# THE SPACE (INNOVATION) RACE: THE INEVITABLE RELATIONSHIP BETWEEN MILITARY TECHNOLOGY AND INNOVATION

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*Access to outer space is becoming more achievable by a wider array of state and non-state actors. This access is partly fuelled by the constant development of technology that brings down the cost of such access and makes actual space activities more varied and widespread. Associated with these developments is the correlative use of space by military forces, thus manifesting an enduring competition for strategic ascendancy. The combination of multiple actors, advancing technology and the ever-present reality of geopolitical contention in space has put pressure on the existing outer space treaty regime. This treaty regime was primarily drafted in a different era where the realities of contemporary civil–military space activity could only be imagined. This article surveys the development of technology and the nature of civil–military activity in space. It argues that while the outer space treaty regime provides a sound starting point for addressing technological development and military activity in space, there is a strong case for invoking other principles and rules of international law to tackle emerging issues. Presciently, 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') actually envisages this application of general international law, but there has been a tendency to marginalise this invocation and assimilation. This article argues that the time has come to reconcile differing legal regimes to craft solutions for the current space realities. Moreover, creative thinking in merging 'soft' international law with 'hard' domestic law, reaching past the inertia that current international decision-making bodies seem to exhibit, and rethinking interpretations of some Outer Space Treaty provisions by having regard to actual state practice, are areas which need to be fully explored. More strategically, creating a new appreciation and legal mindset for tackling the exponential growth of technology and civil–military space activity is required if space exploration and use is to be sustainably undertaken.*

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## I INTRODUCTION

In the 1967 James Bond movie 'You Only Live Twice', the evil international organisation 'Spectre' contrives to capture the space vessels of both the Soviet

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Union ('USSR') and the United States, intending to spark conflict between the two Cold War space powers.[1] Even before humanity succeeded in landing on the Moon in 1969, the potential for a war in space preoccupied both popular culture and the real world global calculation. Fortunately, in the fictional Bond film, Her Majesty's Special Agent 007 was able to avert the disaster of a war over, or in space, but the potential for war in space remains a reality today.

Armed conflict in space was averted during the Cold War due to numerous diplomatic and security measures, but was also grounded in the grim recognition by the space powers of the day that a war in space would be catastrophic for Earth.[2] Even the conduct of the Starfish Prime nuclear test explosion over the Pacific Ocean in 1962, at a height of 248 miles, proved that nuclear explosions in low Earth orbit would have significant and long-lasting effects.[3] The conclusion 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*') in 1967 was intended to prevent the escalation of space war by at least prohibiting the placement of weapons of mass destruction ('WMD') in permanent Earth orbit.[4] However, the massive growth in the number of states and corporations able to access space and the increasing competition for access to the space domain raise new challenges to the 'truce' reflected in the *Outer Space Treaty* and the other four principal space treaties (collectively known as the 'outer space treaty regime').[5]

Arguably, that truce has been sustained by the significant technological superiority of the US. Namely, that in the absence of strategic offensive superiority, the role of space assets maintained by the US would render any

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1 *You Only Live Twice* (EON Productions, 1967).

2 Forrest E Morgan, *Deterrence and First-Strike Stability in Space: A Preliminary Assessment* (RAND, 2010) ch 2.

3 David SF Portree, 'Starfish and Apollo (1962)', *Wired* (online, 21 March 2012) <https://www.wired.com/2012/03/starfishandapollo-1962/>, archived at <https://perma.cc/8Q82-LHKN>. The explosion on 9 July 1962 caused an electromagnetic pulse that damaged electrical systems as far as Oahu, Hawaii, 800 miles from the blast, and contributed high energy particles into the Van Allen radiation belts which encompass the Earth. It is believed that this increased radiation led to the failure of the Telstar 1 communication satellite, also launched in July 1962, and there were fears that the increased radiation in low Earth orbit would affect and possibly prevent the crewed Apollo missions as the spacecraft orbited through the Van Allen belts. The impact on the Van Allen belts diminished over the subsequent few years.

4 *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies*, opened for signature 27 January 1967, 610 UNTS 205 (entered into force 10 October 1967) art IV ('*Outer Space Treaty*'). See generally D Goedhuis, 'Some Observations on the Efforts to Prevent a Military Escalation in Outer Space' (1982) 10(1) *Journal of Space Law* 13.

5 The outer space treaty regime is composed of the following treaties: *Outer Space Treaty* (n 4); *Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space*, opened for signature 22 April 1968, 672 UNTS 119 (entered into force 3 December 1968); *Convention on International Liability for Damage Caused by Space Objects*, opened for signature 29 March 1972, 961 UNTS 187 (entered into force 1 September 1972) ('*Liability Convention*'); *Convention on Registration of Objects Launched into Outer Space*, opened for signature 14 January 1975, 1023 UNTS 15 (entered into force 15 September 1976); *Agreement Governing the Activities of States on the Moon and Other Celestial Bodies*, opened for signature 18 December 1979, 1363 UNTS 3 (entered into force 11 July 1984).

armed conflict unlikely to be successful in any war-fighting domain.[6] However, in more recent years this superiority has been greatly eroded, due in part to the fluctuations in funding of the space sector and setbacks such as the end of the Space Shuttle Program.[7] The potential lag in US space-related technological superiority is exemplified by simple raw figures such as the fact that in 2018 the US carried out 31 launches, compared to 39 by China, 20 by Russia and 8 by Europe.[8] Concerns are now being expressed that the US — long considered the technological leader in the space domain — is falling behind in its technological advancement, and unless the regulatory and procurement context adapts rapidly, the fragile truce engendered by this context will evaporate.[9] The competition for the strategic 'high-ground' of space appears to have been reignited despite increasing fears for the fragile space environment.[10]

Of greater importance has been the entrance of new players into the space domain, both nation states and commercial start-ups, disrupting the traditional state of play — ie that space is so technical, expensive and complex, that only states can afford or would want to access and use that domain.[11] The cost and

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6 See generally Simon P Worden and John E Shaw, *Whither Space Power? Forging a Strategy for the New Century* (Air University Press, 2002).

7 There was a decline in government funding in the United States between 2009 and 2015. However, since 2015 there has been an increase in funding from both the government and the private sector: see Kimberly Amadeo, 'NASA Budget, Current Funding, History, and Economic Impact: How $1 Spent on NASA Adds $10 to the Economy', *The Balance* (Blog Post, 25 June 2019) <https://www.thebalance.com/nasa-budget-current-funding-and-history-3306321>, archived at <https://perma.cc/FS46-35JM>; Augusto González, 'A Snapshot of Commercial Space' (White Paper No 2017–01, Center for Science and Technology Policy Research, 2 February 2017) <https://sciencepolicy.colorado.edu/admin/publication_files/white_papers/2017.01.pdf>, archived at <https://perma.cc/ZK6J-YZU2>; 'Global Space Industry Dynamics' (Research Paper, Bryce Space and Technology, 2018) <https://www.industry.gov.au/sites/g/files/net3906/f/June%202018/document/extra/global_space_industry_dynamics_-_research_paper.pdf>, archived at <https://perma.cc/2JBC-ASZ6>. On the closure of NASA's Space Shuttle Program, see Robert Frost, 'Why Did NASA End the Space Shuttle Program?', *Forbes* (online, 2 February 2017) <https://www.forbes.com/sites/quora/2017/02/02/why-did-nasa-end-the-space-shuttle-program/#6ecb035c799f>, archived at <https://perma.cc/5XLX-QNAT>. See also Vincent G Sabathier and G Ryan Faith, 'The Global Impact of the Chinese Space Program', *World Politics Review* (Blog Post, 17 May 2011) <https://www.worldpoliticsreview.com/articles/8878/the-global-impact-of-the-chinese-space-program>, archived at <https://perma.cc/35RA-F2PD>.

8 Sandra Erwin, 'Defense Official: We're Failing at Space Innovation', *Space News* (online, 16 January 2019) <https://spacenews.com/defense-official-were-failing-at-space-innovation/>, archived at <https://perma.cc/84XB-ZWNZ>.

9 See, eg, Olivia Gazis, 'US Falling Behind in New Space Race, Says CIA's Former Head of Science and Tech', *CBS News* (online, 12 December 2018) <https://www.cbsnews.com/news/u-s-falling-behind-in-new-space-race-says-cias-former-head-of-science-and-tech/>, archived at <https://perma.cc/YD64-29HF>.

10 See, eg, United States Space Command, *Vision for 2020* (Report, February 1997) <https://thecommunity.com/wp-content/uploads/2018/08/Vision2020.pdf>, archived at <https://perma.cc/8HBR-8AAV>, which refers to control of the 'space medium to ensure US dominance on future battlefields': at 7. Reignition of this sentiment is exemplified by President Trump's announcement of the creation of a US Military Space Force and a unified Combatant US Space Command: see Marcia Smith, 'Trump Orders Establishment of Unified Combatant US Space Command', *Spacepolicyonline.com* (Web Page, 18 December 2018) <https://spacepolicyonline.com/news/trump-orders-establishment-of-unified-combatant-u-s-space-command/>, archived at <https://perma.cc/5UA2-UTWN>.

11 See Organisation for Economic Co-operation and Development, *The Space Economy in Figures: How Space Contributes to the Global Economy* (OECD Publishing, 2019) 149.

complexity of accessing space has drastically decreased and, as it has done so, commercial operators have perceived the growing opportunities for money making ventures, such as Internet of Things connectivity, space situational awareness, communication, remote sensing, space tourism and even, space mining.[12] In addition, many states other than the traditional space-faring powers are now keen to share in the potential benefits of space.[13] The growth in civilian and commercial uses of space brings with it heightened risks for space security. Technological developments across the board raise the stakes for preserving the fragile peace of space that has been sustained for the past 50-plus years.[14]

This article will consider the close relationship between technological innovation and space superiority. It will explore the inherently dual-use nature of space and the consequences of this characteristic for international and domestic laws regulating the use of space. The relevant international law will be examined to assess how applicable it is to the increasingly commercial space domain, with particular attention to the legality of military uses of space under international law. It will also assess the effectiveness of so-called 'soft law' initiatives to fill perceived gaps in international treaty law in the light of increasing tensions in the space domain.

It will conclude that while the *Outer Space Treaty* has for many years provided a useful legal framework for dealing with superpower rivalry in space, the current realities of military, civil and commercial activity in space require a new approach to ground the interpretative enterprise. Recent events, such as the Indian 'Mission Shakti' anti-satellite ('ASAT') missile test in March 2019, which will be discussed below,[15] provide particularly stark examples of both the desire of new space players to demonstrate their technological strength, as well as the lack of clarity and global consensus on the application of international law to such demonstrations.

Paradoxically, the *Outer Space Treaty* itself seemed to anticipate these developments as art III recognises the role of general international law in addressing broader issues of international peace and security in space.[16] While the *Outer Space Treaty* will remain applicable for resolving potential conflict, its role may become less significant vis-à-vis the application of new and more specific rules of international law. Such a change should be recognised in a positive light, as a consequence of the technological and legal realities of contemporary use of space and a reflection of humanity's renewed ambition in space.

