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Shared risks:

An examination of universal space security challenges

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UNIDIR RESOURCES

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List of acronyms and abbreviations

ASAT	anti-satellite weapon
CD	Conference on Disarmament
GGE	Group of Governmental Experts
ITU	International Telecommunication Union
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

Key findings

- The space economy continues to grow at a rapid pace in large part because of the lowering cost of access to space. However, the on-going development of counter-space capabilities by a few key actors creates threats for all stakeholders, affecting space actors and end users alike.
- Three challenges are common to space technologies associated with counter-space capabilities: they can be dual use/multi-use; they can be destructive beyond intended targets; and the intentions behind use are often unclear, especially when used by the military. Together, these three challenges could combine to threaten the peaceful and sustainable use of Earth’s orbits.
- To understand and try to respond to these challenges, several United Nations bodies are presently carrying out discussions, including the Disarmament Commission Working Group II, which is looking at ways to effectively implement transparency and confidence-building measures (TCBMs).
- TCBMs that can be implemented today to reduce tension in space include advance notice of on-orbit drone manoeuvres, adoption of anti-satellite weapon test guidelines, and publishing policies on the use of counter-space capabilities. Furthermore, a coalition of like-minded States could encourage adoption of TCBMs by committing only to purchasing technology and services from States and companies that implement them.

Part I—Where we are

1 Introduction

Today, there are more human activities in outer space than at any point in history. Diverse actors with new-found access to space are finding new applications for emerging technologies, further widening the spectrum of stakeholders in the space environment. An ever-broader range of governments, companies and academic institutions are all increasing their space presence in a bid to gain a share of the 'space economy', which is now valued at US$ 350 billion.[1] Indeed, space-based services already underpin many of the technological advances taking place all over the world and will only become more critical in years to come.

While the range of space stakeholders continues to broaden, only a small group of States tend to prompt conversations about 'space security', a topic that deals with harmful, intentional acts against space systems. More specifically, a subset of military space activities—namely the development of 'counter-space capabilities'—seems to gain the most attention in the media and international forums. Yet, the vast majority of stakeholders involved in commercial or scientific space activities do not see themselves as part of the geopolitical tension that exists in the news.

The reality, though, is that everyone's interests are connected in the exploitation of outer space. While most actors in space today do not directly deal with counter-space capabilities, its ongoing development and possible deployment changes the overall context of all space activities. In particular, three space security issues apply to everyone. First, many space technologies are 'dual use' or 'multi-use' by nature, so even civilian operations can advance military aims or affect geopolitical relations among States. Secondly, some concepts for counter-space capabilities are destructive, which can lead to long-lived space debris with implications for objects beyond the intended target. Thirdly, the intent or purpose behind some space activities is inherently unclear, creating uncertainty that further exacerbates tensions among geopolitical rivals and others. Because of these issues, it is difficult today to categorize civilian and military activities clearly or distinguish between defensive and aggressive intentions in outer space. Moreover, the lack of international regulations and transparency related to space technology increases the likelihood of the active development, testing and deployment of counter-space capabilities.

To address these and other challenges, there are several United Nations forums for dialogue that seek to strengthen stability and reduce tension in outer space. In particular, the United Nations is exploring various strategies that can help to prevent an arms race in outer space. These include efforts to elaborate measures that could form elements of a new, legally binding instrument, as well as voluntary, political agreements. Part I of this paper contextualizes these efforts, including how the space economy is growing and what some of the drivers are behind that growth. It will also show how space security challenges impact all space stakeholders, regardless of classification or origin. Finally, it will describe the current United Nations initiatives aimed at overcoming space security challenges.

Part II of this paper will examine several recommendations, made by a United Nations Group of Governmental Experts in 2013, to implement transparency and confidence-building measures (TCBMs) for outer space activities. In particular, this paper will indicate how space stakeholders can

[1] "The Annual Compendium of Commercial Space Transportation: 2018", US Federal Aviation Administration, January 2018, p. 9, https://www.faa.gov/about/office_org/headquarters_offices/ast/media/2018_AST_Compendium.pdf.

implement TCBMs not only at the multilateral level but also at the regional or national level, where State governments have more flexibility in their policies. Moreover, this paper will suggest how momentum to adopt TCBMs could flow inward, originating with stakeholders that are still new to space activities and reaching established space-faring nations. The combination of these two approaches, TCBMs and outside-in momentum, could play a significant role in creating the conditions necessary to overcome today's space security challenges.

2 The current space security outlook

2.1 GROWTH IN THE SPACE ECONOMY

The 'space economy' is a short-hand reference for all the activities and transactions related to the outer space sector that create economic value. This includes everything from satellite manufacturing revenue to rocket launches to the sale of transportation information. By examining certain aspects of this phenomenon, it is possible to see how far space technology and services have grown in recent years.

For example, in 2008, seven countries, and a regional organization, launched 106 objects into orbit, 42 of which were commercial.[2] There were a total of 69 rocket launches, 28 of which were commercial and valued at roughly US$ 1.97 billion.[3] Including manufacturing, satellite services and ground equipment, that year the space economy was valued at roughly US$ 144 billion.[4] In 2017, 19 countries, and a regional organization, launched 469 objects, of which 292 were commercial.[5] The number of launches rose to 90, 33 of which were commercial and valued at nearly US$ 3 billion.[6] Along with all other related space sectors, the total value of the space economy rose to US$ 350 billion.[7]

The number of objects launched per year quadrupled in less than 10 years, while the ratio of commercial to non-commercial objects went up six-fold. The countries of origin of these objects also more than doubled, with payloads originating not only from the Russian Federation and the United States, but also from other countries, for example Ecuador and the United Arab Emirates. Furthermore, the nature and purpose of space objects is expanding. In addition to supporting telecommunications and remote-sensing industries, new applications like in-space manufacturing and on-orbit servicing are emerging. This demonstrates that growth in space is not only vertical, in terms of improving technology, but also horizontal, in spreading to new domains.

Much of the growth in space activities is attributable to improvements in hardware and the diminishing price of access to outer space.[8] The combination of lighter payloads and more-efficient launch vehicles permits a wider range of actors to become engaged in space activities. These actors are both public and private, including academic institutions, companies and civil space agencies.

