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ORIGINAL ARTICLE

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Self-defence in outer space: Anti-satellite weapons and the *jus ad bellum*

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Abstract

Space is an increasingly militarized domain, with the potential to be a source and place of armed conflict. Tests of anti-satellite (ASAT) weapons capable of neutralizing civilian and military satellites have fuelled fears of warfare in that domain. Resulting space debris 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 the functioning of 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. Yet, how the *jus ad bellum*, which regulates when states may use 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 article argues that *jus ad bellum* regulation of ASAT technologies directly addresses state concerns regarding protecting their space assets and avoiding conflict in space. This author contends that states acting defensively in space are restricted by the requirements of *jus ad bellum* necessity and proportionality in their choice of targets, thereby protecting civilians and the interests of other states. A clearer understanding of how these *jus ad bellum* requirements apply in space helps decision makers avoid putative defensive acts being characterized as unlawful uses of force. Adherence to these requirements ultimately helps to secure international peace and security on Earth and in space.

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

1. Introduction

Space activities underpin all instruments of national power.[1] For militarily powerful states, space is an integrated part of their national security. In recent years, states like the United Kingdom and the United States have established dedicated space commands and articulated space related strategies that reflect the significance of space, as well as the dangers associated with space activities.[2] NATO recognizes space as an operational domain, alongside air, land, sea, and

*This article is based on a paper presented at the NATO Cooperative Cyber Defence Centre of Excellence's 16th International Conference on Cyber Conflict: *Over the Horizon*, Tallinn, Estonia (May 2024). C. O'Meara, 'Anti-Satellite Weapons and Self-Defence: Law and Limitations', (2024) *Proceedings of the NATO Cooperative Cyber Defence* Centre of Excellence's *16th International Conference on Cyber Conflict: Over the Horizon* 249.

[1]K. A. Bingen et al., 'Space Threat Assessment 2023', *Center for Strategic and International Studies*, 14 April 2023, at 1.

[2]The USA, as the current preeminent space power, established its new Space Force in 2019 in recognition that space is a 'national security imperative'. See generally at www.spaceforce.mil/. The United Kingdom established a new UK Space Command in 2021, recognizing that disruptions to the United Kingdom's use of space, or the use of space by its allies, could

cyberspace.[3] Outside of NATO, the EU has likewise identified space as a strategic domain and set out a space strategy that includes protecting its space assets, maximizing the use of space for security and defence purposes, and deterring hostile activities in space.[4] China and Russia are both major spacefaring nations. China also designates space as a military domain,[5] and both states continue to develop their already significant space capabilities.[6] India is a rising space power and other states like Iran, North Korea, Australia, France, Japan, Israel, and South Korea are focusing on their own space programmes and developing space technologies.[7] Other states will undoubtedly follow and, meanwhile, they lease satellite services or are otherwise reliant on the services that satellites provide. Increasingly, therefore, space is hugely significant to all states.

Space is also an increasingly contested domain, with the potential to be a source and place of armed conflict. The prospect of war in space is of real concern and states assert their right to act to defend their interests in that domain.[8] Unease over the militarization, or 'weaponization' of space[9] is accordingly at the top of the international agenda, with bodies such as the UN General Assembly (UNGA) consistently emphasizing the need for international cooperation on the peaceful uses of outer space, as well as expressing serious concern about an arms race in that domain.[10] In particular, there is great unease over states developing counterspace weapons that might threaten access to, and freedom to operate in, space.[11] To date no state has used such a weapon against a satellite of another state[12] but, given their importance to military operations, satellites might be considered very attractive targets for states in situations of conflict. This fact is evidenced by the testing and possible future use of offensive and defensive anti-satellite (ASAT) weapons capable of disrupting or destroying both civilian/commercial and military satellites.[13] ASAT weapons are a persistent feature of the discourse among states and international organizations relating to the threat environment in space.[14] Indeed, a recent EU statement to the UN Conference on Disarmament on preventing an arms race in space referenced Russia's test of a kinetic direct ascent ASAT missile in 2021 as a 'strong reminder' of the need for development in the legal governance of space activities.[15]

significantly affect civilian, commercial, and defence activity. See www.raf.mod.uk/what-we-do/uk-space-command/. See also the UK National Space Strategy, available at www.gov.uk/government/publications/national-space-strategy.

[3]NATO, 'NATO's Overarching Space Policy', 17 January 2022, available at www.nato.int/cps/en/natohq/official_texts_190862.htm.

[4]European Commission, Joint Communication to the European Parliament and the Council, 'European Union Space Strategy for Security and Defence', JOIN/2023/9 final (10 March 2023), available at =eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52023JC0009.

[5]Secure World Foundation, 'Global Counterspace Capabilities: An Open Source Assessment', April 2023, available at swfound.org/counterspace/, at xxi.

[6]For an overview of the capabilities of Russia, China, and other spacefaring states, see K. A. Bingen et al., *supra* note 1; see Secure World Foundation, ibid.

[7]See K. A. Bingen et al., *supra* note 1, 21–32.

[8]On the right of self-defence, see Section 3, *infra*.

[9]On the 'weaponization' of outer space debate, see J. Su, 'Use of Outer Space for Peaceful Purposes: Non-Militarization, Non-Aggression and Prevention of Weaponization', (2010) 36(1) *Journal of Space Law* 253.

[10]See, for example, UNGA, Res. 55/122, UN Doc. A/RES/55/122 (27 February 2001); UNGA, Res. 72/78, UN Doc. A/RES/72/78 (14 December 2017); UNGA, Res. 77/41, UN Doc. A/RES/77/41 (12 December 2022).

[11]See NATO, *supra* note 3, para. 2.

[12]See K. A. Bingen et al., *supra* note 1, at 4.

[13]See Section 2, *infra*.

[14]The various types of ASATs are described in Section 2, *infra*.

[15]EU Delegation to the UN in Geneva, EU Statement, 'Conference on Disarmament – Prevention of an Arms Race in Outer Space', 31 March 2023. On Russia's 2021 missile test, see Section 2, *infra*.

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The call for legal regulation of ASAT weapons is particularly urgent given the physics of space and the potential enduring effects of space debris[16] that might result from ASAT weapon use.[17] Space debris imperils other satellites in orbit, many of which are fundamental to the operation of human societies and to the functioning of global economies. The modern world relies on the essential services that these space-based assets provide.[18] States view space debris as a significant threat to this space environment, with the intentional destruction of satellites exacerbating the threat.[19] Yet, despite the importance of satellites, international law pertaining to state activities that might threaten them is scarce.[20] Multilateral attempts to restrain the escalating weaponization of space have failed.[21] Legally regulating the targeting of satellites using ASAT weapons relies, therefore, on bodies of international law that were not originally designed for space but naturally pertain to the use of ASAT weapons.

To date, aside from failed attempts at weapons control, much of the deliberation surrounding military activities in space has centred on international humanitarian law (IHL).[22] This focus is entirely understandable given that IHL governs how states conduct hostilities, including laying down targeting rules that apply to ASAT weapon use during armed conflict. It is axiomatic that these IHL precepts apply equally to all belligerents and regardless of a state's reason for entering into hostilities.[23] Yet, the separate question of legality under the *jus ad bellum*, which governs when states may lawfully use force in their international relations, is equally important. The legal justification for states using force against satellites and what limitations apply as a result of that justification must also be appraised to establish the legality of targeting satellites. Although states assert their right of self-defence in space, however, this essential *jus ad bellum* issue has received little attention.[24] This is an opportunity lost for the examination of the legality of ASAT weapon deployment. This article addresses this gap by investigating how the *jus ad bellum* applies to ASAT weapons and restricts their use, including in self-defence.

This article begins in Section 2 by considering the types of ASAT weapons that states have developed to date and might use in self-defence, as well as providing an overview of contemporary international space law that relates to the development and use of such weapons. Section 3 proceeds to examine the application of the *jus ad bellum* to space and, more specifically, how the rules of the *jus ad bellum* regulate the targeting of satellites using ASAT weapons in self-defence. This author argues that when a state is exercising its right of self-defence in space, civilian and military planners are restricted by the *jus ad bellum* in their choice of targets in that domain. Sections 4 and 5 explain this contention through the exploration of the *jus ad bellum* requirements

[16]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', available at orbitaldebris.jsc.nasa.gov/faq/.

[17]See Section 5, *infra*.

[18]See Section 4.1, *infra*.

[19]See UNGA, Res. 77/41, *supra* note 10.

[20]See Section 3, *infra*.

[21]P. B. Larsen, 'Outer Space Arms Control: Can the USA, Russia and China Make This Happen', (2018) 23 *Journal of Conflict and Security Law* 137. See further Section 2, *infra*.

[22]For example, M. Bourbonnière, 'Law of Armed Conflict (LOAC) and the Neutralisation of Satellites or *Jus in Bello Satellitis*', (2004) 9 *Journal of Conflict and Security Law* 43; M. N. Schmitt, 'International Law and Military Operations in Space', (2006) 10 UNYB 89, 114–24; P. J. Blount, 'Targeting in Outer Space: Legal Aspects of Operational Military Actions in Space', (25 November 2012) *Harvard National Security Journal, Features, Online Edition*, available at harvardnsj.org/2012/11/25/targeting-in-outer-space-legal-aspects-of-operational-military-actions-in-space/; J. Mawdsley, 'Applying Core Principles of International Humanitarian Law to Military Operations in Space', (2020) 25 *Journal of Conflict and Security Law* 263; H. Nasu, 'Targeting a Satellite: Contrasting Considerations between the *Jus Ad Bellum* and the *Jus in Bello*', (2022) 99 *International Law Studies* 142. See further Section 4, *infra*.

[23]See, for example, the 1977 Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of International Armed Conflicts (Protocol I), 1125 UNTS 3 (API), Preamble.

[24]An exception is F. Tronchetti, 'The Right of Self-Defence in Outer Space: An Appraisal', (2014) 63 *ZLW* 92, although limited consideration is given to *jus ad bellum* necessity and proportionality examined in this article.

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of necessity and proportionality that condition the exercise of a state's right of self-defence. Section 4 emphasizes that, despite the potential military advantage that might be gained by targeting satellites, *jus ad bellum* necessity restricts the target options available to a defending state[25] to ensure that its military response is confined to the defensive and is directed solely at an aggressor. Even if IHL and *jus ad bellum* necessity do not prevent a state from damaging or destroying a satellite, Section 5 illustrates how the operation of *jus ad bellum* proportionality might nevertheless preclude ASAT weapon use because of the ensuing effects of targeting a satellite on civilians and/or on the interests of other states and the international community more broadly.

