

# Anti-Satellite Weapons and Self-Defence: Law and Limitations

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**Abstract:** Space is an increasingly militarized domain with the potential to be a source and place of armed conflict. In recent years, tests of anti-satellite (ASAT) weapons capable of neutralizing civilian and military satellites have fuelled fears of warfare in that domain. Satellites are potentially attractive targets during armed conflict, making ASAT weapons central to assessing the threat environment in space. Space debris resulting from ASAT weapon use is of particular concern, as it threatens other satellites in orbit, many of which underpin the operation of human societies and global economies. Although states recognize this threat, attempts at weapons control have failed. Instead, we must look to existing international law that governs military activities in space, including in the cyber domain. Yet, how the *jus ad bellum* (JAB), which regulates state uses of force, applies to ASAT weapons has received little attention. This is despite state assertions of their right to act in self-defence in space.

This paper argues that JAB regulation of ASAT technologies addresses state concerns regarding protecting space assets and avoiding conflict in space. This author contends that states acting defensively in space are restricted in their choice of targets by the requirements of JAB necessity and proportionality, which protect civilians and the interests of other states. While defensive acts, including cyber operations, that do not cause space debris are most likely to be JAB-compliant, this is not guaranteed. Military actions of any kind against mixed-use or multi-user satellites raise particular concerns for JAB proportionality due to the potential resulting harm to civilians and to the interests of other states. A clearer understanding of how the JAB regulates ASAT weapons helps decision makers avoid lawful acts of self-defence being characterized

as unlawful uses of force. Adherence to these JAB rules ultimately helps secure international peace and security on Earth and beyond Earth's atmosphere.

**Keywords:** *ASAT weapons, jus ad bellum, necessity and proportionality, self-defence, space*

## 1. INTRODUCTION

Space activities underpin all instruments of national power,<sup>1</sup> with states increasingly considering space as an integrated part of their national security. NATO, for example, recognizes space as an operational domain, alongside air, land, sea, and cyberspace.<sup>2</sup> Space is also a contested domain, with the potential to be a source and place of armed conflict. Unease over the 'weaponization' of space<sup>3</sup> is accordingly at the top of the international agenda, with the UN General Assembly (UNGA) consistently emphasizing the need for international cooperation on the peaceful uses of outer space and expressing serious concern about an arms race in that domain.<sup>4</sup> There exists particular unease over states developing counterspace weapons that threaten access to and freedom to operate in space.<sup>5</sup> Although no state has yet used such a weapon against another state's satellite,<sup>6</sup> given their importance to military operations, satellites might be considered attractive targets in armed conflict. This fact is evidenced by the testing of offensive and defensive anti-satellite (ASAT) weapons capable of disrupting or destroying both civilian/commercial and military satellites.

The call for legal regulation of ASAT weapons is urgent, given the physics of space and the potential enduring effects of space debris that might result from ASAT weapon use.<sup>7</sup> Space debris imperils other satellites in orbit, many of which are fundamental to the operation of human societies and global economies. States view space debris as a significant threat to the space environment, with the intentional destruction of satellites exacerbating the threat.<sup>8</sup> Yet, multilateral attempts to restrain the

<sup>1</sup> Kari A Bingen, Kaitlyn Johnson, Makena Young, and John Raymond, *Space Threat Assessment 2023* (Center for Strategic and International Studies, April 2023) 1 (CSIS, *Space Threat Assessment 2023*).

<sup>2</sup> NATO, 'NATO's Overarching Space Policy' (17 January 2022) <[www.nato.int/cps/en/natohq/official\\_texts\\_190862.htm](http://www.nato.int/cps/en/natohq/official_texts_190862.htm)> accessed 1 March 2024.

<sup>3</sup> See Jinyuan Su, 'Use of Outer Space for Peaceful Purposes: Non-Militarization, Non-Aggression and Prevention of Weaponization' 36(1) *Journal of Space Law* (2010) 253.

<sup>4</sup> For example, UNGA Res 55/122 (27 February 2001) UN Doc A/RES/55/122; UNGA Res 72/78 (14 December 2017) UN Doc A/RES/72/78; UNGA Res 77/41 (12 December 2022) UN Doc A/RES/77/41.

<sup>5</sup> NATO's Overarching Space Policy (n 2) para 2.

<sup>6</sup> CSIS, *Space Threat Assessment 2023* (n 1) 4.

<sup>7</sup> Orbital debris is any human-made object in orbit around the Earth that no longer serves any useful purpose. Depending on the orbit, space debris may endure for hundreds of years or more. NASA Orbital Debris Program Office, 'Frequently Asked Questions' <<https://orbitaldebris.jsc.nasa.gov/faq/>> accessed 1 March 2024.

<sup>8</sup> UNGA Res 77/41 (n 4).

escalating weaponization of space have failed.<sup>9</sup> Legally regulating ASAT weapons consequentially relies on bodies of international law that were not originally designed for space but naturally pertain to ASAT weapon use. To date, much of the focus regarding conflict in space has understandably been on international humanitarian law (IHL).<sup>10</sup> Meanwhile, the regulatory potential of the *jus ad bellum* (JAB), which governs when states may use force in their international relations, has received little attention.<sup>11</sup> This is an opportunity lost. This paper addresses this gap by investigating how the JAB restricts the use of ASAT weapons and responds directly to state concerns over their possible use, including in self-defence.

