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SPACE DOSSIER 9

To Space Security and Beyond: Exploring Space Security, Safety, and Sustainability Governance and Implementation Efforts

SARAH ERICKSON · ALMUDENA AZCÁRATE ORTEGA

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METHODOLOGY

A portion of this report contains a survey of selected space governance measures from around the world to provide insights on the current global space governance landscape. To ensure geographical representation, some States from each of the UN General Assembly regional groups were selected. This provisional mapping includes initiatives from 17 States and some international organizations. Any excerpts included from these 17 selected measures are not intended to serve as comprehensive representations of the respective initiative.

This research draws on preliminary findings from UNIDIR's Space Security Portal. It is not intended to be an exhaustive depiction of the global space governance landscape. All measures included in this report were retrieved from open-source information through desk research.

TABLE OF **CONTENTS**

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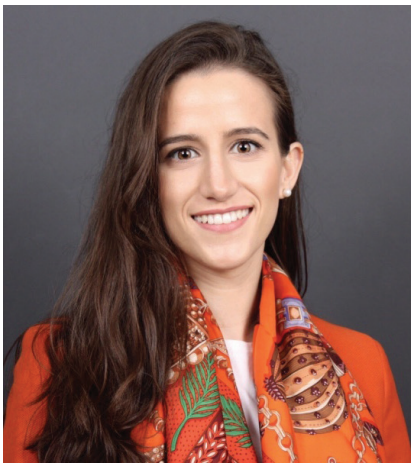

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LIST OF ACRONYMS

ASAT	Anti-satellite
CMI	Civil-military integration
COPUOS	Committee on the Peaceful Uses of Outer Space
GGE	Group of Governmental Experts
HCoC	Hague Code of Conduct against Ballistic Missile Proliferation
IADC	Inter-Agency Debris Coordination Committee
ICBM	Intercontinental ballistic missile
MTCR	Missile Technology Control Regime
OEWG	Open-ended Working Group
OST	Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies
PAROS	Prevention of an Arms Race in Outer Space
PLN	Pre-launch notification
SDA	Space domain awareness
SLV	Space launch vehicle
SSA	Space situational awareness
SSOD I	First special session of the General Assembly devoted to disarmament

KEY TAKEAWAYS

Space technology enables services on which modern life on Earth relies on an ever-increasing manner, fostering a constant growth in both objects and stakeholders in outer space. An ungoverned increase in space assets, including counterspace technologies, endangers both the safety and security of outer space and creates an unsustainable space environment for future generations. Dealing with this challenge will require new mechanisms to govern space achieved through multilateral cooperation.

At the international level, dialogue on outer space is divided into two different groups, which originated due to both historical and practical reasons. On the one hand, discussions relating to space safety and the peaceful uses of outer space aim to ensure space is kept as an environment to be used and explored for the benefit and in the interests of all humankind. On the other hand, negotiations regarding space security focus on the prevention of an arms race in outer space, the 'weaponization' of space, as well as intentional threats to peace involving outer space, such as through the development and use of counterspace capabilities. The issue of space sustainability is increasingly permeating space dialogue, since stakeholders' ability to use, explore and benefit from space is inherently tied to the continued use of and access to outer space. Therefore, while space security and safety are discussed separately in different bodies, it is useful to acknowledge the complementarity between them and the important role that achievements in the case of both would contribute to space sustainability.

Moreover, the multilateral model of separating space safety from security discussions is not always emblematic of what transpires at the State level. In the pursuit of establishing domestic space governance frameworks, States have found synergies between space safety and security thereby establishing domestic mechanisms which address these issues in a complementary manner. This report provides a provisional mapping of domestic implementation efforts which finds that States employ a diverse toolkit of measures in pursuit of increased space stability and sustainability including law, policy, military strategy, organizational structure, political commitments and other non-legally binding mechanisms, and international engagement. What is evident is that many States pursue one or a combination of such measures, demonstrating that there is not a singular model for a domestic space framework that is best. Rather, it is a combination of initiatives across domestic and international levels that will contribute to solving space security challenges and space sustainability issues at large.

Going forward, it may be increasingly helpful to think of space safety and security as two sides of the same coin that is space sustainability. As States work to develop mechanisms to ensure space security at the multilateral, regional and domestic levels, understanding space safety and security in a complementary and mutually reinforcing manner may propel efforts to successfully preserve outer space for our collective continued use and exploration.

INTRODUCTION

In recent years space-related activities have increased dramatically, spurred by growing interest in the space sector among multiple stakeholders, including emerging spacefaring States and the commercial space industry. This ever-increasing interest in outer space shows no sign of abating. As a result, Earth's orbits will become more crowded with new space objects from a rising number of actors.

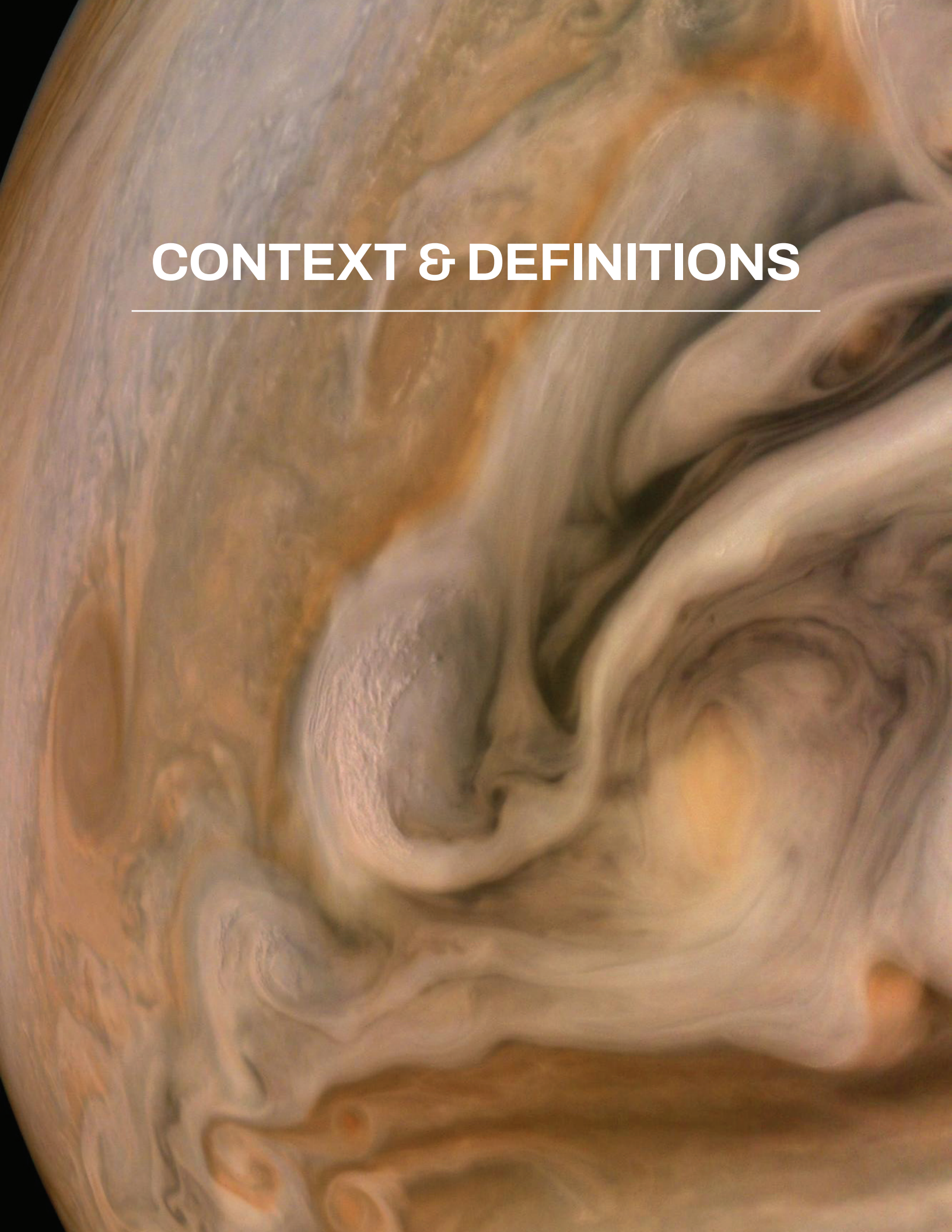
Interconnected with civilian activities, military interest in outer space will almost certainly continue to grow. This may prompt the further development of counterspace capabilities by multiple States, even those that are newly, or not yet, spacefaring. Left unchecked, the increase in space assets, including counterspace technologies, endangers both the safety and security of outer space and creates an unstable and unsustainable space environment for future generations. Dealing with these challenges requires leadership from States operating at the international level to build mechanisms to govern space. However, space security can no longer be achieved by States alone: it will require the cooperation of all stakeholders —international, national and local— to ensure that outer space is kept peaceful and secure. Furthermore, issues on space safety and security should not always be siloed but rather understood as two sides of the same coin: space sustainability.

Multilateral discussions have traditionally divided dialogue on outer space into two different groups, which address matters in separate fora. On the one hand, discussions relating to the peaceful uses of outer space aim to ensure that space is kept as a domain to be explored "for the benefit and in the interests of all countries".[1] Unintentional hazards—risks— to the safety of space systems are considered to belong within this first group. On the other hand, negotiations regarding space security focus on preventing an arms race in outer space, the 'weaponization' of space, and intentional threats to peace involving outer space, such as through the development and use of counterspace capabilities.

However, in practice, space security and safety are not two separate concepts. As States work on developing frameworks to ensure space security, it is imperative that security and safety be considered in complementarity as part of the same ecosystem —while different, they remain connected and interrelated.

This report explores the question of how space security, safety and sustainability are connected, both in theory and practice. The report will first provide context to the issue, by offering an overview of the historical separation of discussions on the peaceful uses of outer space and space security, and how this has resulted in the current concepts and definitions of space security, safety, and sustainability understood by the international community. The report will also focus on the variety of dangers to space sustainability. Either in the form of risks to space safety or threats to space security. The report will then provide a provisional illustrative mapping of existing national space measures to provide wider insight into the current global space governance landscape and how efforts to ensure space safety, security and sustainability are implemented. This report finds that the implementation of measures for space security and safety, although discussed in separate fora, must be complementary to effectively ensure the sustainability of the outer space environment.

1. Art. I 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, 27 Jan. 1967, 18 UST 2410; 610 UNTS 205; 6 ILM 386 [hereinafter "Outer Space Treaty" or "OST"].



CONTEXT & DEFINITIONS

A BRIEF HISTORY OF SPACE SAFETY, SECURITY AND SUSTAINABILITY

On 4 October 1957 the Soviet Union successfully launched Sputnik I, the first artificial satellite to orbit the Earth.[2] This launch, which opened the doors to space exploration, also demonstrated the capability of intercontinental ballistic missile (ICBM) technology for the first time.[3] Soon thereafter, upon realizing the military relevance of this newly accessible domain, certain spacefaring States of the time carried out various tests of counterspace technology.[4] This raised concerns among those members of the international community that wanted "to avoid the extension of (...) rivalries into this new field"[5]. States recognized "the common interest of [hu]mankind in outer space and recogniz[ed] that it is the common aim that outer space should be used for peaceful purposes only".[6] The international community thus sought to "promote energetically the fullest exploration and exploitation of outer space for the benefit of [hu]mankind".[7]

These ideas, as enshrined in UN General Assembly resolution 1348 (XIII) on the "Question of the peaceful use of outer space",[8] marked the birth of three key concepts for multilateral discussions on outer space: space security, space safety as part of the discussions on the peaceful uses of outer space, and lastly, space sustainability.[9]

Resolution 1348 (XIII) prompted the creation of the Committee on the Peaceful Uses of Outer Space (COPUOS),[10] and it was under its auspices that 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)[11], and that subsequent United Nations space treaties[12] were negotiated and entered into force.

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2. *USSR launches Sputnik*, National Geographic Society (14 Aug. 2023, 3:19 PM) https://education.nationalgeographic.org/resource/ussr-launches-sputnik/.

3. Vannevar Bush, *Modern Arms and Free Men: A Discussion of the Role of Science in Preserving Democracy,* 116-117 (1949). Jessica West & Almudena Azcárate Ortega, *Space Dossier 7 - Norms for Outer Space: A Small Step or a Giant Leap for Policymaking?*, UNIDIR, 6 (Mar. 2022), https://doi.org/10.37559/WMD/22/Space/01.

