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State Practice and Military Objectives: International Humanitarian Law Regarding Military Applications of Otherwise Civil/Commercial Satellites

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STATE PRACTICE AND MILITARY OBJECTIVES: INTERNATIONAL HUMANITARIAN LAW REGARDING MILITARY APPLICATIONS OF OTHERWISE CIVIL/COMMERCIAL SATELLITES

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ABSTRACT

In his article Reverse Distinction: A U.S. Violation of the Law of Armed Conflict in Space, Professor David Koplow argues that the intermingling of military capabilities with civilian objects on satellites violates the requirement from Article 58, Additional Protocol 1, for combatants to protect civilians and civilian objects from the effects of attacks.1 This paper challenges that assertion in multiple ways.

First, Professor Koplow's argument requires that a satellite can be sub-divided into multiple objects for the purpose of conducting an analysis under IHL. In other words, a satellite must consist of both a protected civilian object and a lawful military objective. However, under either of the two currently accepted approaches for determining the granularity with which something must be analyzed in order to determine whether it comprises a lawful military objective, satellites should be considered a single object. Because satellites are a single object, they are either a protected civilian object or a lawful military objective — not both. For this reason, there can be no violation of Article 58.

Further, the widespread and consistent practice of States does not square with an interpretation of IHL that reads the practice of using otherwise civil/commercial satellites for military purposes as unlawful. To the contrary, the clear trend among States is to increase military uses of otherwise civil/commercial satellites. Interestingly, not only do States appear to be expanding their own military uses of otherwise civil/commercial satellites, but States also appear to be largely accepting of other States taking these same actions. This State practice must be considered when interpreting international law as it applies in outer space.

ABBREVIATIONS

ASAT — Anti-satellite (weapon)
C4ISR — Command, Control, Communications, Computers, (C4) Intelligence, Surveillance, and Reconnaissance (ISR)
CASC — China Aerospace Science and Technology Corporation
CASIC — China Aerospace Science and Industry Corporation
CCP — Communist Party of China
CHIRP — Commercially Hosted Infrared Payload
CRAF — U.S. Civil Reserve Air Fleet
CSCO — Commercial Satellite Communications Office
DARPA — Defense Advanced Research Projects Agency
DOD — U.S. Department of Defense
EPS-R — Enhanced Polar System Recapitalization
EU — European Union
GEO — Geostationary/Geosynchronous earth orbit
GLONASS — Russia's Global Navigation Satellite System
GNSS — Global Navigation Satellite System
GPS — Global Positioning System
ICBM — Intercontinental Ballistic Missile
ICJ — International Court of Justice
ICRC — International Committee of the Red Cross
IHL — International Humanitarian Law
ISR — Intelligence, Surveillance, and Reconnaissance
JADC2 — Joint All-Domain Command and Control
JDAM — Joint Direct Attack Munition
JSOW — Joint Standoff Weapon
LEO — Low Earth Orbit
MCF — Military-Civil Fusion
MEO — Medium Earth Orbit
NASA — U.S. National Aeronautical and Space Administration
OST — Outer Space Treaty of 1967
PLA — People's Liberation Army
PNT — Position, Navigation, and Timing
POD — Payload Orbital Delivery
QKD — Quantum Key Distribution
RSGS — Robotic Servicing of Geosynchronous Satellites
SATCOM — Satellite Communication
SKA — Space-based Kill Assessment
UN — United Nations
UNCLOS — U.N. Convention on the Law of the Sea
UNCOPUOS — United Nations Committee on the Peaceful Uses of Outer Space
USCENTCOM — U.S. Central Command

INTRODUCTION

"Ukraine civilian Internet was experiencing strange outages – bad weather perhaps? – so SpaceX is helping fix it." - Elon Musk[1]

In his article *Reverse Distinction: A U.S. Violation of the Law of Armed Conflict in Space*, Professor David Koplow argues that intermingling military capabilities with civilian objects on satellites violates the law of armed conflict, also known as international humanitarian law (IHL).[2] He argues that the practice of hosting military capabilities on civilian satellites invites attack upon them and therefore violates the requirement from Article 58, Additional Protocol 1, for combatants to protect civilians and civilian objects from the effects of attacks.[3] Professor Koplow terms this obligation "reverse distinction."[4] Professor Koplow's claim carries enormous implications for military attorneys and commanders who seek to advise on and carry out military operations in accordance with the requirements of international humanitarian law. But if Professor Koplow's argument is correct, then one must acknowledge that the existing and anticipated future practice of States trends toward a widespread and consistent breach of these international obligations.

This paper raises two critiques of Professor Koplow's thesis, arguing that the practice of intermingling military uses with otherwise civil/commercial satellites does not violate Article 58. First, currently accepted interpretations of IHL would not classify a satellite as separate objects for analysis; a satellite is either a protected civilian object or a lawful military objective. For this reason, the text of Article 58 –which inherently requires the existence of both a civilian object and a military objective to be at issue – is not implicated by military uses of otherwise civil/commercial satellites. Second, the trend of State practice in this area is toward a widespread and consistent acceptance of the lawfulness of using otherwise civil/commercial satellites for military purposes.

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* The views expressed in this thesis are those of the author and do not reflect the official policy or position of the United States Air Force, Department of Defense, or the U.S. Government. The author has used only information available to the public in the researching and presentation of his work.

[1] Elon Musk (@elonmusk), Twitter (Mar. 2, 2022, 7:25 PM), https://twitter.com/elonmusk/status/1499194255688019971?lang=en.

[2] DAVID KOPLOW, R*everse Distinction: A U.S. Violation of the Law of Armed Conflict in Space*, 13 Harv. Nat'l Sec. J. 25 (2022).

[3] *Id.*, at 79–83.

[4] *Id.*, at 32.

This thesis proceeds in four parts. After the introduction, this thesis presents the contemporary example of the Ukrainian military utilizing SpaceX's Starlink services in its defensive campaign against Russia's unlawful aggression. This example provides an enormously relevant contemporary example of State practice of military uses of otherwise civil/commercial satellites and the apparent acceptance or acquiescence of other States, including Russia, toward that use.

Next, Part II provides an introduction to useful terminology and then broadly surveys publicly available information regarding the practice of States with respect to their military uses of otherwise civil/commercial satellites. This section focuses particularly but not exclusively on the U.S., China, Russia, and India and primarily seeks to highlight military integrations with the commercial space sector.

Moving from this factual background, Part III first analyzes how the test in IHL for identifying military objectives may apply to satellites in outer space and concludes that the current state of the law does not support Professor Koplow's argument that the practice of hosting, embedding, or obtaining military capabilities on or from otherwise civil/commercial satellites is unlawful. The second portion of Part III considers how State practice can influence the development and interpretation of international law. State practice could either revise the obligations of States in the space domain, or State practice could evince that States interpret their obligations differently in space from other geographic domains like air, land, or sea. This part highlights that the practice of States – not only the U.S. – demonstrates a widespread and consistent acceptance of the practice of using otherwise civil/commercial satellites for military purposes. This reality must be considered in any interpretation of IHL as it applies in the space context. Finally, this part acknowledges areas within which State practice may define the contours of the application of IHL, thereby bringing Professor Koplow's concerns back to the fore.

Finally, Part IV concludes with a recommendation that the U.S. generally recognize that the metes and bounds of the legality of the practice of using otherwise civil/commercial satellites for military purposes very easily may form in the near future. An armed attack against an otherwise civil/commercial satellite may prove to be a "Groatian moment" sufficient to harden new international obligations. The U.S. should be prepared to respond to such an attack in a way that steers the development of international law toward its long-term strategic interests.

I. A PARADIGM SHIFT IN MILITARY APPLICATIONS OF COMMERCIAL ASSETS

The remarkable advances of commercial space actors in recent years have dramatically expanded the landscape of options available to military actors seeking to engage in or enhance their space activities. SpaceX's Starlink provides high-speed, low-latency broadband satellite Internet to consumers in 32 countries,[5] with planned coverage for nearly every State on earth by 2023 (excluding Iran, Afghanistan, Syria, Russia, China, Belarus, Cuba, and Venezuela).[6] The Starlink system is a proliferated constellation of over 2,200 satellites currently in orbit with another approximately 2,200 planned to be in orbit soon.[7] "Proliferation" in this context means "deploying larger numbers of the same platforms, payloads or systems of the same types to perform the same mission."[8] Satellite constellations like Starlink are proliferated systems because each satellite has the same capability, making the system overall more resilient.[9] Another U.S. company, OneWeb, operates a smaller (but still massive by historical standards) satellite constellation providing similar services.

The ongoing armed conflict in Ukraine provides an incredibly unfortunate but highly relevant lens through which to view the practice of hosting, embedding, or obtaining military capabilities on or from otherwise civil/commercial satellites like the Starlink and OneWeb systems. Ukraine's military use of commercial space services portends a qualitative shift in the military usage of otherwise civil/commercial satellites that deserves attention.

One hour before Russia began its unlawful attack upon Ukraine, Russian hackers launched a massive cyberattack against OneWeb.[10] The Ukrainian military had relied upon OneWeb for military command and control functions.[11] The

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[5] Stephen Clark, *SpaceX passes 2.500 satellites launched for Starlink internet network*, SPACEFLIGHT NOW (May 13, 2022), https://spaceflightnow.com/2022/05/13/spacex-passes-2500-satellites-launched-for-companys-starlink-network/#:~:text=The%204%2C400%20satellites%20will%20be,as%20many%20as%2042%2C000%20satellites.

[6] Starlink Availability Map, last accessed 19 July 2022, https://www.starlink.com/map

[7] Clark, *supra* note 6.

[8] OFF. OF THE ASSISTANT SEC'Y OF DEF. FOR HOMELAND DEF. & GLOBAL SEC., SPACE DOMAIN MISSION ASSURANCE: A RESILIENCE TAXONOMY 8-9 (2015), *available at* https://man.fas.org/eprint/resilience.pdf [hereinafter "Resilience Taxonomy White Paper"].

[9] *Id*. at 9.

[10] In the hour before attacking Ukraine, the Russian military targeted ViaSat, a U.S. satellite communications and satellite broadband Internet service provider. *See* Patrick H. O'Neill, *Russia hacked an American satellite company one hour before the Ukraine invasion*, MIT TECHNOLOGY REVIEW (May 10, 2022), https://www.technologyreview.com/2022/05/10/1051973/russia-hack-viasat-satellite-ukraine-invasion/.

[11] *Id*.

cyberattack resulted in an "immediate and significant loss of communication in the earliest days of the war for the Ukrainian military… ."[12] In the days that followed, Ukraine publicly called for assistance from Elon Musk to activate Starlink in Ukraine.[13] Musk obliged and sent additional Starlink terminals to Ukraine's aid.[14] Naturally, Russia took efforts to degrade the Starlink system as well, but Starlink proved highly resilient in the face of these attacks.[15] As reported by Politico:

> The conflict in Ukraine also has provided Musk and SpaceX s fledgling satellite network with a trial-by-fire that has whetted the appetite of many Western militaries. Commanders have been impressed by the company s ability, within days, to deliver thousands of backpack-sized satellite stations to the war-torn country and to keep them online despite increasingly sophisticated attacks from Russian hackers.[16]

While the resilience of Starlink to attacks from Russian hackers may be surprising, the appetite for militaries to use the services of commercial space companies is anything but.

Ukraine may not be a major space power, but it very well may be the first military to openly rely upon purchased commercial services to directly enable actual kinetic military operations. It has been reported that Ukraine's military now actively relies on SpaceX's Starlink constellation to support a variety of military operations, including "drop[ping] bombs on Russian forward positions."[17] It has been reported that "Ukraine s aerial reconnaissance force has used Starlink to connect directly to drones that have knocked out numerous Russian tanks, mobile command centers, and other military vehicles."[18] Starlink is also enabling

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[12] *Id.*

[13] Fatma Khaled, *Ukraine Official Asks Elon Musk for Starlink Stations Amid Russian Invasion,* NEWSWEEK (Feb. 26, 2022, 11:51 AM), *available at* https://www.newsweek.com/ukraine-official-asks-elon-musk-starlink-stations-amid-russian-invasion-1682977.

[14] Michael Sheetz, *Elon Musk's SpaceX sent thousands of Starlink satellite internet dishes to Ukraine, company's president says,* CNBC.com (Mar. 22, 2022), *available at* https://www.cnbc.com/2022/03/22/elon-musk-spacex-thousands-of-starlink-satellite-dishes-sent-to-ukraine.html.

[15] Christopher Miller, Mark Scott, and Bryan Bender, *UkraineX: How Elon Musk's space satellites changed the war on the ground*, POLITICO (June 9, 2022, 4:30 AM), *available at* https://www.politico.com/news/2022/06/09/elon-musk-spacex-starlink-ukraine-00038039.

[16] *Id.*

[17] *Id.*

[18] Vivek Wadhwa and Alex Salkever, *How Elon Musk's Starlink Got Battle-Tested in Ukraine,* Foreign Policy (May 4, 2022, 9:13 AM), *available at* https://foreignpolicy.com/2022/05/04/starlink-ukraine-elon-musk-satellite-internet-broadband-drones/.

Ukrainian "soldiers to fire anti-tank weapons with targeted precision."[19] Additional military uses of Starlink include military communications and Ukrainian President Volodymyr Zelenskyy holding Zoom calls with allied political leaders to call for more foreign military support.[20] The effect of Ukraine's use of Starlink for military purposes has been to "thwart[] Russia's efforts to cut the Eastern European country off from the outside world" and to "totally destroy[] [Vladimir] Putin's information campaign."[21]

Just a week after Russia's invasion of Ukraine, Russia's ROSCOSMOS refused to launch a batch of OneWeb satellites unless the U.K. sold its shares of OneWeb and OneWeb could guarantee that the internet constellation would not be used for military purposes.[22] Russia also may have been concerned with the increased possibility its citizens would have access to the free Internet, which would tend to undermine state propaganda efforts.[23] Not surprisingly, the satellites were not launched. But despite Russian threats that OneWeb would be unable to finish its constellation without Russian assistance,[24] OneWeb contracted for launch services for these same satellites with SpaceX just 18 days after the cancelled Russian launch.[25] Notably, Russia has not complained in any official sense about the legality of OneWeb being used for military purposes – either at the time of demanding such a guarantee or when OneWeb contracted for a launch with SpaceX.

What may be even more remarkable than Ukraine's reliance on commercial systems to directly support battlefield combat operations is how unremarkable States seem to find the activity. No States have yet officially protested Ukraine's use of Starlink in this manner. Other than a Twitter feud between former-ROSCOSMOS chief Dmitry Rogozin and Elon Musk wherein Rogozin criticized

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[19] Alexander Freund, *Ukraine is using Elon Musk's Starlink for drone strikes*, Deutsche Welle (Mar. 27, 2022), *available at* https://www.dw.com/en/ukraine-is-using-elon-musks-starlink-for-drone-strikes/a-61270528.

[20] Miller, Scott, and Bender, *supra* note 16.

[21] *Id.*

[22] Michael Sheetz, *OneWeb's internet satellites caught in UK-Russia standoff days before launch*, CNBC.COM (Mar. 2, 2022, 8:52 AM), *available at* https://www.cnbc.com/2022/03/02/russias-roscosmos-refusing-to-launch-oneweb-internet-satellites.html; Ryan Duffy, *LEO Megaconstellations Are… Dual-Use?* PAYLOAD SPACE (Mar. 4, 2022), *available at* https://payloadspace.com/megaconstellations-dual-us/.

[23] Anatoly Zak, *Russia's love-hate relationship with OneWeb*, RUSSIANSPACEWEB.COM (Mar. 21, 2022), *available at* https://www.russianspaceweb.com/oneweb.html.

[24] Sheetz, *supra* note 23.

[25] Stephen Clark, *OneWeb signs with SpaceX to resume launching internet constellation*, SPACEFLIGHT NOW (Mar. 21, 2022), *available at* https://spaceflightnow.com/2022/03/21/oneweb-signs-with-spacex-to-resume-launching-internet-constellation/#:~:text=OneWeb%20said%20Monday%20it%20has,launches%20on%20Russian%20Soyuz%20rockets.

Musk for providing Ukraine with "purely civilian" Starlink equipment,[26] even Russia has not officially complained about the arrangement. To the contrary, the Russian military has made efforts to degrade Starlink's capabilities through cyber-attacks[27] - just as it did with OneWeb and as it might do if Starlink was a purely military system. No States, including the U.S., have protested that these Russian actions toward OneWeb and Starlink violate IHL.