Section 2 begins by explaining the different types of ASAT weapons and the associated international law, including the application of the JAB. Sections 3 and 4 explore how states exercising their right of self-defence in space are restricted by the JAB. Section 3 emphasizes that, despite the potential military advantage that might be gained by targeting satellites, JAB necessity restricts the target options available to a defending state.<sup>12</sup> Even if IHL and JAB necessity do not prevent a state from targeting a satellite, Section 4 illustrates how the operation of JAB proportionality might nevertheless prohibit ASAT weapon use because of the potential resulting harm to civilians and the interests of other states. Applying these JAB rules has implications at both the strategic level (regarding how states develop space-related policies and ASAT technologies) and the operational and tactical levels (in terms of how military planners execute military operations in space). A clearer understanding of how the JAB rules apply in space helps decision makers avoid acts of self-defence being characterized as unlawful uses of force. Ultimately, JAB regulation of ASAT technologies addresses state concerns regarding protecting their space assets while also helping to avoid conflict and the escalation of conflict in space. Adherence to the JAB rules promotes and helps to secure international peace and security on Earth and beyond the Earth's atmosphere.

## 2. ASAT WEAPONS AND INTERNATIONAL LAW

The development of counterspace weapons that can disrupt, degrade, or destroy satellites and related infrastructure has a long history, going back to the dawn of the space age.<sup>13</sup> The US, China, and Russia currently possess the most advanced

<sup>9</sup> Paul B Larsen, 'Outer Space Arms Control: Can the USA, Russia and China Make This Happen' (2018) 23 J Confl Secur Law 137.

<sup>10</sup> For example, Michael N Schmitt, 'International Law and Military Operations in Space' 10 UNYB (2006) 89, 114–24; Jack Mawdsley, 'Applying Core Principles of International Humanitarian Law to Military Operations in Space' (2020) 25 J Confl Secur Law 263; Hitoshi Nasu, 'Targeting a Satellite: Contrasting Considerations between the *Jus Ad Bellum* and the *Jus in Bello*' (2022) 99 Int'l L Stud 142.

<sup>11</sup> An exception is Fabio Tronchetti, 'The Right of Self-Defence in Outer Space: An Appraisal' (2014) 63 ZLW 92.

<sup>12</sup> A 'defending state' is a state that is, or claims to be, the victim of an armed attack.

<sup>13</sup> See Center for Strategic and International Studies, 'Counterspace Timeline, 1959–2022' (31 March 2021) <<https://aerospace.csis.org/counterspace-timeline/>> accessed 1 March 2024.

ASAT technologies, although other states possess counterspace capabilities.<sup>14</sup> ASAT weapons can be placed into four broad categories.<sup>15</sup> The first category is kinetic physical ASAT weapons, which comprise anti-satellite missiles and other methods of physical kinetic attacks directed against satellites. Such attacks may be launched from the ground (direct ascent ASAT weapons) or from space (co-orbital ASAT weapons). The US, China, Russia, and India have all demonstrated kinetic ASAT capabilities.<sup>16</sup> Non-kinetic physical ASAT weapons, meanwhile, have reversible or permanent physical effects on satellites or other space systems but make no physical contact with them. They include directed energy weapons launched from other satellites, or from land, sea, or airborne weapons platforms on Earth. A third type is electronic ASAT weapons, such as jamming devices that interfere with the transmission of signals to and from satellites and spoofing devices that can falsify signals. The final category comprises cyber attacks that target data and the systems that use data. Such attacks may be used to monitor data, or to intercept, falsify, or corrupt it, and may be temporary or permanent.

Contemporary international space law that governs military activities in space is centred on the Outer Space Treaty of 1967 (OST)<sup>17</sup> and, to a much lesser extent, the Moon Agreement of 1979 (Moon Agreement).<sup>18</sup> Neither treaty prevents ASAT weapons from being used in lawful acts of self-defence.<sup>19</sup> Efforts by the UN to forestall the weaponization of space and to preserve it for peaceful purposes continue but have not yet borne fruit.<sup>20</sup> A comprehensive ban is unlikely in the present geo-political climate.<sup>21</sup> Instead, guiding principles governing space activities and other ‘soft law’ efforts have been pursued by the UN<sup>22</sup> and the EU,<sup>23</sup> while academic projects like the

- 14 See Office of the Director of National Intelligence, ‘2023 Annual Threat Assessment of the U.S. Intelligence Community’ (8 March 2023) 8, 15. See also CSIS, *Space Threat Assessment 2023* (n 1).
- 15 This paper adopts the commonly used categorization of counterspace weapons set out in CSIS, *Space Threat Assessment 2023* (n 1) 3–7.
- 16 CSIS, *Space Threat Assessment 2023* (n 1) 11, 14, 23; Mawdsley (n 10) 279.
- 17 1967 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, 610 UNTS (OST) 205.
- 18 1979 Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, 1363 UNTS 3. The Moon Agreement has received a very limited number of signatories and ratifications, with a notable absence of major spacefaring powers. It is not, therefore, a significant source of space law. See UN Office for Outer Space Affairs, ‘Status of International Agreements Relating to Activities in Outer Space’ <<https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/status/index.html>> accessed 1 March 2024.
- 19 See n 29.
- 20 See UN Office for Outer Space Affairs <[www.unoosa.org/oosa/en/aboutus/index.html](http://www.unoosa.org/oosa/en/aboutus/index.html)> accessed 1 March 2024; the work of the Committee on the Peaceful Uses of Outer Space, including delegate statements to the Sixty-Sixth Session (31 May–9 June 2023) <[www.unoosa.org/oosa/en/ourwork/copuos/2023/statements.html](http://www.unoosa.org/oosa/en/ourwork/copuos/2023/statements.html)> accessed 1 March 2024. See also the work of the UN Conference on Disarmament <<https://disarmament.unoda.org/conference-on-disarmament/>> accessed 1 March 2024.
- 21 See further Shang Kuan, ‘Legality of the Deployment of Anti-Satellite Weapons in Earth Orbit: Present and Future’ (2010) 36 *J Space L* 207, 227–30.
- 22 See UN Office for Outer Space Affairs, ‘Space Law Treaties and Principles’ <<https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties.html>> accessed 1 March 2024.
- 23 European Union, ‘Draft International Code of Conduct for Outer Space Activities’ (Version 31 March 2014) <[www.eeas.europa.eu/sites/default/files/space\\_code\\_conduct\\_draft\\_vers\\_31-march-2014\\_en.pdf](http://www.eeas.europa.eu/sites/default/files/space_code_conduct_draft_vers_31-march-2014_en.pdf)> accessed 1 March 2024.