4. Jessica West & Almudena Azcárate Ortega, *Space Dossier 7 – Norms for Outer Space: A Small Step or a Giant Leap for Policymaking?*, UNIDIR, 6-7 (Mar. 2022), https://doi.org/10.37559/WMD/22/Space/01.

5. G.A. res. 1348 (XIII), Question of the Peaceful Use of Outer Space (13 Dec. 1958), https://www.unoosa.org/oosa/oosadoc/data/resolutions/1958/general_assembly_13th_session/res_1348_xiii.html.

6. *Ibid.*

7. *Ibid.*

8. *Ibid*.

9. Space sustainability would gain prominence in later years, with the increased use of Earth's orbits, and particularly with the growing concern of the international community over space debris. The Scientific and Technical Subcommittee of the United Nations Office for Outer Space Affairs established a dedicated working group to space sustainability, specifically to the long-term sustainability of outer space activities in 2010. For more information on this working group see https://www.unoosa.org/oosa/en/ourwork/copuos/working-groups.html.

10. COPUOS was first created as an ad hoc committee, composed of representatives of Argentina, Australia, Belgium, Brazil, Canada, Czechoslovakia, France, India, Iran, Italy, Japan, Mexico, Poland, Sweden, the Soviet Union, the United Arab Republic, the United Kingdom, and the United States. It would later become a permanent committee, in 1959, with 24 members, and currently has 102 members, as well as several observer organizations. For the full list of members and observers see https://www.unoosa.org/oosa/en/ourwork/copuos/members/evolution.html.

11. The OST itself was in great part based on the Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space, adopted by the General Assembly in 1963. See GA Res. 1962 (XVIII), 18th Sess. Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space (1963) (13 Dec. 1963), https://digitallibrary.un.org/record/ 203965.

12. All United Nations space treaties can be found at https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties.html.

The OST served as an important arms control agreement that contributed to stability in outer space despite the tensions that permeated the earthly geopolitics of the Cold War.[13] It included a provision that prohibits States from "plac[ing] in orbit around the Earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, install[ing] such weapons on celestial bodies, or station[ing] such weapons in outer space in any other manner".[14] The treaty further prohibits the "establishment of military bases, installations and fortifications, the testing of any type of weapons and the conduct of military manoeuvres on celestial bodies".[15]

The OST also stipulates the applicability of international law, including the Charter of the United Nations, to activities related to the exploration and use of outer space, including the Moon and other celestial bodies, "in the interest of maintaining international peace and security and promoting international co-operation and understanding".[16] The applicability of the UN Charter was explicitly included as the drafters sought to ensure the prohibition of the use of force or threat of use of force enshrined in article 2(4) of the UN Charter, as well as other obligations under international law that directly relate to security, were applicable to space activities.[17]

Beyond these key provisions that address space security, the OST, primarily focuses on the peaceful uses of outer space. Subsequent treaties follow the OST's seminal framing, using 'peaceful' to mean 'non-aggressive' or 'non-hostile' rather than 'non-military'. Multilateral discussions relating to the peaceful uses of outer space take place primarily in Vienna at COPUOS, a committee which is tasked with "reviewing international cooperation in peaceful uses of outer space, studying space-related activities that could be undertaken by the United Nations, encouraging space research programmes, and studying legal problems arising from the exploration of outer space".[18] The Committee reports to the Fourth Committee of the General Assembly, which adopts an annual resolution on international cooperation in the peaceful uses of outer space. COPUOS is composed of two subsidiary bodies —the Scientific and Technical Subcommittee,[19] and the Legal Subcommittee[20]— which address topics such as the definition and delimitation of outer space, the character and utilization of different orbits, the use of space technology for sustainable socioeconomic development, space and global health, space weather and the risks it can pose to space systems, and disaster management support to name a few.[21]

Space security, however, is neither the focus of COPUOS discussions, nor the United Nations space treaties, beyond the key provisions highlighted above. The international community feared that said treaties left room for

13. Francis Lyall & Paul B. Larsen, *Space Law: A Treatise* 453–454 (2d ed. 2018). US President Lyndon Johnson termed the OST as *'the most important arms control development since the Limited Test Ban Treaty of 1963'. Lyndon Johnson, Statement by the President Announcing the Reaching of Agreement on an Outer Space Treaty, 8 December 1966, in Lyndon B. Johnson: 1966 (in Two Books): Containing the Public Messages, Speeches, and Statements of the President. [Book 2]* 1441 (Lyndon Johnson ed. 1967), https://quod.lib.umich.edu/p/ppotpus/4731549.1966.002/815?rgn=full+text;view=image.

14. See art. IV. OST.

15. *Ibid*.

16. See art. III. OST.

17. STEVE MIRMINA & CARYN SCHENEWERK, INTERNATIONAL SPACE LAW AND SPACE LAWS OF THE UNITED STATES 267 (2022); *see also* Almudena Azcárate Ortega & Hellmut Lagos Koller, *The Open-Ended Working Group on Reducing Space Threats Through Norms, Rules and Principles of Responsible Behaviours: The Journey so Far, and the Road Ahead*, 48, AIR AND SPACE LAW, 19, 2023. https://kluwerlawonline.com/journalarticle/Air+and+Space+Law/48.SI/AILA2023029.

18. COMMITTEE ON THE PEACEFUL USES OF OUTER SPACE, UNITED NATIONS OFFICE FOR OUTER SPACE AFFAIRS, https://www.unoosa.org/oosa/en/ourwork/copuos/index.html.

19. *Ibid*.

19. *Ibid*.

20. For more information on topics addressed in 2023 by the Legal Subcommittee and the Scientific and Technical Subcommittee refer to the indicative schedules of work and session documents at https://www.unoosa.org/oosa/en/ourwork/copuos/2023/index.html.

the development of conventional weaponry to target space systems, which could serve to increase geopolitical tensions. In the face of this, during the first special session of the General Assembly devoted to disarmament (SSOD I), States decided that "in order to prevent an arms race in outer space, further measures should be taken and appropriate international negotiations held in accordance with the spirit of the [OST]".[22]

This marked the emergence of the concept of the 'Prevention of an Arms Race in Outer Space' (PAROS). In 1981 the General Assembly adopted the first two resolutions related to PAROS,[23] and a year later PAROS was added as an item to the agenda of the Conference on Disarmament, a forum completely separate from COPUOS.[24] Since then, PAROS has been a permanent fixture in multilateral discussions in the United Nations, particularly at the Conference on Disarmament, but also in other fora, such as the First Committee of the General Assembly and the UN Disarmament Commission.

Since its inception, PAROS has evolved to cover a broad range of issues, including topics of relevance to space security such as existing agreements and proposals, as well as future initiatives on PAROS, the definition of the concept of 'space weapon' —to this day there is no generally accepted definition of this term[25]—, and the verification of existing and future agreements on outer space.[26] Examples of issues currently discussed under the banner of PAROS include no first placement of weapons in outer space, further practical measures for PAROS, and reducing space threats through norms, rules and principles of responsible behaviour.[27]

While space security and safety are discussed in different bodies, it is useful to think of space security and safety as two sides of the same coin: space sustainability.[28] Space sustainability requires that space be kept both safe and secure, so that stakeholders may be able to use, explore and benefit from space "without discrimination of any kind, on a basis of equality and in accordance with international law".[29] The more significant space and related technology becomes for humankind, the more important space sustainability becomes, since if outer space is not safe and secure, the ability to use it could be denied to all.[30]

Despite the importance of space sustainability, the international community did not start debating it until much later than it did the peaceful uses of outer space and space security. The increase in the number of actors in space and the consequent rise in space objects in key orbits contributed to the emergence of the concept of space sustainability due to the implications of issues being discussed under both COPUOS and PAROS.

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22. G.A. Res. S-10/2, 10th Special Session of the United Nations General Assembly on Disarmament: Final Document, U.N. Doc A/RES/S-10/2, ¶ 80 (5 Feb. 1980), https://undocs.org/A/RES/S-10/2.

23. G.A. Res. 36/99, Conclusion of a treaty on the prohibition of the stationing of weapons of any kind in outer space (9 Dec. 1981), https://digitallibrary.un.org/record/627719. G.A. Res. 36/97C, Prevention of arms race in outer space (9 Dec. 1981), https://digitallibrary.un.org/record/610780?ln=en.

24. *Conference on Disarmament*, UNITED NATIONS OFFICE FOR DISARMAMENT AFFAIRS, https://disarmament.unoda.org/conference-on-disarmament/.

25. Open-ended Working Group on Reducing Space Threats through Norms, Rules and Principles of Responsible Behaviours, Threats to the Security of Space Activities and Systems, UNIDIR (12 Sep. 2022), UN Doc A/AC.294/2022/WP.16, [hereinafter "Threats Working Paper"] https://documents.unoda.org/wpcontent/uploads/2022/08/20220817_A_AC294_2022_WP16_E_UNIDIR.pdf.

26. Pericles Gasparini Alves, *Prevention of an Arms Race in Outer Space: A Guide to the Discussions in the Conference on Disarmament*, UNIDIR (1991), https://unidir.org/sites/default/files/publication/pdfs//prevention-of-an-arms-race-in-outer-space-a-guide-to-the-discussions-in-the-cd-en-451.pdf.

27. G.A. Res. 77/40, Prevention of an arms race in outer space (7 Dec. 2022), https://undocs.org/A/RES/77/40.

28. Threats Working Paper, *supra* note 25.

29. See art. I. OST.

30. Secure World Foundation, *Space Sustainability – A practical guide* (2018), https://swfound.org/media/206407/swf_space_sustainability_booklet_2018_web.pdf.

The term 'space sustainability' has become increasingly popular in the last two decades, particularly in the context of the work done to mitigate the danger posed by space debris, initially by the Inter-Agency Debris Coordination Committee (IADC),[31] and subsequently by COPUOS. In 2002 the IADC first published the non-legally binding Space Debris Mitigation Guidelines aimed at limiting the creation of long-lived space debris.[32] Item 3.3 on "Orbits and Protected Regions" of the IADC Guidelines specifies that "Any activity that takes place in outer space should be performed while recognising the unique nature of (...) outer space, to ensure [its] future safe and sustainable use. These regions shall be protected regions with regard to the generation of space debris"[33] The Guidelines were presented to the COPUOS Scientific and Technical Subcommittee, where they served as the basis for the Space Debris Mitigation Guidelines adopted by COPUOS in 2007.[34]

Also in 2007, the topic of 'long term sustainability of space activities' was introduced at COPUOS, and it was proposed that the Committee "start discussing how and in which framework 'rules of the road' [on how to avoid interference, collisions and other mishaps that may hamper the use of outer space by all, particularly by newcomers in space operations] could be developed"[35]. A few years later, in 2009, the long-term sustainability of outer space activities was included as an item on the COPUOS agenda.[36] A decade later, in 2019, COPUOS reached consensus on 21 voluntary Guidelines for the Long-Term Sustainability of Outer Space Activities.[37]

Under PAROS, space sustainability is increasingly highlighted, and has been featured as an issue tied to space security on multiple occasions, as actions that favour space security also contribute towards space sustainability, while acts that endanger the former also jeopardize the latter.[38]

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31. The IADC is a forum for the coordination of activities to prevent and mitigate space debris, initially formed by four civilian space agencies (NASA, Roscosmos, ESA and Jaxa). There are currently 13 members of IADC. They are the Agenzia Spaziale Italiana (ASI), Centre National d'Etudes Spatiales (CNES), China National Space Administration (CNSA), Canadian Space Agency (CSA), German Aerospace Center (DLR), European Space Agency (ESA), Indian Space Research Organisation (ISRO), Japan Aerospace Exploration Agency (JAXA), Korea Aerospace Research Institute (KARI), US National Aeronautics and Space Administration (NASA), Russian State Space Corporation (Roscosmos), State Space Agency of Ukraine (SSAU), and UK Space Agency. See Inter-Agency Space Debris Coordination Committee, *What's IADC*, available online at https://www.iadc-home.org/what_iadc.

32. West & Azcárate Ortega, *supra* note 4.

33. Inter-Agency Space Debris Coordination, *IADC Space Debris Mitigation Guidelines* (2020), https://orbitaldebris.jsc.nasa.gov/library/iadc-space-debris-guidelines-revision-2.pdf.