Considering that 70% of Americans now consider Russia an enemy of the United States,[28] it may not be surprising that the U.S. has not protested Ukraine s use of Starlink for kinetic military purposes in its self-defense. But this lack of protest is nevertheless remarkable because such use might run counter to the expressed U.S. intent of supporting Ukraine against Russia s aggressive attack without engaging directly in hostilities itself. The U.S. has drawn a policy line between assistance like providing weapons and actions like establishing a No-Fly-Zone as doing so would invite direct conflict between U.S. and Russian air forces.[29] But the U.S. is internationally responsible for Starlink's actions. Article VI of the 1967 Outer Space Treaty provides in part:

> States Parties to the Treaty shall bear international responsibility for national activities in outer space, including the moon and other celestial bodies, whether such activities are carried on by governmental agencies or by non-governmental entities, and for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty.[30]

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[26] Katya Pavlushchenko (@katlinegrey), Twitter Mar. 2, 2022), https://twitter.com/katlinegrey/status/1499105359751004165; Elon Musk (@elonmusk), Twitter (Mar. 2, 2022, 7:25 PM), https://twitter.com/elonmusk/status/1499194255688019971?lang=en.

[27] Elizabeth Howell, *Elon Musk says Russia is ramping up cyberattacks on SpaceX's Starlink systems in Ukraine*, SPACE.COM (May 12, 2022), *available at* https://www.space.com/starlink-russian-cyberattacks-ramp-up-efforts-elon-musk.

[28] Richard Wike et al, *Seven-in-Ten Americans Now See Russia as an Enemy*, PEW RESEARCH CENTER (Apr. 6, 2022), *available at* https://www.pewresearch.org/global/2022/04/06/seven-in-ten-americans-now-see-russia-as-an-enemy/.

[29] Nancy A. Youssef, *What Is a No-Fly Zone and Why Has NATO Rejected Ukraine's Calls for One?*, THE WALL STREET JOURNAL (Mar. 18, 2022, 11:38 AM), *available at* https://www.wsj.com/articles/what-is-no-fly-zone-ukraine-russia-nato-us-11646783483.

[30] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies art. 6, *adopted* Dec. 5, 1979, 18 U.S.T. 2410, 610 U.N.T.S. 205 [hereinafter Outer Space Treaty].

Therefore, a strict reading of Article VI could bring the U.S. directly into an armed conflict with Russia[31] if the actions of Starlink qualify as either a direct participation in hostilities or otherwise rise to the level of hostilities sufficient to constitute an armed attack under international law.

II. THE PRACTICE OF STATES

Military uses of space are nothing new. From the dawn of the space age, space objects have served military purposes.[32] Spanning from the development of ICBMs in the late 1950s, the use of satellites as "national means of verification" during the Cold War, the use of GPS-location data and SATCOM services in the Gulf War, and the contemporary use of satellites to enable more precise targeting through weapons such as JDAMs and JSOWs, military uses of space have greatly increased in scope and importance over time. Yet the rise of commercial actors in this field presents a qualitatively different operating environment. Commercial space actors can make immediate and meaningful impacts in on-going armed conflicts. They can also provide State militaries with robust capabilities, increased space system resiliency, access to innovation pipelines, and ready-made solutions that might otherwise be entirely unaffordable and inaccessible.

Building on a trend toward increasing proficiency over the last several decades, commercial actors now possess incredibly sophisticated capabilities in terms of space launch, remote imaging, communications, broadband internet, and more. Naturally, many militaries see these increased commercial capabilities as an opportunity for them to tap into the commercial marketplace and benefit from potential cost savings and efficiencies as well as to increase the resilience of their military capabilities.

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[31] According to Dr. Dale Stephens, the Woomera Manual will "note the potential for companies being able to plunge States into Armed conflict (vis-a-vis common Art 2 of the Geneva Conventions) or to otherwise be responsible for uses of force/armed attacks vis-a-vis the UN Charter." *See* Charlie Dunlap, *Are commercial satellites used for intelligence gathering in attack planning targetable?*, LAWFIRE (Mar. 5, 2021), *available at* https://sites.duke.edu/lawfire/2021/03/05/are-commercial-satellites-used-for-intelligence-gathering-in-attack-planning-targetable/.

[32] CHARLES J. DUNLAP, JR., TECHNOLOGY AND THE 21ST CENTURY BATTLEFIELD: RECOMPLICATING MORAL LIFE FOR THE STATESMAN AND THE SOLDIER 22-23 (1999) ("Since the very beginning of space exploration, however, military and civilian developments commingled to a such a degree that '"he separation of military from civilian . . . space technology [is] meaningless.' While there are some purely military systems today, the United States itself relies heavily on civilian satellites, many of which are owned by international consortiums." (internal citations omitted)), *available at* https://scholarship.law.duke.edu/cgi/viewcontent.cgi?article=5192&context=faculty_scholarship.

A. Terminology

This paper uses the phrase "otherwise civil/commercial satellites" to identify the class of satellites that would clearly be "civilian objects" under international humanitarian law but for intended or actual military uses that could qualify the satellites as lawful "military objectives." The point of using the phrase is to highlight the potential doubt cast upon the protected status of the satellites as a result of their actual or intended military uses. This paper uses the phrase "otherwise civil/commercial satellites" to include satellites owned and operated by civil or commercial entities from which a military has either purchased or leased services, from which a military has purchased a "ride-share" on-board the satellite for a hosted payload (i.e., military transponder or sensor),[33] or with which a military has co-developed the satellite with the civil or commercial entity with the intent for it to serve both civil/commercial and military purposes. The term "otherwise civil/commercial satellites" includes satellites or constellations of satellites that are owned and operated either by 1) civil agencies of a State, 2) commercial space companies, or even 3) militaries of a State that provide both civil/commercial and military uses such as with the U.S.'s GPS constellation. Civil agencies may include civil space exploration agencies (e.g., NASA, ROSCOSMOS[34]). Such agencies may also include weather forecasting agencies (e.g., National Oceanic and Atmospheric Administration). Commercial space companies include examples such as the U.S. company SpaceX and the creatively named Chinese company Expace, a wholly owned subsidiary of China Aerospace Science and Industry Corporation (CASIC), which is a defense-oriented Chinese state-owned company.[35]

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[33] The term 'ride-share' in this context can refer either to a situation wherein "a single commercial rocket may boost multiple, diverse types of satellites into orbit, or in which a single satellite 'bus' may contain and continuously support a variety of quite distinct modules." - *See* Koplow, *supra* note 3, at 70.

[34] Notably, while ROSCOSMOS is a civil space agency, its former-director had aligned the agency more closely with the Russian military in recent weeks. This matter is discussed further in the discussion regarding Russian military use of civil and commercial space assets. As of 15 July 2022, Rogozin was removed from his position as the director of ROSCOSMOS by presidential decree. This move coincided with a U.S.-Russian agreement to carry Cosmonauts to the ISS via SpaceX rockets. Christian Davenport, *Russia replaces space agency head as NASA plans new joint missions*, THE WASHINGTON POST (July 15, 2022, 11:43 AM), *available at* https://www.washingtonpost.com/technology/2022/07/15/nasa-soyuz-spacex-cooperation/.

[35] Eduardo Baptista, *Chinese commercial rocket company reaches new heights with latest funding* round, REUTERS (June 29, 2022, 4:38 AM), *available at* https://www.reuters.com/lifestyle/science/chinese-commercial-rocket-company-reaches-new-heights-with-latest-funding-round-2022-06-29/.; *Introduction of CASIC*, CHINA AEROSPACE SCIENCE AND INDUSTRY CORPORATION LIMITED, *available at* http://www.casic.com/n189298/n189314/index.html

Increased reliance on commercial actors opens the door to new ways to increase the resilience of military capabilities. With a focus on maintaining a capability rather than preserving a particular asset, the importance of any one single satellite diminishes. Instead, the focus becomes building a resilient satellite architecture,[36] which opens the door to even more ways in which militaries may use otherwise civil/commercial satellites. To describe the ways in which States may more thoroughly integrate civil/commercial systems in their military planning, this paper adopts the resilience taxonomy set forth in the Office of the Assistant Secretary of Defense for Homeland Defense & Global Security's 2015 Resilience Taxonomy White Paper.[37] These terms are useful in describing State behavior as accurately as possible in order to analyze that behavior within the framework of developing customary international law.

"Disaggregation" is the "separation of dissimilar capabilities into separate platforms or payloads."[38] Disaggregation can serve many functions, including to improve the resilience of a system or to reduce the complexity of a system.[39] Additionally, in the case of separating tactical and strategic assets, disaggregation can "reduce the risk of uncontrolled escalation during a crisis or conflict."[40]

"Distribution" is defined as "utilizing a number of nodes, working together, to perform the same mission or functions as a single node." The 2015 Resilience Taxonomy provides GPS as an example of a distributed system because "no individual satellite, or ground monitoring site… is fundamental to assuring positioning, navigation, and timing (PNT) in any one specific location."[41]

"Diversification" means "contributing to the same mission in multiple ways, using different platforms, different orbits, or systems and capabilities of commercial, civil, or international partners."[42] A military may diversify its space-based capabilities, for example, by utilizing a combination of its own communications systems, commercial communications systems, and even foreign communications systems in order to increase the likelihood that the warfighter always has at least one means of communication available - even if another is degraded or destroyed. The White Paper estimated that by 2020 there would be over 140 individual PNT satellites in orbit across no fewer than nine separate satellite constellations.[43]

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[36] Sandra Erwin, *DoD seeks ideas for connecting government and commercial satellites*, SPACENEWS (Oct. 1, 2021), *available at* https://spacenews.com/dod-seeks-ideas-for-connecting-government-and-commercial-satellites/.
[37] Resilience Taxonomy White Paper, *supra* note 9.
[38] *Id*., at 7.
[39] *Id*.
[40] *Id*.
[41] *Id*., at 6-7.
[42] *Id*., at 8.
[43] *Id*., at 7.

"Proliferation" means "deploying larger numbers of the same platforms, payloads or systems of the same types to perform the same mission."[44] Satellite constellations like Starlink are proliferated systems because each satellite has the same capability. A system can also become proliferated by "increasing the number of downlink and data processing facilities."[45]

Purchasing or leasing existing services represents the simplest and most accessible way for State militaries to benefit from otherwise civil/commercial satellites. Indeed, "[m]ilitary use of services provided by satellites possessed and operated by non-military actors (civil satellites and commercial satellites) has become common internationally." [46] Examples of this arrangement include militaries purchasing satellite communications (SATCOM) services or remote imagery.

In addition to simply purchasing available services, another mode by which militaries can use the commercial space industry to augment their military capabilities is through hosted payloads or other dual-use satellites. This paper uses the term "hosted payload" to describe opportunistic purchasing of space for a military payload aboard an otherwise civil/commercial satellite. This paper uses the term "dual-use" to refer to technologies and capabilities possessed by space objects which are useful for both military and civil/commercial functions. Referring to a satellite as a "dual-use satellite" is short-hand for describing a satellite that possesses technology useful for both military and civil/commercial functions.

Importantly, whether the owner and operator of the satellite intends at present for the satellite to serve both military and civil/commercial functions is not relevant to its classification as a dual-use satellite. What matters for the classification is the potential use of the satellite. Dual-use satellites could include, for example, military PNT constellations like GPS, commercial SATCOM constellations like VIASAT, or civil on-orbit servicing capabilities.

As discussed in more detail below, for the purpose of qualifying as a military objective under IHL, the difficulty with analyzing dual-use satellites is identifying and distinguishing between their *intended* and *potential* uses. Potential military applications of an object may render the object dual-use, but potential uses alone do not render the object as a lawful military objective per se. Indeed, IHL prohibits targeting objects in armed conflict purely because of their potential uses when there does not exist intelligence of intended military uses.

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[44] *Id*., at 8-9.
[45] *Id*., at 9.
[46] NAT'L INST. FOR DEF. STUDIES, NIDS CHINA SECURITY REPORT 2021: CHINA'S MILITARY STRATEGY IN THE NEW ERA 51 (2021), *available at* http://www.nids.mod.go.jp/publication/chinareport/pdf/china_report_EN_web_2021_A01.pdf [hereinafter NIDS Report].

Certainly, the issue of distinguishing between *intended* and *potential* uses of technology drives a significant amount of international tension. The same technology that can generate abundant energy for civilian use can enable the development of nuclear weapons. The same technology that can launch objects into space for peaceful purposes can similarly deploy warheads. And the same satellite-enabled GNSS technology that enables civilians to navigate their cars to the local coffee shop can also guide munitions to their intended targets. Undoubtedly, many States are often less than transparent about their *intended* uses for dual-use technologies.

B. State Practice

Having previously addressed the contemporary example of Ukraine's military use of the Starlink satellite constellation, this section introduces a survey of the practices of the U.S., China, Russia, and India with respect to military uses of otherwise civil/commercial satellites. Of course, other States are engaged in similar practices as well. The European Space Agency (ESA), for example, operates the Galileo global navigation satellite system (GNSS) described as "a civil system that will be deployed and operated by a private concessionaire." According to ESA, "it would be natural for Galileo to be used by military users as today they are using the civilian GPS signal."[47] Similarly, the EU's Copernicus earth observation satellite constellation is intended in part to provide satellite information for "European external actions such as peacekeeping… ."[48]

i. The United States

The U.S. uses of otherwise civil/commercial satellites for military purposes runs the gamut from the purchase or lease of existing commercial services to hosted payloads and other dual-use satellites such as the GPS constellation. This section will show that the U.S. military's reliance on otherwise civil/commercial satellites continues to increase.

The trajectory toward increased U.S. reliance on the commercial sector for SATCOM services is clear. It has been reported that 20% of U.S. satellite communications in Operation Desert Storm took place through commercial

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[47] *Frequently asked questions on Galileo*, THE EUROPEAN SPACE AGENCY, https://www.esa.int/Applications/Navigation/Frequently_asked_questions_on_Galileo

[48] *Copernicus* Benefits, EUROPEAN UNION AGENCY FOR THE SPACE PROGRAMME (May 24, 2021), https://www.euspa.europa.eu/european-space/copernicus/copernicus-benefits#:~:text=Copernicus%20is%20crucial%20for%20Europe's,future%20for%20all%20European%20citizens.

sources.[49] Following the Gulf War, the U.S. Congress directed the Department of Defense "to study ways of using commercial communication satellite capabilities" and begin moving aggressively toward maximum utilization of commercial satellite communications systems."[50] By 2003, the U.S. military bandwidth requirements exceeded DOD capabilities,[51] and Congress's effort to increase military reliance on commercial SATCOM resulted in 80% of U.S. satellite communications occurring through commercial sources by Operation Iraqi Freedom.[52] From 2006-2007, USCENTCOM relied on commercial SATCOM for over 95% of its SATCOM bandwidth.[53] In 2013, the U.S. even contracted with a Chinese state-owned satellite communications service provider to lease SATCOM bandwidth in support of U.S. military operations in Africa.[54]

Today, the Space Force hosts a Commercial Satellite Communications Office (CSCO) specifically for the purpose of procuring commercial SATCOM bandwidth, and the CSCO specifically broadcasts its anticipated needs to the commercial industry.[55] CSCO has indicated it plans to award $2.3 billion worth of commercial SATCOM contracts in the next two years alone.[56] By purchasing SATCOM services from multiple companies as well as relying on its own native capabilities, the U.S. military effectively diversifies the means through which combatants might access communications services, ensuring that one source will always be available and thereby increasing the resilience of the U.S. military's SATCOM capability.

It is hard to overstate the extent to which the U.S. military relies upon commercial SATCOM capabilities and how likely it is for the U.S. to increase its

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[49] Benjamin D. Forest, An Analysis of Military Use of Commercial Satellite Communications 10 (Sept. 1, 2008) (unpublished Master of Science Thesis, Naval Postgraduate School) (on file with Defense Technical Information Center, *available a*t https://apps.dtic.mil/sti/citations/ADA488621).

[50] *Id*., at 11.

[51] Andrew Stanniland & Denis Curtin, *An Examination of the Governmental Use of Military and Commercial Satellite Communications, in* HANDBOOK OF SATELLITE APPLICATIONS 4 (Joseph N. Pelton et al. eds., 2d ed. 2017), *available at* https://link.springer.com/referenceworkentry/10.1007/978-1-4614-6423-5_8-3?noAccess=true.

