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## **Towards ASAT Test Guidelines**

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The United Nations Institute for Disarmament Research (UNIDIR)—an autonomous institute within the United Nations—conducts research on disarmament and security. UNIDIR is based in Geneva, Switzerland, the centre for bilateral and multilateral disarmament and non-proliferation negotiations, and home of the Conference on Disarmament. The Institute explores current issues pertaining to the variety of existing and future armaments, as well as global diplomacy and local tensions and conflicts. Working with researchers, diplomats, government officials, NGOs and other institutions since 1980, UNIDIR acts as a bridge between the research community and governments. UNIDIR's activities are funded by contributions from governments and donor foundations.

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## **Acronyms and abbreviations**

ABM	Anti-Ballistic Missile
ASAT	Anti-Satellite Weapon
CD	Conference on Disarmament
COPUOS	Committee on the Peaceful Uses of Outer Space
EU	European Union
GEO	Geostationary Orbit
GGE	Group of Governmental Experts
ICoC	International Code of Conduct for Space Activities
LEO	Low Earth Orbit
LTS	Guidelines on the Long-Term Sustainability of Outer Space Activities
PAROS	Prevention of an Arms Race in Outer Space
PPWT	Treaty on the Prevention of the Placement of Weapons in Outer Space, the Threat or Use of Force against Outer Space Objects
TCBMs	Transparency and Confidence-Building Measures
UNDC	United Nations Disarmament Commission

## Introduction

There are many examples today of how space technology is increasingly vital to modern societies. Both traditional and non-traditional space activities are opening up new possibilities for how people communicate, do business, and understand their world. It is also enhancing military capabilities, providing new means of securing national interests and projecting power. As was discussed in File 1 of the UNIDIR Space Dossier, a decades-old strategic balance exists in outer space, under which all current activities, whether private or governmental, have come to exist.<sup>1</sup>

Recent events have shown that the world's leading militaries—namely those of the People's Republic of China, the Russian Federation and the United States of America—are developing capabilities that can target space assets, including missile defence interceptors and manoeuvring satellites. Such technologies are commonly referred to as anti-satellite, or ASAT, capabilities. This paper argues that even the development and testing of such capabilities can have ruinous consequences through the creation of space debris for the relative stability that currently exists in Earth's orbits.

Efforts to grapple with this growing threat at the international level have thus far been outpaced by technology and global events. The Conference on Disarmament (CD) has not reached a substantive outcome for many years and there has been no consensus on the negotiation of legally binding rules related to the Prevention of an Arms Race in Outer Space (PAROS). Other initiatives within the United Nations have met with limited success, but, as this paper will also show, these have either been aimed at “peaceful uses of outer space” rather than disarmament, or represent preliminary agreements to further discuss the issue. Nevertheless, the steady increase of orbital-activity investments and the emergence of a robust space economy could provide the necessary incentive to take some modest steps towards ensuring stability and sustainability in outer space.

To that end, this paper suggests one viable option for enhancing stability in outer space and limiting the potential hazards of its weaponization is the adoption of ASAT test guidelines, based on widely accepted best practices. As will be explained, these guidelines can be employed to enhance security and long-term sustainability in outer space without infringing on States' rights to possess or develop anti-ballistic missile (ABM) or ASAT capabilities, provided they do so in a manner that is recognized as being responsible.

## Growth in the space economy

The economic value of human space activities has been steadily on the rise for years now, and there is every indication that it will continue to do so. A recent study by Bank of America Merrill Lynch

### What are ASATs?

ASATs are any capabilities aimed at destroying or disabling space assets for any reason, whether military or civilian, offensive or defensive. They are generally of two types: kinetic and non-kinetic.

Kinetic ASATs must physically strike an object in order to destroy it. Examples of kinetic ASATs include ballistic missiles, drones that drag an object out of orbit or detonate explosives in proximity to the object, or any item launched to coincide with the passage of a target satellite. This means any space asset, even a communications satellite, could become an ASAT if it were used to physically destroy another space object.

A non-kinetic ASAT can use a variety of non-physical means to disable or destroy a space object. These can include frequency jamming, blinding lasers or cyberattacks. These methods can also render an object useless without causing the target to break up and fragment absent additional forces intervening.

<sup>1</sup> See UNIDIR, “Space Security and Strategic Stability”, *The Space Dossier*, File 1, UNIDIR, February 2018, <http://www.unidir.ch/files/publications/pdfs/space-security-and-strategic-stability-en-697.pdf>.

reported that the current space market is valued at roughly US\$ 350 billion, and will continue to grow to reach roughly US\$ 2.7 trillion within the next three decades.<sup>2</sup> Much of this increase will be driven by commercial actors involved in telecommunications and Earth observation, and new non-traditional activities such as orbital manufacturing and private habitats will also likely play a part in developing the space economy. Many of these activities will take place in low Earth orbit (LEO), an area from 160km to approximately 2,000km above the Earth's surface. For example, the new "mega-constellations", which are fleets of small satellites numbering in the thousands, are aiming to provide satellite broadband services to the world from LEO.<sup>3</sup>

In addition to private actors, traditional military players are investing significantly in their space capabilities. Whether for telecommunications, reconnaissance or coordination of nuclear forces, satellites and orbiting space assets play an increasingly critical role in major military operations. In 2018 alone, China, the Russian Federation and the United States, the three leading military powers, have already invested considerably in their military space resources. In January and April, China launched more of its Yaogan remote sensing satellites, which experts report is a military imaging constellation, capable of targeting for ballistic missile strikes.<sup>4</sup> Also in January, the United States launched the billion-dollar SBIRS GEO-4, yet another critical piece of the Air Force's new-generation missile warning system.<sup>5</sup> In April, the Russian Federation launched an unknown payload, designated only as Kosmos-2525, which experts also report is part of a "multi-spacecraft fleet of military-managed Earth-imaging missions".<sup>6</sup> These deployments represent only a small portion of broader efforts by these States, as well as many others, to strengthen national security through space capabilities.

All of this growth is not without limits. As more objects are launched into space, orbits are becoming increasingly congested. What is more, human space activities have led to a proliferation of space debris, namely trash, refuse and shrapnel that has been left in orbit.<sup>7</sup> The speeds at which debris travels in LEO, roughly 8km/s, means that a collision with even a small piece of debris could be devastating for a space object. Each collision creates more debris that poses its own threat to other space objects, possibly triggering a cascade effect called the Kessler Syndrome that would render LEO unusable.<sup>8</sup> Depending on the altitude of the debris, some of it can remain in orbit for decades, known as "long-lived debris". The US Space Surveillance Network today tracks over 23,000 objects

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<sup>2</sup> Sheetz, Michael, "The space industry will be worth nearly \$3 trillion in 30 years, Bank of America predicts", CNBC News, 31 October 2017, <https://www.cnbc.com/2017/10/31/the-space-industry-will-be-worth-nearly-3-trillion-in-30-years-bank-of-america-predicts.html>.

<sup>3</sup> Amos, Jonathan, "Satellite mega-constellation production begins", BBC News, 27 June 2017, <http://www.bbc.com/news/science-environment-40422011>.

