Journal of Aerospace & Security Studies
2023 | Volume II | pp. 20-47

Testing ASATs: A Critical Appraisal

Sameer Ali Khan

Abstract

Human dependence on outer space for civilian and military purposes has increased remarkably. With advancements in developments related to outer space, the threats to space operations have also increased. States are investing in offensive and defensive counter-space capabilities to establish space superiority or to prevent their adversaries from establishing the same. One of the most notable threats is the possession of anti-satellite (ASAT) weapons by the United States (US), Russia, China and India. These weapons rely on kinetic and non-kinetic means to neutralise a satellite's functions. This paper reviews existing literature to categorise kinetic and non-kinetic ASAT weapons and demonstrations of ASAT capabilities to establish possessors and non-possessors of ASAT weapons. Following that, the paper reviews varying degrees of applicability of treaty law and customary international law on the testing and employment of kinetic and non-kinetic ASAT weapons. The paper then reviews the recent developments pertaining to the ban on direct-ascent ASATs and assesses how that could potentially shift the focus from further development and testing of kinetic ASATs toward non-kinetic means.

Subsequently, it argues that as the states ban destructive ASATs and address safety considerations by reducing the potential for debris generation, they should not lose sight of the broader issue of space security for all nations which are inextricably linked with both the kinetic and non-kinetic counter-space capabilities.

Keywords: ASAT Ban, Counter-Space Capabilities, Destructive ASATs, Kinetic ASATs, Non-Kinetic ASATs, LOAC, Space Debris.

Introduction

Since the launch of Sputnik-I, the first satellite, outer space has assumed immense importance. The initial space race essentially involved only the two Cold War antagonists – the US and the former Union of Soviet Socialist Republics (USSR). Even their formative goals were to gain critical information on the other side's nuclear forces and the ability to detect and monitor the launch of nuclear-capable missiles and denied territories. Over the next few decades, space programmes evolved to incorporate earth imagery through satellites for Intelligence Surveillance, Reconnaissance (ISR), early warning, communication, navigation, and even nuclear command and control. With time, commercial and civilian uses of outer space were also explored. However, realising the advantages that space-based assets could afford on either side, the then-leading space-faring nations (the US and the former USSR) started looking at offensive and defensive counter-space options right from the beginning. Just a year after launching its first satellite in 1958, the US demonstrated its ability to destroy a satellite in 1959.[1]

While the civilian utilities of outer space are inevitably linked with commercialisation and cooperation, the military dimensions are aimed at securing an advantageous position and denying the same to the adversary.[2] Until the end of the Cold War, the US space industry was distinctly spread over military, intelligence, civilian and commercial space.[3] However, today, most countries, e.g. the US, Russia, India, China and Japan etc., have commingled space programmes, with military operations increasingly dependent on civilian or dual-use satellites. A clear contemporary global trend is

---

1 Aerospace Security "Counterspace Timeline, 1959 - 2021," March 31, 2021, https://aerospace.csis.org/counterspace-timeline/.

2 United States Space Force, *Space Capstone Publication Spacepower: Doctrine for Space Forces* (Michigan: Nimble Books LLC, 2020).

3 Joan Johnson-Freese, *Space as a Strategic Asset* (New York: Columbia University Press, 2007), 28.

that of unprecedented integration of civilian and military space programmes and assets.[4] But countries' potential employment of counter-space options creates unique challenges depending upon what counter-space means are employed.

This paper seeks to study the more generic term, 'ASATs' (for Anti Satellite Weapons) and its various types to examine their respective impact on the safety and sustainability of space operations. It then segregates the two into kinetic and non-kinetic categories. After briefly touching upon the states that have demonstrated ASAT weapons, it explores the potential for the employment of non-kinetic means to achieve military objectives. Building upon this debate, the paper examines the international law applicable to the testing and employment of such weapon systems. Based on these findings, the paper proposes a way forward for states that do not possess counter-space capabilities and are wary of how such capabilities could affect their peaceful endeavours of exploiting the space before concluding.

Counter-Space Capabilities

With an ever-increasing reliance on space-based assets for national security, states are developing their counter-space capabilities to deny adversaries an advantage. Counter-space capabilities are also known as space control capabilities which essentially allow a state to gain space superiority - the ability to use space for one`s advantage while denying the same to an adversary.[5] These capabilities have both offensive and defensive elements where the former seeks to deny the adversary an advantage in space and the latter seeks to protect one's space-based assets against such

[4] Johnson-Freese, *Space as a Strategic Asset*, 28.

[5] Małgorzata Polkowska, "Global Space Security and Counter-Space Capabilities: The Legal and Political Challenges," *Adam Mickiewicz University Law Review* 9 (2019): 101–20, https://pressto.amu.edu.pl/index.php/ppuam/article/view/21652/20786.

attempts by the adversary. A detailed CSIS study covers the various aspects of defensive counter-space capabilities.[6] However, this paper is restricted in its scope to study only offensive counter-space capabilities.

ASAT weapons are categorised under offensive counter-space capabilities. CSIS' Space Threat Assessment 2023 categorises such capabilities under four distinct categories, i.e., 1) Kinetic Physical, 2) Non-kinetic Physical, 3) Electronic, and 4) Cyber. There is merit in such a classification, and it enables studying each category concerning the potential for collateral damage, attribution, reversibility, barriers to entry, etc.[7] However, for this paper, these capabilities are divided into two broad yet distinct categories of kinetic and non-kinetic capabilities. This categorisation allows for studying these two types based on their potential for generating orbital debris[8] which can affect the civilian and military operations of states which are non-party to the conflict that eventually leads to the employment of these capabilities.

