

Safety Zones as a Means to Ensure a Balanced Liability Regime in Space

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Abstract

The Liability Convention, which establishes the rules for international liability for damage caused by space objects, provides for fault on the side of the damage causer as a condition for compensation for accidents in space. In the absence of the “rules of the road” in space, or at least a common understanding of the standard of care and due diligence, proving fault may become a challenge on the way to obtaining compensation and adequately protecting high-value space assets. In this regard, it can be argued that safety zones established around the locations of space activities can reduce the risks of accidents, while space actors’ conduct in such zones can be an indicator of the presence or absence of any degree of fault. This article analyses the current liability regime applicable to accidents in space and examines whether controversial safety zones can close legal gaps and contribute to the development of space activities.

1. Introduction to the Liability Regime in International Space Law

Humanity has never been as close to the exploitation of celestial bodies as it is today. They attract us as the key to unravelling the mysteries of the universe and a stopover on the way to deep space. Commercial entities are inspired by the wealth of celestial bodies with mineral resources and a unique opportunity to test advanced technologies that can change people’s lives on Earth. In light of the growing interest of nations and the space industry around the world in lunar exploration, missions to the Moon will increase exponentially in the coming decades and lay the script for how various stakeholders will interact on other celestial bodies in the Solar System.

Simultaneous operations of crewed vehicles, robotic spacecraft and fixed infrastructure need to be coordinated beforehand to ensure safety of multiple actors and strike a balance between scientific, commercial and national security interests. Accidents in space can lead not only to multimillion-dollar losses, but also cost the lives of people who depend on space infrastructure, and cause irreparable damage to the environment of celestial bodies,

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including when using nuclear power sources. If, despite the precautions taken, the safety of extraterrestrial activities has not been ensured, adequate and prompt compensation is required.

1.1. The Outer Space Treaty and the Liability Convention

In case damage is caused by a space object, including when it collides with another space object, the norms of the international liability regime are applied. The liability regime in international space law is based on Article VII of the Outer Space Treaty¹ and the Liability Convention² elaborating on it. 112 states have ratified the Outer Space Treaty, and 98 have ratified the Liability Convention.³

The different number of ratifications means that there may be cases where a party to the Outer Space Treaty is not a party to the Liability Convention. The opposite situation also exists where a party to the Liability Convention is not a party to the Outer Space Treaty. In such cases, only the treaty to which the state concerned is a party applies. In the event that a state participates in the Outer Space Treaty and the Liability Convention, both treaties will apply until a conflict between their norms arises. In this case, in accordance with the "*lex specialis derogat legi generali*" principle (the legal maxim according to which specific rules are given priority over general rules), the Liability Convention will apply. It may also be that a state is not a party to either the Outer Space Treaty or the Liability Convention, in which case neither of them is applied. To resolve a liability issue, one would have to turn to general international law. The latter contains rules on responsibility for internationally wrongful acts,⁴ but does not specifically address liability which is generally considered a treaty-based regime.

Most states, including mature and emerging space nations, are parties to the Liability Convention. This scenario is the focus of this article, which considers liability for damage in the context of fault, since it is exactly the Liability Convention that introduces the notion of fault in some cases of accidents with space objects.

1 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, UN Doc. A/RES/2222(XXI), 19 December 1966.

2 Convention on International Liability for Damage Caused by Space Objects, UN Doc. A/RES/2777(XXVI), 29 November 1971.

3 Status of International Agreements relating to activities in outer space as at 1 January 2022, UN Doc. A/AC.105/C.2/2022/CRP.10, 28 March 2022.

4 Customary international law of state responsibility is codified in the International Law Commission's Articles on Responsibility of States for Internationally Wrongful Acts, ILC Yearbook 2001/II(2).

1.2. Correlation between Article VII of the Outer Space Treaty and the Liability Convention

The core of the liability regime of international space law, Article VII of the Outer Space Treaty, lays down a foundational norm according to which each State Party to the Treaty that launches or procures the launching of an object into outer space, including the Moon and other celestial bodies, and each State Party from whose territory or facility an object is launched, is internationally liable for damage to another State Party to the Treaty or to its natural or juridical persons by such object or its component parts on the Earth, in air space or in outer space, including the Moon and other celestial bodies. The same list of liable states was subsequently included in the notion of the “launching state,” which was first introduced by the Liability Convention. Its Article I (c) specifies that, for the purposes of the Liability Convention, the term “launching state” means a state which launches or procures the launching of a space object, and a state from whose territory or facility a space object is launched.

The main difference between Article VII of the Outer Space Treaty and the Liability Convention is that the former establishes liability for damage caused by a space object anywhere, while the Liability Convention contains a narrower scope of application in terms of the place of damage⁵ and, more importantly, establishes liability differently depending on the place where damage is caused.

1.3. The Absolute and the Fault-Based Liability under the Liability Convention

According to Article II of the Liability Convention, “a launching state shall be absolutely liable to pay compensation for damage caused by its space object on the surface of the Earth or to aircraft in flight.” Absolute liability means that the mere fact of causing damage is sufficient to compensate for it, and the assessment of the behaviour that caused the damage does not matter. Absolute liability can arise from both lawful and unlawful conduct resulting in damage. When it comes to damage caused to a space object of one launching state, or to persons or property on board such a space object elsewhere than on the surface of the Earth, by a space object of another launching state, Article III