<sup>4</sup> Chandrashekar, S. and Soma Perumal, "China's constellation of Yaogan satellites & the anti-ship ballistic missile: May 2016 update", International Strategic and Security Studies programme, National Institute of Advanced Studies (Bengaluru, May 2016). See also Barbosa, Rui, "Long March 2C launches Yaogan Weixin-30 Group 4", NASASpaceflight.com, 25 January 2018; Malik, Tariq, "China launches 2 SuperView Earth-Observation satellites into orbit", 10 January 2018, <https://www.space.com/39350-china-launches-superview-earth-satellites.html>; Sheldon, John, "Chinese counterspace and the return of Great Power Geopolitics: Implications and suggested strategic responses for India", speaking at the Observer Research Foundation Kalpana Chawla Space Security Dialogue, 17 February 2018, noting that "Chinese space power plays a critical role in the kill chain of its ballistic and cruise missile capabilities, naval and amphibious forces, and for the command and control and intelligence, surveillance, and reconnaissance support for its long-range air power."; and Barbosa, Rui, "Surprise Chinese launch of the Yaogan Weixing-31-01 mission", NASASpaceflight.com, 10 April 2018, <https://www.nasaspaceflight.com/2018/04/surprise-chinese-launch-yaogan-weixing-31-01/>.

<sup>5</sup> Mariq, Talik, "Atlas V Rocket Launches New Missile-Warning Satellite for US Air Force", Space.com, 19 January 2018, <https://www.space.com/39427-atlas-v-rocket-launches-missile-warning-satellite-sbirs-4.html>. See also Clark, Stephen, "U.S. military satellite launched to fortify against missile attacks", *Spaceflight Now*, 20 January 2018, <https://spaceflightnow.com/2018/01/20/u-s-military-satellite-launched-to-fortify-against-missile-attacks/>.

<sup>6</sup> Clark, Stephen, "Mysterious Russian reconnaissance satellite successfully launched", *Spaceflight Now*, 2 April 2018, <https://spaceflightnow.com/2018/04/02/mysterious-russian-reconnaissance-satellite-successfully-launched/>. See also Zak, Anatoly, "Soyuz-2-1v launches a military payload", Russianspaceweb.com, last updated 3 April 2018, <http://www.russianspaceweb.com/emka.html>.

<sup>7</sup> "Orbital Debris FAQ Sheet", NASA, last visited on 25 April 2018, [https://www.nasa.gov/news/debris\\_faq.html](https://www.nasa.gov/news/debris_faq.html).

<sup>8</sup> Lavone, Michelle, "The Kessler Syndrome: 10 Interesting and Disturbing Facts", *Space Safety Magazine*, last visited on 25 April 2018, <http://www.spacesafetymagazine.com/space-debris/kessler-syndrome/>.

larger than 10cm in orbit and estimates that there are over 500,000 objects larger than 1cm.<sup>9</sup> A recent example of a major debris-generating incident occurred in 2009 when the defunct Russian satellite Cosmos 2251 collided with the US Iridium 33, leaving behind nearly 2,000 pieces of debris larger than 10cm.<sup>10</sup> Each of the remaining pieces represents a new threat to functional space objects in LEO and, ultimately, to the viability of the whole space economy.

To address this problem, governments and commercial space actors have sought to implement mitigation measures such as the Space Debris Mitigation Guidelines, a set of voluntary recommendations developed by the Inter-Agency Space Debris Coordination Committee and endorsed by the United Nations.<sup>11</sup> These guidelines are technical measures that seek to reduce the creation of long-lived debris. There is also a legal incentive not to create debris, found in the United Nations Convention on International Liability for Damage Caused by Space Objects (“Liability Convention”), to which all major space-faring States are parties. Under Article III, a State will incur liability for damage to space objects due to its fault (or the fault of those for whom the State is responsible). To date, this provision of the Liability Convention has never been invoked but it could one day be used in a situation involving space debris. At present, though, it will be a technical challenge to attribute the origin of debris with current technology.

While many of the present concerns regarding space debris are focused on unintentional proliferation, there is one category of emerging capabilities that could lead to the intentional creation of significant amounts of debris, namely the testing of ASAT capabilities. For this, there are at present few limitations.

## The trouble with testing ASATs

ASATs emerged almost as soon as the first satellites were placed into orbit. Both the United States and the Soviet Union started developing nuclear-tipped interceptors as early as the 1950s in order to counter a perceived threat of strikes from space.<sup>12</sup> After some initial tests with nuclear weapons, such as US Operation Starfish Prime,<sup>13</sup> the two States gradually adopted distinct approaches to ASATs. The United States opted for an ABM/ASAT system that could both intercept incoming missiles as well as satellites by physically striking a target (“hit-to-kill”).<sup>14</sup> These “mid-course” intercepts take place in LEO where an inbound missile has ceased thrust and is easier to engage.<sup>15</sup>

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<sup>9</sup> “White House Office of Science and Technology Policy: Orbital Debris Report”, 14 August 2017, <https://www.whitehouse.gov/wp-content/uploads/2017/12/08-14-17-OSTP-Orbital-Debris-Report.pdf>.

<sup>10</sup> Weeden, Brian, “2009 Iridium-Cosmos Collision: Fact Sheet”, Secure World Foundation, last updated 10 November 2010, [https://swfound.org/media/6575/swf\\_iridium\\_cosmos\\_collision\\_fact\\_sheet\\_updated\\_2012.pdf](https://swfound.org/media/6575/swf_iridium_cosmos_collision_fact_sheet_updated_2012.pdf).

<sup>11</sup> Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space, endorsed by COPUOS at its fiftieth session, 2007, A/AC.105/890, §99, [http://www.unoosa.org/pdf/publications/st\\_space\\_49E.pdf](http://www.unoosa.org/pdf/publications/st_space_49E.pdf).

<sup>12</sup> It was necessary to have a nuclear warhead on-board in those days because tracking and targeting technology was not sufficiently sophisticated to physically strike a moving target; Grego, Laura “A History of Anti-Satellite Programs”, Union of Concerned Scientists Global Security Program, January 2012, p. 2.

<sup>13</sup> Plait, Phil, “The 50th anniversary of Starfish Prime: the nuke that shook the world”, Discover Magazine Blog, 9 July 2012, noting that: “The EMP had been predicted by scientists, but the Starfish Prime pulse was far larger than expected. And there was another effect that hadn’t been predicted accurately. Many of the electrons from the blast didn’t fall down into the Earth’s atmosphere, but instead lingered in space for months, trapped by Earth’s magnetic field, creating an artificial radiation belt high above our planet’s surface. When a high-speed electron hits a satellite, it can generate a sort-of miniature EMP. The details are complex, but the net effect is that these electrons can zap satellites and damage their electronics. The pulse of electrons from the Starfish Prime detonation damaged at least six satellites (including one Soviet bird), all of which eventually failed due to the blast. Other satellite failures at the time may be linked to the explosion as well.”

Available at <http://blogs.discovermagazine.com/badastronomy/2012/07/09/the-50th-anniversary-of-starfish-prime-the-nuke-that-shook-the-world/#.WssDVohubcs>.

<sup>14</sup> Weeden, Brian, “Through a Glass Darkly: Chinese, American and Russian Anti-Satellite Testing in Space”, Secure World Foundation, 17 March 2014, pp. 20–29.

<sup>15</sup> See “Mid-Course Phase: Factsheet”, GlobalSecurity.org, last visited on 3 April 2018, <https://www.globalsecurity.org/space/systems/mid-course.htm>.