---

6 Todd Harrison, Kaitlyn Johnson and Makena Young, *Defense Against the Dark Arts in Space*, report (Washington, D.C.: Center for Strategic and International Studies, February, 2021), https://csis-website-prod.s3.amazonaws.com/s3fs-public/publication/210225_Harrison_Defense_Space.pdf?VersionId=wAqLQjDIzXK84wzzWPNbU1WRYs5dnFfU.

7 Todd Harrison, Kaitlyn Johnson, Makena Young, Nicholas Wood and Alyssa Goessler, *Space Threat Assessment 2022*, report (Washington, D.C.: CSIS Aerospace Security Project, April, 2022), https://aerospace.csis.org/wp-content/uploads/2022/05/Harrison_SpaceThreatAssessment2022_WEB_v3-compressed.pdf.

8 National Aeronautics and Space Administration, "Space Debris and Human Spacecraft," May 26, 2021, https://www.nasa.gov/mission_pages/station/news/orbital_debris.html.

Kinetic ASATs

Among all the counter-space capabilities, kinetic ASATs are the oldest with the first one being tested in 1959 by the US.[9] These kinetic weapons are further divided into three sub-categories which include direct-ascent ASAT weapons, co-orbital space weapons, and ground station attacks.[10]

The direct-ascent ASAT weapons are missiles that either directly strike the target satellite or use a proximity explosion. Unlike direct-ascent ASATs, co-orbital space weapons are first placed into an orbit and later maneuvered to strike their target – these maneuverers are also known as Rendezvous and Proximity Operations (RPOs). With their potential for removal of defunct satellites and debris, and against non-friendly satellites RPOs are gaining greater significance. Ground station attacks, on the other hand, are military attacks on the earth-based infrastructure responsible for command, control, and communication with satellites.

While ground station attacks are difficult to anticipate in times of peace and do not ostensibly present the possibility of debris creation, generally such a facility is responsible for multiple satellites, and with a lack of control from the ground, the satellites could themselves become debris and pose a risk of collision with other satellites. The prospects of debris generation in the case of direct-ascent ASATs are most pronounced. States having a Ballistic Missile Defence (BMD) programme can use this capability to target satellites as has been demonstrated by the US in 2008.[11] Likewise,

---

9 Aerospace Security "Counterspace Timeline, 1959 - 2021," March 31, 2021, https://aerospace.csis.org/counterspace-timeline/.

10 Harrison, Johnson, Young, Wood and Goessler, *Space Threat Assessment 2022*.

11 Laura Grego, *The Anti- Satellite Capability of the Phased Adaptive Approach Missile Defense System*, report (Washington, D.C.:

Indian ASAT test of 2019 involved use of India's BMD interceptor.[12] Apart from their debris-creation potential, it is relatively easier to assess possession of this capability by various states and to attribute such actions to a particular state. Moreover, the consequences or damage caused by kinetic ASATs is irreversible. Additionally, use of such kinetic means can potentially endanger employing country's own space-based assets, which should be a restraining factor. But in case of testing and employment of co-orbital space weapons, generation of debris will depend upon the techniques used.

As of 22 December 2022, European Space Agency estimated that a total of 36500 space debris objects greater than 10 cm, 10,00,000 from greater than 1 cm to 10 cm, and 130 million from greater than 1 mm to 1 cm.[13] Under the worst-case scenario, known as Kessler's Syndrome,[14] space debris could eventually make safe space operations impossible. While experts disagree over the likelihood of such an eventuality, it remains a possibility given the proliferation of counter-space capabilities and the increase in the number of actors engaging in outer space activities.

Federation of American Scientists, 2011), https://pubs.fas.org/pir/2011winter/2011Winter-Anti-Satellite.pdf.

12 Shaan Shaikh, "India Conducts Successful ASAT Test," Missile Threat, Center for Strategic and International Studies, March 28, 2019, last modified May 28, 2019, https://missilethreat.csis.org/india-conducts-successful-asat-test/.

13 European Space Agency, "Space Debris by the Numbers," December 22, 2022, https://www.esa.int/Space_Safety/Space_Debris/Space_debris_by_the_numbers.

14 Kessler Syndrome refers to a situation where debris created from one collision can set off a chain of events creating more debris while outpacing the natural course of debris decay.

Non-Kinetic ASATs

Non-kinetic ASATs include non-kinetic physical, electronic, and cyber counter-space capabilities. Non-kinetic physical counter-space capabilities could include the use of lasers, High-Powered Microwave (HPM), and detonation of nuclear weapons in space to generate an Electromagnetic Pulse (EMP) in the space to damage the on-board circuitry of the satellites.[15]

Both, the lasers and HPM, can be deployed on land, air, sea, and space. Lasers are intense beams of light that are concentrated on a target to achieve desired results of either permanent damage or rendering the target temporarily non-functional. While high-powered lasers can irreversibly damage a satellite, low-powered beams can be used to temporarily blind the onboard sensors.[16] HPM-based counter-space capabilities, on the other hand, rely on microwaves to damage a satellite's electronics, and data stored on-board, or cause the processors to restart. An HPM weapon can cause irreversible damage to satellites. In the case of lasers, the point of origin can be ascertained with a degree of reliability and attribution can be made but the HPM weapons can be employed from different angles and even nearby satellites, thereby making the issue of attribution problematic.[17] Because of the irreversible nature of damage, lasers and HPMs are otherwise categorised as physical non-kinetic counter-space capabilities and consequences of their use can closely resemble those of kinetic ASATs. Several states, including the US, Russia, India, China, Israel and France etc,

---

15 Harrison, Johnson, Young, Wood and Goessler*, Space Threat Assessment 2022*.

16 Federation of American Scientists Space Policy Project, *Threats to United States Space Capabilities,* prepared for the Commission to Assess United States National Security Space Management and Organization, (Tom Wilson Space Commission Staff Member, 2001), https://spp.fas.org/eprint/article05.html#ft74.s.