The miniaturization of satellites is a good example of this trend. Smaller computing components and improved energy systems enable the production of satellites weighing as little as 1kg or even less. Moreover, much of the requisite hardware can now be purchased 'off the shelf', so space objects no longer need to be built from scratch. With such resources, even schoolchildren can assemble and

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[2] "Commercial Space Transportation: 2008 Year in Review", US Federal Aviation Administration, January 2009, p. 8, https://www.faa.gov/about/office_org/headquarters_offices/ast/media/2008%20Year%20in%20Review.pdf.
[3] Ibid., p. 9.
[4] "State of the Satellite Industry Report", Satellite Industry Association, August 2009, p. 6, https://www.sia.org/wp-content/uploads/2014/09/2009-State-of-Satellite-Industry-Report-Final-Updated-8-25-2009.pdf.
[5] "The Annual Compendium of Commercial Space Transportation: 2018", US Federal Aviation Administration, January 2018, p. 36, https://www.faa.gov/about/office_org/headquarters_offices/ast/media/2018_AST_Compendium.pdf.
[6] Ibid., p. 40.
[7] Ibid., p. 9.
[8] A. Tartar and Y. Qiu, "The New Rockets Racing to Make Space Affordable", *Bloomberg Businessweek*, 26 July 2018, https://www.bloomberg.com/graphics/2018-rocket-cost/; B. Beyer, "The Decline of Commercial Space Launch Costs", Deloitte, n.d., https://www2.deloitte.com/us/en/pages/public-sector/articles/commercial-space-launch-cost.html.

deploy a small satellite capable of taking images of the Earth or recording scientific data.[9] Such cheap, lightweight satellites permit a much broader range of actors, whether public or private, to consider deploying their own space assets. They are even enabling ‘mega-constellations’, namely networks that will feature hundreds, eventually thousands, of small satellites in a single unified system to provide ubiquitous coverage to the entire world.[10]

Simultaneously, specialized rockets have emerged to meet the demands of launching many small objects rather than a single large payload. New Zealand is the most recent addition to the list of space-faring nations, thanks to the launch of a commercial rocket specially designed for such small satellites.[11] This rocket, built by RocketLabs, is a fraction of the size of traditional rockets and will be available for launch in a matter of days rather than months. Traditional rockets can also launch large numbers of small objects, facilitating the sharing of expensive launch costs among many clients. In 2017, India set the record for most satellites launched in a single mission by releasing 104 small satellites from 7 different clients, nearly all of them commercial in nature.[12]

As the cost of space services decreases, global demand is simultaneously increasing. New services like in-flight connectivity and autonomous vehicles will put greater demands on satellite telecommunications and data. Furthermore, the number of ‘end users’, namely those who use space-enabled services, is set to rise dramatically across the South Pacific, Latin America and Africa, where mobile connectivity and broadband penetration is still relatively low.[13] Satellite broadband, in particular, will be a key enabler for bridging the digital gap in these regions, promoting socioeconomic growth across rural and isolated areas. As a result, over the next few decades, even the least developed countries will be highly dependent on the space economy.

2.2 MILITARY ACTIVITIES IN SPACE

In addition to commercial and other civil applications, some States are investing heavily in military space capabilities in order to assert their national interests more effectively at home and around the world. Accordingly, States are strengthening their military presence in outer space. For example, the European Union is investing in a new military satellite communication system as well as increased capabilities for EU member States to detect and track objects in orbit.[14] The emergence of hypersonic missile technology has also prompted the United States to call for space-based early warning sensors to improve tracking and targeting capabilities for incoming missile threats.[15]

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[9] “Satellite Built by Virginia Students to be Deployed in Space”, CBS News, 5 March 2016, https://www.cbsnews.com/news/cubesat-satellite-nasa-arlington-virginia-school-students-to-be-launched-space/.

[10] C. Henry, “FCC Approves SpaceX, Telesat, LeoSat and Kepler Internet Constellations”, SpaceNews, 15 November 2018, https://spacenews.com/fcc-approves-spacex-telesat-leosat-and-kepler-internet-constellations/.

[11] K. Graham, “Rocket Lab Makes History with 1st Successful Commercial Launch”, Digital Journal, 21 January 2018, http://www.digitaljournal.com/tech-and-science/technology/rocket-lab-makes-history-with-1st-successful-commercial-launch/article/512696#ixzz5XCB9lsE2.

[12] “PSLV-C37 Successfully Launches 104 Satellites in a Single Flight”, Indian Space Research Organisation, 15 February 2017, https://www.isro.gov.in/update/15-feb-2017/pslv-c37-successfully-launches-104-satellites-single-flight.

[13] See “Telecoms in 2018 : A Special Report”, The Economist Intelligence Unit, 2017, pp. 2-4, http://pages.eiu.com/rs/753-RIQ-438/images/Telecoms_in_2018.pdf; see also “Satellite & Telecommunication Resellers Global Market Report 2018”, PR Newswire, 30 October 2018, https://www.prnewswire.com/news-releases/satellite--telecommunication-resellers-global-market-report-2018-300740748.html, noting that the Asia–Pacific region was the largest geographic region in satellite and telecommunications reselling, accounting for around 50 per cent of the global market.

[14] See “EU Budget: A €16 Billion Space Programme to Boost EU Space Leadership beyond 2020”, European Commission, Brussels, 6 June 2018, http://europa.eu/rapid/press-release_IP-18-4022_en.htm.

[15] “Missile Defense Review”, US Department of Defense, January 2019, p. 14, https://www.defense.gov/Portals/1/Interactive/2018/11-2019-Missile-Defense-Review/The%202019%20MDR_Executive%20Summary.pdf.

Furthermore, there is a growing trend of militaries outsourcing space services to commercial actors, particularly for satellite communications, remote sensing, as well as research and development.[16] Militaries have long relied on commercial contractors, but new defence policies are calling for an increase in the use of commercial resources because private companies with specialized knowledge are better able to develop and deploy space technology.[17] This will accelerate the deployment of military space assets. Likewise, military contracts are a major source of revenue for space companies.

2.3 WEAPONIZATION OF SPACE

By themselves, none of the applications listed above necessarily rise to the level of a threat to security and stability in space. Indeed, military activities that leverage space capabilities to support operations on Earth have become common practice and are considered permissible under international law.[18] This is referred to as the 'militarization' of space and has arguably existed since the earliest space activities. However, what is not yet clear is whether space may become 'weaponized', whereby States deploy weapons that are either in space or are aimed at space capabilities.