In contrast, the Soviet Union focused on a system called *Istrebitel Sputnikov* or “satellite destroyer”, namely a co-orbital drone that could catch up to a satellite and disable the target with an explosive charge.<sup>16</sup>

The most intense period of US and Soviet research into this technology lasted until the 1980s and the end of the Cold War. Development continued after that but at a slower pace. Since the end of the 1980s, technology has emerged that enhances accuracy (to some degree) and enables new types of attacks on increasingly critical space resources. Many of the technological advances that raise concerns about threats to space assets have come directly from missile-defence programmes. Notably, ABM systems provide key components like radars and delivery vehicles that enable ASAT capabilities. Likewise, it is impossible to verify if new on-orbit servicing drones, such as those being developed by China and the United States, are for peaceful, civilian purposes or for destructive ones, since the “dual-use” technology involved is virtually the same for both applications.<sup>17</sup> Yet for all these developments and testing of various counter-space capabilities, the United States and the Russian Federation have never used ASATs to physically destroy an enemy target.<sup>18</sup>

Despite there not having been open hostilities in space, the space environment has not emerged unscathed by the development of ASAT technology. Of the nearly 30 operations over the course of more than 50 years that the United States has undertaken in space involving targeting objects, two are known to have created notable space debris.<sup>19</sup> First, in 1985, the United States shot down the *Solwind* satellite with an ASM-135 missile fired from an aircraft.<sup>20</sup> That test created 285 pieces of trackable debris, the last of which only came out of orbit in 2002.<sup>21</sup> This does not include any debris too small to track that would have also been produced. In 2008, during Operation Burnt Frost, the United States downed a second satellite, USA-193, with an SM-3 interceptor creating 174 pieces of

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<sup>16</sup> Arbatov, Alexey, Vladimir Dvorkin and Petr Topychkanov, “Entanglement as a new Security Threat: A Russian Perspective”, *Entanglement as a new Security Threat: Russian and Chinese Perspectives on Non-Nuclear Weapons and Nuclear Risks*, Carnegie Endowment for International Peace, 8 November 2017, p. 17. See also Hendrickx, Bart, “Naryad-V and the Soviet Anti-Satellite Fleet”, *Space Chronicle—The British Interplanetary Society*, Vol. 69 (2016), pp. 1–2, <http://www.bis-space.com/belgium/wp-content/uploads/2016/09/Naryad-V-and-the-Soviet-Anti-Satellite-Fleet.pdf>; and Zak, Anatoly, “Military: IS Anti-Satellite System”, RussianSpaceWeb.com, last updated on 13 July 2017, <http://www.russianspaceweb.com/is.html>.

<sup>17</sup> See Coats, Daniel, “Worldwide Threat Assessment of the US Intelligence Community”, statement for the record issued on 13 February 2018, p. 13, <https://www.dni.gov/files/documents/Newsroom/Testimonies/2018-ATA---Unclassified-SSCI.pdf>. See also “China’s new Orbital Debris Clean-Up Satellite raises Space Militarization Concerns”, *Spaceflight 101*, 29 June 2016, <http://spaceflight101.com/long-march-7-maiden-launch/aolong-1-asat-concerns/#T0eUHXQpVfjrbVbc.99>; Chow, Brian, “Stalkers in Space: Defeating the Threat”, *Strategic Studies Quarterly*, Summer 2017; Axe, David, “The Dangerous Downside to DARPA’s New Repair Satellite,” *Motherboard*, 8 January 2018, [https://motherboard.vice.com/en\\_us/article/xw4vwk/darpa-repair-satellite-rsgs](https://motherboard.vice.com/en_us/article/xw4vwk/darpa-repair-satellite-rsgs); and Davenport, Christian, “Why DARPA and NASA are building robot spacecraft designed to act like service stations in orbit”, *Washington Post*, 22 December 2017, <https://www.washingtonpost.com/news/the-switch/wp/2017/12/22/why-darpa-and-nasa-are-building-robot-spacecraft-designed-to-act-like-service-stations-on-orbit/>.

<sup>18</sup> Non-kinetic ASAT capabilities have allegedly been used in the past against rival satellites, though no incident resulted in the creation of debris. Notably, the United States accused China of causing major weather satellite data outage from October 21 through October 23 (See Flaherty, Mary Pat, Jason Samenow and Lisa Rein, “Chinese hack U.S. weather systems, satellite network”, *The Washington Post*, 12 November 2014); the Democratic People’s Republic of Korea has allegedly jammed GPS signals reaching airports in the Republic of Korea (Ryall, Julian, “North Korea interfering with GPS signals in South Korea as China relations deteriorate”, *The Telegraph*, 1 April 2016); and several Middle Eastern States have been accused of jamming satellite broadcasts (“ITU calls out jammers at WRC-12”, *RadioWorld*, 21 February 2012).

<sup>19</sup> Most of the ASAT test targets were balloons with instrumentation that relayed data back to engineers on the ground. See “The F-15 ASAT story”, an interview with former Air Force Captain Gregory Karambelas, noting, “There were many arguments over who should commit first. Do you waste a \$100 million dollar interceptor, or do you waste a very expensive [instrumented target vehicle] that had to be launched into space many months in advance?” <http://www.svengrahn.pp.se/histind/ASAT/F15ASAT.html>.

<sup>20</sup> Pincus, Walter, “ASAT Test Hit Satellite Sending Scientific Data”, *The Washington Post*, 20 September 1985, [https://www.washingtonpost.com/archive/politics/1985/09/20/asat-test-hit-satellite-sending-scientific-data/dfa87f1a-bf31-4884-8f01-9b670846b27b/?utm\\_term=.d657cd3cb70b](https://www.washingtonpost.com/archive/politics/1985/09/20/asat-test-hit-satellite-sending-scientific-data/dfa87f1a-bf31-4884-8f01-9b670846b27b/?utm_term=.d657cd3cb70b). See also “The F-15 ASAT story”, an interview with former Air Force Captain Gregory Karambelas, <http://www.svengrahn.pp.se/histind/ASAT/F15ASAT.html>.

<sup>21</sup> Weeden, Brian, “Through a Glass Darkly: Chinese, American and Russian Anti-Satellite Testing in Space”, *Secure World Foundation*, 17 March 2014, p. 25; Grego, Laura “A History of Anti-Satellite Programs”, *Union of Concerned Scientists Global Security Program*, January 2012, p. 5.



trackable debris, plus non-trackable shards.<sup>22</sup> The bulk of that debris re-entered the atmosphere within days, though in certain cases it took months.<sup>23</sup> This operation was not technically classified by the United States as an ASAT test; nevertheless, it demonstrated US capabilities to track and intercept a satellite by upgrading software for its *Aegis* missile defence system.<sup>24</sup>

Meanwhile, in a programme that spanned over 20 years starting from the 1960s, the Soviet Union tested its co-orbital system nearly 20 times—creating trackable debris on eight occasions.<sup>25</sup> While some of these tests produced relatively few pieces of debris, 842 trackable pieces were created, in addition to non-trackable shrapnel.

The ASAT test that has resulted in the creation of the most debris to date, however, was carried out by China in 2007. In that instance, China destroyed its FengYun 1C weather satellite with an SC-19 missile, leaving behind a cloud of debris consisting of 3,280 pieces of trackable debris, as well as up to 32,000 pieces that are non-trackable.<sup>26</sup> This cloud spans 3,500km, starting at an altitude of 850km. It has increased risk of collision with debris for all operational spacecraft in LEO, including Earth observation satellites, future “mega-constellations” and the International Space Station. This debris will remain in orbit for decades or longer unless it is physically removed.