17 Harrison, Johnson, Young, Wood and Goessler, *Space Threat Assessment 2022*.

are pursuing DEWs for different military purposes including missile defence. As these technologies mature, there is higher likelihood of these systems assuming a greater counter-space role. However, their likelihood of use will ostensibly be lesser than other non-kinetic means owing to higher costs in terms of physical damage, attribution and potential for debris generation.

The generation of EMP in outer space through nuclear detonation is the crudest counter-space capability available to all the nuclear weapon possessor states. However, this is also the riskiest approach since all the satellites in the particular region will be affected without discrimination – creating unprecedented risks of collisions and debris generation. Besides discrimination, it will also defy the other two principles of proportionality and military necessity under the Law of Armed Conflict (LOAC). Also, testing of nuclear weapons in outer space is banned under the 1963 Partial Test Ban Treaty (PTBT) to which all the nuclear weapon possessor states – except China and North Korea – are a party.[18] Given this situation, the likelihood of such an employment remains low even if it cannot be ruled out completely. Such a use is also unlikely to bode well with the broader nuclear non-proliferation regime where none of the nuclear weapon states – except North Korea – has tested their weapons since 1998 – establishing a taboo against nuclear testing.[19]

Unlike the above-mentioned non-kinetic counter-space capabilities, electronic ASAT weapons target the satellite's communication system by generating 'noise' in the same Radio Frequency (RF)

[18] United Nations, "Treaty Banning Nuclear Weapon Tests in the Atmosphere, In Outer Space and Under Water," August 5, 1963, https://treaties.un.org/doc/Publication/UNTS/Volume%20480/volume-480-I-6964-English.pdf.

[19] Daryl G. Kimball, "Preserving the Nuclear Testing Taboo," *Arms Control Association*, September 2021, https://www.armscontrol.org/act/2021-09/focus/preserving-nuclear-testing-taboo.

band. Such a weapon that interferes with the communication signals sent to the satellite are called uplink jammers while those targeting the data sent from the satellite to the ground are called downlink jammers.[20] These RFs could also be used to transmit false signals to either the satellite or the ground station. Such attacks are reversible and do not directly pose the threat of debris creation unless it results in loss of control. Moreover, the electronic counter-space means are difficult to attribute yet easier to acquire for state and non-state actors alike.

While other non-kinetic counter-space capabilities either rely on blinding/damaging the sensors or disrupting communications, cyber-attacks target the data itself and the various associated systems that use, transmit and control the flow of data.[21] Such attacks can be used to not only monitor and intercept data traffic but also to insert false data. They also find the widest range of targets including the satellite, ground stations, and end-user equipment. In some cases, the damage can be permanent if the attacker can seize control of the satellite. It is believed that this capability presents a lower barrier to entry given low resource requirements but requires a greater understanding of the functioning of the satellite and its operator.[22]

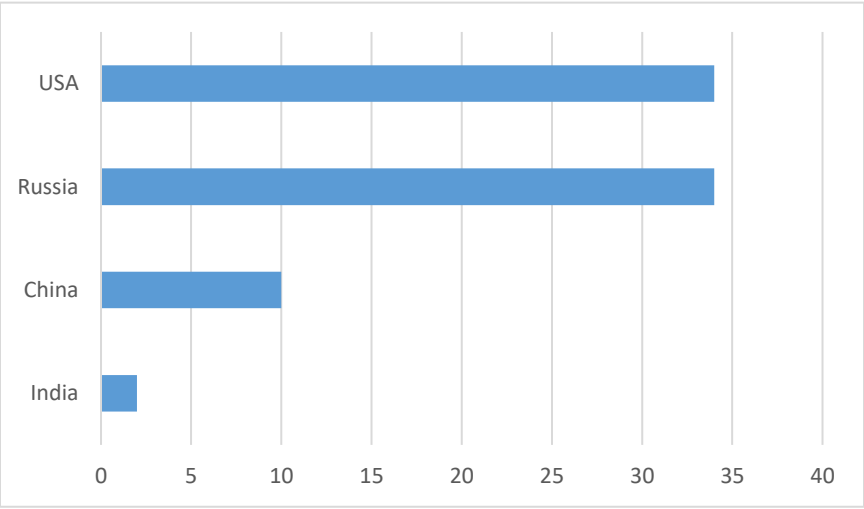
Overview of Entities with Counter-Space Capabilities

Four states – US, Russia, China, and India – have demonstrated ASAT capabilities against their satellites in the orbits. Secure World Foundation's database tracking the history of anti-satellite tests in space has recorded a total of 80 ASAT tests, including direct ascent ASATs and co-orbital, to have been conducted by these four

[20] Harrison, Johnson, Young, Wood and Goessler, *Space Threat Assessment 2022*.
[21] Ibid.
[22] Ibid.

states.[23] Both the US and Russia have tested these weapons 34 times each, while China and India have conducted ten and two such tests, respectively (see Figure 1).

Figure 1: ASAT Tests by Country



Source: Weeden, "History of ASAT Tests in Space."

The Secure World Foundation has separately catalogued the history of Robotic RPOs which are not necessarily military tests but could be seen as demonstrative of such a capability.[24] Under the category of military/intelligence RPOs, the list notes 30 such demonstrations

[23] Brian Weeden, "History of ASAT Tests in Space," *Space-Track.org*, February 8, 2022, https://docs.google.com/spreadsheets/d/1e5GtZEzdo6xk41i2_ei3c8jRZDjvP4Xwz3BVsUHwi48/edit#gid=1252618705.

