Note n°09/24

20 mars 2024

JEUNES chercheurs & doctorants

FONDATION pour la RECHERCHE STRATÉGIQUE

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Buzzword or real threat? How concerns over nuclear capabilities in outer space can trigger the extension of space security discussions

At the start of 2024, the news that a space object with nuclear capabilities is being developed has sparked a heated debate in the international community. And with good reason: the presence of nuclear capabilities – whether as a source of energy or as a weapons system – raises numerous concerns about the safety and security of outer space[*].

On 14 February 2024, Mike Turner, Chairman of the Permanent Select Committee on Intelligence of the US House of Representatives, decided to make public the possibility of a new "*serious threat to national security*"[1]. Following this announcement, unnamed sources spoke of possible counterspace capabilities, not yet operational, that could penetrate low Earth orbit and neutralise objects that are placed there. Turner therefore "*called on the President of the United States, Joe Biden, to declassify information related to these threats so that Congress, the Administration and allies can openly discuss the actions necessary to respond to this threat*"[2]. Since then, many experts have taken up the issue in an attempt to discern the true from the false. The question arose as to the real nature of the system: a device capable of being detonated to explode in orbit, or an energy source for conventional counterspace capability? If the latter, was it a system causing electromagnetic interference, or a thruster used to manoeuvre a satellite in orbit? If the former, as envisaged by anonymous governmental sources, what specific measures or actions will be undertaken by the international community to address and rectify this breach of treaty, ensuring compliance against future violations?

[*] Special thanks to Jessica West, Andrey Baklitskiy, and Nivedita Raju for insights and feedback on early drafts.
[1] Mike Turner, Twitter, 15 February 2024, 3:35 a.m.
[2] *Idem.*

The effect of these statements has been to raise awareness of the dangers posed by counterspace capabilities. These can be used against another space object or a component of a space system in order to deliberately deny, disrupt, degrade, damage or destroy it in a reversible or irreversible manner, so as to gain an advantage over an adversary. While it is possible to classify counterspace capabilities into different groups, including kinetic physics, non-kinetic physics, electronics and cyber, none of these terms, or their definitions, are universally accepted or used[3]. However, threats to outer space can be categorised into three main types: space-to-space, space-to-earth attacks (and *vice versa*), and cyber hostile operations aimed at space assets, originating in the virtual domain but with tangible impacts on the functions of an object[4]. Given that several international legal instruments govern the use and exploration of outer space, is the existing regulatory framework sufficient to deal with this type of situation? The aim of this note is to provide a legal perspective on these different aspects, starting by drawing a distinction. On the one hand, although it presents certain safety risks, the use of nuclear energy sources for the propulsion and use of space objects has long been condoned and somewhat regulated. On the other hand, the placement and transit of nuclear counterspace capabilities in orbit raise space security issues because of the threat posed by their detonation and the radioactivity produced by their explosion.

Security threats and safety risks: how international legal instruments deal with space activities

The States Parties to the 1967 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, or OST), are subject to several obligations and must respect a number of fundamental principles to promote international cooperation[5]. Among these main principles, the Outer Space Treaty provides a general legal basis for the peaceful uses of space right from its preamble. Despite certain ambiguous expressions such as "*the principle of cooperation and mutual assistance*" and "*due regard*" for corresponding interests, certain principles are authoritative. Among them, the prohibition contained in Article IV makes the OST a space security treaty that sets out specific obligations and duties for the maintenance of international peace and security[6].

To a certain extent, Article IX OST also plays a significant role in space security as, according to this Article, State Parties to the treaty shall conduct exploration of outer space, including the moon and other celestial bodies, so as to avoid their harmful contamination, whether by their national activities or another State Party's activities. On the one hand, it requires that parties

[3] Almudena Azcárate Ortega, Victoria Samson (eds.), *A Lexicon for Outer Space Security*, UNIDIR, 2023.

[4] Eytan Tepper, "The Laws of Space Warfare: A Tale of Non-Binding International Agreements", vol. 83, n° 2, Article 4, *Maryland Law Review*, 2024, p. 463.

[5] 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), adopted on 19 December 1966, signed on 27 January 1967, came into force on 10 October 1967.