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12 See, eg, 'Space: Investing in the Final Frontier', *Morgan Stanley* (Web Page, 7 November 2018) <https://www.morganstanley.com/ideas/investing-in-space>, archived at <https://perma.cc/36AG-LJYE>; Samantha Masunaga, 'Why Investment in Space Companies is Heating Up', *Los Angeles Times* (online, 7 July 2016) <https://www.latimes.com/business/la-fi-qa-space-investment-20160707-snap-story.html>, archived at <https://perma.cc/EN3B-BKFU>.

13 See 'Global Space Industry Dynamics' (n 7) 3–5.

14 See below Part VI.

15 Marco Langbroek, 'Why India's ASAT Test Was Reckless', *The Diplomat* (online, 30 April 2019) <https://thediplomat.com/2019/05/why-indias-asat-test-was-reckless/>, archived at <https://perma.cc/V6ZX-WZV7>. See below Parts IV–V.

16 *Outer Space Treaty* (n 4) art III.

## II SPACE: A DUAL-USE DOMAIN

Military technology is embedded in the fundamental nature of space technology.[17] In the recent book by Avis Lang and renowned astrophysicist Neil deGrasse Tyson, examining the close relationship between astrophysics and the military, they note: 'it has long been clear to me that the space research my colleagues and I conduct plugs firmly and fundamentally into the nation's military might'.[18] This legacy can be traced directly back to the German V-2 rocket program which delivered devastation to cities in England, Belgium and France in World War II. At the end of the War, both the US and the USSR rushed to obtain not only the stockpiles of German rockets, but also, more importantly, the scientists and engineers who had developed them, including Wernher von Braun[19] — 'one of the most important rocket developers and champions of space exploration in the twentieth century'.[20] As deGrasse Tyson and Lang observe, the first tests of the US-assembled V-2s involved representatives of the military, industry and academia, and the payload included amongst other things, a Geiger counter, telemetry systems, spectrographs and a microwave-band radio transmitter — all producing data of interest and relevance to all of these stakeholders.[21]

Both the US and the USSR poured significant resources into the rocket program, realising its potential not only to carry a nuclear warhead but also to carry its cargo, both scientific and military, into space.[22] This rivalry inevitably became a race to determine who would be first to succeed in reaching space. Ivan Vlasic observes that the launch by the USSR of Sputnik in 1957 — particularly the rocket that propelled the satellite — was perceived by the political elites of the two superpowers 'not primarily as a triumph for world science but as a revolutionary military instrument with potentially awesome strategic consequences'.[23] This event spurred the US on to a renewed and concerted effort with its own space program and also became the foundation of an understanding that orbit around the Earth was freely available to any comer. Just as the USSR had placed a satellite in orbit around the Earth with overflight

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17 See Ivan Vlasic, 'Space Law and the Military Applications of Space Technology' in Nandasiri Jasentuliyana (ed), *Perspectives on International Law* (Kluwer Law International, 1995) 385, 385–9.

18 Neil deGrasse Tyson and Avis Lang, *Accessory to War: The Unspoken Alliance between Astrophysics and the Military* (WW Norton, 2018) 17.

19 See Richard Hollingham, 'V2: The Nazi Rocket that Launched the Space Age', *BBC Future* (online, 8 September 2014) <http://www.bbc.com/future/story/20140905-the-nazis-space-age-rocket>, archived at <https://perma.cc/E9VY-FNQ5>. See also deGrasse Tyson and Lang (n 18) 192–3; David H DeVorkin, *Science with a Vengeance: How the Military Created the US Space Sciences after World War II* (Springer-Verlag, 1992) 34–57. See generally William E Burrows, *This New Ocean: The Story of the First Space Age* (Random House, 1998).

20 'Biography of Wernher Von Braun', *NASA* (Web Page) <https://www.nasa.gov/centers/marshall/history/vonbraun/bio.html>, archived at <https://perma.cc/RQR5-WXUG>.

21 deGrasse Tyson and Lang (n 18) 193.

22 Ibid 193–4.

23 Vlasic (n 17) 385.

of many countries, so too could the US then seek unfettered access to the space domain.[24]

The following years bore witness to several more launch successes, such as Yuri Gagarin's orbit of the Earth in 1961,[25] and failures, such as the tragedy of the Apollo 1 fire during a launch rehearsal in 1967,[26] as both powers pursued human spaceflight. Of course, the majority of astronauts and cosmonauts were members of their respective national militaries.[27] These projects culminated in the NASA Moon landing in 1969. The historic Moon landing of Apollo 11 and Neil Armstrong's first Moon walk carried with it significant symbolism regarding the implications for claims of space sovereignty.[28] Armstrong's deliberate choice of words — '[t]hat's one small step for a man, one giant leap for mankind' — were intended to echo and endorse the principles of the recently concluded *Outer Space Treaty*.[29] The symbolic planting of the US flag on the surface of the Moon was also very carefully planned. The relevant NASA appropriations bill provided that the planting of the flag was 'intended as a symbolic gesture of national pride in achievement' and 'not to be construed as a declaration of national appropriation by claim of sovereignty'.[30]

Whilst this symbolism was important to ensuring the principle of freedom of access to space, it was clear from the outset that underpinning this race to space was the desire to reach the ultimate strategic high-ground.[31]

## III THE IMPORTANCE OF INNOVATION

Whilst rocket technology is at the heart of space technology, it is now more likely that the defence industry will purchase rather than develop such technology.[32] Early uses of space were primarily for intelligence, surveillance and reconnaissance. Flowing from this, space has subsequently been used for

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24 Everett C Dolman, *Astropolitik: Classical Geopolitics in the Space Age* (Frank Cass, 2002) 107–9; Burrows (n 19) 187; deGrasse Tyson and Lang (n 18) 268–9.

25 See Tom Wolfe, *The Right Stuff* (Farrar, Straus and Giroux, 1979) 297.

26 See 'Apollo 1 (AS–204)', *Smithsonian National Air and Space Museum* (Web Page) <https://airandspace.si.edu/explore-and-learn/topics/apollo/apollo-program/orbital-missions/apollo1.cfm>, archived at <https://perma.cc/AGN7-LQZW>.

27 For a detailed account of the early years of US spaceflight, see generally Wolfe (n 25).

28 See Anne M Platoff, *Where No Flag Has Gone Before: Political and Technical Aspects of Placing a Flag on the Moon* (NASA Contractor Report No 188251, August 1993) 1–2, 5–6 <https://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/19940008327.pdf>, archived at <https://perma.cc/T6AG-GHMM>; Nell Greenfieldboyce, 'How Do You Preserve History on the Moon?', *NPR* (Web Page, 21 February 2019) <https://www.npr.org/2019/02/21/696129505/how-do-you-preserve-history-on-the-moon>, archived at <https://perma.cc/6X4V-Q9KZ>.

29 See Executive Office of the President and National Aeronautics and Space Council, 'Aeronautics and Space Report of the President 1969' (Report to Congress, 1969) vi <https://history.nasa.gov/presrep1969.pdf>, archived at <https://perma.cc/269W-L5GP>; *Outer Space Treaty* (n 4) Preamble, art I.

30 *National Aeronautics and Space Administration Authorization Act 1970*, 42 USC §202 (2019); Alice Gorman, 'The Cultural Landscape of Interplanetary Space' (2005) 5(1) *Journal of Social Archaeology* 85, 100.

31 Michael N Schmitt, 'International Law and Military Operations in Space' (2006) 10 *Max Planck Yearbook of United Nations Law* 89, 94.

32 Ashton B Carter, Marcel Lettre and Shane Smith, 'Keeping the Technological Edge' in Ashton B Carter and John P White (eds), *Keeping the Edge: Managing Defense for the Future* (MIT Press, 2001) 129, 136.

communication, navigation and weather monitoring.[33] In the 1970s, the US commenced deployment of the US Global Navigation Satellite System ('GNSS'), including its primary system, the Global Positioning System (GPS).[34] Whilst this was originally restricted to military use, civilian applications and use have rapidly outstripped military uses, raising key issues regarding the now ubiquitous role of GNSSs in daily life.[35] GNSS have also been developed in Russia (GLONASS), China (BeiDou), India (IRNSS) and the European Union (EGNOS and Galileo).[36]

During the Cold War, the US developed the 'offset strategy' — a policy whereby rather than trying to match its opponents in terms of numbers and size, it would do so with superior technology.[37] Making the technology a reality required the support of innovative research and development, as well as a skilled industrial base. A further component of this strategy was to deny other users from accessing this advanced technology through implementing strict export controls.[38] As Ashton Carter notes, the 1991 Gulf War (designated Operation 'Desert Storm') was a clear example of the success of this strategy, being the first conflict in which outer space — and the access to the high-ground advantage that satellite surveillance and communication could provide — played a central role.[39] Notably, however, this superiority also entailed the purchase of commercial satellite imagery by the US Department of Defense — a sign of things to come.[40] It is now commonplace for the military to acquire high resolution imagery from commercial providers such as Planet.[41]

However, the market forces which supported this model are being rapidly eroded by globalisation and commercialisation. As commercial providers such as Blue Origin, SpaceX and Bigelow begin to offer cheaper and superior technology, the procurement and implementation practices of the defence and

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33 Vlasic (n 17) 388. See generally Roger D Launius et al, 'Spaceflight: The Development of Science, Surveillance, and Commerce in Space' (2012) 100 (Special Centennial Issue) *Proceedings of the Institute of Electrical and Electronics Engineers* 1785.

34 Paul B Larsen, 'Issues Relating to Civilian and Military Dual Uses of GNSS' (2001) 27(1) *Space Policy* 111, 111. See also 'GPS Policy: Selective Availability', *Federal Aviation Administration* (Web Page) <https://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/techops/navservices/gnss/gps/policy/availability/>, archived at <https://perma.cc/4KCU-843T>.

35 Larsen (n 34) 112.

36 See ibid; 'Global Navigation Satellite Systems (GNSS)', *United Nations Office for Outer Space Affairs* (Web Page) <http://www.unoosa.org/oosa/en/ourwork/psa/gnss/gnss.html>, archived at <https://perma.cc/X7DP-4NXC>.

37 See Carter, Lettre and Smith (n 32) 129.

38 Ibid.

39 Ibid. See also Vlasic (n 17) 388.

40 See generally James F Keeley and Rob Huebert, *Commercial Satellite Imagery and United Nations Peacekeeping: A View from Above* (Routledge, 2017). See also Vlasic (n 17) 388.

41 Caleb Henry, 'Planet Wins Second NGA Satellite-Imagery Contract', *Space News* (online, 20 July 2017) <https://spacenews.com/planet-wins-second-nga-satellite-imagery-contract/>, archived at <https://perma.cc/L5TS-2AN6>. See also Olivia Solon, 'This Satellite Offers Military-Grade Imagery to the Masses', *Wired* (online, 14 August 2014) <https://www.wired.co.uk/article/world-view-3-satellite>, archived at <https://perma.cc/NQF3-JHVF>.

space sectors will also have to change.[42] Much of the technology required by the defence space sector may need to be acquired from outside of the traditional defence supply channels and indeed, from outside of the US. This requires both a need to align the existing procurement practices with those of the commercial sector and the capacity to respond to technological change rapidly and efficiently.[43] However, there are also strong opportunities here for the US to work with its traditional allies in pooling resources and developing mutually beneficial advanced space research and development, such as can be seen in the example of Rocket Lab, discussed below.