34. United Nations Office for Outer Space Affairs, *Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space* (2010), https://www.unoosa.org/pdf/publications/st_space_49E.pdf.

35. Committee on the Peaceful Uses of Outer Space, *Future role and activities of the Committee on the Peaceful Uses of Outer Space Working paper submitted by the Chairman*, (10 May 2007), UN Doc A/AC.105/L.268, ¶ 26-29, https://digitallibrary.un.org/record/607211?ln=es.

36. Gérard Brachet, *The origins of the "Long-term Sustainability of Outer Space Activities" initiative at UNCOPUOS*, 28, SPACE POLICY, 161, 164 (Aug. 2012).

37. United Nations Office for Outer Space Affairs, *Guidelines for the Long-term Sustainability of Outer Space Activities of the Committee on the Peaceful Uses of Outer Space* (2019), https://www.unoosa.org/documents/pdf/PromotingSpaceSustainability/Publication_Final_English_June2021.pdf.

38. Report of the Secretary-General A/76/77, on reducing space threats through norms, rules and principles of responsible behaviours, ¶¶ 14, 17 (13 Jul. 2021), https://undocs.org/en/A/76/77.

SPACE SAFETY, SECURITY AND SUSTAINABILITY AS UNDERSTOOD BY THE INTERNATIONAL COMMUNITY

Both space security and safety ensure that the space domain is kept peaceful and sustainable; however, there are certain differences between the two that have prompted the international community, as seen above, to address them in separate fora.[39]

- **Space security** – Commonly understood to refer to measures designed to prevent deliberate harms to a space system, including its component parts, from intended or intentional threats by another actor. Space security is also concerned with the relationship between space objects and the maintenance of international peace and security, as well as the work of States to prevent an arms race in outer space.

  Dangers to space security are commonly known as 'threats' (as opposed to 'risks', an expression used to refer to dangers to the peaceful uses of outer space). In the context of space security, 'threat' generally refers to the danger to the security of a space system or any of its components, that is to say the possibility of intended or intentional damage (involving agency, or done in a deliberate manner) to space systems. The identification of threats is not a straightforward task, as threat perception can be subjective in nature, due to the diverse range of interests and views of what can constitute a threat to different actors and stakeholders, and the fact that, globally, space situational awareness (SSA) and space domain awareness (SDA) are not perfect tools to identify and address threats.

39. Threats Working Paper, *supra* note 25.

Space security discussions largely fall under the purview of the Conference on Disarmament, as well as the General Assembly's First Committee, and the UN Disarmament Commission.[40]

- **Space safety** – Commonly understood to refer to measures aimed at preventing accidental or unintentional hazards to space systems. These hazards can be natural, such as geomagnetic storms, or stem from human-made objects, such as the accidental malfunctioning of a satellite, or collision with a piece of debris.

  Space safety measures therefore seek to mitigate any non-intentional damage to a space system. The possibility of such damage is generally considered a 'risk', that is to say, the probability of an outcome having a negative effect on people, systems or assets. When used in the context of space security, 'risk' generally refers to the danger to the safety of a space system or any of its components, that is to say, the possibility of accidental or unintended damage to space systems, or to people depending on the services provided by those systems.

  Issues of space safety are generally understood to be part of the broader topic of the peaceful uses of outer space, which is discussed at COPUOS and under the purview of the General Assembly's Fourth Committee.[41]

Although space security and safety are distinct from one another, the two are also interrelated, and can intersect and overlap. Many languages do not differentiate between 'safety' and 'security', and therefore confusion can arise in distinguishing the two.[42] Moreover, certain stakeholders' policies consider space safety and security either jointly or in a closely related manner.[43]

Space safety and security both contribute to **space sustainability**, which is commonly understood to mean stakeholders' ability to continue to be able to use space and benefit from it. Space sustainability requires that space be kept safe and secure, so that stakeholders may be able to use, explore, and benefit from space "without discrimination of any kind, on a basis of equality and in accordance with international law" (see article I OST). Space sustainability therefore seeks to preserve the usability of space and of the domain itself over time.[44]

Understanding the ways in which space safety, security, and sustainability are perceived and used at the multilateral level is important, as activity at the multilateral level influences global space discussions across fields at large. However, the delineation highlighted above that exists within multilateral fora does not always trickle down to domestic contexts especially when considering its practical implementation, as this report evidences below. In particular, at the domestic level, States may not always find it feasible nor conducive to

40. *Ibid*. See also Almudena Azcárate Ortega & Victoria Samson (Eds.) *A Lexicon for Outer Space Security*, UNIDIR (2023), https://doi.org/10.37559/WMD/23/Space/05.

41. Threats Working Paper, *supra* note 25.

42. In Spanish the word *seguridad* means both safety and security. In Russian the word безопасность refers to both safety and security. In French the expression *sûreté de l'espace* is used to refer to space security, and *sécurité de l'espace* refers to space safety. In Chinese, the word 安全 can generally be used to refer to security, while 安保 can refer to safety. In Arabic, أمن is used to refer to security, while أمان is used to refer to safety.

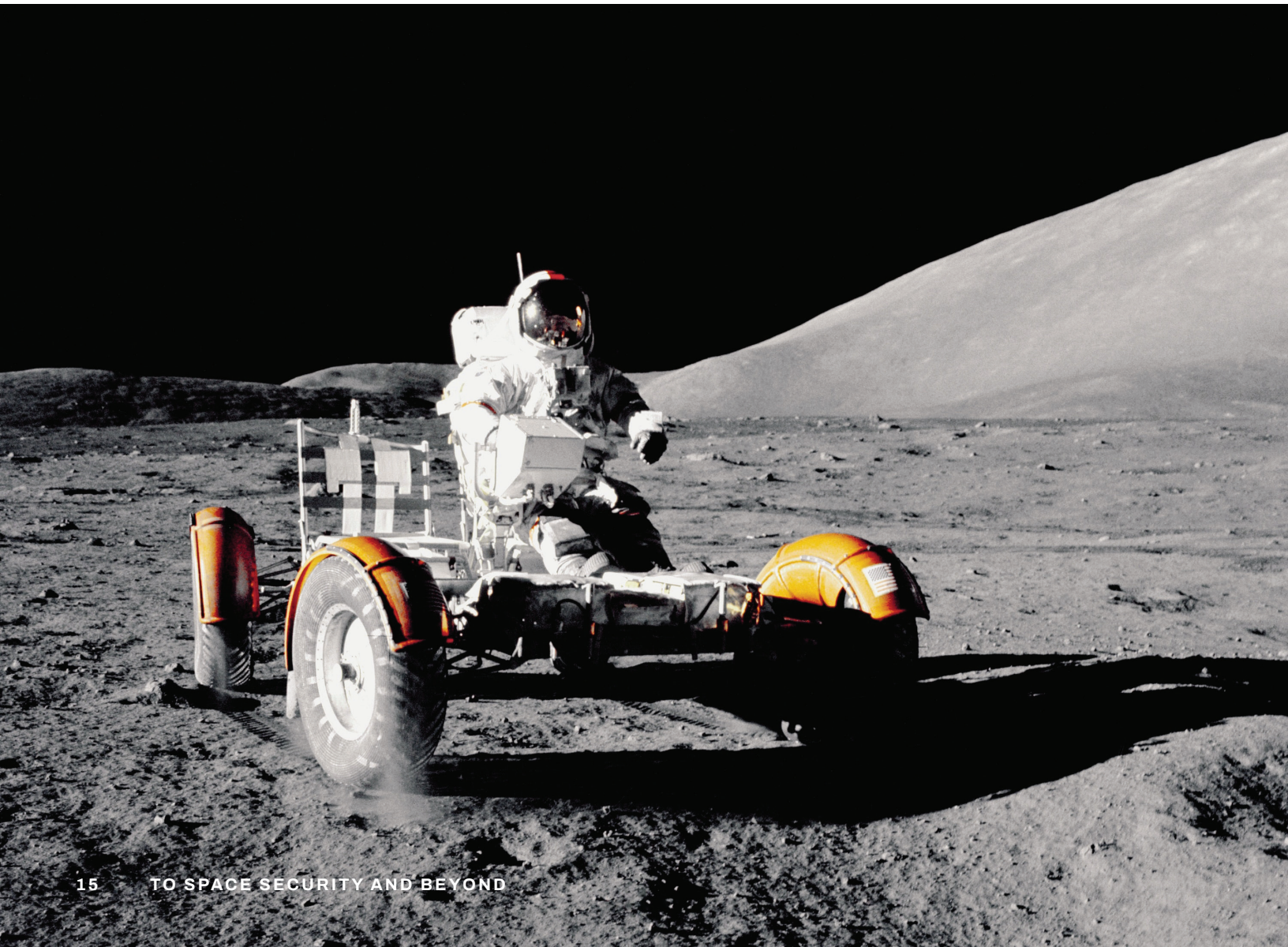
43. Threats Working Paper, *supra* note 25.

44. *Ibid*. See also Secure World Foundation, *supra* note 30.

achieving national space sustainability goals to pursue and implement domestic measures in parallel and siloed methods. This report will further explore this question of practical implementation below.

Space Sustainability	
Space sustainability is an overarching concept that is inclusive of both:	
SPACE SAFETY	SPACE SECURITY
PEACEFUL USES OF OUTER SPACE	PREVENTION OF AN ARMS RACE IN OUTER SPACE (PAROS)
COPUOS, FOURTH COMMITTEE OF THE GENERAL ASSEMBLY	CONFERENCE ON DISARMAMENT, FIRST COMMITTEE OF THE GENERAL ASSEMBLY, DISARMAMENT COMMISSION
RISKS	THREATS

Figure 1: The Interconnected Relationship between Space Safety, Security, and Sustainability part 1



DANGERS TO SPACE SUSTAINABILITY

The safety, security and operability of space systems are endangered by a myriad of risks and threats that vary from natural phenomena to human-created and enabled incidents. As highlighted above, the terms risk and hazard (a term commonly used interchangeably with risk) are generally associated with space safety and may be understood as the possibility of unintended damage to space systems from natural origins or accidental circumstances.[45] The term threat is used in space security to denote deliberate disruptive or harmful interference to the normal operation of a space system as a consequence of human intervention.[46] It is important to understand that space systems are generally understood as comprising three parts: the space segment, the ground segment, and the data link connecting the two segments.[47] Risks and threats to space systems can affect any individual segment of a space system at a given time or may have consequences on the totality of a space system or combination of its parts. Furthermore, dangers to space systems span a spectrum of reversible to irreversible damage.[48] Despite this distinction between space safety risks and security threats, it should be noted that the distinction may not always be clear. In particular, there are dangers to space systems which can span this conceptual divide, furthering the need to consider the overlapping nature of space safety and security as intertwined contributors to space sustainability. The following subsections are intended to provide a non-exhaustive overview of key dangers to space systems, using an illustrative method of categorizing dangers.[49]

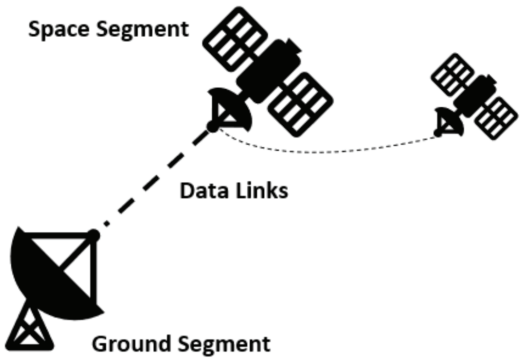


Figure 2. Space Systems Diagram

45. For a more detailed explanation of commonly used terminology relevant to space security see Almudena Azcárate Ortega & Victoria Samson (Eds.), *A Lexicon for Outer Space Security*, UNIDIR (2023), https://doi.org/10.37559/WMD/23/Space/05.

46. *Ibid*.

47. Threats Working Paper, *supra* note 25.

48. Cécile Aptel & Sarah Erickson, *Outer Space Security: Past and Ongoing Multilateral Efforts and Challenges*, 35, THE JOURNAL OF EAST ASIAN AFFAIRS, 5, (2022).

49. It should be noted that within United Nations nomenclature there is not an official framework for categorizing counterspace measures. For further examples of categorizations see Threats Working Paper, *supra* 25 and *see* Report of the Secretary-General A/76/77, on Reducing space threats through norms, rules and principles of responsible behaviours, *supra* note 38.