[6] P. J. Blount, "Peaceful Purposes for the Benefit of All Mankind: The Ethical Foundations of Space Security", *in* Cassandra Steer, Matthew Hersch (eds.), *War and Peace in Outer Space: Law, Policy, and Ethics*, Ethics National Security Rule Law Series, Oxford University Press, 2021.

shall undertake appropriate international consultations before proceeding with any activity or experiment planned by it or its nationals in outer space, including the moon and other celestial bodies, if they have reason to believe that this activity or experiment would cause potentially harmful interference with the activities of other States Parties in the peaceful exploration and use of outer space. On the other hand, a State Party to the Treaty may request consultation concerning the activity or experiment planned by another State Party in outer space, including the moon and other celestial bodies, that may cause potentially harmful interference with activities in the peaceful exploration and use of outer space.

However, the international legal framework applicable to outer space is open to interpretation. Furthermore, conventional counterspace capabilities are not formally prohibited. However, their placement, use or transit in outer space may prove problematic in terms of space security and stability, particularly if these capabilities have the potential to cause electromagnetic interference and large-scale disruption. Thus, in the context of the dialogues initiated at the Conference on Disarmament under the agenda item entitled "Prevention of an arms race in outer space" (PAROS)[7], the international community discusses the relevance of the rules applicable to space security issues and the mechanisms designed to strengthen transparency and confidence.

The concepts of "safety" and "security" are interdependent: the adverse use of nuclear energy in outer space has an impact on the safety of space activities, particularly because of the debris generated and the effects on normal operations of other space assets. Conversely, these safety risks can lead to tense situations between geopolitical rivals operating strategic space objects[8], as a safety incident could trigger security concerns for strategic assets. The distinction between space "safety" and "security" is not always clear-cut in terms of activities carried out in orbit. Safety measures make it possible to reduce the risks to space systems and protect them in the event of malfunctions during their day-to-day operations. Security refers to the maintenance of peace and stability and the protection of space objects against intentional threats and harmful activities[9].

Even though a dedicated legal instrument provides for safety measures through design features and mission operations to prevent or mitigate malfunctions, there remain gaps regarding the governance of the utilisation of nuclear energy sources, especially with respect to their security implications.

Regulating nuclear power sources

A space object may use a power energy source to conduct its activities. Because of the presence of more radioactive materials and their proximity to the surrounding human population and the Earth's environment, reactors used on Earth require more safety measures than small space nuclear reactors designed to remain inactive until they are launched into space. Despite the advantage of the distance separating nuclear power sources used in space, their remoteness has the disadvantage of preventing any maintenance operations, safety improvements or equipment upgrades from being carried out[10]. This is not a new issue, but one that is being

[7] Paul Meyer, "The CD and PAROS A Short History", *UNIDIR Resources*, April 2011.
[8] *Ibid.*; Jessica West, Gilles Doucet, "From safety to security: reducing the threat environment through the responsible use of outer space", *Survey Report*, Ploughshares, July 2020.
[9] Laetitia Cesari, "What's in a word? Notions of 'security' and 'safety' in the space context", *Commentary*, UNIDIR, 2020.
[10] *Ibid.*, p. 6.

discussed at multilateral level to ensure that States have a coherent and effective safety framework for their space activities involving the use of nuclear power sources. In addition to propulsion, space assets require energy for sustaining life support functions, operating communication systems, and powering various equipment.

Without going into technical considerations on the conversion of nuclear energy into electricity, it should be noted that the use of nuclear power sources in outer space is governed by the Principles Relevant to the Use of Nuclear Power Sources in Outer Space, adopted in 1992 (1992 Principles)[11], which provide a safety framework. It is important to distinguish between space exploration missions and satellites in orbit that will re-enter the Earth's atmosphere. In some cases, scientific space probes use radioisotope generators, which do not pose a problem of re-entry into the atmosphere as they are intended to "*be used for interplanetary missions and other missions leaving the gravity field of the Earth*" or be "*stored in a high orbit*"[12]. This is particularly the case for some space probes used for scientific missions, such as Pioneer, Voyager and Cassini, which have nuclear propulsion capabilities[13]. These capabilities allow spacecraft to benefit from a more powerful source of energy over longer periods without depending on the position of the Sun or the charging of batteries. In other cases, certain satellites orbiting the Earth are equipped with nuclear reactors. Their operations and risk of re-entry into the atmosphere are subject to special monitoring and supervision[14]. In this context, concerns about system safety relate less to the launch or routine operations in space and more to potential malfunctions, particularly during re-entry into the atmosphere. Furthermore, some of these systems have been de-orbited and placed in graveyard orbits so as not to interfere with functional objects.

