructure. From telephones and television to remote sensing capabilities, if access to crucial satellites were denied, both routine daily life and military and intelligence operations would be seriously affected. In addition, though military-only satellites have always existed and will continue to exist in the future, the commercial sector is working harder than ever to help meet the space demands of the United States military. This blurring of lines between civilian and military technology in space poses new legal challenges for future armed conflicts. As the dependence of the military on the commercial sector—both domestic and international—grows, so too will those challenges.

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[18] David C. Arnold, *SpaceCRAF: A Civil Reserve Air Fleet for Space-Based Capabilities*, U.S. ARMY WAR COLLEGE PROGRAM RESEARCH PROJECT (2011); Andrea Shalal, *Commercial Satellite Industry Sees Growing U.S. Military Demand*, Reuters, Mar. 9, 2016.
[19] Arnold, *supra* note 18, at 4.
[20] Arnold, *supra* note 18, at 4-5.

B. Types of Orbit

Another way of classifying satellites is by what type of orbit they inhabit. Though space seems infinitely vast, the number of usable orbits above Earth is actually quite limited, and only becoming more crowded. The various orbital slots, along with implicating different targeting considerations, also provide different benefits and capabilities. Nearly circular orbits are categorized based on their altitude. Low earth orbit (LEO) begins at eighty kilometers from the Earth's surface, and ends at roughly 1,700 kilometers.[21] Medium earth orbit (MEO) is between 1,700-35,700 kilometers, and geosynchronous orbit (GSO) refers to satellites with an altitude of about 35,700 kilometers. Elliptical orbits also have further classifications, most relevantly including the Molniya, used frequently by Russian satellites.[22]

Different types of orbit, because of the different benefits they provide, also generally host varying types of satellites. The vast majority of satellites currently in orbit, including the International Space Station and the Hubble Space telescope, are located in low-earth orbit (803), followed by geosynchronous orbit (522).[23] GPS satellites fly in medium Earth orbit, while communications satellites are frequently located in geosynchronous orbit. Within GSO orbit is geostationary orbit (GEO), which provides unique benefits for satellites that require continuous coverage of a particular region of earth, and which is used by communications satellites, among others. Called the "most important element of space" by the commander of U.S. Strategic Command, GEO has an orbital period of roughly 24 hours, meaning that satellites here appear to be stationary if viewed from Earth.[24] However, the growing number of actors in space will

[21] Low earth, nearly circular orbits can also be classified by their inclination: equatorial, nonpolar inclined, polar, and sun-synchronous.
[22] *Molniya Orbit*, U.S. CENTENNIAL OF FLIGHT COMMISSION, http://www.centennialofflight.net/essay/Dictionary/MOLNIYA/DI166.htm.
[23] *UCS Satellite Database*, *supra* note 9.
[24] *UCS Satellite Database User's Manual*, UNION OF CONCERNED SCIENTISTS, Jan. 1, 2017, https://s3.amazonaws.com/ucs-documents/nuclear-weapons/sat-database/4-11-17-update/User+Guide+1-1-

eventually overwhelm GEO, a limited natural resource, causing satellites to interfere with one another once that region becomes overpopulated.[25] The orbit location of a satellite affects targeting considerations, if considering the use of an anti-satellite weapon, and situational awareness.

C. Anti-Satellite Weapons (ASATs)

Exploiting the benefits of new environments, like space, means new opportunities, but also new threats. Two recent challenges: anti-satellite weapons (ASATs) and space debris have captured the attention of policymakers and practitioners alike. Since any weapon that is used to destroy a satellite is technically an ASAT, ASATs can take many different forms.

There are two major categories of anti-satellite weapons: direct ascent and co-orbital systems.[26] Direct-ascent systems use ballistic missiles to intercept a target in orbit, but do not enter orbit themselves.[27] They generally destroy their target through the sheer kinetic force of impact, and China's famous destruction of its own weather satellite with the SC-19 was an example of this type of ASAT.[28] According to a 2016 RAND report, the only country with current ASAT capabilities is the United States.[29] Russia once developed and tested ASAT weapons, and though their program is now defunct it is thought that the Russians may be able to regain their ASAT capabilities if needed as well. Though potentially very effective, direct ascent ASATs can also cause long-lived orbital debris (China's 2007 test left thousands of pieces of

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17+wAppendix.pdf; Cheryl Pellerin, *Hyten: Deterrence in Space Means No War Will Be Fought There*, DOD NEWS, Jan. 26, 2017, http://www.defense.gov/News/Article/Article/1061833/hyten-deterrence-in-space-means-no-war-will-be-fought-there/.

[25] Brian D. Green, *Space Situational Awareness Data Sharing: Safety Tool or Security Threat*, 75 A.F. L. REV. 39 (2016).

[26] Brian Weeden, *Anti-Satellite Tests in Space—The Case of China*, SECURE WORLD FOUNDATION, Aug., 16, 2013, http://swfound.org/media/115643/china_asat_testing_fact_sheet_aug_2013.pdf.

[27] Green, *supra* note 25, at 63.

[28] It is estimated to have a range of 1,000 to 1,500 kilometers, making it capable of targeting most satellites in low earth orbit. Weeden, *supra* note 26.

[29] Id.

debris), and they must be timed to launch at the precise moment their target passes over the launch site.