THREATS TO SPACE SYSTEMS

Kinetic physical or hard-kill counterspace capabilities

Kinetic physical or hard-kill[50] counterspace[51] capabilities can be any mass that either strikes a space system component or detonates a warhead near it.[52] Kinetic physical threats can be conducted via direct-ascent or co-orbital methods.[53] In addition, kinetic physical strikes may be carried out against ground stations and other ground segments. Hard-kill actions against space segments are likely to result in irreversible damage as well as the creation of space debris. A growing number of States and space actors have expressed concern over the threat imposed by deliberate space debris creation.[54]

Non-kinetic or soft-kill counterspace capabilities

Directed energy and non-kinetic physical hostile actions can have physical effects on space systems resulting in consequences that range from reversible to irreversible damage. For example, focused energy in the form of lasers, particle or microwave beams, and electromagnetic pulses can blind, dazzle,[55] or damage satellite

50. Although most deem kinetic and hard-kill to be synonyms, there are some that consider the former to refer solely to those capabilities dependent on the destructive power generated by their motion and interception trajectory, instead of an explosive. Hard-kill, on the other hand, is a broader term that comprises kinetic physical capabilities, but also includes the aforementioned explosive payloads. *See* Azcárate Ortega & Samson, *supra* note 45.

51. Counterspace capabilities refers to capabilities, techniques, or assets that can be used against another space object or a component of a space system to deliberately deny, disrupt, degrade, damage or destroy it reversibly or irreversibly, so as to gain advantage over an adversary. See Azcárate Ortega & Samson, *supra* note 45.

52. Sarah Erickson, *Prospects for preventing an Arms Race in Outer Space: Political and Legal Aspects*, 34, PIR CENTER SECURITY INDEX 34, 6, (2022), https://pircenter.org/wp-content/uploads/2022/12/SI-INT-%E2%84%967-34-Erickson.pdf.

53. For a more descriptive explanation of direct-ascent and co-orbital anti-satellite attacks see Threats Working Paper, *supra* note 25.

54. Threats Working Paper, *supra* note 25.

55. Blinding and dazzling both refer to interference with a satellite's optics, however blinding causes permanent damage while dazzling temporarily effects the optics of a satellite. For more information see Center for Strategic and International Studies, Counterspace Weapons 101, https://aerospace.csis.org/aerospace101/counterspace-weapons-101/#:~:text=High%2DPowered%20Laser&text=If%20directed%20toward%20a%20satellite's,of%20sight%20for%20the%20satellite.

technology.[56] Electronic counterspace technologies target the electromagnetic spectrum used by space systems to transmit and receive data, thereby jamming or spoofing space system communications and interfering with information integrity.[57] Electronic interference is generally reversible. Hostile operations conducted via cyber means or methods use software and network techniques to compromise, control, interfere, or destroy computer systems of space systems.[58] Cyber counterspace capabilities can cause both reversible and irreversible damage and can even target end-user components.[59] In general, soft-kill attacks are less or non-visible to third party observers, making them more difficult to detect and attribute.

Space Debris

Space debris is both natural meteoroid and human-made objects that no longer serve a useful function.[60] Space debris is a key concern for space actors as it is an indiscriminate and highly prevalent danger to all space assets. Space debris can be intentionally created via hostile actions, such as destructive direct-ascent or co-orbital ASAT capabilities. Additionally, other counterspace measures may cause the loss of control of a satellite further contributing to space debris as the satellite remains in orbit but inoperable. More States are citing the intentional creation of debris as a growing threat to space systems, therefore marking space debris as an issue of both space security and safety as shown in fig. 3 below.[61]

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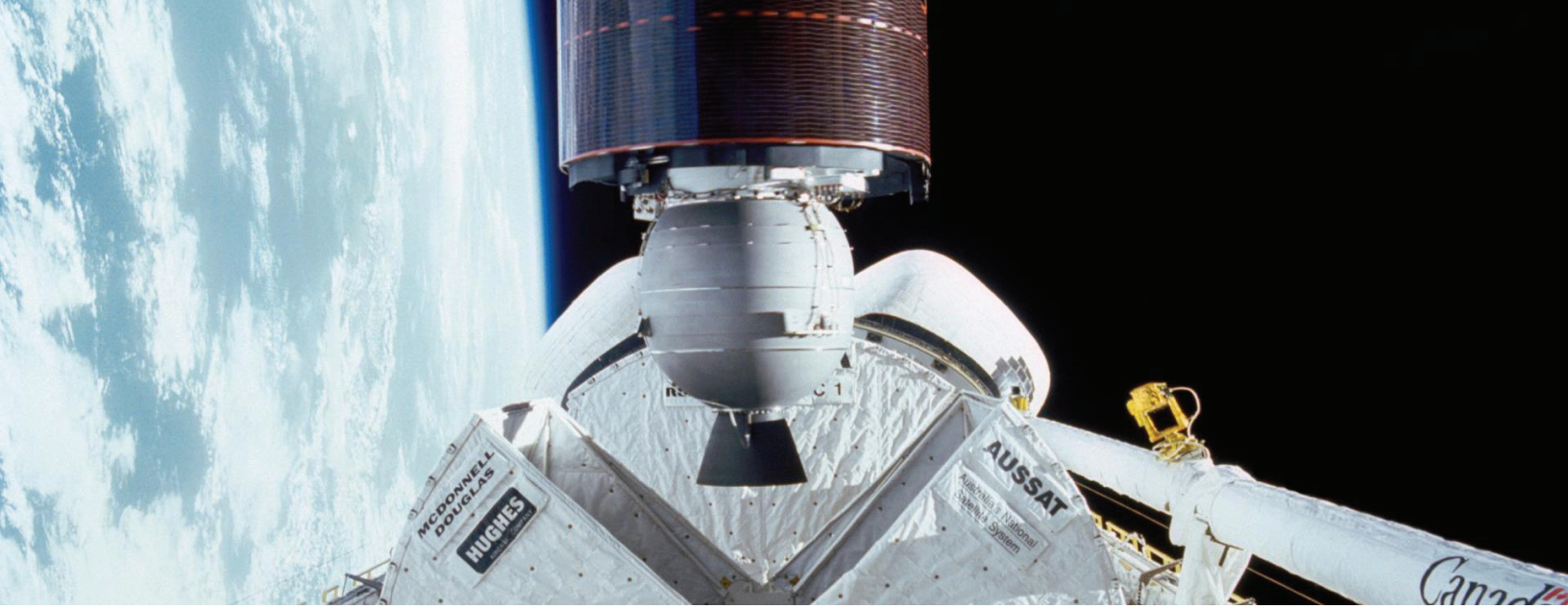
56. Brian Weeden & Victoria Samson (Eds), *Global counterspace capabilities: An open-source assessment*, Secure World Foundation (2023), https://swfound.org/counterspace/.
57. Threats Working Paper, *supra* note 25.
58. Weeden & Samson, *supra* note 56.
59. Threats Working Paper, *supra* note 25.
60. Azcárate Ortega & Samson, *supra* note 45.
61. *Ibid*.



HAZARDS AND RISKS TO SPACE SYSTEMS

Space Weather

Space weather refers to the natural conditions in the Earth's outer space environment especially as influenced by solar activity.[62] Space weather phenomena[63] can disrupt the normal operation of space systems and jeopardize the health of crew onboard space systems. For example, space weather incidents such as solar flares can damage spacecraft electronics, increase drag for satellite operators, adversely affect power grids, communication and radio navigation, and cause surface charging of spacecraft resulting in anomalies which can lead to system failure or material damage.[64] It is important to note that space weather can have implications for space security as well. As described above, certain threats such as cyber or electronic counterspace capabilities are considerably difficult to attribute. The difficulty of attribution is compounded by the fact that a number of adverse impacts from non-kinetic counterspace interference may appear the same as effects on space systems from space weather phenomena.

Accidental Collisions, Technical Malfunctions and Space Debris

As the number of actors and assets in outer space increases, the space environment grows increasingly congested. Lack of communication between satellite operators, loss of satellite control or lack of accurate and updated data could contribute to possible collisions between spacecraft.[65] Accidental collision can lead to the creation of debris and may render a spacecraft completely inoperable. Not every risk to a space asset's

62. *Space weather and its hazards*, EUROPEAN SPACE AGENCY (14 AUG. 5:11 PM), https://www.esa.int/Space_Safety/Space_weather_and_its_hazards3.

63. This includes phenomena such as ambient plasma, magnetic fields, electromagnetic radiation and energetic charged particles. For further technical information on space weather see *Space Weather*, United Nations Office for Outer Space Affairs, https://www.unoosa.org/oosa/en/ourwork/topics/space-weather.html.

64. *Solar Storm and Space Weather - Frequently Asked Questions*, NASA (14 Aug. 2023 5:16PM), https://www.nasa.gov/mission_pages/sunearth/spaceweather/index.html#q26 (see Question 26. When do the effects of space weather show up?)

65. Xavier Pasco, *Various Threats of Space Systems*, in HANDBOOK OF SPACE SECURITY, 675 (Kai-Uwe Schrogl et al., 2015).

safe operation is due to the impact of an external circumstance. Technical malfunctions or human-caused error in space technology construction may lead to defective function, inoperability, or even loss of satellite control. As discussed above, space debris can be intentionally created via counterspace measures. However, hostile actions towards spacecraft are not the only case of intentional creation of debris. Satellites without a controlled re-entry plan at end of life that are abandoned in-orbit, upper stages of launchers, operational debris released during mission, fragmentation debris from accidental collision, and propellant residue all contribute to the space debris inventory.[66] Natural meteoroid orbital debris also add to space debris.

Space Sustainability	
Space sustainability is an overarching concept that is inclusive of both:	
SPACE SAFETY	SPACE SECURITY
PEACEFUL USES OF OUTER SPACE	PREVENTION OF AN ARMS RACE IN OUTER SPACE (PAROS)
COPUOS, FOURTH COMMITTEE OF THE GENERAL ASSEMBLY	CONFERENCE ON DISARMAMENT, FIRST COMMITTEE OF THE GENERAL ASSEMBLY, DISARMAMENT COMMISSION
RISKS	THREATS
SPACE WEATHER	KINETIC–PHYSICAL COUNTERSPACE CAPABILITIES
ACCIDENTAL COLLISIONS AND TECHNICAL MALFUNCTIONS	KINETIC–PHYSICAL COUNTERSPACE CAPABILITIES
SPACE DEBRIS	

Figure 3: The Interconnected Relationship between Space Safety, Security, and Sustainability part 2

66. Fernand Alby, *The Issue of Space Debris, in* HANDBOOK OF SPACE SECURITY, 675 (Kai-Uwe Schrogl et al., 2015).

MEASURES TO PREVENT OR MITIGATE DANGERS TO SPACE SUSTAINABILITY

As explained in previous sections, discussions at the multilateral level on space security and safety take place in parallel processes in separate fora. However, what transpires at the State level does not always mirror this siloed framework. On the contrary, many States have taken advantage of synergies between space safety and security, by establishing domestic mechansims which address these issues in a complementary manner. As depicted in figure 4, mechanisms of statecraft such as law, policy, military strategy, organizational structure, political commitments, norms, and international engagement all contribute to a diverse toolkit that when employed by a State contributes to overall increased space stability and sustainability. Furthermore, domestic measures contribute to the strengthening of the international space legal regime by implementing multilateral conventions and reinforcing international legal principles at the State level. In the current outer space governance landscape, States are using an array of tactics to work towards space safety, security and overall sustainability.