The US Department of Defense is recognising that it needs to adapt to a much faster and more flexible product development and procurement cycle. Proposals such as the creation of a Space Development Agency,[44] alongside the announcement of a Space Force,[45] suggest the recognition of a growing need to work more closely with more innovative 'New Space' developers.[46]

## IV ROCKET LAB

New Zealand recently undertook a swift and efficient entry into the space domain. This was driven largely by the activities of one company, Rocket Lab, a California-based corporation with a New Zealand subsidiary. Rocket Lab completed construction of a commercial launch complex on the Māhia Peninsula, on the east coast of the North Island of New Zealand in September 2016.[47] From that site, it has successfully conducted seven launches of its own Electron rocket, which uses a unique Rutherford engine — notable for the fact that it is largely three-dimensionally printed and can be produced in

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42 See generally 'Global Space Industry Dynamics' (n 7); Michael Sheetz, 'NASA Budget Reveals Even More Reliance on Private Companies like SpaceX and Blue Origin', *CNBC* (online, 12 March 2019) <https://www.cnbc.com/2019/03/11/nasa-budget-more-reliance-on-private-companies-like-spacex.html>, archived at <https://perma.cc/AA45-8MJK>.

43 See Carter, Lettre and Smith (n 32) 131–2.

44 Sandra Erwin, 'Pentagon Analyzing Possible Missions for a New Space Development Agency', *Space News* (online, 4 December 2018) <https://spacenews.com/pentagon-analyzing-possible-missions-for-a-new-space-development-agency/>, archived at <https://perma.cc/5R7J-58FV>.

45 Erin Durkin, 'Space Force: Mike Pence Launches Plans for Sixth Military Service', *The Guardian* (online, 10 August 2018) <https://www.theguardian.com/us-news/2018/aug/09/space-force-mike-pence-military-service>, archived at <https://perma.cc/D6GH-GJ7G>.

46 'New Space' companies are distinguished from traditional space companies in that they have characteristics of being innovative, consumer focused, flexible, more willing to take risks (indeed, in many cases this includes the risk of failure), and focused on novel technological solutions: Jason Hay et al, 'Global Space Industry: Refining the Definition of *New Space*' (Conference Paper, AIAA SPACE 2009 Conference and Exposition, 14–17 September 2009) <https://arc.aiaa.org/doi/10.2514/6.2009-6400>, archived at <https://perma.cc/8TGS-UHFG>.

47 Melissa de Zwart, 'Outer Space' in William H Boothby (ed), *New Technologies and the Law in War and Peace* (Cambridge University Press, 2019) 337, 351 n 46; Kirsty Hutchison et al, 'Managing the Opportunities and Risks Associated with Disruptive Technologies: Space Law in New Zealand' (2017) 13(4) *Policy Quarterly* 28, 28–9. See also David Szondy, 'Rocket Lab's Electron Booster Reaches Orbit', *News Atlas* (online, 21 January 2018) <https://newatlas.com/electron-orbit-second-try/53055/>, archived at <https://perma.cc/4B7J-CW9K>.

approximately 24 hours.[48] The launch on 21 January 2018, known as 'Still Testing', successfully carried and deployed cubesats for commercial providers Spire and Planet, as well as the controversial Humanity Star.[49]

Prior to the establishment of the Rocket Lab launch site and associated support facilities, New Zealand had little involvement in the space industry. New Zealand had no domestic space legislation providing a regulatory framework. Rocket Lab therefore commenced operations pursuant to a contractual agreement with the New Zealand government.[50] These arrangements transitioned to the legislative regime upon commencement in December 2017. The introduction of the domestic space regulatory regime was a swift process, from the first introduction of the Outer Space and High-Altitude Activities Bill into the New Zealand Parliament on 19 September 2016, to the review by the Foreign Affairs, Defence and Trade Committee, which was reported on 21 April 2017.[51] The *Outer Space and High-Altitude Activities Act 2017* (NZ) was passed on 4 July 2017, received Royal Assent on 10 July 2017 and entered into force on 21 December 2017.[52]

Faced with the restrictions of US export controls, an impediment even to a company with a US parent, the New Zealand government also had to execute a bilateral *Technology Safeguards Agreement* with the US in 2016 addressing

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48 Beau Jackson, '3D Printing Powered Rocket Lab Closes $140 Million in Funding', *3D Printing Industry* (Web Page, 23 November 2018) <https://3dprintingindustry.com/news/3d-printing-powered-rocket-lab-closes-140-million-in-funding-144174/>, archived at <https://perma.cc/EW6E-HCXP>. For information on the successful launches that Rocket Lab has conducted from its Māhia Peninsula launch complex, see 'Completed Missions', *Rocket Lab* (Web Page) <https://www.rocketlabusa.com/missions/completed-missions/>, archived at <https://perma.cc/PZ4Z-W2RP>.

49 See 'Still Testing', *Rocket Lab* (Web Page) <https://www.rocketlabusa.com/missions/completed-missions/still-testing/>, archived at <https://perma.cc/7FZE-2AUT>; Stephen Clark, 'Rocket Lab Delivers Nanosatellites to Orbit on First Successful Test Launch', *Spaceflight Now* (online, 21 January 2018) <https://spaceflightnow.com/2018/01/21/rocket-lab-delivers-nanosatellites-to-orbit-on-first-successful-test-launch/>, archived at <https://perma.cc/DR37-BB45>; Alice Gorman, 'A Sports Car and a Glitter Ball Are Now in Space: What Does That Say about Us as Humans?', *The Conversation* (online, 7 February 2018) <https://theconversation.com/a-sports-car-and-a-glitter-ball-are-now-in-space-what-does-that-say-about-us-as-humans-91156>, archived at <https://perma.cc/MEN5-H4UG>. On the carriage of the controversial Humanity Star and the controversy of such carriage, see Stephen Clark, 'Rocket Lab's Test Launch Carried Two Previously-Unannounced Passengers', *Spaceflight Now* (online, 29 January 2018) <https://spaceflightnow.com/2018/01/29/rocket-labs-test-launch-carried-two-previously-unannounced-passengers/>, archived at <https://perma.cc/TU2M-NUES>.

50 See Hutchison et al (n 47) 28–9; New Zealand Government, 'Govt Signs Contract Authorising Rocket Lab Launches' (Media Release, 17 September 2016) <https://www.beehive.govt.nz/release/govt-signs-contract-authorising-rocket-lab-launches>, archived at <https://perma.cc/NZ3N-AU46>; *Agreement between Her Majesty the Queen in Right of New Zealand Acting by and through the Minister for Economic Development (Government) and Rocket Lab Ltd New Zealand and Rocket Lab USA Inc*, signed 16 September 2016 (Contract) <https://www.mbie.govt.nz/assets/85a65881f2/agreement-nz-government-rocket-lab-nz-usa.pdf>, archived at <https://perma.cc/J53X-45P9>.

51 Outer Space and High-Altitude Activities Bill (179–1) 2016 (NZ); *Outer Space and High-Altitude Activities Act 2017* (NZ) sch 2 ('*Outer Space and High-Altitude Activities Act*'); 'Outer Space and High-Altitude Activities Bill', *New Zealand Parliament* (Web Page) <https://www.parliament.nz/en/pb/bills-and-laws/bills-proposed-laws/document/00DBHOH_BILL71017_1/outer-space-and-high-altitude-activities-bill>, archived at <https://perma.cc/WU9D-NTY5>.

52 *Outer Space and High-Altitude Activities Act* (n 51) s 2, sch 2.

restrictions which would otherwise have applied under the American Missile Technology Control Regime.[53] Terms from this *Agreement* are also reflected in the *Outer Space and High-Altitude Activities Act 2017* (NZ).[54]

Rocket Lab successfully launched an experimental Radio Frequency Risk Reduction Deployment Demonstration ('R3D2') satellite for the US Defense Advanced Research Projects Agency ('DARPA') on 28 March 2019 from its Māhia Peninsula launch complex.[55] The R3D2 is intended to test the application of deployable antennas, with the intention that small satellites may be launched with large deployable antennas which are necessary to support high-bandwidth communications. The R3D2 satellite was developed by Northrop Grumman in conjunction with an antenna developed by MMA Design, whilst the satellite bus itself was developed and constructed by Blue Canyon Technologies.[56] This project demonstrates the strong integration of government and small and large technology companies, which is necessary to support this type of launch and level of innovative design and construction. Rocket Lab founder, Peter Beck, noted that '[i]t's particularly fitting to be flying the DARPA payload and demonstrating true responsive access to space'.[57] The short timeline of the project, of approximately 18 months from conception to launch, was made possible by this collaboration.[58] This was noted by the Director of DARPA's Tactical Technology Office, Fred Kennedy:

> The Department of Defense has prioritized rapid acquisition of small satellite and launch capabilities. By relying on commercial acquisition practices, DARPA streamlined the R3D2 mission from conception through launch services acquisition …[59]

This project exemplifies the growing co-dependency of military and commercial space ventures.

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53 *Agreement between the Government of New Zealand and the Government of the United States of America on Technology Safeguards Associated with United States Participation in Space Launches from New Zealand*, signed 16 June 2016, New Zealand Treaties Online B2016-07 (entered into force 12 December 2016) <https://www.treaties.mfat.govt.nz//search/details/t/3858/c_1>, archived at <https://perma.cc/S2C9-QPJN>. See Craig Martin, 'How Has the New Zealand Government Accommodated the Requirements of ITAR within Its Space Activities Legal Regime?' (Research Paper No 18–04, Adelaide Law School Research Unit on Military Law and Ethics, 2018) 3 <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3182899>, archived at <https://perma.cc/33BB-NFTL>. See also 'Frequently Asked Questions (FAQS)', *Missile Technology Control Regime* (Web Page) <http://mtcr.info/frequently-asked-questions-faqs/?lang=en>, archived at <https://perma.cc/GL3J-EKJT>.

54 *Outer Space and High-Altitude Activities Act* (n 51) s 63. See also Martin (n 53) 7.

55 Rocket Lab, 'Rocket Lab Successfully Launches R3D2 Satellite for DARPA' (Media Release, 28 March 2019) ('Rocket Lab Successfully Launches R3D2') <https://www.rocketlabusa.com/news/updates/rocket-lab-successfully-launches-r3d2-satellite-for-darpa/>, archived at <https://perma.cc/9CZ7-GLTW>.

56 Jeff Foust, 'Rocket Lab to Launch DARPA Satellite', *Space News* (online, 22 January 2019) <https://spacenews.com/rocket-lab-to-launch-darpa-satellite/>, archived at <https://perma.cc/2S79-92YZ>.

