Legal Implications of Intentional Interference with Space Signals

Kuan-Wei Chen

The jamming and spoofing of satellite signals are widespread occurrences. Due to the socio-economic, as well as security and strategic interests involved, interference with space signals is a serious concern for governments and space operators, as well as users of civilian applications such as telecommunications, navigation and geolocation. Not only does space signal interference have serious repercussions for societies and economies, there are also various legal implications that need to be better understood.

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Key points

This paper discusses the legal implications of intentional interference with space signals, which has been in the news due to the impact on the safety of air navigation. Key points include:

- Space signals are critical to countless applications and uses that form the backbone of modern societies, economies and militaries.
- Intentional interference with space signals will have an impact on a variety of space services and applications, including navigation and geolocation services.
- Intentional interference with space signals may have serious implications for international peace and security.
- It is vital to keep in mind rules of international law, including space law and telecommunication that apply to intentional interference with space signals.

The Paper draws on:

Ram Jakhu, Setsuko Aoki, Kuan-Wei Chen and Bayar Goswami, *McGill Manual on International Applicable to Military Uses of Outer Space: Volume II—Commentaries* (forthcoming, Springer)

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The views expressed herein are those of the author alone.

Background

In early 2023, the International Federation of Air Line Pilots' Associations (IFALPA) issued a safety notice alerting airliners of possible interference with global navigation satellite systems (GNSS) from military warships in the Pacific region.[1] Shortly thereafter, Qantas publicly admitted that its planes have suffered radio interference and GPS jamming 'reportedly coming from Chinese warships in Asia Pacific'.[2] Elsewhere, the ongoing invasion of Ukraine, tens of thousands of airplanes have been affected, and many flights cancelled,[3] due to a spike in GPS interference.[4]

Such incidences of interference with satellite-based signals are expected to increase and pose significant challenges to aviation safety.[5] Further, in light of a heightening of geopolitical tensions, interference with the operation of space systems will increase mistrust, misunderstanding and miscalculations,[6] as well as endanger international peace and security.

It is important that governments, space operators, and the public at large are aware of the potential fallout from disruptions to space signals, as well as the legal framework that can deter such behaviour.

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[1] International Federation of Air Line Pilots' Associations, 'Communication Interference by Military Warships in the Pacific Region', Safety Bulletin 23SAB03 (2 March 2023).

[2] Mostafa Rachwani, 'Qantas pilots told to fly through radio interference reportedly coming from Chinese warships', *The Guardian* (online, 17 March 2023) <https://www.theguardian.com/business/2023/mar/17/qantas-pilots-told-to-fly-through-radio-interference-reportedly-coming-from-chinese-warships>.

[3] Gwyn Topham, 'Thousands of flights to and from Europe affected by suspected Russian jamming', *The Guardian* (online, 22 April 2024) <https://www.theguardian.com/business/2024/apr/22/thousands-of-flights-to-and-from-europe-affected-by-suspected-russian-jamming>

[4] Briar Stewart, 'Airlines grapple with spike in GPS interference. Experts say it's collateral damage from global conflicts', *CBC News* (online, 25 May 2024) <https://www.cbc.ca/news/world/gps-interference-airlines-1.7213538>.

[5] Matt Burgess, 'The Dangerous Rise of GPS Attacks', *WIRED* (online, 30 April 2024) <https://www.wired.com/story/the-dangerous-rise-of-gps-attacks/>.

[6] See generally, UNGA, *Reducing space threats through norms, rules and principles of responsible behaviours: Report of the Secretary-General*, UN Doc A/76/77 (13 July 2021), and also views of Canada, France, Germany, Japan, Mexico, the Netherlands, Slovenia, Sweden, the United Kingdom, the United States, and the European Union in the same document. See also UNCOPUOS, *Survey of the problem of discretion exercised by States in interpreting basic legal principles and norms related to safety and security in outer space: Working Paper submitted by the Russian Federation,* UN Doc A/AC.105/L.319 (2019), especially [18].

Importance and Vulnerabilities of Space Systems

Space applications and technologies have provided humanity immeasurable scientific, socio-economic, and strategic benefits.[7] The use of satellites is crucial to facilitate telecommunications, broadcasting and the safe operation of land, air and maritime transportation worldwide.[8] The use of space has also been credited with helping 'close the digital divide'[9] by providing people in developing countries and remote regions who lack the infrastructure with connectivity to the Internet, which itself has been deemed to be crucial for the full enjoyment and exercise of various human rights.[10]

For militaries, space systems are essential to the provision of accurate intelligence, surveillance and reconnaissance (ISR) data, positioning, navigation and timing (PNT) functions, and of course the relay of satellite communications (SATCOM), all of which are vital for the formulation and implementation of strategic decisions and operations.[11]

Exactly due to the critical nature of the space infrastructure, it is also vulnerable to a variety of methods and means of disruption (known as 'counter-space capabilities' or 'anti-satellite' (ASAT) attack) that are being developed and refined.[12] Satellites in Earth

[7] See generally, Jeff Greenblatt and Al Anzaldua, 'How Space Technology Benefits the Earth', *The Space Review* (online, 29 July 2019) <https://www.thespacereview.com/article/3768/1>; and UNOOSA, 'Benefits of Space for Humankind', *United Nations Office for Outer Space Affairs* (web page) <https://www.unoosa.org/oosa/en/benefits-of-space/benefits.html>.