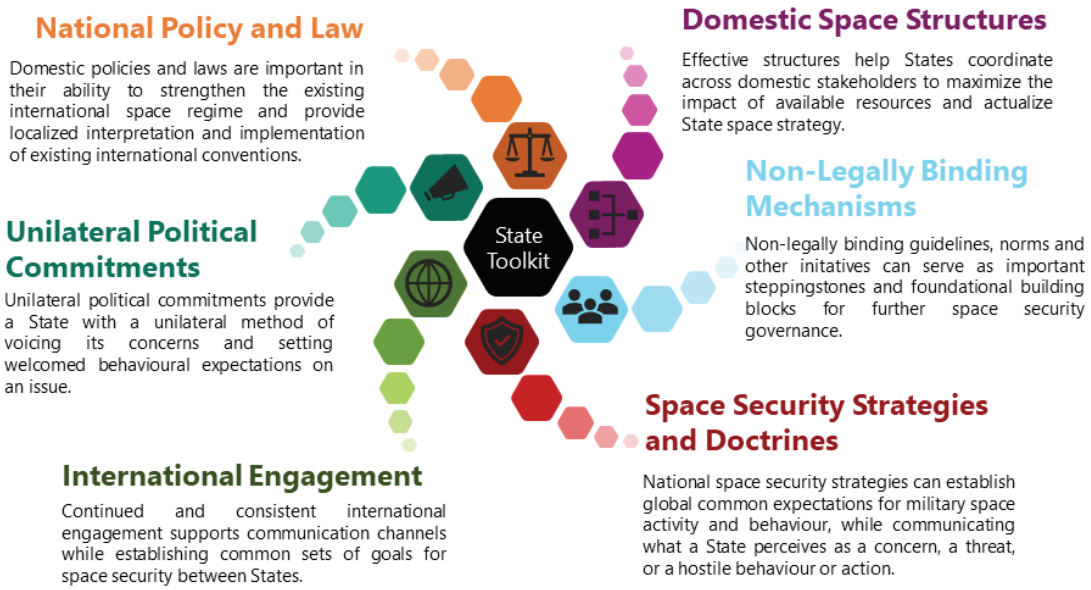


Figure 4: State Governance Toolkit for Space Sustainability

NATIONAL SPACE POLICIES AND LAWS

The importance of effective and accessible policy and law cannot be overstated. Domestic policies and laws are important in their ability to strengthen the existing international space regime and provide localized interpretation and implementation of existing international conventions. State policies are also crucial for establishing global common expectations over the activities of a State, which in turn contribute to a more predictable and secure space environment. Many States have released national space policies to communicate their national priorities, values and objectives when conducting space-related activities.

A consistent trend in existing national space policies is emphasizing the inalienable right of the State to access and use outer space for peaceful purposes, as was established first by the Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space of 1962 and later codified in the Outer Space Treaty under article I wherein it states, “Outer space, including the Moon and other celestial

equality and in accordance with international law, and there shall be free access to all areas of celestial bodies".[67] For example, the Kenyan Space Policy importantly draws from article I highlighting its right to access and transition from a nation that is space 'nascent' to one that is spacefaring when it states: "This policy has been developed to structure the process of transitioning Kenya from a passive user of space and space technologies into a contributor to the development of space technology. This is a process of development of the science and technology base necessary to utilize space for national development. It is a journey that Kenya must urgently make, taking advantage of an already trodden path to reap maximum benefit from what other nations have already done".[68]

Furthermore, some States highlight the relationship between access to and use of outer space as enshrined in article I of the OST and the necessity to conduct outer space activities in a sustainable manner, which ultimately enables the collective prolonged use of outer space. An example of this relationship can be seen in A Strategy for Swedish Space Activities wherein it states, "Sweden's freedom of action in and access to space can be strengthened through the contributions the country makes to a long-term sustainable use of space in which the extra-terrestrial environment is kept safe and predictable. Safeguarding this should be a strategic objective". [69]

Additional trends include marking the important and interdependent relation of space activity to industry sectors. As industry actors continue to lead the space economy and make up the largest share of actors in space, more States are focusing attention on the value that industry input and cooperation can have in optimizing policymaking and realizing national priorities.[70] Some States outline specialized goals in this regard to stimulate their space industry sectors. For example, the Czech Republic's national space plan outlines a highly specified plan which includes targets such as "being compliant with market trends and needs", "creating, protecting and exploiting Intellectual Property Rights", "creating synergies among companies and between small and medium size enterprises (SMEs) and large industry", "increasing ratio of private investments", and "stimulating and accelerating technology and knowledge transfer".[71]

States bear international responsibility for national activities in outer space, including those carried out by non-governmental entities. Article VI of the OST further states, "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". In support of this, some States take implementation steps of article VI through their national policies, For example, the Mexican Space Policy in its General Line of Policy number 9, promotes the creation and development of relevant regulations, standardization, accreditation and certifications.[72]

67. See art. I. OST.

68. Ministry of Defense of the Republic of Kenya, *Kenya Space Policy* 2015 (2015), https://www.unoosa.org/documents/pdf/spacelaw/national/Kenya_Space_Policy-_Signed.pdf.

69. Ministry of Education and Research Government of Sweden, *A strategy for Swedish space activities* (2019), https://www.government.se/contentassets/ea187b8c0a814ac09c36b8a43154eb49/a-strategy-for-swedish-space-activities.pdf.

70. Almudena Azcárate Ortega & James Revill, *Space Industry Workshop Report*, UNIDIR, (2021), https://doi.org/10.37559/WMD/21/Space/01.

71. Government of the Czech Republic, National Space Plan 2020-2025 (2020), https://www.czechspaceportal.cz/wp-content/uploads/2020/08/NSP2020-2025_EN.pdf.

Policy is not always released by a State as an isolated measure. In fact, there are instances where a State crafts its space policy within the framework of a national space law. We can see an example of this in the previously mentioned case of Mexico, where its national space policy was created in tandem with the law that created the Mexican Space Agency.[73] Other emerging space-capable States have utilized this model by creating a comprehensive legislative act to encompass many of their national objectives. A clear illustration of this can be seen in the work of the Philippines. The Philippine Space Act declares the policy of the State and establishes a policy framework that includes six key development areas: national security and development, hazard management and climate studies, space research and development, space industry capacity-building, space education and awareness, and international cooperation[74]. The framework is such that the policy is inclusive of varying concerns across space security, safety, and sustainability issues. It is also notable that the Philippine Space Act, in addition to declaring State space policy, explicitly paves the way for State ratification of international treaties and conventions, thereby serving as an implementation measure in and of itself of international space law and governance.[75]

Another example of a national space law is the Law of the Republic of Kazakhstan on Space Activities, which demonstrates the important relation between the international legal framework and domestic laws. In article 2, the national law stipulates that "if an international treaty that [is] ratified by the Republic of Kazakhstan establishes other rules than contained in the present Law, then the rules of the international treaty are applied".[76] This showcases the direct implications and influence that the State's ratification of international space treaties places on its domestic legal framework. Furthermore, this law exemplifies the complementarity of space safety and security concerns. Under Chapter 5. Safety of Space Activities, the law addresses provisions such as Article 30. Interdictions and restrictions in the space activities (2–4); "injection into the orbit, deployment of mass destruction weapon in the outer space", "use of space engineering and (or) celestial bodies for negative influence on the environment", and "infringement of the international norms and standards on pollution of outer space". Such restrictions echo concerns about ensuring continued access of outer space through sustainable space activity, which reinforces article IX of the OST, and initiatives such as the Space Debris Mitigation Guidelines. However, the law also addresses space security concerns over the weaponization of outer space and reinforces international mechanisms such as article IV of the OST.

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72. General Line of Policy number 9 is as follows (the English translation of the subtitle is unofficial):

    9. Coordinación, reglamentación y certificación

    - Coordinar los esfuerzos realizados por los distintos actores en materia aeroespacial.
    - Organizar y vincular mediante redes a los diferentes sectores que participan en el ámbito aeroespacial.
    - Promover la creación de una normatividad acorde con la dinámica del sector que facilite su desarrollo.
    - Coordinar el desarrollo de sistemas de normalización, acreditación y certificación en la materia, en colaboración con las dependencias nacionales y organismos extranjeros e internacionales competentes.

Gobierno de México [Government of Mexico], Acuerdo mediante el cual se dan a conocer las Líneas Generales de la Política Espacial de México [Agreement by which the General Lines of the Space Policy of Mexico are made known] (2012), https://www.gob.mx/aem/documentos/lineas-generales-de-la-politica-espacial-de-mexico.

73. *Ibid*.

74. Philippines Space Act, 2019 (Act No. 11363) (Republic of the Philippines), https://philsa.gov.ph/philippine-space-act/.

75. How the instrument paves the way for ratification of international conventions is exemplified in *supra* note 74 at *Section 23. National Registry of Space Objects* and *Section 24. Liability of the Philippines for National Space Objects* which sets the groundwork for the State to ratify the Registration Convention and the Liability Convention, respectively.

76. Law of the Republic of Kazakhstan on Space Activities, 2012 (No. 528-IV) (Republic of Kazakhstan), https://www.unoosa.org/documents/pdf/spacelaw/national/kazakhstan/528-IV_2012-01-06E.pdf.

Issues addressed in National Space Policies and Laws

Concern	Rationale	Illustrative Domestic Example	Relevant International Mechanisms
Right of access to outer space	Critical functions of society are increasingly reliant on outer space services. This is happening at a time when outer space is becoming progressively crowded and congested. Therefore, States prioritize their right of access to space in national laws and policies in an increasingly competitive environment.	Kenya Space Policy 2015 – Guiding Principal 7	• Article I of the OST • Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space
Ensured continued use of and benefit from outer space	In order to guarantee future use and exploration of outer space, the space environment needs to remain accessible. This can be facilitated through sustainable outer space actions.	A Strategy for Swedish Space Activities – International cooperation for the peaceful and sustainable use of space Law of the Republic of Kazakhstan on Space Activities – Article 30 (3-4)	• Article IX of the OST • Guidelines for the Long-term Sustainability of Outer Space Activities • Space Debris Mitigation Guidelines
Synergy between industry and government space activity	Industry is now the largest stakeholder in outer space. States seek to stimulate domestic space industry sectors for economic opportunity and establish regulatory frameworks.	National Space Plan 2020 – 2025 of the Czech Republic - 3 Vision and Objectives Mexican Space Policy– General Line of Policy No. 9	• Article VI of the OST
Weaponization of outer space	A key universal principal governing space activity is the peaceful use of outer space. Preserving space for peaceful use is at jeopardy should counterspace capabilities be developed, deployed, used and proliferated.	Law of the Republic of Kazakhstan on Space Activities – Article 30 (2)	• Article VI of the OST

Figure 5: Issues addressed in National Space Policies and Laws

NATIONAL SPACE SECURITY STRATEGIES AND MILITARY DOCTRINES

Much like national space policies, dedicated national space security doctrines provide insight into States' strategic priorities and national security concerns. National space security strategies may also establish global common expectations for military space activity and behaviour, while communicating what a State perceives as a concern, a threat, or a hostile behaviour or action.

A current example of this type of measure is Japan's recently released Space Security Concept. In this initiative are Japan's space security goals and approaches, including its two ideas of space security: protecting those systems that it deems essential for its security, and protecting space systems that are indispensable to society.[77] Japan includes an outline of its perceived threats in outer space in section 1(2), listing threats such as kinetic counterspace capabilities (with an emphasis on destructive anti-satellite strikes), non-kinetic counterspace capabilities, space debris, and the increasingly crowded environment due to the growing number of actors and large-scale satellite constellations.[78] In its strategic approach Japan highlights the need to ensure the safe and stable use of outer space, with a technical emphasis on further developing SDA, on-orbit services, satellite life-cycle management, government decision-making and response in unforeseen circumstances, the compatibility and interoperability of satellite data, and unilateral contributions to international norms and rule-making. [79]

Additional strategic priorities can be found in the dedicated space security strategies of other States as well. For example, Australia's Defence Space Strategy highlights lines of effort such as "[e]nhance [Australia's] space

77. Ministry of Foreign Affairs of the Government of Japan, 宇宙安全保障構想の策定 [Formulation of the Space Security Concept] (2023), https://www.mofa.go.jp/mofaj/fp/msp/page24_002219.html. The Space Security Concept is a document based on the National Security Strategy of Japan that sets the overall direction of Japan's security. For more information see National Security Strategy of Japan, https://www.cas.go.jp/jp/siryou/221216anzenhoshou/nss-e.pdf.
78. *Ibid.*
79. *Ibid.*

capability to assure joint force access in a congested, contested and competitive space environment" and "[i]ncrease the national understanding of the criticality of space".[80] Such approaches are created on the basis of the State's threat assessment which includes a threat to access to space on account of counterspace interference, 'grey zone' activities, and increased orbital congestion from space debris and the number of satellites.