[52] *Id*.; Forest, *supra* note 50.

[53] *Id.*

[54] Timothy M. Bonds & Isaac R. Porche III, *Satellites for Rent: Commentary*, THERANDBLOG (Nov. 8, 2013), *available at* https://www.rand.org/blog/2013/11/satellites-for-rent.html.

[55] Mike Nichols, *Satellite Communications Office Forecast to Industry* [PowerPoint Presentation], HEADQUARTERS, U.S. SPACE FORCE (Oct. 29, 2021), *available at* https://www.disa.mil/-/media/Files/DISA/News/Events/Forecast-to-Industry---2021/01---US-Space-Force-Commercial-Satellite-Communications-Office---Nichols.ashx.

[56] Sandra Erwin, *DoD Satcom: Big money for military satellites, slow shift to commercial services*, SPACENEWS (June 22, 2022), *available at* https://spacenews.com/dod-satcom-big-money-for-military-satellites-slow-shift-to-commercial-services/.

dependence on the commercial sector for these services even more in the future. As the U.S. military moves toward implementing Joint All-Domain Command and Control (JADC2),[57] it will have unprecedented data transfer requirements. Further, according to General Kevin P. Chilton, USAF (Ret.) and Lukas Autenried of the Mitchell Institute for Aerospace Studies,

> Improvements in sensor quality; the use of more data-intensive forms of intelligence, surveillance, and reconnaissance (ISR); and the proliferation of cheap and ubiquitous sensors among both government and commercial entities has led to an exponential growth in the amount of data being collected and available to be pushed to decision-makers and other consumers of data.[58]

It is hard to see U.S. reliance on commercial SATCOM decreasing as it continues to deploy more sensors - each creating more data than ever - to conduct more missions. Indeed, the 2022 National Defense Authorization Act further pushes the DOD in this direction with a requirement for the Pentagon to brief lawmakers on the military's plan to "operationalize commercial satellite communication capabilities using non-geostationary orbit satellites… ."[59]

In addition to SATCOM communication services, the U.S. military subscribes to broadband satellite internet services. [60] The advent of large, proliferated commercial satellite constellations providing broadband satellite internet services from LEO could be particularly desirable for military planners as constellations in LEO offer the potential for faster communications relative to GEO systems - speeds that could "be the difference between a successful intercept [of a hypersonic missile] or mission failure."[61]

In sum, the U.S. has used both domestic and foreign commercial satellite services in support of its own military operations, and such use is only likely to continue and increase. As discussed above regarding Ukraine, the U.S. has also

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[57] *See* U.S. Dep't of Def., *Summary of the Joint All-Domain Command & Control (JADC2) Strategy* (Mar. 2022), *available at* https://media.defense.gov/2022/Mar/17/2002958406/-1/-1/1/SUMMARY-OF-THE-JOINT-ALL-DOMAIN-COMMAND-AND-CONTROL-STRATEGY.PDF

[58] Gen. Kevin P. Chilton (USAF, Ret.) & Lukas Autenried, *The Backbone of JADC2: Satellite Communications for Information Age Warfare* 12, THE MITCHELL INSTITUTE (Vol. 32, Dec. 2021), *available at* https://mitchellaerospacepower.org/wp-content/uploads/2021/12/The_Backbone_of_JADC2_Policy_Paper_32-ver2.pdf.

[59] National Defense Authorization Act for Fiscal Year 2022, § 1614(b)(1).

[60] *See e.g.*, Greg Hadley, *Multiple Air Force Units Buy SpaceX's Starlink Satellite Internet Service*, AIR FORCE MAGAZINE (Aug. 9, 2022), *available at* https://www.airforcemag.com/multiple-air-force-units-buy-spacexs-starlink-satellite-internet-services/.

[61] *Id*., at 19.

allowed a foreign military to use its own commercial systems even when such use might not comport neatly with stated U.S. policy. Taken together, the practice of the U.S. would suggest a broad and accepting stance toward military uses of purchased or leased commercial services.

The U.S. uses hosted payloads for military purposes far less frequently than it purchases commercial SATCOM services for military purposes. Nevertheless, the U.S.'s use of hosted payloads seems to be increasing as well. Prior to 2019, the U.S. had launched only three experimental hosted payloads on otherwise civil/commercial satellites.[62] One of these was the Commercially Hosted Infrared Payload (CHIRP), "which was launched aboard the SES-2 telecommunications satellite owned by fleet operator SES of Luxembourg."[63] Despite the small number of hosted payload satellite arrangements launched, the U.S. Department of Defense nevertheless estimates that these hosted payloads saved "several hundred million dollars."[64]

As of 2019, there were three additional hosted payloads planned: 1) the Phoenix Payload Orbital Delivery (POD) System,[65] the final Spacebased Kill Assessment (SKA) launch,[66] and the Enhanced Polar System Recapitalization (EPS-R) launch.[67] Ultimately, two of those three planned hosted payloads have either been launched or are on track for future launch. The third was replaced with a different mission. First, the SKA was completed in 2019.[68] SKA was planned to "utilize a network of small IR sensors integrated onto commercial host satellites which, while on orbit, will observe missile defense intercepts and deliver a kill

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[62] U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-18-493, MILITARY SPACE SYSTEMS: DOD'S USE OF COMMERCIAL SATELLITES TO HOST DEFENSE PAYLOADS WOULD BENEFIT FROM DECENTRALIZING DATA 9 (2018), *available at* https://www.gao.gov/assets/gao-18-493.pdf [hereinafter GAO Commercial/Defense Payload Report].

[63] Mike Gruss, *MDA Kill Assessment Sensors Would Be Commercially Hosted*, SPACENEWS (Mar. 20, 2015) *available at* https://spacenews.com/mda-kill-assessment-sensors-would-be-commercially-hosted/.

[64] GAO Commercial/Defense Payload Report, *supra* note 63, at 9.

[65] *See* Erin Fowler et al, DARPA Phoenix Payload Orbital Delivery (POD) System: Progress towards Small Satellite Access to GEO [PowerPoint Presentation], DARPA (Aug. 10, 2015), *available at* https://digitalcommons.usu.edu/smallsat/2015/all2015/6/.

[66] *Space-based Kill Assessment (SKA)*, MISSILE DEFENSE ADVOCACY ALLIANCE (May 2022), *available at* https://missiledefenseadvocacy.org/defense-systems/space-based-kill-assessment-ska/.

[67] GAO Commercial/Defense Payload Report, *supra* note 63, at Figure 1, *available at* https://www.gao.gov/assets/gao-18-493.pdf.

[68] Navy Vice Admiral Jon A. Hill & Dee Dee Martinez, *Transcript of News Briefing on President Biden's Fiscal 2023 Missile Defense Budget*, U.S. DEP'T OF DEF. (Mar. 28, 2022), *available at* https://www.defense.gov/News/Transcripts/Transcript/Article/2981858/missile-defense-agency-officials-hold-a-news-briefing-on-president-bidens-fisca/.

assessment declaration to the BMDS."[69] The SKA payloads were developed by the Johns Hopkins University Applied Physics Laboratory[70] and were expected to be hosted by Iridium Next satellites launched on SpaceX Falcon 9 rockets.[71] Iridium Next satellites are made by Iridium Communications, Inc., a global satellite communications company registered in the U.S.[72]

The second of these three missions, EPS-R, is on track for launch in 2023.[73] EPS-R was developed by Northrup Grumman[74] and will be hosted by a Space Norway space vehicle.[75] Space Norway is a company owned by the Norwegian Ministry of Trade, Industry and Fisheries.[76] SpaceX will launch the Space Norway vehicle.[77]

Of the three hosted payload missions planned as of 2019, the Phoenix POD system represents the one mission that met a different fate. Beginning in 2011, DARPA's Phoenix PODS program sought to host military payloads on commercial GEO satellites to "enable a servicing vehicle, such as the DARPA Phoenix Servicer/Tender, to retrieve the dispensed payload via free-flight capture."[78] The Phoenix POD system would have "enable[d] a new paradigm in on-orbit repair, upgrade, refurbishment, augmentation and enhancement of existing and new space systems."[79] DARPA had contracted with a private company, Orbital ATK, to re-purpose an already-existing, government-owned satellite bus to "demonstrate the ability to harvest and reuse valuable components from retired, nonworking GEO

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[69] Dep't of Def. Fiscal Year (FY) 2019 Budget Estimates, Exhibit R-2 (Feb. 2018), *available at* https://comptroller.defense.gov/Portals/45/Documents/defbudget/fy2020/budget_justification/pdfs/03_RDT_and_E/RDTE_Vol2_MDA%20RDTE_PB20_Justification_Book.pdf.

[70] National Security Space Highlights, Spacebased Kill Assessment (SKA), *available at* https://www.jhuapl.edu/OurWork/NationalSecuritySpaceHL.

[71] Mike Gruss, *U.S. Missile Defense Agency's hosted payload delayed until mid-2017*, SPACENEWS (Apr. 21, 2016), *available at* https://spacenews.com/u-s-missile-defense-agencys-hosted-payload-delayed-until-mid-2017/.

[72] https://www.iridium.com/

[73] SSC Public Affairs, *USSF's EPS-R Program on Schedule for Historic Polar* Mission, SPACE SYSTEMS COMMAND (Oct. 29, 2021), *available at* https://www.ssc.spaceforce.mil/Newsroom/Article-Display/Article/2827813/ussfs-eps-r-program-on-schedule-for-historic-polar-mission.

[74] Sandra Erwin, *Space Force delivers first of two U.S. payloads to launch on Space Norway's arctic broadband mission*, SPACENEWS (June 9, 2022), *available at* https://spacenews.com/space-force-delivers-first-of-two-u-s-payloads-to-launch-on-space-norways-arctic-broadband-mission/

[75] SSC Public Affairs, *supra* note 74.

[76] https://spacenorway.no/en/

[77] Erwin, *supra* note 75.

[78] Brook Sullivan et al, *DARPA Phoenix Payload Orbital Delivery System (PODs): "FedEx to GEO,"* AIAA Space 2013 Conference Paper (Sept. 2013), *available at* https://www.researchgate.net/publication/268459544_DARPA_Phoenix_Payload_Orbital_Delivery_System_PODs_FedEx_to_GEO.

[79] *Id.*

satellites."[80] However, by 2015 DARPA s vision had changed "from a demonstration mission to a long-term operation with additional capabilities."[81] As DARPA transitioned away from Phoenix POD and toward its Robotic Servicing of Geosynchronous Satellites (RSGS) program, Orbital ATK sued DARPA, and some members of Congress criticized DARPA for not relying on the commercial space sector enough.[82] Ultimately, DARPA selected Space Logistics, LLC, a wholly-owned subsidiary of Northrop Grumman Corporation, as its commercial partner for the RSGS program.[83] RSGS is now slated for launch in 2023.[84]

From a dual-use perspective, on-orbit servicing capabilities like those being developed by the RSGS program can also be deployed as ASAT weapons. Because such servicing would require on-orbit rendezvous and docking capability, the same technology that can be used to service or repair a defunct satellite or to clean up space debris can also be used to destroy the satellite or transfer it to a different orbit. Such a weapon would be particularly useful in the space environment because a military could attack a satellite without creating a harmful debris field. At the end of the first episode in the *Netflix* series Space Force, the show depicts a Chinese satellite clipping the solar panels off a U.S. military satellite, rendering it unusable.[85] While this was of course a fictional account, the story certainly mirrored real-life issues. Less than a year after the episode aired, and just a few months after U.S. Space Force Chief of Space Operations General John W. Raymond publicly stated that China's Shijian-21 satellite had the ability to reach out and grab other satellites with a robotic arm,[86] the Shijian-21 satellite demonstrated this exact capability by docking with the defunct Beidou-2 satellite and towing it to a graveyard orbit.[87]

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[80] *Orbital ATK, Inc. v. Walker*, 1:17-cv-163 (LMB/IDD) (E.D. Va. Jul. 12, 2017).
[81] *Id.*
[82] Caleb Henry, *DARPA satellite servicing project comes under congressional fire*, SPACENEWS (Jan. 26, 2017), *available at* https://spacenews.com/darpa-satellite-servicing-project-comes-under-congressional-fire/.
[83] Press Release, *In-space Robotic Servicing Program Moves Forward with New Commercial Partner*, DARPA (Mar. 4, 2020), *available at* https://www.darpa.mil/news-events/2020-03-04.
[84] Press Release, *Parts Come Together This Year for DARPA's Robotic In-Space Mechanic*, DARPA (July 17, 2020) *available at* https://www.darpa.mil/news-events/2020-07-17.
[85] *Space Force: The Launch (*Netflix May 29, 2020).
[86] Amanda Miller, *Resilient Architecture vs. Civilian Risk*, AIR FORCE MAGAZINE (Feb. 16, 2022), *available at* https://www.airforcemag.com/article/resilient-architecture-vs-civilian-risk/.
[87] Andrew Jones, *China's Shijian-21 towed dead satellite to a high graveyard orbit*, SPACENEWS (Jan. 27, 2022) *available at* https://spacenews.com/chinas-shijian-21-spacecraft-docked-with-and-towed-a-dead-satellite/.

ii. China

Much of China's activities in outer space — especially with respect to military activities — remains shrouded in secrecy. Nevertheless, the relationship between so-called private entities and the Chinese state, especially considered in light of the strategy of civil-military fusion discussed further below, highlights the reality that China engages in similar practice to the U.S. with respect to hosting military and civil or civilian capabilities on the same satellites. The extent of Chinese State involvement in the Chinese commercial space program makes it difficult to categorize the PLA's activities neatly within the framework of purchased/leased services versus hosted payloads or other arrangements for the use of dual-use satellites. For example, the Shijiang-21 satellite discussed above was developed by the Shanghai Academy of Spaceflight Technology,[88] which is a subsidiary of the state-owned China Aerospace Science and Technology Corporation (CASC),[89] which itself has been banned from U.S. investors because of its ties with the PLA.[90]

In June 2017, Chinese President Xi Jinping called for a great effort to turn the space domain into the foremost sector in the development of military-civil fusion."[91] According to the United States Department of State, the Communist Chinese Party (CCP) is aggressively pursuing this strategy of "military-civil fusion" (MCF).[92] The strategy involves "eliminat[ing] barriers between China's civilian research and commercial sectors, and its military and defense industrial sectors."[93] The State Department notes that the PRC specifically seeks to exploit the inherent 'dual-use' nature of many technologies, which have both military and civil applications, such as quantum computing and aerospace technology.[94] Leveraging this dual-use technology allows China to "meet national security

[88] Stephen Clark, *China says it has launched a space debris mitigation tech demo satellite*, SPACEFLIGHT NOW (Oct. 25, 2021), *available at* https://spaceflightnow.com/2021/10/25/china-says-it-has-launched-a-space-debris-mitigation-tech-demo-satellite/.
[89] http://www.sast.net/about2.html
[90] Press Release, *FACT SHEET: Executive Order Addressing the Threat from Securities Investments that Finance Certain Companies of the People's Republic of China,* The White House (June 3, 2021), *available at* https://www.whitehouse.gov/briefing-room/statements-releases/2021/06/03/fact-sheet-executive-order-addressing-the-threat-from-securities-investments-that-finance-certain-companies-of-the-peoples-republic-of-china/
[91] Lorand Laskai, Testimony before the U.S.-China Economic and Security Review Commission Hearing on China in Space: A Strategic Competition? (Apr. 25, 2019), *available at* https://www.uscc.gov/sites/default/files/Lorand%20Laskai%20USCC%2025%20April.pdf.
[92] Military-Civil Fusion and the People's Republic of China, U.S. Dep't of State (May 2020), *available at* https://www.state.gov/wp-content/uploads/2020/05/What-is-MCF-One-Pager.pdf
[93] *Id.*
[94] *Id.*

objectives while fulfilling economic goals."[95] In other words, "an overall improvement in space activities could strengthen China's military capabilities in the space domain."[96]

In September 2020, "the General Office of the Central Committee of the Chinese Party (CCP) issued the *Opinion on Strengthening the United Front Work of the Private Economy in the New Era*, calling on the nation's United Front Work Departments (UFWDs) to increase CCP ideological work and influence in the private sector."[97] The document relates "in no uncertain terms that Chinese private companies will be increasingly called upon to conduct their operations in tight coordination with governmental policy objectives and ideologies."[98] With respect to the Chinese space industry, until the last decade or so, "China's space activity has been overwhelmingly dominated by two state-owned enterprises."[99] This dominance has shifted with the rise of many new commercial space companies funded by private equity and venture capital.[100]

However, despite the rise in the number of these companies that "look private on paper, they must still submit to government guidance and control, and accept some level of interference."[101] Notably, a significant number of these space startups in China are run by individuals who "previously ran military-affiliated institutes," and the startups plan to launch "LEO satellite constellations, providing remote sensing and communications to meet the C4ISR needs of the Chinese military."[102] The extent to which one anticipates interference from the government with any space company — and the extent to which one can meaningfully consider Chinese "commercial" and "military" satellites to be distinct from one another — should be informed by the CCP's official intent to influence the private sector

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[95] Kevin Pollpeter, Testimony before the U.S.-China Economic and Security Review Commission Hearing on "China in Space: Strategic Competition" 19 (Apr. 2019), *available at* https://www.uscc.gov/sites/default/files/Kevin%20Pollpeter%20USCC%2025%20April.pdf.