[24] Kaila Pfrang, "History of Robotic Rendezvous and Proximity Operations in Space," *Space-Track.org*, May 14, 2022, https://docs.google.com/spreadsheets/d/1pHzvC-zGjF34Jrd6TdmM4odTL_MinBBoS_ld9X3jsW4/edit#gid=1782604784.

by Russia (10), the US (14), and China (6).[25] With the availability of Space Situational Awareness (SSA), such demonstrations can be monitored and attributed. In 2017, France accused Russian satellite, Luch, of espionage on a French-Italian military satellite. Previously, the same Russian satellite had performed RPOs on Intelsat's satellites, a US commercial communication company.[26] However, Russia is not alone in conducting RPOs and instances of such manoeuvres by the US and China have also been reported.[27]

While testing of laser and HPM counter-space capabilities could still be detected, albeit with difficulty, the use and testing of electronic and cyber counter-space capabilities are extremely difficult to ascertain. And hence, there are no such existing databases. However, it can still be argued that all advanced militaries could work in this direction and there will be little visibility. Electronic jamming means are widely accessible to all militaries and the cyber domain presents fairly low barriers to entry. Especially electronic jamming devices are commercially available even though these devices violate the International Telecommunication Union (ITU) convention.[28] Such devices can disrupt the onboard communication receivers of aircraft, cause degradation or total loss of communication for passenger, cargo, and humanitarian flights etc. In some cases, they can even cause

---

25 Pfrang, "History of Robotic Rendezvous and Proximity Operations."

26 Kaitlyn Johnson, *Key Governance Issues in Space: Rendezvous and Proximity Operations*, report (Washington, D.C.: Center for Strategic and International Studies, 2020), https://www.jstor.org/stable/resrep26047.7.

27 Colin Clark, "US, China, Russia Test New Space War Tactics: Sats Buzzing, Spoofing, Spying," *Breaking Defense*, October 28, 2021, https://breakingdefense.com/2021/10/us-china-russia-test-new-space-war-tactics-sats-buzzing-spoofing-spying/.

28 Brian Weeden, *Radio Frequency Spectrum, Interference and Satellites Fact Sheet*, report (Washington, D.C.: Secure World Foundation, June 25, 2013), https://swfound.org/media/108538/swf_rfi_fact_sheet_2013.pdf.

radio navigation satellite services receivers to provide incorrect information to pilots and present a major safety risk.

Recently, there have been instances of Russia jamming satellite signals in the ongoing Ukraine war. After similar electronic warfare operations in its 2014 invasion of Crimea, Russia started employing similar means in 2019.[29] Russia intensified these operations through the next years[30] and in the run-up to Russia's 2022 invasion of Ukraine, the Organization for Security and Cooperation in Europe (OSCE) reported a sharp increase in jamming in 2021. OSCE's Uncrewed Aerial Vehicles (UAVs) experienced signal interference on 16 percent of flights in February, 28 percent in March, and 58 percent in April of 2021.[31] Russian employment of electronic warfare in the Ukraine war has so far resulted in a loss of ninety percent of Ukrainian drones.[32] This could be the reason behind ITU issuing a warning against use of such jamming devices, noting a sharp increase in their use.[33]

In the aftermath of Russia denying internet services in Ukraine, Starlink – a commercial internet service provider using a

---

29 Michael Sheldon, "Russian GPS-Jamming Systems Return to Ukraine," *Digital Forensic Research Lab*, May 23, 2019, https://medium.com/dfrlab/russian-gps-jamming-systems-return-to-ukraine-8c4ff7d8dcb8.

30 Dana Goward, "Russia Ramps up GPS Jamming along with Troops at Ukraine Border," *GPS World*, April 21, 2021, https://www.gpsworld.com/russia-ramps-up-gps-jamming-along-with-troops-at-ukraine-border/.

31 David Axe, "Russia's Electronic-Warfare Troops Knocked Out 90 Percent of Ukraine's Drones," *Forbes*, December 24, 2022, https://www.forbes.com/sites/davidaxe/2022/12/24/russia-electronic-warfare-troops-knocked-out-90-percent-of-ukraines-drones/.

32 Ibid.

33 ITU News, "ITU Issues Warning on Interference with Radio Navigation Satellite Service," *UN Specialized Agency for ICTs,* August 23, 2022, https://www.itu.int/hub/2022/08/warning-harmful-interference-rnss/.

constellation of satellites in the LEO – filled in the void by shipping its receivers into the conflict zones. While Starlink's provision of services was seen as an altruistic measure, the US government and other European states were paying for most of the financial costs and the company warned of its inability to provide services in case the US government did not increase its financial contribution.[34] The deployment of Starlink receivers was supposedly meant for use by Ukrainian people, hospitals and schools. However, its greater adoption by the Ukrainian military force to aid their offensive drone operations soon caused the company to restrict its services. The company had to clarify that its services were 'never never meant to be weaponised.'[35] Such involvement of commercial entities in conflict zones risks making them a party to the conflict once their services are utilised for offensive military operations rather than in aid of humanitarian purposes.