57 Ibid.

58 Ibid; 'Rocket Lab Successfully Launches R3D2' (n 55).

59 Foust (n 56). See also Nina Godlewski, 'Watch Live, Stream: Rocket Lab to Launch $25 Million Military Test Satellite for DARPA', *Newsweek* (online, 28 March 2019) <https://www.newsweek.com/rocket-lab-live-watch-stream-launch-when-satellite-darpa-1379146>, archived at <https://perma.cc/3MDX-9MJ3>.

## V THE RESPONSE OF INTERNATIONAL LAW

What then is the international law regime governing access to and use of outer space, and how is it adapted to deal with increasing demands for access to and use of outer space?

The UN General Assembly ('UNGA') adopted its first resolution making a direct reference to outer space on 14 November 1957.[60] This resolution urged states to conclude a disarmament agreement that provides for an inspection system directed to ensuring 'that the sending of objects through outer space shall be exclusively for peaceful and scientific purposes'.[61] This was followed on 13 December 1958 with UNGA *Resolution 1348 (XIII)* regarding the 'peaceful use of outer space', which established the Committee on the Peaceful Uses of Outer Space ('UNCOPUOS') as an ad hoc committee of the UN.[62] UNCOPUOS was established as a permanent committee of the UNGA on 12 December 1959.[63] The specific mandate of UNCOPUOS (specifically its Scientific and Technical Subcommittee) pursuant to UNGA *Resolution 1472 (XIV)* is to 'study practical and feasible means for giving effect to programmes in the peaceful uses of outer space which could appropriately be undertaken under United Nations auspices'.[64] It reports to the Fourth Committee of the UNGA, which adopts an annual resolution endorsing 'international cooperation in the peaceful uses of outer space'.[65] All matters regarding international space security, including military activities, are addressed to the UN Conference on Disarmament ('CD').[66]

Prohibition upon the specific use of weapons in outer space was first articulated in a multilateral treaty in the 1963 *Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and under Water*, which provided that each party undertook 'to prohibit, to prevent, and not to carry out any nuclear

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60 *Regulation, Limitation and Balanced Reduction of All Armed Forces and All Armaments; Conclusion of an International Convention (Treaty) on the Reduction of Armaments and the Prohibition of Atomic, Hydrogen and Other Weapons of Mass Destruction*, GA Res 1148 (XII), UN GAOR, UN Doc A/RES/1148 (XII) (14 November 1957).

61 Ibid para 1(f).

62 *Question of the Peaceful Use of Outer Space*, GA Res 1348 (XIII), UN GAOR, UN Doc A/RES/1348 (XIII) (13 December 1958) para 1 ('*Resolution 1348 (XIII)*').

63 *International Co-operation in the Peaceful Uses of Outer Space*, GA Res 1472 (XIV), UN Doc A/Res/1472 (XIV) (12 December 1959) ('*Resolution 1472 (XIV)*').

64 Ibid pt A para 1(a). UNCOPUOS's two subsidiary bodies, the Technical and Scientific Subcommittee and the Legal Subcommittee were established in 1961. See 'Committee on the Peaceful Uses of Outer Space', *United Nations Office for Outer Space Affairs* (Web Page) <http://www.unoosa.org/oosa/en/ourwork/copuos/index.html>, archived at <https://perma.cc/2N3H-2HZ4>; 'COPUOS History', *United Nations Office for Outer Space Affairs* (Web Page) <http://www.unoosa.org/oosa/en/ourwork/copuos/history.html>, archived at <https://perma.cc/3H26-V8YZ>.

65 See 'Committee on the Peaceful Uses of Outer Space', *United Nations Office for Outer Space Affairs* (Web Page) <http://www.unoosa.org/oosa/en/ourwork/copuos/index.html>, archived at <https://perma.cc/2N3H-2HZ4>.

66 Scott Pace, 'Security in Space' (2015) 33(2) *Space Policy* 51, 52, noting that '[t]he Conference on Disarmament … is the UN forum for international security discussions but it has been deadlocked for years on non-proliferation topics and is not likely to be able to tackle space activities'.

weapon test explosion … in the atmosphere … including outer space'.[67] This was followed by UNGA *Resolution 1884 (XVIII)* which required states:

> (a) To refrain from placing in orbit around the earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, installing such weapons on celestial bodies, or stationing such weapons in outer space in any other manner;
>
> (b) To refrain from causing, encouraging or in any way participating in the conduct of the foregoing activities.[68]

The *Outer Space Treaty* should be regarded as the major achievement of UNCOPUOS. Of the five major treaties comprising the outer space treaty regime,[69] the *Outer Space Treaty* has the highest number of ratifications, standing currently at 109 ratifying parties and an additional 23 signatories.[70]

The *Outer Space Treaty* articulates the overarching framework for the use of outer space and adopts many of the principles mandated in the earlier resolutions of the UNGA. For example, the specific reference to 'weapons of mass destruction' in *Resolution 1884 (XVIII)* was retained and repeated in art IV of the *Outer Space Treaty*.[71] Given its Cold War origins and the fact that space activities were at that time contemplated as being only within the capacity of very few nation states,[72] the reach and scope of the *Outer Space Treaty* provides little clarification with respect to the key issues arising in the context of modern day military, civilian and commercial uses of space. It is clear that the drafters intended to create a regime that provided a measure of balance and transparency to ensure continued access to space by the nations that were at that time space-faring, ie US and USSR. The later space treaties reflect an emerging interest by non-spacefaring and developing countries to be able to access the growing benefits of access to the space environment. However, uncertainty still arises in the application of the *Outer Space Treaty* and the other space treaties to the modern uses of space for both civilian and military purposes.

It is necessary to briefly outline the key provisions of the *Outer Space Treaty*, before analysing their potential interpretation and application.

The Preamble to the *Outer Space Treaty* provides that it recognises: 'the common interest of all mankind in the progress of the exploration and use of outer space for peaceful purposes'[73] and the context of the *Outer Space Treaty* in '[d]esiring to contribute to broad international co-operation in the scientific as well as the legal aspects of the exploration and use of outer space for peaceful

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67 *Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and under Water*, signed 5 August 1963, 480 UNTS 43 (entered into force 10 October 1963) art I(1)(a).

68 *Question of General and Complete Disarmament*, GA Res 1884 (XVIII), UN Doc A/RES/1884 (XVIII) (17 October 1963) para 2 ('*Resolution 1884 (XVIII)*').

69 See above n 5.

70 Legal Subcommittee, Committee on the Peaceful Uses of Outer Space, *Status of International Agreements Relating to Activities in Outer Space as at 1 January 2019*, 58th sess, Agenda Item 5, UN Doc A/AC.105/C.2/2019/CRP.3 (1 April 2019) 10.

71 *Resolution 1884 (XVIII)*, UN Doc A/RES/1884 (XVIII) (n 68) para 2; *Outer Space Treaty* (n 4) art IV.

72 See above Parts I–II.

73 *Outer Space Treaty* (n 4) Preamble para 2.

purposes'.[74] This expresses the foundational concept that space is open to use by all states and the desire that space may be a domain for international cooperation — a hope that has been recognised in projects such as the International Space Station ('ISS').

Article I of the *Outer Space Treaty* provides:

> The exploration and use of outer space, including the moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind.[75]

The wording of this article, as with most of the *Outer Space Treaty*, is highly aspirational. It draws upon UNGA *Resolution 1962 (XVIII)* which included in its preamble the intention 'that the exploration and use of outer space should be carried on for the betterment of mankind and for the benefit of States irrespective of their degree of economic or scientific development'.[76] UNGA *Resolution 1962 (XVIII)* further enounced the following guiding principles:

> 1 The exploration and use of outer space shall be carried on for the benefit and the interests of all mankind.
>
> 2 Outer space and the celestial bodies are free for exploration and use by all States on a basis of equality and in accordance with international law.[77]

Article III of the *Outer Space Treaty* also adopts the above wording and intentions of UNGA *Resolution 1962 (XVIII)*, restating the application of the principles of international law:

> States Parties to the Treaty shall carry on activities in the exploration and use of outer space, including the moon and other celestial bodies, in accordance with international law, including the *Charter of the United Nations*, in the interest of maintaining international peace and security and promoting international co-operation and understanding.[78]

Again, these principles focus upon the desire that space should remain open to all users. However, it does not make it explicit how a domain which is inherently difficult, dangerous and expensive to access may be exploited 'in the interests of all countries'.[79]

Article IV addresses the prohibition on placing nuclear or other WMD in orbit, or stationing them on a celestial body or in outer space, and also includes two of the four references to 'peaceful purposes'[80] in the *Outer Space Treaty*.[81]

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74 Ibid Preamble para 4.

75 Ibid art I.

76 *Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space*, GA Res 1962 (XVIII), UN Doc A/RES/1962 (XVIII) (13 December 1963) Preamble para 3 ('*Resolution 1962 (XVIII)*'). See also Stephan Hobe, 'Article I', in Stephan Hobe, Bernhard Schmidt-Tedd and Kai-Uwe Schrogl (eds), *Cologne Commentary on Space Law* (Carl Heymanns Verlag, 2009–15) vol 1, 25, 29.

77 *Resolution 1962 (XVIII)*, UN Doc A/RES/1962 (XVIII) (n 76) paras 1, 2.

78 *Outer Space Treaty* (n 4) art III.

79 Ibid art I.

80 The other references to peaceful purposes are found in the Preamble to the *Outer Space Treaty* already outlined above.

Article IV therefore articulates two key principles:

(a) the prohibition upon placement of weapons of mass destruction in space; and
(b) the requirement that the moon and other celestial bodies be used exclusively for peaceful purposes.[82]

Notably, the provision has not been relied upon by states as preventing the transit of WMD *through* outer space. The announcement by Russian President Vladimir Putin in 2018 of the proposed RS-28 Sarmat — an intercontinental nuclear weapon intended to be placed in an extended orbital trajectory around Earth — has highlighted and reinforced that non-permanent transit through an orbital trajectory is not regarded as a violation of the *Outer Space Treaty*.[83] Nor does it prevent the placement or use of (non-WMD) weapons in outer space, nor the placement of military space stations in space itself as opposed to on a celestial body.[84] Further, it leaves open the conduct of military space-based exercises and (non-WMD) weapons testing.[85] This reinforces the conclusion that

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81 *Outer Space Treaty* (n 4) art IV:

> States Parties to the Treaty undertake not to place in orbit around the earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons on celestial bodies, or station such weapons in outer space in any other manner.
>
> The moon and other celestial bodies shall be used by all States Parties to the Treaty exclusively for peaceful purposes. The establishment of military bases, installations and fortifications, the testing of any type of weapons and the conduct of military manoeuvres on celestial bodies shall be forbidden. The use of military personnel for scientific research or for any other peaceful purposes shall not be prohibited. The use of any equipment or facility necessary for peaceful exploration of the moon and other celestial bodies shall also not be prohibited.