[96] NIDS Report, *supra* note 47, at 51.

[97] SCOTT LIVINGSTON, THE CHINESE COMMUNIST PARTY TARGETS THE PRIVATE SECTOR, CENTER FOR STRATEGIC AND INTERNATIONAL STUDIES (Oct. 8, 2020), *available at* https://www.csis.org/analysis/chinese-communist-party-targets-private-sector.

[98] Stephen Olson, *Are Private Chinese Companies Really Private?* THE DIPLOMAT (Sept. 30, 2020), *available at* https://thediplomat.com/2020/09/are-private-chinese-companies-really-private/.

[99] Neel V. Patel, *China's surging private space industry is out to challenge the US*, MIT TECHNOLOGY REVIEW (Jan. 21, 2021), *available at* https://www.technologyreview.com/2021/01/21/1016513/china-private-commercial-space-industry-dominance/.

[100] *Id*.

[101] *Id.*

[102] Kartik Bommakanti, "Strengthening the C4ISR Capabilities of India's Armed Forces: The Role of Small Satellites," *ORF Occasional Paper No. 253*, June 2020, Observer Research Foundation, *available at* https://www.orfonline.org/research/strengthening-the-c4isr-capabilities-of-indias-armed-forces-the-role-of-small-satellites-67842/.

toward its own interests and President Xi Jinping's announced strategy of civil-military fusion. "At the least, the Chinese are likely to embed military payloads in commercial or civilian LEO-based constellations."[103]

In January 2022, China published a white paper detailing its space program ambitions.[104] The paper noted a desire toward enhancing the commercial space industry and noted that part of the mission of China's space program is to meet the demands of national security.[105] Unfortunately, the white paper notably leaves off any details regarding China's military space program.[106] Nevertheless, a 2020 report prepared for The U.S.-China Economic and Security Review Commission concluded that "China s national space program is largely managed by the PLA, and Chinese space assets are probably assigned as either military or dual-use (military-civil) assets to be mobilized in the event of a crisis or war."[107]

China's BeiDou constellation, a GPS-like GNSS system coordinated by the Chinese military, demonstrates the "indistinctness between civilian and military/defense entities" in China.[108] The dual-use BeiDou system provides both the PLA and civilians with "real-time navigation, rapid positioning, precise timing, location reporting and short message communication."[109] BeiDou enables the PLA to project military forces "in far-flung regions."[110] The implementation of BeiDou

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[103] *Id.*

[104] THE STATE COUNCIL INFORMATION OFFICE OF THE PEOPLE'S REPUBLIC OF CHINA, CHINA'S SPACE PROGRAM: A 2021 PERSPECTIVE (2021), *available at* http://www.cnsa.gov.cn/english/n6465645/n6465648/c6813088/content.html.

[105] *Id.*

[106] R. Lincoln Hines, *Beijing issued a white paper on China's space program. Here's what's new.*, THE WASHINGTON POST (Feb. 2, 2022, 7:00 AM), *available at* https://www.washingtonpost.com/politics/2022/02/02/beijing-issued-white-paper-chinas-space-program-heres-whats-new/ ("Overall, China's newest space white paper provides important clues about Beijing's space ambitions in the next five years. Yet the document is (unsurprisingly) silent on China's military space plans and, as a result, isn't likely to assuage growing concerns in the United States and elsewhere about China's military space ambitions. As other scholars have argued, even capabilities used to mitigate space debris have dual-use functions and may be perceived as space weapons." https://economictimes.indiatimes.com/news/defence/china-attempting-to-militarise-space-as-it-seeks-to-modernise-its-military-power/articleshow/77851406.cms?from=mdr ("China's latest white paper on space activities, released in 2016, omitted any mention of the military and state security aspects of its space programme.")

[107] MARK STOKES ET AL, CHINA'S SPACE AND COUNTERSPACE CAPABILITIES AND ACTIVITIES, U.S.-CHINA ECONOMIC AND SECURITY REVIEW COMMISSION 10, *available at* https://www.uscc.gov/sites/default/files/2020-05/China_Space_and_Counterspace_Activities.pdf.

[108] *Id*., at 61.

[109] *China attempting to militarise space as it seeks to modernise its military power*, THE ECONOMIC TIMES (Aug. 31, 2020, 5:06 PM), *available at* https://economictimes.indiatimes.com/news/defence/china-attempting-to-militarise-space-as-it-seeks-to-modernise-its-military-power/articleshow/77851406.cms?from=mdr

[110] *Id.*

also allows China to benefit from GNSS-services during hostilities without fear of losing access to GPS.[111]

Additionally, China's achievements in the field of quantum communication provide a notable example of the civil and military fruits of this MCF strategy. Chinese researchers have successfully accomplished entanglement-based quantum key distribution (QKD) with a space-based satellite,[112] publishing their results in 2020.[113] They noted that they "not only increase[d] the secure distance on the ground tenfold but also increase[d] the practical security of QKD to an unprecedented level." The researchers also noted that their satellite successfully demonstrated effective countermeasures against numerous types of attacks, including for example, blinding attacks.[114] In other words, Chinese researchers are on their way toward developing truly unbreakable, space-based quantum encryption techniques that could protect secure military communications around the globe, and they are developing this technology in parallel with defensive countermeasures to protect these satellite systems from attacks. While clearly still in the early stages, one can easily imagine how useful this technology would be both for military and civilian applications.

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[111] Namrata Goswami, *The Economic and Military Impact of China's BeiDou Navigation System*, THE DIPLOMAT (July 1, 2020), *available at* https://thediplomat.com/2020/07/the-economic-and-military-impact-of-chinas-beidou-navigation-system/.

[112] Karen Kwon, *China Reaches New Milestone in Space-Based Quantum Communications*, SCIENTIFIC AMERICAN (June 25, 2020), *available at* https://www.scientificamerican.com/article/china-reaches-new-milestone-in-space-based-quantum-communications/.

[113] Juan Yin et all, *Entanglement-based secure quantum cryptography over 1,120 kilometres*, NATURE (June 2020), *available at* https://www.nature.com/articles/s41586-020-2401-y.

[114] *Id.*

iii. Russia

Russia appears to have been inspired by China's approach to military civil fusion.[115] After a brief, failed flirtation with encouraging private enterprise, the Russian state has become more and more involved with the Russian economy.[116] The state "significantly expanded its control in certain strategic sectors such as banking, transportation, energy, technology."[117] This "strategic nationalization"[118] also extended to the space sector. Russian President Vladimir Putin re-nationalized the Russian space industry in 2013 with the creation of the Rocket and Space Company, a joint-stock company wholly owned by the state. In 2016, this company merged with the Russian Space Agency to create ROSCOSMOS. ROSCOSMOS exists today as a "state corporation" and serves as the primary driver of Russian space activity. ROSCOSMOS purportedly exists as the civilian corollary of the military Russian Space Forces established in 2015.

Nevertheless, the former head of ROSCOSMOS has made explicit the role ROSCOSMOS plays in the Russian military strategy. In March 2022 after the beginning of the aggressive Russian assault upon Ukraine, Dmitry Rogozin, the former-ROSCOSMOS agency head, declared, "Our space programme, of course will be adjusted. Firstly, priorities will be set… The priority here is the creation of spacecraft in the interests of both Roscosmos and Russia's defence ministry."[119] He added that "all future spacecraft will be of dual-purpose."[120] Then in April 2022, Rogozin promised the transfer of Sarmat ballistic missiles to aid in Russia's campaign of military aggression in Ukraine.[121] The missiles, which the Russian News Agency claims may carry gliding hypersonic warheads, were developed by

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[115] SAMUEL BENDETT ET ALL, ADVANCED MILITARY TECHNOLOGY IN RUSSIA 14, CHATHAM HOUSE (Sept. 2021), *available at* https://www.chathamhouse.org/sites/default/files/2021-09/2021-09-23-advanced-military-technology-in-russia-bendett-et-al.pdf.

[116] *See e.g.*, MARCO ALIBERTI AND KSENIA LISITSYNA, RUSSIA'S POSTURE IN SPACE (2019).

[117] Nini Arshakuni & Natasha Yefimova-Trilling, *What Is the State's Share in Russia's Economy?* RUSSIAMATTERS.ORG (June 26, 2019) *available at* https://www.russiamatters.org/analysis/what-states-share-russias-economy.

[118] *Putin's "Nationalization" to Strengthen State Role in Russian Economy, Analysts Say*, RUSSIAN BUSINESS TODAY (June 27, 2019), *available at* https://russiabusinesstoday.com/economy/putins-nationalization-to-strengthen-state-role-in-russian-economy-analysts-say/.

[119] *Russia to priortise making military satellites*, THE ECONOMIC TIMES (Mar. 3, 2022, 6:13 PM), *available at* https://economictimes.indiatimes.com/news/defence/russia-to-prioritise-making-military-satellites/articleshow/89972701.cms?from=mdr

[120] *Id.*

[121] *No More Peace: Roscosmos will supply ballistic missiles to the Russian army*, THE UNIVERSE (Apr. 29, 2022), *available at* https://universemagazine.com/en/no-more-peace-roscosmos-will-supply-ballistic-missiles-to-the-russian-army/; *Roscosmos plans to start shipping Sarmat missiles to armed forces in fall- company CEO*, TASS RUSSIAN NEWS AGENCY (Apr. 20, 2022), *available at* https://tass.com/science/1440741

ROSCOSMOS units.[122] Most recently in June 2022, Rogozin asserted that Russian navigation, communication, surveillance, and relaying satellites "can be used as a tool in an armed struggle,"[123] and he added that ROSCOSMOS was developing military satellites for the Defense Ministry.[124] ROSCOSMOS may have even taken on a greater role in the military aspects of the Russian state in order to effectively exploit dual-use technologies and components in order to thwart international sanctions levied on Russia for its unlawful invasion of Ukraine.[125] It seems clear from the official statements coming out of ROSCOSMOS that Russia intends going forward to only develop and manufacture spacecraft that can serve both military and civil or civilian purposes.

Of course, this evolution may be considered one of scope as Russia has used dual-use systems for military purposes since the dawn of the Space Age. In addition to the Soviet Union's state-controlled space activities in the Cold War-era, modern Russia also has utilized dual-use systems. The Russian satellite navigation GLONASS system consists of 24 satellites that provide similar accuracy as the U.S. GPS system.[126] Russia recently used the GLONASS system in support of military operations in Syria, and its use is likely to continue as Russia begins to implement the use of more precision guided munitions.[127] However, the usefulness of GLONASS may be diminishing as a result of sanctions imposed on Russia after its unlawful invasion of Ukraine in 2014.[128] Another satellite Russia uses for dual-use purposes is Recurs-P. Operated by ROSCOSMOS, the Russian military used the satellite to map terrain in Syria.[129] A third dual-use Russian system is Ellips. The project, co-funded by ROSCOSMOS and the Ministry of Defense, consists of a 4-

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[122] *Roscosmos plans to start shipping Sarmat missiles to armed forces in fall- company CEO,* TASS RUSSIAN NEWS AGENCY (Apr. 20, 2022), *available at* https://tass.com/science/1440741

[123] *Roscosmos has new generation wars-related technologies — Rogozin*, TASS RUSSIAN NEWS AGENCY (June 2, 2022) *available at* https://tass.com/defense/1459729 utm_source=google.com&utm_medium=organic&utm_campaign=google.com&utm_referrer=google.com.

[124] *Id.*

[125] James Wilson, *Russia Exploits Dual Use Loophole to Source Parts for Lethal Missiles*, EU POLITICAL REPORT (April 2022), *available at* https://www.eupoliticalreport.eu/russia-exploits-dual-use-loophole-to-source-parts-for-lethal-missiles/.

[126] Bendett et all, *supra* note 116, at 37.

[127] *Id*., at 37-38.

[128] Mark Krutov & Sergei Dobrynin, *In Russia's War On Ukraine, Effective Satellites Are Few And Far Between*, RADIOFREEEUROPE RADIOLIBERTY (Apr. 11, 2022, 7:24 PM), *available at* https://www.rferl.org/a/russia-satellites-ukraine-war-gps/31797618.html.

[129] Ivan Synergiev & Ivan Safronov, *The space group did not have enough "Resource,"* KOMMERSANT (Nov. 26, 2018, 12:20 AM), *available at* https://www.kommersant.ru/doc/3811631 ("According to a Kommersant source close to the Ministry of Defense, the capabilities of "Resource" No. 1 were used not only for civilian, but also for military purposes. For example, along with the Persona optical-electronic reconnaissance satellites, it was involved in surveying the terrain in Syria."); Bendett et all, *supra* note 117, at 40.

satellite constellation planned to support encrypted military communications and civilian uses like air traffic control.[130]

iv. India

India too seeks to capitalize on the dual-use possibilities of satellites in order to economize its investments and achieve maximum return for both its economic development and military security.[131] A recent study discussed India's space capabilities in terms of deficiencies in its utilization of commercial space resources.[132] Citing perceived deficiencies in C4ISR capabilities, the study notes that the "emergence of space startups and the private space sector in India throws up some attractive possibilities for the country's armed services."[133]

A 2021 article in the Columbia Journal of International Affairs notes that a "large portion of space assets that India uses for military purposes are dual-use in nature: in addition to military applications, they are also being used for several civilian and commercial applications."[134]

For example, many of India's Cartosat series[135] satellites multi-task by providing both military and civil remote sensing functions.[136] "Other militarily important multi-taskers are the Resourcesat 2 (2011) series, weather satellites like SARAL (2013), OceanSat 2 (2009) and the RISAT 2 (2009) and RISAT 1 (2012). So data may flow to the [Indian Space Research Organization (ISRO)] stations or to those managed by the defence and intelligence agencies."[137]

In sum, this part has demonstrated a trend toward increased military uses of otherwise civil/commercial satellites among the U.S., Russia, China, and India. Further, a similar trend is clear among other States. The EU, for example, is driving

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[130] Anatoly Zak, *Russian communications satellites*, RUSSIAN SPACE WEB, *available at* http://www.russianspaceweb.com/spacecraft_comsats.html.

[131] Sanjay B. Maharaj, *India's Military Satellite Options*, MAGZTER (Jan. 2020), *available at* https://www.magzter.com/stories/Military-Defence/Geopolitics/INDIAS-MILITARY-SATELLITE-OPTIONS ("India has a long history of deploying dual purpose satellites with civilian and military purposes.").

[132] Bommakanti, *supra* note 103.

[133] *Id.*

[134] Rahul Krishna & Radhika Chhabra, *The Future of Indian Deterrence in Space*, COLUMBIA JOURNAL OF INTERNATIONAL AFFAIRS (Aug. 21, 2018), *available at* https://jia.sipa.columbia.edu/online-articles/future-indian-deterrence-space.

[135] *Cartosat-2 Series Satellite*, DEP'T OF SPACE INDIAN SPACE RESEARCH ORGANISATION (Jan. 12, 2018), *available at* https://www.isro.gov.in/Spacecraft/cartosat-2-series-satellite-2.

[136] Manoj Joshi, *India has a long way to go before it can use space for modern warfare*, OBSERVER RESEARCH FOUNDATION (June 17, 2019) *available at* https://www.orfonline.org/research/india-has-a-long-way-to-go-before-it-can-use-space-for-modern-warfare-52106/.