Woomera and MILAMOS manuals seek to clarify rules pertaining to the use of ASAT weapons.<sup>24</sup>

In the absence of a treaty banning ASAT weapon testing and use, all military activities in space, including the use of ASAT weapons, must nevertheless comply with general public international law, including the rules of the UN Charter.<sup>25</sup> Although the focus to date has naturally been on the detailed targeting rules of IHL, the JAB, grounded in the UN Charter and customary international law, also applies to ASAT weapon use.<sup>26</sup> Under Article 2(4) of the UN Charter, states are prohibited from threatening or using force in their international relations,<sup>27</sup> subject to two recognized exceptions, being force authorized by the UN Security Council (UNSC) under Chapter VII of the UN Charter and force used in self-defence pursuant to Article 51 and customary international law.<sup>28</sup> Accordingly, absent UNSC authorization, any actions against satellites that constitute a threat or use of force require justification as lawful acts of self-defence or they will contravene Article 2(4) as unlawful uses of force.

### 3. NECESSITY IN OUTER SPACE

A state's right of self-defence arises when an armed attack occurs.<sup>29</sup> JAB necessity and proportionality then apply to the entirety of a defensive military operation to condition the exercise of that right so that force is contained and confined purely to the defensive.<sup>30</sup> They are requirements of customary international law that must be strictly adhered to in order for acts of self-defence to be considered lawful.<sup>31</sup> Necessity first stipulates that defensive force be a measure of last resort, where peaceful alternatives are unavailable or unfeasible and/or, on their own, will be ineffective to halt, repel,

<sup>24</sup> Woomera Manual on the International Law of Military Space Activities and Operations <<https://law.adelaide.edu.au/woomera/>> accessed 1 March 2024; The McGill Manual on International Law Applicable to Military Uses of Outer Space (MILAMOS) <[www.mcgill.ca/milamos/](http://www.mcgill.ca/milamos/)> accessed 1 March 2024.

<sup>25</sup> OST (n 17) art III. The exceptions are rules that are domain-specific, geographically constrained, or otherwise incompatible with the space environment. Kubo Mačák, 'Military Space Operations', in Sergey Sayapin and others (eds), *International Conflict and Security Law: A Research Handbook* (Springer 2022) 399, 406. See further Frans G von der Dunk, 'Armed Conflicts in Outer Space: Which Law Applies?' (2021) 97 Int'l L Stud 188.

<sup>26</sup> The UN Charter applies 'to any use of force, regardless of the weapons employed'. *Legality of the Threat or Use of Nuclear Weapons* (Advisory Opinion) [1996] ICJ Rep 226, para 39.

<sup>27</sup> 1945 Charter of the United Nations, 892 UNTS 119 (UN Charter), art 2(4).

<sup>28</sup> Art 51 recognizes a state's inherent right of individual or collective self-defence if an armed attack occurs. States assert their right to act in self-defence in space and while not universally accepted, the dominant view is that states may lawfully exercise that right in space and the JAB applies there to condition the exercise of that right. Tronchetti (n 11) 104–7; Nasu (n 10) 153; Von der Dunk (n 25) 199, 208–9; Mačák (n 25) 407. See also NATO's Overarching Space Policy (n 2) para 12; MILAMOS (n 24) rule 152.

<sup>29</sup> UN Charter (n 27) art 51.

<sup>30</sup> Necessity and proportionality apply on an ongoing basis, throughout the duration of an armed conflict prompted by self-defence. Judith Gardam, *Necessity Proportionality and the Use of Force by States* (CUP 2004) 155–56; Tom Ruys, 'Armed Attack' and Article 51 of the UN Charter: Evolutions in Customary Law and Practice (CUP 2010) 124.

<sup>31</sup> *Military and Paramilitary Activities in and Against Nicaragua (Nicaragua v United States)* (Judgment) [1986] ICJ Rep 14, para 176.

or (if some form of anticipatory self-defence is accepted)<sup>32</sup> prevent an armed attack. Force used in self-defence must be the only reasonable choice of means available to the defending state in the circumstances.<sup>33</sup> Any acts of self-defence, in space or on Earth, must surpass this initial hurdle to be considered lawful under the JAB. Any use of force that is unnecessary is unlawful. For defending states considering using ASAT weapons, therefore, the first question is whether options not involving military force are practical and will likely be effective to counter an armed attack, or have a reasonable chance of doing so.<sup>34</sup> In addition to UNSC responses, diplomacy, countermeasures, or military action falling below the threshold of a use of force are obvious alternatives. The latter category might include limited cyber operations that temporarily disable a satellite but do not cause it to collide with other space objects or otherwise create debris. Only when such non-forceful alternatives, on their own, are insufficient to respond to an armed attack does the necessity of using force in self-defence arise. Unless and until this requirement is satisfied, ASAT weapons that comprise a use of force may not be used.