Applying the *jus ad bellum* rules analyzed in this article has implications at both the strategic level (regarding how states develop space related policies and ASAT technologies) as well as the operation and tactical levels (in terms of how military planners execute military operations in space). A clearer understanding of the *jus ad bellum* rules as they apply in space helps decision makers avoid putative acts of self-defence being characterized as unlawful uses of force. Ultimately, the *jus ad bellum* 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 *jus ad bellum* rules promotes and helps to secure international peace and security on Earth and beyond the Earth's atmosphere.

2. ASAT weapon types and applicable international law

To examine how the *jus ad bellum* applies to the use of ASAT weapons, we must first consider the types of such weapons. 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 itself.[26] The USA, China, and Russia have developed the most advanced ASAT technologies, although other states possess counterspace capabilities.[27] ASAT weapons can be placed into four broad categories.[28] The first category is kinetic physical ASAT weapons, comprising anti-satellite missiles or 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 latter type of weapons are sent into orbit and, by way of rendezvous and proximity operations, placed near their intended target. Examples include satellite-launched projectiles,[29] kinetic kill vehicles, chemical sprayers, and the use of space-based robotic arms to grab target satellites.[30] Suspicious use of inspection and repair satellites has also been identified as a potential

[25]A 'defending state' is a state that is, or claims to be, the victim of an armed attack.

[26]For a timeline of counterspace weapons development, see Center for Strategic and International Studies, 'Counterspace Timeline, 1959–2022', 31 March 2021, available at aerospace.csis.org/counterspace-timeline/.

[27]On the history of American ASAT development, see C. M. Petras, 'The Use of Force in Response to Cyber-Attack on Commercial Space Systems – Re-examining Self-Defense in Outer Space in Light of the Convergence of U.S. Military and Commercial Space Activities', (2002) 67 *Journal of Air Law and Commerce* 1213, 1222–31. The USA's Annual Threat Assessment of 2023 notes that Russia and China also possess advanced counterspace weapons capabilities. Office of the Director of National Intelligence, '2023 Annual Threat Assessment of the US Intelligence Community', 8 March 2023, at 8, 15. See also See K. A. Bingen et al., *supra* note 1.

[28]This article adopts the commonly used categorization of counterspace weapons set out in CSIS 'Space Threat Assessment 2023', see K. A. Bingen et al., *supra* note 1, at 3–7. See further United States Defence Intelligence Agency, 'Challenges to Security in Space', 2022, available at www.dia.mil/Military-Power-Publications/.

[29]On 15 July 2020, Russia conducted a non-destructive test of a space-based ASAT weapon comprising a 'new object' or projectile released into orbit from its Cosmos 2543 satellite. United States Space Command, 'Russia Conducts Space-Based Anti-Satellite Weapons Test', 23 July 2020, available at www.spacecom.mil/Newsroom/News/Article-Display/Article/2285098/russia-conducts-space-based-anti-satellite-weapons-test/. Russia responded to American and British concerns over this ostensible on-orbit ASAT weapons test by insisting that the incident was limited to satellite inspection activity. 'US Accuses Russia of Testing Anti-Satellite Weapon in Space', *The Associated Press*, 23 July 2020, available at apnews.com/article/technology-moscow-politics-russia-united-states-091b05982eaffb5e7b876834025be811.

[30]The USA has expressed concern about Chinese satellites potentially employing robotic arms to grapple other satellites. See United States Defence Intelligence Agency, *supra* note 28, at 18, 47.

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threat to space-based assets.[31] To date, the USA, China, Russia, and India have all demonstrated kinetic ASAT capabilities.[32] Most recently, in November 2021, Russia tested a direct-ascent ASAT missile that destroyed one of its own satellites called Cosmos 1408 in orbit, creating a large and long-lived debris field.[33]

The second category comprises non-kinetic physical ASAT weapons, which have reversible or permanent physical effects on satellites or other space systems, but which make no physical contact with them. They include directed-energy weapons that can be used to damage, disrupt, or destroy space systems. For example, lasers can temporarily dazzle or permanently blind satellite sensors or cause components to overheat. High-powered microwaves can likewise disrupt or permanently damage electronics. Nuclear devices could also be detonated in space, creating a high-radiation environment and electromagnetic pulses that can harm satellites. Such non-kinetic physical counterspace weapons may be launched from other satellites, or from land, sea, or airborne weapons platforms on Earth. Electronic ASAT weapons, such as jamming devices that interfere with the transmission of signals to and from satellites and spoofing devices that can falsify such signals, are the third category of weapons. Finally, cyberattacks that target data (as opposed to communications signals) and the systems that use data are the fourth type. Such attacks may be used to monitor data, or to intercept, falsify, or corrupt it, in each case on a temporary or permanent basis.

Specific legal regulation of the use of these ASAT technologies is scarce. Contemporary international space law that governs military activities in space is centred on the Outer Space Treaty of 1967 (OST)[34] and, to a much lesser extent, the Moon Agreement of 1979 (Moon Agreement).[35] Article IV of the OST explicitly bans the placing of nuclear weapons and other weapons of mass destruction in orbit, on celestial bodies, and otherwise stationing such weapons in outer space. According to the rules of treaty interpretation,[36] the ordinary meaning of the term 'weapons of mass destruction' confines this prohibition to weapons aimed at causing widespread devastation and loss of life, being chemical, biological, or nuclear weapons.[37] The use or testing of nuclear weapons in space is also prohibited by the Partial Test Ban Treaty.[38] However, other types of weapons, including conventional ASAT technologies placed in orbit, are not prohibited by current international space law.[39] The caveat to this partial weapons ban is that the moon and other celestial bodies are fully demilitarized by Article IV and may only be used for peaceful

[31]The USA has also expressed concern over the suspicious use of such satellites by Russia and their potential to be used to kinetically 'kill' other satellites in orbit. Ibid., at 29, 37.

[32]See K. A. Bingen et al., *supra* note 1, at 11, 14, 23; see Mawdsley, *supra* note 22, at 279.

[33]S. Bugos, 'Russian ASAT Test Creates Massive Debris', Arms Control Association, December 2021, available at www.armscontrol.org/act/2021-12/news/russian-asat-test-creates-massive-debris.

[34]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 205.

[35]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', available at www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/status/index.html.

[36]See 1969 Vienna Convention on the Law of Treaties, 1155 UNTS 331, Art. 31.

[37]F. Tronchetti, 'Legal Aspects of the Military Uses of Outer Space', in F. von der Dunk (ed.), *Handbook of Space Law* (2015), 331 at 336.

[38]1963 Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water, 480 UNTS 43.

[39]See Schmitt, *supra* note 22, at 104; see Tronchetti, *supra* note 37, at 335–41; R. J. Lee, 'The *Jus ad Bellum in Spatialis*: The Exact Content and Practical Implications of the Law on the Use of Force in Outer Space', (2003) 29 *Journal of Space Law* 93, 95–8; K. Mačák, 'Military Space Operations', in S. Sayapin et al. (eds.), *International Conflict and Security Law: A Research Handbook* (2022), 399 at 405. See further M. Bourbonnière and R. J. Lee, 'Legality of the Deployment of Conventional Weapons in Earth Orbit: Balancing Space Law and the Law of Armed Conflict', (2007) 18(5) *EJIL* 873, 888–9.

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purposes.[40] Regardless, and important for this article, ASAT weapon use in lawful self-defence is not affected by these OST and Moon Agreement provisions.[41]

In the absence of specific regulation by current international law, the apprehension associated with states testing and potentially using ASAT weapons persists. Efforts by the UN to forestall the weaponization of space and to preserve it for peaceful purposes continue, but have not yet borne fruit.[42] The UNGA, in a widely supported resolution, has called upon all states to commit not to conduct destructive direct-ascent ASAT missile tests.[43] Several states, including the USA, Canada, France, Germany, Japan, New Zealand, the United Kingdom, and South Korea have unilaterally agreed not to conduct debris-generating direct-ascent ASAT weapons tests.[44] However, the prospect of securing multilateral support for such a comprehensive ban, including from Russia and China, is unlikely in the present geo-political climate.[45] It is notable that a draft treaty first proposed by China and Russia in 2002 and updated in 2008 and 2014[46] aimed at banning the placement and use of weapons in space has failed to be adopted by any state.[47] Instead, guiding principles governing space activities and other 'soft law' efforts have been pursued by international organizations such as the UN[48] and the EU.[49] Notably, under the EU's Draft International Code of Conduct for Outer Space Activities, even if states lawfully exercise their right of self-defence, they undertake to do so in a manner which minimizes, to the greatest extent practicable, the creation of space debris.[50] Absent new international law banning or restricting ASAT weapon use, these endeavours and other efforts like the Woomera and MILAMOS manuals that seek to clarify rules pertaining to the use of ASAT weapons, are very welcome.[51] A clearer understanding of the *jus ad*

[40]Art. IV prohibits the placement and testing of any type of weapon on the moon and other celestial bodies and bans military installations, fortifications, and manoeuvres. See also the Moon Agreement, *supra* note 35, Arts. 1(1), 3.

[41]See Section 3, *infra*.

[42]See the UN Office for Outer Space Affairs, available at www.unoosa.org/oosa/en/aboutus/index.html and 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, available at www.unoosa.org/oosa/en/ourwork/copuos/2023/statements.html. Preventing an arms race in space is firmly on the agenda of the UN Conference on Disarmament, see at disarmament.unoda.org/conference-on-disarmament/.

[43]See UNGA, Res. 77/41, *supra* note 10, approved by a recorded vote of 155 in favour to nine against, with nine abstentions.

[44]See EU Space Strategy, *supra* note 4, 15; Arms Control Association, 'Seven Countries Join ASAT Test Ban', November 2022, available at www.armscontrol.org/act/2022-11/news-briefs/seven-countries-join-asat-test-ban.

[45]See further, S. Kuan, 'Legality of the Deployment of Anti-Satellite Weapons in Earth Orbit: Present and Future', (2010) 36 *Journal of Space Law* 207, 227–30.

[46]Conference on Disarmament, Letter dated 10 June 2014 from the Permanent Representative of the Russian Federation and the Permanent Representative of China to the Conference on Disarmament addressed to the Acting Secretary-General of the Conference transmitting the updated Russian and Chinese texts of the Draft Treaty on the Prevention of the Placement of Weapons in Outer Space and of the Threat or Use of Force against Outer Space Objects (PPWT) introduced by the Russian Federation and China, UN Doc. CD/1985 (12 June 2014).