Co-orbital systems, as the name implies, are launched into orbit and then maneuvered closer and closer to their target until they destroy it.[30] The means through which satellites are targeted through maneuvering are not limited to kinetic methods. Laser and directed energy weapons could permanently blind and disable, or temporarily "dazzle" satellites, but have never been used.[31] They have, however, been the subject of development and study by the United States since at least the 1980s, particularly in the context of missile defense.[32] Satellites can also be interfered with through their radio communications—also known as jamming. Jamming can occur on the uplink or downlink, meaning either during ground-to-satellite or satellite-to-ground data transfer. Both the United States and Russia are believed to possess jamming capabilities.[33] There are a number of other low tech and non-kinetic ways in which satellites can be targeted, including cyber attacks.[34]

D. Space Debris

A second major concern is the growth of space debris. In 1978, NASA scientist Don Kessler first postulated that the increasing number of objects in space—including both satellites and other debris located in low Earth orbit—would grow so large that collisions would become inevitable. These initial collisions would lead to more debris that in turn causes other collisions and so on, a scenario known now as Kessler Syndrome. NASA, ESA, and others are currently taking active measures to slow the growth of space debris, and ESA has stated that its strategic

[30] Id.
[31] Green, *supra* note 25, at 64.
[32] Ashton B. Carter, *Directed Energy Missile Defense in Space*, Apr. 1984, https://www.princeton.edu/~ota/disk3/1984/8410/8410.PDF.
[33] Laura Grego, *A History of Anti-Satellite Programs*, Union of Concerned Scientists, Jan. 2012, http://www.ucsusa.org/sites/default/files/legacy/assets/documents/nwgs/a-history-of-ASAT-programs_lo-res.pdf.
[34] Green, *supra* note 25, at 64.

goal is to engage in active removal.[35] However, that is not possible with current technology. Though debris accumulates through the normal use of space, both with old satellites and unintentional collisions, anti-satellite weapons have the potential to drastically increase the amount of space debris. Currently, there are over 500,000 tracked objects the size of marble or larger labeled "space junk" that are orbiting the Earth, all of which travel extremely fast and have the potential to damage or destroy other satellite or spacecraft.[36] Over 20,000 of those are larger than the size of a softball. China's anti-satellite test in 2007 contributed 3,300 objects to the U.S. Space Surveillance Network that tracks these objects—leading the ESA to label it "by far the worst break-up event in space history."[37] An unintentional collision between an American and Russian satellite in 2009 holds second place, with over 2,000 traceable fragments.[38]

Though space debris will continue to accumulate regardless of whether or not anti-satellite weapons are used, ASATs clearly have the potential to make an existing problem exponentially worse. This will pose an uncontrolled threat to all of the satellites currently in orbit and used for a variety of purposes—both civilian and military. And, if Kessler's Syndrome were truly to occur, access to these now-essential technologies, like GPS, communications and predicting the weather, would be irrevocably impaired.[39] This is one major consideration that cautions against the use of ASATs, and especially against any excessive or unnecessary use. Even without ASATs, though, space debris will remain a threat to satellite operations. This has

[35] *Active Debris Removal*, EUROPEAN SPACE AGENCY, http://www.esa.int/Our_Activities/Operations/Space_Debris/Active_debris_removal.
[36] *Space Debris and Human Spacecraft*, NASA, Sept. 26, 2013, https://www.nasa.gov/mission_pages/station/news/orbital_debris.html.
[37] *Space Debris: Frequently Asked Questions*, EUROPEAN SPACE AGENCY, http://m.esa.int/Our_Activities/Operations/Space_Debris/FAQ_Frequently_asked_questions.
[38] *About Space Debris*, European Space Agency http://m.esa.int/Our_Activities/Operations/Space_Debris/About_space_debris.
[39] *Micrometeoroids and Orbital Debris*, NASA, June 14, 2016, https://www.nasa.gov/centers/wstf/site_tour/remote_hypervelocity_test_laboratory/micrometeoroid_and_orbital_debris.html.

led to a call for increased data sharing to ensure that collisions are avoided, often called increased Space Situational Awareness (SSA).[40] After all, even an unintentional collision between two allied nations not at risk of engaging in further hostilities would produce debris affecting all other satellite-owning nations. As of today, the majority of countries are either both capable of launching and own satellites, or own their own satellites.[41]

Satellites have an ubiquitous influence on our daily lives and, today, "every facet of the U.S. military utilizes space."[42] Other countries will follow suit as soon as they have the capabilities. Not only that, but as the push for CHMPs shows, the line between commercial and military space assets will only become more blurry. Space debris is set to threaten the assets of every satellite-owning country in the relatively near future, and the International Space Station has already had to maneuver to avoid collisions with existing debris.[43] Coupled with the development of ASAT weapons by countries such as the United States, China, and Russia, space is ripe with future legal challenges, especially in the context of armed conflict. In the next armed conflict, the desire to deny adversaries benefits reaped from space-based assets will be high, and capabilities for disabling and destroying satellites already exist. Unfortunately, space law lags behind these rapid technological developments.

II. TARGETING SATELLITES IS NOT INHERENTLY UNLAWFUL

Given the many uses of satellites and the advantage that they can provide on the battlefield, it will be tempting for military commanders in the next war to target their adversary's

[40] Green, *supra* note 25, at 42.
[41] *UCS Satellite Database*, *supra* note 9.
[42] *Preventing War in Space*, AIR FORCE MAG., Jan. 30, 2017, http://www.airforcemag.com/DRArchive/Pages/2017/January%202017/January%2030%202017/Preventing-War-in-Space.aspx.
[43] Tariq Malik, *Space Station Dodges Debris From Destroyed Chinese Satellite*, SPACE.COM, Jan. 29, 2012, http://www.space.com/14398-space-station-dodges-chinese-space-junk.html.

satellites. There is currently no international law that directly addresses whether or not this would be lawful during an armed conflict. However, a careful analysis of existing law suggests that there may be scenarios in which destroying a satellite would be considered a lawful use of force. Nonetheless, it would not always be lawful to target a satellite, and importantly, this Section only addresses the lawfulness of targeting a satellite *during an already existing conflict*.