According to the 1992 Principles, nuclear reactors can be operated on interplanetary missions in orbits high enough not to pose a risk to existing and future space missions and to minimise the risk of collision with other space objects, and in low-Earth orbits if they are stored in sufficiently high orbits after the operational part of their mission[15]. Despite the difficulty in assessing the effectiveness of these behavioural norms, in the use of nuclear power sources in space assets, technical experts view these Principles as a robust basis for national policies and standards. They have advocated for their adoption as the cornerstone for any forthcoming international efforts related to this type of activity[16].

In particular, the 1992 Principles propose a general concept of "defence in depth" which, when applied to space nuclear power sources (NPS), provides for the use of design features and mission operations to prevent or mitigate the consequences of system malfunctions. These principles are the result of discussions dating back to 1972, during the negotiation of the Convention on International Liability for Damage Caused by Space Objects. However, although the use by the United States of radioisotope thermoelectric generators as early as 1961 and nuclear reactors in space as early as 1965 gave rise to debate, it was not until 1978 that

[11] Principles relevant to the Use of Nuclear Power Sources in Outer Space, adopted on 14 December 1992 (1992 Principles).
[12] 1992 Principles, Principle 3, 3 (a).
[13] U.S. Department of Energy, A History of Space Nuclear Power and Propulsion in the United States, 2015, p. 10, p. 13, pp. 134-135.
[14] 1992 Principles, Principles 3-5.
[15] 1992 Principles, Principle 3.
[16] *A Brief Overview of Norms Development in Outer Space*, UNIDIR, CFSP/2012/05/COC-UNIDIR, 2013, p. 4; Leopold Summerer, Ulrike Bohlmann, "The STSC/IAEA Safety Framework for Space Nuclear Power Source Applications", *in* Irmgard Marboe (ed.), *Soft Law in Outer Space: The Function of Non-Binding Norms in International Space Law*, Böhlau, 2012, pp. 261-265.

discussions on the adoption of a safety framework accelerated, with the re-entry into the atmosphere of the Cosmos-954 satellite and its impact on the ground in the Canadian Northwest Territories[17].

As a result, the establishment of a multilateral regime with strict and fully effective norms, safeguards and limitations on the use of nuclear power sources in outer space was proposed to the Scientific and Technical Subcommittee of the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS)[18]. During the negotiations, the International Atomic Energy Agency (IAEA), a specialised United Nations agency that sets safety standards, was forced to react following the accident at the Chernobyl nuclear power station. In 1986, in response to this tragedy, the Convention on Early Notification of a Nuclear Accident and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency were adopted[19]. These Conventions served in particular to facilitate the design and application of the safety framework for nuclear power source applications in outer space.

The OST also plays a role in governing the use of nuclear energy in outer space. Article XI promotes transparency and the sharing of information. It encourages States to provide information to the United Nations, the public and the international scientific community concerning their space activities, thereby fostering trust, scientific collaboration and technological advancement.

At the national level, NPS are subject to highly controlled procedures at the end of which, if they meet the safety requirements, launch authorisation is granted to their operators[20]. According to official information provided by the United Nations Office for Outer Space Affairs (UNOOSA), while States regularly communicate, within the framework of Article XI of the Outer Space Treaty, on the deorbiting of their space objects and their re-entry into the atmosphere, only a very limited number of requests relating to nuclear systems have been filed[21]. Of all the information provided, only three notes verbales have been transmitted to this effect, two by the United States, in 2005[22] and 2020[23], and one by the Russian Federation in 2023[24], with reference to Principle 4 of the 1992 Principles[25].

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[17] Carl Q. Christol, "United Nations: General Assembly Resolution and Principles Relevant to the Use of Nuclear Power Sources in Outer Space", *International Legal Materials*, vol. 32, n° 3, May 1993, p. 917.

[18] UN General Assembly, Note verbale dated 8 February 1978 from the Permanent Representative of Canada to the United Nations addressed to the Secretary-General – Notification of the recovery of component part of Cosmos 954 under Article V of the Rescue Agreement, A/AC.105/214; UN General Assembly, Note verbale dated 3 March 1978 from the Permanent Representative of Canada to the United Nations addressed to the Secretary-General – Notification of the recovery of component part of Cosmos 954 under Article V of the Rescue Agreement, A/AC.105/217; UN General Assembly, Note verbale dated 19 December 1978 from the Permanent Representative of Canada to the United Nations addressed to the Secretary-General – Notification of the recovery of component part of Cosmos 954 under Article V of the Rescue Agreement, A/AC.105/236.