While China has continued testing ABM/ASAT capabilities, it has not created any long-lived debris since 2007. In the last five years, and as recently as February 2018, China has carried out five mid-course missile intercept tests, although leaving no or very little low-flying shrapnel, which would soon de-orbit.<sup>27</sup> In 2013, China also tested a new ballistic missile, the trajectory of which indicates that it is capable of reaching targets at altitudes much higher than LEO, possibly in geostationary orbit (GEO, located at roughly 36,000km altitude) where many telecommunication and military satellites operate.<sup>28</sup> This test did not result in the strike of an actual target. While such missions have raised concerns that China is developing ASAT capabilities, these activities have not generated the same widespread criticism as its 2007 test. Some experts have gone on record to attribute China’s restraint to international public outcry,<sup>29</sup> though Chinese authorities may have been just as concerned about incurring liability for damage caused by debris under the Liability Convention as

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<sup>22</sup> Petrucci, Nicole, “Reflections on Operation Burnt Frost”, *Air Power Strategy*, 5 March 2017, <http://www.airpowerstrategy.com/2017/03/05/burnt-frost/>. See also Weeden, Brian, “Through a Glass Darkly: Chinese, American and Russian Anti-Satellite Testing in Space”, Secure World Foundation, 17 March 2014, pp. 26–27.

<sup>23</sup> Interview with Nick Johnson, former NASA Chief Scientist for Orbital Debris, “Operation Burnt Frost”, noting that the mission was commissioned by the US President to mitigate the risk of people on Earth coming into contact with fuel remaining in the defunct satellite’s tank, <https://sma.nasa.gov/sma-disciplines/orbital-debris/nick-johnson---future-of-orbital-debris-work#video-2>.

<sup>24</sup> See Office of the Assistant Secretary of Defense Satellite Engagement Plan, 14 February 2008, noting that:

“To prepare to engage this satellite, we had to make modifications to three sea-based missile defense interceptors, three ships, and the system’s command-and-control software. We have not made these modifications to any other missile defense system, nor do we plan to. None of our other missile defense systems have the capability to engage a satellite. Any of these interceptors that are not used, the ships and the system’s command-and-control software will be returned to their original configuration as a defensive capability.”

[http://www.governmentattic.org/docs/\(U\)\\_OASD\\_Satellite\\_Engagement\\_Communications\\_Plan\\_\(1400\\_hrs\\_14\\_Feb\\_08\).pdf](http://www.governmentattic.org/docs/(U)_OASD_Satellite_Engagement_Communications_Plan_(1400_hrs_14_Feb_08).pdf).

<sup>25</sup> Weeden, Brian, “Through a Glass Darkly: Chinese, American and Russian Anti-Satellite Testing in Space”, Secure World Foundation, 17 March 2014, pp. 29–30.

<sup>26</sup> David, Leonard, “China’s Anti-Satellite Test: Worrisome Debris Cloud Circles the Earth”, Space.com, 2 February 2007, <https://www.space.com/3415-china-anti-satellite-test-worrisome-debris-cloud-circles-earth.html>. Weeden, Brian, “Through a Glass Darkly: Chinese, American and Russian Anti-Satellite Testing in Space”, Secure World Foundation, 17 March 2014, p. 17.

<sup>27</sup> Weeden, Brian and Victoria Samson (eds), “Global Counterspace Capabilities: An Open Source Assessment”, Secure World Foundation, 2018, p. 1-18. See also Keck, Zachary, “China claims that it has tested a Mid-Course missile defence system”, *The National Interest*, 11 February 2018, <http://nationalinterest.org/blog/the-buzz/china-claims-it-has-tested-mid-course-missile-defence-system-24434>; and Weeden, Brian, “Antisatellite tests in space – the case of China”, Secure World Foundation, 18 May 2015.

<sup>28</sup> US Department of Defence Annual Report to Congress: Military and Security Developments Involving the People’s Republic of China 2015, generated on 7 April 2015, p. 14, noting that “[t]he launch profile was not consistent with traditional space-launch vehicles, ballistic missiles or sounding rocket launches used for scientific research. It could, however, have been a test of technologies with a counterspace mission in geosynchronous orbit.”

<sup>29</sup> Gruss, Mike, “US Official: China Turned to Debris-Free ASAT Tests Following 2007 Outcry”, *SpaceNews.com*, 11 January 2016, citing Mallory Stewart, Deputy Assistant Secretary for Emerging Security Challenges and Defence Policy at the US State Department, who stated “There have been subsequent tests by China, but none of them have been debris-generating ... . At the State Department, we like to attribute that to the huge international outcry.”

they were about public opinion.<sup>30</sup> Nevertheless, these incidents are illustrative of broader attitudes towards ASAT testing: if an ASAT test is to be conducted, it should not create long-lived debris.

In addition to these major military powers, India has also demonstrated a desire to possess ASATs.<sup>31</sup> India has undertaken space activities for more than half a century, integrating many capabilities into its national security strategy. While India has long maintained a position against the weaponization of outer space, after the 2007 Chinese test, India also began to look at options to use its own missile defence capabilities against targets in space, though it has never carried out a test or demonstration on an actual space object.<sup>32</sup>

## Growing tensions

In light of the developments described above, concern is growing that a new arms race has emerged reminiscent of the Cold War, and that space will play a major role therein. For example, given the proximity of events, many saw the US 2008 ASAT incident as a direct response to the 2007 Chinese test.<sup>33</sup> Russian President Vladimir Putin said in a March 2018 interview that an arms race, of which outer space is a key component, started in 2001 when the United States withdrew from the 1972 Anti-Ballistic Missile Treaty.<sup>34</sup> In any case, outer space continues to grow in strategic and tactical importance for all major military actors, and it is increasingly being characterized as a warfighting domain.<sup>35</sup>

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<sup>30</sup> Article III of the Convention on International Liability for Damage Caused by Space Objects (Liability Convention) states that Launching States are liable for damages caused to other space objects through fault.

<sup>31</sup> Pilla Rajagopalan, Rajeswari, "India's Changing Policy on Space Militarization: The Impact of China's ASAT Test", *India Review*, 10 November 2011, p. 368, citing the HQ Integrated Defense Staff's *Technology Perspective and Capability Roadmap* (May 2010) which states that India will develop ASATs "for electronic or physical destruction in both the LEO and geosynchronous orbits."

<sup>32</sup> Pilla Rajagopalan, Rajeswari, "India's Changing Policy on Space Militarization: The Impact of China's ASAT Test", *India Review*, 10 November 2011, pp. 367–369.

<sup>33</sup> "US spy satellite plan 'a cover'", BBC News, 17 February 2018, quoting an official statement from the Russian defence ministry: "Speculations about the danger of the satellite hide preparations for the classical testing of an anti-satellite weapon." Available at <http://news.bbc.co.uk/2/hi/americas/7248995.stm>. See also Kaufman, Marc and Walter Pincus, "Navy Will Attempt to Down Spy Satellite", *The Washington Post*, 15 February 2008, quoting Mr Michael Krepon: "There has to be another reason behind this ... . In the history of the space age, there has not been a single human being who has been harmed by man-made objects falling from space."; and Shachtman, Noah, "Experts Scoff at Sat Shoot-down Rationale (Updated)", *Wired*, 15 February 2008, noting that "the satellite shot is a chance for the military to try out its missile defence capabilities; a way to keep secret material out of the wrong hands; and a warning to the Chinese, after they destroyed a satellite about a year ago."

Available at <https://www.wired.com/2008/02/fishy-rationale/>.