[47]The American analysis of the 2014 draft treaty sets out perceived fundamental flaws. Conference on Disarmament, Note Verbale dated 2 September 2014 from the Delegation of the United States of America to the Conference on Disarmament addressed to the Acting Secretary-General of the Conference transmitting the United States of America analysis of the 2014 Russian–Chinese Draft Treaty on the Prevention of the Placement of Weapons in Outer Space, the Threat or Use of Force against Outer Space Objects, UN Doc. CD/1998 (3 September 2014).

[48]UNGA, International Co-Operation in the Peaceful Uses of Outer Space, adopted by UNGA Res. 1721, UN Doc. A/RES/1721 (20 December 1961); UNGA, Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space, adopted by UNGA, Res. 1962 (XVIII), UN Doc. A/RES/1962 (13 December 1963); UNGA, Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking into Particular Account the Needs of Developing Countries, adopted by UNGA, Res. 51/122, UN Doc. A/RES/51/122 (13 December 1996); UNGA, Group of Governmental Experts on Transparency and Confidence-Building Measures in Outer Space Activities, UN Doc. A/68/189 (29 July 2013).

[49]EU, 'Draft International Code of Conduct for Outer Space Activities', 31 March 2014, available at www.eeas.europa.eu/sites/default/files/space_code_conduct_draft_vers_31-march-2014_en.pdf.

[50]Ibid, Art. 4.2. See further Section 5, *infra*.

[51]J. Beard and D. Stephens (eds.), *The Woomera Manual on the International Law of Military Space Operations* (2024) (Woomera Manual); R. S. Jakhu and S. Freeland (eds.), *McGill Manual on International Law Applicable to Military Uses of Outer Space: Volume I – Rules* (2022) (MILAMOS).

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bellum regulation of ASAT weapons is a significant part of the answer. As will be seen in the following sections, the *raison d'être* of the *jus ad bellum* is the maintenance of international peace and security and adherence to its requirements directly addresses the fears associated with ASAT weapon use.

3. Applying the *jus ad bellum* to the use of ASAT weapons in self-defence

General international law applies to human activities in space.[52] We see this principle reflected in Article III of the OST, which requires state parties to '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'.[53] Likewise, the UNGA continues to reaffirm the applicability of the UN Charter and general international law to activities in outer space, including in its resolutions specifically addressing the use of ASAT technologies.[54] State practice also reflects this position. For example, the USA, as the main power in space, together with all other NATO countries and the EU, have publicly expressed their commitment to responsible behaviour in space and to act in space in accordance with international law.[55] Even in the absence of a treaty banning ASAT weapon testing and use, therefore, all military activities in space, including the use of ASAT weapons, must comply with these generally applicable legal rules. The difficulty is determining how such rules developed for the terrestrial realm are necessarily interpreted to apply beyond Earth, particularly given the physics of space, as well as the nature of certain satellites and their importance for humanity. These factors are discussed in detail in the following sections.

Regarding ASAT weapon use specifically, the focus to date has naturally been on the detailed targeting rules of IHL and how they apply in space. Such rules are discussed further in Section 4. In addition, the rules of the *jus ad bellum*, grounded in the UN Charter and customary international law, apply to ASAT weapons. Indeed, the ICJ has confirmed that the UN Charter applies 'to any use of force, regardless of the weapons employed'.[56] Under the *jus ad bellum*, states are generally prohibited from threatening or using force in their international relations. This prohibition is reflected in Article 2(4) of the UN Charter.[57] The two recognized exceptions to this cardinal rule are 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.[58] State consent to a use of force against one of its own satellites would also preclude a potential breach of Article 2(4) as between the states concerned. Accordingly, absent such state consent or UNSC authorization, any actions against satellites that constitute a threat or use of force require justification as lawful acts of self-defence. Otherwise, these actions will contravene Article 2(4) and

[52]The exceptions are rules that are domain-specific, geographically constrained, or otherwise incompatible with the space environment. See Mačák, *supra* note 39, at 406. See further F. G. von der Dunk, 'Armed Conflicts in Outer Space: Which Law Applies?', (2021) 97 *International Law Studies* 188.

[53]See OST, *supra* note 34, Art. III.

[54]See, for example, UNGA, Res. 77/41, *supra* note 10.

[55]United States Space Force, Space Capstone Publication, 'Spacepower: Doctrine for Space Forces', June 2020, 43; NATO, 'NATO 2022 Strategic Concept', 29 June 2022, para. 25; EU Statement at the 66th Committee on the Peaceful Uses of Outer Space (COPUOS), 31 May 2023, available at www.eeas.europa.eu/delegations/vienna-international-organisations/eu-statement-66th-committee-peaceful-uses-outer_en. See also UNGA, Open-Ended Working Group on Reducing Space Threats Through Norms, Rules and Principles of Responsible Behaviours, Chairperson's Summary, UN Doc. A/AC.294/2023/WP.22 (1 September 2023), at paras. 11, 20.

[56]*Legality of the Threat or Use of Nuclear Weapons*, Advisory Opinion of 8 July 1996, [1996] ICJ Rep. 226, at 244, para. 39. The ICJ has also affirmed the customary status of *jus ad bellum* necessity and proportionality. See note 76 and accompanying text, *infra*. See further, Woomera Manual, *supra* note 51, Rules 21, 23, 26.

[57]1945 Charter of the United Nations, 892 UNTS 119, Art. 2(4) prohibits the threat or use of force against the territorial integrity or political independence of any state, or in any other manner inconsistent with the purposes of the UN.

[58]Art. 51 recognizes a state's inherent right of individual or collective self-defence if an armed attack occurs.

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will be characterized as unlawful uses of force. The focus of this article is on ASAT weapon use in self-defence to respond to armed attacks that occur on Earth or in space.

We should note that states assert their right to act in self-defence in space.[59] While not universally accepted, the dominant view is that states may lawfully exercise that right in that domain and the *jus ad bellum* applies in space to condition the exercise of that right.[60] Although Article IV of the OST stipulates that the 'moon and other celestial bodies shall be used by all States Parties to the Treaty exclusively for *peaceful purposes*',[61] it is generally agreed that, in line with the UN Charter, peaceful purposes equates to 'non-aggressive' or 'non-hostile', rather than 'non-military' purposes.[62] This means that the OST and the Moon Agreement do not preclude the exercise of self-defence in space.[63] Regardless, the right of self-defence would take priority over any such treaty provisions that are incompatible with that right.[64] As such, states retain the right of self-defence where an armed attack occurs in or from, or is directed through or towards, space.[65]

Several important issues are implicated by the starting premise that the *jus ad bellum* regulates ASAT weapon use in self-defence. Among them is the crucial question of what constitutes a use of force in space, as well as whether such force might amount to an 'armed attack', which triggers a state's right of self-defence.[66] Establishing whether a state has in fact been the object of an armed attack based on the nature of the satellite (i.e., civilian or military, or both) and/or whether it is the state of registry of that satellite, is but one challenging issue.[67] Determining whether the so-called gravity threshold of violence is also surpassed to comprise an armed attack is likewise not straightforward. On this latter point, only 'grave' uses of force, based on their scale and effects, constitute armed attacks, thereby triggering a state's right of self-defence.[68] As such, ASAT weapon use against a satellite falling below this notoriously indeterminate line of demarcation does not permit the target state to respond using force. Instead, state responses must be confined to the non-forceful, such as deploying countermeasures.[69] Therefore, although context dependent,

[59]See Tronchetti, *supra* note 24, 104–7, including examples of state practice. NATO countries recently agreed that attacks to, from, or within space may trigger the self-defence provisions of the Art. 5 of the North Atlantic Treaty. See NATO, *supra* note 3, para. 12.

[60]I. Brownlie, 'The Maintenance of International Peace and Security in Outer Space', (1964) 40 *BYIL* 1, at 20–21, 23; see Lee, *supra* note 39, 98–9; see Tronchetti, *supra* note 24, 105–7; see Tronchetti, *supra* note 37, 354–5; see Nasu, *supra* note 22, 153; D. Stephens, 'Increasing Militarization of Space and Normative Responses', in R. Venkata Rao et al. (eds.), *Recent Developments in Space Law: Opportunities & Challenges* (2017), 91 at 95–8; see Von der Dunk, *supra* note 52, at 199, 208–9; see Mačák, *supra* note 39, 407; see Woomera Manual, *supra* note 51, Rule 26. Russia, for example, has explicitly accepted that UN Charter provisions that relate to the right of self-defence apply in space. Working Paper Submitted by the Russian Federation to the UN Committee on the Peaceful Uses of Outer Space, Fifty-Eighth Session, Achievement of a Uniform Interpretation of the Right of Self-Defence in Conformity with the Charter of the United Nations as Applied to Outer Space as a Factor in Maintaining Outer Space as a Safe and Conflict-Free Environment and Promoting the Long-Term Sustainability of Outer Space Activities, UN Doc. A/AC.105/L.294 (29 April 2015), para. 3. See also the draft PPWT, *supra* note 46, Art. IV.

[61]See OST, *supra* note 34, Art. IV (emphasis added).

[62]See Schmitt, *supra* note 22, 101–2; see Kuan, *supra* note 45, 213–14; see Mačák, *supra* note 39, 404.

[63]See Schmitt, *supra* note 22, 101–2; see Mačák, *supra* note 39, 404. See also Petras, *supra* note 27, 1249–57; see Nasu, *supra* note 22, 153; see Bourbonnière and Lee, *supra* note 39, 889; see Kuan, *supra* note 45.

[64]The ILC guidance is that, subject to compliance with IHL, states exercising their right of self-defence in accordance with the UN Charter are entitled to suspend in whole or in part the operation of a treaty to which they are party insofar as that operation is incompatible with the exercise of that right. International Law Commission, Draft Articles on the Effects of Armed Conflicts on Treaties, with Commentaries 2011, UN Doc. A/66/10 (2011), Part VI.E, Art.14.

[65]See MILAMOS, *supra* note 51, Rule 152; see Woomera Manual, *supra* note 51, Rule 26.

[66]See Tronchetti, *supra* note 24, 113–17; see Nasu, *supra* note 22, 155–60; see Mačák, *supra* note 39, 407–11; See E. Pobjie and A. A. Ortega, *Space Security Legal Primer 1: Outer Space & Use of Force* (2024); see Woomera Manual, *supra* note 51, Rules 21, 23.