A. Sources of Applicable Law

The international legal regime governing space includes five core space treaties, and a host of other, smaller agreements. Though not explicitly envisioned with space in mind, the law of armed conflict (LOAC) almost certainly also applies. Finally, other customary international law, to the extent that any exists in space, would also bind all space-faring nations.

1. Treaties

The first of the five space treaties was the 1967 Outer Space Treaty.[44] Though now half a century old, the Outer Space Treaty has been extremely influential, serving as the "foundation[] for all the rest of space law."[45] It was the second "nonarmament treaty," and its goal was to avoid an arms race in space.[46] As such, it categorically bans any kind of stationing in outer space of nuclear weapons or weapons of mass destruction in Article IV.[47] The same Article also prohibits "the establishment of military bases, installations and fortifications" in outer space, espousing instead a view that space, the moon, and the celestial bodies are to be explored and researched

[44] *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies*, January 27, 1967, 610 UNTS 205, Art. IV [hereinafter *Outer Space Treaty*].
[45] Frans G. von der Dunk, *A Sleeping Beauty Awakens: The 1968 Rescue Agreement After Forty Years*, 34 J. SPACE L. 411, 412 (2008).
[46] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, *U.S. Department of State: Current Treaties and Agreements*, https://www.state.gov/t/isn/5181.htm.
[47] *Outer Space Treaty*, *supra* note 44, art IV.

for the "benefit of all peoples."[48] Article III of the Outer Space Treaty establishes the goal of using space "in accordance with international law . . . in the interest of maintaining international peace and security."[49] When combined with the principles of treaty interpretation, Article III clearly applies both general international law and space law to outer space.[50] Additionally, the Outer Space Treaty emphasizes the peaceful nature of activities conducted in space. Unfortunately, no agreement exists either between countries or scholars as to the exact meaning of "peaceful."[51] Interpretations range from "non-military" to entirely "non-aggressive," and different possible standards can be applied to the moon and other celestial bodies than to outer space void. In particular, a "number of Western experts" take the view that activities not expressly prohibited by Article IV are permitted.[52] This interpretation leaves states a considerable amount of freedom in outer space void, including potentially with satellites.

The existence of military satellites in space means that, for better or worse, space now plays a role on the modern battlefield. The Outer Space Treaty give no further guidance on whether or not targeting those assets during an armed conflict would be lawful, and the remaining four treaties are even less relevant. The 1968 Rescue Agreement,[53] the 1972 Liability Convention,[54] the 1974 Registration Convention,[55] and the Moon Agreement[56] followed the

[48] Id.
[49] *Outer Space Treaty*, *supra* note 44, art III.
[50] Cassandra Steer, *Sources and Law-Making Processes Relating to Space Activities*, *in* ROUTLEDGE HANDBOOK OF SPACE LAW 3, 12 (Ram S. Jakhu & Paul Stephen Dempsey eds., 2017).
[51] *See* Setsuko Aoki, *Law and Military Uses of Outer Space*, *in* ROUTLEDGE HANDBOOK OF SPACE LAW, *supra* note 49, at 197.
[52] Aoki, *supra* note 51, at 202-03.
[53] The Rescue Agreement deals with the obligation of states to rescue and return astronauts and return space objects to the relevant state party. *Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space*, April 22, 1968, 672 UNTS 119 [hereinafter *Rescue Agreement*].
[54] *Convention on the International Liability for Damage Caused by Space Objects*, March 29, 1972, 961 UNTS 187 [hereinafter *Liability Convention*].
[55] *Convention on Registration of Objects Launched into Outer Space*, January 14, 1975, 1023 UNTS 15 [hereinafter *Registration Convention*].
[56] *Agreement Governing the Activities of States on the Moon and Other Celestial Bodies*, December 18, 1979, 1363 UNTS 3 [hereinafter *Moon Agreement*].

OST. Though these five treaties form the core of modern space law and are important for shaping norms in space, they have little to do with prescribing or proscribing conduct relating to weapons or wartime.

The last and least successful of these agreements was adopted by the General Assembly in 1979—nearly four decades ago. Though space use and technology has advanced dramatically since then, no major treaty has been negotiated or updated to reflect these changes. As one author describes it, "political developments made [the U.N. Committee on the Peaceful Uses of Outer Space (COPUOS)] weary to draft any further treaties on space."[57] It remains an open question whether political developments since then have left the world's major space powers more or less open to any new space agreements today, but the general view leans towards the latter option.[58] Finally, outside of the core treaties, there are additional treaties, which may or may not explicitly have space in mind but nonetheless impact certain activities. Relating to the use of force, the most relevant of these would likely be the UN Charter and the 1963 Partial Test Ban Treaty.[59] Like their space treaty counterparts, these treaties have little to say on whether or not targeting satellites during wartime is legal.

2. Customary International Humanitarian Law (IHL)

The LOAC, also known as International Humanitarian Law (IHL), is a vast body of law governing *jus in bello*, or the "conduct of parties engaged in conflict."[60] IHL has a long history and is rooted in the traditions of varied cultures.[61] Numerous treaties contribute to IHL, including

[57] Von der Dunk, *supra* note 44, at 411.
[58] Steer, *supra* note 50, at 24.
[59] *Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water*, August 5, 1963, 480 UNTS 43 [hereinafter *Partial Test Ban Treaty*].
[60] *International Humanitarian Law: Answers to Your* Questions, INTERNATIONAL COMMITTEE OF THE RED CROSS, Jan. 22, 2015, https://www.icrc.org/en/document/what-are-jus-ad-bellum-and-jus-bello-0.
[61] Mary Ellen O'Connell, *Historical Development and Legal Basis*, *in* THE HANDBOOK OF INTERNATIONAL HUMANITARIAN LAW (3d ed. 2013) 1, 16.

the 1907 Hague Convention (IV) Respecting the Laws and Customs of War on Land,[62] and the 1977 Protocol Additional to the 1949 Geneva Conventions Relating to the Protection of Victims of International Armed Conflicts (AP I).[63] The Hague Convention (IV) concerned itself with land warfare, and therefore at least one scholar has suggested that the Hague Convention (IV) is not directly applicable in space,[64] but much of IHL is customary international law. As such, though particular treaties may only be binding on the states that have ratified them, many principles of IHL are considered binding customary international law and will apply in an armed conflict regardless of ratification.