<sup>34</sup> Megyn Kelly, Interview with President Vladimir Putin, NBC News, 1 March 2018, <https://www.nbcnews.com/nightly-news/video/exclusive-putin-denies-cold-war-1174558275948>. President George W. Bush pulled the United States out of this major pillar in the détente between the United States and the Russian Federation because of the alleged threat posed by terrorists and rogue States, not the Russian Federation or China; see "U.S. Withdrawal from the ABM Treaty: President Bush's Remarks and U.S. Diplomatic Notes (13 December 2001)", [https://www.armscontrol.org/act/2002\\_01-02/docjanfeb02](https://www.armscontrol.org/act/2002_01-02/docjanfeb02). See also Neilan, Terence, "Bush Pulls out of ABM Treaty; Putin Calls Move a Mistake", *New York Times*, 13 December 2001.

<sup>35</sup> See Weeden, Brian and Victoria Samson (eds), "Global Counterspace Capabilities: An Open Source Assessment", *Secure World Foundation*, 2018, pp. 1-20 through 1-23, noting in particular that "China's 2015 defense white paper, China's Military Strategy, for the first-time designated outer space as a military domain and linked developments in the international security situation to defending China's interests in space." See also White House Announcement, "President Donald J. Trump is Unveiling an America First National Space Strategy: Factsheet", 23 March 2018, recognizing that "our competitors and adversaries have turned space into a warfighting domain", <https://www.whitehouse.gov/briefings-statements/president-donald-j-trump-unveiling-america-first-national-space-strategy/>. It should be noted that following the release of this factsheet, the White House sent an official explanation to *Space Policy Online*, confirming that the contents of the factsheet replace the 2011 US National Security Space Strategy; see Smith, Marcia, "White House Releases Fact Sheet on New National Space Strategy—Updated", *Space Policy Online*, 24 March 2018, <https://spacepolicyonline.com/news/white-house-releases-fact-sheet-on-new-national-space-strategy/>. See also Hendrickx, Bart, "Naryad-V and the Soviet Anti-Satellite Fleet", *Space Chronicle—The British Interplanetary Society*, Vol. 69 (2016), p. 19, citing a Russian interview with Vladimir Popovkin, stating that:

"In March 2009 the then Deputy Minister of Defence Vladimir Popovkin stated that Russia was continuing to develop anti-satellite systems, saying that 'we can't just sit and watch while others are doing this'. Popovkin was reacting to a journalist's question about the first Chinese ASAT test in January 2007 and a US operation in February 2008 in which a standard ship-based anti-ballistic missile system had been used to destroy a decaying out-of-control American reconnaissance satellite that might have posed a health hazard if it survived re-entry."

Available at <http://www.bis-space.com/belgium/wp-content/uploads/2016/09/Naryad-V-and-the-Soviet-Anti-Satellite-Fleet.pdf>.

In this context, there is a growing possibility that on-going developments in ABM technologies, backed by significant financial commitments, will once again segue into ASAT testing and the creation of more long-lived debris. As already noted above, China has continued testing its ABM system, even at altitudes in space where ballistic missiles do not travel. The United States has interpreted these actions as a threat<sup>36</sup> and has increased efforts to develop its ABM systems as well—including the same system used to destroy US-193—with a view towards improved efficiency in “mid-course intercepts” in LEO.<sup>37</sup> This includes defence against ABM/ASAT capabilities, such as the ones China has been testing, that could target US assets at higher altitudes, such as GEO. The Russian Federation has also announced that the 2018–2027 federal defence procurement programme includes funds for the development of the “*Rudolph* mobile anti-satellite complex”, a mobile missile system designed to target assets in orbit.<sup>38</sup> None of these systems are finished products, and so will see further testing in the field. The concern, though, is that the Chinese, US or Russian militaries will once again find it necessary to test or demonstrate their capabilities in ways that result in long-lived debris.

As noted earlier, these actors are not alone in developing the building blocks for ASATs. India has also been testing a ballistic missile defence system that could be used as the foundation for its own ABM/ASAT capabilities.<sup>39</sup> Upgrades would be necessary, particularly to strike objects beyond those transiting directly over India’s landmass, but these would be technically within India’s reach.<sup>40</sup> Tensions in the region have led to public debate examining the pros and cons of not only developing

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<sup>36</sup> See comments by Susan Gordon, Principal Deputy Director for National Intelligence, during the 2nd meeting of the US National Space Council, 21 February 2018, in describing the “plans and actions of our foreign adversaries and competitors who would seek to impede our operations or challenge our advantage”, stated that “Russia and China are each developing counterspace capabilities to use during a potential future conflict with the United States, to reduce US and allied advantage and effectiveness, eroding our information advantage.” Available at <https://www.youtube.com/watch?v=suNvPOykm6k>. See also Coats, Daniel, “Worldwide Threat Assessment of the US Intelligence Community”, statement for the record issued on 13 February 2018, noting that “if a future conflict were to occur involving Russia or China, either country would justify attacks against U.S. and allied satellites as necessary to offset any perceived U.S. military advantage derived from military, civil or commercial space systems.” Available at <https://www.dni.gov/files/documents/Newsroom/Testimonies/2018-ATA---Unclassified-SSCI.pdf>.

<sup>37</sup> See §1683: Development of persistent space-based sensor architecture, “US National Defense Authorization Act for Fiscal Year 2018”, p. 498, noting that:

“The sensor architecture developed under subsection (a) shall include one or more of the following functions:

- (1) Control of increased raid sizes.
- (2) Precision tracking of threat missiles.
- (3) Fire-control-quality tracks of evolving threat missiles.
- (4) Enabling of launch-on-remote and engage-on-remote capabilities.
- (5) Discrimination of warheads.
- (6) Effective kill assessment.
- (7) Enhanced shot doctrine.
- (8) Integration with the command, control, battle management, and communication program of the ballistic missile defense system.
- (9) Integration with all other elements of the current ballistic missile defense system, including the Terminal High Altitude Area Defense, Aegis Ballistic Missile Defense, Aegis Ashore, and Patriot Air and Missile Defense systems.”

Notably, the Aegis Ballistic Missile Defense system was used in Operation Burnt Frost, <https://www.congress.gov/115/crpt/hrpt404/CRPT-115hrpt404.pdf>.

<sup>38</sup> Abbasova, Vusala, “Star Wars Continue, as Russia Develops Rudolph”, Caspian News, 9 December 2017, <https://caspiannews.com/news-detail/star-wars-continue-as-russia-develops-rudolph-2017-12-7-7/>. See also Zak, Anatoly, “Russian anti-satellite systems”, Russia Space Web, 30 November 2017, <http://www.russianspaceweb.com/naryad.html>. It should be noted that the budget was approved on 21 December 2017; see “Russian government approves 2018 state arms procurement program”, TASS Russian News Agency, 22 December 2017, <http://tass.com/defense/982420>.

<sup>39</sup> “Defence Research and Development Organisation (DRDO) successfully conducts Interceptor Missile Test”, Press Information Bureau: Government of India, 28 December 2017, <http://pib.nic.in/PressReleaseDetail.aspx?PRID=1514567>. See also Hafeez, Qura, “India’s Quest for Ballistic Missile Defence Shield”, *Modern Diplomacy*, 1 February 2018, <https://modern diplomacy.eu/2018/02/09/indias-quest-ballistic-missile-defense-shield/>; Bagla, Pallava, “India Ahead in Elite Missile Club with a ‘Star Wars’ Like Advanced Air Defence System: 10 Facts”, New Delhi Television, 28 December 2017, <https://www.ndtv.com/india-news/india-ahead-in-elite-missile-club-with-a-star-wars-like-system-1793150>; and O’Connor, Tom, “India Launches ‘Star Wars’ Missile Defence as China and Pakistan Join Forces”, Newsweek, 28 December 2018, <http://www.newsweek.com/india-launches-star-wars-missile-defense-china-pakistan-join-forces-762347>.