82 Ibid.

83 The US State Department condemned the weapons system as a violation of the *Intermediate-Range Nuclear Forces Treaty* but made no claims in respect of violation of art IV of the *Outer Space Treaty*. See Taunton Paine, 'Bombs in Orbit? Verification and Violation under the Outer Space Treaty', *The Space Review* (Blog Post, 19 March 2018) <http://www.thespacereview.com/article/3454/1>, archived at <https://perma.cc/3KYG-893T>; *Treaty between the United States of America and the Union of Soviet Socialist Republics on the Elimination of Their Intermediate-Range and Shorter-Range Missiles*, signed 8 December 1987, 1657 UNTS 2 (entered into force 1 June 1988) ('*Intermediate-Range Nuclear Forces Treaty*').

84 Schmitt (n 31) 104.

85 Ibid. In this context, note that the Indian Government expressed the view that the Indian ASAT (anti-satellite weapons) test was permitted under international law:

> India has no intention of entering into an arms race in outer space. We have always maintained that space must be used only for peaceful purposes. We are against the weaponization of Outer Space and support international efforts to reinforce the safety and security of space based assets.

these aspirational statements of the *Outer Space Treaty* are interpreted restrictively in practice. This will be analysed further below.

Article VI provides that states bear 'international responsibility' for 'national activities' undertaken in outer space by government and non-government users.[86]

This provision becomes particularly important in the context of space activities being undertaken by non-government, commercial entities. States remain responsible for activities undertaken by commercial entities and are obliged by the *Outer Space Treaty* to provide continuing supervision for such activities.[87] As the nature and extent of such supervision is not specified, it is left to the determination of the individual state. In most cases this has been undertaken by states in the form of enacting domestic space legislation, regulating matters such as registration, launch permits and insurance and indemnity requirements.[88] The US on the other hand has a complex regime of disparate pieces of legislation which regulate different aspects of US space activities.[89] In addition, the *Convention on International Liability for Damage Caused by Space Objects* provides that state liability extends to all launches which are made from that state's territory or facility.[90] As Frans von der Dunk

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Ministry of External Affairs, Government of India, 'Frequently Asked Questions on Mission Shakti, India's Anti-Satellite Missile Test Conducted on 27 March, 2019' (Press Release, 27 March 2019) <https://www.mea.gov.in/press-releases.htm?dtl/31179/Frequently_Asked_Questions_on_Mission_Shakti_Indias_AntiSatellite_Missile_test_conducted_on_27_March_2019>, archived at <https://perma.cc/H8VZ-WMMZ> ('FAQ on Mission Shakti'). Consider also that in 2007 China conducted an ASAT test, purposefully destroying its own weather satellite, and that the US similarly destroyed its own satellite in 2008: Melissa de Zwart, 'New Technologies Symposium: Contested and Fragile', *OpinioJuris* (Blog Post, 7 May 2019) <https://opiniojuris.org/2019/05/07/new-technologies-symposium-contested-and-fragile-the-dual-use-space-environment/>, archived at <https://perma.cc/LYX4-8VR6>.

86 *Outer Space Treaty* (n 4) art VI:

> States Parties to the Treaty shall bear international responsibility for national activities in outer space, including the moon and other celestial bodies, whether such activities are carried on by governmental agencies or by non-governmental entities, and for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty. The activities of non-governmental entities in outer space, including the moon and other celestial bodies, shall require authorization and continuing supervision by the appropriate State Party to the Treaty. When activities are carried on in outer space, including the moon and other celestial bodies, by an international organization, responsibility for compliance with this Treaty shall be borne both by the international organization and by the States Parties to the Treaty participating in such organization.

87 Ibid.

88 For example, the New Zealand regime discussed above in Part III, and the Australian *Space Activities Act 1998* (Cth), to be renamed the *Space (Launches and Returns) Act 2018* (Cth) pursuant to *Space Activities Amendment (Launches and Returns) Act 2018* (Cth) sch 1 s 3. For further information regarding domestic space legislation, see generally: Paul Stephen Dempsey, 'National Laws Governing Commercial Space Activities: Legislation, Regulation, & Enforcement' (2016) 36(1) *Northwestern Journal of International Law and Business* 1.

89 Frans G von der Dunk, 'Effective Exercise of "In-Space Jurisdiction": The US Approach and the Problems It Is Facing' (2015–16) 40(1–2) *Journal of Space Law* 147, 149 ('Effective Exercise of "In-Space Jurisdiction"').

90 *Liability Convention* (n 5) arts I(c), II. See also *Outer Space Treaty* (n 4) art VIII regarding jurisdiction over spacecrafts and personnel on any spacecrafts launched from the relevant state's territory:

observes, regardless of the approach taken by the individual state to regulation, either through detailed legislative provisions or a 'light touch' permissive approach, the outer space treaty regime makes it 'clear that the states concerned are going to be held responsible *in any event* for any violation of international space law and liable for any damage caused by space objects launched with their involvement'.[91]

Article IX of the *Outer Space Treaty* introduces the concepts of conducting activities in the exploration and use of outer space with 'due regard' and the prohibition upon 'harmful interference'.[92] The principles of 'due regard' and 'harmful interference', in relation to art IX, have not been extensively considered in the context of increasing access to and use of space.[93] However, as commercial operators are placing exponentially larger numbers of objects in space, including large constellations of satellites, these principles may be invoked to address and guide the rapidly emerging need for space traffic management.[94] The dramatic growth in commercial launch and satellite activity has already raised issues of how many small satellites can be deployed before

> A State Party to the Treaty on whose registry an object launched into outer space is carried shall retain jurisdiction and control over such object, and over any personnel thereof, while in outer space or on a celestial body. Ownership of objects launched into outer space, including objects landed or constructed on a celestial body, and of their component parts, is not affected by their presence in outer space or on a celestial body or by their return to the Earth. Such objects or component parts found beyond the limits of the State Party to the Treaty on whose registry they are carried shall be returned to that State Party, which shall, upon request, furnish identifying data prior to their return.

91 Von der Dunk, 'Effective Exercise of "In-Space Jurisdiction"' (n 89) 159 (emphasis in original).

92 *Outer Space Treaty* (n 4) art IX:

> In the exploration and use of outer space, including the moon and other celestial bodies, States Parties to the Treaty shall be guided by the principle of co-operation and mutual assistance and shall conduct all their activities in outer space, including the moon and other celestial bodies, with due regard to the corresponding interests of all other States Parties to the Treaty. States Parties to the Treaty shall pursue studies of outer space, including the moon and other celestial bodies, and conduct exploration of them so as to avoid their harmful contamination and also adverse changes in the environment of the Earth resulting from the introduction of extraterrestrial matter and, where necessary, shall adopt appropriate measures for this purpose. If a State Party to the Treaty has reason to believe that an activity or experiment planned by it or its nationals in outer space, including the moon and other celestial bodies, would cause potentially harmful interference with activities of other States Parties in the peaceful exploration and use of outer space, including the moon and other celestial bodies, it shall undertake appropriate international consultations before proceeding with any such activity or experiment. A State Party to the Treaty which has reason to believe that an activity or experiment planned by another State Party in outer space, including the moon and other celestial bodies, would cause potentially harmful interference with activities in the peaceful exploration and use of outer space, including the moon and other celestial bodies, may request consultation concerning the activity or experiment.

93 See, eg, Michael C Mineiro, '*FY-1C* and *USA-193* ASAT Intercepts: An Assessment of Legal Obligations under Article IX of the Outer Space Treaty' (2008) 34(2) *Journal of Space Law* 321, which discusses 'due regard' and 'harmful interference' in the context of outer space activities undertaken by states: at 351.

94 See generally Frans G von der Dunk, 'Space Traffic Management: A Challenge of Cosmic Proportions' (2016) 58 *Proceedings of the International Institute of Space Law 2015* 385; Paul B Larsen, 'Space Traffic Management Standards' (2018) 83(2) *Journal of Air Law and Commerce* 359.

they pose a hazard to other users trying to access space. Such issues are currently handled by domestic regulation.[95] The potential for active debris removal is also hampered by the provisions of the space treaties.[96]

It should also be noted that the International Telecommunication Union's regulation of radio spectrum represents a generally successful international regime that regulates and allocates a scarce space resource.[97]

## VI THE CONDUCT OF MILITARY ACTIVITIES, THE *OUTER SPACE TREATY* AND INTERNATIONAL LAW

As noted above, the 1960s heralded an unprecedented optimism in the power of technology to advance humanity's quest beyond the bounds of Earth and to the stars. US President John F Kennedy spoke in a strident tone when he challenged the US to go to the Moon and return before the end of the decade, not because it was easy, he stressed, but because it was hard.[98] Humanity's ingenuity coupled with unquestioning faith in technology provided the opportunity for unparalleled human exploration of space.

It was a time of massive financial investment into space programs by both the US and the USSR where the limits of human imagination and the limits of technology seemed to be unbounded.[99] Against this backdrop, the *Outer Space Treaty* was drafted. It anticipated a new epoch of space exploration and sought to establish rules that would advance international understanding and cooperation into the heavens. In particular, as already highlighted, the *Outer Space Treaty* refers to the freedom of exploration of space, of undertaking space activities for the benefit of all humanity and of ensuring that space activity would be peaceful in its purposes.

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95 See, eg, Ian Christensen, 'Unlicensed Swarms in Space: Suggestions for Community Response to an Unauthorized Commercial Satellite Launch', *The Space Review* (online, 2 April 2018) <http://www.thespacereview.com/article/3465/1>, archived at <https://perma.cc/3L2U-ZTAW>.

96 The outer space treaty regime hampers the potential for active removal of space debris because 'launching states would bear costs associated with accidents during debris removal, those states may be unwilling to participate in or permit such efforts': Alexander William Salter, 'Space Debris: A Law and Economics Analysis of the Orbital Commons' (2016) 19(2) *Stanford Technology Law Review* 221, 234. Whilst theoretically insurance could partly remediate the costs, this 'remediation would still make debris removal engagements less appealing': at 234.

97 Geostationary orbit ('GEO'), approximately 35,786 km above the equator, enables satellites to remain in an apparently continuous fixed location above the Earth. This is the ideal location for communication satellites and therefore this orbit represents a scarce and valuable 'location'. Each 'slot' in GEO equates to a particular frequency and the International Telecommunications Union regulates this space by way of frequency allocation: see Frans von der Dunk, 'Legal Aspects of Satellite Communications' in Frans von der Dunk with Fabio Tronchetti (eds), *Handbook of Space Law* (Edward Elgar, 2015) 456, 458–93. Note that this system is not without its challenges, such as the *Bogotá Declaration* urging for the sovereignty of equatorial countries in superjacent areas: see Audrey L Allison, *The ITU and Managing Satellite Orbital and Spectrum Resources in the 21st Century* (Springer, 2014) 22. See generally Carl Q Christol, 'International Space Law and the Use of Natural Resources: Solar Energy' (1980) 15(1) *Belgian Review of International Law* 28, 38.

98 John F Kennedy, 'Rice Stadium Moon Speech' (Speech, Rice Stadium, 12 September 1962) <https://er.jsc.nasa.gov/seh/ricetalk.htm>, archived at <https://perma.cc/ZB3F-KC76>.