Where reasonable alternatives are unavailable or will be ineffective, targeting satellites in self-defence using ASAT weapons might be considered an attractive option for defending states.<sup>35</sup> Satellites are an integral part of modern warfare, providing precise navigation, furnishing real-time targeting and weather data, allowing instantaneous global communications, warning of possible missile threats, collecting intelligence, and carrying out surveillance and reconnaissance.<sup>36</sup> Satellites might also be the source of an armed attack in space. As such, the defensive advantage of neutralizing a satellite that supports an adversary's aggressive behaviour seems readily apparent. Yet, even if the *prima facie* necessity is established for a state to resort to force in self-defence in some form, it does not follow that satellites automatically become fair game. To be lawful, targeting satellites must comply with the further requirement of JAB necessity that confines defensive responses to targets that serve a defensive purpose.<sup>37</sup> For policymakers and military planners, therefore, JAB necessity constitutes a further hurdle to overcome, in addition to complying with IHL targeting rules that also govern whether or not satellites are targetable. Under IHL, satellites may be targeted if they constitute 'military objectives' and IHL proportionality limitations are adhered to. 'Civilian objects' may not be directly targeted.<sup>38</sup> In addition, JAB necessity restricts

32 See Chris O'Meara, 'Reconceptualising the Right of Self-Defence Against 'Imminent' Armed Attacks' (2022) 9(2) J Use Force Int Law 278.

33 Chris O'Meara, *Necessity and Proportionality and the Right of Self-Defence in International Law* (OUP 2021) 38–42.

34 Elizabeth Wilmshurst, 'The Chatham House Principles of International Law on the Use of Force in Self-Defence' (2006) 55(4) ICLQ 963, 967.

35 'Targeting' a satellite involves engagement or action to alter or neutralize the function it performs for the adversary. United States Chairman of the Joint Chiefs of Staff, Joint Publication 3-60, *Joint Targeting* (31 January 2013) I-1. This may mean physically damaging or destroying a satellite or otherwise permanently or temporarily disabling or neutralizing it.

36 Schmitt (n 10) 90.

37 See O'Meara (n 33) 84–93.

38 1977 Protocol Additional to the Geneva Conventions, 12 August 1949, and Relating to the Protection of Victims of International Armed Conflicts, 1125 UNTS 3 (AP I) arts 48, 51(2), 52(2), 57(2).

these targeting decisions to ensure they remain defensive.<sup>39</sup> JAB necessity imposes an additional and separate targeting obligation that operates cumulatively and in parallel to these IHL rules, requiring that defensive force be (i) directed against the source of the armed attack<sup>40</sup> and (ii) limited to military targets connected with that armed attack.<sup>41</sup>

That JAB necessity requires self-defence to be connected to an armed attack means that it is only necessary to target military assets that belong to the authors of that attack. Yet, the challenges associated with legally attributing armed attacks to their author<sup>42</sup> are potentially exacerbated in space. An incorrect assessment of attribution might result in military action being characterized as an unlawful armed attack because it is directed at the wrong object. As well as breaching Article 2(4) of the UN Charter, if rising to the level of an armed attack, misdirected action risks a military response by the target state in self-defence. Tracing the use of ASAT weapons to their author depends heavily on the technology employed. Direct ascent ASAT missile attacks against satellites are more easily attributed than other counterspace weapons because launches from Earth are detectable and their effects can create identifiable orbital debris.<sup>43</sup> Beyond that method of attack, however, identifying aggressive acts in space is generally challenging. Other technologies, such as non-kinetic directed energy ASAT weapons, electronic ASAT weapons, and cyber operations, are often much less visible and are consequently more difficult to attribute to an aggressor.<sup>44</sup> Moreover, not all threats to satellites come from states. Acts like signal jamming and cyber attacks might also be carried out by non-state actors, including terrorist organizations.<sup>45</sup> This possibility further complicates the threat assessment and related response. Ultimately, on a good faith assessment, if there is no reasonable and objective basis for concluding that a particular state is the author of an armed attack, JAB necessity precludes the targeting of that state's satellites in response, together with any other asset belonging to that state. For attacks not involving direct ascent ASAT missiles, this is likely to be a high evidential burden to meet.

The nature and composition of satellites also factor heavily in whether satellites may be lawfully targeted in self-defence. Satellites can be purely civilian or commercial in nature, meaning they are not lawful targets for the purposes of JAB necessity. Alternatively, it may be established that a satellite registered to an aggressor state clearly serves a military purpose, is wholly owned or used by it, and is factually connected with the armed attack being defended against. If so, JAB necessity imposes

<sup>39</sup> *Case Concerning Oil Platforms (Iran v United States)* (Judgment) [2003] ICJ Rep 161, paras 51, 74–77; O'Meara (n 33) 84–93.

<sup>40</sup> Ruys (n 30) 108–9.

<sup>41</sup> See further below in this section regarding the military nature of targets.

<sup>42</sup> See Ruys (n 30) 368–510.

<sup>43</sup> United States Defense Intelligence Agency, *2022 Challenges to Security in Space*, 46 <[www.dia.mil/Portals/110/Documents/News/Military\\_Power\\_Publications/Challenges\\_Security\\_Space\\_2022.pdf](http://www.dia.mil/Portals/110/Documents/News/Military_Power_Publications/Challenges_Security_Space_2022.pdf)> accessed 1 March 2024.

<sup>44</sup> CSIS, *Space Threat Assessment 2023* (n 1) 4–5.