[137] *Id.*

toward increased recognition of the military capabilities of its civil satellite constellations. Additionally, Ukraine has shown how dramatically a State may rely upon commercial satellites to directly enable kinetic military activities. As the following section will show, this trend toward the increased militarization of otherwise civil/commercial satellites comports with State's obligations under Article 58 and should be considered in any interpretation of IHL as it applies in space.

III. STATE PRACTICE AND THE STATE OF THE LAW

Broadly speaking, the practice of hosting military capabilities on otherwise civil/commercial satellites raises the concern of an increased risk of attack upon these satellites should an armed conflict extend hostilities into outer space itself. Arguably then, the practice might be considered unlawful because it could violate a State's obligation to protect civilians and civilian objects from the effects of attack.

First, this section argues that the practice does not violate this rule of IHL. Article 58 protects civilian objects from the risks inherent in being intermingled with military objectives. However, otherwise civil/commercial satellites that qualify as military objectives under the appropriate test in IHL are military objectives in their entirety. As such, there is no intermingling of "civilian objects" - a legal term of art denoting a protected class of objects, not a reference to an object used by civilians - with military objectives. Therefore, there is no violation of Article 58.

Second, one must take State practice into consideration in any interpretation of IHL as it applies in the space context. The trajectory of State practice in this area may justify certain behaviors outright or spur changes in legal obligations - either with respect to the test for military objectives under IHL or with respect to the interpretation of Article 58, Additional Protocol 1, for example.

Finally, this section highlights a few issues with State practice in the area of military applications of otherwise civil/commercial satellites that appear to be ripe for maturing into concrete interpretations of existing legal rules as they apply in outer space or new international legal norms altogether. This part highlights the rapid trend toward increasing military uses of otherwise civil/commercial satellites and warns there may soon be a "Groatian moment" in IHL as it applies in outer space.

A. IHL Does Not Prohibit the Practice of Hosting, Embedding, or Obtaining Military Capabilities on or From Otherwise Civil/Commercial Satellites

In his article *Reverse Distinction: A U.S. Violation of the Law of Armed Conflict in Space*, Professor David Koplow argues that the U.S. practice of hosting military capabilities on civilian satellites violates the law of armed conflict.[138] Professor Koplow argues that the U.S. is in violation of the obligation to take precautions against the effects of attacks articulated in Additional Protocol 1 to the 1949 Geneva Conventions, which he rebrands as an affirmative obligation of States to practice reverse distinction."[139] Second, he argues that even if there is no such rule in international law that would extend the obligation outside of active armed conflict, then the U.S. is in anticipatory breach of the obligation.[140] Professor Koplow ultimately concludes that this practice of hosting military capabilities on civilian satellites is both unlawful and unwise.[141] This section addresses Professor Koplow's interpretation of Article 58 as it would apply in the space context and disagrees that the intermingling at issue would violate Article 58 (and therefore would also render the anticipatory breach concern moot).

In order for the intermingling at issue to raise a violation of Article 58, one must first presume that a dual-use satellite possesses protected status as a civilian object which falls within the ambit of Article 58 and that such a satellite also separately qualifies as a military objective. Neither the plain text of Article 58 nor the practice of States appears to support that conclusion.

At the outset, this paper agrees with the notion that international humanitarian law would apply to hostilities in outer space. Article III of the Outer Space Treaty requires that States "carry on activities in the exploration and use of outer space, including the moon and other celestial bodies, in accordance with international law, including the Charter of the United Nations, in the interest of maintaining international peace and security and promoting international co-operation and understanding."[142] Further, while the UN Charter may be "tethered to territorial sovereignty,"[143] a concept which does not apply in outer space,[144]

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[138] Koplow, *supra* note 3.
[139] *Id.*, at 32.
[140] *Id.*, at 98-99.
[141] *Id.*, at 105.
[142] Outer Space Treaty, *supra* note 31, art III.
[143] P.J. Blount, *Peaceful Purposes for the Benefit of All Mankind: The Ethical Foundations of Space Security*, *in* War and Peace in Outer Space 113 (Cassandra Steer & Matthew Hersch, 2021).
[144] *Id.*

Common Article II to the Geneva Conventions nevertheless provides that the Convention "shall apply to all cases of declared war or of any other armed conflict which may arise between two or more of the High Contracting Parties, even if the state of war is not recognized by one of them."[145] This provision makes no reference to any categorical inclusion or exclusion of geographic areas with respect to the applicability of its terms. And the ICJ made clear in the *Oil Platforms* case that the provisions of international humanitarian law apply outside of any particular State's territory, as a State's right of self-defense applies if it suffers an armed attack on the high seas.[146] Further still, in its *Legality of the Threat or Use of Nuclear Weapons* advisory opinion, the ICJ noted that IHL "applies to all forms of warfare and to all kinds of weapons, those of the past, those of the present and those of the future."[147] This language would seem to include forms of warfare that extend into outer space.

With respect to the duty to protect civilians and civilian objects from the harmful effects of war, Article 58, AP 1, provides:

> The Parties to the conflict shall, to the maximum extent feasible: a) ...endeavour to remove the civilian population, individual civilians and civilian objects under their control from the vicinity of military objectives; b) avoid locating military objectives within or near densely populated areas; c) take the other necessary precautions to protect the civilian population, individual civilians and civilian objects under their control against the dangers resulting from military operations.

Article 58 thus has three parts. In the consideration of satellites in outer space, the second of these parts is largely inapplicable - at least in contemporary times - as there are no densely populated areas in space. However, the first and third parts would seem directly relevant to the practice of using otherwise civil/commercial

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[145] Article II of the Geneva Conventions is common to each of the four treaties comprising the Geneva Conventions: Geneva Convention for the Amelioration of the Condition of the Wounded and Sick in Armed Forces in the Field, Aug. 12, 1949, 6 U.S.T. 3114, 75 U.N.T.S. 31; Geneva Convention for the Amelioration of the Condition of the Wounded, Sick and Shipwrecked Members of the Armed Forces at Sea, Aug. 12, 1949, 6 U.S.T. 3217, 75 U.N.T.S. 85; Geneva Convention Relative to the Treatment of Prisoners of War, Aug. 12, 1949, 6 U.S.T. 3316, 75 U.N.T.S. 135; Geneva Convention Relative to the Protection of Civilian Persons in Time of War, Aug. 12, 1949, 6 U.S.T. 3516, 75 U.N.T.S. 287, art II.

[146] *See Case Concerning Oil Platforms (Islamic Republic of Iran v. United States of America* para 57-61, International Court of Justice (ICJ), 6 November 2003 (analyzing whether the particular facts of the case amounted to an armed attack sufficient to justify the use of armed force in self-defense).

[147] *Legality of the Threat or Use of Nuclear Weapons,* Advisory Opinion, [1996], ICJ Rep. 226.

satellites for military purposes. The first part requires a State to endeavor to remove *civilian objects* under their control from the vicinity of military objectives. The third part requires a State to take necessary precautions to protect *civilian objects* under their control against the dangers resulting from military operations.

Because military equipment like sensors or transponders can be military objectives, the argument goes that placing them on otherwise civil/commercial satellites fails to remove the otherwise civil/commercial satellite (i.e., a "civilian object") from the vicinity of military objectives and fails to protect the otherwise civil/commercial satellite (i.e., a civilian object") from the dangers resulting from military operations. However, in order to make this argument, one must first ascertain whether all or part of the satellite in question qualifies for protected status as a "civilian object."

In international humanitarian law, there are "civilian objects" and there are "military objectives."[148] If something is not a "military objective," then it is a "civilian object."[149] Many satellites are considered "dual-use" objects.[150] "Dual-use" objects are those that serve both military and civilian functions, and space is full of them.[151] While "dual-use" is a useful term for identifying these satellites or technologies that may pose a military threat or for highlighting potential consequences relevant for a proportionality or precautions-in-attack analysis, this does not mean that a potential target is both a "military objective" and a "civilian object" at the same time.[152] All individual objects are either "military objectives" or "civilian objects." There is no separate classification in international humanitarian law for "dual-use objects."[153]

Article 52(2) of the 1977 Additional Protocol I to the Geneva Conventions provides, "In so far as objects are concerned, military objectives are limited to those objects which by their nature, location, purpose, or use make an effective contribution to military action and whose total or partial destruction, capture, neutralization, in the circumstances ruling at the time, offers a definite military advantage."[154] The term "civilian objects" is defined in the negative by Article 52(1).[155] That article provides that "[c]ivilian objects are all objects which are not

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[148] *See* DEPARTMENT OF DEFENSE LAW OF WAR MANUAL, para 5.7 – *Military Objectives.*
[149] *Id*., at 5.7.1.2 - *Dual-Use Objects.*
[150] *See* Cassandra Steer & Dale Stephens, *International Humanitarian Law and Its Application in Outer Space, in in* War and Peace in Outer Space 39 (Cassandra Steer & Matthew Hersch, 2021).
[151] *See* DEPARTMENT OF DEFENSE LAW OF WAR MANUAL, para 5.7.1.2 – *Dual-Use Objects.*
[152] Koplow, *supra* note 3, FN 34.
[153] *See e.g.*, DEPARTMENT OF DEFENSE LAW OF WAR MANUAL, para 5.7.1.2 – *Dual-Use Objects.*
[154] Protocol Additional to the Geneva Conventions of 12 August 1949, and relating to the Protection of Victims of International Armed Conflicts (Protocol I), June 8, 1977 [hereinafter cited as Additional Protocol I], *reprinted in* U.N. Doc. A/32/144; 1977 Int'l Rev. Red Cross (Aug.-Sep.); 16 Int'l Leg. Mat. 1391 (1977); 72 Am. J. Int'l L. 457 (1978), art 52(2).
[155] *See Id*., at art 52(1).

military objectives as defined in paragraph 2."[156] The U.S. is not a party to the Additional Protocol I but agrees many of its provisions, including Article 52 (with the exception of portions related to reprisals) to be part of customary international law.[157] Other conventions define "military objective" substantively identically to AP I.[158]

In their article "International Humanitarian Law and Its Application in Outer Space," authors Cassandra Steer and Dale Stephens highlight two aspects of the Article 52(2) definition of "military objectives," namely, "(a) that the object must make an effective contribution to military action, and this must be by virtue of its nature, location, purpose, or use; and (b) the total or partial destruction, capture, or neutralization must offer a definite military advantage under circumstances ruling at the time."[159] Steer and Stephens further discuss each of the four aspects of the first element. They note that with respect to the "nature" of a satellite, this could potentially apply to any satellite used by the military, leaving open the question about whether military uses such as broadcast entertainment would qualify.[160] Next, they note that a satellite's "location" may make an effective contribution to military action even if the satellite is not used by a military if its "total or partial destruction, capture, or neutralization may affect a military need due to its proximity to any other military object… ."[161] Regarding "purpose" and "use," the authors note that targeting objects based on their potential uses alone is impermissible.[162] They highlight the difficulty of determining that an "adversary *in fact* intends to use the object in a particularly military way" because "in the space domain… intended uses of space objects are often not communicated, or only partially, or even falsely." Finally, Steer and Stephens recognize that the second element of the test for "military objectives" can be difficult to apply to satellites as the circumstances of their nature, location, purpose, or use may easily change. For

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[156] *Id.*
[157] Steer & Stephens, *supra* note 151, at 38, FN76-77;
See also COL. THEODORE T. RICHARD, UNOFFICIAL UNITED STATES GUIDE TO THE FIRST ADDITIONAL PROTOCOL TO THE GENEVA CONVENTIONS OF 12 AUGUST 1949 (2019), *available at* https://www.airuniversity.af.edu/Portals/10/AUPress/Books/B_0157_UNOFFICIAL_UNITED_STATES_GUIDE_TO_THE_FIRST_ADDITIONAL_PROTOCOL_TO_THE_GENEVA_CONVENTIONS_OF_12_AUGUST_1949.PDF p 98; DEPARTMENT OF DEFENSE LAW OF WAR MANUAL, para 5.7.3 - *Objects That Are Military Objectives.*
[158] *See* DEPARTMENT OF DEFENSE LAW OF WAR MANUAL, para 5.7.3 FN144 (citing CCW Amended Mines Protocol, art 2(6); CCW Protocol III On Incendiary Weapons art 1(3); 10 U.S.C. § 950p(a)(1)
[159] Steer & Stephens, *supra* note 151, at 38.
[160] *Id.*, at 38-39.
[161] *Id.*, at 39.
[162] *Id.*

example, a satellite may quickly change velocity and orbital paths or the ownership of a satellite might change.[163]

The DOD Law of War Manual phrases the two part test as "(1) that the object somehow makes an effective contribution to military action; and (2) attacking the object, in the circumstances, offers a definite military advantage."[164] The DOD Law of War Manual notes that some objects like military equipment and bases are always considered to meet the definition of "military objective" and are therefore categorically recognized as "military objectives."[165] Such objects "may be made the object of attack without specifically applying the [two-part test analysis]."[166]

Applying this two-part test to an otherwise civil/commercial satellite being used for military purposes can become difficult. In the simpler case, if the otherwise civil/commercial satellite as a whole is providing purchased or leased services to a military, and as a result, the satellite makes an effective contribution to military action and attacking the satellite would, in the circumstances, offer a definite military advantage, then the entire satellite is a military objective. As a result, the satellite is not a civilian object. Because the satellite is not a civilian object, there can be no violation of Article 58, as there is no civilian object to protect.

On the other hand, if the otherwise civil/commercial satellite hosts a military payload (e.g., a sensor or transponder) or could somehow be physically separated into a military use part and an otherwise civil/commercial part, then at least a portion of the satellite qualifies as a military objective (assuming that portion meets the two-part test for military objectives). However, a question remains as to whether the remainder of the satellite enjoys protected status as a "civilian object." If a satellite can be properly sub-divided into both a military objective and a protected civilian object, then an Article 58 violation could arise. But as the following will show, this is not the case under the current state of the law.

The question here is to what degree of granularity an object must be considered for purpose of this IHL analysis. Is the entire satellite a single object for the purpose of conducting an IHL analysis, or are each of the sensors or other satellite payloads to be considered individually? This matters because there can be no violation of Article 58 for failing to take precautions against the effects of attacks if there is no civilian object to protect. Additionally, if the entire satellite is a "military objective," then damage to the non-military portions of the satellite would

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[163] *Id.*

[164] DEPARTMENT OF DEFENSE LAW OF WAR MANUAL, para 5.7.5 - *Definition of Military Objective for Objects: A Two-Part Test.*

[165] DEPARTMENT OF DEFENSE LAW OF WAR MANUAL, para 5.7.4 - *Objects Categorically Recognized as Military Objectives.*

[166] *Id.*

not be considered in a proportionality analysis (although the effects from any expected loss of services to civilians on earth may be considered).

As with the application of IHL to nearly any novel means of war fighting, there does not exist clear guidance for the application of IHL to the space domain. In particular, States have not agreed to interpretations of IHL that would clearly classify either the entirety or sub-components of a satellite as an object for purposes of determining "military objectives." There is also no existing State practice of attacking satellites that would help identify how States believe these rules must be applied in this regard. State practice may inform the answer to this question of granularity.

This question of granularity has been addressed in other war fighting domains. Professor Koplow analogizes the practice of using otherwise civil/commercial satellites for military purposes to Saddam Hussein's abuses of the law of war.[167] During the Gulf War, Saddam Hussein infamously parked two Soviet Mig-21s immediately adjacent to the ziggurat, which has been described as "the most spectacular archeological relic in Mesopotamia."[168] The stunt was "obviously an effort to use the archeologically significant facility to protect his military capabilities."[169] In this case, clearly the fighter jets constituted military objectives and the ziggurat did not. Fighter jets and temples are clearly separate objects for purposes of conducting an IHL analysis no matter how closely the jets happen to be parked.

As a result, the U.S. criticized Saddam Hussein because by putting the fighter jets where he did, he abused IHL as a shield to protect his fighter jets from attack. He also invited damage to the protected cultural heritage site. By placing the jets near the temple, he failed to take the necessary precautions to protect civilian objects under his control from the dangers resulting from military operations. Indeed, his hopes may have been to invite an attack against the jets that would damage the temple, as the propaganda campaign he could launch might have been more strategically beneficial than any benefit he could have derived from dated Soviet-era fighter jets as the U.S. had achieved air superiority within the first hours of combat.[170]

But unfortunately, the issue of parking fighter jets near protected temples does not demonstrate the true difficulty of the granularity problem. Unlike the case

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[167] Koplow, *supra* note 3, at 47-49.