Customary IHL should be presumed to apply in space. Though no previous treaties on the subject have specifically mentioned space, they are concerned with armed conflict, wherever it occurs. Particular treaties may be binding on specific mediums, but the part of IHL that is customary international law should remain relevant and binding on military commanders even if nations decide to wage war in space. The International Court of Justice (ICJ), in an Advisory Opinion issued in 2006, held that the Hague Conventions were binding on all states.[65] Much of AP I is likewise considered customary international law and many of its provisions are codified in the International Committee of the Red Cross's *Customary IHL Database*.[66] These principles therein are binding on all nations, even those like the United States, who have not yet ratified the particular treaty a provision may originally be located in.

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[62] *Regulations respecting the Laws and Customs of War on Land, Annex to Convention (IV) respecting the Laws and Customs of War on Land*, October 18, 1907, 36 Stat. 2295.
[63] *Protocol Additional to the Geneva Convention of August 12, 1949, and relating to the Protection of Victims of International Armed Conflicts (Protocol I)*, June 8, 1977, 1125 UNTS 17512 [*hereinafter* AP I].
[64] Michael N. Schmitt, *International Law and Military Operations in Space*, *in* 10 MAX PLANCK YEARBOOK OF UNITED NATIONS LAW (A. von Bogdandy & R. Wolfrum, eds. 2006) 89, 114-15.
[65] *Advisory Opinion on the Legality of the Threat or Use of Nuclear Weapons*, ICJ Reports 1996.
[66] International Committee of the Red Cross, *Customary IHL Database*, Cambridge University Press, https://ihl-databases.icrc.org/customary-ihl/eng/docs/home [*hereinafter Customary IHL Database*].

Since war in space has not yet occurred, there is no way to know for certain how states will behave. However, prior scholarly work has agreed that customary IHL should apply in space, but at least one author—though not taking the position himself—has recognized that the applicability of AP I to space could be questioned.[67] Interestingly, though, not even the extremely comprehensive *Handbook on International Humanitarian Law* makes any note of whether or not (or how) these principles would apply. In fact, the only time outer space is mentioned is in distinguishing space from airspace belonging to a particular territory.[68] The following sections apply the fundamental requirements of distinction, proportionality, and feasible precautions to the decision to target satellites, while highlighting the ambiguities that current law does not resolve. Even if a consensus were reached that IHL governs in space, that is a far cry from deciding *how* exactly IHL would apply.

Finally, just like any other medium, space is subject to the customary international law that has developed (and will develop) through state interaction.[69] However, given the recent, rapid, and continuing development of space activities, and the requirement of time for customary international law norms to crystallize, there is currently little if any binding customary law specific to space.[70]

B. Compliance with the Distinction Requirement

One of the most basic principles of the LOAC is distinction. Embodied in Article 48 of AP I, distinction requires targeting only military objectives and expressly forbids targeting civilian objectives.[71] In unclear cases, persons and objects are presumed to be civilian.[72] There

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[67] Schmitt, *supra* note 64, 115.
[68] Jann K. Kleffner, *Scope of Application of International Humanitarian Law*, *in* THE HANDBOOK OF INTERNATIONAL HUMANITARIAN LAW, *supra* note 61, at 57.
[69] Steer, *supra* note 50, at 8.
[70] Id.
[71] AP I, *supra* note 63, art. 48; Rule 7, *Customary IHL Database*, *supra* note 66.

are slightly different rules that apply to civilian persons and civilian objects, but both lose their status as "civilian" if "their nature, location or use make an effective contribution to military action" and their "neutralization . . . offered a definite military advantage."[73] The *Customary IHL Database* clarifies that an object's military "purpose" is also enough for it to lose protections, and that its "partial or total destruction, capture or neutralisation, in the circumstances ruling at the time" must offer a definite military advantage.[74] One tricky aspect of distinction comes from so-called dual-use objects, which are used for both civilian and military purposes. The DOD has stated its view that such objects are "liable to attack if there is a military advantage to be gained from their attack."[75] Additionally, there is a general view that the concrete military advantage gained can come from the "whole military operation of which the attack is a part," as opposed to an immediate advantage.[76]

In deciding whether to strike a satellite, military planners must first determine the kind of satellite involved. A purely military satellite would be an appropriate target, subject to the requirements of other applicable principles. Dual-use satellites, however, could only be targeted if their "nature, location, purpose, or use" contributed to a military action and their partial or total destruction or neutralization would provide a definite military advantage. Any CHMPs that hosted military payloads, though their initial and primary function may be commercial and civilian, would undeniably lose their protection as civilian objects if they met these criteria. In wartime, then, enemy states could legitimately target these satellites, provided the attack meets the rest of the criteria discussed below. At the very least, this should give companies pause when

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[72] AP I, *supra* note 63, art. 52(3).
[73] AP I, *supra* note 63, art. 52(2).
[74] Rule 8, *Customary IHL Database*, *supra* note 66.
[75] US, Department of Defense, Final Report to Congress on the Conduct of the Persian Gulf War, 10 April 1992, *in* INTERNATIONAL COMMITTEE OF THE RED CROSS, 2 CUSTOMARY INTERNATIONAL HUMANITARIAN LAW (Jean-Marie Henckaerts & Louise Doswald-Beck, eds. 2005) 187-88.
[76] RED CROSS, *supra* note 75, at 188.

deciding whether or not to host CHMPs. The economic benefits may be tempting, but they also come at the price of losing protected status in wartime. CHMPs are not the only ones at risk. *Any* satellite that serves a dual military and civilian function would be subject to the same test.