[8] See ICRC, Statement to the Open-ended working group on reducing space threats through norms, rules and principles of responsible behaviours (online, 13 September 2022) <https://documents.unoda.org/wp-content/uploads/2022/09/ICRC-statement-under-agenda-item-6b-OEWG-on-reducing-space-threats.pdf >.

[9] See Chris Teale, 'Satellite internet can fill broadband gaps', *GNC* (online, 13 March 2023) <https://gcn.com/cloud-infrastructure/2023/03/satellite-internet-can-fill-broadband-gaps/383906/>. Satellites can also fill the gap in includes situations during armed conflict, when Internet connectivity is disrupted or destroyed: see James Purtill, 'The battle to keep Ukraine connected to the internet amid Russian missile attacks', *ABC News* (online, 27 February 2023) <https://www.abc.net.au/news/science/2023-02-27/ukraine-internet-russia-rocket-strikes-connected-kyiv/102009234>.

[10] See Human Rights Council, *The promotion, protection and enjoyment of human rights on the Internet*, UN Doc A/HRC/RES/47/16 (2021), Preamble [5].

[11] See e.g. US, *Space Operations,* Joint Publication 3-14 (Incorporating Chage 1, 26 October 2020); and Australia, *Air-Space Integration*, Air Force Doctrine Publication 1-19 (2019).

[12] See generally Brian Weeden and Victoria Samson, *Global Counterspace Capabilities Report* (online, 2024), 4/2024 <https://swfound.org/media/207826/swf_global_counterspace_capabilities_2024.pdf>.

orbit and the ground-based infrastructure on Earth are susceptible to kinetic and non-kinetic means of interference that can disable or disrupt the functions of the space infrastructure, and severely hinder space applications.[13]

In this interconnected world, it is inconceivable for societies, economies and militaries to function in '[a] day without space'.[14] However, as the International Committee of the Red Cross (ICRC) cautions, due to the dual-use nature of many space systems, whereby it is difficult to distinguish between civilian and military space applications, 'the disruption or destruction of space systems serving critical infrastructure that enables the delivery of essential civilian services could have wide-reaching consequences for the civilian population'.[15] States must therefore exercise great restraint before interfering with space systems and space signals.

[13] Kinetic means of interfering with or destroying part of the space infrastructure refers to a 'physical' attack. This may be achieved through a direct-ascent ASAT weapon such as a missile or projectile, co-orbital ASATs manoeuvre, such as the conduct of a rendezvous and proximity operation (RPO), or a physical strike against a ground facility on Earth.

Other than jamming and spoofing, non-kinetic means of interference include the detonation of an electromagnetic device in orbit, the use of directed energy attacks (such the use of lasers to dazzle or blind a part of the space infrastructure), or cyber means of attack through hacking or the insertion of malware to corrupt and/or disable computer systems of the space infrastructure. See generally, *Global Counterspace Capabilities Report* (n 12); and UNGA, *Threats to the security of space activities and systems: Submitted by the United Nations Institute for Disarmament Research* (UNIDIR), UN Doc A/AC.294/2022/WP.16 (2022).

[14] 'A new animation shows 'A day without space'', German Aerospace Center DLR (web page) <https://www.dlr.de/content/en/articles/news/2021/02/20210611_a-new-animation-shows-a-day-without-space.html>.

[15] *ICRC Statement to the Open-ended working group* (n 8). See also UNGA, *Reducing space threats* (n 6) [5] ['Many space objects are regarded as potentially of dual use, raising new concerns for ensuring the security of space systems and efforts to prevent an arms race in outer space'].

What are Jamming and Spoofing?