Another dimension of commercial space entities operations was witnessed in case of protests in Iran. Once the Iranian government imposed internet restrictions to curb the protests – in response to the death of a girl in Iranian custody – Starlink got involved on the pretext of protecting the right to protest and freedom of expression. However, in this case it suffered serious limitations. Even as the Starlink receivers were smuggled into Iran, there were no ground stations in Iran and the communications had to rely on nearby

[34] Alex Marquardt, "Exclusive: Musk's SpaceX says It Can No Longer Pay for Critical Satellite Services in Ukraine, asks Pentagon to Pick Up the Tab," *CNN*, October 14, 2022, https://edition.cnn.com/2022/10/13/politics/elon-musk-spacex-starlink-ukraine/index.html.

[35] Joey Roulette, "SpaceX Curbed Ukraine's Use of Starlink Internet for Drones - Company President," *Reuters*, February 9, 2023, https://www.reuters.com/business/aerospace-defense/spacex-curbed-ukraines-use-starlink-internet-drones-company-president-2023-02-09/.

ground stations in Turkey, Iraq or Azerbaijan.[36] While the outcomes of Starlink's provisions of services in the desired direction remained limited, the development was used by hackers to spread malware on Iranian devices.[37] Such activism by commercial entities also raises an important issue of selective approach. While the company has been active in areas of Western concerns, similar approach seems to have been absent in other conflict areas like Indian Illegally Occupied Jammu and Kashmir (IIOJ&K) where the residents were subject to Indian government's unprecedented internet blackout for 552 days[38] but neither the commercial nor the government entities took such drastic measures to aid restoration of communication services in the disputed region.

While the Russian employment of electronic counter-space capabilities has gained prominence because of employment in the Ukraine war, the US, China, and India are also known to possess similar capabilities. The Secure World Foundation's report on 'Global Counter-space Capabilities' has identified Australia, France, Iran, Japan, North Korea, South Korea, and the United Kingdom (UK) as seven new actors with emerging counter-space capabilities or

[36] Emma Woollacott, "Starlink Terminals Smuggled Into Iran - But How Effective Can They Be?," *Forbes*, October 25, 2022, https://www.forbes.com/sites/emmawoollacott/2022/10/25/starlink-terminals-smuggled-into-iranbut-how-effective-can-they-be/?sh=329d355d1027.

[37] Maziar Motamedi, "Why Elon Musk's Starlink will not Affect Protests in Iran," *Al Jazeera*, September 26, 2022, https://www.aljazeera.com/news/2022/9/26/why-elon-musks-starlink-wont-impact-protests-in-iran.

[38] Surf Shark, "4.2 billion People Experienced Internet Censorship in 2022," *Surf Shark*, January 17, 2023, https://surfshark.com/blog/internet-censorship-2022.

programmes.[39] Of these, only Iran and North Korea are seen as hostile actors by the US and its allies.

Unlike kinetic counter-space capabilities, the use of non-kinetic counter-space capabilities is not only difficult to attribute but their possession by other states can also not be ascertained. Electronic and cyber counter-space capabilities are especially noteworthy in this regard owing to their wider availability, lower barriers to entry, and difficulty in detection and attribution. Space operations' increasing dependence on digital technologies and the use of computer networks introduces new vulnerabilities and cybersecurity threats. Orbital hacking, compromising the security of a space system through cyber means, is an exacerbating concern for space actors. In case of non-kinetic counter-space capabilities, attribution becomes a particularly worrisome issue. In the absence of clear evidence, attribution of a cyber or electronic attack to a particular actor can be complex. This highlights the need for enhanced cooperation and information-sharing between space actors to improve situational awareness and mitigation of risks posed by these capabilities.

However, the focus on banning the testing of ASATs remains restricted to kinetic counter-space capabilities. This is essentially because such a capability is easier to demonstrate and is closely linked with the issue of debris generation in outer space which is gaining wider attention – due to the growing commercial and economic relevance of outer space. Moreover, the issue of kinetic ASAT testing is also linked with the wider applicability of the LOAC and the various environmental protection laws which are now gaining prominence.

---

[39] Brian Weeden and Victoria Samson, *Global Counterspace Capabilities: An Open Source Assessment,* report (Washington, D.C.: Secure World Foundation, 2022), https://swfound.org/media/207350/swf_global_counterspace_capabilities_2022_rev2.pdf.

Legality of ASATs in International Law

Most recent destructive ASAT tests by India and Russia have resulted in greater attention to the issue. India demonstrated its DA-ASAT capability in 2019 when it used a variant of its BMD interceptor, Prithvi Defence Vehicle (PDV), to destroy one of its own satellites in the LEO. Russia also tested a DA-ASAT in 2021 which resulted in significant debris creation and received wider condemnation. The driving force behind this attention appears to be the destructive and debris-creating nature of these tests. Primarily, the argument revolves around the understanding that such testing would negatively affect the sustainability of the outer space environment for peaceful purposes by making accidents in space more likely and raising the costs for space operations. In the absence of any international law explicitly banning the testing and employment of ASATs, a new treaty is considered to be the way forward.[40]

The existing space treaties do not cover the aspect of ASAT weapons and the early negotiations between the US and former USSR hit roadblocks when it came to defining ASATs, inclusion or exclusion of US space shuttles, verification of compliance and membership for such a treaty. In the absence of treaty law on the issue, it is important to consider how such actions are governed under Customary International Law (CIL) – which consists of rules that come from a general practice accepted as law and exist independent of treaty law.[41] More importantly, CIL applies to all states, unlike the treaty law that only applies to member states – the only exemption from CIL is available to states that persistently

[40] Bruce McClintock, "U.S. Decision on ASAT Testing a Positive Step Towards Space Sustainability," *RAND Corporation*, April 21, 2022, https://www.rand.org/blog/2022/04/united-states-decision-on-asat-testing-a-positive-step.html.