<sup>45</sup> NATO's Overarching Space Policy (n 2) para 4.

no obvious restrictions on targeting it.<sup>46</sup> Yet, verifying the military nature of a satellite is generally difficult. Moreover, other satellites may not have one sole function. They may be dual-use, hosting multiple payloads, some serving civilian or commercial purposes, and others having military functions. Payloads themselves, notably providing communication and navigation services, may also be dual-use in that they serve both civilian/commercial and military clients.<sup>47</sup> SpaceX's Starlink service, which provides internet access to support Ukraine's self-defence against Russia's ongoing invasion, is a good example<sup>48</sup> since civilians have likewise relied heavily on the service.<sup>49</sup> In addition to mixed civilian and military use, Starlink demonstrates how satellites may not be exclusively owned, operated, or used by one state but rather by a multiplicity of states, international organizations, and/or private entities.<sup>50</sup>

Mixed-use and multi-owner/user satellites pose significant challenges for military planners. Even if connected with an armed attack, the fact that a satellite may not be exclusively military in nature and/or may not be owned, operated, or used solely by the aggressor state logically limits actions against it. At a minimum, JAB necessity restricts which type of ASAT weapon may be used to target a satellite. Direct ascent or co-orbital kinetic physical ASAT weapons that are not capable of being directed at particular payloads and cannot avoid harm to other payloads on the same satellite are ruled out by this requirement. Their effects cannot be limited solely to military objects connected to the armed attack. Anti-satellite missiles are the obvious example, as they are likely to destroy or damage the entire satellite and all payloads without distinction. Other types of ASAT weapons, however, do have the potential to comply with the rule that only the aggressor and not innocent third parties are targeted in self-defence, depending on how they are used. Such weapons might include co-orbital robotic arm technologies, non-kinetic ASAT weapons like electronic devices that jam specific military signals, or cyber operations that can be specifically targeted and their effects contained. However, limiting the effects of these types of weapons is not guaranteed due to the mixed-use or multi-user nature of such satellites, as well as the inherent difficulties of operating in space and any action the victim of an intended attack might take to thwart it, which might result in kinetic impacts.

<sup>46</sup> Targeting may breach the requirements of JAB proportionality, however. See Section 4.

<sup>47</sup> Nasu (n 10) 143–44.

<sup>48</sup> 'How Elon Musk's Satellites Have Saved Ukraine and Changed Warfare', *The Economist* (5 January 2023) <[www.economist.com/briefing/2023/01/05/how-elon-musks-satellites-have-saved-ukraine-and-changed-warfare?utm\\_medium=cpc.adword.pd&utm\\_source=google&ppccampaignID=18156330227&ppcadID=&utm\\_campaign=a.22brand\\_pmax&utm\\_content=conversion.direct-response.anonymous&gclid=Cj0KCQjw4s-kBhDqARIsAN-ipH0xw65Ux5B1mojK1AQkrW3EO133GC\\_qyAHXbu3XGp9MuSEKM7VE1xoaAiMuEALw\\_wcB&gclsrc=aw.ds](http://www.economist.com/briefing/2023/01/05/how-elon-musks-satellites-have-saved-ukraine-and-changed-warfare?utm_medium=cpc.adword.pd&utm_source=google&ppccampaignID=18156330227&ppcadID=&utm_campaign=a.22brand_pmax&utm_content=conversion.direct-response.anonymous&gclid=Cj0KCQjw4s-kBhDqARIsAN-ipH0xw65Ux5B1mojK1AQkrW3EO133GC_qyAHXbu3XGp9MuSEKM7VE1xoaAiMuEALw_wcB&gclsrc=aw.ds)> accessed 1 March 2024.

<sup>49</sup> Daryna Antoniuk, 'How Elon Musk's Starlink Satellite Internet Keeps Ukraine Online', *The Kyiv Independent* (3 September 2022) <<https://kyivindependent.com/how-elon-musks-starlink-satellite-internet-keeps-ukraine-online/>> accessed 21 March 2024.

<sup>50</sup> Intelsat and Immarsat are other obvious examples. See PJ Blount, 'Targeting in Outer Space: Legal Aspects of Operational Military Actions in Space' *Harvard National Security Journal, Features, Online Edition* (25 November 2012) <<https://harvardnsj.org/2012/11/25/targeting-in-outer-space-legal-aspects-of-operational-military-actions-in-space/>> accessed 1 March 2024.



Given these risks, defending states should avoid targeting mixed-use and multi-owner/user satellites entirely. Only targeting satellites that are (i) solely owned, operated, or used by the aggressor state, (ii) exclusively military, and (iii) factually connected with the armed attack, will likely comply with JAB necessity. However, given the potential effects of damaging or destroying any type of satellite, even if the JAB necessity (and IHL) requirements are capable of being satisfied, JAB proportionality is likely to act as a strong limitation on whether or not a satellite may lawfully be targeted in self-defence and might even prohibit the targeting of certain satellites entirely.

## 4. PROPORTIONALITY IN OUTER SPACE

If self-defence is necessary, JAB proportionality proceeds to restrict how much total force states may use in military operations to achieve a legitimate defensive purpose. It permits states to effectively defend themselves but requires that states do no more than that.<sup>51</sup> Unlike IHL proportionality, which operates at an operational level of decision-making to minimize collateral harm to civilians resulting from individual planned attacks,<sup>52</sup> JAB proportionality operates at the strategic level to limit a defending state's total military response viewed as a whole. It is, therefore, a prohibition against excessive overall military reactions by states that undertake necessary acts of self-defence. More specifically, JAB proportionality requires states to balance their defensive force and its outcomes primarily against the legitimate defensive purpose. It also requires that defensive operations do not have undue negative impacts on civilians and on the interests of other states and the international community more broadly.<sup>53</sup>

JAB proportionality has particular significance in space due to its physical characteristics. The dangers associated with the possible use of prohibited nuclear ASAT weapons in this domain are manifest,<sup>54</sup> and the risk of enduring space debris caused by damage to or destruction of satellites by conventional weapons is also a factor peculiar to the space environment. Moreover, the risk is growing. Space is an increasingly congested domain. More than 6,700 satellites currently orbit the

<sup>51</sup> O'Meara (n 33) 97–100.