[168] Oswald Johnston, *Iraqis Put Warplanes at Ancient Temple, U.S. Says: Archeology: Secretary Cheney says MIGs are next to ruins of historic site. Hussein reportedly has customarily placed military installations near cultural locations*, LOS ANGELES TIMES (Feb. 14, 1991, 12:00 AM), *available at* https://www.latimes.com/archives/la-xpm-1991-02-14-mn-1799-story.html.

[169] *Id.*

[170] BENJAMIN S. LAMBETH, THE WINNING OF AIR SUPREMACY IN OPERATION DESERT STORM 1, RAND CORP. (1993), *available at* https://www.rand.org/content/dam/rand/pubs/papers/2009/P7837.pdf.

of satellites serving both military and civil/commercial purposes, fighter jets and protected temples are not dual-use objects. They are clearly separate and distinct objects from each other. A satellite carrying both military and civil/commercial payloads, on the other hand, cannot be so neatly separated into multiple objects. Indeed, depending on the engineering of the particular satellite, physical separation of these capabilities may not only be unfeasibly difficult from the perspective of an attacking force, but it may also be technically impossible. As such, the fighter jets parked near the ziggurat example does not adequately depict the issue of identifying all or a portion of a satellite as a military objective.

A better example for parsing out the law of military objectives as applied to dual-use satellites is an apartment building. Unlike a fighter jet parked near a temple, an apartment building represents "a structure in which all components thereof comprise an integral whole."[171] In *Targeting Dual-Use Structures: An Alternative Interpretation*, Professor Michael N. Schmitt identifies the "two general approaches to targeting such 'dual-use' structures… ."[172] He also proposes a third approach. In all three approaches, a dual-use satellite would likely qualify as a military objective in its entirety, rendering Professor Koplow's criticism of the practice moot.

The first approach, adopted by the U.S., treats the entire building as a military objective "and therefore concludes that an attacker need not consider damage to the structure in the proportionality and precautions-in-attack analyses."[173] Professor Schmitt notes that other militaries, including Israel and Denmark, adopt this same or similar legal view. He cites the 2020 Danish Military Manual as providing:

> As far as dual-use objects are concerned, the entire object constitutes a military objective. Under international law, this means that damage to the dual-use object is not regarded as collateral either in whole or in part if the object is effectively indivisible. As a rule, the non-military share of the object should not be taken into consideration in the proportionality assessment.[174]

Professor Schmitt notes that this approach risks the possibility that lawfully targeting a relatively minor military objective could result in damage that would

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[171] Michael N. Schmitt, *Targeting Dual-Use Structures: An Alternative Interpretation*, Lieber Institute (Jun. 28, 2021), *available at* https://lieber.westpoint.edu/targeting-dual-use-structures-alternative/.
[172] *Id.*
[173] *Id.*
[174] *Id.* (citing DANISH MINISTRY OF DEFENCE MILITARY MANUAL, para 3.1, *available at* https://usnwc.libguides.com/ld.php?content_id=59166472.

have otherwise precluded the lawfulness of the attack in the proportionality analysis.

The second approach, adopted by some academics and the ICRC, would similarly treat the entire building as a military objective but would require that:

> the impact of the attack on the civilian part or component of the object (such as apartments in a building whose basement is used as a munitions depot) or on the simultaneous civilian use or function of the object (such as in the case of a bridge or electricity station used for both military and civilian purposes) must also be taken into consideration in the assessment of proportionality.[175]

Professor Schmitt notes that this second approach contradicts the plain text of the law. He writes, "Only harm to *civilian objects* is factored into the [proportionality and precautions-in-attack] assessments."[176] "And according to Article 52(1) of the Additional Protocol I, which is well-accepted as reflecting customary law, "[c]ivilian objects are all objects which are not military objectives… ."[177]

Ultimately, Professor Schmitt argues that "[n]either approach comports neatly with IHL's object and purpose… ."[178] He proposes a third approach, which he says has not been adopted by any States thus far, but which would more adequately meet the tenets of IHL while squaring the interpretation within existing textual rules.[179] By this interpretation, the degree of granularity by which an object must be considered separate and distinct for purposes of an IHL analysis depends on the capabilities of the attacking force.[180] If an attacking force can identify the portion of the structure being used for military purposes and can "surgically strike" that portion, then "the aspect of the structure the enemy is using qualifies as a military objective, but its separate and distinct components that are not being used for military purposes retain their civilian character."[181]

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[175] *Id*. (citing Laurent Gisel, *International Expert Meeting Report: The Principle of Proportionality in the Rules Governing the Conduct of Hostilities under International Humanitarian Law*, ICRC (June 2016), *available at* https://www.icrc.org/en/document/international-expert-meeting-report-principle-proportionality)
[176] *Id.*
[177] *Id.*
[178] Michael N. Schmitt, *Military Necessity and Humanity in International Humanitarian Law: Preserving the Delicate Balance*, VA. J. INT'L L., Vol. 50, No. 4, 795 (2010), *available at* https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1600241.
[179] Schmitt, *supra* note 172.
[180] *Id.*
[181] *Id.*

In both of the first two approaches, States would consider an otherwise civil/commercial satellite that meets the test for a military objective under IHL to be a military objective in its entirety. In the first approach, the entire satellite could be targeted as a military objective, and the non-military portion of the satellite would not be considered in a proportionality or precautions-in-attack analysis. By the second approach, the entire satellite still could be targeted as a military objective, but the damage to the non-military portion of the satellite would be taken into consideration for the purpose of a proportionality analysis. Under this second approach, even though the damage to the non-military portion of the satellite could be considered in the proportionality analyses, there still is no protected "civilian object" such that Article 58 would apply.

Under Professor Schmitt's proposal, if an attacking force could ascertain which portion of the satellite served the military function, and if the attacking force feasibly could strike only that portion with precision, then the non-military portion would be a "civilian object." As difficult as it may be for an attacking force to ascertain which portion of an apartment building is being used for military purposes, identifying the particular circuitry, sensors, or other components of a satellite that are being used for military purposes would likely prove exceedingly more difficult both for physical and technical reasons. And even if an attacking force could identify the particular portion of a satellite being used for military purposes, attacking only that portion could be incredibly difficult. However, considering that multiple States, including the U.S. and China, are developing technologies that permit docking with other satellites on orbit, the ability to precisely target a particular payload on a satellite is not that far-fetched. Whether such an ability is "feasible" for the purposes of international humanitarian law is highly contextual and outside the scope of this paper.

If States were to adopt Professor Schmitt's proposal to base considerations of military necessity upon an attacking force's ability to target with precision, then this could change the status quo with respect to Article 58 of AP 1. Whereas the military uses of a satellite under the current state of the law may render the whole satellite a lawful military objective such that there can be no violation of Article 58, a change to that law based on the practice of States could split a satellite into both a protected "civilian object" and a "military objective." If this state of affairs were to come to fruition, then Professor Koplow's concerns regarding the lawfulness of this intermingling return to the fore. Suddenly, that which was previously a military objective could now be considered a military objective nestled within a protected civilian object. This division of the satellite would only occur for States with the sophisticated capabilities to attack the satellite with such precision. Interestingly then, the co-mingling State would have created something of a "Schrödinger satellite" - a satellite whose state of existence as either 1) solely a military objective or 2) a military objective within a civilian object depends upon the perspective from

which one views the object. As a result, the co-mingling State simultaneously could be both in violation of Article 58 and not in violation of Article 58, depending on the capabilities of any particular, potential attacker. Certainly, this problem of applying Professor Schmitt's proposal within the context of Article 58 would also exist in the terrestrial sense, but the technical disparities of space-faring nations only aggravate the issue. The impossibility of applying this interpretation of IHL as it would apply in space will likely preclude Professor Schmitt's proposal from being adopted in the space domain.

A "Schrödinger satellite" situation could be beneficial for a State with advanced space capabilities like the U.S. or China because until other States possess the capability to surgically target only portions of satellites, then such States could not be said to be in violation of Article 58. Further, while these intermingled satellites may constitute "military objectives," very few States or non-State actors practically possess the capability to engage them as targets at all. Of course, the benefit to this situation quickly erodes if considering an attacking State that does possess the ability to attack the satellites. The benefit further erodes if a State possesses the capability to target only a particular payload because the attacking State could both attack with legal impunity and credibly claim the attacked State was violating its obligations under Article 58. The ways in which State practice ultimately evolve these interpretive nuances regarding military objectives under international humanitarian law in space could therefore have significant implications for the lawfulness of military uses of otherwise civil/commercial satellites.

In all three approaches for determining the divisibility of objects for conducting an IHL analysis, damage to the non-military portion of the satellite could result in a loss of use of services that may be relevant for a proportionality analysis. Additionally, a kinetic attack on any part of the satellite would likely destroy the entire thing and create thousands of pieces of space debris, resulting in an overall degradation to the orbital environment. These considerations may ultimately counsel against any physical attack on a dual-use satellite, but not because the satellite constituted a "civilian object."

The Civil Reserve Air Fleet (CRAF) provides a third potential analogy to help with the problem of the granularity with which one must consider a satellite to be a single object or multiple objects. As will be shown, the CRAF straddles a line between the ease of separating the military objective of fighter jets from the protected status of temples and the general consensus that an entire apartment building can considered a military objective.

The Civil Reserve Air Fleet (CRAF) is a voluntary program between the U.S. Department of Transportation, Department of Defense, and commercial air carriers that provides additional airlift capacity to augment U.S. military airlift

capacity during times of war or other national emergency.[182] The CRAF has been activated only three times in its history. During Desert Shield and Desert Storm from 1990-1991, the CRAF stood-up to deliver approximately 60% of U.S. military personnel and 25% of military supplies to the war zone.[183] From 2002-2003, CRAF supported Operation Iraqi Freedom by deploying nearly 10% of all U.S. military personnel.[184]

Oftentimes, the supplies carried by CRAF missions constitute military objectives. Weapons and military equipment qualify as military objectives, but if they are being transported on an aircraft that qualifies as a "civilian object" then the aircraft would need to be considered in a proportionality and precautions-in-attack analysis. As a practical matter and with the exception of a scud missile threat in the Gulf War, [185] CRAF deployments have historically operated in permissive airspace.[186] Perhaps for this reason, there does not seem to be much literature regarding the potential for the cargo of CRAF missions to become lawful objects of attack.

Additionally, under certain circumstances, the CRAF aircraft themselves could qualify as military objectives.[187] States have an obligation to refrain from attacks against civil aircraft in peacetime,[188] but this obligation does not affect the rights and obligations of States under the UN Charter.[189] As such, a State could use force against a civil aircraft in self-defense.[190] In particular, civil aircraft may lose their protected status as civilian objects and may become military objectives if they take a direct part in hostilities, act in any capacity as a naval or military auxiliary to

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[182] *Civil Reserve Airfleet [sic] Background, History*, US DEPT OF TRANSPORTATION, (Nov. 20, 2020), *available at* https://www.transportation.gov/mission/administrations/intelligence-security-emergency-response/ civil-reserve-airfleet-allocations.

[183] Charles Imbriani, *Civilian Involvement in the 1990-91 Gulf War Through the Civil Reserve Air Fleet*, FLORIDA STATE UNIVERSITY LIBRARIES 14 (2012), *available at* https://diginole.lib.fsu.edu/islandora/ object/fsu:185053/datastream/PDF/view, p 14; *See also* Lt Col Rob A. Kyrouac, *Civil Reserve Air Fleet: A Rough Road Ahead*, NAVAL WAR COLLEGE 8 (May 18, 2004), *available at https://www.hsdl.org/? view&did=451126.*

[184] Lt Col Rob A. Kyrouac, Civil Reserve Air Fleet: A Rough Road Ahead, NAVAL WAR COLLEGE 8-9 (May 18, 2004), available at https://www.hsdl.org/? view&did=451126.

[185] Theodore J. Crackel, *Research Studies Series: A History of the Civil Reserve Air Fleet*, AIR FORCE HISTORY & MUSEUMS PROGRAM, 223 (1998), *available at* https://media.defense.gov/2013/Sep/ 16/2001329866/-1/-1/0/AFD-130916-006.pdf.

[186] *See* General Jacqueline D. Van Ost, Responses to Senate Armed Services Committee Advance Policy Questions for General Jacqueline D. Van Ost, USAF, Nominee to be Commander, U.S. Transportation Command, (2021), available at https://www.armed-services.senate.gov/imo/media/doc/ Van%20Ovost%20APQ%20responses.pdf.

[187] DEPARTMENT OF DEFENSE LAW OF WAR MANUAL, paras 14.8.3.2, 14.8.3.3.

[188] *See Convention on International Civil Aviation*, 7 December 1944, 15 UNTS 295, ICAO Doc 7300/6 [Chicago Convention], art 3bis.

[189] DEPARTMENT OF DEFENSE LAW OF WAR MANUAL, 14.8.3.1.

[190] *Id.*

the enemy's armed forces, or are otherwise integrated into the enemy's war-fighting or war-sustaining effort.[191] Considering the extent to which the CRAF has historically provided augmentation to U.S. military airlift capacity during armed conflicts, one may reasonably conclude that CRAF aircraft could - in some cases - be considered military objectives and thus lawful objects of attack. That a CRAF aircraft has not yet been targeted as such during an armed conflict remains more a product of the air superiority achieved by the U.S. in the conflicts with which CRAF has engaged than a result of IHL's constraining effect on adversaries. This may not always be true in the future.

The CRAF example may inform the application of the IHL principle of military objectives to the practice of hosting military capabilities on otherwise civil/commercial satellites in two ways. First, just as the weapons in the cargo bay of a CRAF aircraft are lawful military objectives, then the military payload on an otherwise civil/commercial satellite can be considered a lawful military objective. Second, just as a CRAF aircraft itself may be considered a lawful object of attack under particular circumstances, so too may an entire otherwise civil/commercial satellite. When otherwise civil/commercial satellites take direct part in hostilities, act in any capacity as a naval or military auxiliary to the enemy's armed forces, or are otherwise integrated into the enemy's war-fighting or war-sustaining effort, then they may lose any protected status they would otherwise enjoy. Starlink satellites directly enabling kinetic strikes against Russian tanks, for example, are more likely to be considered military objectives than communications satellites broadcasting summer blockbusters to military bases.

Reasoning from the established law from the traditional war fighting domains regarding identifying military objectives, one may reasonably conclude that entire satellites may be considered military objectives when they are actually used or intended to be used for military purposes. That the entire satellite may constitute a single object also finds support in the Convention on Registration of Objects Launched into Outer Space. Article I(b) provides that the term "space object" includes component parts of a space object as well as its launch vehicle and parts thereof. A review of the information transmitted to the United Nations pursuant to Article IV of the Registration Convention demonstrates that States treat each individual satellite as an individual space object. States do not separately register subcomponents of satellites. States do register each satellite within a constellation individually. At least for purposes of the Registration Convention, States treat each satellite individually as a single object. The negotiating States did not require that registrations separately identify military and otherwise civil/commercial subcomponents.

[191] DEPARTMENT OF DEFENSE LAW OF WAR MANUAL, 14.8.3.2.

Finally, in the interest of completeness, there also may be a legal presumption that objects have protected status as "civilian objects" unless the test for military objectives, described below, is satisfied.[192] A concern with such a presumption is that operators facing time-sensitive decisions may be precluded from making lawful attacks as a result of perceived evidentiary hurdles to overcoming a "presumption" versus simply applying the test for military objectives to the potential object of attack at issue. The resolution of this debate regarding a presumption of protected status could prove outcome determinative in targeting analyses of satellites. Because of the technical difficulty of observing satellites and understanding the utility of their particular operations, attackers may lack the degree of information they would have about a terrestrial object which they may have been able to observe and understand more completely. This paper takes no position on the debate regarding a presumption of protected status for objects, as the determination of the issue has no effect on the test for lawful military objectives itself. However, this paper does note that the issue of protected status may amount to a gap in the law that the practice of States could fill.

In sum, all of the pre-existing and accepted tests for military objectives under international humanitarian law support treating a satellite - even an otherwise civil/commercial satellite with military applications - as a single entity. This would be true even if there was a presumption of protected status because the test for military objectives, if met, would override that presumption. As such, under existing law, a satellite that qualifies as a military objective may be targeted as a whole. Because such a satellite qualifies as a military objective, no part of it qualifies as a protected "civilian object." Because no part of such a satellite can be considered a protected "civilian object," there is no co-location of a military objective with a civilian object, and there can be no violation of Article 58, Additional Protocol 1.