<sup>40</sup> Chandrashekar, S. “Space, War & Security—A Strategy for India”, International Strategic and Security Studies Programme, National Institute of Advanced Studies (Bengaluru), December 2015, pp. 89–91.

but also demonstrating an Indian “hit-to-kill” ASAT capability.<sup>41</sup> Such a demonstration could have long-term consequences for LEO and all activities carried out therein.

## Efforts to find cooperative solutions

There is no specific treaty-based, legal obligation that prohibits the *possession* of ASATs. Article IV of the 1967 Outer Space Treaty prohibits the placement of nuclear weapons and weapons of mass destruction in orbit, but not other types of weapons.<sup>42</sup> The 1963 Limited Test Ban Treaty prohibits “any nuclear weapon test explosion, or any other nuclear explosion” in outer space, but stops there.<sup>43</sup> Importantly, both instruments are designed to be compatible with the Charter of the United Nations and the right to self-defence, enshrined in Article 51, which, arguably, gives States the right to *use* ASATs in response to an armed attack. How self-defence should be applied is not yet clear and there is an ongoing debate at the international level on self-defence in the context of outer space.<sup>44</sup>

Progress on strengthening the mechanisms to avoid an arms race in space are moving very slowly. The CD, which has PAROS as one of its main agenda items, has seen scant activity in two decades.<sup>45</sup> Both China and the Russian Federation have proposed a legally binding instrument, the draft Treaty on the Prevention of the Placement of Weapons in Outer Space, the Threat or Use of Force against Outer Space Objects (PPWT).<sup>46</sup> However, the PPWT has been rejected by several States, including the United States, on grounds that it neither addresses verification nor bans ground-based ASAT weapons.<sup>47</sup> Likewise, a resolution first proposed by the Russian Federation in 2014 at the General Assembly First Committee, entitled “No First Placement of Weapons in Outer Space”, seeks a pledge

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<sup>41</sup> See “Why India Needs to Demonstrate Anti Satellite (ASAT) Capability—Publicly”, Strategic Frontier Research Foundation, 11 December 2017, noting the comments of Dr Vijay Kumar Saraswat, Director General of the Defence Research and Development Organisation (DRDO) and the Chief Scientific Advisor to the Indian Minister of Defence, from a 3 January 2010 interview: “We are working to ensure space security and protect our satellites. At the same time we are also working on how to deny the enemy access to its space assets ... . To achieve such capabilities, a kill vehicle needs to be developed and that process is being carried out under the Ballistic Missile Defence programme.”

In the interview, it was added that no tests were planned but that the technology should be available, <https://www.strategicfront.org/india-needs-demonstrate-asat-capability-publicly/>. See also Vasani, Harsh, “India’s Anti-Satellite Weapon”, *The Diplomat*, 14 June 2016, <https://thediplomat.com/2016/06/indias-anti-satellite-weapons/>; Listner, Michael, “India’s ABM test: a validated ASAT capability or a paper tiger?”, *The Space Review*, 28 March 2011, <http://www.thespacereview.com/article/1807/1>; Joshi, Manoj, “Expect greater rivalry between India and China in South Asia”, Observer Research Foundation, 23 February 2018, <http://www.orfonline.org/research/expect-greater-rivalry-between-india-and-china-in-south-asia/>; and Pillai Rajagopalan, Rajeswari, “Are China–India Relations Really Improving?”, *The Diplomat*, 1 March 2018, <https://thediplomat.com/2018/03/are-china-india-relations-really-improving/>.

<sup>42</sup> Article IV of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (Outer Space Treaty), <http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspacetreaty.html>.

<sup>43</sup> Article I of the Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water, <https://www.state.gov/t/isn/4797.htm>.

<sup>44</sup> Thomas Markram, Deputy High Representative for Disarmament Affairs, speaking at the second Joint Meeting of the First and Fourth Committee (12 October 2017, GA/SPD/640), where his comments were reported as follows:

“Yet, some aspects of the legal regime in that realm remained largely undeveloped, he said, noting the lack of a common understanding on how the right of self-defence could be applied in conformity with international law without resulting in severe and long-lasting consequences.”

During that same meeting, the Russian Federation “called upon [COPUOS] to consider hypothetical legal grounds for resorting to the right of self-defence in space so that hostile actions could be defined and a mutual understanding developed.” It should also be noted that legal and policy experts have gathered to draft the Woomera Manual on the International Law of Military Space Operations, a document on military and security law as it applies to space, which will be completed in 2020.

<sup>45</sup> See UNIDIR, “Space Security and Strategic Stability”, *The Space Dossier*, File 1, UNIDIR, February 2018, <http://www.unidir.ch/files/publications/pdfs/space-security-and-strategic-stability-en-697.pdf>.

<sup>46</sup> PPWT (draft, as of 16 June 2014), [http://www.fmprc.gov.cn/mfa\\_eng/wjwb\\_663304/zjzg\\_663340/jks\\_665232/kjfywj\\_665252/t1165762.shtml](http://www.fmprc.gov.cn/mfa_eng/wjwb_663304/zjzg_663340/jks_665232/kjfywj_665252/t1165762.shtml).

<sup>47</sup> Mission of the United States, “Ambassador Robert Wood: Ensuring the Long-Term Sustainability and Security of the Space Environment”, 9 September 2014, <https://geneva.usmission.gov/2014/09/09/ambassador-robert-wood-ensuring-the-long-term-sustainability-and-security-of-the-space-environment/>.



from States as the title suggests.<sup>48</sup> However, this resolution lacks support from important space players like the United States and the European Union (EU) on the grounds that it fails to define what a “weapon” is and, like the PPWT, is light on verification and does not ban ground-based ASATs.<sup>49</sup> Meanwhile, the EU’s proposed International Code of Conduct for Space Activities (ICoC)—a set of voluntary guidelines aimed at enhancing safety and security in outer space—seems to have lost its momentum for now, though there may yet be hope of it being introduced at the General Assembly.<sup>50</sup>

Some small but important steps have been taken. In 2013, a Group of Governmental Experts (GGE) on Outer Space Transparency and Confidence-Building Measures (TCBMs) agreed to a consensus report that included a list of recommended voluntary measures whereby States could build trust with each other.<sup>51</sup> Importantly, that GGE issued a recommendation that covers ASAT testing:

#### Notification of intentional orbital break-ups

45. Intentional destruction of any on-orbit spacecraft and launch vehicle orbital stages or other harmful activities that generate long-lived debris should be avoided. When intentional break-ups are determined to be necessary, States should inform other potentially affected States of their plans, including measures that will be taken to ensure that intentional destruction is conducted at sufficiently low altitudes to limit the orbital lifetime of resulting fragments. All actions should be carried out in conformity with the Space Debris Mitigation Guidelines of the United Nations as endorsed by the General Assembly in its resolution 62/217, entitled “International cooperation in the peaceful uses of outer space”.<sup>52</sup>

This recommendation contains three key requirements on behaviour in space: no long-lived debris, low debris when necessary, and notification. This recommendation is not binding and must be implemented by States within their own practices. Nevertheless, it does identify certain basic elements of responsible behaviour for such an activity. Furthermore, the GGE encouraged efforts to pursue further political commitments, such as declarations or codes, to encourage responsible actions in outer space, and its continued peaceful use.<sup>53</sup>

Building on the GGE’s progress, the United Nations Disarmament Commission (UNDC)—a deliberative body of the General Assembly with the function of considering and making recommendations on various issues in the field of disarmament—has held informal discussions on

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<sup>48</sup> UN First Committee Agenda item 97(b): Prevention of an arms race in outer space: no first placement of weapons in outer space, A/C.1/72/L.53, <http://undocs.org/A/C.1/72/L.53>.