<sup>52</sup> IHL proportionality requires an assessment of whether expected civilian loss or injury and damage to civilian objects that result from a particular planned attack would be excessive in relation to the concrete and direct military advantage anticipated. AP I (n 38) art 51(5)(b).

<sup>53</sup> See O'Meara (n 33) 100–25, 146–55.

<sup>54</sup> The placing of nuclear weapons and other weapons of mass destruction in orbit, on celestial bodies, and otherwise stationing such weapons in outer space is prohibited. OST (n 17) art IV; 1963 Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water, 480 UNTS 43. On the possible devastating effects of detonating nuclear weapons in space, see David Wright, Laura Grego, Lisbeth Gronlund, *The Physics of Space Security: A Reference Manual* (2005) 138–39; Charlie JP Bennett, 'Nuclear Space-Based ASAT Weapons – A Brief International Legal Perspective' (27 February 2024) *EJIL: Talk!* <[https://www.ejiltalk.org/nuclear-space-based-asat-weapons-a-brief-international-legal-perspective/?utm\\_source=mailpoet&utm\\_medium=email&utm\\_campaign=ejil-talk-newsletter-post-title\\_2](https://www.ejiltalk.org/nuclear-space-based-asat-weapons-a-brief-international-legal-perspective/?utm_source=mailpoet&utm_medium=email&utm_campaign=ejil-talk-newsletter-post-title_2)> accessed 1 March 2024.

Earth,<sup>55</sup> with one estimate predicting 24,500 satellites in orbit by the end of 2031.<sup>56</sup> Debris-creating defensive ASAT weapon use could accordingly have long-lasting and unforeseen consequences for the rights and interests of many spacefaring actors. Space debris does not discriminate,<sup>57</sup> so the risk of collision with debris ‘is to all civilian, commercial, and government satellites of all nations’.<sup>58</sup> States, therefore, view space debris as ‘the most significant threat to the space environment’, with ‘the intentional destruction of satellites using kinetic force as exacerbating such threats’.<sup>59</sup> Any or all of their satellites, together with any vital services that rely on them, could be affected to varying degrees by ASAT weapons use. Adherence to JAB proportionality addresses this concern.

### *A. Civilian Harm*

On Earth, ‘it is the strategic impact of large-scale civilian casualties and damage that appears to influence what might constitute a disproportionate exercise of the right to self-defence by a State’.<sup>60</sup> That civilian harm stands as the clearest indicator of JAB disproportionality is clearly reflected in the practice of states.<sup>61</sup> Of greatest significance for present purposes is the potential harm to satellites owned and operated by civilians (including corporations), together with the effects on Earth of damaging or destroying satellites that serve civilian populations. Such consequential civilian harm may result from a satellite being targeted directly by ASAT weapons or because satellites are damaged or destroyed by space debris that has resulted from targeting other satellites. Given the potential enduring nature of debris clouds, any number of satellites belonging to civilians or serving civilian needs are put at risk. That risk is hugely significant, given how central satellites are to human societies and global economies. Even temporary disruption to satellites that serve these vital civilian needs may have effects stretching and enduring well beyond the use of the ASAT weapon.

An obvious example of the significance of this risk is any harm caused to the American Global Positioning System (GPS)<sup>62</sup> and its equivalents,<sup>63</sup> which provide military and civilian users with global positioning, navigation, and timing (PNT) services. PNT services are indispensable to the functioning of modern civilizations. Agriculture, transport networks (including global aviation), financial markets, banking systems,

<sup>55</sup> Union of Concerned Scientists, ‘Union of Concerned Scientists Satellite Database’ (1 May 2022) <[www.ucsusa.org/resources/satellite-database](http://www.ucsusa.org/resources/satellite-database)> accessed 1 March 2024.

<sup>56</sup> Euroconsult, ‘Satellite Demand to Quadruple over the next Decade’ (12 December 2022) <[www.euroconsult-ec.com/press-release/satellite-demand-to-quadruple-over-the-next-decade/](http://www.euroconsult-ec.com/press-release/satellite-demand-to-quadruple-over-the-next-decade/)> accessed 1 March 2024.

<sup>57</sup> Von der Dunk (n 25) 227.

<sup>58</sup> *2022 Challenges to Security in Space* (n 43) 37.

<sup>59</sup> UNGA Res 77/41 (n 4).

<sup>60</sup> Kenneth Watkin, *Fighting at the Legal Boundaries: Controlling the Use of Force in Contemporary Conflict* (OUP 2016) 62.

<sup>61</sup> See O’Meara (n 33) 139–46.

<sup>62</sup> See ‘GPS: The Global Positioning System’ (*GPS.gov*) <[www.gps.gov/](http://www.gps.gov/)> accessed 1 March 2024.