This is the context in which 'counter-space capabilities' are emerging. These are capabilities that can target, disable, or even destroy objects in space, although not all were originally designed for such purposes. Their appearance is not surprising, as it is understandable that geopolitical rivals should seek to protect their assets and potentially deny military capabilities to their adversaries. Two recent reports catalogued and assessed numerous counter-space capabilities that exist or are in development.[19] The four main categories of these capabilities are:

- kinetic physical—involves a direct physical strike or detonation of a warhead near the target, or the physical interference or movement of an object out of a stable orbit;
- non-kinetic physical—uses lasers, microwaves or an electromagnetic pulse to have a physical effect on a target without physical contact;
- electronic—disrupts a target's 'transmit and receive' functions through jamming or spoofing;
- cyber—targets space systems through data and software.[20]

One striking aspect of emerging counter-space capabilities is that the list of actors seeking these tools is very short. China, the Russian Federation and the United States are the only States that have demonstrated capabilities across all four categories. A few other States, such as India, the Islamic Republic of Iran and Israel, have the requisite technology to develop some counter-space capabilities, but have thus far limited their operations in this area. However, as can be seen in other

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[16] A. Pasztor and D. Cameron, "Defense Companies Run Space Race", *Wall Street Journal*, 24 August 2018, https://www.wsj.com/articles/defense-companies-run-space-race-1535130547.

[17] "DOD's Use of Commercial Satellites to Host Defense Payloads Would Benefit from Centralizing Data", US Government Accountability Office, 30 July 2018, https://www.gao.gov/products/GAO-18-493; S. Erwin, Sandra, "U.K. Military Seeks to Ride Wave of Commercial Space Innovation", SpaceNews, 7 November 2018, https://spacenews.com/ u-k-military-seeks-to-ride-wave-of-commercial-space-innovation/.

[18] F. Tronchetti, "Legal Aspects of the Military Uses of Outer Space", *Handbook of Space Law*, Edward Elgar Publishing, 2015, p. 333; F. Lyall and P. Larsen, "Space Law: A Treatise", Ashgate Publishing, 2007, p. 514; S. Hobe and N. Hedman, "Preamble", *Cologne Commentary on Space Law*, Carl Heymanns Verlag Publishing, 2009, p. 22, §9.

[19] "Global Counterspace Capabilities: An Open Source Assessment", Secure World Foundation, April 2018, https://swfound.org/media/206118/swf_global_counterspace_april2018.pdf; "Space Threat Assessment 2018", Center for Strategic and International Studies, April 2018, https://aerospace.csis.org/wp-content/uploads/2018/04/ Harrison_SpaceThreatAssessment_FULL_WEB.pdf.

[20] "Space Threat Assessment 2018", Center for Strategic and International Studies, April 2018, pp. 3-4, https://aerospace.csis.org/wp-content/uploads/2018/04/Harrison_SpaceThreatAssessment_FULL_WEB.pdf.

cases of space technology, horizontal proliferation is likely to take place over time. Electronic and cyber capabilities are particularly attractive tools because they are cost effective, are relatively easy to acquire and have the potential to balance asymmetric rivalries.[21] The extent of damage possible to a space system through a sophisticated cyber-attack is still unknown, but the socioeconomic consequences could be extensive.

Regardless of the specific purposes or applications of counter-space capabilities, their development and deployment fundamentally change the context of space activities either by raising suspicions about space operations or creating new hazards. Counter-space capabilities raise three questions that apply in some form or another to all space activities:

- whether the underlying technology is dual use or multi-use;
- whether the resultant capabilities are destructive or non-destructive; and
- what are the policies behind the technology.

These questions can make the activities of all actors, including governmental, commercial and civilian ones, seem potentially threatening or destabilizing. As such, each will have to consider how their behaviours might contribute to space security problems as well as how to respond to threats from counter-space capabilities.

[21] "Global Counterspace Capabilities: An Open Source Assessment", Secure World Foundation, April 2018, p .7-1; "Space Threat Assessment 2018", Center for Strategic and International Studies, April 2018, p. 5, https://swfound.org/media/206118/swf_global_counterspace_april2018.pdf.

3 Shared risks

3.1 DUAL USE AND MULTI-USE

In general, 'dual-use' technology is that which can be used both for civil and military purposes. While there is no widely accepted definition, most institutional discussions on dual use focus on technologies that are available to the public but can be used for military objectives.[22] Examples of dual-use space systems include global positioning, telecommunications and reconnaissance, all of which can serve either civilians or militaries. This is different from technology that is 'multi-use', which is technology that can serve defensive or offensive ends. This type of technology can originate with civilian (including commercial) entities who intend the technology to be used for civilian purposes but can nevertheless be weaponized.

One of the classes of dual-use/multi-use space technology that has generated concern is that of the co-orbital drone. This technology has several other names, including 'rendezvous proximity operation vehicle' (RPOs) or 'on-orbit service vehicle'. These drones are small, manoeuvrable objects that can be equipped with a variety of tools such as cameras, grappling arms or refuelling equipment. Their functions are as diverse as their designations, including the potential to inspect, repair and refuel all classes of satellites, as well as to conduct debris removal.[23] These objects are controlled from the Earth but will increasingly possess autonomous capabilities, particularly for approach manoeuvres with other objects. This technology is likely one of the next major innovations in space activities and there are wide ranges of governmental and non-governmental actors all over the world developing these tools.[24]

In addition to the 'extension of life' applications listed above, however, is the potential for both defensive and offensive military operations. Indeed, the very earliest co-orbital vehicle was the *Istrebitel Sputnikov*, or 'satellite destroyer'.[25] Developed by the Soviet Union in the 1950s, this craft could be launched to catch up to an object orbiting in space, then detonating an explosive charge that would disable or destroy the target. Today, publicly available evidence shows that, in addition to close-range detonations, co-orbital drones are capable of capturing satellites,[26] intercepting

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[22] See the Wassenaar Arrangement, which does not define 'dual-use' specifically but sets out lists of sensitive dual-use technology, the transfer of which should be restricted under the terms of the Arrangement, https://www.wassenaar.org/about-us/; see also Article 2(1) of the European Council Regulation no. 428/2008 of 5 May 2009, "Setting up a Community Regime for the Control of Exports, Transfer, Brokering and Transit of Dual-Use Items", which defines dual-use as "items, including software and technology, which can be used for both civil and military purposes, and shall include all goods which can be used for both non-explosive uses and assisting in any way in the manufacture of nuclear weapons or other nuclear explosive devices."

[23] "DARPA Creating Industry/Government Group for Safe Operation of Space Robotics", *Defense Advanced Research Projects Agency*, 11 November 2016, https://www.darpa.mil/news-events/2016-11-29; Y. Fu, "'Space Rescue Vehicle' Allows Satellites to 'Delay Retirement'", *Science and Technology Daily*, 1 August 2018, http://www.spacechina.com/n25/n148/n272/n4789/c1896199/content.html.

[24] S. Erwin, "In-Orbit Services Poised to Become Big Business", SpaceNews, 10 June 2018, https://spacenews.com/in-orbit-services-poised-to-become-big-business/.