If the satellite in question were used for purely commercial or civilian purposes, under current law, it would not be a permissible target.[77] IHL does not make any exceptions for objects unless they become legitimate military objectives.[78] At this early stage, the analysis would be the same whatever the contemplated methods for satellite destruction. Therefore, any attack on a purely commercial or civilian satellite would be inherently unlawful. Satellites that by their nature, location, or use contribute directly to military action would theoretically be targetable, no matter who owned them. Perhaps the trickiest question in this context would concern technology that is used by both civilians and the military, such as that provided by certain communications and navigation satellites. The distinction requirement does not automatically reject a target because it is used for both civilian and military purposes, rather it only requires that the military advantage be definite. Given the reliance of the military on these assets for communications, navigation, weapons guidance, and a myriad of other military activities, it is probably safe to conclude the advantage satellites provide is definite.

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[77] However, given the uncertainty of the status of space, there are other possibilities. For example, AP I is applicable to attacks from the air and sea that target land, but "do[es] not otherwise affect the rules of international law applicable in armed conflict at sea or in the air." AP I, *supra* note 63, art. 49. In particular, the law of the sea is robust, and merchant vessels are accorded much less protection than similarly situated objectives located on enemy territory. If, in the same way, outer space were deemed not to be a part of national territory (in contrast with airspace, Jann K. Kleffner, *supra* note 68, at 57), something similar to the law of the sea could apply. Enemy merchant ships, as well as, in principle, "seagoing private vessels, such as yachts and pleasure-boats," are not exempt from capture like they are in land warfare. Wolff Heintschel von Heinegg, *The Law of Armed Conflict at Sea*, *in* THE HANDBOOK OF INTERNATIONAL HUMANITARIAN LAW, *supra* note 61, 1023. Though also not considered legitimate military objectives, if "circumstances preclude taking . . . an enemy merchant ship for adjudication . . . it may become necessary to destroy it." Von Heinegg, at 1026 & Commentary. Of course, this would only be permissible once all the passengers' safety has been accounted for. Today's technology does not permit satellites to carry any passengers, so casualties from a direct attack would not be a concern. It is also not currently possible to "capture" a satellite and bring it down from orbit peacefully. That may mean that a legal regime modeled after the law of the sea would allow states to target commercial satellites even if they do not make an effective contribution to military action.

[78] Rule 10, *Customary IHL Database*, *supra* note 66.

Non-kinetic ASAT attacks, and specifically cyber satellite attacks, face an open question as to whether a cyber attack would be considered the type of attack that the law of armed conflict applies to at all. Article 49 of AP I defines an "attacks" as "acts of violence against the adversary, whether in offense or in defense."[79] While kinetic ASATs would clearly fall in this category, international law has not yet squarely decided whether all cyber attacks constitute armed attacks, or even whether they are an "act of force."[80] Factors that have been identified as relevant to this analysis include the immediacy and nature of the effects and the attack's military character.[81] Whether or not an attack is an act of violence appears to be a third standard, but the argument has been made that cyber attacks with large-scale disruption effects could constitute acts of violence under international law.[82] Until this issue is definitively resolved, however, states with the capabilities to do so may be incentivized to using non-kinetic means of targeting satellites both to cause less collateral damage and to shield individual state actors potential liability for war crimes.

C. Compliance with the Proportionality Requirement

Even if a target has passed the distinction requirement, it must also pass the proportionality requirement. According to the principle of proportionality, the military advantage gained from any attack must be greater than the collateral damage caused by that attack.[83] The anticipated military advantage must be concrete and direct, but the collateral damage calculation does not include damage to civilian objects being used for military purposes. Indiscriminate

[79] AP I, *supra* note 63, art. 49(1).
[80] Michael Schmitt, *International Law and Cyber Attacks: Sony v. North Korea*, JUST SECURITY, Dec. 17, 2014, https://www.justsecurity.org/18460/international-humanitarian-law-cyber-attacks-sony-v-north-korea/.
[81] Id.
[82] Ido Kilovaty, *Virtual Violence—Disruptive Cyberspace Operations as 'Attacks' Under International Humanitarian Law*, 23 MICH. TELECOMM. & TECH. L. REV. 113 (2016).
[83] AP I, *supra* note 63, art. 51 and 57; Rule 14, *Customary IHL Database*, *supra* note 66.

attacks are also prohibited.[84] This means that a method of targeting a military objective is unlawful if that method cannot specifically target said military objective, distinguishing between it and civilian objects.

In meeting the proportionality requirement, planners of an attack must determine that the expected collateral damage from the planned attack is not excessive compared to the concrete and direct advantage to be gained. Collateral damage calculations include *both* the anticipated civilian casualties and damage to civilian objects. In space, civilian casualties are not currently likely. However, damage to civilian objects is quite likely. In the proportionality analysis, the means used to target a satellite would matter a great deal. There are two basic options: kinetic ASATs, which destroy their targets through sheer force of impact or a blast, and non-kinetic ASATs, like jamming or cyber attack.

If the planned attack used a kinetic ASAT, destroying its target, the result would be not one satellite, but many thousands of pieces of satellite left in orbit. As the 2007 Chinese ASAT test and other incidents have shown, the fall out from such an event would cause massive amounts of space debris. Some of this could be tracked, allowing other satellites to maneuver out of the way, but would nonetheless continue to affect current and future satellites for decades to come.[85] The results would not only be potentially disastrous, but the trajectory and impact of future debris is also quite unpredictable.