[19] Nuclear safety conventions, IAEA Website; Convention on Early Notification of a Nuclear Accident, adopted on 26 September 1986.

[20] UN General Assembly, Committee on the Peaceful Uses of Outer Space (COPUOS), A review of international documents and national processes potentially relevant to the peaceful uses of nuclear power sources in outer space, Report of the Working Group on the Use of Nuclear Power Sources in Outer Space, A/AC.105/781, 12 March 2002, pp. 14-15.

[21] Index of Submissions by States under Article XI, United Nations Office for Outer Space Affairs (UNOOSA) website.

[22] UN General Assembly, Note verbale dated 19 December 2005 from the Permanent Mission of the United States of America to the United Nations (Vienna) addressed to the Secretary-General, A/AC.105/864.

[23] UN General Assembly, Note verbale dated 28 July 2020 from the Permanent Mission of the United States of America to the United Nations (Vienna) addressed to the Secretary-General (Notification by the United States under Principle 4 of the 1992 Principles Relevant to the Use of Nuclear Power Sources in Outer Space concerning a safety-assessment carried out for the Mars 2020 mission), A/AC.105/1233.

The 1992 Principles are "*widely accepted and [have] proved valuable to member States when developing and/or applying their national systems*"[26], although they could be completed with additional measures applying to the "potential involvement of non-governmental and commercial entities in a variety of space NPS missions"[27]. Therefore, in 2024, the COPUOS also circulated a questionnaire containing a number of questions to its members in order to gather information on the potential uses of nuclear energy sources in space and related challenges[28].

These challenges mentioned in the questionnaire have been the subject of discussions within the COPUOS, particularly in the event of proliferation of nuclear energy sources or the use of nuclear propulsion in low Earth orbit[29], because in the event of malfunction, this type of capability presents safety risks both on Earth and in space. In this context, the questionnaire circulated in 2024 aimed to assess States' awareness of the guidance provided by the Safety Framework, particularly regarding the objective to protect people and the environment in the Earth's biosphere from potential hazards associated with relevant launch, operation and end-of-service phases of space NPS applications. It also requested for information regarding whether States would use the guidance provided and related difficulties or challenges in implementing the framework. Moreover, it encouraged States to share information on future uses of NPS in outer space, particularly those involving nuclear reactors.

Although there are potential safety risks associated with the use of NPS in outer space, these are thought to be well governed and are not traditionally viewed as posing a security risk. A space object powered by nuclear energy is not regulated in the same way as an object carrying nuclear weapons and other types of weapons of mass destruction which, under the Outer Space Treaty, will represent a prohibited weapons system because of its implications for space security[30].

Balancing OST provisions on space security: strict prohibitions, tolerances and the peaceful use of outer space principle

Article IV of the Outer Space Treaty is particularly relevant to space security as it seems to provide a clear legal prohibition: the placement in orbit around the Earth of any objects carrying nuclear weapons or any other kinds of weapons of mass destruction and the installation of such

[24] UN General Assembly, Note verbale dated 4 August 2023 from the Permanent Mission of the Russian Federation to the United Nations (Vienna) addressed to the Secretary-General (Notification by the Russian Federation indicating that the design of the nuclear power sources constituting part of the Luna-Glob spacecraft meets current international requirements as set out in the 1992 Principles Relevant to the Use of Nuclear Power Sources in Outer Space), A/AC.105/1297.
[25] 1992 Principles, Principle 4.
[26] UN General Assembly, COPUOS, Draft implementation plan to achieve the objectives of the Working Group on the use of Nuclear Power Sources in Outer Space under its five-year workplan for the period 2024–2028, Prepared by the Chair of the Working Group on the Use of Nuclear Power Sources in Outer Space, A/AC.105/C.1/L.413, 20 November 2023, pp. 1-2; UN General Assembly, COPUOS, Report of the Scientific and Technical Subcommittee on its sixtieth session, held in Vienna from 6 to 17 February 2023, A/AC.105/1279, 27 February 2023.
[27] *Ibid*.
[28] UN General Assembly, COPUOS, Draft Questionnaire containing a preliminary set of questions to collect information under the objectives of the workplan of the Working Group on the Use of Nuclear Power Sources in Outer Space Working paper, Item 14 of the provisional agenda, A/AC.105/C.1/2024/CRP.31, 6 February 2024.
[29] UN General Assembly, COPUOS, Reservations of the delegation of the Bolivarian Republic of Venezuela concerning the Safety Framework for Nuclear Power Source Applications in Outer Space, Note by the Secretariat, A/AC.105/938, 8 May 2009, pp. 2-4.
[30] Outer Space Treaty, Article IV.

weapons on celestial bodies, or the stationing of such weapons in outer space in any other manner[31].