[67]See Tronchetti, *supra* note 24, at 93, 99; see Nasu, *supra* note 22, 165–68; see Mačák, *supra* note 39, 410.

[68]*Military and Paramilitary Activities in and against Nicaragua* (*Nicaragua v. United States*), Judgment of 27 June 1986, [1986] ICJ Rep.14, at 101, para. 191 and 103, para. 195.

[69]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) (ARSIWA), Arts. 22, 49–54.

non-kinetic ASAT weapon use against satellites that does not cause physical damage (for example, jamming or limited cyberattacks) is highly problematic for determining whether an armed attack has occurred and the right of self-defence is triggered.[70] If not armed attacks, using ASAT weapons might nonetheless amount to unlawful uses of force or constitute other internationally wrongful acts, such as unlawful intervention in the sovereign affairs of a state.[71]

However, where the armed attack threshold is crossed either as a result of force used against a state in space or on Earth, targeting satellites in self-defence using ASAT weapons might be viewed as an attractive option. For this to be lawful, however, such targeting must comply with IHL and the requirements of *jus ad bellum* necessity and proportionality discussed in the following sections. Adherence to *jus ad bellum* necessity and proportionality ensures that targeting a satellite is capable of achieving a legitimate defensive purpose, being to halt, repel, or (if some form of anticipatory self-defence is accepted[72]) prevent an armed attack. For the purposes of the ensuing analysis, 'targeting' satellites in self-defence involves engagement or action to alter or neutralize the function it performs for the adversary.[73] This may mean physically damaging or destroying a satellite or otherwise permanently or temporarily disabling or neutralizing it.

4. Necessity in outer space

As noted in the previous section, a state's right of self-defence arises when an armed attack occurs.[74] *Jus ad bellum* 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.[75] The ICJ has affirmed that *jus ad bellum* necessity and proportionality are requirements of customary international law that must be strictly adhered to in order for acts of self-defence to be considered lawful.[76] In terms of applying these requirements to ASAT weapons, the *jus ad bellum* requirement of necessity must be considered first. If necessity is established, whether or not defensive action is also proportionate may then be examined.

4.1. Defensive force as a measure of last resort

Necessity represents the fundamental idea that, given the general prohibition on states using force,[77] the resort to force even in self-defence is an exceptional and limited response to a genuine situation of emergency. To that end, necessity requires defensive force to be a measure of last resort, where alternatives to force are unavailable or unfeasible and/or, on their own, will be ineffective to halt, repel, or prevent an armed attack. Force used in self-defence must be the only

[70]See, for example, Tronchetti, *supra* note 37, at 355; see Nasu, *supra* note 22, 155–60; see Mačák, *supra* note 39, 408. This threshold issue is discussed further in the following sections.

[71]Where there is the requisite element of coercion. See *Nicaragua*, *supra* note 68, at 108, para. 205.

[72]A right of anticipatory self-defence in response to future armed attacks is a controversial topic. A limited right of anticipatory self-defence in response to imminent armed attacks is supported by some states and scholars. On this basis, future armed attacks may need to be 'prevented' by acts of self-defence. For states and scholars that reject any form of anticipatory self-defence, defensive acts are limited to 'halting' or 'repelling' armed attacks that are occurring. For further analysis and this author's position, see C. O'Meara, 'Reconceptualising the Right of Self-Defence Against "Imminent" Armed Attacks', (2022) 9(2) *JUFIL* 278.

[73]United States Chairman of the Joint Chiefs of Staff, Joint Publication 3–60, *Joint Targeting* (31 January 2013) I-1.

[74]See UN Charter, *supra* note 57, Art. 51.

[75]That necessity and proportionality apply on an ongoing basis, throughout the duration of an armed conflict prompted by self-defence, see C. Greenwood, 'The Relationship Between *Ius ad Bellum* and *Ius in Bello*', (1983) 9 *Review of International Studies* 221, 222–5; J. Gardam, *Necessity Proportionality and the Use of Force by States* (2004), 155–6; T. Ruys, *'Armed Attack' and Article 51 of the UN Charter: Evolutions in Customary Law and Practice* (2010), 124.

[76]See *Nicaragua*, *supra* note 68, para. 176; see *Nuclear Weapons*, *supra* note 56, para. 41; *Case Concerning Oil Platforms* (*Iran v. United States*), Judgment of 6 November 2003, [2003] ICJ Rep. 161, at 196–9, paras. 73–7.

[77]See UN Charter, *supra* note 57, Art 2(4).

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reasonable choice of means available to the defending state in the circumstances.[78] Any acts of self-defence, whether they be in space or on Earth, must surpass this initial hurdle in order to be considered lawful under the *jus ad bellum*. Any use of force that is unnecessary will be unlawful. This *jus ad bellum* assessment is independent of lawfulness under IHL.

For defending states considering using ASAT weapons, therefore, the first question will always be 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.[79] If recourse to the UNSC results in adequate and effective measures that remove the threat to the defending state, exercising self-defence will not be necessary.[80] The same applies to non-forcible measures that resolve the situation, such as diplomacy, retorsion, or the application of countermeasures. Likewise, military action falling below the threshold of the use of force[81] may stand as a reasonable alternative to force, whether directed at satellites or other assets belonging to the aggressor. Cyber operations that temporarily disable a satellite, but do not cause it to collide with other space objects or otherwise create debris, are a potential example. It is only where such non-forceful alternatives, on their own, are insufficient to respond to an armed attack that there is a necessity of using force in self-defence. Unless and until this requirement is satisfied, ASAT weapons may not be used.

4.2. Targeting satellites: Lawful objects of self-defence?

Targeting particular satellites is ostensibly an attractive option for defending states. Satellites are an integral part of enabling military operations on Earth. They are hardwired into the infrastructure 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.[82] 'Operation Iraqi Freedom' in 2003 is often cited as an exemplar of the pivotal role that satellites play to contemporary combat operations,[83] and this role is equally evident today in Russia's ongoing invasion of Ukraine.[84] As discussed in Section 2, 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 in the particular circumstances for a state to resort to force in self-defence in some form (because reasonable alternatives to force are unavailable or will be ineffective to respond to an armed attack), it does not follow that satellites, or any other targets, automatically become fair game from the perspective of the *jus ad bellum*. *Jus ad bellum* necessity goes further than the general premise set out in Section 4.1 by requiring that states confine any necessary defensive response to targets that serve a defensive purpose.[85] For policy makers and military planners who are considering whether they may lawfully target satellites in self-defence, therefore, *jus ad bellum*

[78]For further analysis of this summary, see C. O'Meara, *Necessity and Proportionality and the Right of Self-Defence in International Law* (2021), 38–42.

[79]E. Wilmshurst, 'The Chatham House Principles of International Law on the Use of Force in Self-Defence', (2006) 55(4) *ICLQ* 963, 967.

[80]Under Art. 51 of the UN Charter, the right of self-defence remains unimpaired until the UNSC takes 'necessary measures' to restore international peace and security. Once restored, the necessity of self-defence falls away.

[81]See note 68 and accompanying text, *supra*.

[82]See Schmitt, *supra* note 22, 90.

[83]Operation Iraqi Freedom relied on satellites to communicate among coalition forces, to detect Iraqi rocket launches, and to operate drones. See Schmitt, *supra* note 22, 90–1.

[84]'[S]pace capabilities, including commercial satellites, [have] played a highly visible and compelling role in Ukraine's resistance to the invasion. Communications and imagery satellites have been used to connect Ukrainian troops across the battlefield, track Russian military movements, and map humanitarian corridors.' See K. A. Bingen et al., *supra* note 1, 2.

[85]For analysis of this aspect of *jus ad bellum* necessity, see O'Meara *supra* note 78, 84–93.

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necessity constitutes a further hurdle to overcome, in addition to complying with IHL targeting rules that also govern whether or not satellites are targetable.[86]

Under IHL, satellites may only be targeted in an armed conflict if they constitute 'military objectives'. 'Civilian objects' may not be directly targeted.[87] These core tenets of IHL constitute customary international law that binds all states in both international and non-international armed conflicts.[88] Attacks against satellites must be cancelled or suspended under these IHL rules if it becomes apparent that the satellite is not a military objective or if destroying the satellite would violate IHL proportionality limitations.[89] As a consequence, IHL naturally has primacy for states considering using ASAT weapons in a defensive operation and will generally be the 'first point of call' in forming and carrying out targeting decisions against satellites.[90] In addition, *jus ad bellum* necessity also restricts these targeting decisions to ensure they remain defensive and do not take state acts into the realm of unlawful uses of force. This understanding of *jus ad bellum* necessity accords with the ICJ's approach in *Oil Platforms*, as well as academic commentary and state practice.[91] For decision makers, this means that *jus ad bellum* necessity imposes an additional and separate targeting requirement that operates cumulatively and in parallel to IHL. This additional requirement is that defensive force should in principle be directed against the source of the armed attack(s) being halted, repelled, or prevented[92] and be limited to military targets connected with that armed attack.[93] Simply put, targeting something that has no military function cannot be necessary to achieve a lawful defensive purpose.[94] Furthermore, without a nexus or a 'functional link'[95] between attack and defence, targeting a satellite risks being deemed punitive and unlawful, rather than being defensive and lawful.

The operation of this *jus ad bellum* targeting requirement as it applies to satellites as potential objects of self-defence raises some very important difficulties for states operating in the space domain. Yet, it also acts as an important guard rail to ward against conflict in space, as well as avoiding escalation of conflict on Earth into that domain. That *jus ad bellum* necessity requires acts of self-defence to be connected to an armed attack means that it is only necessary to target in self-defence military assets that belong to the authors of that attack. While perhaps facile to state,

[86]On the application of IHL in space, including targeting satellites, see the references in note 22.

[87]See API, *supra* note 23, Arts. 48, 51(2), 52(2). For satellites to constitute 'military objectives', they must constitute objects that by their 'nature, location, purpose or use make an effective contribution to military action and whose total or partial destruction, capture or neutralization, in the circumstances ruling at the time, offers a definite military advantage'. Ibid, Art. 52(2).

[88]Rule 1 of The International Committee of the Red Cross's Customary IHL Database, available at ihl-databases.icrc.org/customary-ihl/eng/docs/v1_rul_rule1.

[89]See API, *supra* note 23, Art. 57(2).

[90]J. A. Green and C. P. M. Waters, 'Military Targeting in the Context of Self-Defence Actions', 84 (2015) *Nordic Journal of International Law* 3, 6.