<sup>63</sup> For example, the Russian Global Navigation Satellite System (GLONASS), China’s BeiDou Navigation Satellite System (BDS), the EU’s Galileo global navigation satellite system, India’s NavIC system, and Japan’s Quasi-Zenith Satellite System (QZSS).

logistics, communications systems, critical infrastructure (such as power grids), emergency services, environmental protection, disaster surveillance, military operations, and the preservation of national security more generally, all rely on PNT technology.<sup>64</sup> Even a temporary and reversible disruption to PNT services could have disastrous consequences for millions of civilians who rely on them on Earth. The effects might be economic, caused by havoc wrought on financial markets. In this regard, the head of UK Space Command has noted how Russia could potentially use jamming satellites that could ‘cut off the UK from the outside world’.<sup>65</sup> The effects could equally be physical, for example, because emergency services or disaster relief teams are unable to respond, aircraft cannot fly safely or other transport systems cannot function properly, agricultural production is disrupted, and so forth. The International Committee of the Red Cross (ICRC), among others, has voiced its concern about such potential severe human costs,<sup>66</sup> with civilian injury or death being readily foreseeable in many instances.

Given the importance of PNT services to life on Earth, the potential effects on individuals and on human society caused by ASAT weapons are, in many respects, unforeseeable and unquantifiable. Accordingly, given the requirement to minimize collateral civilian harm, JAB proportionality arguably rules out the direct targeting of satellites that provide PNT and equivalent essential services, as well as the targeting of other satellites (such as those in proximate orbits) that put such essential services at risk because of resulting debris. This JAB prohibition operates separately and in addition to consideration of civilian harm for the purpose of compliance with IHL proportionality.<sup>67</sup> Even the use of non-kinetic ASAT weapons, such as cyber attacks, to disrupt essential services temporarily seems impossible to justify under the JAB. This is so despite a functional link between a satellite and an armed attack that might satisfy JAB necessity. For JAB proportionality, the potential repercussions of these acts on Earth are too varied and potentially too significant to evaluate in any meaningful way that might justify the pursuit of a defensive purpose. The possible repercussions also mean that deploying ASAT weapons, including cyber attacks, against PNT and other essential services that *prima facie* fall below the threshold of a use of force is also a risky strategy. This is because the resulting scale and effects might mean that the threshold of violence is eventually crossed and the JAB requirements that states wished to avoid nevertheless end up applying.

<sup>64</sup> ‘GPS Applications’ (*GPS.gov*) <[www.gps.gov/applications/](http://www.gps.gov/applications/)> accessed 1 March 2024.

<sup>65</sup> George Grylls, ‘China “Will Drill Moon for Minerals”’ *The Times* (1 July 2023).

<sup>66</sup> ICRC, ‘The Potential Human Cost of the Use of Weapons in Outer Space and the Protection Afforded by International Humanitarian Law’ (April 2021) <<https://www.icrc.org/en/document/potential-human-cost-outer-space-weaponization-ihl-protection>> accessed 1 March 2024.

<sup>67</sup> See O’Meara (n 33) 155–61. IHL proportionality assessments might, or might not, also rule out such acts of targeting, but this is a distinct legal question.

The only possible exception to these conclusions, as with the use of nuclear weapons, is greater freedom to use ASAT weapons where the survival of the state is at stake.<sup>68</sup> Beyond such extreme and unusual circumstances, however, JAB proportionality acts as a significant limitation on defensive action in space. Where satellites that provide non-essential services are targeted and/or where the scale and effects of targeting are in fact limited, the risk is consequentially less. Context is determinative, however, and the wider effects of such targeting must be considered. States must account for impacts on civilians resulting from harm to any kind of satellite, even those not providing essential services. JAB proportionality requires decision makers to consider very carefully the possible resulting consequences in space and on Earth, in each case so as to minimize collateral civilian harm.

### *B. Third-Party Rights and Interests*

Beyond civilian harm, state interests also factor in the JAB proportionality assessment. JAB proportionality requires that the legally protected rights of other states must not be unduly harmed when defending states use ASAT weapons.<sup>69</sup> In addition to potentially breaching the obligation of due regard under Article IX of the OST,<sup>70</sup> excessive harm to such third-party rights risks defensive action being deemed disproportionate under the JAB. Although this assessment is largely fact-dependent, the risk of enduring space debris caused by ASAT weapon use clearly poses a direct threat to satellites owned or operated by third states and to satellite-provided services on which such states rely (including essential PNT services). Depending on the nature of the satellite targeted, the impacts on other state interests could be multiple and varied, encompassing effects on Earth and in space. Physical or non-physical harm might result from ASAT weapon use, including significant economic loss resulting from the denial of access to a satellite-provided service. A number of other legally protected rights might also be implicated, among them a state's right to neutrality.<sup>71</sup> Harm might also extend to rights and interests appertaining to all states. Significantly, the International Court of Justice (ICJ) has indicated that respect for the environment goes to assessing whether acts of self-defence conform to the requirements of necessity and proportionality,<sup>72</sup> with the UNGA underscoring that ASAT technologies might generally threaten the 'long-term sustainability of the outer space environment'.<sup>73</sup> Debris-creating ASAT weapon use could contaminate space in the long term and affect the ability of any and all states to operate in that domain and to benefit from the freedom to explore and use space peacefully, including placing satellites in orbit. The UNGA also reminds us that 'the

<sup>68</sup> The ICJ has ruled that JAB proportionality may not exclude the use of nuclear weapons in the extreme circumstance of self-defence, where the very survival of a state would be at stake. *Nuclear Weapons* (n 26) paras 41–44, 97.

<sup>69</sup> See Gardam (n 30) 17; O'Meara (n 33) 146–55. See also Nasu (n 10) 170–72.

<sup>70</sup> Art IX obliges all states parties to the OST to conduct their space activities with due regard to the corresponding interests of all other states parties, including an obligation to avoid the harmful contamination of space.

<sup>71</sup> See Wolff Heintschel von Heinegg, 'Neutrality and Outer Space' (2017) 93 *Int'l L Stud* 526; O'Meara (n 33) 147–53.