Other States highlight additional specific problems and challenges within their designated space security strategies. For example, the United States in its unclassified summary of its Defense Space Strategy reflects on its own extreme reliance on space-based capabilities. Furthermore, it states that the central problem is that "the U.S. defense space enterprise was not built for the current strategic environment. The intentions and advancements of potential adversaries in space are threatening the ability of the United States to deter aggression, to protect U.S. national interests, and to fight and win future conflicts.".[81] In addition to this, it shares perceived challenges such as having "limited operational experience with conflict beginning in or extending into space, despite rapid counterspace advancements by potential adversaries", and that "international understanding and agreement of what constitutes unsafe, irresponsible, or threatening behavior in space is nascent".[82]

However, it is not only through a dedicated space security strategy that States can communicate their security concerns and military interests and priorities regarding space. Many States have started to utilize and update their existing military doctrines as a channel for speaking about these issues. For example, China's Military Strategy highlights outer space as a new security domain and underlines the issue of weaponization as a concern.[83] Additionally, it describes some of its planned tactics to deal with growing security concerns. One such approach is the "in-depth development of civil–military integration (CMI)."[84] Through this strategy, "China encourages joint building and utilization of military and civilian infrastructure, joint exploration of the sea, outer space and air, and shared use of such resources as surveying and mapping, navigation, meteorology and frequency spectra. Accordingly, military and civilian resources can be more compatible, complementary and mutually accessible".[85]

As seen above, some States use specific space military doctrines or national security strategies to express perceived threats and security priorities specific to the space sector. However, it is important to showcase the diverse functionality of a military doctrine. Some States utilize military doctrines to designate outer space as a specialized strategic sector, enabling them to capitalize on military resources in order to strengthen national space programmes. For example, the Brazilian National Defence Policy names three specific strategic technology sectors essential to national defence, one of which is outer space.[86] This structure instructs the

80. Department of Defence of Australia, *Australia's Defence Space Strategy* (2022), https://www.airforce.gov.au/our-work/strategy/defence-space-strategy.

81. Department of Defense of the United States, *Defense Space Strategy Summary* (2020), https://media.defense.gov/2020/Jun/17/2002317391/-1/-1/1/2020_DEFENSE_SPACE_STRATEGY_SUMMARY.PDF.

82. *Ibid*.

83. THE STATE COUNCIL INFORMATION OFFICE OF THE PEOPLE'S REPUBLIC OF CHINA, CHINA'S MILITARY STRATEGY (2015), http://english.www.gov.cn/archive/white_paper/2015/05/27/content_281475115610833.htm.

84. *Ibid*. The concept of civil-military integration is sometimes replaced with the evolved concept of civil-military fusion which further enhances coordination and comprehensive integration. For more information on civil-military fusion see 习近平：坚决推动军民融合深度发展 为中国梦和强军梦提供强大力和略支撑 [*Xi Jinping: Solidly promote the in-depth development of military-civilian integration to provide strong impetus and strategic support for the realization of the Chinese Dream and the dream of a strong military*], http://www.xinhuanet.com/politics/2018lh/2018-03/12/c_1122526642.htm.

85. The State Council Information Office of the People's Republic of China, *supra* note 83.

86. Ministry of Defence of Brazil, *Estratégia Nacional de Defesa [National Defence Strategy]* (2022), https://www.gov.br/defesa/pt-br/assuntos/copy_of_estado-e-defesa/pnd_end_congresso_1.pdf.

space sector of the Air Force, the Brazilian Space Agency and Industrial Base of Defence to coordinate on national security goals. These include guaranteeing access to data and enabling development of critical technologies, increasing the competences associated with the design, manufacture and integration of satellites to meet the demands of defence agencies, and seeking innovative solutions for telecommunication between the ground and space segments.[87] Other States have also included the importance of space in their national security strategy; Nigeria, for example, states that it intends to "develop significant capacities to exploit the space-based potential for improvements in overall national security preparedness and responses".[88] Moreover, Nigeria capitalizes on its military resources to establish a Defence Space Administration through which it can help to realize national security goals such as the "generation of a critical mass of academic interest in the use of space through funding in designated Nigerian universities and other initiatives", development of indigenous space technologies, development of advanced communications and surveillance capabilities, and development of proprietary space infrastructure.[89]

Issues addressed in National Space Policies and Laws

Concern	Rationale	Illustrative Domestic Example	Relevant International Mechanisms and Processes
Weaponization of outer space	Concerning the use, research, and development of counterspace capabilities and systems.	Space Security Initiative of Japan China's Military Strategy	• Article IV of the OST • Conference on Disarmament • First Committee • Disarmament Commission
Right of access to and use of outer space	Harmful interference by counterspace capabilities resulting in a spectrum of reversible to irreversible damage may affect access to outer space technology and services crucial to civil and military sectors.	Space Security Initiative of Japan National Defence Strategy of Brazil National Security Strategy of Nigeria	• Article I of the OST • Article IX of the OST • Conference on Disarmament • First Committee
Ensured continued use of and benefit from outer space	Future use and exploration of outer space is denied due to increased orbital congestion from intentional creation of space debris and objects in orbit.	Space Security Initiative of Japan Australia's Defence Space Strategy	• Article I of the OST • Article IX of the OST • Guidelines for the Long-term Sustainability of Outer Space Activities • Space Debris Mitigation Guidelines • COPUOS

87. *Ibid*.
88. Federal Republic of Nigeria, *National Security Strategy* (2019), https://ctc.gov.ng/wp-content/uploads/2020/03/ONSA-UPDATED.pdf.
89. *Ibid.*

Lack of common understanding on what constitutes unsafe, threatening, and irresponsible behaviour	Stakeholders operate in space without a universal framework prescribing safe, predictable and welcomed behaviour which contributes to mistrust and inadvertent escalation.	Australia's Defence Space Strategy Defense Space Strategy Summary of the United States	• COPUOS • Conference on Disarmament • First and Fourth Committees • Disarmament Commission

Figure 6: Issues addressed in National Space Security Strategies and Military Doctrines

DOMESTIC SPACE STRUCTURES

Another tool at the disposal of the State is its ability to create designated agencies in charge of space activity. Effective structures help States coordinate across domestic stakeholders to maximize the impact of available resources, and actualize State strategy. Since the utility of space systems is paramount to the overall well-being of societies, creating a dedicated space agency to lead the national talent, research, policy, resources and development of a national space sector is a crucial action a State can take in orchestrating its space priorities. There is not a single model for how a State may design its domestic space structures. National space agencies have been created on a spectrum of little to high military integration. Furthermore, many States have additional space governing bodies that may be under civilian, military, or mixed leadership.

For example, the United Arab Emirates Space Agency does not have a military-integrated leadership structure with overt national security goals but rather describes its focus as raising national capabilities and the use of space technology to help the State achieve its diversification plans and to support the creation of a knowledge-

based economy.[90] The South African National Space Agency follows a similar model, however with a space agency vision that contains a regional perspective aiming for "an integrated national space capability that responds to socio-economic challenges in Africa by 2030".[91]

Other space agencies have an overt focus on security and defence included within their agency objectives. For example, the Venezuelan space agency has a localized vision of formulating and executing the national space policy with socialist values, in accordance with the provisions of the Constitution of the Bolivarian Republic of Venezuela, in order to use space science and technology to contribute to the development, sovereignty, security and integral defence of the State.[92] Space-emerging and space-capable States may increasingly find utility in this structural model which coordinates security, safety, and sustainability goals within one framework to capitalize on resources and establish a cohesive vision. Another example of this model can be seen through the Polish Space Agency (POLSA) which designates security and defence as one if its main areas of activity among others such as education and international cooperation. The POLSA states, "The priority task of the Polish Space Agency is to provide security for Poland and its citizens. Another task is to increase Polish defence capabilities through the use of satellite systems".[93]

While many States have established or are in the process of establishing national space agencies with many taking advantage of a mixed civilian and military model, a smaller but growing fraction of States have created designated military organs in charge of overseeing the State's strategic defensive and competitive interests in space. As outer space assets and systems become increasingly crucial to civilian and military functions, more States have determined the utility of creating dedicated space military forces to pursue and protect national space interests.

In previously mentioned case examples such as Nigeria, there were dedicated State military structures charged with the implementation of the State's space security goals.[94] This paradigm is not particularly new, however. One of the first contemporary examples of a dedicated military organ for space operations was the Russian Aerospace Defence Forces, which has a dedicated space force charged with missions such as "monitoring space objects and identification of potential threats to the Russian Federation in space and from space" and "carrying out spacecraft launches and placing into orbit, controlling satellite systems, including integrated ones (intended to be used for both military and civilian purposes) in flight, and using separate ones towards providing the Russian Federation Armed Forces with the necessary information".[95] Similar dedicated

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90. *About*, UNITED ARAB EMIRATES SPACE AGENCY (14 Aug. 2023 5:59PM), https://space.gov.ae/Home/Index.

91. Overview, SOUTH AFRICAN NATIONAL SPACE AGENCY (14 AUG. 2023 6:00PM), https://www.sansa.org.za/about-sansa/#Overview.

92. The full and official title of the Venezuelan space agency is La Agencia Bolivariana para Actividades Espaciales (ABAE). *¿Quiénes somos?*, LA AGENCIA BOLIVARIANA PARA ACTIVIDADES ESPACIALES (14 AUG. 2023 6:02PM), http://www.abae.gob.ve/quienes-somos/.

93. POLISH SPACE AGENCY, https://polsa.gov.pl/en/. (last visited 14 Aug. 2023).

94. As previously mentioned the National Security Strategy of Nigeria establishes the Defence Space Administration tasked with implementing the security and defence aspects of the National Space Policy and facilitating space related objectives of the National Security Strategy. For more information see DEFENCE SPACE ADMINISTRATION, https://dsa.mil.ng/history.php.

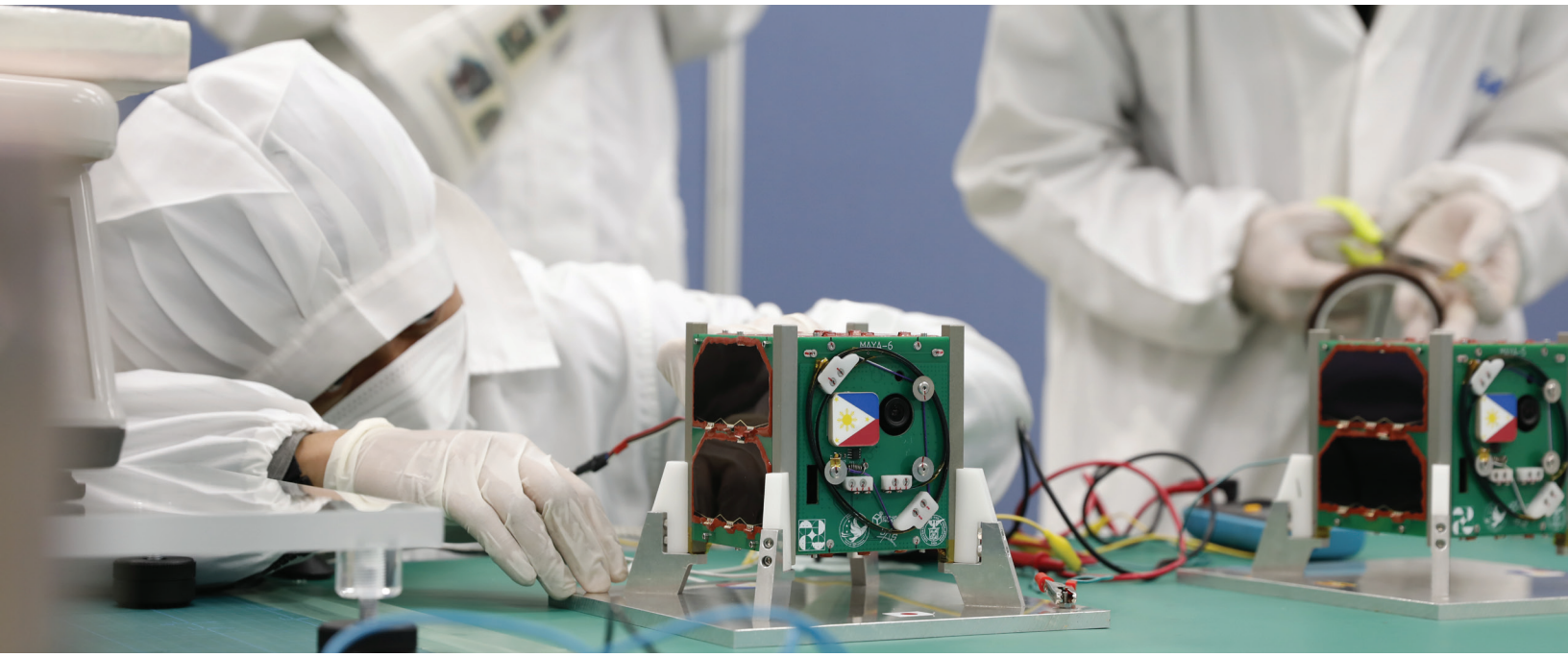
95. The quoted text is from the Russian Ministry of Defence website, at https://eng.mil.ru/en/structure/forces/cosmic.htm. The original Russian text from the same site is as follows:

наблюдение за космическими объектами и выявление угроз России в космосе и из космоса, а при необходимости – парирование таких угроз; …

осуществление запусков космических аппаратов на орбиты, управление спутниковыми системами военного и двойного (военного и гражданского) назначения в полете и применение отдельных из них в интересах обеспечения войск (сил) Российской Федерации необходимой информацией;

Воздушно-космические силы, МИНИСТЕРСТВО ОБОРОНЫ РОССИЙСКОЙ ФЕДЕРАЦИИ (МИНОБОРОНЫ РОССИИ) (14 Aug. 2023 6:07PM) https://structure.mil.ru/structure/forces/vks/cosmic.htm.

military organs are used by other States as well, such as the French Space Command which operates space capabilities providing services in support of government authorities and military operations, thus contributing to overall national security goals.[96]



POLITICAL COMMITMENTS, BEHAVIOURAL NORMS, AND NON-LEGALLY BINDING GUIDELINES

Another long-standing mechanism in a State's governance toolkit is the creation of or adherence to political commitments or normative expectations of behaviour. Such non-legally binding initiatives are useful diplomatic tools because of their ability to be flexibly adopted, particularly where State's express frustration or distress due to contemporary actions or even the lack of action and existing governance mechanisms.[97] Norms are also valuable in their ability to provide a State with a unilateral method of voicing its concerns and setting welcomed behavioural expectations and desired shared values on an issue regardless of what multilateral negotiation mechanism may currently be active or what the current geopolitical environment may be. This approach has been particularly relevant in the context of the Open-ended Working Group on Reducing Space Threats through Norms, Rules and Principles of Responsible Behaviours [herein OEWG], in which States are exploring behavioural-based approaches as one out of many tactics to address PAROS.[98] Generally, in the context of outer space activity where States are working to establish and clarify further governance measures across safety and security concerns, voluntary and non-legally binding mechanisms can serve as important stepping stones and foundational building blocks. A prime example can be drawn from the historical formation

96. *Commandement de l'Espace*, MINISTÈRE DES ARMÉES (14 Aug. 2023 6:09PM), https://air.defense.gouv.fr/cde.
97. West & Azcárate Ortega, *supra* note 4.
98. Azcárate Ortega & Lagos Koller, *supra* note 17.

of the OST, which was initiated from a collection of non-binding principles in the form of General Assembly resolutions.[99]

In contemporary global space security discussions, even prior to the beginning of the OEWG, States have been utilizing non-binding political initiatives to address space security challenges. One illustration is the political commitment led by the Russian Federation not to be the first to place weapons in outer space. The resolution on "No first placement of weapons in outer space"[100], which was introduced by the Russian Federation to the General Assembly in 2014, "Encourages all States, especially space-faring nations, to consider the possibility of upholding as appropriate a political commitment not to be the first to place weapons in outer space". The resolution passed, in addition with national support from 11 States that made national political commitments not to be the first to place weapons in outer space.[101] Since 2014, the resolution has been voted on subsequently every year in the General Assembly and the current number of States that have made this political commitment has grown to 30.[102]

Another contemporary political commitment was the U.S. initiated commitment not to conduct destructive direct-ascent anti-satellite missile testing, declared on 18 April 2022.[103] The political commitment was made in an attempt to establish an international norm exemplifying responsible behaviour in outer space. The United States introduced this political commitment to the General Assembly as a resolution and it was adopted on 7 December 2022 with 155 votes in favour, 9 abstentions, and 9 votes against.[104] In addition, outside the support

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99. G.A. Res. 1884 (XVIII), Question of General and Complete Disarmament (17 October 1963), https://digitallibrary.un.org/record/203960 and G.A. Res. 1962 (XVIII), Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space (13 December 1963), https://digitallibrary.un.org/record/ 203965.

100. G.A. Res. 69/32, No first placement of weapons in outer space (2 December 2014), https://digitallibrary.un.org/record/785136?ln=en.

101. The first 11 States to make the political commitment were Argentina, Armenia, Belarus, Brazil, Cuba, Indonesia, Kazakhstan, Kyrgyzstan, Russian Federation, Sri Lanka and Tajikistan. This list can be viewed in note 4 of the G.A. Res. 69/32, *ibid*.

102. The current States that have made the political commitment not to be the first to place weapons in outer space are Argentina, Armenia, Belarus, Bolivia (Plurinational State of), Brazil, Burundi, Cambodia, Comoros, Congo, Cuba, Ecuador, Guatemala, Indonesia, Kazakhstan, Kyrgyzstan, Lao People's Democratic Republic, Myanmar, Nicaragua, Pakistan, Russian Federation, Seychelles, Sierra Leone, Sri Lanka, Suriname, Syrian Arab Republic, Tajikistan, Togo, Turkmenistan, Uruguay, Uzbekistan, Venezuela (Bolivarian Republic of) and Viet Nam. The list can be viewed in note 4 of the 2022-2023 resolution available here: https://digitallibrary.un.org/record/3997623?ln=en.

103. THE WHITE HOUSE, FACT SHEET: VICE PRESIDENT HARRIS ADVANCES NATIONAL SECURITY NORMS IN SPACE (2022), https://www.whitehouse.gov/briefing-room/statements-releases/2022/04/18/fact-sheet-vice-president-harris-advances-national-security-norms-in-space/.

104. G.A. Res. 77/41, Destructive direct-ascent anti-satellite missile testing (7 December 2022), https://digitallibrary.un.org/record/3997622?ln=en.

of the General Assembly voting procedure, 13 States have made the unilateral commitment to adhere to the moratorium on destructive direct-ascent anti-satellite missile testing.[105]

In addition to unilaterally initiated political commitments, there are also multilateral non-binding mechanisms. States can take action to develop, adopt and adhere to multilateral voluntary initiatives to strengthen their domestic positions on space security, safety and sustainability while increasing overall global common behaviour and understanding. The Hague Code of Conduct against Ballistic Missile Proliferation (HCoC) is a multilateral transparency and confidence-building instrument concerning the spread of ballistic missiles. Subscribing States, the current number of which is 143,[106] "voluntarily commit themselves politically to provide pre-launch notifications (PLNs) on ballistic missile and space-launch vehicle launches (SLVs) and test flights. Subscribing States also commit themselves to submit an annual declaration of their country's policies on ballistic missiles and space-launch vehicles".[107] These widespread voluntary commitments by States, such as those outlined in the HCoC, contribute to the establishment of expected or normative behaviours regarding space-related activity and foster a more predictable and stable space environment.

Similarly, the Missile Technology Control Regime (MTCR) is another set of international voluntary guidelines that seeks to control the export of missile and rocket technology.[108] The MTCR holds 'responsible' partner governments accountable to a set of measures which they voluntary adhere to regarding the control of exports of goods and technologies that could contribute to the proliferation of WMD delivery systems.[109] The MTCR contributes to space stability by increasing oversight and regulation of key technologies in the space sector, primarily those used for space launch vehicles.

Another prominent multilateral set of voluntary guidelines contributing to overall sustainability of outer space is the Space Debris Mitigation Guidelines of COPUOS. Although they are more associated with space safety,

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105. The 13 States to have made the commitment include, in no particular order:
- United States, https://www.whitehouse.gov/briefing-room/statements-releases/2022/04/18/fact-sheet-vice-president-harris-advances-national-security-norms-in-space/;
- Canada, https://documents.unoda.org/wp-content/uploads/2022/05/Canada-General-Statement-for-Translators-OEWG-Space-Threats-Session-bilingual.pdf;
- New Zealand, https://www.beehive.govt.nz/speech/otago-foreign-policy-school-opening-address;
- Japan, https://www.mofa.go.jp/press/release/press3e_000451.html;
- Germany, https://www.auswaertiges-amt.de/en/aussenpolitik/themen/anti-satellite-missile-tests/2551852;
- United Kingdom, https://www.gov.uk/government/news/responsible-space-behaviours-the-uk-commits-not-to-destructively-test-direct-ascent-anti-satellitemissiles;
- Republic of Korea, https://www.mofa.go.kr/www/brd/m_4080/view.do?seq=372800;
- Australia, https://www.minister.defence.gov.au/statements/2022-10-27/australia-advances-responsible-action-space;
- Switzerland, https://reachingcriticalwill.org/images/documents/Disarmament-fora/1com/1com22/statements/26Oct_Switzerland.pdf;
- France, https://www.diplomatie.gouv.fr/en/french-foreign-policy/security-disarmament-and-non-proliferation/news/2022/article/space-france-s-commitment-not-to-conduct-destructive-direct-ascent-anti
- Netherlands, https://www.permanentrepresentations.nl/documents/speeches/2023/2/27/conference-on-disarmament-gva-statement-minister-dutchmfa;
- Austria, https://docs-library.unoda.org/Conference_on_Disarmament_-_(2023)/Austria_Statement.pdf; and
- Italy, https://www.esteri.it/en/sala_stampa/archivionotizie/comunicati/2023/04/dichiarazione-del-vicepresidente-del-consiglio-tajani-in-merito-allimpegno-dellitalia-a-non-condurre-test-distruttivi-di-missili-anti-satellite-ad-ascesa-diretta/.

106. Current subscribing States can be seen at https://www.hcoc.at/subscribing-states/list-of-hcoc-subscribing-states.html.
107. Description of HCoC, THE HAGUE CODE OF CONDUCT, https://www.hcoc.at/what-is-hcoc/description-of-hcoc.html.
108. Almudena Azcárate Ortega & Dmitry Stefanovich, Chapter 4: Space Launch Vehicles and Ballistic Missiles, in EXPLORING OPTIONS FOR MISSILE VERIFICATION, 43 (Pavel Podvig ed., UNIDIR, 2022), https://doi.org/10.37559/WMD/22/Misver/01.
109. *Ibid*.

like the fourth guideline—"avoid[ing] intentional destruction and other harmful activities".[110] Additionally, as is evidenced through multiple examples of national security interpretations, the continued access and use of outer space is crucial to the national security and well-being of States. Therefore, guidelines addressing the issue of space debris at large and "limit[ing] the probability of accidental collision in orbit" are also important to the security and continued existence of space systems.[111] Similarly, the Guidelines for the Long-Term Sustainability of Outer Space activities by COPUOS provide an additional framework of voluntary measures States can adhere to.[112]

INTERNATIONAL ENGAGEMENT AND COOPERATION

Building on the importance of State interaction to multilateral voluntary initiatives, States also have the ability of employing diplomatic mechanisms such as establishing memorandums of understanding, engaging in inter-State partnerships, and ratifying international treaties and conventions. Continued and consistent international engagement supports communication channels while establishing common sets of goals between States.