[91]In *Oil Platforms, supra* note 76, at 186–7, para. 51, the ICJ held that the USA must show that the oil platforms targeted in purported acts of self-defence were legitimate military targets. The Court rejected the USA's assertions that the oil platforms performed a military function, concluding that the American attacks were not necessary acts of self-defence (ibid., paras. 74–7). See further O'Meara, *supra* note 78, 84–93. Some authors consider targeting in the *jus ad bellum* as a matter for proportionality rather than necessity. However, this author rejects that approach. See O'Meara *supra* note 78, at 85–7, 163–6.

[92]See Ruys, *supra* note 75, 108–9.

[93]See further below in this section regarding the military nature of targets selected for defensive responses.

[94]See O'Meara, *supra* note 78, 85. That targeting something that has no military function will breach *jus ad bellum* necessity as well as IHL, see further C. Greenwood, 'Self-Defence and the Conduct of International Armed Conflict', in Y. Dinstein and M. Tabory (eds.), *International Law at a Time of Perplexity: Essays in Honour of Shabtai Rosenne* (1989), 273 at 278–9; see Gardam, *supra* note 75, 171–2; O. Corten, *The Law Against War: The Prohibition on the Use of Force in Contemporary International Law* (2010), 488; see Ruys, *supra* note 75, at 108–10, 121–3. These commentators also consider targeting to be limited by *jus ad bellum* proportionality which, as noted (see note 91, *supra*), this author refutes.

[95]Cannizzaro argues that *jus ad bellum* necessity secures the existence of a 'functional link' between military action and a defensive purpose. E. Cannizzaro, 'Proportionality in the Law of Armed Conflict', in A. Clapham and P. Gaeta (eds.), *The Oxford Handbook of International Law in Armed Conflict* (2014), 332 at 346.

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the challenges associated with legally attributing[96] armed attacks to their author (a requirement for any act of self-defence) are potentially exacerbated in the space domain. Attribution of an armed attack is particularly difficult when the attack itself is by way of ASAT weapons directed against a putative defending state's own satellites operating in Earth's orbit. The difficulty is being able to positively identify the aggressor where the object of the armed attack is in space and, by operation of necessity, to limit the defensive response accordingly. An incorrect assessment of this 'who did it' question might mean that an intended act of lawful self-defence is instead 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 of ASAT missiles from Earth are detectable and their effects can create detectable orbital debris.[97] Beyond that method of attack, identifying with any precision aggressive acts in space is generally challenging. Other technologies, such as non-kinetic directed energy ASATs weapons (notably lasers and high-powered microwaves), electronic ASAT weapons, and cyber operations, are often much less visible and are more difficult to attribute.[98] Likewise, co-orbital ASAT weapons of all types are harder to identify and track in orbit.[99] Behaviour by satellites may also look unusual or threatening to other satellites but, without further information, it is difficult to clarify what precisely is occurring so far from Earth.[100] All of these technical problems pose practical difficulties for state compliance with *jus ad bellum* necessity in terms of ensuring the object of self-defence is correctly identified as belonging to the aggressor. It should also be noted that not all threats to satellites come from states. Although military activities in outer space are likely to remain largely limited to states, at least in the near future,[101] threats like signal jamming and cyberattacks might also be carried out by non-state actors, including terrorist organizations.[102] This possibility further complicates the threat assessment and related response.

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, *jus ad bellum* necessity precludes the targeting of that state's satellites in response, as well as any other asset belonging to that state. Given the potential disastrous consequences of targeting satellites (see Section 5), states are advised to be extremely careful in attributing aggressive conduct in space to other states in order to allow for a defensive response in the space domain. Moreover, public justifications of defensive action against satellites, including reports of self-defence to the UNSC,[103] must be accompanied by sufficient information so that third party reviewers can judge whether the legal test of attribution is met and, therefore, whether acts of self-defence are necessary in that they are appropriately targeted. In cases not involving direct ascent ASAT missile attacks, this is likely to be a high evidential burden to meet.

In addition to the difficulty of attributing conduct in space, a further limitation of *jus ad bellum* necessity regarding whether satellites are lawful targets of self-defence relates to their nature and

[96]Attribution might be established under Art. 3(g) of the Definition of Aggression or the laws of state responsibility. See UNGA, Res. 3314, UN Doc. A/RES/3314(XXIX) (14 December 1974); see ARSIWA, *supra* note 69. See further Ruys, *supra* note 75, 368–510.

[97]See United States Defense Intelligence Agency, *supra* note 28, 46.

[98]See K. A. Bingen et al., *supra* note 1, 4–5.

[99]Ibid., 14.

[100]This is the issue with Russia's Luch 'inspector satellite' that has made several unusual direct approaches to other satellites, which have involved it loitering around these satellites with unclear intentions. Ibid., 14, 19–20.

[101]See Von der Dunk, *supra* note 52, 209.

[102]Noted in NATO's Overarching Space Policy, see NATO, *supra* note 3, para. 4.

[103]Art. 51 of the UN Charter requires states to immediately report to the UNSC measures taken in the exercise of their right of self-defence.

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composition. It might be possible to establish that a satellite registered to an aggressor state is wholly owned or used by it and clearly serves a military purpose, such as surveillance and reconnaissance or providing targeting information for military operations. In cases where a satellite can be positively characterized in this way, and a factual connection with an armed attack being defended against is established, the *jus ad bellum* necessity requirement described in this section imposes no obvious restrictions on targeting it.[104] Yet, verifying whether a satellite is in fact military in nature is generally very difficult. It is nearly impossible to get a first-hand look at satellites in space, so a military planner must gather information on potential targets from a variety of intelligence sources,[105] including the very limited information contained in the UN Register of Objects Launched into Outer Space.[106] Notably, however, this Registry does not disclose whether a satellite is military or civilian in nature and not all satellites are actually registered.

Some satellites are purely civilian or commercial in nature and do not constitute lawful targets for the purposes of *jus ad bellum* necessity. Other satellites may not have one sole function, however. They may be dual use, serving both civilian/commercial and military clients. Notable examples include communication and navigation satellites. Additionally, satellites may host multiple payloads, which are also dual use in that they have both civilian/commercial and military users.[107] A celebrated example of a dual use satellite system is SpaceX's Starlink service, which provides internet access to support Ukraine's self-defence against Russia's ongoing invasion. The Ukrainian government and military have depended on Starlink as the 'linchpin' of the Ukraine armed services' command, control, communications, computers, intelligence, surveillance, and reconnaissance capabilities.[108] Civilians have likewise relied heavily on the service.[109] In addition to the potential for dual civilian and military use, SpaceX's Starlink service 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.[110]

Dual use and multiple owner/user satellites pose significant challenges for military planners, including assessing compliance with IHL targeting rules. Yet, whether a satellite or other object is a lawful target for the purpose of IHL is separate to the question of legality under the *jus ad bellum*.[111] The question for our purposes is whether, regardless of legality under IHL's targeting rules, these types of satellites are generally targetable in self-defence because of the requirements of *jus ad bellum* necessity.[112] For certain states, it would seem that the answer is in the affirmative. In 2022, Russia publicly warned that commercial infrastructure in outer space used for military purposes can become legitimate targets for retaliation.[113] This is a deeply problematic view and, if

[104]Targeting may breach the requirements of *jus ad bellum* proportionality, however. See Section 5, *infra*.

[105]See Blount, *supra* note 22.

[106]The 1974 Convention on Registration of Objects Launched into Outer Space, 1023 UNTS 15, requires states that launch space objects to register them in national and UN held registries. Information to be furnished to the UN is set out in Art. IV of the Convention. The UN Register of Objects Launched into Outer Space is available at www.unoosa.org/oosa/en/spaceobjectregister/index.html.

[107]See Nasu, *supra* note 22, 143–4. That many states may be involved with the launch, procurement, and operation of satellites and their payloads is also an issue for identifying for *jus ad bellum* purposes which states are the victims of armed attacks against satellites. This question is beyond the scope of this paper, but see Nasu, *supra* note 22, 164–8.

[108]'How Elon Musk's Satellites Have Saved Ukraine and Changed Warfare', *The Economist*, 5 January 2023, available at www.economist.com/briefing/2023/01/05/how-elon-musks-satellites-have-saved-ukraine-and-changed-warfare.

[109]D. Antoniuk, 'How Elon Musk's Starlink Satellite Internet Keeps Ukraine Online', *The Kyiv Independent*, 3 September 2022, available at kyivindependent.com/how-elon-musks-starlink-satellite-internet-keeps-ukraine-online/.

[110]Intelsat and Immarsat are other obvious examples. See Blount, *supra* note 22.

[111]State conduct may be lawful under one body of international law and unlawful under another. *Application of the Convention on the Prevention and Punishment of the Crime of Genocide (Croatia v. Serbia),* Judgment of 3 February 2015, [2015] ICJ Rep 3, at 138, para. 474.

[112]Regarding the *jus ad bellum* proportionality assessment of targeting such satellites, see Section 5, *infra*.

[113]See Office of the Director of National Intelligence, *supra* note 27, 16.

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indeed related to Russia's appreciation of possible lawful targets of self-defence, does not accord with the obvious requirements of *jus ad bellum* necessity. As noted, for state responses in self-defence to be confined exclusively to a defensive purpose, any target selected in the course of defensive operations must be military in nature and connected with the armed attack being halted, repelled, or prevented.[114] Applying this general rule to targeting satellites which have a dual military/civilian function or which provide services to multiple states as well as non-state actors is complicated. The *jus ad bellum* does not comprise detailed rules of targeting that are found in IHL. For example, it is unclear whether the *jus ad bellum* requirement that the target be military in nature is identical or similar to the requirement under IHL that targets be limited to 'military objectives'. The ICJ's understanding of this requirement per its dictum in *Oil Platforms* certainly leaves room for debate.[115] However, even if connected with an armed attack, the fact that a satellite may not be exclusively a military target and/or may not be owned, operated, or used solely by the aggressor state must logically limit the responses that may be directed against that satellite using ASAT weapons in self-defence.

At a minimum, *jus ad bellum* necessity restricts which type of ASAT weapon may be used against a dual use or multiple owner/user 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 would naturally seem to be ruled out by this requirement. This is because their effects cannot be limited solely to military targets connected to the armed attack. Anti-satellite missiles are the obvious case in point as their use is likely to destroy, or at least severely 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 military targets of 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, as well as 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 because of the dual use or multiple user nature of such satellites, 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).