<sup>49</sup> See Explanation of Vote in the First Committee on Resolution L.54, Agenda Item 97(b): No First Placement of Weapons in Outer Space, Ambassador Robert Wood, U.S. Permanent Representative to the Conference on Disarmament, 30 October 2017 (New York), <https://usun.state.gov/remarks/8084>. See also Explanation of Vote delivered by Estonia on behalf of European Union Member States at the 72nd Session of the United Nations General Assembly First Committee on No First Placement of Weapons in Outer Space, 30 October 2017 (New York), [https://eeas.europa.eu/headquarters/headquarters-homepage/36635/eu-explanation-vote-%E2%80%93-united-nations-1st-committee-no-first-placement-weapons-outer-space\\_en](https://eeas.europa.eu/headquarters/headquarters-homepage/36635/eu-explanation-vote-%E2%80%93-united-nations-1st-committee-no-first-placement-weapons-outer-space_en).

<sup>50</sup> Pellegrino, Massimo and Gerald Stang, “Space Security for Europe”, Institute for EU Security Studies, Report #29, July 2016, p. 85, <http://www.css.ethz.ch/content/dam/ethz/special-interest/gess/cis/center-for-securities-studies/resources/docs/EUISS-Space%20security%20for%20Europe.pdf>.

<sup>51</sup> Report of the Group of Governmental Experts on Transparency and Confidence-Building Measures in Outer Space Activities, A/68/189, June 2013, [https://www.stimson.org/sites/default/files/file-attachments/GGE\\_July\\_2013\\_1.pdf](https://www.stimson.org/sites/default/files/file-attachments/GGE_July_2013_1.pdf).

<sup>52</sup> In 2016, the Secretary General of the CD asked States to submit reports on how they had been implementing the recommendations of the GGE on TCBMs. Only the United States addressed §45, noting retroactively that it had adhered to those measures in Operation Burnt Frost; see Note Verbale dated 29 August 2016 from the Delegation of the United States of America addressed to the Secretary General of the CD transmitting the submission of the United States to the Conference on Disarmament: “Implementing the Recommendations of the Report (A/68/189\*) of the Group of Governmental Experts on Transparency and Confidence-Building Measures in Outer Space Activities to Enhance Stability in Outer Space (16 September 2016, CD/2078), §§ 27–28.

<sup>53</sup> Report of the Group of Governmental Experts on Transparency and Confidence-Building Measures in Outer Space Activities, A/68/189, June 2013, § 69.

the practical implementation of TCBMs.<sup>54</sup> This issue was added to the agenda of the UNDC 2015–2017 term by way of a joint proposal by China, the Russian Federation and the United States, and has given way to small but meaningful exchanges on implementation of TCBMs. The issue will also be discussed in the 2018–2020 term.

Another GGE was recently established with the mandate “to consider and make recommendations on substantial elements of an international legally binding instrument on PAROS, including, *inter alia*, on the prevention of the placement of weapons in outer space.”<sup>55</sup> This GGE is scheduled to meet in 2018 and 2019. In addition, the CD recently established (in principle) subsidiary working groups to find means of advancing each of its individual agenda items, including PAROS.<sup>56</sup> Both of these initiatives are merely proposals to examine the issue of an arms race in space but they provide opportunities for States to engage in a constructive dialogue on ASAT capabilities.

The most tangible positive contribution to space stability in recent times occurred in the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS), rather than disarmament forums. There, Guidelines on the Long-Term Sustainability of Outer Space Activities (LTS) are being developed as a means of establishing best practices in space.<sup>57</sup> These guidelines address a variety of aspects of space activities, including sustainable space utilization, space debris mitigation, space operations, and tools to support collaborative space situational awareness. The LTS, however, do not speak directly to the dangers of a growing arms race in outer space, nor do they provide a clear limitation on the purposeful creation of debris through ASAT testing. The Working Group on LTS has declined to address the issue of self-defence in any of the guidelines so far adopted.

While it is unlikely that, under current conditions, efforts towards a comprehensive ban on the weaponization of outer space will meet with any success, there is some room for progress. As evidenced by §45 of the 2013 GGE recommendations, there is recognition, even among the major space powers, that (1) space debris poses a serious threat to the nascent space economy and (2) that some guidance on the use of force in space is needed. In the United States, there have been calls from across the policy spectrum in favour of placing restrictions on the types of weapons used in space in order to avoid indiscriminate harm.<sup>58</sup> This is not surprising since the United States does and likely will continue to have the greatest share of private sector investment in outer space for the foreseeable future. Likewise, the Russian Foreign Minister, Sergei Lavrov, has signalled that “no item on the CD agenda is taboo for Russia”, exhorting members to move towards a treaty on weapons in space in any way.<sup>59</sup> Similarly, China consistently supports a comprehensive ban on weapons in space,<sup>60</sup> as does India.<sup>61</sup>

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<sup>54</sup> See Secretariat non-paper for Working Group II: “In accordance with the recommendations contained in the report of the Group of Governmental Experts on Transparency and Confidence-building Measures in Outer Space Activities (A/68/189), preparation of recommendations to promote the practical implementation of transparency and confidence-building measures in outer space activities with the goal of preventing an arms race in outer space.” Available at <https://www.un.org/disarmament/institutions/disarmament-commission/session-2018/>.

<sup>55</sup> “Further practical measures for the prevention of an arms race in outer space”, resolution adopted by the First Committee, 13 October 2017, A/C.1/72/L.54, [http://www.un.org/ga/search/view\\_doc.asp?symbol=A/C.1/72/L.54](http://www.un.org/ga/search/view_doc.asp?symbol=A/C.1/72/L.54).

<sup>56</sup> Conference on Disarmament Decision, adopted at the 1442nd plenary meeting, CD/2119, 16 February 2018.

<sup>57</sup> Working Group on the Long-term Sustainability of Outer Space Activities: Preambular Text and Nine Guidelines, A/AC.105/C.1/2018/CRP.18/Rev.1, 8 February 2018, [http://www.unoosa.org/res/oosadoc/data/documents/2018/aac\\_105c\\_12018crp/aac\\_105c\\_12018crp\\_18rev\\_1\\_0\\_html/AC105\\_C1\\_2018\\_CRP18Rev01E.pdf](http://www.unoosa.org/res/oosadoc/data/documents/2018/aac_105c_12018crp/aac_105c_12018crp_18rev_1_0_html/AC105_C1_2018_CRP18Rev01E.pdf).