As space infrastructure relies on the reception and transmission of signals to operate,[16] any interference with or disruption of radio frequencies on the electromagnetic spectrum will also impact the operation of space systems and potentially impede crucial space applications such as geopositioning and navigation. Of particular concern are so-called 'jamming' and 'spoofing' incidents, which are intentional (sometimes referred to as purposeful or non-consensual) interference[17] using 'radio-frequency energy to disrupt, deny, deceive or degrade space services'.[18]

The **jamming of space signals** is the intentional interference with signals to or from satellites with the goal of denying or degrading the capabilities of those satellites.[19] Such uplink or downlink signals can be degraded or even completely hindered,[20] by, for instance, physically blocking the transmitter, or sending false signals on the same or similar frequency to overwhelm the receiver(s). Other than the examples of GPS jamming to disrupt the accuracy of navigation and geolocation services, another major concern is the frequent jamming of satellite broadcasts and space-based internet in order to suppress the free flow of information and ideas.[21] For instance, in late 2022, Eutelsat complained of harmful interference with the transmission of television and

[16] Secure World Foundation, 'Radio Frequency Spectrum, Interference and Satellites Fact Sheet'(online, updated 25 June 2013) <https://swfound.org/media/108538/swf_rfi_fact_sheet_2013.pdf>.

[17] This paper addresses only interference that is intentionally caused. There are instances of interference caused by operator or equipment error, inadvertent misuse of radio equipment, and other instances of accidental or natural interference.

[18] UNGA, *Reducing space threats* (n 6) [14(f)]. See also Australia, Department of Defence, 'Electronic Warfare', Defence Science and Technology Group, Department of Defence (online) <https://www.dst.defence.gov.au/research-area/electronic-warfare> ['Electronic attack involves the use of electromagnetic spectrum to attack enemy facilities, equipment or personnel with the intent of degrading, neutralising or destroying enemy combat capability'].

[19] Secure World Foundation, 'Radio Frequency Spectrum, Interference and Satellites Fact Sheet' (n 19).

[20] UNGA, *Reducing space threats* (n 6) 96 (reply of the United States) ['Uplink jamming is directed towards the satellite, and must operate at the same frequency and approximate power level as the target signals. Effects can be widespread. Downlink jamming is directed at users on the ground, and its effects are more localized'].

[21] For instance, in the wake of 'a wave of civil uprisings' during Arab Spring in the early 2010s, commercial satellite operators experienced of jammings: Peter B. de Selding, 'Jamming No Mere Nuisance for Middle East Satellite Operators', *Space.com* (23 March 2012).

radio channels that the satellite operator traced back to the Islamic Republic of Iran.[22] Meanwhile, since 2013, the United Kingdom has repeatedly raised the issue of deliberate jamming of BBC broadcasting services that, according to international monitors, originates from within China.[23]

The spoofing of space signals, on the other hand, is the intentional use of a fake or false signal to deceive the satellite receiver.[24] For instance, it has been reported that China has developed a space-based spoofing system designed to deceive missile defence.[25] GPS coordinates have also been concealed or manipulated in attempts to obfuscate the path of oil tankers that may be violating international sanctions.[26] The spoofing of signals is also commonly used by (transnational) criminals for the purposes of trafficking narcotics, 'unapproved operation of autonomous vehicles, illegal fishing and piracy'.[27]

[22] Eutelsat, 'Eutelsat statement on satellite jammings originating from Iran' (press release, 7 October 2022) <https://www.eutelsat.com/en/news/press.html#/pressreleases/please-find-below-a-statement-from-eutelsat-3209454?>.

[23] See BBC, 'Statement regarding interference to BBC World Service transmissions' (press release, 25 February 2013) <https://www.bbc.com/mediacentre/statements/shortwave-jamming> ['The deliberate and co-ordinated efforts by authorities in countries such as China and Iran illustrate the significance and importance of the role the BBC undertakes to provide impartial and accurate information to audiences around the world']. See also ITU, Minutes of the 90th meeting of the Radio Regulations Board, ITU Doc RRB22-2/16E (2022).

[24] UNGA, *Reducing space threats* (n 6) 46 (reply of Germany).

[25] Gabriel Honrada, 'China's 'phantom space strike' made to spoof US defenses', *Asia Times* (online, 23 February 2023) <https://asiatimes.com/2023/02/chinas-phantom-space-strike-made-to-spoof-us-defenses/>.

[26] Anatoly Kurmanaev, 'How Fake GPS Coordinates Are Leading to Lawlessness on the High Seas', *New York Times* (online, 3 September 2022) <https://www.nytimes.com/2022/09/03/world/americas/ships-gps-international-law.html>

[27] See Frank Wolfe, 'Pentagon Looks to Improve Awareness of GNSS Disruptions', *Defense Daily* (online, 10 August 2021) <https://www.defensedaily.com/pentagon-looks-to-improve-awareness-of-gnss-disruptions/space/>. Spoofing of GPS signals may also cause drivers to be led astray to remote locations where they can be robbed or attacked: Thomas Brewster, 'This GPS Spoofing Hack Can Really Mess with Your Google Maps Trips', *Forbes* (online, 12 July 2018) <https://www.forbes.com/sites/thomasbrewster/2018/07/12/google-maps-gps-hack-takes-victims-to-ghost-locations>

Both jamming and spoofing of signals are hard to detect, and as a result are also hard to deflect and attribute.[28] Furthermore, the technology to electronically interfere with signals is 'is commercially available, relatively inexpensive and thus accessible',[29] making it a means of misuse that is open to military as well as non-military or even nefarious actors.