Irrespective of the debate on the interpretation of the notion of the Moon and other celestial bodies being used exclusively for peaceful purposes, Article IV of the Treaty on the Prohibition of Objects Carrying Nuclear Weapons and Other Weapons of Mass Destruction sets out the limit imposed on States with regard to prohibited weapons systems.

It was proven very early on that a nuclear detonation in space was of no military interest. It could damage satellites indiscriminately without it being possible to contain their range, while having harmful long-term effects because of the radioactivity or debris they generate[32]. No major space power can afford the risk of losing its space capabilities, especially navigation, communication and guidance[33].

This was demonstrated by the Starfish Prime nuclear test in 1962, during which the United States detonated a nuclear-tipped missile some 400 km above the Earth's surface[34]. The year after this test, a Treaty was adopted to ban nuclear weapons tests and other nuclear explosions under the sea, in the atmosphere and in outer space[35]. The Outer Space Treaty formalised this ban and extended it to other types of weapons of mass destruction. At the height of the Cold War, this strategic restraint enabled states to constrain each other and ensure that they would continue to be able to use outer space, a new area of interest at the time[36]. Researchers calculated that using delivery mechanisms, especially intercontinental ballistic missiles (ICBMs), would be less costly and less technically challenging if done from the ground than from outer space and, therefore, that, from a strategic perspective, the efficiency of ground-based capabilities dispenses with the need for orbital deployment[37]. Conversely, securing assets used for space-based reconnaissance and early warning systems was essential, as it ensured monitoring capabilities, thereby maintaining a form of offensive and defensive balance[38].

Moreover, as well as being extremely costly, this type of weapons system posed a threat to all objects placed in low-Earth orbit and could compromise the spacecraft of other states, whether allies or rivals, thereby posing a risk to diplomatic relations and international cooperation. For the space powers, this is a mutual agreement based on a pragmatic balance. The aim is to preserve an area that is useful to them, for scientific missions, commercial and civil uses or military operations. On the other hand, space security considerations have been stretched in the past. For instance, and despite some criticism, the transit of intercontinental ballistic missiles has been, to a certain extent, tolerated[39].

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[31] *Ibid*.
[32] Cassandra Steer, "Is there really a nuclear weapon in space?", *The Interpreter*, 16 February 2024.
[33] *Ibid.*
[34] Bleddyn E. Bowen, *Original Sin Power: Technology and War in Outer Space*, Hurst and Company, 2022, p. 255.
[35] Treaty banning nuclear weapon tests in the atmosphere, in outer space and under water, signed on 5 August 1963, came into force on 10 October 1963.
[36] Cassandra Steer, *op. cit.*; Béatrice Hainaut, *L'établissement de normes de comportement dans l'espace extra-atmosphérique – De la Terre à la Lune, et au-delà*, Étude 110, IRSEM, November 2023, p. 25.
[37] David Wright, Laura Grego, Lisbeth Gronlund, *The Physics of Space Security: A Reference Manual*, American Academy of Arts and Sciences, 2005, pp. 95-96.
[38] Xavier Pasco, "Haute technologie spatiale et conflits", *Annuaire français de relations internationales*, Bruylant, vol. I, 2000, p. 833.
[39] Nivedita Raju, Wilfred Wan, "Escalation Risks at the Space-Nuclear Nexus", *SIPRI Research Policy Paper*, SIPRI, February 2024, p. 13.

Nevertheless, maintaining a balance between the development of counterspace capabilities and the adherence to the principle of peaceful use of outer space remains crucial and is upheld by existing laws and principles, even if significant legal gaps persist[40]. Additionally, this situation gets more complicated because States are involved in space activities and also make the laws that regulate them.

Various capabilities have the potential to disrupt the operation of space objects which do not fall into the category of nuclear weapons or weapons of mass destruction. Leading research institutes have documented the development and use of pulse energy, radio frequency jamming, lasers, and high-powered microwaves, to name but a few[41]. These non-kinetic capabilities are threatening in that they have the potential to rapidly damage and disable satellite constellations, which until now have been praised for their resistance to destruction caused by collisions or direct hits. And for good reason: as well as being cheap and small, the satellites that make up a constellation are sufficiently numerous and dispersed to constitute a robust and resilient system in the event of an incident, as opposed to strategic satellites, which represent a target that is easier to identify and hit. This approach spreads potential targets across a wider area, making it more resource-intensive for adversaries to target and destroy the space segment of a satellite constellation. For all these reasons, the mere mention of a counterspace capability (even more so when a nuclear system is involved) immediately conjures up a GoldenEye or Ghost Fleet scenario.