<sup>72</sup> *Nuclear Weapons* (n 26) para 30.

<sup>73</sup> UNGA Res 77/41 (n 4).

creation of long-lived orbital debris arising from the deliberate destruction of space systems increases the risk of in-orbit collisions and the potential for misunderstanding and miscalculations that could lead to conflict'.<sup>74</sup> This statement speaks to the wider possible impact of ASAT weapon use on international peace and security, in which all states have an interest. This peace and security is legally protected by Article 2(4) of the UN Charter and by strict adherence to the requirements of necessity and proportionality that limit states acting in self-defence. Consequently, ASAT weapon use that threatens this peace and security is likely to be regarded as disproportionate.

These conclusions have practical repercussions for states contemplating using ASAT weapons in self-defence. JAB proportionality obliges decision makers to consider the effects of the methods they use on Earth and in space. Given the risks associated with space debris, outside of extreme situations of self-defence threatening the existence of the state, JAB proportionality likely rules out using most, if not all, kinetic physical ASAT weapons. Non-kinetic alternatives, such as directed energy and electronic ASAT weapons, as well as cyber operations, might also be problematic for JAB proportionality compliance. This is so where the impacts on third-party interests are comparable to kinetic physical ASAT weapon use. An example is a cyber operation that causes a satellite to lose control and collide with another satellite or space object, resulting in damage and debris. Cyber operations might also impair the functionality of satellites providing essential PNT services either temporarily or permanently. Unless other satellites in a constellation ensure the continuation of the service, catastrophic consequences might ensue, potentially including loss of life. More generally, cyber operations raise particular concerns because attacks on a specific system may have repercussions for other systems and cause indiscriminate effects due to the interconnected nature of cyberspace.<sup>75</sup> Likewise, targeting mixed-use and multi-owner/user satellites with non-kinetic weapons might still result in potentially unquantifiable harm to states other than the aggressor, as well as to other non-state entities. With each example, affected third-party interests will weigh heavily on determinations of proportionality.

Not all potential targets will be multi-owner/user or mixed-use satellites, however, or will obviously implicate third-party interests. Where ASAT weapons do not cause space debris, these types of satellites might comprise less risky targets for defensive military operations, provided the effects of the targeting are contained. Yet, given the dangers of targeting satellites using any type of ASAT weapon, where self-defence can be effectively achieved by striking a target on Earth that has a nexus with the armed attack, rather than targeting a satellite in space, JAB proportionality logically requires that the former target be preferred over the latter. If a satellite can be neutralized by an

<sup>74</sup> UNGA Res 75/36 (16 December 2020) UN Doc A/RES/75/36.

<sup>75</sup> ICRC, 'International Humanitarian Law and Cyber Operations During Armed Conflicts' (28 November 2019) 2, 5, 6, 7. Raised in the context of applying IHL to the cyber domain but pertaining generally to cyber operations against mixed-use and multi-user satellites.

attack against a ground-based control node in a remote area, rather than targeting the satellite directly, this option must be taken.<sup>76</sup> Generally, targeting Earth-based objects avoids the risk of escalation in space and the associated threat to third parties and to international peace and security that JAB proportionality seeks to avoid.

## 5. CONCLUSION

Space is the ‘province of all mankind’.<sup>77</sup> All states must be free to explore and use space peacefully, to benefit from satellites placed in space, and to have this communal resource protected from excessive military activities. Impingements on this freedom must be strictly controlled. Absent a multilateral ASAT weapons control treaty, the JAB (alongside IHL) must be regarded as an essential part of the international law framework limiting their use. Although states continue to develop new counterspace weapons and space is an ever-contested military domain, adherence to the requirements of JAB necessity and proportionality has the potential to limit ASAT weapon deployment. A clearer understanding of these JAB requirements, therefore, directly addresses pressing international concerns regarding the weaponization of space and the fear of wars between states in that domain. Given the unique nature of the space environment and the importance of satellites to the functioning of states and human societies, JAB compliance means that ASAT weapon use in self-defence is heavily restricted and may even be denied in all but the most extreme circumstances. Generally, targets of self-defence should be confined to the Earth. Where satellites are targeted with any form of ASAT weapon, states must take extreme caution. In addition to IHL, the JAB requires that methods employed to neutralize satellites be strictly controlled, limited to achieving a legitimate defensive purpose while minimizing harm to civilians and to third-party interests. Alternatives to ASAT weapons that cause physical damage should be preferred to avoid space debris. Weapons that only temporarily destabilize satellites or render them dysfunctional, or which are limited to interfering with or falsifying the transmission of signals to and from satellites, are most likely to comply with the JAB requirements. The same is true for targeted and limited cyber attacks on satellite-related computer networks. In each case, compliance depends on the harm caused by such ‘soft kill’ techniques to civilians and third-party interests.<sup>78</sup> Ultimately, adherence to JAB necessity and proportionality helps to avoid conflict and the escalation of conflict in space. JAB compliance underpins international peace and security and state aspirations of safeguarding space for peaceful purposes and ensuring its valuable resources continue to benefit all mankind.

<sup>76</sup> Schmitt makes this point in respect of target selection and IHL precautions in attack requirements, but this conclusion arguably also applies to the requirements of JAB proportionality. Schmitt (n 10) 121.

<sup>77</sup> OST (n 17) art I.

<sup>78</sup> Methods at the lower end of the spectrum of military activity might not constitute uses of force and, therefore, do not require justification by reference to the JAB. However, they might constitute internationally wrongful acts. See UNGA, Articles on Responsibility of States for Internationally Wrongful Acts, annexed to UNGA, Res 56/83, UN Doc A/RES/56/83 (28 January 2002).