[41] International Committee of the Red Cross, "Customary International Humanitarian Law," October 29, 2010, https://www.icrc.org/en/war-and-law/treaties-customary-law/customary-law.

object to the newly arising norm. Professor David A. Koplow has an interesting take on the subject. In his seminal work, Koplow asserts that existing LOAC applies in the case of employment of destructive ASATs.[42] This is primarily because of three underlying reasons:

1. **Discrimination**. Under the LOAC, any use of military force has to be able to discriminate between legitimate military targets and non-combatants. While kinetic ASATs are highly capable of discriminating but their indirect or second-order effects do not retain this characteristic and resultant debris could affect civilian satellites. Moreover, satellites are becoming increasingly dual-use and cannot always be neatly distinguished.
2. **Proportionality**. Under the principle of proportionality, the attacker must consider short, medium, and long-term effects on neutral states and even nature. While the perceived value of an ASAT operation could be extremely high, it ought to be seen in relation to the potential for collateral damage – which in the case of kinetic ASATs could be extremely high.
3. **Necessity**. The principle of necessity dictates that an ASAT operation has to be indispensable in securing the prompt submission of the enemy. While a certain state's reliance on space-based assets could be very high, it remains uncertain if the destruction of its space-based assets would prompt it to submit.

These LOAC principles of discrimination, proportionality, and necessity are only applicable to the employment of kinetic ASAT weapons in times of armed conflict and hence do not govern the testing of ASAT weapons. On the issue of testing these weapons,

[42] David A Koplow, "ASAT-Isfaction: Customary International Law and the Regulation of Anti-Satellite Weapons," *Michigan Journal of International Law* 30:1187 Summer (2009), https://scholarship.law.georgetown.edu/cgi/viewcontent.cgi?referer=&httpsredir=1&article=1452&context=facpub.

Koplow asserts that environmental agreements, like the 1972 Stockholm Declaration and 1992 Rio Declaration on Environment and Development, require states to ensure that 'activities within their jurisdiction or control do not cause damage to the environment of other states or areas beyond the limits of national jurisdiction.'[43] This essentially means that states could condemn such destructive tests as illegal and against the spirit of these declarations as they harm the outer space environment and affect humankind's ability to benefit from it. The recent Indian and Russian ASAT tests can be seen as a missed opportunity in this regard as the condemnations fell short of terming these actions illegal under the existing environmental laws.

It is ostensibly this scare around debris creation and sustainability of outer space that drives attention towards banning destructive ASATs rather than addressing the broader issue of space weaponisation.[44] Another associated factor could be the advanced offensive and defensive ballistic missile programmes that various countries around the world have developed. For instance, the US used its SM-3 interceptor missiles deployed on Aegis destroyers for its 2008 ASAT operation. The operation only required 'modification of the system software and could have been done from any of the 5 cruisers or 16 destroyers equipped with the Aegis system.'[45] Notably, the same missile defence capability is operated by Japan, South Korea, Poland and Romania. The US is not the only state to

---

43 Koplow, "ASAT-Isfaction: Customary International Law and the Regulation of Anti-Satellite Weapons."

44 Victoria Samson, "Breaking the Impasse Over Security in Space," *Arms Control Association*, September 2022, accessed January 27, 2023, https://www.armscontrol.org/act/2022-09/features/breaking-impasse-over-security-space#endnote01.

45 Laura Grego, *The Anti- Satellite Capability of the Phased Adaptive Approach Missile Defense System*, report (Washington, D.C.: Federation of American Scientists, 2011), https://pubs.fas.org/pir/2011winter/2011Winter-Anti-Satellite.pdf.

have such a capability, even the Indian DA-ASAT test of 2019 was an offshoot of its BMD programme.

The use of non-kinetic ASATs primarily evades the popular discourse because the capabilities are not known for causing collateral damage except in circumstances where the target satellite also escapes ground control and acts as debris itself. Moreover, non-kinetic capabilities are currently known to be only possessed by developed states (with the possible exception of Iran and North Korea). Even as these countries test, it would be difficult for others to detect and attribute in most cases. Any efforts to bring non-kinetic counter-space capabilities are also going to face the herculean task of ensuring adequate verification mechanisms. Since such capabilities are less likely to cause any collateral damage, are discriminate, and will pass the principles of proportionality and military necessity; their employment is unlikely to be seen as a violation of the LOAC.[46] Similarly, their unlikely impact on the space environment will keep them outside the ambit of international environmental laws. However, these observations will not be valid in case of non-kinetic counter-space capabilities which cause irreversible damage.

[46] Koplow, "ASAT-Isfaction: Customary International Law and the Regulation of Anti-Satellite Weapons."

Table 1: LOAC and Use of Kinetic/ Non-Kinetic ASATs

Principles of LOAC	Discrimination	Proportionality	Necessity
Kinetic	Yes, but indirect or second-order effects.	Likely collateral damage for neutral states and their space-based assets defies proportionality.	Does not guarantee the enemy's submission.
Non-Kinetic	Yes – as long as doesn't result in debris.	As long as there's no collateral damage.	Even if it doesn't result in the enemy's submission, the absence of collateral damage can be used to build a case.

Source: Author's own.