Collateral damage would also likely extend back to Earth. The extent of the damage would depend on the use of the satellite. For instance, if a GPS satellite were targeted, the results would include severe economic damage. Other commercial satellites—whether or not they are concurrently being used to support military action—could cause similar disruption. Given the

[84] AP I, *supra* note 63, art. 51; Rule 3, *Customary IHL Database*, *supra* note 66.
[85] Green, *supra* note 25, at 66.

extensive relevance of space-based assets by citizens in their daily life on Earth, and the possibility of debris disabling or damaging other satellites, the consequences could be far-reaching. It is unlikely that anyone would die directly as a result of an attack, but the economic damage could be extensive. Since the collateral damage could be so extensive, the military advantage gained would have to be huge. It is also not clear how an attack's proponents would manage the unpredictability of the collateral damage. The many unknowns—the damage done by the debris caused by a kinetic attack would not be predictable—leave ample room for military planners to underestimate the potential catastrophic results of an attack and later claim they were unpredictable. For these reasons, meeting the proportionality requirement with a kinetic ASAT, though possible, would be difficult.

Employing non-kinetic ASATs in targeting would significantly alter the collateral damage calculations. This mode of disabling or destroying enemy satellites would not cause the physical destruction of the satellite, eliminating the problem of space debris (and long-term damage to the environment, discussed further below). However, damage on Earth that stemmed from the loss of function of the satellite would still be a factor in the calculations. Since today's space-based assets are a major part of military operations, however, it is entirely possible that the concrete advantage gained will outweigh any collateral effects, allowing the attack to lawfully proceed. It appears it would be significantly easier to meet the proportionality requirement with a non-kinetic ASAT than with a kinetic one.

D. Compliance with the Feasible Precautions Requirement

Importantly, both the attacking state and the state responsible for a certain territory—and presumably also a state responsible for a certain property—are under an obligation to avoid collateral damage. Under the principle of precautions, the attacking state must "take all feasible

precautions" both in means and method of attack to avoid and minimize damage to, among other things, civilian objects.[86] For the state responsible for a certain territory, this means avoiding locating military objectives amongst civilian populations. Presumably, this would also mean avoiding locating military objects so close to crucial civilian objects that they are likely to be destroyed together to the extent this is possible, though lives would certainly take precedence over objects in this calculus.

The principle of taking all feasible precautions to minimize damage to civilian objects, and choose the means and method of attack that minimizes such damage also affects the consideration of what kind of ASAT to use when targeting a satellite. If the same objectives can be met with both kinetic and non-kinetic ASATs, but the latter causes considerably less damage, state would be under an obligation to choose the option that causes less damage, all other things equal. Similar to its effects on collateral damage, non-kinetic ASATs would best fit with the precautionary principle.

This principle also imposes a duty on the targeted state to refrain from locating military objectives amongst the civilian population or near civilian objects "to the extent feasible."[87] Applying this rule to military and civilian objects would have interesting consequences for the state that owns and operates the satellite. Knowing that an attack could cause major disruption to civilian and commercial satellites and their uses, states may have a responsibility to separate one from the other. It follows from this that some CHMPs may not be in compliance with the precautionary principle. Military strategists have certainly recognized the difficult targeting dilemmas that CHMPs pose for an enemy state as an advantage.[88] Since most states comply with international humanitarian law in times of armed conflict, they would be wary of causing

[86] AP I, *supra* note 63, art. 57; Rule 15, *Customary IHL Database*, *supra* note 66.
[87] Rule 24, *Customary IHL Database*, *supra* note 66.
[88] David C. Arnold, *supra* note 18, at 4.

unnecessary collateral damage to civilian objects. Using the potential deterrent effect of the disastrous consequences of a strike as an advantage by hosting military payloads on commercial satellites, however, may violate the duty to take feasible precautions *not* to invite such damage. After all, it is certainly feasible that the same assets could be sent into space on a separate solely military asset, though probably on a longer timeframe and with a bigger budget.

E. Environmental Considerations

Articles 35 and 55 of AP I indicate that methods or means of warfare intended or expected to "cause widespread, long-term and severe damage to the natural environment" are prohibited.[89] This principle has not seen the same widespread support as distinction, proportionality, or feasible precautions, but the U.S. Naval Handbook does provide that the "commander has an affirmative obligation to avoid unnecessary damage to the environment," indicating that it may be at least a factor that states consider when making targeting decisions.[90] In some sense, most military attacks will cause some kind of lasting damage to the immediate surrounding environment, but the principle embodied in the AP I articles is likely subject to the same proportionality analysis as other attacks.

A kinetic attack on a satellite would undoubtedly cause severe and long-term damage to the space environment in the form of space debris. Additionally, though a single attack today may not have disastrous effects across the whole globe, a norm that condoned kinetic ASAT attacks certainly would. Space debris will accumulate regardless of whether or not ASAT attacks are conducted, but until the technology exists to remove debris from orbit, more attacks will only mean more damage to a finite resource that nearly the entire world is currently taking advantage of. As such, environmental considerations would point against kinetic ASAT attacks in all but

[89] AP I, *supra* note 63, art. 35, 55; Rules 43-35, *Customary IHL Database*, *supra* note 66.
[90] RED CROSS, *supra* note 75, at 846.

the most extreme circumstances. Non-kinetic ASATs would not would not leave thousands of pieces of satellite in orbit. Therefore, these latter kinds of attacks will not have the same devastating effect on the space environment.

F. Legal Conclusions

Every potential attack on a satellite would need to pass through the complete analysis in this Section. No part of existing international law directly prohibits targeting a satellite during an armed conflict, but additional information would be needed to make the final decision on whether or not force would be lawful in a particular instance. IHL only governs during an existing conflict, so more questions (outside the scope of this Essay) would arise if the contemplated attack would be a first strike. In an ongoing conflict, the major issues to resolve would be the legality of targeting dual-use civilian and military satellites like CHMPs, how unpredictable calculations of space debris can adequately fit into expectations of collateral damage, whether a non-kinetic ASAT is preferable to a kinetic one, and whether cyber attacks in space constitute acts of violence at all. Current law does not provide precise guidance on how to resolve these ambiguities, leaving it up to the targeting state and its legal advisors to decide.