<sup>58</sup> See Erwin, Sandra, “Pentagon space posture: Don’t even try to mess with us”, SpaceNews, 19 January 2018, quoting Secretary of Defence Jim Mattis: “We’ll come up with arms control agreements at some point, and we’ll start getting this under control”, adding, “In space we will do our best to deter. But for right now, it’s about sizing up the problem and making certain that our diplomats will be negotiating from a position of strength.” See also Loverro, Douglas, “Why the US must lead again: An open memo to the incoming executive secretary of the National Space Council on the occasion of the 50th anniversary of the Outer Space Treaty”, *The Space Review*, 14 August 2017, <http://www.thespacereview.com/article/3307/1>.

<sup>59</sup> Foreign Minister Sergey Lavrov’s statement at the Conference on Disarmament, Geneva, February 28, 2018, [http://www.mid.ru/en/foreign\\_policy/news/-/asset\\_publisher/ckNNonkJE02Bw/content/id/3102270](http://www.mid.ru/en/foreign_policy/news/-/asset_publisher/ckNNonkJE02Bw/content/id/3102270).

<sup>60</sup> Statement by Ambassador FU Cong, Head of Chinese Delegation at the UNIDIR Space Security Conference, 24 August 2015, <http://www.china-un.ch/eng/hom/t1291114.htm>.

<sup>61</sup> Statement by Ms Rachita Bhandari, First Secretary Permanent Mission of India to the Conference on Disarmament at the UNIDIR Space Security Conference, 20 April 2017, <http://www.unidir.ch/files/conferences/pdfs/india-en-1-1220.pdf>.

## No debris, low debris, notification

Acknowledging that any limitation on the possession of ASATs is unlikely, this paper suggests that States consider adopting three basic guidelines for testing, based on the recommendation of the GGE on TCBMs cited above: no debris, low debris, notification.

As discussed throughout this paper, the proposed ASAT guidelines are, by and large, already used in practice. By avoiding the creation of significant amounts of long-lived debris in ASAT tests throughout the last decade, China and the United States have avoided the widespread public criticism that earlier ASAT tests drew. By explicitly stating these principles in guidelines, States would provide each other, as well as private actors, with assurances that testing new ASAT technology will not put the long-term sustainability of human space activities at risk.

These proposed guidelines would also apply to all types of ASAT capabilities, whether they be a missile interceptor or a co-orbital drone, whether it be “hit-to-kill” or energy based. The key element would be that the test should not create long-lived debris. In this respect, the guidelines would implement the recommendations of the GGE on TCBMs on intentional orbital breakups, including that of compliance with existing COPUOS Space Debris Mitigation Guidelines.<sup>62</sup> The notification guideline would also be in line with The Hague Code of Conduct Against Ballistic Missile Proliferation, a voluntary agreement under which subscribers commit to providing pre-launch notifications on launches of ballistic missiles and space-launch vehicles and test flights.<sup>63</sup>

Yet perhaps the most compelling argument for adopting these three guidelines is that it would promote the very stability and sustainability necessary for investments in space. Notably, they would be consistent with existing US, Russian and Chinese policies to unleash the full economic potential of their domestic space resources. For the United States, this would be of particular importance as it prepares to authorize a wide array of non-traditional space activities within those orbits most at risk from ASAT tests. Indeed, the thriving space economy that benefits people all over the world could come under serious threat should there be any more incidents like the 2007 test.

These guidelines would, of course, not be legally binding on States. There are, however, legal implications that should incentivize States to abide by such norms, namely the notion of responsibility under the Outer Space Treaty and fault under the Liability Convention. The guidelines would help States avoid incurring liability for any damages resulting from space debris created by ASAT testing, as stipulated by these treaties. This could be of particular importance as tracking capabilities are steadily improving, which makes the correct attribution of damage to a third party more likely. This same technology will also assure the verifiability of the guidelines by allowing third parties to track and monitor ASAT testing activities in orbit.

It is important to note that these ASAT test guidelines would not be a blanket prohibition on the testing of ASATs, or their possession. They would also not be intended to interfere with the development of ballistic missile technology or missile defence shields. Nor would such guidelines be

### Proposed ASAT test guidelines

**No Debris:** if an actor wishes to test ASAT capabilities, they should not create debris;

**Low Debris:** if an actor must create debris during an ASAT test, the test should be carried out at an altitude sufficiently low that the debris will not be long-lived; and,

**Notification:** actors testing ASATs should notify others of their activities (even if they are not completely transparent on the motivation behind the test) to avoid misperceptions or misinterpretations.

<sup>62</sup> Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space, endorsed by COPUOS at its fiftieth session, 2007, A/AC.105/890, § 99, [http://www.unoosa.org/pdf/publications/st\\_space\\_49E.pdf](http://www.unoosa.org/pdf/publications/st_space_49E.pdf).

<sup>63</sup> Section 4(a)(iii) of The Hague Code of Conduct against Ballistic Missile Proliferation. India, the Russian Federation and the US are Subscribing States to the Code; China is not, [https://www.hcoc.at/?tab=what\\_is\\_hcoc&page=text\\_of\\_the\\_hcoc](https://www.hcoc.at/?tab=what_is_hcoc&page=text_of_the_hcoc).



intended to prejudice the subsequent development of space security agreements—which could be broader in nature or legally binding. Rather, the guidelines would spell out the types of behaviour that have thus far been globally acknowledged as responsible. The purpose of these guidelines is, therefore, to limit behaviour that generates long-lived debris.

Finally, some consideration should be given to the possible options for adoption of this suggestion by the international community. §45 of the report of the GGE on TCBMs demonstrates that the principles underlying these guidelines are already acknowledged as being desirable among certain members of the international community, but further steps are needed for effective implementation. There are two bodies that have been discussed in this paper the mandates of which are most relevant to ASAT testing: the CD and the UNDC. The CD might be the most likely forum to address this issue, particularly within the newly formed working group on PAROS. However, there are still many challenges to progress in the CD and so other options should be considered. The UNDC, could also discuss the guidelines in its Working Group II as a means to implement the recommendations of the GGE on TCBMs. It might even be possible to address these guidelines in COPUOS, but there has historically been hesitance to discuss issues such as self-defence and “weapons” in the context of “peaceful uses of outer space”. An alternative means of codifying the guidelines could be through the First Committee of the General Assembly, whereby they could be proposed in a resolution. If this should also not prove to be possible, Member States could make individual declarations, indicating their willingness to incorporate the guidelines into national policies. By acknowledging the efficacy of this limited approach to ASAT testing, individual States can strengthen the argument that the guidelines represent best practices and responsible behaviour.

## **Conclusion**

In light of increased tensions among the major spacefaring States, it is critical that steps be taken to protect the tremendous growth of activities in orbit, which benefit all humankind. While the time may not yet be ripe for a comprehensive ban on the weaponization of outer space, a limited, focused initiative could help to provide the basis for consensus by building confidence in this key area of ASAT testing norms. The proposed guidelines—no debris, low debris and notification—based on the recommendation of the GGE on TCBMs, would not only be consistent with international law and soft law norms, they would also commend themselves to the national economic policies of the very States who seek to possess ASATs. By adopting these limited guidelines, the international community could take a small step not only towards ensuring the utility of our orbits for the future but also, in its own way, to strengthen confidence here on Earth.





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## **Towards ASAT Test Guidelines**

Today, the world's military and space superpowers are simultaneously investing in space capabilities as well as counter-space technologies that neutralize, even destroy, satellites and other space objects. Even if these technologies are never deployed, mere testing could greatly deteriorate stability in Earth's orbits by producing large amounts of debris. Guidelines for the testing of such technologies—no debris, low debris, notification— could be one option for enhancing security in outer space.