The legal risks to defending states of making dual use or multiple owner/user satellites targets of military action are manifest. Damaging or destroying space objects not exclusively owned, operated, or used by the aggressor exposes the defending state to potential legal claims from third states,[116] as well as possible private claims by non-state actors affected by military action. Moreover, the scale and effects of defending states using certain ASAT weapons might comprise an armed attack, giving rise to a right of the victim state to exercise self-defence against the (initial) defending state.[117] If multiple states are affected by the ASAT weapon use, the risk of military escalation becomes dangerously apparent and the fear of wars in space becomes very real. Given these risks, states using force in self-defence should abide by a broad understanding of *jus ad bellum* necessity by avoiding targeting dual use and multiple owner/user satellites entirely. Defending states that only target 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 most likely comply with this *jus ad bellum* requirement. Adherence to *jus ad bellum* necessity

[114]See notes 92–5 and accompanying text, *supra*.

[115]See note 91, *supra*.

[116]See Arts. VI and VII of the OST, *supra* note 34 and 1971 Convention on International Liability for Damage Caused by Space Objects, 961 UNTS 187. See further S. Hobe et al. (eds.), *Cologne Commentary on Space Law: Outer Space Treaty* (2017), 442–7, 459–61. Demands might also be made for reparation for committing internationally wrongful acts under the laws of state responsibility. See ARSIWA, *supra* note 69, Art. 31. Under Art. 21, wrongfulness preclusion of lawful self-defence operates solely between the aggressor and defending states. Art. 21 leaves open all issues of the effects of defensive action vis-à-vis third states. See ARSIWA, *supra* note 69, Art. 21 Commentary, para. 5.

[117]Regarding which states may be entitled to exercise self-defence, see Nasu, *supra* note 22, 164–8.

benefits the defending state by allowing it to avoid potential legal liability, as well as protecting itself from being a target of military responses by other states affected by ASAT weapon use.

A defending state may nevertheless choose to target in self-defence military satellites exclusively owned, operated, or used by the aggressor state. A defending state may likewise employ non-kinetic ASAT weapons against dual use or multiple user satellites that constitute uses of force, but which decision makers believe satisfy *jus ad bellum* necessity. If so, that is not the end of the story. Given the potential effects of damaging or destroying any type of satellite, even if the *jus ad bellum* necessity requirements are capable of being satisfied, *jus ad bellum* proportionality might nevertheless prevent targeting such satellites with ASAT weapons.

5. Proportionality in outer space

If some form of forceful military response in self-defence is necessary because force is the only reasonable option in the circumstances and the targeting requirements of both IHL and *jus ad bellum* necessity are also satisfied, it does not automatically follow that an ASAT weapon may be used in self-defence. As the following analysis reveals, *jus ad bellum* 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 preclude entirely the targeting of certain types of satellites.

Jus ad bellum proportionality restricts how much total force a state may use in a military operation to achieve a legitimate defensive purpose (being to halt, repel, or prevent an armed attack). It allows states to effectively defend themselves, but requires that states do no more than that.[118] *Jus ad bellum* proportionality operates differently from IHL proportionality and compliance with each requirement is a distinct legal question. To be lawful, any act of defensive targeting of a satellite must comply independently with both sets of rules. In terms of how these requirements function, IHL proportionality operates at the micro or operational level of decision-making to regulate the specifics of individual attacks in order to minimize resulting harm to civilians and civilian objects. *Jus ad bellum* proportionality meanwhile operates at the macro or strategic level to limit a defending state's total military response viewed as a whole. *Jus ad bellum* proportionality, therefore, acts as a prohibition against excessive overall military reactions by states that undertake necessary acts of self-defence.[119]

Regarding appraising state compliance, *jus ad bellum* proportionality is not limited to an assessment of expected civilian harm resulting from particular planned attacks, which is at the core of IHL proportionality.[120] *Jus ad bellum* proportionality instead is concerned with the bigger picture and the totality of the wider defensive response, requiring states to balance uses of force and their outcomes primarily against a defensive purpose (being to halt, repel, or prevent an armed attack). *Jus ad bellum* proportionality also requires that defensive operations, viewed as a whole, are not excessive in terms of the overall negative impacts they might have on civilians and on the interests of other states and the international community more broadly.[121]

In space, *jus ad bellum* proportionality has particular significance. This is partially due to the nature of certain satellites and the services that they provide, which are discussed further below in this section. More generally, the physical characteristics of space mean that there are serious consequences to targeting defensively all kinds of satellites.[122] Reports in February 2024 that

[118]See O'Meara, *supra* note 78, 97–100.

[119]Regarding the relationship between IHL proportionality and *jus ad bellum* proportionality, ibid., 155–61.

[120]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 from that attack. See API, *supra* note 23, Art 51(5)(b).

[121]See O'Meara, *supra* note 78, 100–25, 139–55.

[122]'The physical and legal characteristics of outer space must be taken into account in any exercise of a State's right of self-defence.' See MILAMOS, *supra* note 51, Rule 152. This general rule finds specific granularity through the requirements of *jus ad bellum* proportionality.

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Russia was pursuing the deployment of a nuclear-based ASAT weapon in space focused attention on the potentially devastating consequences to all states of a nuclear detonation in that domain.[123] Yet, even the deployment of conventional weapons in space raises particular concerns for third-party interests. Before moving to the detailed analysis, a familiar ASAT testing case study illustrates how targeting a satellite in self-defence might affect these interests. In January 2007, China employed a kinetic kill vehicle ASAT to destroy once of its own ageing weather satellites called Fengyun 1C.[124] This ASAT test caused international concern as the destruction of the satellite created a large cloud of debris, which spread out and travelled into different orbits above the Earth. The effects of this particular debris cloud have been long-lasting. It is estimated that more than 2,700 pieces of Fengyun 1C debris remain in orbit and most of these will continue orbiting the Earth for decades.[125] The threat of the debris to third parties materialized six years later when, in January 2013, fragments of Fengyun 1C collided with a small Russian laser-ranging retroreflector satellite called 'Ball Lens in The Space', knocking it from its orbit.[126] The satellites of other states, as well as the International Space Station, were also put at risk from this enduring cloud of space junk.[127]

Other more recent examples of ASAT weapon use include India's 'Mission Shakti' in March 2019, comprising the test of a missile to destroy one of its own satellites in low Earth orbit.[128] As with the destruction of Fengyun 1C, India's test highlights the risks to other states' space activities and assets in space caused by the debris that may result from the use of ASAT weapons. Indeed, following India's test, NASA administrator Jim Bridenstine reminded us that '[d]ebris ends up being there for a long time; if we wreck space, we're not getting it back'.[129] Russia's destruction of Cosmos 1408 in 2021 also exemplifies this fear.[130] The USA continues to track approximately 1,500 pieces of the debris resulting from this incident, highlighting the ongoing concern that states have regarding the repercussions that flow from the use of ASAT weapons.[131]

The risk of enduring space debris caused by damage to or destruction of a satellite is a factor that is peculiar to the space environment and the risk is growing. Space is a rapidly transforming and an increasingly congested domain. More than 7,500 satellites currently orbit the Earth,[132] and with satellite demand set to quadruple in the next decade, one estimate places 24,500 satellites in orbit by the end of 2031.[133] Debris-creating defensive ASAT weapon use could have long lasting and unforeseen consequences for the rights and interests of many spacefaring actors. Space debris does not discriminate,[134] so the risk of collision 'is to all civilian, commercial, and government

[123]See C. J. Borgen, 'Russia's Alleged Nuclear Anti-Satellite Weapon: International Law and Political Rhetoric', *Articles of War*, 31 July 2024, available at lieber.westpoint.edu/russias-nuclear-anti-satellite-weapon-international-law/; C. J. P. Bennett, 'Nuclear Space-Based ASAT Weapons – A Brief International Legal Perspective', *EJIL:Talk!* 27 February 2024, available at www.ejiltalk.org/nuclear-space-based-asat-weapons-a-brief-international-legal-perspective.

[124]'China Confirms Satellite Downed', *BBC News*, 23 January 2007, available at news.bbc.co.uk/1/hi/world/asia-pacific/6289519.stm.

[125]See United States Defence Intelligence Agency, *supra* note 28, 17.

[126]K. Tate, 'Russian Satellite Crash with Chinese ASAT Debris Explained (Infographic)', *Space.com*, 9 March 2013, available at www.space.com/20145-russian-satellite-chinese-debris-crash-infographic.html.

[127]L. David, 'China's Anti-Satellite Test: Worrisome Debris Cloud Circles Earth', *Space.com*, 2 February 2007, available at www.space.com/3415-china-anti-satellite-test-worrisome-debris-cloud-circles-earth.html.

[128]D. E. Urrutia, 'India's Anti-Satellite Missile Test Is a Big Deal. Here's Why', *Space.com*, 30 March 2019, available at www.space.com/india-anti-satellite-test-significance.html.

[129]S. Lewin, 'NASA Chief Slams India's "Terrible" Anti-Satellite Test. Here's Why', *NBC News*, 2 April 2019, available at www.nbcnews.com/mach/science/nasa-chief-slams-india-s-terrible-anti-satellite-test-ncna990206.

[130]See note 33 and accompanying text, *supra*.

[131]G. Grylls, 'China "Will Drill Moon for Minerals"', *The Times*, 1 July 2023.

[132]Union of Concerned Scientists, 'Union of Concerned Scientists Satellite Database', available www.ucsusa.org/resources/satellite-database. This number is an estimate as at 1 May 2023.

[133]Euroconsult, 'Satellite Demand to Quadruple over the Next Decade', 12 December 2022, available at www.euroconsult-ec.com/press-release/satellite-demand-to-quadruple-over-the-next-decade/.

[134]See Von der Dunk, *supra* note 52, 227.

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satellites of all nations'.[135] 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'.[136] Any or all of their satellites, together with the essential services that rely on them, could be affected to varying degrees by ASAT weapons use. The weapons tests referred to above illustrate this concern and there have been efforts to address it. In the EU's Draft International Code of Conduct for Outer Space Activities, for example, states resolve to minimize, to the greatest extent practicable, the creation of space debris, even when exercising their right of self-defence under the UN Charter.[137] *Jus ad bellum* proportionality is the positive law answer to this soft law aspiration. The following sections explain how these aftereffects factor in the *jus ad bellum* proportionality calculus.