Way Forward

Towards the end of 2020, UK pushed a resolution, 'Reducing Space Threats through Norms, Rules and Principles of Responsible Behaviours,' at the United Nations General Assembly (UNGA). The resolution recognised the challenges associated with effective verification of the space objects vis-a-vis their civilian or military utility and invited member states to inform the relevant bodies about their national space security policies, strategies or doctrines on a voluntary basis.[47] It further encouraged the member states to 'share their ideas on the further development and implementation

[47] United Nations General Assembly, "Reducing Space Threats through Norms, Rules and Principles of Responsible Behaviours," December 16, 2020, https://documents-dds-ny.un.org/doc/UNDOC/GEN/N20/354/39/PDF/N2035439.pdf?OpenElement.

of norms, rules and principles of responsible behaviours and on the reduction of the risks of misunderstanding and miscalculations with respect to outer space.'[48] The resolution was adopted by 164 votes in favour, 12 against (Bolivia, Burundi, China, Comoros, Cuba, DPRK, Iran, Nicaragua, Russia, Syria, Venezuela, and Zimbabwe), and 6 abstentions (Armenia, Belarus, India, Israel, Madagascar, Palau).[49]

The UK-sponsored UNGA resolution on responsible behaviour also stressed that, '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.'[50] However, the Russian destructive ASAT test, in November 2021, may have provided the necessary impetus for the US unilateral moratorium on destructive ASAT testing and the subsequent UNGA resolution. The US Department of Defense condemned the Russian test while calling for an end to debris-creating tests.[51] Only a few months later in April 2022, the US announced a unilateral moratorium on testing destructive ASATs.[52] Other countries, including Australia, Canada, France, Germany, Japan, New Zealand, South Korea, Switzerland,

---

48 United Nations General Assembly, "Reducing Space Threats."

49 United Nations General Assembly, "75th Session, 37th Plenary Meeting," December 7, 2022, https://documents-dds-ny.un.org/doc/UNDOC/GEN/N20/343/94/PDF/N2034394.pdf?OpenElement.

50 Opcit.

51 Marcia Smith, "Space Council Condemns Russian ASAT Test, DOD Calls for End to Debris-Creating Tests," *SpacePolicyonline.Com*, December 1, 2021, https://spacepolicyonline.com/news/russian-asat-test-draws-more-condemnation-from-national-space-council-dod-wants-to-end-debris-creating-tests/.

52 Daryl G. Kimball, "U.S. Commits to ASAT Ban," *Arms Control Association*, May 2022, https://www.armscontrol.org/act/2022-05/news/us-commits-asat-ban.

and the UK have also made similar commitments following the US moratorium.[53]

This approach of banning destructive ASATs is gaining global momentum reflected in the UN General Assembly's adoption of the resolution on 'Destructive Direct-Ascent Anti-Satellite Missile Testing' that received the support of 154 countries while eight countries opposed the resolution and 10 abstained.[54] Pakistan was amongst the countries that abstained from voting and questioned if the initiative added any relevance and value and to what extent it contributed 'meaningfully to the universally shared goal of preventing an arms race and placement of weapons in outer space.'[55] While the resolution is non-binding, it demonstrates the majority's preference for addressing safety-related concerns before moving to the more problematic and polarising issue of security in outer space.

The direction, that international discourse is taking, seems to be in line with RAND Corporation's assessment that safety in outer space is a more immediate concern and should be tackled as such.[56] It is appreciable that the redressal of safety concerns in outer space is

---

53 Rajeswari Pillai Rajagopalan, "Why an ASAT Test Ban is Important," *Observer Research Foundation,* December 20, 2022, https://www.orfonline.org/research/why-an-asat-test-ban-is-important/.

54 United Nations General Assembly, "Approving 21 Drafts, First Committee Asks General Assembly to Halt Destructive Direct-Ascent Anti-Satellite Missile Tests in Outer Space," Seventy-Seventh Session, 27th & 28th Meetings, November 1, 2022, https://press.un.org/en/2022/gadis3703.doc.htm.

55 Ibid.

56 Bruce McClintock, Katie Feistel, Douglas C. Ligor and Kathryn O'Connor, *Responsible Space Behavior for the New Space Era: Preserving the Province of Humanity*, report (California: RAND Corporation, 2021), https://www.rand.org/content/dam/rand/pubs/perspectives/PEA800/PEA887-2/RAND_PEA887-2.pdf.

gaining momentum and could eventually evolve into legally binding instruments of international law to forbid testing of destructive ASATs that degrade the outer space environment and risk sustainability. However, this could also be the first step towards consolidating the 'haves' and 'have-nots' when it comes to the demonstration of a counter-space capability that could consolidate space superiority for the 'haves' at the cost of space (in)security for 'have-nots'. This particular approach is reflected in Indian abstention from voting but also from the analysis suggesting that India should conduct more such tests to develop a triad of ASATs (land, air, and sea-based destructive ASATs) to serve its military objectives in outer space.[57]

It remains unclear if Russia, China, and India would respect this emerging norm even if their national security considerations dictate otherwise. However, it will be difficult for a new entrant to demonstrate such a capability in the future without risking the label of 'illegal actions.' The only other option for such states (that feel threatened by their adversary's perceived space superiority) would be to move in the direction of non-kinetic counter-space capabilities. This could well be the case with states like Australia, France, Germany, Japan, South Korea, and UK joining the US-led moratorium on destructive ASATs even though they are otherwise known to be pursuing non-kinetic counter-space capabilities.[58]

There is a common factor driving these three DA-ASAT capability possessors' opposition or abstention (in case of India) and that is a preference for a legally binding treaty. Russia maintains that its proposal for PPWT and NFPWOS is a more comprehensive approach to dealing with the issue of arms race in outer space and that this particular resolution fails to achieve that. The Russian

---

[57] Kartik Bommakanti, "An A-SAT Test Ban can Wait: India needs to Widen Kinetic A-SAT Capabilities," *Observer Research Foundation*, January 25, 2023, https://www.orfonline.org/expert-speak/an-a-sat-test-ban-can-wait/.