[25] A. Arbatov, V. Dvorkin and P. 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 B. Hendrickx, "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/wpcontent/uploads/2016/09/Naryad-V-and-the-Soviet-Anti-Satellite-Fleet.pdf; see also A. Zak, "Military: IS Anti-Satellite System", RussianSpaceWeb.com, 13 July 2017, http://www.russianspaceweb.com/is.html.

[26] "RemoveDEBRIS", University of Surrey, n.d., https://www.surrey.ac.uk/surrey-space-centre/missions/removedebris.

communications[27] and conducting on-orbit jamming.[28] Some experts have suggested that a State could deploy many drones and leave them dormant, located in orbit behind strategically important satellites belonging to a rival; these drones would be in a position to carry out simultaneous strikes that disrupt an entire space system.[29]

At present, it is difficult to know what a particular co-orbital drone might be capable of without physically inspecting it. In fact, the dual-use nature of co-orbital drones, combined with the often-opaque nature of military space activities, has led to several recent instances of high-level accusations that such technology is compromising the national security of States.[30] While these accusations were denied, without further information from either party it is difficult to objectively settle these matters. Instances such as these raise suspicions about co-orbital technology and its purposes in general.

What is more, non-military actors could unintentionally be adding to the tension among space powers through their own advancements. For example, a consortium of civilian and commercial actors recently successfully tested a small, manoeuvrable drone, called RemoveDEBRIS, that used a net to capture a space object.[31] This device is intended to be used to clean up debris but, from a technical or defence perspective, could be perceived as the testing of a weapon. Consequently, a private consortium could inadvertently contribute to mistrust among State actors.

The inability to distinguish between civilian and military objects comes with the additional complication that it might make some civilian objects appear as legitimate military targets. Under article 52 of the 1977 Protocol Additional to the Geneva Conventions of 12 August 1949, and relating to the Protection of Victims of International Armed Conflicts (Additional Protocol I), civilian objects should not be attacked, only those objects "which by their nature, location, purpose or use make an effective contribution to military action and whose total or partial destruction, capture or neutralization, in the circumstances ruling at the time, offers a definite military advantage".

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[27] See T. Molczan, "Unknown GEO Object 2000-653A / 90007 Identified as Prowler", *Visual Satellite Observer*, 21 January 2011, http://satobs.org/seesat_ref/STS_38/Unknown_GEO_Object_2000-653A_-_90007_Identified_as_Prowler.pdf; see also "Prowler Profile", Gunter's Space Page, 17 January 2018, https://space.skyrocket.de/doc_sdat/prowler.htm.

[28] B. Gertz, "Inside the Ring: China Targets Global Hawk drone," *The Washington Times*, 11 December 2013, https://www.washingtontimes.com/news/2013/dec/11/inside-the-ring-china-targets-global-hawk-drone/; "Depth: How does China interfere with the US Global", *Sina Military News*, 28 May 2015, http://mil.news.sina.com.cn/2015-05-28/1648831946.html; "Space Threat Assessment 2018", *Center for Strategic and International Studies*, April 2018, p. 10, https://aerospace.csis.org/wp-content/uploads/2018/04/Harrison_SpaceThreatAssessment_FULL_WEB.pdf.

[29] See B. Chow, "Stalkers in Space: Defeating the Threat", *Strategic Quarterly Studies*, 1 June 2017, https://www.airuniversity.af.mil/Portals/10/SSQ/documents/Volume-11_Issue-2/Chow.pdf.

[30] See United States remarks at the CD, as delivered by Assistant Secretary of State for Arms Control, Verification and Compliance Yleem D.S. Poblete, 14 August 2018, Geneva, Switzerland, https://geneva.usmission.gov/2018/08/14/remarks-by-assistant-secretary-yleem-d-s-poblete-at-the-conference-on-disarmament/; see also Russian Federation Remarks at the CD, as delivered by Deputy Permanent Representative to the CD Mr. Alexander Deyneko, 14 August 2018, Geneva, Switzerland, https://conf.unog.ch/digitalrecordings/#; see also J. Irish, "France Accuses Russia of Spying on Military from Space", Reuters, 7 September 2018, https://uk.reuters.com/article/uk-france-russia-security/france-accuses-russia-of-spying-on-military-from-space-idUKKCN1LN1YG; see also "The [Russian] Foreign Ministry Responded to Charges of France in an Attempt to Intercept Satellite Signals", RIA News, 13 September 2018, https://ria.ru/space/20180913/1528505033.html

[31] "Net Successfully Snares Space Debris", University of Surrey, 19 September 2018, https://www.surrey.ac.uk/news/net-successfully-snares-space-debris.

Thus, under the Protocol—which applies to the activities of all States under customary international law[32]—civilian space objects should not be targets of attack, regardless of the methods used. However, if the civilian object is making an effective contribution to military actions, such as interfering with critical military satellites, then it loses its protection under international law. In the case of co-orbital drones, if rivals perceive these as tools for advancing military objectives in space, even commercial drones and the companies that operate them could be treated as legitimate targets. As such, the drones might be the targets of persistent jamming, or the companies themselves could be the subject of cyberattacks.

At present, there are no rules prohibiting the placement of any type of technology in space other than nuclear weapons or weapons of mass destruction.[33] However, there is widespread agreement that some rules should be put in place.[34] Co-orbital drones are just one type of technology that raises international concerns and may require new rules or norms, including for the purpose of keeping civilian objects safe from attack. One possibility is to regulate dual-use/multi-use technology at the international level. Yet one of the biggest challenges when developing rules for any technology, and a source of government caution in this regard, is the difficulty of regulating dangerous applications without hindering desirable ones. However, this could change if there were to be a strike on a satellite using destructive capabilities.

3.2 DESTRUCTIVE AND NON-DESTRUCTIVE

A wide array of methods exists for neutralizing space objects, including jamming, blinding or physical destruction.[35] The latter approach can involve the use of direct-ascent anti-satellite (ASAT) missiles, co-orbital drones or other means such as high-powered lasers.[36] The space debris that would result from the use of physically destructive counter-space capabilities makes these a major challenge to the long-term sustainability of human space activities. Resulting debris from an on-orbit breakup travels at speeds fast enough to cause serious damage to satellites and can remain in orbit for decades.[37] The US Space Surveillance Network tracks more than 23,000 objects larger than 10 cm in orbit and estimates that there are over 500,000 objects larger than 1 cm.[38] While some debris is a consequence of routine space activities, like parts of old rockets, other debris comes from intentional acts. For example, China destroyed one of its own satellites in 2007, creating a cloud of debris consisting of 3,280 pieces of trackable debris, as well as up to 32,000 pieces that are too small to track.[39] The threat of destructive counter-space capabilities thus goes beyond a single object, extending to all objects operating in nearby orbits.