To date, there is no publicly available information that would confirm the existence of space-based counterspace capability[42]. However, this does not mean that transparency and confidence -building measures are unnecessary, quite the contrary[43]. On the one hand, the Outer Space Treaty contains fundamental principles, in particular communication and notification, to encourage cooperation and mutual assistance between States in the exploration and use of outer space. The international community also uses diplomatic processes and methods. The Conference on Disarmament has an agenda item entitled "Prevention of an Arms Race in Outer Space" (PAROS), under which States enter into multilateral negotiations to ensure the security of space activities[44].

Firstly, according to the provisions of the Outer Space Treaty, States Parties must have due regard to the corresponding interests of all other States Parties to the Treaty. As such, Article IX is also strongly linked to the notion of "*due diligence*"[45] as it encourages States to actively engage in international consultations before undertaking activities potentially harmful to others in outer space or if they have reason to believe that an activity or experiment contemplated by

[40] Jessica West, "Arms Control and the Myth of Peaceful Uses in Outer Space Get access", *in* Saadia M. Pekkanen, P. J. Blount (eds.), *The Oxford Handbook of Space Security*, Oxford Academics, 22 February 2024, pp. 223-224.
[41] *Global Counterspace Capabilities Report*, Secure World Foundation, April 2023; *Counterspace Weapons 101*, Center for Strategic and International Studies, Aerospace Security Project, 28 October 2019, updated on 14 June 2022.
[42] Todd Harrison, Kaitlyn Johnson, Makena Young, *Defense Against the Dark Arts in Space: Protecting Space Systems from Counterspace Weapons*, Report, CSIS Aerospace Security Project, Center for Strategic and International Studies, February 2021, p. 3.
[43] Ching Wei Sooi, *Direct-Ascent Anti-Satellite Missile Tests: State Positions on the Moratorium, UNGA Resolution, and Lessons for the Future*, Secure World Foundation, Swiss Existential Risk Initiative, October 2023, pp. 16-17, p. 23, pp. 38-39.
[44] France Diplomatie website, Les négociations multilatérales sur les dossiers spatiaux; Ching Wei Sooi, "The lay of the stars: Space security today", *Geneva Policy Outlook 2024*, Geneva Graduate Institute, 5 February 2024.
[45] Interview with Duncan Blake, *Australian Space Outlook*, 2019, p. 89.

another State would cause potentially harmful interference with the peaceful exploration and use of outer space[46].

The expression "*having due regard*" of the corresponding interests of other States is often used by experts and in multilateral discussions on space security[47]. As to whether this article can be applied to tests of debris-creating counterspace capabilities, this provision was designed to facilitate problem-solving between States and anticipate any escalation of tensions. However, the formal consultations provided for in the Outer Space Treaty have not so far been used in the context of tests of counterspace capabilities, even in situations where large quantities of debris have been created. This may reflect the effectiveness of existing cooperation and coordination and indicate that the mechanisms of dialogue are sufficient, or it may simply signify a reluctance on the part of States to formalise conflicts[48]. Conversely, these situations may be handled at the State level through diplomatic channels, as these incidents may be leveraged as part of their strategic narrative in an adverse situation.

The regulatory landscape of space governance has gradually transformed since the adoption of the Outer Space Treaty, evolving in a non-linear manner across various layers, from national to regional, with instruments that are both legally and non-legally binding. This development has involved contributions from a diverse range of stakeholders. Within the Conference on Disarmament, States are undertaking extensive diplomatic work, including on "*certain proposals for arms control in space, in particular the placement of weapons in space and the manner of defining threats and verifying States' compliance with their international obligations*"[49].