In the ongoing multilateral discussions on threats to outer space, interference with space signals has been widely recognised as being 'irresponsible behaviour'.[30] Though not quite reaching the threshold of what is considered a use of force under international law, and therefore not specifically prohibited under the Charter of the United Nations (UN Charter),[31] such destabilising and unfriendly 'grey-zone' activity run the risk of being 'normalised'.[32] In certain circumstances, interference with space

[28] UNGA, *Reducing space threats* (n 6) 46 (reply of Germany); and 90 (reply of Switzerland). See also Paul Tullis, 'GPS Is Easy to Hack, and the U.S. Has No Backup', *Scientific American* (1 December 2019), online: *Scientific American* <https://www.scientificamerican.com/article/gps-is-easy-to-hack-and-the-u-s-has-no-backup/>.

[29] UNGA, *Reducing space threats* (n 6) 46 (reply of Germany).

[30] See e.g. UNGA, *Reducing space threats* (n 6) (views of Canada; Germany; Japan; Luxembourg; Switzerland; the United Kingdom; and the United States). However, there are States who have opposed the discussion on what is 'irresponsible' behaviour: see e.g. UNGA, *Submission of China Pursuant to United Nations General Assembly Resolution 75/36*, UN Doc A/AC.294/2022/WP.9 (2022) ['The binary distinction between responsible and irresponsible behaviours in outer space is over-simplified and subjective and can easily be used as a political tool']; and Iran, *Statement by Mr. Nasserddin Heidari, Representative of the Islamic Republic of Iran before the Second Session of the OEWG on reducing Space Threats through Norms, Rules and Principles of responsible Behaviours* (online, 13 September 2022) <https://documents.unoda.org/wp-content/uploads/2022/09/2022-0914-Iran-Stament-before-the-OEWG-on-Responsible-Behaviours-in-Outer-Space.pdf> 4 ['[…] the so-called the concept of responsible behavior might be an attractive political gesture, but is subjective, oversimplified, vague and unclear phrase to define norm setting as standard of appropriate behavior for political act that complying with it, is driven by political expectations'].

[31] *Charter of the United Nations*, 24 October 1945, 1 UNTS XVI, art 2(4). See also *Legal Consequences of the Construction of a Wall in the Occupied Palestinian Territory, Advisory Opinion* [2004] ICJ Rep 136 [87] ['the principles as to the use of force incorporated in the Charter reflect customary international law']. See also UNGA, *Second part: existing international legal and other normative frameworks concerning threats arising from State behaviours with respect to outer space: Submitted by the European Union,* UN Doc A/AC.294/2022/WP.5 (2022) [6] ['The EU and its Member States consider that any international law principles, including of customary international law, that apply to the use of force, apply in outer space'].

[32] *Global Counterspace Capabilities Report* (n 12) 16-17.

signals may, according to the European Union, have 'dramatic consequences on international peace, security and stability'.[33]

What is the law on space signals interference?

Fortunately, intentional activities that aim to 'disrupt, damage, disable or destroy' the space infrastructure[34] and interfere with the transmission of space signals are subject to an overarching global governance framework and international legal principles that have existed and ensured peace and prosperity since the beginning of the Space Age.[35]

The following will provide a brief outline of legal issues that interference with space signals touches on. Though the various legal issues are discussed under different bodies of law, it is important to underline that legal principles do not operate in silos, as they interrelate and potentially overlap. Ultimately, these principles must be read with the preservation of international peace and security, as well as the interference-free of use of the radiofrequency spectrum in mind.

General International Law

States are sovereign entities under international law that enjoy the freedom to determine affairs within their borders free from external interference,[36] and to act freely on the international plane.[37] Provided there is no treaty or customary prohibition, States are free to act as long as their actions, or activities or objects under

[33] European Union, 'EU joint contribution to the Open-Ended Working Group on reducing space threats: Third part: current and future threats by States to space systems, and actions, activities and omissions that could be considered irresponsible' (online, September 2022) <https://documents.unoda.org/wp-content/uploads/2022/09/EU-joint-contribution-to-the-Open-Ended-Working-Group-on-reducing-space-threats.pdf>. See also *Survey of the problem of discretion exercised by States* (n 6) [22].
[34] UNGA, *Reducing space threats* (n 6) [9].
[35] See generally, Ram Jakhu and Kuan-Wei Chen, 'The Need for Expanding Global Space Governance' in *Liber Amicorium Sergio Marchisio: Il diritto della comunità internazionale tra caratteristiche strutturali e tendenze innovative* (Editoriale Scientifica, 2022) 1091.
[36] *Military and Paramilitary Activities in and against Nicaragua* (*Nicaragua v United States of America*) [1986] ICJ Rep 14 [205]
[37] See generally, Dan Svantesson, Samuli Haataja, Danielle Ireland-Piper and Kuan-Wei Chen, 'On Sovereignty' (2023) 17:1 Masaryk University Journal of Law and Technology 33.