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[32] "Legality of the Threat or Use of Nuclear Weapons: Advisory Opinion of 8 July 1996", International Court of Justice, §79, https://www.icj-cij.org/files/case-related/95/095-19960708-ADV-01-00-EN.pdf.

[33] 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.

[34] General Assembly resolution 72/26, "Prevention of an Arms Race in Outer Space", adopted by vote 182-0-3, noting that "Convinced that further measures should be examined in the search for effective and verifiable bilateral and multilateral agreements in order to prevent an arms race in outer space, including the weaponization of outer space."

[35] "Global Counterspace Capabilities: An Open Source Assessment", Secure World Foundation, April 2018, p. xviii, https://swfound.org/media/206118/swf_global_counterspace_april2018.pdf.

[36] "Space Threat Assessment 2018", Center for Strategic and International Studies, April 2018, p. 3, https://aerospace.csis.org/wp-content/uploads/2018/04/Harrison_SpaceThreatAssessment_FULL_WEB.pdf.

[37] "Orbital Debris FAQ Sheet", NASA, n.d., https://www.nasa.gov/news/debris_faq.html.

[38] "White House Office of Science and Technology Policy: Orbital Debris Report", 14 August 2017, https://www.whitehouse.gov/wpcontent/uploads/2017/12/08-14-17-OSTP-Orbital-Debris-Report.pdf.

[39] See "NORAD Two-Line Element Sets: Current Data", Center for Space Standards and Innovation, 7 February 2019, https://celestrak.com/NORAD/elements/; L. David, "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-

Destructive counter-space capabilities pose the most immediate threat to actors not involved in geopolitical rivalries. Indeed, non-kinetic forms of counter-space capabilities are already used, but do not attract widespread attention. As evidence, over the last 10 years, there has been ample documentation of electronic jamming of satellite signals on the battlefield—including in Ukraine and the Syrian Arab Republic[40]—as well as examples of hacking satellite systems.[41] However, these uses of counter-space capabilities are part of standard tactical operations and have not (so far) provoked the public outcry that followed earlier kinetic ASAT tests.[42] This is largely due to the fact that electronic and cyber operations do not necessarily have permanent, physical implications for the rest of the space community through the creation of debris. This suggests that while non-destructive counter-space activities are at least tolerable to the international community, destructive capabilities raise the biggest concerns because of the indiscriminate harm that can follow.

3.3 THE ROLE OF SPACE POLICIES

Often, when States detect the manoeuvres of foreign objects in space, they have little information beyond what they perceive with telescopes and radars. These observations might reveal the trajectory of the object and some physical characteristics, but one cannot determine the nature of an object's mission without further information. Intent is, therefore, a very difficult thing to assess.

The 1972 Convention of the Registration of Objects Launched into Outer Space (Registration Convention) provides States with a platform to share information. Under this agreement, States commit to providing technical details to the United Nations Register, operated by the United Nations Office for Outer Space Affairs in Vienna, such as the name of the launching State or States, designator/registration number of the object, date and territory or location of launch and basic orbital parameters.[43] However, many objects, particularly military satellites, are either not registered or are registered with only very general information.[44] This makes it difficult to assess the nature of objects like co-orbital drones. Article II of the Registration Convention also obliges States to maintain a national registry to record space objects launched by that State. However, most do this sporadically.[45] Consequently, national registries are not reliable sources when trying to determine intentions behind military manoeuvres in orbit.

States can also look to filings made with the International Telecommunication Union (ITU), whose mandate includes coordination of frequency usage and geostationary orbital slot assignments, as

circles-earth.html; B. Weeden, "Through a Glass Darkly: Chinese, American and Russian Anti-Satellite Testing in Space", Secure World Foundation, 17 March 2014, p. 17, https://swfound.org/media/167224/through_a_glass_darkly_march2014.pdf.

[40] "Space Threat Assessment 2018", Center for Strategic and International Studies, April 2018, p. 15, https://aerospace.csis.org/wp-content/uploads/2018/04/Harrison_SpaceThreatAssessment_FULL_WEB.pdf.

[41] Ibid., p. 11.

[42] See D. Porras, "Towards ASAT Test Guidelines", UNIDIR, May 2018, pp. 5–6, http://unidir.org/files/publications/pdfs/-en-703.pdf.

[43] Article IV of the Convention of the Registration of Objects Launched into Outer Space.

[44] The United Nations Office for Outer Space Affairs notes on its website that, "[t]o date over 90% of all satellites, probes, landers, crewed spacecraft and space station flight elements launched into Earth orbit or beyond have been registered with the Secretary-General", http://www.unoosa.org/oosa/en/spaceobjectregister/index.html; a review of many of the registrations shows that many are very general in nature (listing the general function of a satellite as 'remote sensing' or 'scientific experiment') and regularly exclude orbital parameters.

[45] R. Jaku, B. Jasani and J. McDowell, "Critical Issues Related to Registration of Space Objects and Transparency of Space Activities", *Acta Astronautica*, vol. 143, 2018, pp. 408–409, https://planet4589.org/space/papers/JJM2018/JJM_published.pdf.

well as maintenance of a registry with each filing.[46] While these filings might disclose additional details related to types of applications, military satellites are not bound by ITU parameters and may change frequencies if circumstances so require.[47] Furthermore, many States now employ optical (laser) technology for communicating with satellites, operating at frequencies outside of the ITU's mandate.[48] ITU registrations are, therefore, also insufficient for States to ascertain the true intentions of an unknown object in space.

In the absence of further additional information, many States and other actors have only the official State policies (or doctrines) of others on their space activities to provide the necessary context for what certain actions might mean. Such policy declarations are often general in nature and do not necessarily cover all specific classes of activities. Nevertheless, they can offer insight into the aims and objectives of a particular State. For example, the French Space Policy lists four priorities: maintaining independent access to space, providing opportunities for civil and industry actors, developing space-data services and maintaining their scientific programmes.[49] These four pillars provide context for all French space activities and, since most of their activities generally align with these policies, other actors can have some confidence in the nature of French space manoeuvres. Certain national actors have recently generated anxiety among the international community as they refine their policies, particularly with the desire to further leverage private actors for military purposes.[50] Others do not publish formal policies at all, which, in the case of major space actors that are seeking counter-space capabilities, leads to uncertainties about the circumstances or situations in which certain technology might be used.[51]

The danger that is growing in space activities is that the combination of rapidly developing technology, a proliferation of space-capable actors and mistrust will lead to States racing for counter-space capabilities. Mistrust, in particular, can lead to miscalculations and misunderstandings when there is novel technology involved. Both major space powers and minor ones can contribute to this mistrust. Consequently, any solution to govern mistrust over counter-space capabilities will have to factor this in.