B. State Practice Must Be Taken Into Account When Interpreting IHL as It Applies in Space

Moving now beyond the textual objection to Professor Koplow's argument, this section argues that State practice provides evidence of interpretations of existing international rules that allow for military applications of otherwise

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[192] *See* Ryan Goodman, *Clear Error in the Defense Department's Law of War Manual on Presumptions of Civilian Status*, Just Security (Feb. 9, 2022), *available at* https://www.justsecurity.org/80147/clear-error-in-the-defense-departments-law-of-war-manual-on-presumptions-of-civilian-status/#:~:text=%E2%80%9CUnder%20customary%20international%20law%2C%20no,exists%20for%20persons%20or%20objects.%E2%80%9D&text=Article%2050(1)%3A%20%E2%80%9CIn,considered%20to%20be%20a%20civilian.%E2%80%9D.

civil/commercial satellites. Alternatively, State practice could result in adaptive interpretations of these rules to allow for the trending practice, or it could form new rules pertaining to the application of international humanitarian law in outer space altogether.

The notion that State practice plays a meaningful role in the development of international law rings particularly true for matters pertaining to outer space. While a handful of multilateral treaties were negotiated in the field of international space law in the latter part of the 20th century, both those treaties and customary international space law generally came into being primarily as ad hoc reactions to ongoing practices and customs of space-faring nations. For this reason, States must remain particularly attuned not only to their own activities in space but also to the activities of other States, as these practices could ultimately result in the creation of binding international rules that a State may or may not find desirable within the context of its long-term strategic ambitions.

This part highlights the modes through which custom may impact the status of international law. In the context of international space law, this could mean clarifying or modifying treaty rules derived from the major international space law treaties or other international obligations, or it could mean developing new customary international law altogether. Treaties and custom comprise the two sources of international law. Treaty rules of course derive from the explicit consent of States seeking to be bound by those rules. Rules of customary international law are said to exist when "states generally engage in specific actions (the 'state practice' requirement) and accept that those actions are obligatory or permitted (the 'opinion juris sive necessitatis" element)."[193] While a doctrinal analysis of the formation or elements of customary international law remains outside the scope of this paper, this paper does survey three ways in which state practice can be said to affect the status of customary international law. First, state practice can provide interpretive guidance as to the meaning of terms contained within treaties. Second, some scholars suggest that state practice can substantively alter treaty-derived

[193] Rebecca Crootof, *Change Without Consent: How Customary International Law Modifies Treaties*, 41 YALE J. INT'L L. 237, 242 (2016), AVAILABLE AT https://openyls.law.yale.edu/bitstream/handle/20.500.13051/6707/Crootof_Rebecca.pdf?sequence=2.; *See also* BIN CHENG, PART II THE UNITED NATIONS AND OUTER SPACE, 7 UNITED NATIONS RESOLUTIONS ON OUTER SPACE: 'INSTANT' INTERNATIONAL CUSTOMARY LAW? 10 (1997), ("The orthodox view is that a rule of customary law has two constitutive elements: (i) *corpus*, the material or objective element, and (ii) *animus*, the psychological or subjective element. The *corpus* of a rule of customary law is the existence of a usage (*consuetudo*) embodying a rule of conduct. The *animus* consists in the conviction on the part of States that the rule embodied in the usage is binding (*opinio juris*). This view finds expression in Article 38(1)(b) of the Statute of the International Court of Justice which speaks of the Court applying 'international custom, being evidence of a general practice accepted as law'.").

rules. Third, as noted above, state practice comprises the first of two elements required for the recognition of customary international law.

i. Interpretive Effect of Custom

As with any law, the meaning of specific treaty terms may come into question, and the terms may require interpretation in order to resolve a dispute among States. The Vienna Convention on the Law of Treaties (VCLT) codified customary international law governing treaties, and its Articles 31-33 pertain to treaty interpretation.[194] Article 31(3)b) directs that one must take into account any subsequent practice in the application of the treaty which establishes the agreement of the parties regarding its interpretation" when interpreting treaty provisions.[195] "Subsequent practice" itself is a term of art reflecting upon the subset of state practice which contracting States to a treaty have agreed is relevant for purposes of interpreting the provisions of a treaty.[196] In principle, "'interpretation' illuminates a treaty's terms or applicability… Interpretation may be in line with the existing law (amendment secundum or intra legem) or serve a gap-filling function (amendment praeter legem)."[197]

In some cases, existing or evolving State practice may appear to diverge from the plain text of treaty rules. In these cases, State practice may drive adaptive interpretations of treaty texts. Adaptive interpretations of treaty text are "interpretations not immediately suggested by the treaty, but which attempt to reconcile outdated text with actual (or desired) state action."[198] On a spectrum from interpreting existing rules to creating new rules, adaptive interpretations rest at the farthest reaches of the concept of interpreting existing rules without quite entering the realm of altering existing rules (at least not admittedly so).

Not only does this concept of custom informing the interpretation of a treaty provision apply in the context of international space law, but also large portions of the corpus of international space law may have been developed specifically with an eye toward future developments based on custom. It has been argued that the 1967 Outer Space Treaty was drafted with both hard rules and also "aspirational norms to add an ethical dimension to the law of outer space."[199] These aspirational norms would imbue "an underlying ethics of humanism and multilateralism" onto the hard

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[194] *Vienna Convention on the Law of Treaties*, opened for signature 23 May 1969, 1155 UNTS 331 (entered into force 27 January 1980) arts 31-33.
[195] *Id.*, at art 31.
[196] Crootof, *supra* note 194, at 258.
[197] *Id*. at 259, (citing GODEFRIDUS J. H. HOOF, RETHINKING THE SOURCES OF INTERNATIONAL LAW 276-79 (1983).)
[198] *Id.*, at 239.
[199] Blount, *supra* note 144, at 113.

rules found in the treaty text "without the possibility of compromising emerging, innovative technologies."[200] As the 1967 Outer Space Treaty was largely a security instrument drafted within the context of bipolar Cold War competition, one may consider that the drafters of the treaty specifically envisioned future military uses of space to guide the interpretations of treaty terms such as the "due regard" provision in Article IX as well as the "peaceful purposes" provision of Article IV and treaty preamble.

In December 2021, China sent a note to UN COPUOS regarding two alleged instances wherein the China Space Station was required to maneuver in order to avoid a potential collision with a Starlink satellite.[201] Interestingly, China's note cited only Article V of the Outer Space Treaty, which requires State Parties to "immediately inform the other States Parties to the Treaty or the Secretary-General of the United Nations of any phenomena they discover in outer space, including the moon and other celestial bodies, which could constitute a danger to the life or health of astronauts." China's note did not cite Article IX of the Outer Space Treaty. Article IX provides in part:

> In the exploration and use of outer space, including the moon and other celestial bodies, States Parties to the Treaty shall be guided by the principle of co-operation and mutual assistance and shall conduct all their activities in outer space, including the moon and other celestial bodies, with due regard to the corresponding interests of all other States Parties to the Treaty.[202]

In response, the U.S. wrote a note denying that the Starlink satellites met "the threshold of established emergency collision criteria." The U.S. asserted that "emergency notifications were not warranted in either case" and also that the "United States is unaware of any contact or attempted contact by China with the United States Space Command, the operators of Starlink-1095 and Starlink-2305 or any other United States entity to share information or concerns about the stated incidents prior to the note verbale from China to the Secretary General."[203] In a press conference, a Chinese Foreign Ministry spokesperson responded to the U.S. note by arguing that "the US has no right to unilaterally set a lower limit for

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[200] *Id.*

[201] UN Committee on the Peaceful Uses of Outer Space, *Note verbale dated 3 December 2021 from the Permanent Mission of China to the United Nations (Vienna) addressed to the Secretary-Genera,* A/AC.105/1262, *available at* https://www.unoosa.org/res/oosadoc/data/documents/2021/aac_105/aac_1051262_0_html/AAC105_1262E.pdf.

[202] Outer Space Treaty, *supra* note 31, art IX.

[203] Note verbale, *supra* note 202.

emergency collision standards."[204] The Chinese spokesperson then also referenced Article IX's due regard provision.[205] This incident shows evolving practice with respect to interpretations of the "due regard" provision and could prove useful in discerning evolved legal rules over time. Specifically, the episode serves as evidence that States have not fully determined the metes and bounds of the meaning of the Outer Space Treaty's phrase "due regard" as the phrase applies in the outer space context. The evolving State practice will show how States come to interpret "due regard" in outer space, which very well may differ from how States have interpreted "due regard" in other more terrestrial contexts such as the "due regard" provisions within the UN Convention on the Law of the Sea (UNCLOS).

Similarly, State practice will illuminate how States interpret the obligations of Article 58 of Additional Protocol I as it applies in the outer space context. States may determine not to treat outer space identically to how they treat other more terrestrial domains, and for that reason, they may choose to interpret the obligations of Article 58 differently in outer space. As such, even if Professor Koplow's analysis of Article 58 is correct in a terrestrial sense, States may interpret these obligations differently for activities in outer space. Indeed, if practice thus far is any indication of how States intend to treat outer space, a space-specific interpretation of Article 58 - or even an "adaptive interpretation" of Article 58 as discussed below - may be warranted if States seek to square their behavior with the law.

ii. Modification by Subsequent Practice

In her article, "*Change Without Consent: How Customary International Law Modifies Treaties*," Professor Rebecca Crootof argues that subsequently developed customary international law can modify treaty obligations.[206] Adaptive interpretation differs from treaty modification by subsequent practice. Whereas adaptive interpretation represents the outer bounds of what States may do to interpret existing treaty terms in potentially novel ways, the process of modification through State practice substantively changes the rights and obligations derived from a treaty. The legality of adaptive interpretation "was clarified in the Vienna Convention and has a reputable history" whereas the legitimacy of modification is "less well-established."[207] In fact, the International Law Commission "elected to remove a provision [from the VCLT] providing for treaty modification based in

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[204] Global Times, *US denial of SpaceX satellites' close encounters endangering China's crewed space station 'a move of shirking responsibility': FM*, GLOBAL TIMES (Feb. 10, 2022, 7:06 PM), *available at* https://www.globaltimes.cn/page/202202/1251961.shtml.
[205] *Id.*
[206] Crootof, *supra* note 194, 264.
[207] *Id*., at 260.

agreement manifested through the subsequent practice of the states parties, leaving open the question of the legitimacy of such modification." On the other hand, by deciding to remain silent on the relationship between treaty and customary international law, the Commission did not foreclose the possibility that the latter could modify the former."[208]

Professor Rebecca Crootof highlights the development of the law of submarine warfare as illustrative of how customary international law substantively modified the treaty-derived obligations of States. In 1930, the U.S., U.K., Japan, France, and Italy signed the Treaty for the Limitation and Reduction of Naval Armament ("London Naval Treaty").[209] Article 22 of the London Naval Treaty determined that submarines "must conform to the rules of international law to which surface vessels are subject" and that "except in the case of persistent refusal to stop on being duly summoned, or of active resistance to visit or search, a warship, whether surface vessel or submarine, may not sink or render incapable of navigation a merchant vessel without having first placed passengers, crew and ship's papers in a place of safety."[210] "These provisions were then reiterated to the letter in the 1936 London Protocol, ratified by all naval powers, including Germany."[211]

However, as World War II began, the London Protocol treaty requirements were not followed as "all naval participants with the means to do so (except Japan) engaged in some form of unrestricted submarine warfare."[212] As Crootof writes, "subsequent and contradictory state practice has created a vast number of customary exceptions to the treaty rules" and that the "customary 'exceptions' to the treaty law have essentially swallowed the rule."[213] She provides an excerpt of the Max Planck Encyclopedia of Public International Law as support for this proposition:

> [C]ustomary international law now provides that the London Protocol of 1936, coupled with the customary practice of belligerents during and following World War II, imposes upon submarines the responsibility to provide for the safety of passengers, crew, and ship's papers before destruction of an enemy merchant vessel, unless the enemy merchant vessel persistently refuses to stop when duly summoned to do so; it actively resists visit and search or capture; it is sailing under convoy of enemy warships or enemy military aircraft; it is armed; it is incorporated into, or is assisting in

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[208] *Id*., at 281.
[209] Office of the Historian, *The London Naval Conference, 1930*, U.S. DEP'T OF STATE, *available at* https://history.state.gov/milestones/1921-1936/london-naval-conf.
[210] Treaty for the Limitation and Reduction of Naval Armaments, (Part IV, Art. 22, relating to submarine warfare). London, 22 April 1930.
[211] Crootof, *supra* note 194, at 270.
[212] *Id*.
[213] *Id*., at 271.

> any way the enemy's military intelligence system; it is acting in any capacity as a naval or military auxiliary to an enemy's armed forces; or the enemy has integrated its merchant shipping into its war-fighting effort and compliance with the London Protocol of 1936 would, under the circumstances of the specific encounter, subject the submarine to imminent danger or would otherwise preclude mission accomplishment.[214]

As the submarine episode demonstrates, customary international law can modify treaty rules, including within the realm of international humanitarian law. Clearly then, one must consider how customary international law might affect the rights and obligations of States within the field of international humanitarian law applied in the space domain. That is to say that even if Professor Koplow's thesis, that the practice of hosting military payloads or capabilities on otherwise civil/commercial satellites is unlawful, would be correct under the interpretation of Article 58 given by States to terrestrial domains, one must take account of how State practice could substantively modify this rule such that the practice becomes lawful in outer space. Given the ever-increasing military uses of otherwise civil/commercial satellites and the lack of States protesting the practice as unlawful, the trend certainly seems to be moving toward a widespread acceptance of this practice by States.

iii. Generative Effect of Custom

Outside of simply modifying or clarifying treaty rules, custom plays a role in the formation of completely new customary international law. Whether custom amounts to a constitutive element of customary international law, or merely as evidence of *opinio juris* with the *opinion juris* itself being sufficient to evolve new legal rules,[215] custom clearly serves an important role in the creation of new customary international law.

In the international space law context, the launch of Sputnik is often described as forming "instant customary international law."[216] The Soviet Union did not seek permission from any State over which the satellite would fly prior to launching it. Upon launching it, no overflown States protested. Indeed, the U.S.

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[214] *Id*., (citing MAX PLANCK ENCYCLOPEDIA OF PUB. INT'L L., http://opil.ouplaw.com/view/10.1 093/law:epil/9780199231690/law9780199231690e412?rskey=ugUuAj &result-2&prd=OPIL (Aug. 2009).

[215] *See* BIN CHENG, PART II THE UNITED NATIONS AND OUTER SPACE, 7 UNITED NATIONS RESOLUTIONS ON OUTER SPACE: 'INSTANT' INTERNATIONAL CUSTOMARY LAW? 10 (1997)

[216] Ram S. Jake & Steven Freeland, *The Relationship Between the Outer Space Treaty and Customary International Law* 5, 59th IISL Colloquium on the Law of Outer Space (2016), *available at* https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3397145.

shortly followed with satellites of its own. Taking the practice of overflying States in outer space without permission together with the acquiescence of other States to the behavior, the Sputnik episode therefore demonstrated all of the elements necessary to evince a new rule of customary international law allowing permissive overflight in space.

The formation of this rule was remarkable because until this point, overflight over another State's territory was expressly prohibited. Both as an extension of the concept of State sovereignty and as a result of the codification of this rule in Article 1 of the Chicago Convention,[217] overflight of another State without permission was unlawful. The prohibition extended, of course, to surveillance aircraft. For the four years between July 4, 1956, and May 1, 1960, the U.S. covertly flew U-2 reconnaissance missions over Soviet airspace to verify developments of its nuclear program.[218] The U-2 spy plane could fly at a ceiling of approximately 70,000 feet, high enough to potentially avoid detection from Soviet radar. Because of the violation of Soviet sovereignty, the President of the U.S. at the time, President Dwight Eisenhower retained personal approval authority for each of these U-2 missions. The USSR actually could detect the flights but lacked either the means to shoot them down or evidence necessary to definitively link the flights to the U.S. in order to protest publicly. On May 1, 1960, that changed as the USSR successfully shot down a U-2 over its airspace. Notably, the U.S. did not complain about this Soviet action because the U.S. recognized that its missions violated Soviet sovereignty.