5.1. Civilian harm

On Earth, '[i]t 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'.[138] That civilian harm stands as the clearest indicator that claims of self-defence might be deemed disproportionate under the *jus ad bellum* is clearly reflected in the reactions of states and international organizations.[139] A classic example is Israel's invasion of Lebanon in 2006, justified as self-defence, but most frequently cited as disproportionate based primarily on the factor of excessive harm to civilians and to civilian infrastructure.[140] Applying this indicator to ASAT weapons use, damage to or destruction of a satellite may indeed lead directly to civilian death or personal injury. The rise of commercial space tourism puts private 'space tourists' in danger, although harm to astronauts on board a space station or transiting through space are perhaps more significant examples of the potential risk to civilians. The debris field from the destruction of Cosmos 1408 led to astronauts on the International Space Station to seek shelter, demonstrating the very real concern to life and limb of those operating in orbit.[141] That said, astronauts may have military or civilian backgrounds and they possess a unique status in international space law as 'envoys of mankind in outer space'.[142] Consequently, astronauts are not automatically civilians for *jus ad bellum* proportionality assessment purposes. Yet, if not engaging in hostilities, astronauts should logically be regarded as civilians, meaning that death or injury to them will likely weigh more heavily in proportionality determinations. Conversely, harm to astronauts engaging in hostilities will be less significant for such assessment.[143] Regardless, given the relatively small numbers of both astronauts and private civilians operating in space, direct harm to individuals in that domain resulting from ASAT weapon use is likely to be limited, at least for now.

Of much greater significance to *jus ad bellum* proportionality is the potential harm to satellites owned and operated by civilians and 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 directly targeted by an ASAT weapon, or because satellites are damaged or destroyed by space debris that has resulted from targeting another satellite. Given the potential

[135]See United States Defence Intelligence Agency, *supra* note 28, 37.

[136]See UNGA, Res. 77/41, *supra* note 10.

[137]See EU's Draft International Code of Conduct, *supra* note 49, Art. 4.2.

[138]K. Watkin, *Fighting at the Legal Boundaries: Controlling the Use of Force in Contemporary Conflict* (2016), 62.

[139]See O'Meara, *supra* note 78, 139–46.

[140]Ibid., 141–3.

[141]See Grylls, *supra* note 131. See note 33 and accompanying text, *supra*.

[142]See OST, *supra* note 34, Art. V. For further analysis of 'astronauts' and 'space tourists', see F. Lyall and P. B. Larsen, *Space Law: A Treatise* (2018), 117–34. See also Woomera Manual, *supra* note 51, Rule 13.

[143]See O'Meara, *supra* note 78, 143. In addition, if regarded as combatants or civilians directly participating in hostilities, astronauts are potentially targetable under IHL. Conversely, if not participating in hostilities, astronauts will not be targetable. See Mawdsley, *supra* note 22, 287–8; see Von der Dunk, *supra* note 52, 219–20. On direct participation in hostilities, see API, *supra* note 23, Art. 51(3).

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enduring nature of debris clouds, any number of satellites belonging to civilians or serving civilian needs may be at risk. That risk is hugely significant. As mentioned, satellites are central to the operation of human societies and to global economies. Even temporary disruption to a satellite that serves these vital civilian needs may have long lasting effects stretching and enduring well beyond the use of the ASAT weapon. An obvious example of the scale of this risk to civilians is any harm caused to the American Global Positioning System (GPS)[144] and its equivalents,[145] which provide military and civilian users with global positioning, navigation, and timing (PNT) services. It is no exaggeration to say that PNT systems are indispensable to the functioning of modern civilizations. Among other essential services, agriculture, aviation and other transport networks, financial markets, banking systems, logistics, communications systems and networks, power grids and other critical infrastructure, emergency services, environmental protection, disaster surveillance, humanitarian relief, military operations, and the preservation of national security more generally, all rely on PNT technology.[146]

Even a temporary and reversible disruption to these essential services resulting from ASAT weapon use could have disastrous consequences for millions of civilians who rely on them, as well as for civilian infrastructure on Earth. The effects might be economic, caused by havoc wrought on financial markets. This possibility has been noted by the head of UK Space Command in reference to Russia's potential use of jamming satellites that could 'cut off the UK from the outside world'.[147] The effects could also 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, among others, has voiced its concern about such potential severe human costs,[148] with civilian injury or death being readily foreseeable in many instances. Given the centrality of space-based 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, even if regarded as military objectives for IHL purposes, given the *jus ad bellum* proportionality requirement to minimize civilian harm, it is arguable that the *jus ad bellum* generally rules out the direct targeting of satellites that provide PNT and equivalent essential services. The risk to civilians of disrupting such services, even temporarily, is too great. The use of non-kinetic ASAT weapons to disrupt PNT or other essential services temporarily seems equally impossible to justify from a *jus ad bellum* perspective. This is so despite a functional link between such a satellite and an armed attack that might satisfy *jus ad bellum* necessity. For *jus ad bellum* proportionality, the potential repercussions on Earth of these acts 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 against space-based 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 scale and effects of that act might mean that the threshold of violence is eventually crossed and the *jus ad bellum* requirements that states wished to avoid nevertheless end up applying. This conclusion counters the idea that temporary or reversible disruption to a satellite's function would not generally amount to a use of force.[149] However, this

[144]See the official GPS website, www.gps.gov/.

[145]Although the American's GPS system is perhaps the best-known satellite-based geolocation and timing service, other examples include 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).

[146]GPS.gov, 'GPS Applications', available at www.gps.gov/applications/.

[147]See Grylls, *supra* note 131.

[148]International Committee of the Red Cross, 'The Potential Human Cost of the Use of Weapons in Outer Space and the Protection Afforded by International Humanitarian Law', April 2021, available at www.icrc.org/en/document/potential-human-cost-outer-space-weaponization-ihl-protection.

[149]See Nasu, *supra* note 22, 158. See also Mačák, *supra* note 39, 408.

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may be true where satellites that provide non-essential services are targeted and/or where the scale and effects of targeting are in fact limited. Context is determinative and the wider effects of such targeting, including on Earth, must be considered for the purposes of the initial use of force threshold determination and the *jus ad bellum* proportionality analysis.

Additionally, the foregoing analysis applies where the targeting of other satellites would put PNT and other essential services at risk because of the debris created by that act of targeting. Targeting satellites in proximate orbits is the most obvious example. The only possible exception to these conclusions, as with the use of nuclear weapons, is a greater freedom to use ASAT weapons where the survival of the state is at stake.[150] Beyond such extreme and unusual circumstances, however, *jus ad bellum* proportionality acts as a significant limitation on defensive action in space in terms of directly targeting certain type of satellites and incidentally causing harm to them and the essential services they provide. Furthermore, states must still account for the impact on civilians resulting from defensively targeting any kind of satellite, even those that do not provide such essential services. *Jus ad bellum* 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. In addition to any harm to civilians, in assessing whether the results of that targeting might be excessive, possible consequences for other states must also factor in the *jus ad bellum* proportionality assessment.

5.2. Third party rights and interests

Beyond civilian harm, state interests more broadly factor in the *jus ad bellum* proportionality assessment. This idea is rooted generally in international space law. Article I of the OST stipulates that the exploration and use of outer space shall be carried out for the benefit and in the interests of all states and shall be the province of all mankind.[151] Furthermore, states parties to the OST are obliged by Article IX to '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'.[152] These general presumptions of how states should operate in space in times of peace encapsulate the essence of *jus ad bellum* proportionality, which is designed to limit the excesses of war. In particular, *jus ad bellum* proportionality requires that the legally protected rights of other states must not be unduly harmed when states use ASAT weapons.[153] Excessive harm to such rights risks defensive action being viewed as disproportionate under the *jus ad bellum*. Determining what harm to third-party rights and interests might be deemed disproportionate is not an exact science, however. The *jus ad bellum* provides no detailed rules on this point, and we do not have state practice and *opinio juris* to guide us that has resulted from ASAT weapon use in self-defence. Moreover, whether third party reviewers (be they other states, international organizations, or courts and tribunals) will regard defensive action as excessive will be largely fact dependent. Nevertheless, there are certain conclusions we can readily draw.

First, the risk of enduring space debris caused by ASAT weapon use poses a direct threat to satellites owned or operated by third states and to satellite provided services on which they rely, such as essential PNT services. Depending on the nature of the satellite targeted, the impacts of ASAT weapon use on interests of other states could be multiple and varied. They encompass effects on Earth and in space. Physical or non-physical harm might result, 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

[150]The ICJ has ruled that *jus ad bellum* 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. See *Nuclear Weapons*, *supra* note 56, at 245, paras. 41–4 and at 263, para. 97.

[151]See OST, *supra* note 34, Art. I.

[152]Ibid., Art. IX. This due regard obligation extends to avoiding the harmful contamination of space.

[153]See Gardam, *supra* note 75, 17; see O'Meara, *supra* note 78, 146–53. See also Nasu, *supra* note 22, 170–2.

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state's right to neutrality.[154] These outcomes of defensive ASAT weapon use are likely to factor highly in assessments of *jus ad bellum* proportionality by third states and other international actors. Moreover, the threat posed by damage or destruction to satellites reaches beyond individual state rights and interests, to rights and interests appertaining to all states and to the international community more broadly. Particularly notable are the possible effects of ASAT weapon use on both terrestrial and space environments. The ICJ has indicated that, for the *jus ad bellum*, '[r]espect for the environment is one of the elements that go to assessing whether an action is in conformity with the principles of necessity and proportionality.'[155] The UNGA has meanwhile underscored that ASAT technologies might generally threaten the 'long-term sustainability of the outer space environment'.[156] The use of nuclear weapons in space clearly implicates this concern, given the potential perils for space and Earth, but dangerous conventional ASAT weapon use could likewise contaminate the space environment in the long term. ASAT weapon use has the potential to impair the ability of all states to operate in space and to benefit from the freedom to explore and use space peacefully, including placing satellites in orbit. Enduring clouds of space debris are the clearest example of this risk.

In terms of other community interests that might be affected by space debris, the UNGA also reminds us that 'the 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'.[157] 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 *jus ad bellum* necessity and proportionality that condition a state's right of self-defence. Indeed, the ultimate rationale of *jus ad bellum* proportionality has been described as the maintenance of international peace and security, by seeking to minimize disruption to the international order caused by an exercise of self-defence.[158] Consequently, ASAT weapon use against another state that directly threatens this peace and security by creating space debris that may affect all spacefaring states is likely to be regarded as disproportionate under the *jus ad bellum*.