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[46] §1(2)(a) of the ITU Constitution (2015), http://search.itu.int/history/HistoryDigitalCollectionDocLibrary/5.21.61.en.100.pdf.

[47] §48(1) of the ITU Constitution notes that "Member States retain their entire freedom with regard to military radio installations".

[48] S. Freedberg, "Army, NASA Want Laser Micro-Satellites for 50 Times the Bandwidth", *Breaking Defense*, 2 August 2018, https://breakingdefense.com/2018/08/army-nasa-want-laser-micro-satellites-for-50-times-the-bandwidth/.

[49] "France's Space Policy", 28 October 2016, https://www.gouvernement.fr/en/france-s-space-policy.

[50] "President Donald J. Trump is Unveiling an America First National Space Strategy", White House, 23 March 2018, https://www.whitehouse.gov/briefings-statements/president-donald-j-trump-unveiling-america-first-national-space-strategy/; see also M.B. Griggs, "Trump's Space Force Aims to Create 'American Dominance in Space' by 2020", *Popular Science*, 9 August 2018.

[51] "Global Counterspace Capabilities: An Open Source Assessment", Secure World Foundation, April 2018, p. 2-32, https://swfound.org/media/206118/swf_global_counterspace_april2018.pdf.

4 Current multilateral processes

One of the major agenda items for the Conference on Disarmament (CD)—the principal forum for multilateral dialogues on disarmament and arms control—is the prevention of an arms race in outer space (PAROS). The CD has been examining this issue for decades but, due to its inability to agree on a programme of work, there is little substantive progress to show on PAROS within this forum.[52] In 2018, the CD took the historic step of forming Subsidiary Bodies, including one for PAROS, to examine agenda items outside of the plenary.[53] The Subsidiary Body on PAROS produced a report that contained some ideas on how to move forward, but it is as yet unclear what will be done with this report.[54] Additionally, there are two dialogues ongoing within the United Nations aimed at addressing the challenges around counter-space capabilities and PAROS. These have two distinct but complementary approaches: one seeking a legally-binding treaty and one seeking voluntary TCBMs.

For a treaty, the Chinese and Russian delegations to the CD proposed in 2008 (and revised in 2014) a draft Treaty on the Prevention of the Placement of Weapons in Outer Space, the Threat or Use of Force against Outer Space Objects (PPWT).[55] This text has met with a variety of responses from States, including a view that it is unverifiable.[56] In 2017, the General Assembly passed a resolution for the formation of a Group of Governmental Experts (GGE) to examine elements that might go into a legally binding instrument on PAROS.[57] This Group of 25 Member States met in Geneva for its first session (August 2018) and will meet again (March 2019) to attempt to adopt a consensus report. If such a report is achieved, it will be a meaningful step, but many more will be needed to achieve a legally binding instrument. In the meantime, there is still considerable blockage within the United Nations, where even traditionally popular resolutions on space security are being met with new resistance.[58]

Others have recommended the adoption and implementation of voluntary TCBMs as an interim or complementary approach to pursuing a new legal instrument. In particular, in 2013, a GGE on TCBMs adopted a consensus report.[59] In their report, the GGE issued a number of recommendations that might serve as “a means by which Governments can share information with the aim of creating

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[52] P. Meyer, “The CD and PAROS : A Short History”, UNIDIR, April 2011, p. 6, http://www.unidir.org/files/publications/pdfs/the-conference-on-disarmament-and-the-prevention-of-an-arms-race-in-outer-space-370.pdf.

[53] Conference on Disarmament, document CD/2119, 19 February 2018, http://undocs.org/cd/2119.

[54] “Subsidiary Body 3: Prevention of an Arms Race in Outer Space”, Report to the Conference on Disarmament, CD/2140, http://undocs.org/cd/2140.

[55] See the text of the draft Treaty on the Prevention of the Placement of Weapons in Outer Space, the Threat or Use of Force against Outer Space Objects, 16 June 2014, https://www.fmprc.gov.cn/mfa_eng/wjb_663304/zzjg_663340/jks_665232/kjfywj_665252/t1165762.shtml.

[56] “Ambassador Robert Wood: Ensuring the Long-Term Sustainability and Security of the Space Environment”, Mission of the United States, 9 September 2014, https://geneva.usmission.gov/2014/09/09/ambassador-robert-wood-ensuring-the-long-termsustainability-and-security-of-the-space-enviroment/.

[57] General Assembly, “Further Practical Measures for the Prevention of an Arms Race in Outer Space”, document A/RES/72/250, 24 December 2017, http://www.un.org/en/ga/search/view_doc.asp?symbol=A/RES/72/250.

[58] See “Transparency and Confidence-Building Measures in Outer Space Activities”, A/C.1/73/L.68/Rev1, adopted by the First Committee by vote for the first time (176-2-2). The United States, while still supporting the adoption of TCBMs, explained that its vote was due to the linkage of TCBMs to on-going discussions for the draft PPWT; see http://reachingcriticalwill.org/disarmament-fora/unga/2018/resolutions.

[59] See General Assembly, “Report of the Group of Governmental Experts on Transparency and Confidence-Building Measures in Outer Space Activities”, document A/68/189, 29 July 2013, https://documents-dds-ny.un.org/doc/UNDOC/GEN/N13/408/35/pdf/N1340835.pdf.

mutual understanding and trust, reducing misperceptions and miscalculations and thereby helping both to prevent military confrontation and to foster regional and global stability".[60]

These recommendations—which can be implemented at a multilateral, bilateral or national level—were intended to be voluntary in nature so that they could be adopted quickly and without embarking on lengthy negotiations. Importantly, some of these recommendations offer useful short-term measures that can be employed at a policy level by any actor to address shared challenges facing space security.

While TCBMs are widely seen as desirable, little has been done to give them practical effect. Consequently, in 2017, the United Nations Disarmament Commission (UNDC) agreed to add this topic to its agenda for its deliberations during the 2018–2020 triennium. The UNDC Working Group was tasked with making recommendations on how to implement TCBMs in outer space activities with a goal of preventing an arms race in outer space and in accordance with the 2013 GGE report. The UNDC Working Group nevertheless offers an opportunity to formulate concrete proposals to reduce tensions in outer space activities.

[60] Ibid., §20.