Space situational awareness is important to the totality of the space sector; it can generally be understood to mean "information about the space environment and activities in space that can be used to operate safely and efficiently; avoid physical and electromagnetic interference; detect, characterize, and protect against

110. United Nations Office for Outer Space Affairs, *Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space* (2010), *supra* note 34.
111. United Nations Office for Outer Space Affairs, *Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space* (2010), *supra* note 34.
112. United Nations Office for Outer Space Affairs, *Guidelines for the Long-term Sustainability of Outer Space Activities of the Committee on the Peaceful Uses of Outer Space* (2019), *supra* note 37.

threats; and understand the evolution of the space environment".[113] Therefore, having agreements on SSA can increase the stability, safety, and security of a State's space programme.[114]

International data-exchange is also paramount to the enhanced capability of not only a State's space programme but the whole of government and society. The Copernicus Programme is an example of such cooperation, providing free and openly accessible information services that draw from Earth-observation data and in-situ data.[115] The Copernicus Programme is a multilateral cooperative partnership between the European Union and the African Union, Australia, Brazil, Canada, Chile, Colombia, India, Japan, Panama, Serbia, Ukraine, and United States.[116]

Finally, States may exercise their power to ratify any of the key treaties[117] which serve as the foundation for international space law, in addition to overseeing the enforcement of such treaties domestically through compliant national mechanisms, as evidenced in some of the previous case examples. Moreover, States have the ability to contribute to the creation of new international conventions through effective, consistent and active participation in international negotiating processes at the United Nations. Processes such as the General Assembly, the General Assembly's First and Fourth Committees, COPUOS, the Disarmament Commission, the Conference on Disarmament, the current OEWG on reducing space threats through norms, rules and principles of responsible behaviours, and the forthcoming Group of Governmental Experts on further effective measures for PAROS provide forums for States to partake in proactive debate dedicated to advancing the goals of the ensured and continued access to outer space.

113. Brian Weeden, *SSA Concepts Worldwide, in* HANDBOOK OF SPACE SECURITY POLICIES, APPLICATIONS AND PROGRAMS (Kai-Uwe Schrogl et. al., 2015).

114. Some examples of SSA agreements between a number of different States and the United States can be seen here: https://www.stratcom.mil/Newsroom/Images/igphoto/2002045860/.

115. *About Copernicus*, COPERNICUS (14 Aug. 2023 6:35PM), https://www.copernicus.eu/en/about-copernicus.

116. *International Cooperation in the area of Data Exchange*, COPERNICUS (14 Aug. 2023 6:35PM), https://www.copernicus.eu/en/international-cooperation-area-data-exchange.

117. For more detailed analyses of each of the five treaties mentioned in addition to other treaties applicable to outer space see UNIDIR's working paper *Existing Legal and Regulatory Frameworks concerning threats arising from State behaviours with respect to outer space*, available here: https://documents-dds-ny.un.org/doc/UNDOC/GEN/G22/248/57/PDF/G2224857.pdf?OpenElement. For the original and complete text of the treaties see here: https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties.html.

LESSONS LEARNED

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Space safety and security are distinct but connected concepts

The concepts of space safety and security are discussed separately within the United Nations. Although both are needed to ensure the sustainability of the space environment, historical and practical reasons led to the creation of different fora with distinct mandates in which concerns related to the use and exploration of outer space are addressed.

The introduction of space sustainability to outer space negotiations as a growing concern has highlighted that, even when treated in different fora, space security and space safety should not be considered in a siloed manner, but rather as two parts of the whole that is space sustainability. Efforts to address space security concerns directly benefit the overall goals of space sustainability, ensure the safety of space assets and stabilize the space environment. The mitigation of intentional debris creation through deliberate counterspace activity is an example of this. Efforts to ensure the safety and security of space technologies should be seen as mutually reinforcing. States should encourage cross communication and collaboration between the diplomatic, research, and scientific communities which work to achieve their respective space security or safety objectives.

Issues of space safety and security are not always kept separate at the domestic level

Although States at the multilateral level engage in separate parallel processes to address the issues of space safety and security, what is practiced at the domestic level is not always so distinctly organized. In fact, as was evidenced from the brief survey of contemporary domestic governance measures, many States have adopted one or a combination of measures such as instituting State space structures, declaring national policies, enacting a national space law, and declaring or adhering to a political commitments that address both issues of space safety and space security. By pursuing this approach, States may better maximize their resources, and in the case of some may not feel an impediment to initiating a national space programme.

Space sustainability will not be achieved by any single initiative

It is important to acknowledge that no measure will singlehandedly be able to address all the concerns that stem from the use and exploration of space. In order to successfully regulate outer space, a network of mutually reinforcing and complementary mechanisms is needed.[118] The global space legal and regulatory framework is enriched by domestic regulations that align with international treaties. Similarly, political commitments that serve to reinforce legally binding instruments also aid in creating common understanding among the members of the international community.[119] They can also serve as a basis upon which to build other legally binding agreements.

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118. For further reading on additional governance mechanisms *see* Julia Selman Ayetey, *Non-Compliance Procedures: A Proactive Approach to Dispute Avoidance in International Space Law 45*, AIR AND SPACE LAW, 457 (2020), https://kluwerlawonline.com/journalarticle/Air+and+Space+Law/45.4/AILA2020062 and Open-ended Working Group on Reducing Space Threats through Norms, Rules and Principles of Responsible Behaviours, *The role of norms, rules and principles of responsible behaviour for space security*, UNIDIR (24 Jan. 2023), UN Doc A/AC.294/2023/WP.3, https://docs-library.unoda.org/Open-Ended_Working_Group_on_Reducing_Space_Threats_-_(2022)/A_AC294_2023_WP3_UNIDIR.pdf.

119. West & Azcárate Ortega, *supra* note 4.

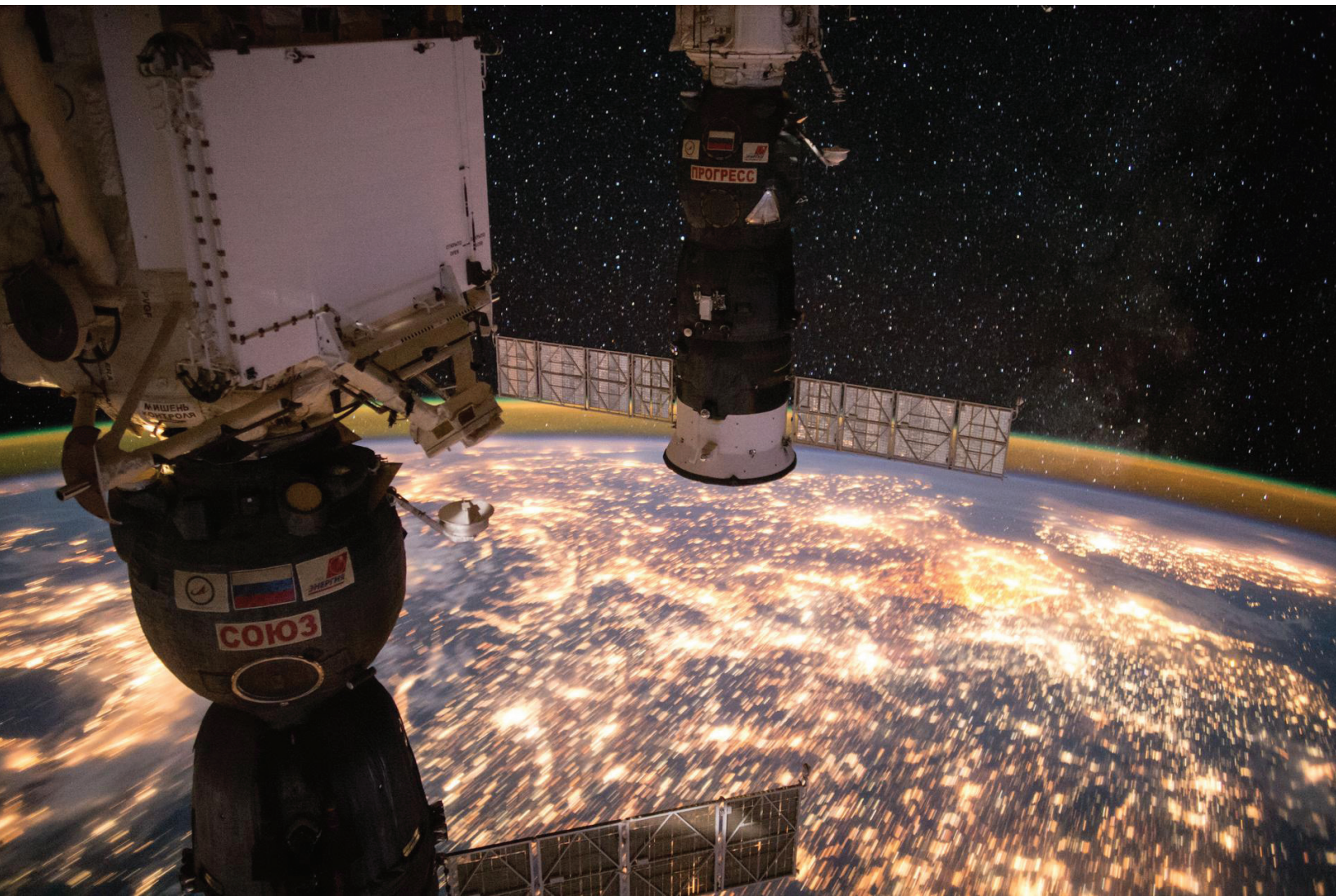
The reverse is also possible, and law, as an expression of values, principles, and practices, can be the basis for non-legally binding initiatives.[120] It is therefore important that the international community build a common understanding of the risks and threats to outer space, in order to successfully work —both in the international and domestic spheres— towards the security, safety, and sustainability of the space environment in a manner that allows for cooperation and complementarity across States, regions, mechanisms and initiatives.

In addition to pursuing unilateral and domestic action, States can engage in international partnerships, inter-State cooperation, and multilateral negotiating discussions. As outer space is an environment "for the benefit and in the interests of all countries",[121] it is in the interest of States to give active, consistent, and effective participation to multilateral negotiating bodies on space governance, so that the resulting international mechanisms may be reflective of global interests.[122] This is especially relevant in an era of increased emerging space-capable and spacefaring States. What is clear is that it is valuable to the global space governance ecosystem when States work to adopt effective and transparent domestic space measures. Moreso, the international space framework can be further strengthened by States adopting domestic measures that align with and enforce existing international conventions, such as the OST.

120. *Ibid*, at 15.

121. See art. I. OST.

122. Sarah Erickson, Laetitia Cesari and Almudena Azcárate Ortega, *African Perspectives for Advancing Space Security through Norms, Rules and Principles of Responsible Behaviours Workshop Summary Report*, UNIDIR, (2023), https://doi.org/10.37559/WMD/23/Space/03.



CONCLUSION

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As States work to develop mechanisms to ensure space security at the multilateral, regional and domestic levels, complementarity must be underscored as acritical element of value. The complementarity between mechanisms is apparent in many different contexts: (i) complementarity between binding and voluntary modes of governance, (ii) complementarity across domestic and international levels of action; and (iii) complementarity between the multilateral concepts of space safety, security and sustainability.

When it comes to the complementarity between binding and voluntary modes of governance, it is essential to acknowledge that there is no single mechanism which will solve issues of space sustainability. Rather it is the combination of many efforts that will result in a better and more comprehensive space governance regime. The pursuit of legally and non-legally binding measures are mutually reinforcing. The history of outer space law is testimony to the importance of establishing voluntary initiatives and common expectations as a foundation. Similarly, laws can be further enhanced and clarified through the development of non-legally binding mechanisms that expand on them. In this sense, non-legally binding tools often inform and reflect how law is interpreted and applied in practice and can help to resolve conflicting legal rules.

In relation to the complementarity across domestic and international levels of action, the international community should support and encourage the employment of any tool of statecraft that contributes to a more transparent and stable space environment. In this light, the provisional mapping of existing national measures demonstrates the importance of unilateral initiatives to the overall international space regime. Currently, States are employing a variety of mutually reinforcing tools such as national policies, laws, structures, military doctrines, and political commitments or norms in the pursuit of a space sustainability. By adopting such mechanisms, States provide localized interpretation, implementation, and in some cases enforcement, which serve to strengthen the global space governance framework. What is clear is that there is not a one size fits all approach for domestic space governance. Rather it is the overall and collective action taken by States which will contribute towards a more sustainable space environment.

Lastly, with regard to the complementarity between space safety and security, it is necessary to explore the historical development of space safety and security as separate concepts in United Nations processes, as it evidences the merit of their distinct existence for their ability to facilitate dialogue in multiple parallel processes. However, by understanding the threat and risk landscape to space assets, it is also clear the limits to which these concepts may feasibly be considered distinct. Furthermore, as demonstrated in the illustrative mapping of national governance measures, States address space safety and security in a holistic manner. Many States employ varied toolkits that have single measures which address all issues as interconnected. Going forward it may be increasingly helpful to think of space safety and security as two sides of the same coin that is space sustainability. Striving towards space sustainability aligns all processes and efforts to the shared goal of protecting and ensuring our collective continued use and exploration of outer space.

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