In general, given the potential collateral damage in space as well as on Earth, the targeted satellite would need to contribute substantially to an enemy nation's military capabilities. Though destroying satellites is not inherently unlawful, the analysis from here sharply diverges for kinetic versus non-kinetic methods. Kinetic methods, because of their potential for large amounts of collateral damage as well as the damage's unpredictability, would almost never pass the proportionality requirement. Non-kinetic methods may pass, but because they also have the potential to irreversibly disrupt life back on Earth if used on many occasions, even these would only pass IHL requirements in more extreme circumstances than usual instances of lawful force

on land. Finally, IHL may also require that nations take feasible precautions by not unnecessarily and purposely placing crucial military payloads on commercial satellites, an option that has become attractive to both the military and the commercial sector. This does not necessarily mean that *all* CHMPs would need to be banned, but perhaps only those that involved critically important military payloads.

Clearly, space is not a complete legal void. The core space treaties, international humanitarian law, and other legal instruments extend their reach into space, some more clearly than others. The resulting rules and norms are sometimes clear, but mostly ambiguous, and wartime would not be an ideal moment to decide exactly how international law—and particularly the LOAC—applies to space operations. Considering the extent to which current military operations in the United States rely on space-based assets, and the clear strategic advantage this gives countries like the United States and others with similar capabilities, targeting these assets in wartime will be particularly tempting.

III. SATELLITES SHOULD GENERALLY NOT BE TARGETED

Though satellites could be lawfully targeted in some scenarios, it does not follow that they should be. First, as regards kinetic attacks, these have the potential for large-scale and irreversible destruction. Therefore, kinetic ASAT attacks should almost never occur. Non-kinetic attacks, on the other hand, may cause less destruction, but nonetheless retain the potential for large-scale damage. Normalizing non-kinetic ASAT attacks would also be disruptive to modern life. Therefore, outside of a full-scale war, non-kinetic ASAT attacks should not occur either. Unfortunately, non-kinetic ASAT capabilities are cheaper and easier to acquire. Both states and non-state actors, including independent hackers, have already acquired the capabilities to exploit

existing satellite vulnerabilities.[91] ASATs' potential for large-scale destruction has led to calls for banning anti-satellite weapons entirely.[92] The current legality of ASATs remains contested, and countries are not the only ones having difficulty resolving that question. The literature is also in disagreement on whether or not ASATs should be illegal,[93] but the answer to that question largely answers whether targeting satellites is permissible. After all, if the answer is yes, then destroying a satellite also becomes illegal, because no weapon other than an ASAT can do that. Though ASATs should only be used in extreme circumstances and in full accordance with the laws of armed conflict, a blanket ban is currently neither feasible nor necessarily desirable.

A. Feasibility of a Ban on ASATs

The most recent attempt to make serious progress on an ASAT ban has been an agreement proposed by Russia and China. The Russian-Chinese Treaty on the Prevention of the Placement of Weapons in Outer Space, the Threat or Use of Force against Outer Space Objects (PWWT), was first proposed in 2008 with a second version submitted in 2014.[94] Russia and China envisioned their document as a legally binding agreement.[95] Though the PWWT ostensibly specifically dealt with the issue of weapons in space, it left open significant gaps. For instance, most ASATs are not banned. Though not explicitly authorized by the treaty either, the PWWT does not address direct-ascent ASATs at all, and even certain co-orbital ASATs could

[91] Deborah Housen-Couriel, *Cybersecurity and Anti-Satellite Capabilities (ASAT): New Threats and New Legal Responses*, 4 J. L. & CYBER WARFARE 116, 117-18 (2015).
[92] *See* David A. Koplow, *ASAT-isfaction: Customary International Law and the Regulation of Anti-Satellite Weapons*, 30 MICH. J. INT'L L. 1187 (2009).
[93] *See, e.g.*, David A. Koplow, *supra* note 89; Shang Kuan, *Legality of the Deployment of Anti-Satellite Weapons in Earth Orbit: Present and Future*, 36 J. SPACE L. 207 (2010).
[94] Draft Treaty on the Prevention of Placement of Weapons in Outer Space, the Threat or Use of Force Against Outer Space Objects, Feb. 29, 2008, file:///Users/Downloads/PPWT.pdf [hereinafter *PWWT*]; Michael Listner & Rajeswari Pillai Rajagopalan, *The 2014 PWWT: A New Draft but with the Same and Different Problems*, SPACE REV., Aug. 11, 2014, http://www.thespacereview.com/article/2575/1.
[95] Listner & Rajagopalan, *supra* note 94.

slip in as permissible.[96] The issue of space debris, which occupies a prominent role in the EU's proposal discussed below, does not come up once in the PWWT. For its part, the United States dismissed both versions of the PWWT as "fundamentally flawed," chiefly for these reasons, while also claiming to be open to any future arms control proposals that address these issues.[97]

The European Union proposed a Code of Conduct for space in 2010.[98] Though the EU recognized the void of applicable law to new space developments and the potential dangers of a full-scale arms race in space, the Code did not address the applicability of the LOAC to space. Instead, it merely proposed that outer space should only be used for peaceful purposes, while still allowing for the right of self-defense. Importantly, the Draft Code of Conduct, characterized as a set of "best practices," is non-binding by nature.[99] The Code of Conduct also dealt extensively with measures designed to address the problem of space debris, including registration practices, notification, and registration of space objects. The legality of anti-satellite weapons was completely left out of consideration, as there was no mention of ASATs anywhere in the treaty, except by the implicit conclusion that the only force allowed in space would be self-defense.