99 See above Parts I–II.

The *Outer Space Treaty* is heralded by many space lawyers as the principal charter for the governance of all of humanity's activities in outer space. Indeed, it's overtures to peace, cooperation and universality in space are laudable and are to be genuinely celebrated. Despite these virtuous goals, it may be fair to ask whether devotion to the *Outer Space Treaty*, as the exclusive or even primary mechanism for delivering these outcomes, is perhaps overstated. The *Outer Space Treaty* itself is a relatively modest treaty with merely 17 articles that are mostly expressed in general terms. Compared with other regimes, such as the 1982 *United Nations Convention on the Law of the Sea* with over 320 articles that govern the world's maritime areas,[100] the expectations surrounding the *Outer Space Treaty* would appear to be very ambitious, perhaps too ambitious. Moreover, as highlighted above, its language is largely aspirational and mostly lacking in specificity, particularly with respect to New Space technologies.

With respect to military uses of space, there has long been a minority academic view that the 'peaceful purposes' provisions of the *Outer Space Treaty* actually prohibited military activity altogether.[101] Such a view sought to largely classify military activity in a binary manner, equating 'peaceful' as meaning simply 'non-military'. This was done on the basis that any military activity in space by one state carried with it an inherent threat to the security of other states. The only exception to this view was the very narrow opportunity for military scientific activity that carried with it the promise of universal benefits for all states.[102]

The mood that reigned in the 1960s saw space as a new environment where humanity might transcend the historic difficulties that bedevilled international cooperation on Earth. Accordingly, the somewhat aspirational wording of the *Outer Space Treaty* was to be given particular interpretative meaning and promoted as the *lex specialis* of legal regulation in space. The goals of the *Outer Space Treaty* could be realised by adopting an interpretative stance that ensured singular priority to the peaceful, cooperative and equality provisions of the *Outer Space Treaty*.

The difficulty with this view is that it didn't reflect reality, even in the 1960s. As has been already highlighted above, military use of space has been manifested 'since the beginning of the space age'.[103] The first space-farers were military personnel, the first rockets were launched by the German military in World War II, the first rockets in the modern era were engineered and launched by US and USSR military forces in the late 1950s and the first satellites were already serving military purposes. Subsequent arms limitations agreements actually relied upon military use of space for verification ('national technical

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100 *United Nations Convention on the Law of the Sea*, opened for signature 10 December 1982, 1833 UNTS 3 (entered into force 16 November 1994).

101 Fabio Tronchetti, 'Legal Aspects of the Military Uses of Outer Space' in Frans von der Dunk (ed), *Handbook of Space Law* (Edward Elgar, 2015) 331, 333, 339–41.

102 Ibid 339–41. The exception for scientific research is explicitly provided for in *Outer Space Treaty* (n 4) art IV.

103 Kai-Uwe Schrogl and Julia Neumann, 'Article IV' in Stephan Hobe, Bernhard Schmidt-Tedd and Kai-Uwe Schrogl (eds), *Cologne Commentary on Space Law* (Carl Heymanns Verlag, 2009) vol 1, 70, 71.

means')[104] and modern military forces are all heavily integrated into space systems.[105]

Given these developments, it seems counterproductive to assert that broad terms used in the *Outer Space Treaty* regarding 'peaceful purposes' and 'use of outer space … for benefit … of all countries',[106] can be interpreted in a manner that renders the vast military activity occurring in space as somehow unlawful or at least legally questionable. Such a view does not accord much weight to the drafting history, or more importantly, to subsequent state practice — both of which provide contextual meaning to many of the key terms of the *Outer Space Treaty*.[107]

In this regard, it is imperative that the *Outer Space Treaty* be interpreted in a manner that takes account of current military and commercial technical capacities and actual uses. Importantly, art III of the *Outer Space Treaty* provides a helpful means for reconciling potentially divergent views. At its core, art III applies international law, 'including the *Charter of the United Nations*, in the interest of maintaining peace and security' to activities in space.[108] The incorporation of general international law to govern legal relationships in outer space offers vastly more tools to resolve friction and dispute in outer space than does a strained reading of what particular aspirational terms in the *Outer Space Treaty* might provide. For example, questions relating to mining activities on celestial bodies, interception and surveillance activities of space objects, and proximity operations of satellites, all need resolution in accordance with the full panoply of applicable international law. Most of these activities are not new in origin, just their application in the context of outer space. Hence international law, in its general application, provides a better means to ensure continuing international security and peace, than exclusive or even primary reliance on just the terms of the *Outer Space Treaty*.

The conduct of military operations in outer space necessarily animates different international legal regimes that regulate such conduct. Article 31(1) of the *Vienna Convention on the Law of Treaties* ('*VCLT*') is a natural starting point for interpreting military space operations under applicable treaty regimes — especially in peacetime — with its emphasis on criteria of good faith, ordinary

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104 The term first appeared in art V(1) of an agreement that resulted from the first round of the Strategic Arms Limitation Talks (SALT I): *Interim Agreement between the United States of America and the Union of Soviet Socialist Republics on Certain Measures with Respect to the Limitation of Strategic Offensive Arms*, signed 26 May 1972, 23 UTS 3462 (entered into force 3 October 1972). See Lisa M Schenck and Robert A Youmans, 'From Start to Finish: A Historical Review of Nuclear Arms Control Treaties and Starting over with the New Start' (2012) 20(2) *Cardozo Journal of International and Comparative Law* 399, 416–18.

105 See Schrogl and Neumann (n 103) 90–3. See generally Brian Weeden and Victoria Samson, Secure World Foundation, *Global Counterspace Capabilities: An Open Source Assessment* (Report, April 2018).

106 Such references are found in *Outer Space Treaty* (n 4) Preamble, arts I, IV.

107 For example, the US Department of Defense *Law of War Manual* interprets 'peaceful' as meaning 'non-aggressive and beneficial' as opposed to non-military: Department of Defense, United States, *Law of War Manual* (Manual, June 2015) 926–7 [14.10.4] ('*US LOW Manual*') <http://archive.defense.gov/pubs/Law-of-War-Manual-June-2015.pdf>, archived at <https://perma.cc/TQA5-TUWW>.

108 *Outer Space Treaty* (n 4) art III.

meaning, context and object/purpose.[109] Further guidance is provided by art 31(3)(b) of the *VCLT*, which directs attention to subsequent state practice to aid in discerning meaning.[110] To this end, identifying the actions of states, including their reactions to military actions and activities in outer space, is a useful means of settling meaning. Additionally, statements made at international fora (such as UNCOPUOS and the CD)[111] meetings and publications (such as national operational law manuals)[112] are also helpful in evidencing views of states in ascertaining meaning.

Where there is specificity in the *Outer Space Treaty* and other treaties in the outer space treaty regime, there is more confidence that they are able to address emerging weapons systems, dual-use technologies and potential national security threats. Hence, the prohibition on the placement of WMD in orbit in outer space, as contained in art IV of the *Outer Space Treaty*, would seem to be definitive. In this regard, it is difficult to conclude that the placement of such weapons could be lawful in any circumstance, even in times of national or collective self-defence under the authority of art 51 of the *Charter of the United Nations*.[113] However, other instances of specific application of the *Outer Space Treaty* are not so straight forward. Additionally, the manner in which weapons systems can be deployed or used in space is also open to interpretative ambiguity. For example, the US Department of Defense *Law of War Manual*, explicitly provides that 'weapons that are not weapons of mass destruction (eg, anti-satellite laser weapons and other conventional weapons)' are not subject to the prohibition in art IV of the *Outer Space Treaty*,[114] and thus may be deployed in outer space in conformity with the *Outer Space Treaty*.

Outside of the outer space treaty regime, the 1978 *Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques*[115] ('*ENMOD Convention*') is a treaty that obliquely deals with developing weapons systems technologies. The *ENMOD Convention* prohibits a state party from engaging in 'military or any other hostile use of environmental modification techniques having widespread, long-lasting or severe effects as the means of destruction, damage or injury to any other State Party'.[116] Critically,

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109 *Vienna Convention on the Law of Treaties*, opened for signature 23 May 1969, 1155 UNTS 331 (entered into force 27 January 1980) art 31(1) ('*VCLT*').

110 Ibid art 31(3)(b).

111 'Conference on Disarmament', *United Nations Office at Geneva* (Web Page, 7 June 2019) <https://www.unog.ch/cd>, archived at <https://perma.cc/8MDY-JND7>.

112 For a methodological position adopted by the International Committee of the Red Cross, in their assessment of existing customary international law applicable to armed conflict, see Jean-Marie Henckaerts and Louise Doswald-Beck, *Customary International Humanitarian Law: Rules* (Cambridge University Press, 2005) vol 1.

113 Noting however, that the International Law Commission ('ILC') does in fact conclude that the right of self-defence, as reflected in art 51 of the *Charter of the United Nations*, occupies a pre-eminent position when reconciling applicable treaty regimes: International Law Commission, *Report of the International Law Commission on the Work of its Sixty-Third Session*, UN GAOR, 66th sess, Supp No 10, UN Doc A/66/10 (26 April – 3 June and 4 July – 12 August 2011) 195.

114 *US LOW Manual* (n 107) 925–6 [14.10.3.1].

115 *Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques*, opened for signature 18 May 1977, 1108 UNTS 151 (entered into force 5 October 1978).

116 Ibid art I.

'environmental modification techniques' are defined in art II as 'any technique for changing — through the deliberate manipulation of natural processes — the dynamics, composition or structure of the earth, including its biota, lithosphere, hydrosphere and atmosphere, or of outer space'.[117] Hence there is, somewhat uniquely, express recognition of the space environment itself as a potential target of military manipulation. Furthermore, it also provides an associated prohibition on methods of military activity that changes the natural processes of outer space in a manner that has a widespread, long-lasting or severe effect that causes destruction, damage or injury to any state party.

Outside of these express treaty prohibitions that apply to weapons and their deployment or use in space, it is left to general international law to provide the means for addressing emerging technologies and the means and methods of using such technologies that threaten international peace and security in outer space. Hence, issues concerning foreign interference with space operations, intervention and even outright use of force, all need to be contextualised for space operations. Legal questions emerge regarding the jamming of satellites, physical manipulation of satellites or even just dazzling optical sensors on satellites with ground-based lasers. There is no clear articulation of the legal significance of these actions in the *Outer Space Treaty*, nor where, on the general international law use of force spectrum, such actions should be located.

The answer to interpreting the general terms of the *Outer Space Treaty* and reconciling the application of different treaty regimes is thus probably best served by evaluating state practice. As previously mentioned, the *VCLT* recognises subsequent state practice as an authentic means for assisting in the interpretation of treaty terms. The International Law Commission ('ILC') has in fact embarked upon a multi-year study of what constitutes relevant state practice to inform treaty meaning. Significantly, in the reports that have been produced to date, the ILC has determined that subsequent practice can comprise legislative action, administrative practice, official acts as well as action, reaction, acquiescence and even relevant silence by other states in the face of relational acts.[118]

Hence, actions like the recent Indian ASAT test provide a critical opportunity where state reaction can be gauged to ascertain relevant state practice that in turn informs treaty meaning. Thus, despite the fact that the test created debris — the trajectory of which did not conform to Indian modelling which predicted safe dispersal and consequently resulted in anticipated dangers to the ISS (as well as operational satellites of other nations)[119] — the test itself was not condemned as unlawful by any state. Both China and the US have previously undertaken their own ASAT tests in 2007 and 2008 respectively, without any condemnation that the actions were themselves unlawful under the *Outer Space Treaty* or general international law.[120] In the case of the Chinese test in particular, a large debris

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117 Ibid art II.