The role of diplomatic work in reducing tensions

Discussions on the Prevention of an Arms Race in Outer Space (PAROS) date back to the 1980s[50], when several initiatives were launched, ranging from a draft legally binding instrument to the development of voluntary measures. For example, a draft Treaty on the Prevention of the Placement of Weapons in Outer Space, the Threat or Use of Force against Outer Space Objects (PPWT), sponsored by the People's Republic of China and the Russian Federation, proposes a more restrictive space security measure than that contained in the Outer Space Treaty. The draft broadly defines the concept of "weapon in space" to mean "*any outer space object or its component produced or converted to eliminate, damage or disrupt normal functioning of objects in outer space, on the Earth's surface or in the air, as well as to eliminate population, components of biosphere important to human existence, or to inflict damage to them by using any principles of physics*"[51]. Moreover, this draft not only reduces the room for manoeuvre of its States Parties with regard to their counterspace capabilities, but also explicitly prohibits the threat or use of force against the space objects of its States Parties, in accordance with Article 2(4) of the UN

[46] Outer Space Treaty, Article IX.
[47] Almudena Azcárate Ortega, Laetitia Cesari, "The road to a moratorium on kinetic ASAT testing is paved with good intentions, but is it feasible?", *Notes de la FRS*, n° 22/2022, FRS, 23 May 2022.
[48] Jinyuan Su, "Space Arms Control: Lex Lata and Currently Active Proposals", *Asian Journal of International Law*, vol. 7, n° 1, January 2017, pp. 78-79; Stacey Henderson, "Arms Control and Space Security", *in* Kai-Uwe Schrogl (ed.), *Handbook of Space Security*, Springer, Cham, 2020.
[49] Laetitia Cesari, "Une nouvelle étape dans le désarmement spatial : le cas des tests de missiles antisatellites à ascension directe", *Notes de la FRS*, n° 39/2022, FRS, 7 December 2022.
[50] Nivedita Raju, "A Proposal for a Ban on Destructive Anti-Satellite Testing: A Role for the European Union*", Non-Proliferation and Disarmament Papers*, EU Non-Proliferation and Disarmament Consortium, April 2021, p. 8.
[51] Ministry of Foreign Affairs of the People's Republic of China website, Treaty on the Prevention of the Placement of Weapons in Outer Space, the Threat or Use of Force against Outer Space Objects (Draft), 16 June 2014.

Charter[52], except in the exercise of individual or collective self-defence, recognised by Article 51 of the UN Charter[53].

This draft PPWT raised the question of whether the presence of a treaty necessarily implies the requirement for verification mechanisms. Yet, the unique attributes of space assets pose significant challenges in clearly identifying and monitoring them to ensure treaty compliance. For instance, the use of multiple payloads onboard a satellite can make it challenging to distinguish between real and decoy assets and complicates the ability to determine with certainty the nature of a space object. Transparency and confidence-building measures cannot replace verification efforts, as they are hampered by issues of ambiguity, quality, correctness, and completeness, along with the varying abilities of States to supply the necessary information. However, considering that "the more trust, the less need for verification", is there a universal understanding for such verification[54] or could States have the flexibility to adjust verification levels based on their specific threat perceptions?

Furthermore, the Conference on Disarmament intends to adopt a programme of work for the negotiation of an "*international legally binding instrument on the prevention of an arms race in outer space, including on the prevention of the placement of weapons in outer space and of the threat or use of force in outer space, from space against Earth and from Earth against objects in outer space*"[55], constituting a sub-item entitled "Further practical measures for the prevention of an arms race in outer space" under the heading "Prevention of an arms race in outer space"[56].

To put this work into practice, an open-ended working group will be set up for the period 2024-2028, following on the work carried out by the group of governmental experts which met in 2023 to discuss about an international legally binding instrument to prevent an arms race in outer space and to make recommendations on this subject[57].

In 2022 and 2023, States also entered into discussions as part of the sessions of an "open-ended working group on reducing space threats"[58]. The aim of this working group was to develop norms, rules and principles of responsible behaviour that would serve as a starting point for the development of legal instruments applicable to space activities[29]. Discussions focused in particular on the application of existing international law, the identification of space threats and the development of transparency and confidence-building measures, while encouraging the maintenance of open and regular communication between the various powers involved in space activities.