Part II: Where we might go

5 Operationalizing TCBMs

As noted in Part I of this paper, the 2013 GGE issued recommendations for the implementation of TCBMs. The recommendations are general in nature, which is intentional so that States can adapt them to their own needs. Recognizing that TCBMs can improve stability in space, various United Nations entities already engage with Member States to implement such measures within existing mandates, as evidenced by the work of the Inter-Agency Meeting on Outer Space Activities (UN-Space).[61] However, the ongoing emergence of space security threats indicates that more work needs to be done. Some of the specific recommendations that the UNDC Working Group could examine at its next meeting in 2019 to address the space security issues identified in this paper are:

- notifications on scheduled manoeuvres;
- notifications of intentional orbital break-ups; and
- publication of information on national space policies.

The following are suggestions on how these three TCBMs can be given practical effect by a wide range of States, not only space-faring nations. Furthermore, in order to engender momentum for the widespread adoption of best practices and TCBMs, States could consider forming a coalition that preferentially purchases space technology and services from actors that implement TCBMs.

5.1 NOTIFICATIONS OF SCHEDULED MANOEUVRES

Section 42 of the GGE Report on TCBMs recommends that "States should notify, in a timely manner and to the greatest extent practicable, potentially affected States of scheduled manoeuvres that may result in risk to the flight safety of the space objects of other States".[62]

As noted above, one kind of space technology creating concern is that of co-orbital drones. These objects are designed to manoeuvre often, with comparatively erratic flight trajectories compared to traditional satellites. These objects can be both dual use and multi-use (from extension of life to espionage) and have destructive capabilities (something tested successfully in the past).[63] It is, therefore, understandable that States, or any other actors, have serious reservations about unidentified co-orbital drones approaching their space assets.

Today, provided there is no harmful interference, there are no laws or regulations against approaching a foreign space object. Some experts have proposed the establishment of 'safety zones' or 'exclusionary zones', namely safe distances within which other objects cannot approach without permission.[64] Multilateral guidelines could establish such zones, or failing that even unilateral policy declarations could have some effect by creating informal norms of behaviour.

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[61] See General Assembly, "Transparency and Confidence-Building Measures in Outer Space Activities: Report of the Secretary-General", document A/72/65, 16 February 2017, https://undocs.org/en/A/72/65.

[62] General Assembly, "Report of the Group of Governmental Experts on Transparency and Confidence-Building Measures in Outer Space Activities", document A/68/189, 29 July 2013, https://documents-dds-ny.un.org/doc/UNDOC/GEN/N13/408/35/pdf/N1340835.pdf.

[63] D. Porras, "Towards ASAT Test Guidelines", UNIDIR, May 2018, p. 4, http://unidir.org/files/publications/pdfs/-en-703.pdf.

[64] B. Chow, "Stalkers in Space: Defeating the Threat", *Strategic Quarterly Studies*, 1 June 2017, p. 96, https://www.airuniversity.af.mil/Portals/10/SSQ/documents/Volume-11_Issue-2/Chow.pdf.

Even in the absence of such zones, actors could voluntarily declare when their operations will bring them within a certain distance of another space object. Civilian actors, such as national space agencies, already set a high standard of behaviour by ensuring that they regularly notify States about such manoeuvres. However, militaries will likely be hesitant to divulge information about classified missions. Yet as more actors, such as the European Union and private companies, gain increasingly sophisticated space-tracking capabilities, there will be less reason for covert operations in orbit, since they will be detected anyway. Providing notice of a manoeuvre will enable all classes of operators to avoid alarming other space actors, particularly military ones whose space assets carry strategically valuable payloads. Thus, one way to implement §42 of the GGE Report on TCBMs could be *to provide advance notice of on-orbit drone manoeuvres to potentially affected actors*. At the international level, States could implement this measure by sharing information through a central body, such as the United Nations Office for Outer Space Affairs (UNOOSA).[65] This body's mandate could be expanded to include collection and dissemination of manoeuvre information to a network of national or other points of contact. However, this policy will also have to be enacted at the national level, through regulation on civilian and private actors. As such, it will be important to include these stakeholders in any dialogue on implementing this type of measure in order to ensure that they do not hinder beneficial technological development.

It should be noted that there is already a forum where industry and other stakeholders are discussing best practices for on-orbit services, including not approaching spacecraft without permission—the Consortium for Execution of Rendezvous and Servicing Operations (CONFERS).[66] Such initiatives will help ensure the creation of a vibrant on-orbit service economy without putting the long-term sustainability of outer space activities at risk. Policymakers can work directly with industry members in forums such as this in order to find models for new notification practices that meet national and international security needs. Likewise, by engaging with governments, private actors can help set the standards of best practices while simultaneously helping to reduce the overall suspicion around certain classes of technology.

5.2 NOTIFICATION OF INTENTIONAL ORBITAL BREAK-UPS

Another of the GGE recommendations specifically speaks to the destructive force of some space technologies. Section 45 recommends that:

> 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".[67]

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[65] General Assembly, "Role of United Nations Entities in Supporting Member States in the Implementation of Transparency and Confidence-Building Measures in Outer Space Activities", document A/AC.105/1116, 28 April 2016, §37.

[66] See "DARPA Creating Industry/Government Group for Safe Operation of Space Robotics", DARPA, 29 November 2016, https://www.darpa.mil/news-events/2016-11-29.

[67] General Assembly, "Report of the Group of Governmental Experts on Transparency and Confidence-Building Measures in Outer Space Activities", document A/68/189, 29 July 2013, https://documents-dds-ny.un.org/doc/UNDOC/GEN/N13/408/35/pdf/N1340835.pdf.

As discussed in Part I, kinetic ASATs are a particular concern. These pose a hazard not just if used in open conflict but even in testing.[68] Testing increases tension among space rivals and produces debris that is a threat to all space objects. As noted above, the most significant incident of human-generated debris was not an accidental collision but an intentional orbital break-up. The present concern with this technology is that States will see kinetic ASATs as a critical component of a modern military arsenal and will, therefore, continue testing the technology just to keep the option available for possible use in the future.

The GGE Report on TCBMs makes a recommendation on intentional orbital break-ups that reflects certain 'best practices'.[69] Specifically, §45 can be broken down into three principles:

- **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.

As detailed in a previous UNIDIR publication, one way to give effect to §45 would be *to adopt ASAT test guidelines*.[70] This could be achieved through a multilateral agreement or even unilateral declarations. By so doing, States pursuing ASATs can at least minimize the creation of harmful space debris that could negate progress achieved in lowering the cost of access to space. Moreover, it reduces the possibility that an ASAT test is misperceived as an offensive use. States uninterested in acquiring ASATs can also adopt these policies, adding weight to test guidelines representing desirable practices. Likewise, by issuing regular declarations on the desirability of ASAT test guidelines, States that are not pursuing such measures can build the argument that creating debris through ASAT testing is contrary to best practices in space. Private actors will not likely engage in the testing of ASATs either, but they should also be aware of the implications of kinetically generated debris. As such, civil and commercial actors can encourage leaders and policymakers to pursue international guidelines that preserve economic space investments.