118 Georg Nolte, Special Rapporteur, International Law Commission, *First Report on Subsequent Agreements and Subsequent Practice in Relation to Treaty Interpretation*, 65th sess, UN Doc A/CN.4/660 (19 March 2013) 43 [110]–[111]. For an overview of work by the Commission, see at 3–5 [1]–[7].

119 See 'FAQ on Mission Shakti' (n 85); Langbroek (n 15).

120 See generally Mineiro (n 93). See also above n 85.

field was created and there was only an inference by some states that China had not properly complied with art IX of the *Outer Space Treaty*.[121] This article requires consultation where there is the possibility of space activity causing 'potentially harmful interference' with the activities of other states party.[122] However, there was no assertion by any state that the ASAT test itself was unlawful.

This absence of state practice condemning such ASAT tests, points to a high threshold for violation of not only the *Outer Space Treaty*, but also other principles of general international law regarding the use of force. Despite this apparent tolerance, it is equally evident that general principles also apply and that their limits are yet to be properly articulated. In this context, the first case ever decided by the International Court of Justice, the *Corfu Channel (United Kingdom v Albania)* case,[123] may prove to be instructive. The case dealt with, inter alia, the laying of mines by Albania in the Corfu Channel during peacetime that threatened the safety of passing ships. The Court drew upon humanitarian principles resident in the law of armed conflict (*jus in bello*) to condemn the laying of such mines as being inconsistent with 'elementary considerations of humanity',[124] despite the fact that there was no armed conflict underway. Such resort to general principles, as permitted under art 38(1)(c) of the *Statute of the International Court of Justice*,[125] provides a useful interpretative touchstone to anticipate how international law may apply to condition the conduct of military activities in outer space.

Much like the conduct of maritime operations within international waters, the prospect of escalating security tension and potential military conflict remains ever-present in outer space, especially with burgeoning new technology being deployed to outer space. In the maritime context, military-to-military negotiations have sought to reduce the potential for conflict in a manner that has proven remarkably effective. Initiatives like the Code for Unplanned Encounters at Sea (CUES) have been developed to provide a means for ships from foreign navies to better signal intentions at sea and to thus reduce the potential for miscalculation.[126] There exists no forum for military-to-military engagement in space operations and hence no avenue for constructive engagement between military forces in articulating limits on the conduct of military operations in outer space. While bodies such as UNCOPUOS and the CD provide a viable means for progressing diplomatic initiatives, experience from the naval context suggests that military-to-military engagement may lead to the development of a more durable outcome for preserving international peace and security in space. Such negotiations should necessarily be undertaken with a practical focus of avoiding conflict, but should also be guided by a consideration of 'elementary

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121 Mineiro (n 93) 355.

122 *Outer Space Treaty* (n 4) art IX.

123 *Corfu Channel (United Kingdom v Albania) (Merits)* [1949] ICJ Rep 4.

124 Ibid 22. On the principles residing in the law of armed conflict, see generally Dale Stephens and Michael W Lewis, 'The Law of Armed Conflict: A Contemporary Critique' (2005) 6(1) *Melbourne Journal of International Law* 55.

125 *Statute of the International Court of Justice* art 38(1)(c).

126 Western Pacific Naval Symposium, 'Code for Unplanned Encounters at Sea' (Version 1, 22 April 2014) <https://www.jag.navy.mil/distrib/instructions/CUES_2014.pdf>, archived at <https://perma.cc/ZV7K-R44H>.

considerations of humanity' to ensure that the broader goals of the *Outer Space Treaty* and, indeed the *Charter of the United Nations*, are met so as to avoid potential conflict and to provide the foundation for greater civil and commercial uses of outer space.

## VII SPACE SECURITY: WOULD RESTRAINTS ON TECHNOLOGY LEAD TO A SAFER SPACE?

With the increased number of users of space, there is also an increased concern regarding the security of space. As noted above, the relevant international law deriving from the outer space treaty regime does not extend far in terms of establishing clear rules for an increasingly congested domain. New challenges have emerged to the safety and security of the space domain, including an increased number of users, the prevalence of large cubesat constellations, the exponential growth of (and consequent potential for vast increase of) space debris and the entry into the market of a large number of commercial operators, none of which was contemplated or foreseen by the outer space treaty regime. Some of those commercial operators have even gone so far as to flout existing domestic space laws by conducting unauthorised launches.[127] Several attempts have been made to fill these perceived gaps in international law with various resolutions, confidence building measures and codes of conduct: so-called 'soft law'.[128] Whilst these measures have attracted some multilateral support, they have raised particular concerns in the US regarding the potential impact on space innovation and space defence. Notably, one of the difficulties with such proposals is the lack of clarity regarding what constitutes a space weapon. In an age where automated proximity operations involving, for example, active debris removal or on-orbit servicing of satellites, could equally be used to damage or destroy a satellite (or undertake less obvious interference) clarity of definitions becomes very difficult.[129] Further issues arise with respect particularly to matters of dual-use technology and the complexity of attribution in the space domain. More recently, the US has moved beyond abstention or

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127 See, eg, Devin Coldewey, 'FCC Fines Swarm Technologies $900K over Unauthorized Satellite Launch', *TechCrunch* (Blog Post) <https://techcrunch.com/2018/12/20/fcc-fines-swarm-technologies-900k-over-unauthorized-satellite-launch/>, archived at <https://perma.cc/5TPY-9ZPM>.

128 Jack M Beard, 'Soft Law's Failure on the Horizon: The International Code of Conduct for Outer Space Activities' (2017) 38(2) *University of Pennsylvania Journal of International Law* 335. See especially Beard's discussion of Marco Ferrazzani, 'Soft Law in Space Activities: An Updated View' in Irmgard Marboe (ed), *Soft Law in Outer Space: The Function of Non-Binding Norms in International Space Law* (Böhlau, 2012) 99: at 343 n 29 and accompanying text. See also Beard's discussion of Fabio Tronchetti, 'A Soft Law Approach to Prevent the Weaponisation of Outer Space' in Irmgard Marboe (ed), *Soft Law in Outer Space: The Function of Non-Binding Norms in International Space Law* (Böhlau, 2012) 361: at 343 n 29 and accompanying text.

129 See Brian Weeden, 'Dancing in the Dark Redux: Recent Russian Rendezvous and Proximity Operations in Space', *The Space Review* (Blog Post, 5 October 2015) <http://www.thespacereview.com/article/2839/1>, archived at <https://perma.cc/6MUV-Y5EJ>; Brian G Chow, 'Space Arms Control: A Hybrid Approach' (2018) 12(2) *Strategic Studies Quarterly* 107, 108.

non-participation in such processes to a more overt stance against such initiatives.[130]

The Prevention of an Arms Race in Outer Space ('PAROS') has been a standing agenda item in the CD since 1982.[131] An ad hoc committee of the CD was formed to specifically address matters relevant to this topic between 1985 and 1994, however no progress had been made in that committee nor generally by the CD with respect to the matter of space-related security.[132] An annual resolution on the '[p]revention of an arms race in outer space' has been submitted by Egypt and Sri Lanka at the CD for over 30 years.[133] This non-binding resolution has regularly received majority support.[134] In 2014 Russia introduced a resolution on '[n]o first placement of weapons in space' and has annually submitted the resolution since that time.[135] Whilst the US has repeatedly raised concerns regarding the ability to verify and monitor such an obligation, rather than choosing to abstain from voting as it had previously done, the US (along with other countries) voted to reject that resolution in 2018.[136]

The UN Group of Governmental Experts ('GGE') was formed by UNGA *Resolution 65/68* in 2011 to study transparency and confidence-building measures ('TCBM') for outer space activities with a mandate 'to conduct a study … on outer space transparency and confidence-building measures'.[137] The final report of GGE was presented to the UNGA in December 2013.[138] The UNGA endorsed that report and encouraged member states to implement the soft law measures through relevant domestic processes.[139] This initiative is regarded as one of the most successful initiatives of the UN in building consensus on the peaceful uses of outer space and the US continues to point to the value of the TCBM process in its response to more recent initiatives, such as the European Draft Code of Conduct and the Russian and Chinese sponsored draft Treaty on Prevention of the Placement of Weapons in Outer Space and of the Threat or Use of Force against Outer Space Objects (both discussed below).

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130 Paul Meyer, 'Washington Sparks a Space Spat at the United Nations', *Bulletin of the Atomic Scientists* (online, 11 December 2018) <https://thebulletin.org/2018/12/washington-sparks-a-space-spat-at-the-united-nations/>, archived at <https://perma.cc/5D4P-KC44> ('Washington Sparks a Space Spat').

131 Paul Meyer, 'Dark Forces Awaken: The Prospects for Cooperative Space Security' (2016) 23 (3–4) *Nonproliferation Review* 495, 496 ('Dark Forces Awaken').

132 Ibid.

133 *Final Record of the One Thousand Three Hundred and Sixth Plenary Meeting*, UN Doc CD/PV.1306 (18 February 2014) 6.

134 Meyer, 'Washington Sparks a Space Spat' (n 130).

135 *No First Placement of Weapons in Outer Space*, GA Res 69/32, 69th sess, Agenda Item 94(b), UN Doc A/RES/69/32 (11 December 2014); Meyer, 'Washington Sparks a Space Spat' (n 130).

136 *No First Placement of Weapons in Outer Space*, GA Res 73/31, 73rd sess, Agenda Item 99(b), UN Doc A/RES/73/31 (11 December 2018); Meyer, 'Washington Sparks a Space Spat' (n 130).

137 *Transparency and Confidence-Building Measures in Outer Space Activities*, GA Res 65/68, 65th sess, Agenda Item 97(y), UN Doc A/RES/65/68 (11 January 2011) 2 para 2.

138 *Transparency and Confidence-Building Measures in Outer Space Activities*, GA Res 68/50, 68th sess, Agenda Item 99(c), UN Doc A/Res/68/50 (10 December 2013) ('*Resolution 68/50*'); *Report of the Group of Governmental Experts on Transparency and Confidence-Building Measures in Outer Space Activities*, UN Doc A/68/189 (29 July 2013).

139 *Resolution 68/50*, UN Doc A/RES/68/50 (n 138) 2 para 2.