their jurisdiction, do not unlawfully impinge on the rights of other States.[38] A State may be held responsible for injuring the rights and interests of other States in causing transboundary harm.[39]

By way of example, when a defunct Soviet satellite deorbited and intruded into Canadian air space and crash landed on Canadian territory, Canada claimed that its sovereignty had been violated, and that its 'sovereign right' to determine acts performed on its territory were interfered with.[40]

These cardinal principles of international law also apply to activities such as using space or space systems to facilitate telecommunications. Interference with space communications of other States is akin to causing transboundary harm and acting in a manner that is contrary to the rights of and injurious to the interests of other States.

However, it should be noted that there is no accepted international standard to determine the threshold beyond which a conduct or degree of interference is considered injurious to the rights or interests of another State. Applied to the context of interference with space signals, the exact nature of what is considered a violation of a State's sovereign rights must be determined on a case-by-case basis, and the tolerance for and threshold of interference of each State may vary. For instance, the United States has expressly stated that any form of '[p]urposeful interference with space systems, including supporting infrastructure, will be considered an infringement of a nation's rights', and that it reserves the right to respond to such interference at a 'time, place, manner, and domain' of their choosing.[41]

Some States have expressed that interference with certain space objects may be 'a precursor to other, more escalatory activities'.[42] Such a tolerance for interference may

[38] *Corfu Channel (United Kingdom of Great Britain and Northern Ireland v. Albania)*, [1949] ICJ Rep 4 at 22 [States must not 'allow knowingly its territory to be used for acts contrary to the rights of other States']. See also *Pulp Mills on the River Uruguay (Argentina v. Uruguay)* [2010] ICJ Rep 14 [101].
[39] *Trail Smelter Case (United States, v Canada)*, [1949] III RIAA 1905, 1965.
[40] 'Canada: Claim Against the Union of Soviet Socialist Republics for Damage Caused by Soviet Cosmos 954*',* Annex A: Statement of Claim (1979) 18:4 ILM 899 [21].
[41] United States, *National Space Policy*, Memorandum of 9 December 2020, 85 FR 81755, (published on 16 December 2016), sect 2(6).
[42] UNGA, *Proposals of the United States of America Regarding Responsible State Behavior for Outer Space Activities: Submitted by United States of America,* UN Doc A/AC.294/2023/WP.5 (2023), sec E. See also Japan, *Statement by Japan at the First Session of the Open-Ended Working Group on reducing space threats through norms, rules and principles of responsible behaviours* (9 May 2022) ['[…] interference

also vary depending on the space activity or space object that is harmfully interfered with. Obviously, interference with signals that are key to facilitating military command and communications would be perceived and received as more threatening and escalatory than interference with signals from a remote sensing satellite used for monitoring weather patterns and climate change.

International Space Law

Under international space law, States are free to explore and use outer space as long as such activities are conducted 'in accordance with international law, including the UN Charter, and 'in the interest of maintaining international peace and security and promoting international co-operation and understanding'.[43] Using outer space for the purposes of space communications, and the transmission and reception of signals through space systems, are clearly all permissible activity,[44] so long as such activities do not unlawfully impinge on the rights or sovereignty of other States, and is conducted in any way that is inconsistent with the UN Charter.[45] Intentional interference with space signals would impinge on the rights of other States to conduct space activities, and also would not be consistent with the interest of international peace and security and promoting international cooperation and understanding.

The general international law obligation not to cause injury to the rights and interests of other States should be read in conjunction with the obligation of States under international space law to conduct space activities with due regard to the corresponding interests of other States to peacefully explore and use space.[46]

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with those services could lead to serious social disorder and raise potential risks of misunderstanding and miscalculation'].

[43] *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies,* 27 January 1967, 610 UNTS 205 (entered into force 10 October 1967) [*Outer Space Treaty*] art III.

[44] Nicholas N. Matte, 'Aerospace Law: Telecommunications Satellites' (1980) 166 *Recueil des Cours 119, 148. See also* Manfred Lachs, Manfred, *The law of outer space: an experience in contemporary law-making*, Tanja Masson-Zwaan and Stephan Hobe (eds), (Martinus Nijhoff Publishers, 2010), ch VIII.

[45] UNGA, *Verbatim Records of the 1491st Session, First Committee,* UN Doc A/C.1/PV.1491 (1966) 118 ['Not only must States not abuse their rights, they must respect those of others'].

[46] *Outer Space Treaty* (n 43) art IX.