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[52] UN Charter, signed on 26 June 1945, came into force on 24 October 1945, Article 2(4).
[53] UN Charter, Article 51.
[54] Ola Dahlman, "Verification: to detect, to deter and to build confidence", *in* Kerstin Vignard (ed.)*, Disarmament forum.* 2010/3), UNIDIR, 2010, p. 3.
[55] UN General Assembly, Agenda item 97 (c), Prevention of an arms race in outer space (PAROS): further practical measures for the prevention of an arms race in outer space, A/C.1/78/L.55, 12 October 2023, paragraph 5.
[56] *Ibid.*, paragraph 12.
[57] Agenda item 97 (c), PAROS, paragraph 8.
[58] Laetitia Cesari, "Éthique et responsabilité dans l'exploration spatiale : l'essor de la soft law pour encadrer les nouvelles pratiques", *Notes de l'IFRI*, IFRI, September 2023, pp. 17-18; Mathieu Bataille, Daniel Porras, *What's Next for Europe in Multilateral Engagement on Space Security? The UN OEWG and its success(ors) – Full Report*, European Space Policy Institute, February 2024.
[59] Laetitia Cesari, December 2022, *op. cit.*

At the end of these sessions, the UN General Assembly decided to continue these discussions by holding another open-ended working group in 2025 and 2026, whose work will follow on that of previous years[60]. Discussions will focus in particular on the deliberate damage and destruction of space assets, threats to the safe operation of space objects, rendezvous and proximity operations that may increase the risk of misunderstandings and misjudgements, and the protection of essential space services provided to civilians and services supporting humanitarian operations. In this context, it will also be necessary to work on activities and measures likely to reduce the risk of inadvertent escalation and conflict[61]. To a certain extent, these discussions are evolving towards a polycentric model, with the advancement of international law applicable to space activities are also occuring "via multiple forums, each with differing membership, topics, and instruments produced"[62].

Conclusion

With regard to the risk of unintended escalation, the concerns raised by the possibility of a nuclear counterspace capability designed to be placed in space may serve as a "trigger" for the introduction of effective legal measures. They may invigorate a debate and lead the international community to agree on the best way to prevent an arms race in space. As researcher Jessica West points out[63], these debates could be a starting point for thinking about these issues in the context of norms of responsible behaviour[64]. With the growing awareness of the dangers posed by counterspace capabilities, both nuclear and non-nuclear, it seems that the effectiveness of the international legal instruments currently in force is questioned[65].

As the case of February 2024 illustrates, addressing the development of counterspace capabilities is challenging, and nobody knows exactly what type of assets are orbiting the Earth. While the Outer Space Treaty already bans nuclear weapons and weapons of mass destruction in outer space, it lacks a verification mechanism to ensure compliance. The absence of such a system raises questions about how to effectively enforce this prohibition. Discussions on implementing verification measures are ongoing, but they face significant challenges, including the technological and diplomatic complexities involved. There are concerns about the effectiveness of multilateral processes and how legal prohibitions and the establishment of norms, rules, and principles for responsible behaviour in outer space can prevent such a situation, given the limitations of existing agreements.

[60] Agenda item 97 (c), PAROS, paragraphs 4-6.
[61] *Ibid.*
[62] Eytan Tepper, *op. cit.*, p. 515.
[63] Jessica West, Twitter, 16 February 2024, 2:23 a.m.
[64] Jessica West, "Recommendations by states from the Third Session of the UN OEWG on Reducing Space Threats: January 30 to February 3,2023", *Report*, Ploughshares, 15 June 2023.
[65] UN General Assembly Resolution 75/35, Prevention of an arms race in outer space, A/RES/75/35, 16 December 2020, p. 3, paragraphs 2-3; Paul Meyer, "Could an optional protocol be the way to stop the weaponization of outer space?", *International Journal: Canada's Journal of Global Policy Analysis*, vol. 76, n° 2, June 2021, p. 333; Wu Xiaodan, "China's Lunar Exploration and Utilization: Positive Energy for International Law or Not?", *Anuario Mexicano de Derecho Internacional*, vol. 15, 2015, pp. 151-152.

Despite their crucial and founding role in regulating the use and exploration of space, these legal instruments, particularly in emergency situations, often struggle to offer rapid and appropriate solutions and to respond to the threats to space activities. These shortcomings, highlighted by the February 2024 declarations and the ensuing discussions (and speculation), rekindle the need to supplement the existing legal framework to make it more appropriate to today's issues. This is the purpose of the two open-ended working groups whose sessions will soon be held respectively on the negotiation of a legally binding international instrument to prevent an arms race in outer space and, *inter alia*, the deployment of weapons in outer space and the threat or use of force in outer space, both from outer space to Earth and from Earth to space objects, and on reducing threats from outer space through norms, rules and principles of responsible behaviour.

Fondation pour la Recherche Stratégique (FRS)

55 rue Raspail 92300 Levallois-Perret

Fondation reconnue d'utilité publique par décret du 26 février 1993

Directeur de la publication : Bruno Racine

ISSN : 2273—4643

WWW.FRSTRATEGIE.ORG