The European Union circulated a draft Code of Conduct for Activities in Outer Space in December 2008,[140] with a draft first released in October 2010[141] and a revised version of the Code of Conduct produced on 31 March 2014.[142] This Code of Conduct addresses a range of factors and is intended 'to enhance the safety, security, and sustainability of all outer space activities pertaining to space objects, as well as to the space environment'.[143] Though initially attracting momentum, its adoption was finally not agreed to due to opposition from a number of non-European countries that preferred a more multilateral process of consultation.[144] The US, on the other hand, maintained passive support for the proposal.[145]

Russia and China also proposed a draft Treaty on Prevention of the Placement of Weapons in Outer Space and of the Threat or Use of Force against Outer Space Objects ('PPWT') to the CD in 2008.[146] After the failure of that initial instrument, they presented a revised version in 2014.[147] Specific US objections to the PPWT include: the absence of a clear definition of what constitutes a space weapon, the omission of verification procedures, and the focus on weapons based in space and not on the ground.[148] Commentators have observed that whilst proposing the PPWT and advocating for a prohibition upon space

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140 Council of the European Union, *Council Conclusions on the Draft Code of Conduct for Outer Space Activities*, Doc No 17175/08 (17 December 2008) annex I.

141 Council of the European Union, *Council Conclusions of 27 September 2010 on the revised draft Code of Conduct for Outer Space Activities*, Doc No 14455/10 (11 October 2010).

142 *International Code of Conduct for Outer Space Activities: Version 31 March 2014, Draft* (31 March 2014) <https://eeas.europa.eu/sites/eeas/files/space_code_conduct_draft_vers_31-march-2014_en.pdf>, archived at <https://perma.cc/7XZC-MK94>.

143 Ibid para 1.1.

144 Brazil, Russia, India, China and South Africa (BRICS) issued a joint statement that 'the elaboration of such an instrument should be held in the format of inclusive and consensus-based multilateral negotiations within the framework of the UN, based on a proper and unequivocal mandate, without specific deadlines and taking into account the interests of all States': 'BRICS Joint Statement regarding the Principles of Elaboration of International Instruments on Outer Space Activities', *Permanent Mission of the Russian Federation to the European Union* (Web Page, 30 July 2015) <https://russiaeu.ru/en/news/brics-joint-statement-regarding-principles-elaboration-international-instruments-outer-space-ac>, archived at <https://perma.cc/5RZB-ZK57>, quoted in Meyer, 'Dark Forces Awaken' (n 131) 499.

145 See Meyer, 'Dark Forces Awaken' (n 131) 499–500.

146 Conference on Disarmament, *Draft Treaty on Prevention of the Placement of Weapons in Outer Space and of the Threat or Use of Force against Outer Space Objects*, UN Doc CD/1839 (29 February 2008).

147 Meyer, 'Dark Forces Awaken' (n 131) 497; Conference on Disarmament, *Draft Treaty on the Prevention of the Placement of Weapons in Outer Space, the Threat or Use of Force against Outer Space Objects*, UN Doc CD/1985 (12 June 2014).

148 Meyer, 'Dark Forces Awaken' (n 131) 497. See also Michael Listner and Rajeswari Pillai Rajagopalan, 'The 2014 PPWT: A New Draft but with the Same and Different Problems', *The Space Review* (Blog Post, 11 August 2014) <http://www.thespacereview.com/article/2575/1>, archived at <https://perma.cc/H78D-94T2>.

weapons, both China and Russia continue to develop ground based Anti-Satellite ('ASAT') weapons.[149]

In addition to these proposed instruments, the PAROS process has recently been revived under the UN GGE process. An initiative led by Russia at the 2017 meeting of the UNGA resulted in the establishment of a new Group of Government Experts to consider 'substantial elements of an international legally binding instrument on the prevention of an arms race in outer space'.[150] This group commenced meetings in August 2018 and reported back in March of 2019.[151]

As Beard has noted: '[a] soft law instrument with broad and vague objectives that restricts future military activities may thus serve to effectively limit some technological options available to participating democratic states'.[152] The US is clearly reluctant to be bound by an instrument that may hamper the technological advantage that the US has built up since the dawn of the space age and which, to many US strategists, forms the basis of a deterrent strategy. However, as noted above, this technological high-ground is increasingly challenged by commercial developments.

The absence of verification procedures from the outer space treaty regime as well as these more recent soft law initiatives were foreshadowed in discussions before the UN at the dawn of the space age. In an address to the UN General Assembly on 22 September 1960, US President Dwight Eisenhower stated that, in addition to the agreement that celestial bodies are not subject to national appropriation, and that 'nations of the world shall not engage in warlike activities on these bodies',[153] the US agreed 'subject to appropriate verification, that no nation will put into orbit or station in outer space weapons of mass destruction. All launchings of space craft should be verified in advance by the United Nations.'[154] Notably, whilst the language of peaceful purposes appears in the *Outer Space Treaty*, requirements of 'appropriate verification' are more difficult to find. Article X makes reference to opportunities for observation of the flight of space objects, art XI requires states, 'to the greatest extent feasible and practicable', to provide information to the UN, the public and the international

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149 See above n 148; Conference on Disarmament, *Analysis of the 2014 Russian-Chinese Draft Treaty on the Prevention of the Placement of Weapons in Outer Space, the Threat or Use of Force against Outer Space Objects*, UN Doc CD/1998 (3 September 2014) 5 [14]–[15]. But see Conference on Disarmament, *Follow-Up Comments by the Russian Federation and China on the Analysis Submitted by the United States of America of the Updated Russian-Chinese Draft PPWT*, UN Doc CD/2042 (14 September 2015).

150 *Further Practical Measures for the Prevention of an Arms Race in Outer Space*, GA Res 72/250, UN GAOR, 72nd sess, Agenda Item 97(a), UN Doc A/RES/72/250 (12 January 2018) para 3.

151 Ibid para 4; Guilherme de Aguiar Patriota, *Report by the Chair of the Group of Governmental Experts on Further Practical Measures for the Prevention of an Arms Race in Outer Space* (Report, 31 January 2019) <https://s3.amazonaws.com/unoda-web/wp-content/uploads/2019/02/oral-report-chair-gge-paros-2019-01-31.pdf>, archived at <https://perma.cc/2DMH-UQC8>.

152 Beard (n 128) 378.

153 Dwight D Eisenhower, *Public Papers of the Presidents of the United States: Dwight D Eisenhower 1960–61* (Ann Arbor, 2005) 714.

154 Ibid. See also Schrogl and Neumann (n 103) 75; Bin Cheng, 'Military Use of Outer Space: Article IV of the 1967 Space Treaty Revisited' in Chia-Jui Cheng and Doo Hwan Kim (eds), *The Utilization of the World's Air Space and Free Outer Space in the 21st Century* (Kluwer Law International, 2000) 305, 315.

scientific community, on the nature, conduct, locations and results of space activities.[155] Further, art XII states that '[a]ll stations, installations, equipment and space vehicles on the moon and other celestial bodies shall be open to representatives of other States Parties to the Treaty on a basis of reciprocity'.[156] However, none of these provisions address the level of inspection and verification that would typically be found in other arms control agreements, rather they provide a slightly asymmetrical approach to regulation of space technology and one that fails to deal sufficiently with the problems of dual-use.

Suggestions have been made that the US is increasingly becoming an outlier in the establishment of space security measures.[157] The US maintains a position that whilst it 'would prefer that the space domain remain free of conflict, we will prepare to meet and overcome any challenge that arises'.[158] As Joan Johnson-Freese points out, this rhetoric condemns the use of force whilst reserving the position of the US to protect its own space assets and (potentially) those of its allies.[159] Further, specific terminology used by the US Department of Defense with respect to the need to 'dominate' or 'control' space, has been criticised as overtly hostile.[160] Although the 'peaceful purposes' terminology is unhelpful, is there a better and more useful discourse that may be developed? Johnson-Freese suggests that the US needs to forge a 'grand bargain' in space with China to demonstrate its own goodwill, such as by an offer to partner on work on the ISS.[161]

The focus on these soft law instruments — particularly the US rejection of their terms — is itself adding to a sense of growing tension with respect to the space domain. Whilst these measures are labelled, and assert their purpose, as avoiding an arms race in outer space, unless they regulate and impact upon all parties equitably, they are ineffective as regulatory devices. Johnson-Freese may be correct at least in pointing to a need for space lawyers to direct their attention elsewhere; perhaps not to the ISS but rather to articulating and expanding upon how international law itself might fill these gaps and potentially diffuse and escalation of conflict. The *Woomera Manual on the International Law of Military Space Operations* project is drafting an objective statement of existing international law (*lex lata*) applicable to military space operations, addressing the application of the law on the resort to the use of force by and against states (*jus ad bellum*) and the law of armed conflict (*jus in bello*) in outer space.[162] Such an articulation may fill the normative gap more effectively than soft law instruments.

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155 *Outer Space Treaty* (n 4) art XI.

156 Ibid art XII.

157 Meyer, 'Washington Sparks a Space Spat' (n 130).

158 Department of Defense, United States of America, *United States Space Force* (Report, February 2019) 1 <https://media.defense.gov/2019/Mar/01/2002095012/-1/-1/1/UNITED-STATES-SPACE-FORCE-STRATEGIC-OVERVIEW.PDF>, archived at <https://perma.cc/7TSZ-DBT9>.

159 Joan Johnson-Freese, *Space Warfare in the 21st Century: Arming the Heavens* (Routledge, 2017) 3–4.

160 Ibid 181.

161 Ibid 170.

162 See generally 'The Woomera Manual', *The University of Adelaide* (Web Page, 13 February 2019) <https://law.adelaide.edu.au/woomera/>, archived at <https://perma.cc/Z93W-HJQD>.

## VIII CONCLUSIONS

The standoff portrayed in the 1967 Bond movie was de-escalated through the use of diplomacy. Is there still scope for such an outcome in the face of increased tension in space today or is there a need for increased legal regulation of a congested space domain?

As argued in this article there has been a general tendency in the space law literature to marginalise the manner in which principles, concepts or regimes of general international law may apply to achieve the goals set in the *Outer Space Treaty*. With the increasing militarisation and commercialisation of space activity, the capacity of the open-ended and opaque *Outer Space Treaty* to exclusively, or even primarily, govern such complexity seems hopeful at best. The role of soft law approaches provides a possible way forward in giving meaning to principles under the *Outer Space Treaty*, but there is mixed success with the acceptance and adoption of these soft law mechanisms. Certainly, as currently framed, they do not provide a solid and mutually agreed way forward on concepts of what constitutes a space weapon, nor the principle of verification of compliance, nor do they prevent destructive 'tests' which create debris fields and pose serious risks to access to space. This article has argued that the massive expansion in space technology, and particularly its common basis now in both civilian and military partnerships, has created novel difficulties in terms of identification and consequent control of potential hostile purposes.

Accordingly, this article has argued that familiar principles of international law dealing with competition, rising tension and even outright hostility should be assimilated into the space law regime in a manner that does require a re-thinking of the manner in which the *Outer Space Treaty*'s interpretation and relationship with other applicable legal regimes is traditionally undertaken. Moreover, there is a need for military-to-military engagement to establish rules for governing encounters in space. Any such resulting agreement should be informed by 'elementary considerations of humanity' to ensure that tension is de-escalated and conflict is avoided. Recognising the need to provide a holistic legal approach to grappling with emerging military technology and activity in space will also address the realities of the outer space domain today, one that is open to more users than ever before, with the potential for enormous human endeavour and technological achievement in the exploration and use of outer space.