5.3 PUBLICATION OF INFORMATION ON NATIONAL OUTER SPACE POLICIES

Section 37 of the GGE Report on TCBMs recommends that:

> States should publish information on their national space policies and strategies, including those relating to security. States should also publish information on their major outer space research and space applications programmes in order to build a climate of trust and confidence between States worldwide on military and non-military matters. This should be carried out in line with existing multilateral commitments. States may provide any additional information reflecting their relevant defence policy, military strategies and doctrines.[71]

This recommendation is aimed at putting many space activities into context. That is, some of the controversies discussed above emerged largely because States are unable to place specific actions of others within the context of overall space policies, or because there was unclear or conflicting information about what a State's intentions could be throughout a particular mission.

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[68] D. Porras, "Towards ASAT Test Guidelines", UNIDIR, May 2018, pp. 3–6, http://unidir.org/files/publications/pdfs/-en-703.pdf.
[69] Ibid., p. 11.
[70] Ibid.
[71] General Assembly, "Report of the Group of Governmental Experts on Transparency and Confidence-Building Measures in Outer Space Activities", document A/68/189, 29 July 2013, https://documents-dds-ny.un.org/doc/UNDOC/GEN/N13/408/35/pdf/N1340835.pdf.

As §37 states, this information could help to "build a climate of trust and confidence between States worldwide on military and non-military matters". This confidence can be of critical importance when State actors are confronted with a situation that requires a quick response. By gaining a clearer picture of what a State's overall strategy in space entails, it will be easier to distinguish between defensive actions and aggressive ones. The urgency of this measure may not seem obvious to all State actors for the moment, but space policies will become increasingly important as dual-use/multi-use technology becomes widely available, even more so if the technology has destructive capabilities. In this sense, States with space programmes of all sizes can give effect to §37 by *publishing policies on the use of counter-space capabilities*, consistent with their aims in space. Even States that have no counter-space ambitions can publish their space policies, noting that such technology is not desired, to build the case that such publication is a best practice. The more information that is published by States, the more glaring long-standing omissions will be.

Commercial actors in space can take an active role by encouraging their leaders and policymakers to formulate and publish a policy. This can be done in conjunction with the development and dissemination of other policies that are conducive to a vibrant space sector, such as debris mitigation or regulatory reform. Likewise, civilian and commercial actors should seek to be as open and transparent as possible about their operations. Companies might see it as advertisement or social outreach, but extensive public engagement, such as in the case of the RemoveDEBRIS mission discussed above, can have the benefit of making others comfortable with their technology.[72] By increasing the public's understanding of space missions, even private actors can set their own space policies.

5.4 IMPLEMENTATION THROUGH A COALITION

Every State increasingly has an interest in continued access to space services and to maintaining stability in outer space. Whether it be through telecommunications or global positioning, space technology is seeping into daily life around the world, making even the least technologically advanced country susceptible to disruptions in space-based services. However, the efforts of a small number of military actors to develop and possibly deploy counter-space capabilities puts all space activities at risk. The three suggestions for TCBMs listed above that States can readily implement to alleviate existing tensions in space activities would help ease some of this risk. At the same time, some major space-faring States may not yet be ready to commit to these.

Yet there may be options for generating momentum for the widespread adoption of TCBMs from the outside in. One approach could be to form a coalition of States that make it a policy to purchase space capabilities and services preferentially from States (or companies from States) that have adopted best-practice measures. For example, when deciding to launch a satellite, members of the coalition could make it a policy to seek launch services from States (or companies within those States) that implement TCBMs, such as the ones outlined above. This approach would be especially useful for States across Southern Asia, Latin America and Africa. States in these regions regularly purchase space technologies and services but have limited means to influence actors seeking counter-space capabilities. By joining together, States across the southern hemisphere could use their combined purchasing power to incite more decisive action on the adoption of TCBMs.

[72] It should be noted that, at the time of writing, RemoveDEBRIS had not been registered with the United Nations Registry.

It should be noted, however, that any efforts to form preferential policies would have to be done in such a way as not to fall afoul of the World Trade Organization and the General Agreement on Tariffs and Trade.

6 Conclusion

As the space economy continues to grow, space-based services are becoming increasingly central to all aspects of life. This is especially true for militaries that seek to leverage space technology for security purposes. However, the ongoing emergence of counter-space capabilities is changing the context in which all space activities are conducted, raising the likelihood that geopolitical competition will spread to the space domain. This could have the consequence of destabilizing the space environment for all actors. Several United Nations processes are currently seeking to find solutions to this growing risk, including efforts to adopt a legally binding instrument on PAROS and the adoption of voluntary measures.

One possible, practical pathway to reduce tensions in outer space activities is to adopt voluntary TCBMs, as recommended in the 2013 GGE Report on Space TCBMs. Any State can adopt the recommendations contained in that report, even in the absence of consensus among Member States on a multilateral instrument. Three possible options for meaningfully implementing the recommended TCBMs could be:

- providing advance notice of on-orbit drone manoeuvres to potentially affected actors,
- adopting ASAT test guidelines; and
- publishing policies on the use of counter-space capabilities.

Adoption of these policies is possible through multilateral initiatives, but also by a like-minded coalition and unilateral actions. By implementing these voluntary measures through national policies, States can be proactive in developing best practices for space activities that involve TCBMs. In particular, widespread adoption of best practices could be useful in mitigating fears and tension related to new technology. Finally, those States that regularly voice their concerns over the possible 'weaponization' of outer space, and that regularly support the adoption of TCBMs, can generate momentum to adopt such measures by forming a coalition of States that make it a policy to purchase space technology and services only from those States and companies that implement TCBMs. In this way, States might be able to leverage their growing demand for space capabilities to encourage good behaviour and reinforce stability in outer space.

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Briefing paper for the

United Nations Disarmament Commission

Shared risks:

An examination of universal space security challenges

The space economy is becoming critical in importance globally as technology improves and space services become more affordable. Yet the development and possible deployment of counter-space capabilities by a few States could create instability and degrade the space environment for everyone. This paper examines three key challenges that apply for all actors in space. It also offers concrete proposals on how to implement measures to reduce tension in space and encourage adoption of best practices from the 'outside in'.

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