[58] Weeden and Samson, *Global Counterspace Capabilities*.

representative further highlighted that the US had already carried out the necessary ASAT tests and the resolution did not address the issue of production and development of DA-ASATs.[59] An added criticism was based on the fact that this resolution neither prevents states from employment of ASATs, destruction of existing ASAT capabilities and testing of non-kinetic ones.

China also supported the Russian position and emphasised the need for considering a legally binding arrangement to address space security issue in a comprehensive manner.[60] In an editorial, carried by China Military Online, Yang Min argues that the ban is an attempt to prevent other countries from developing similar capabilities and protecting the US satellites against the threat of space debris.[61] Unlike Russia and China, India abstained from voting on the resolution. While it shared its concern over the potential dangers arising from space debris, it highlighted Indian preference for a legally binding instrument to prevent arms race in outer space which it believed was not addressed in the resolution.[62] While Indian officials acknowledge the potential dangers of space debris, certain Indian academics believe that modernisation of the country's counter-space capabilities is essential for ensuring its space security.[63]

Russia rightly identified the critical gap that leaves non-kinetic capabilities unaddressed. But, as has been highlighted earlier, non-kinetic capabilities are difficult to demonstrate and will be ill-suited for states that want to deter their potential adversaries from the use

---

59 United Nations General Assembly, "Approving 21 Drafts, First Committee Asks General Assembly to Halt Destructive Direct-Ascent Anti-Satellite Missile Tests in Outer Space."

60 Ibid.

61 Yang Min, "Why US Bans Direct Ascent Anti-Satellite Missile Test?," *China Military Online*, December 22, 2022, http://eng.chinamil.com.cn/view/2022-12/21/content_10207040.htm

62 Opcit.

63 Bommakanti, "An A-SAT Test Ban can Wait."

of counter-space capabilities. States wary of their adversary's counter-space capabilities are more likely to move in the direction of developing and employing non-kinetic capabilities which are neither seen as violating the LOAC nor as threatening the sustainability of outer space. Under these factors and limited abilities of detection and attribution, such capabilities are more likely to be employed in times of peace and war – thereby increasing the likelihood of warfighting in outer space.

While banning destructive ASATs could be a useful first step, it should not be the last. It should incrementally lead to greater communication, engagement, and transparency to build trust and confidence among the various stakeholders. An environment of trust should then enable progress toward security agreements as safety issues are addressed.

Conclusion

The distinction between kinetic and non-kinetic counter-space capabilities is instructive in the sense that the former, also referred to here as DA-ASATs, is older, easily identifiable and an attributable capability. Because of its pronounced potential for debris generation and risking the sustainability of outer space for peaceful purposes, DA-ASAT capabilities have gained greater public attention. This focus is reflected in the UNGA resolution banning DA-ASAT testing. With the UNGA resolution, albeit non-binding, it appears that the era of destructive ASAT weapons testing may be coming to an end with a greater focus on the risks that they pose to the sustainability of outer space. The instruments of international law are catching up to declare such testing as illegal. Of the four possessors of destructive ASAT capabilities, only the US has committed to banning these. Even though the US commitment is shared by nine more like-minded states (Australia, Canada, France, Germany, Japan, New Zealand, South Korea, Switzerland, and the UK), the three other possessors (Russia, China, and India) have not indicated such intentions. Nonetheless, if these holdouts

do not resume testing of destructive ASATs, the norm of non-testing is likely to consolidate. Eventually, there could be a treaty law with verification and implementing mechanisms to outlaw the testing of destructive ASATS.

However, as DA-ASATs are banned, the next issues to be addressed are those of space security and weaponisation since DA-ASATs are not the only threat to sustainable space operations. Banning DA-ASAT weapons only addresses a singular aspect of space security. As has been discussed, even in case of employment of non-kinetic counter-space capabilities like lasers and HPMs, there are risks of debris creation in case of irreversible damage or permanent loss of control over a satellite. Failing to comprehensively address the issue of space security would only exacerbate security dilemmas for various states.

The motivations to gain space superiority, or deny an adversary the same, would push states in the direction of non-kinetic counter-space options as demonstration of DA-ASAT capability becomes difficult in the wake of emerging opposition to such tests. While, in most cases, such options reduce the potential for collateral damage and debris creation, they carry an inherent lack of transparency. Moreover, limitations with detection and attribution make such weapons more likely to be used. Unlike destructive ASATs, their employment in conflicts is also unlikely to be hindered by the LOAC.

As the world moves to ban certain categories of weapons (destructive ASATs in this case), it should not increase motivations for states to develop other categories of weapons (non-kinetic ASATs). Unless the issues of space security and weaponisation are addressed satisfactorily, the situation could result in the perpetual establishment of ASAT haves and have-nots. Such an approach has failed in case of the nuclear non-proliferation regime where states have developed their own nuclear weapons capabilities to serve their national security interests irrespective of the established non-

proliferation norms. If history is any guide, replication of such an approach in the domain of outer space is unlikely to serve collective security concerns when it comes to outer space.

Sameer Ali Khan has served as Assistant Director (Research) at the Arms Control and Disarmament Affairs (ACDA) Branch of Pakistan's Strategic Plans Division (SPD). Mr Khan was also Visiting Research Fellow at several institutions, including the South Asia Center of the Atlantic Council in Washington, D.C.; the James Martin Center for Nonproliferation Studies (CNS) in Monterrey; and the Cooperative Monitoring Center (CMC) in Albuquerque. His expertise covers a wide array of critical areas, such as nuclear doctrines, command and control, safety and security, non-proliferation, arms control, disarmament, cyber security, and the militarisation of outer space.