The Sputnik incident carved outer space out from this previously existing prohibition of overflight and instantly created a rule that provided for permissive overflight in outer space, including by surveillance spacecraft. If the elements for the formation of customary international law are met, then a new rule can be said to exist - even if these elements have only been satisfied for a short time. As the ICJ noted in the *North Sea Continental Shelf* case:

> Although the passage of only a short period of time is not necessarily, or of itself, a bar to the formation of a new rule of customary international law on the basis of what was originally a purely conventional rule, an indispensable requirement would be that within the period in question, short though it might be, State practice, including that of States whose interests are specially affected, should have been both extensive and virtually uniform in the sense of the provision invoked; and should moreover have occurred in

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[217] *See Convention on International Civil Aviation*, 7 December 1944, 15 UNTS 295, ICAO Doc 7300/6 [Chicago Convention], art 1.

[218] Office of the Historian, *U-2 Overflights and the Capture of Francis Gary Powers, 1960, available at* https://history.state.gov/milestones/1953-1960/u2-incident.

> such a way as to show a general recognition that a rule of law or legal obligation is involved.[219]

The Sputnik incident demonstrated "extensive and virtually uniform" practice consistent with the right of overflight in outer space, and the lack of protest to the USSR's activity - especially considered within the context of Cold War politics - showed "a general recognition that a rule of law or legal obligation" had formed.

States may still avoid becoming bound by this new rule if they persistently object to the rule. The persistent objector doctrine "provides that if a state 'persistently and consistently objects to a newly emerging norm of customary international law during the period of the formation of that norm . . . the objecting state is exempt from the customary norm in question once it has crystallized and for so long as the objection is maintained.'"[220] However, if the new rule of customary international law reaches the status of a *jus cogens* norm, then a State may not successfully object to becoming bound by the rule as no derogations are permitted from *jus cogens* norms.[221] The U.S. did not join the 1977 Additional Protocols to the Geneva Conventions but does recognize portions of Additional Protocol 1 as representative of customary international law. With respect to other portions of Additional Protocol 1, the U.S. has remained a persistently objector.

iv. Doctrine of Specially-Affected States

The ICJ's ruling in *North Sea Continental Shelf* made reference to "States whose interests are specially affected" by a potential new rule of customary international law - applicable *erga omnes* - based on an existing treaty rule. In the outer space context, this "Doctrine of Specially Affected States" carries particular importance because while an increasing number of States are entering the foray of space activities in some manner or another, relatively few States yet possess substantial space-related capabilities. The doctrine would require that the interests

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[219] North Sea Continental Shelf, Judgment, I.C.J. Reports 1969, p.3, para 74, *available at* https://www.icj-cij.org/public/files/case-related/52/052-19690220-JUD-01-00-EN.pdf.

[220] Shelly Aviv Yeini, *The Persistent Objector Doctrine: Identifying Contradictions*, 22 Chicago J. of Int'l L. Art 4, 583, *available at* https://chicagounbound.uchicago.edu/cgi/viewcontent.cgi?article=1817&context=cjil (citing JAMES A. GREEN, THE PERSISTENT OBJECTOR RULE IN INTERNATIONAL LAW 1 (2016).

[221] *Id*. (citing JAMES A. GREEN, THE PERSISTENT OBJECTOR RULE IN INTERNATIONAL LAW 1,191 (2016) (describing the notion of "peremptory norms trump the persistent objector rule" as a "majority view"); Curtis A. Bradley & Mitu Gulati, Withdrawing from International Custom, 120 YALE L.J. 202, 213 (2010) ("Jus cogens norms cannot be overridden, even by treaty, and there is no right to opt out of them by prior persistent objection."); Dino Kritsiotis, On the Possibilities Of and For Persistent Objection, 21 DUKE J. COMPAR. & INT'L L. 121, 132–34 (2010) (discussing the inapplicability of POD to jus cogens norms)).

of these States specially affected by changes to the legal regime governing outer space activities must be considered in the process of recognizing any new rule of customary international law.

In the case of the development of the right of overflight in outer space that formed as a result of the Sputnik launch, the USSR and U.S. would qualify as specially affected States whose interests must be considered to determine whether a new rule of law or legal obligation had formed with respect to the right of overflight in outer space. In the Sputnik episode, of course, both the USSR and U.S. supported this right, and the right of overflight in outer space was consistent with their practice and their interests. As a result, the new rule came into existence.

Like the modification of treaty rules as a result of subsequent practice of States, the "Doctrine of Specially Affected States" can be said to run counter to the consent-based nature of international law. With regard to rules of outer space activities in particular, very few States can drive the development of rules binding on all. This disadvantages developing States by preventing their particular interests from being considered - even if they have aspirations toward outer space activities in the future. The Sputnik episode, for example, formed a rule of international law binding on all States despite there being only two existing space-faring nations at the time and despite the fact that the rule effects every State on earth.

In addition to this concern about the fairness of the doctrine, applying the doctrine in the context of developing rules pertaining to military uses of otherwise civil/commercial satellites could be further complicated depending on the scope of the rule at issue. If considering specifically rules pertaining to States seeking to deeply integrate their military capabilities with otherwise civil/commercial satellite constellations on multiple orbital planes at multiple altitudes and across a variety of platforms in order to further expand their ability to project military power around the globe, the number of States engaged in this practice would be relatively few. On the other hand, the low cost and low barrier to entry of purchasing satellite Internet services, for example, would enable virtually any State to make military applications of otherwise civil/commercial satellites. Indeed, Ukraine's ongoing use of SpaceX's Starlink services to enable kinetic attacks against Russian invaders demonstrates how accessible and transformative the military applications of otherwise civil/commercial satellites can be. This democratization of space capabilities enabled by the commercial sector complicates the analyses of specially affected States because previously inaccessible capabilities can now be had easily by any State and without massive upfront investment into space or defense enterprises. This ease of access potentially expands the pool of States whose interests are specially affected. As such, the problem of determining where to draw the line between States whose interests are specially affected and those whose interests are not becomes even more difficult.

Despite these concerns, the activities of a few States can undoubtedly establish a custom or interpretation of international law that is widely accepted by others. Any State may voice objection to any practice of any other State - even if the complaining State has no capability itself to engage in the controversial activity. When States who may not be "specially affected" by particular practices fail to object to developing custom in circumstances in which they might be expected to object, the absence of objection can be viewed as evidence of acquiescence to or acceptance of the practice.

Just like the U.S. did not object to the U.S.S.R.'s overflight with Sputnik, so too are no States objecting today to the military uses of otherwise civil/commercial satellites. No States - not even Russia - have formally protested Ukraine's military uses of Starlink. No States are alleging legal violations for the U.S.'s plans to build a resilient architecture in space that is dependent on distributed and proliferated commercial systems in multiple orbits. The clear trend of State practice is toward widespread adoption and acceptance of the practice of intermingling military capabilities with otherwise civil/commercial satellites. As such, this State practice coupled with the lack of formal protests to these activities may provide the necessary evidence required to form either a space-specific interpretation of Article 58, an adaptive interpretation of Article 58 that squares the practice with the law, or even to generate new customary rules that render Professor Koplow's concerns moot.

C. Areas Within Which State Practice May Define the Contours of the Application of IHL, Thereby Bringing Concerns over Anticipatory Breach back to the Fore.

Another issue to consider is whether States may consider that an orbit itself can be treated as an object for IHL analysis. For example, if Russia knows that the U.S. must have access to GEO in order to launch a successful military campaign, could Russia treat the entire orbit as an object and deny the U.S. access to and use of this space entirely? Such a treatment of an orbit as an object under IHL would have profound implications for civil and commercial uses of space because Russia may be able to disregard all of the collateral damage to civil and commercial satellites in that orbit in its targeting analyses.

Arguably, Russia has already demonstrated its willingness to do this. On 15 November 2021, Russia tested a direct-ascent ASAT weapon[222] against a defunct

[222] For a history and explanation of ASAT weapons, see here: https://www.ucsusa.org/sites/default/files/2019-09/a-history-of-ASAT-programs_lo-res.pdf

Soviet-era satellite.[223] The destructive test resulted in no fewer than 1,500 pieces of trackable space debris in earth's orbit, which may generate "hundreds of thousands"[224] of smaller pieces of space debris.[225] The United States quickly condemned the test as "dangerous and irresponsible" - especially as the Russian space debris directly threatened the safety and lives of the U.S. astronauts aboard the International Space Station[226] - as well as the two Russians and one German among the crew.[227] The debris cloud also threatened astronauts aboard the Chinese space station[228] and will continue to pose a threat to space objects in Low Earth Orbit (LEO), like Starlink satellites,[229] for years to come.

It may seem absurd to treat an orbit as an object which can be made a military objective. After all, an orbit is not a physical object. But consider how significantly the physical characteristics of space differ from those on earth. If a bomb is dropped into a sea lane, the water returns to normal after the initial splash. If a bomb destroys a road, it may be rebuilt or tanks can drive around the hole. On the other hand, an attack on one or more satellites in orbit can result in hundreds of thousands of pieces of hazardous space debris that could threaten life and property in space for hundreds of years. The debris can collide with other space objects,

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[223] *Russian direct-ascent anti-satellite missile test creates significant, long-lasting space debris,* UNITED STATES SPACE COMMAND, (Nov. 15, 2021), https://www.spacecom.mil/News/Article-Display/Article/2842957/russian-direct-ascent-anti-satellite-missile-test-creates-significant-long-last/; https://www.datacenterdynamics.com/en/news/russian-asat-test-creating-thousands-of-conjunction-alerts-for-satellite-operators/

[224] *Id.*

[225] Jonathan Amos, *Russian anti-satellite missile test draws condemnation,* BBC NEWS (1 day ago), https://www.bbc.com/news/science-environment-59299101 (last visited Nov. 17, 2021)

[226] Joey Roulette, *Debris From Test of Russian Antisatellite Weapon Forces Astronauts to Shelter*, NYTIMES.COM (last updated Nov. 16, 2021), *available at* https://www.nytimes.com/2021/11/15/science/russia-anti-satellite-missile-test-debris.html.

[227] *International Space Station [Mission Summary] - The Expedition 66 Crew*, https://www.nasa.gov/sites/default/files/atoms/files/exp-66-summary.pdf (last visited Nov. 17, 2021).

[228] *NASA Administrator Statement on Russian ASAT Test*, (Nov. 15, 2021) https://www.nasa.gov/press-release/nasa-administrator-statement-on-russian-asat-test

[229] *See e.g.*, Dan Swinhoe, *Russian ASAT test creating thousands of conjunction alerts for satellite operators*, DATA CENTER DYNAMICS (Feb. 21, 2022), *available at* https://www.datacenterdynamics.com/en/news/russian-asat-test-creating-thousands-of-conjunction-alerts-for-satellite-operators/*;* Marianne Guenot, *Space debris from a Russian missile test could disrupt Elon Musk's Starlink project to beam the internet from orbit,* BUSINESS INSIDER (Nov. 17, 2021), *available at* https://www.businessinsider.com/starlink-russia-missile-test-debris-may-disrupt-the-satellite-network-2021-11?r=US&IR=T.

generating more and more debris until either the entire orbit or perhaps all of space becomes unusable for generations as a result of the Kessler Syndrome.[230]

While abstract in nature, an orbit can be identified in physical terms. Indeed, certain orbits like GEO are particularly valuable specifically because of their physical properties. For example, the physical nature of GEO allows observation of the entire earth with just three satellites. An orbit could be analogized to a bridge that provides the only available river crossing. Certainly, a bridge can be an object for IHL purposes. And an orbit itself can also meet the requirements of the two-part test for military objectives. The nature of the GEO orbit is such that a military may need access to GEO in order to maintain continuous global communications or surveillance. The location of GEO is valuable for this exact reason. The use of GEO enables military functions. And attacking GEO itself would give a State like Russia a distinct military advantage.

This logic would extend to other orbits as well. Arguably, the relative ease of attacking lower orbits such as LEO or MEO would tend to make such an attack upon an entire orbit even more likely. For example, GNSS satellites occupy the MEO orbit, and unlike the dependent relationship between the U.S. military and GPS, Russian military doctrine apparently does not even count on its GLONASS system being available for military purposes during armed conflict, planning instead to rely upon terrestrial navigation systems.[231]

Indeed, as the practice of States trends toward increasing resilience of military capabilities through proliferation, distribution, and diversification, an attack on an orbit only seems more likely - especially where there is space-reliance disparity among hostile States. While the act of implementing a resilience taxonomy is intended to deter adversaries through denial,[232] the reality is that resilient architectures may "recomplicate" the problem and result in "revenge effects" from adversaries.[233] Instead, it must be recognized that "[w]ell intentioned efforts can paradoxically create problems worse than the ones a specific invention was meant to solve."[234] Rendering an entire orbit unusable may be a rather unfortunate and long-lived recomplicating effect of implementing resilient space architecture, but for some States, it may be the only option available to wage a

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[230] Mike Wall, *Kessler Syndrome and the space debris problem*, SPACE.COM (Nov. 15. 2021), *available at* https://www.space.com/kessler-syndrome-space-debris#:~:text=The%20Kessler%20Syndrome%20is%20a,satellites%2C%20astronauts%20and%20mission%20planners.

[231] Tracy Cozzens, *Russia expected to ditch GLONASS for LORAN in Ukraine invasion*, GPS WORLD (Feb. 17, 2022), *available at* https://www.gpsworld.com/russia-expected-to-ditch-glonass-for-loran-in-ukraine-invasion/.

[232] *See* Michael P. Gleason & Peter L. Hays, *Getting the Most Deterrent Value from U.S. Space Forces, Center for Space Policy and Study* 4 (Oct. 2020).

[233] Dunlap, *supra* note 33, at 3.

[234] *Id.*

successful military campaign against the otherwise architecturally resilient capabilities of their adversary. States building resilient architectures for advanced military space capabilities in orbit would be wise to keep this likely recomplicating effect in mind.

IV. CONCLUSION

Professor Koplow's assertion that the intermingling of military capabilities with otherwise civil/commercial satellites violates the law of armed conflict does not square with existing interpretations of IHL, nor does it take full account of the current practice of States. The current state of international law treats a satellite as a single object. For that reason, the intermingling of capabilities does not mean necessarily that there is an intermingling of civilian objects with military objectives. Importantly, while this interpretation of the law lessens the concern of a violation of Article 58, AP1, the interpretation does not solve the concerns of how the proportionality analysis should apply with respect to the effects upon the civilian population for the destruction of satellites.

The practice of States must be considered for purposes of interpreting obligations under Article 58 as it applies in the outer space context. State practice is particularly important to consider in the space environment because the unique physical properties of space differ so significantly from the physical properties of air, land, and sea. The physical properties of space drive make concerns regarding space debris incredibly important and effect numerous issues relating to distinction and proportionality. As demonstrated in this paper, neither existing State practice nor the trend of State practice suggest the existence of a rule requiring States to operate wholly independent military satellites. Indeed, because of the unique physical properties of space, disaggregating military space systems from otherwise civil/commercial space systems would arguably increase the risk of harmful effects on the civilian population should armed conflict breakout in space. The destruction of a solely-military satellite would pollute the orbital environment similarly as the destruction of a dual-use satellite, and the exponentially greater number of objects in space as a result of the growth of proliferated satellite constellations would be compounded if States decided to maintain wholly independent military constellations. Arguably, the civilian population is most spared the harmful consequences of armed conflict in space by States maintaining fewer numbers of overall satellites.

The U.S. should be prepared for the rapid development of IHL in space because a physically destructive attack against a satellite, an entire constellation, or perhaps an entire orbit would be precisely the sort of catalyst event or "Grotian moment"[235] that has historically driven the evolution of international space law. The increasing practice of States to host national military space capabilities on otherwise civil/commercial satellites is apparent, and the global response to an armed attack against a satellite may provide the *opinio juris* required to positively determine the lawfulness or unlawfulness of the practice. A lack of specific

[235] *See* Michael P. Sharf, Accelerated Formation of Customary International Law, 20 ILSA J. of Int'l & Comp. L, 308 (2014).

criticism that the objects of attack were civilian objects may instantly cement a global understanding that such satellites are proper military objectives. On the other hand, official statements deriding such an attack as against civilian objects may cement the opposite rule. Therefore, the U.S. should be particularly keen on the implications of its own activities in space as well as the activities of other States toward driving legal interpretations or the creation of new binding rules that may or may not be aligned with its long-term strategic interests.