Though it is as yet unclear what the principle of due regard looks like in the space context, under the law of the sea, the principle has been clarified as 'a conscious balancing of rights and interests'.[47] Having due regard means refraining from actions that would unjustifiably interfere with the rights of another State.[48] Placed in context, having due regard means refraining from interference with the rights and activities of other States, and would prohibit intentional jamming or spoofing, for there is no justifiable reason to engage in such acts.

As the Philippines and Germany have asserted, due regard is a legally binding principle that 'does not permit States to merely note other States' rights and still do as they wish'.[49] States should not simply 'conduct or knowingly support activities' that result in 'loss of operational control over or irreversible damage or permanent loss of space systems of another State'.[50]

Furthermore, under international space law, there is an obligation to refrain from activities that would cause harmful interference with the activities of other States.[51] Though the exact meaning of what is 'harmful' and what constitutes interference is still being debated,[52] already in 1959, it there was recognition that interference with radio frequencies and communications is a matter of concern, as it could 'cripple the conduct

[47] *Chagos Marine Protected Area Arbitration (Mauritius v. United Kingdom),* Award of 18 March 2015, PCA No 2011-03 (2015) [535].
[48] *Ibid* [485].
[49] UNGA, *Recommendations on possible norms, rules and principles of responsible behaviors relating to threats by States to space systems: Submitted by the Federal Republic of Germany and the Republic of the Philippines*, UN A/AC.294/2023/WP.1 (2023) [3]
[50] *Ibid* [6].
[51] *Outer Space Treaty* (n 43) art IX. See also UNGA, *Verbatim Record of the 44th Meeting, Committee on the Peaceful Uses of Outer Space,* UN Doc A/AC.105/PV.44 (1966) 13 (per the Chairman); and more recently *Survey of the problem of discretion exercised by States* (n 6) [22] ['[…] the notion of 'harmful interference' encompasses a wide spectrum of situations that may lead to conflict']; and *Submission by the European Union* (n 31) [20].
[52] See e.g. *Survey of the problem of discretion exercised by States* (n 6) [22] ['Article IX of the Outer Space Treaty is devoid of specifications as regards both the description of "harmful interference" notion and quantitative characteristics of harmful interference']; and Japan, *Statement delivered by Ambassador Ichiro Ogasawara of the delegation of Japan to the Conference on Disarmament, Second Session of the Open-Ended Working Group on reducing space threats through norms, rules and principles of responsible behaviours* (12 September 2022); and UNGA, *Responsible behaviours as a practical contribution to the prevention of an arms race in outer space and to strengthening the international frameworks on space security: Submitted by Germany*, UN Doc A/AC.294/2022/WP.6 (2022); and UNGA, *Reducing space threats* (n 6) (view of Australia).

of space programmes'.[53] Some States have already expressed that they consider intentional interference with essential or critical space services, such as positioning, navigation and timing signals, to be a clear example of irresponsible behaviour and threatening to international peace and security.[54]

Attention should turn also to the unique nature of space law, which differs slightly from general international law in terms of responsibility for the acts of non-governmental entities. While under international law, the acts of private individuals or entities must be attributable to a State,[55] under space law, States bear international responsibility for all national space activities, including the activities conducted by non-governmental entities.[56] States must additionally ensure that the space activities of their non-governmental entities are in conformity with relevant international law, including space law.[57]

Thus, if a rogue actor operating in State A engages in the jamming of space communications of State B, State A may be considered internationally responsible for the activities of that rogue actor that infringe on the ability and freedom of State B to conduct space activities. In this regard, it is essential for States to adopt national space legislation to ensure that they have oversight over the space activities taking place and/or entities or individuals conducting activities under their jurisdiction that may interfere with space signals.[58]

[53] UNGA, *Report of the Ad Hoc Committee on the Peaceful Uses of Outer Space,* UN Doc A/4141 (1959) 45.
[54] UNGA, *Reducing space threats* (n 6) (views of Finland; France; Germany; Japan; Norway; Switzerland; the United Kingdom; the United States).
[55] ILC, *Responsibility of States for Internationally Wrongful Acts*, 53 UN GAOR Supp (No. 10) at 43, UN Doc A/56/83 (2001) Ch II.
[56] *Outer Space Treaty* (n 43) art VI.
[57] *Ibid.*
[58] For instance, nobody is not allowed to 'use or operate any apparatus for the transmission of energy or communications or signals by radio [within] the jurisdiction of the United States' without a license: 47 USC §301; and 47 CFR 25 § 25.102.