These general conclusions have practical real-world repercussions for those contemplating using ASAT weapons in self-defence. That adherence to *jus ad bellum* proportionality requires the minimization of harm to the interests of other states and to the international community equates to an obligation on decision makers to consider the effects on Earth and in space of the methods they use. Given the consequences associated with the creation of space debris, outside of extreme situations of self-defence threatening the existence of the state,[159] it is arguable that *jus ad bellum* proportionality *prima facie* precludes the use of most, if not all, kinetic physical ASAT weapons. Non-kinetic alternatives, such as directed energy and electronic ASAT weapons and cyber operations, might also be problematic for *jus ad bellum* proportionality compliance. This will be so where the effects of such weapons on third-party interests are comparable to kinetic physical ASAT weapon use because of the effect on the targeted satellite and/or related service, or the effects cannot be quantified or confined to the aggressor state. An example is a cyber operation that causes a satellite to lose control and collide with another satellite or space object, resulting in

[154]The law of neutrality is complicated, not least because of its relationship with the UN Charter. Detailed consideration of this issue is beyond the purview of this article. See further W. H. von Heinegg, 'Neutrality and Outer Space', (2017) 93 *International Law Studies* 526; see O'Meara *supra* note 78, 147–53.

[155]See *Nuclear Weapons*, *supra* note 56, at 242, para. 30.

[156]See UNGA, Res. 77/41, *supra* note 10. For further analysis of environmental considerations and space, see Lyall and Larsen, *supra* note 142, 245–80.

[157]UNGA, Res. 75/36, UN Doc. A/RES/75/36 (16 December 2020).

[158]See Greenwood, *supra* note 94, 278; see Gardam, *supra* note 75, 16; R. Van Steenberghe, 'Proportionality under *Jus ad Bellum* and *Jus in Bello*: Clarifying their Relationship', (2012) 45(1) *Israel Law Review* 107, 118–19.

[159]See note 150 and accompanying text, *supra*.

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damage and debris. Cyber operations, as well as lasers and high-powered microwaves, might also be used to impair satellites providing essential PNT services to a state or group of states temporarily or permanently. Unless other satellites in a constellation can ensure the continuation of the relevant service, catastrophic consequences might ensue, potentially including loss of life. Likewise targeting dual use and multiple owner/user satellites with such non-kinetic weapons might result in potentially unquantifiable harm to states other than the aggressor, as well as to other non-state entities. Cyber operations raise particular concerns because attacks on one system may have repercussions for various other systems and cause indiscriminate effects due to the interconnected nature of cyberspace.[160] With each example, affected third-party interests will weigh heavily on determinations of whether ASAT weapon use is disproportionate under the *jus ad bellum*.

Not all potential targets will be multiple owner/user or dual use satellites, however, or will obviously implicate third-party interests. Non-kinetic physical ASAT weapons might be used to target a military satellite wholly owned and operated by an aggressor state, or a commercial satellite that constitutes a military objective for the purposes of IHL[161] and also passes the *jus ad bellum* targeting rules discussed in Section 4.2. The aim might be to blind satellite sensors, cause components to overheat, damage electronics, or compromise data. Where the use of such weapons will not cause space debris, these types of satellites might appear to be obvious and potentially, legally, risk-free targets for defensive military operations. In certain cases that may be true, provided the effects of the targeting are contained and there are no excessive negative impacts on other states. Yet, such actions, because of their scale and effects, might nevertheless comprise a use of force, requiring a justification of self-defence, and may still prove problematic for *jus ad bellum* proportionality compliance. This is most likely where the satellite is targeted in self-defence in response to an armed attack on Earth.

For this author, *jus ad bellum* proportionality does not obviously restrict a defensive response to its immediate locality, meaning that there must be a geographical nexus between an armed attack and acts of self-defence.[162] Accordingly, defensively targeting a satellite in space in response to an armed attack on Earth should not be regarded as precluded by *jus ad bellum* proportionality simply because of the geographical distance between those acts. Instead, *jus ad bellum* necessity governs this scenario by requiring that the satellite targeted is connected to the armed attack on Earth. If this connection is established, as discussed in Section 4.2, there is a *prima facie* defensive necessity to such action. Yet, targeting a satellite in response to a terrestrial armed attack nevertheless risks being characterized as disproportionate under the *jus ad bellum*. This is not because of geography or distance, however. Self-defence of this kind will be regarded as *jus ad bellum* disproportionate if using an ASAT weapon against a satellite in response to an armed attack on Earth is regarded as a significant escalation of hostilities.[163]

If defensive acts create space debris, they should always be regarded as an unwarranted escalation of hostilities because of the potential and unquantifiable harm to third parties discussed above in this section. Where non-kinetic physical ASAT weapons are used, arguably there is also a risk that taking the defensive responsive away from the Earth-based armed attack to space is unduly escalatory. A defensive response in space transports the conflict to a new domain of warfare and, given its peculiar physical characteristics, the rights and interests of other states are more likely to be negatively affected as a result. As NATO rightly cautions, 'any conflict that extends into space has the potential to affect all users of space'.[164] The ensuing threats to third

[160]International Committee of the Red Cross, 'International Humanitarian Law and Cyber Operations During Armed Conflicts', 28 November 2019, at 2, 5, 6, 7. This concern is raised in the context of applying IHL to cyber operations, but it pertains generally to cyber operations against dual use and multiple user satellites.

[161]See note 87 and accompanying text, *supra*.

[162]Some commentators argue that proportionality imposes a clear geographical limitation on self-defence in this manner. This author disagrees. See O'Meara, *supra* note 78, 132–7. See further Woomera Manual, *supra* note 51, Rule 26, para. 9.

[163]See Ruys, *supra* note 75, 123; see Gardam, *supra* note 75, 171.

[164]See NATO, *supra* note 3, para. 5b.

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party interests and to international peace and security are thereby multiplied. Furthermore, a military response in space risks a further riposte by the aggressor in that domain. Therefore, a reciprocal escalation of the conflict arising from an armed attack on Earth exposes states to the prospect of wars in space that they fear so much.[165] *Jus ad bellum* proportionality directly addresses this danger of significant escalation that might take conflict on Earth to conflict in space. *Jus ad bellum* proportionality requires states to consider this macro picture and to limit defensive action accordingly.

Given the nature of the space environment and the potential negative effects of targeting a satellite using any form of ASAT weapon, it seems sensible to conclude that, where self-defence can be effectively achieved by striking a military target on Earth that has a nexus with the armed attack rather than targeting a satellite in space, the general requirement that flows from *jus ad bellum* proportionality must be that the former target be preferred over the latter. That terrestrial targets are generally preferred would also naturally apply in response to armed attacks in space.[166] It might be possible, for example, for a satellite to be neutralized by a strike against a ground-based control node in a remote area, rather than risking targeting the satellite directly. If so, this option must be taken.[167] Compliance with this general approach to targeting Earth-based objects avoids the risk of significant escalation and the threat to third parties and to international peace and security that *jus ad bellum* proportionality seeks to avoid.

In summary, for states seeking to abide by the tenets of *jus ad bellum* proportionality, targeting satellites with any form of ASAT weapon must be approached with extreme caution. Clearly, alternatives to ASAT weapons that cause physical damage and destruction should generally be preferred to avoid the problems of space debris and impinging unduly on third party interests. Weapons that only temporarily destabilize or render dysfunctional satellites, or electronic jamming or spoofing devices that are limited to interfering with or falsifying the transmission of signals to and from satellites, are most likely to comply with *jus ad bellum* proportionality. The same is true for targeted and limited cyberattacks on satellite-related computer networks. In each case, compliance depends on whether such 'soft kill'[168] techniques can be used in a way that causes no, or only minimal, damage to non-aggressor states and to the interests of other third parties. States, like the USA, appear broadly to agree with this approach to minimizing civilian collateral harm and the effects of military action on space activities, albeit not expressed explicitly in *jus ad bellum* terms. American policy to negate enemy space capabilities is incremental, going in ascending order in the methods it adopts, from deception and denial to degradation and ending at destruction of space assets.[169] Of course, methods at the lower end of the spectrum of military activity might not constitute a use of force at all, because the scale and effects of their use do not cross that threshold of violence. If so, these operations do not require justification by reference to the *jus ad bellum*, albeit that their use might implicate the laws of state responsibility and/or other bodies of international law.[170]

6. Conclusion

Space is the 'province of all mankind'.[171] 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

[165]See notes 9–15 and accompanying text, *supra*.

[166]See Tronchetti, *supra* note 37, 356, making a similar argument.

[167]Schmitt makes this point in respect of target selection and IHL precautions in attack requirements, but such conclusion arguably also applies to the requirements of *jus ad bellum* proportionality. See Schmitt, *supra* note 22, 121.

[168]A term adopted by Schmitt discussing IHL precautions in attack requirements, but equally applicable here. Schmitt, *supra* note 22, 119. See also J. V. Berge and H. S. Hiim, 'Killing them Softly: China's Counterspace Developments and Force Posture in Space', (2024) *Journal of Strategic Studies* 1.

[169]See Schmitt, *supra* note 22, 119. See also discussion of China's preference for 'soft kill' counterspace capabilities in Berge and Hiim, ibid.

[170]See notes 71 and 116 and accompanying text, *supra*.

[171]See OST, *supra* note 34, Art. I.

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from excessive use of military activities. Impingements on this freedom must be strictly controlled. Absent specific regulation of military activities in space, including a multilateral weapons control treaty pertaining to ASAT weapons, the *jus ad bellum*, alongside IHL, must be viewed as an essential part of the current international law framework limiting the use of ASAT weapons. Although states continue to develop new counterspace weapons and space is an ever-contested military domain, adherence to the requirements of *jus ad bellum* necessity and proportionality has the potential to limit ASAT use. A clearer understanding of these *jus ad bellum* requirements 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, *jus ad bellum* compliance means that ASAT weapon use in defensive military operations is heavily restricted, and it may even be denied in all but the most extreme circumstances of self-defence. Instead, targets of self-defence should generally be confined to Earth. Where satellites are targeted, in addition to IHL targeting limitations, the *jus ad bellum* requires that the methods employed to neutralize satellites be strictly controlled to minimize harm to civilians and to third party interests and to avoid conflict and the escalation of conflict in space. Adherence to the *jus ad bellum* requirements of necessity and proportionality underpins international peace and security and state aspirations of safeguarding space for peaceful purposes and ensuring its valuable resources continue to benefit all mankind.

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