At least part of the reason that neither of these proposals directly addressed the legality of ASATs—direct-ascent or otherwise—is that this issue remains unsettled under current law and nations are unlikely to agree on any full ban. In fact, even defining what constitutes a "weapon" in space presents difficult questions. As Donald Mahley, former Acting Deputy Assistant Secretary for Threat Reduction and Export Controls, explained in a speech in 2008, definitional problems are "compounded because some non-weapon space systems, including civil and

[96] Id.
[97] Jeff Foust, *U.S. Dismisses Space Weapons Treaty Proposal as 'Fundamentally Flawed'*, SPACE NEWS, Sept. 11, 2014, http://spacenews.com/41842us-dismisses-space-weapons-treaty-proposal-as-fundamentally-flawed/.
[98] European Council Document 14455/10, Council Conclusions Concerning the Revised Draft Code of Conduct for Outer Space Activities, 2010 [henceforth *Draft Code of Conduct*].
[99] *Draft Code of Conduct*, *supra* note 98, art. 1.3.

commercial systems, possess inherent anti-satellite capabilities."[100] Any definition that excludes those systems also leaves loopholes that can be exploited by other countries to use more traditional weapons.[101] If countries cannot even agree on what a weapon is, figuring out how to limit an undefined class of items seems an almost insurmountable goal. At this point, since little incentive exists for a blanket ban on ASATs, and any ban would not be easily negotiated, an international ASAT ban is probably not feasible.

B. Desirability of a Ban on ASATs

Even if the international community decided to ban ASATs this would present additional difficulties. First, the international community would have to decide *which kinds* of anti-satellite weapons were legal. It is safe to assume that nuclear weapons disguised as ASATs would not be allowed. But what about direct ascent and co-orbital ASATs? Kinetic or non-kinetic attacks? In assessing the available options, the following considerations are crucial. Kinetic attacks are certain to cause debris, compounding an already serious problem. One attack is not likely to have immediate, worldwide devastating consequences, but every single attack will cause lasting damage to the space environment. In addition, a norm that does not punish kinetic ASAT use increases the probability of multiple attacks, which could cause devastating consequences and accelerate the development of Kessler Syndrome.[102] The effect of multiple attacks, or even tests, of kinetic ASATs like China's 2007 test will be debris left in orbit for many decades with the potential to impact, and even destroy, all satellites that ever cross its path.

[100] Amb. Donald A. Mahley, Acting Deputy Assistant Secretary for Threat Reduction, Export Controls, Remarks at the Space Policy Institute, Jan. 24, 2008, https://2001-2009.state.gov/t/isn/rm/2008/99746.htm.
[101] Id.
[102] *Micrometeoroids and Orbital Debris*, *supra* note 39.

NASA, ESA, and others are currently working to develop technology that will remove debris in orbit.[103] This would certainly eliminate some of the worst effects of a kinetic ASAT war in space. However, damage to civil and commercial assets, especially if hosted on the same satellite as a military payload, would still be likely. If the satellites' commercial and military assets belonged to different countries, destroying the entire object could escalate conflict as well by bringing in an additional actor.

Until the technology for removing debris develops, however, states should still use caution when considering non-kinetic means of disabling satellites, like jamming and cyber attacks. Though these methods would not cause any extraneous debris since their aim is to disable and destroy only their intended target, they still have other consequences. First and foremost, cyber attacks in particular require significantly less resources. By some estimates, non-state actors may be able to acquire the capabilities for these kinds of attacks in the relatively near future.[104] An international norm that condoned these kinds of attacks would make it harder to control this threat, and terrorists in particular are less likely to abide by customary international law considerations of distinction and proportionality. Second, diminished visibility makes it harder to both confirm the success of an attack and attribute responsibility afterwards. This may be an asset for attackers seeking plausible deniability, but it also has the potential to create the kind of confusion that can unintentionally escalate an armed conflict.

Not only is a ban not feasible at present, but there may be extenuating circumstances in which using ASATs, particularly non-kinetic ASATs, would realistically be necessary. A blanket ban on all ASATs is therefore neither realistic nor desirable. If a proposal to limit ASATs did go forward, however, it would be most useful if it severely limited the use of kinetic ASATs and

[103] Listner & Rajagopalan, *supra* note 94.
[104] *Cyber and Space*, CHATHAM HOUSE, http://www.unidir.ch/files/conferences/pdfs/a-review-of-the-chatham-house-space-and-cyber-linkages-project-en-1-983.pdf.

made clear that even non-kinetic attacks should only occur when in instances of absolute military necessity.

CONCLUSION

Space developments over the past few decades have transformed communications, military operations, and other aspects of daily life. The booming space sector presents new economic opportunities, but international law has not kept pace with this progression. Instead, while space-based assets have become tempting targets for the next armed conflict, existing treaties and the LOAC leave ambiguities as to the legality of targeting these assets. Political considerations mean that a new international treaty on space is unlikely to occur soon, and recent efforts to reach international consensus have largely failed to clarify any pressing issues. Instead, countries will likely be left to their own devices in resolving legal questions related to space in the next major armed conflict between space powers. International law does not currently ban targeting satellites in wartime, and under customary IHL, there may be scenarios in which targeting a satellite would be considered a lawful use of force. The risk to both civilian assets and all other satellites is therefore high, and careful attention should be paid to the decision to engage in space war. In the meantime, the international community should continue to try reaching a consensus on less controversial aspects of space, while clarifying that the LOAC does apply, and deciding which adaptations, if any, are both feasible and necessary for space. Kinetic ASAT attacks should be avoided, while non-kinetic attacks should only be used when absolutely necessary.