International telecommunication law

As space signals make use of the radio frequency spectrum, attention should be turned to the regulation of this shared and 'limited natural resource'.[59] The United Nations (UN) has underlined that interference-free and uninterrupted access and use of the radio frequencies goes hand in hand with the peaceful and sustainable use of outer space.[60]

With near universal membership, the International Telecommunication Union (ITU) is the specialised agency of the UN for setting global technical standards and harmonising the rules pertaining to the use of frequencies and associated orbits for telecommunications.[61] This body of binding rules[62] are commonly referred to as international telecommunication law, and also encompass frequencies and orbits used for the reception and transmission of space signals for various space applications.

International telecommunication law recognises 'the sovereign right of each State to regulate its telecommunication'[63] and signals may not be transmitted into the territory of another State without prior consent.[64] However, the sovereign right is curtailed in that telecommunications and the use of radio frequencies, including for space services, must be in such a manner that does not cause 'harmful interference' with the use of radiocommunication services by other States.[65]

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[59] *Constitution and Convention of the International Telecommunication Union*, 22 December 1992, 1825 UNTS 331 (entered into force 1 July 1994) in *Collection of the basic texts adopted by the Plenipotentiary Conference,* as revised by the 2022 Plenipotentiary Conference of the International Telecommunication Union (January 2023) [*ITU Constitution*], art 44(2).

[60] UN, *Guidelines for the Long-term Sustainability of Outer Space Activities of the Committee on the Peaceful Uses of Outer Space*, UN Doc ST/SPACE/79 (2021), Guideline A.4.

[61] *ITU Constitution* (n 59) art 1(1) and 1(2)(a).

[62] *ITU Constitution* (n 59) art 4(3).

[63] ITU Constitution, *supra* note…, Preamble; art 34 (right to stop telecommunications); and art 35 (right to suspend services). See also, Plenipotentiary Conference of the International Telecommunication Union (Minneapolis, 1998), *Role of the Secretary-General of ITU as depositary for memoranda of understanding*, Resolution No. 100, para 1(d) ["[…] the sovereignty and rights of ITU Member States are fully respected and preserved"].

[64] *ITU Radio Regulations* (n 65) art 23, No. 23.13 § 4.

[65] *ITU Constitution* (n 59) art 45(1); and ITU, *Radio Regulations* (Edition of 2020, WRC-19) (entered into force 1 January 2021) [*ITU Radio Regulations*] Preamble [0.4].

According to the ITU, harmful interference refers to 'interference which endangers the functioning of a radionavigation service or of other safety services or seriously degrades, obstructs or repeatedly interrupts a radiocommunication service'.[66] The jamming and spoofing of space signals would certainly be considered a means of harmful interference, and therefore prohibited under international telecommunication law. In fact, the ITU has condemned any intentional acts of interference with communications 'in the strictest terms'.[67]

Furthermore, the ITU Radio Regulations expressly prohibits 'unnecessary transmissions, or the transmission of superfluous signals',[68] as well as the 'transmission of false or misleading signals'.[69] Even without mentioning the commonly used terms of jamming or spoofing, it is clear that such intentional interference with space signals are prohibited. Indeed, in response to several Middle Eastern States jamming the satellite radio and television broadcasts of the BBC, France 24, Deutsche Welle and Voice of America, the ITU unequivocally stated that 'any transmission which has the intent to cause harmful interference to stations of other administrations is an infringement of the ITU Constitution, Convention or Radio Regulations'.[70]

The ITU has also reminded States that radio navigation satellite service (RNSS) is an 'essential component of global critical infrastructure' that must be 'protected from interference'.[71] Further, distress and safety communications enjoy 'absolute international protection, and all States are obliged to refrain from causing any interference with such vital communications.[72] Therefore, the actual examples of interference with such services impacting civil aviation are clear infringements of ITU rules.

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[66] *ITU Constitution* (n 59) Annex; and *ITU Radio Regulations* (n 65) art 1, No. 169.
[67] ITU, *Report by the Radio Regulations Board to WRC-23 on Resolution 80 (Rev.WRC-07): Note by the Secretary-General,* ITU Doc 50-E (2023), sect 4.8.1.3.
[68] *ITU Radio Regulations* (n 65) art 15, No. 15.1.
[69] *ITU Radio Regulations* (n 65) art 15, No. 15.1; and art 19, No. 19.2.
[70] ITU, 'ITU statement on satellite jamming following EBU press release of 22 October, 2012', (Press release, 26 October 2012) <https://www.itu.int/net/pressoffice/press_releases/2012/OS01.aspx>.
[71] ITU, 'Prevention of harmful interference to Radio Navigation Satellite Service Receivers in the 1559 – 1610 MHz frequency band', ITU Circular Letter CR/488 (2022). See also ITU, 'ITU issues warning on interference with radio navigation satellite service', ITU News (press release, 23 August 2022) <https://www.itu.int/hub/2022/08/warning-harmful-interference-rnss>.
[72] *ITU Radio Regulations* (n 65) art 15, No. 15.28.

Despite the clear prohibitions on causing harmful interference to space signals, it should be noted that States do enjoy freedom to use military radio installations that are used for national defence services.[73] Thus, there is a special 'carve out' for military installations, which can be operated in a manner that does not need to meet all the obligations set out in ITU instruments.[74]

However, this exemption for military installations must be restrictively understood and applied only to, for instance, satellites that are exclusively used for military purposes.[75] As GNSS, such as the GPS, serve both civilian and military purposes, it would not qualify under the military exemption.[76] As the ITU has clarified, the exemption for military installations is not 'a complete and definitive derogation' from ITU rules.[77] Radiocommunication installations that exclusively are used for military purposes must still 'so far as possible' observe provisions in relation to giving assistance in case of distress and measures taken to prevent harmful interference.[78]

Conclusion

As the ongoing Ukraine conflict and tensions in the South China Sea underline, deliberate acts of interference with space signals have repercussions on space applications that in turn can jeopardise safety and lives on Earth. Further, certain governments are continuing to employ means to suppress the free flow of information, including through the jamming of space transmissions.

[73] *ITU Constitution* (n 59) art 48(1). See also United States, Combined Communications-Electronics Board, *Guide to Electromagnetic Spectrum Management in Military Operations*, Allied Communications Publications (ACP) 190D, (September 2007), Chap II (2-1) [203].
[74] ITU, *Report by the Radio Regulations Board to World Radio Communication Conference 2015,* 30 June 2015, ITU Doc 14-E, CMR15/14-E (2015) [4].
[75] ITU, 'WRC-15 decisions included in the minutes of plenary meetings', ITU Circular Letter CR/389 (2016), sect 3.2.4.3. See also ITU, 'Use of frequency assignments by military radio installations for national defence services' in *Final Acts of the Plenipotentiary Conference, Bucharest*, Resolution 216 (2022).
[76] Michael Schmitt, *Tallinn Manual 2.0 on the International Law Applicable to Cyber Operations* (2nd ed) (Cambridge University Press, 2017) Rule 64 [4].
[77] ITU, *Report from the Radio Regulations Board: Invocation of Article 48 of the Constitution in Relation to the Radio Regulations,* ITU Doc 63-E (13 July 2022).
[78] *ITU Constitution* (n 59) art 48(2)-48(3).

Exactly because of the immense value that space as a critical infrastructure adds to economies, societies, and the conduct of military operations across the globe, it is also susceptible as a target of disruption and interference.

The aforementioned principles of international law, space law and telecommunication law do not operate in silos and must be read together as part and parcel of the overarching global governance framework that underpins international peace and security. For instance, in 2022, Iran complained that US-based Starlink provided satellite broadcasting and broadband services over Iranian territory without authorisation. The same incident was raised before the ITU,[79] as well as before the United Nations Committee on the Peaceful Uses of Outer Space, where Iran accused the United States of violating Iran's sovereignty, territorial integrity, political independence and sovereign jurisdiction.[80]

Understanding the applicable rules governing space activities,[81] and knowing where 'red lines' lie, are crucial to prevent miscalculations or misunderstandings that may potentially escalate into conflict.

As the consequences on civilian life, economies, and societies on Earth, and the long-term use of outer space cannot be imagined, every effort must be made to avoid the wanton and unjustifiable disruption of space signals and systems.[82]

[79] ITU, *Summary of Decisions of the 95th Meeting of The Radio Regulations Board*, 4 - 8 March 2024, ITU Doc RRB24-1/14-E, Revision 1 (2024) [7.3].

[80] UN, *Note verbale dated 25 November 2022 from the Permanent Mission of the Islamic Republic of Iran to the United Nations and other International Organizations in Vienna addressed to the United Nations Office for Outer Space Affairs,* UN Doc A/AC.105/1295 (2022).

[81] See Ram Jakhu and Steven Freeland, *McGill Manual on International Applicable to Military Uses of Outer Space: Volume I—Rules* (Centre for Research in Air and Space Law, McGill University, 2023) <https://www.mcgill.ca/milamos/files/milamos/mcgill_manual_volume_i_-_rules_final_0.pdf>.

[82] Steven Freeland, Kuan-Wei Chen and Ram Jakhu, ''War in space' would be a catastrophe. A return to rules-based cooperation is the only way to keep space peaceful', *The Conversation* (online, 30 November 2020) <https://theconversation.com/war-in-space-would-be-a-catastrophe-a-return-to-rules-based-cooperation-is-the-only-way-to-keep-space-peaceful-150947>.

About the Centre for Space, Cyberspace & Data Law

The Centre for Space, Cyberspace & Data Law is established at the Faculty of Law, Bond University (Australia). The Centre brings together researchers and experts in all aspects of space, cyberspace, and data-flows law to engage in research aimed at creating a better understanding of, and a better direction for, the relationship between space, cyberspace, and data.

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