5 Article VII of the Outer Space Treaty establishes international liability for damage caused by a space object or its component parts “on the Earth, in air space or in outer space, including the Moon and other celestial bodies.” In case of damage caused by a space object in airspace, Article VII of the Outer Space Treaty covers the whole variety of incidents in which damage is caused to another state, its individuals and legal entities, while the Liability Convention covers only damage to an aircraft in flight or other space object. The latter, *i.e.* a collision of two space objects in airspace during launch and re-entry, is unlikely to happen in practice, although theoretically possible. Damage caused by a space object in airspace to assets other than an aircraft in flight or a space object is not covered by the Liability Convention. To deal with such cases of damage, the Outer Space Treaty can be applied.

of the Liability Convention establishes that the latter is only liable “if the damage is due to its fault or the fault of persons for whom it is responsible.” The difference between Article II of the Liability Convention, which provides for absolute liability for damage on Earth and to aircraft in flight, and Article III, where it is necessary to establish fault in order to ascribe liability, reflects the difference in the position of the victims. It is reasonable that persons on Earth or in airspace who are not involved in space activities need the highest protection. Space actors, on the other hand, must bear risks associated with conducting space activities, and the settlement of incidents between them requires an assessment of the behaviour of each.

A similar distinction in the liability regimes is contained in Article IV (1) of the Liability Convention, which covers more complex cases consisting of several interrelated accidents. In particular, it regulates cases where damage is first caused elsewhere than on the surface of the Earth by a space object of one launching state to a space object of another launching state or to persons or property on board such a space object, and then, as a result of this first accident, the second accident happens where damage is caused to a third state or to its natural or legal persons. The first two states are jointly and severally liable for damage caused to the third state, however, liability will vary depending on the place of the damage.

If such damage is caused on the surface of the Earth or to aircraft in flight, the first two states’ liability to the third state is absolute. If such damage is caused to a space object of the third state or to persons or property on board that space object elsewhere than on the surface of the Earth, liability of the first two states towards the third state is based on the fault of either of the first two states or on the fault of persons whom either is responsible for. In all cases of joint and several liability of the first two states, the burden of compensation for damage is apportioned between them in accordance with the extent to which they are at fault. If the extent of fault of each of these states cannot be established, the burden of compensation is apportioned equally between them.

Although the Liability Convention establishes fault as a condition for compensation for damage under its Articles III and IV (1b) and a criterion for apportioning the burden of compensation for damage among several liable states under its Article IV (2), it does not provide a definition of fault. The notion of fault has been on the minds of scholars for decades and keep doctrinal discussions alive.⁶

6 For further details on the notion of fault and the fault of persons whom states are responsible for, *see* E. Morozova, A. Laurenava, *To the Moon and Back: on the Way to a Well-Balanced Liability Framework for Lunar and Cislunar Activities* (2021), *Journal of Space Law*, Volume 45, pp. 176-200; E. Morozova, A. Laurenava, *International liability for commercial space activities and related issues of debris*, *Oxford Research Encyclopedia of Planetary Science* (2021).

2. The Notion of Fault

Since fault is not defined in the Liability Convention, the general rule of interpretation must apply. This rule is set out in the Vienna Convention on the Law of Treaties,⁷ which is widely accepted to reflect customary international law. Its Article 31 (1) specifies that a treaty must be interpreted in good faith in accordance with the ordinary meaning to be given to the terms of the treaty in their context and in the light of its object and purpose. For a discussion of the notion of fault in the context and in the light of the Liability Convention, it is useful to refer to its Article VI, which establishes an exoneration from absolute liability. For a potentially liable launching state to be granted such an exoneration, firstly, the damage must have resulted from activities carried out by that state in conformity with international law,⁸ and secondly, the damage must have been the result, either wholly or partially, of gross negligence of the victim or its act or omission done with intent to cause damage.⁹

2.1. Failure to Comply with International Law as an Indicator of Fault

Considering that, in order to ascribe liability, the Liability Convention assesses the presence and extent of fault, it can be assumed that setting the absence of a violation of international law as a condition for exoneration from liability means that a violation of international law might indicate fault for the purposes of the Liability Convention. The doctrine of international space law argues that fault generally stands for the failure to adhere to a legal obligation.¹⁰

A well-known legal issue in this context is the absence of the “rules of the road” in space. The simplest analogy that comes to mind is the rules of the road for cars. In case of violation of these rules, for example, in case of passing a junction at a prohibited traffic light, the driver, as a general rule, will be found at fault for an accident. Similar rules in space would facilitate the practical application of the fault-based liability regime if they defined specific obligations of space actors. Their violation would make it possible to establish fault and result in compensation for damage caused in the event of a violation of such obligations.

7 Vienna Convention on the Law of Treaties, 23 May 1969, UN Doc A/Conf.39/27, 1155 UNTS 331, 8 ILM 679 (1969), 63 AJIL 875 (1969) (entered into force 27 January 1980).

8 According to Article VI (2) of the Liability Convention, this includes, in particular, the United Nations Charter and the Outer Space Treaty.

9 To be granted an exoneration, a potentially liable launching state must establish gross negligence or an act or omission done with intent to cause damage, on the part of a claimant state or of natural or juridical persons it represents. *See* Article VI of the Liability Convention.

10 L. J. Smith & A. Kerrest, Article III, in II Cologne Commentary on Space Law 131, 132 (S. Hobe et al., eds. 2013).

The existing legally binding rules most relevant in cases of damage caused in space are contained in Article IX of the Outer Space Treaty. In particular, it establishes obligations by states to carry out space activities with due regard to the corresponding interests of other states, be guided by the principle of cooperation and mutual assistance, and undertake appropriate international consultations in certain cases. Article XI of the Outer Space Treaty is also relevant as it encourages states to share information on the nature, conduct, locations and results of their activities in outer space. The practical content of these obligations is rather vague, and the practice of their application is very scarce or absent, which makes it difficult to refer to these rules when making claims for damage under the fault-based liability regime.

2.2. Gross Negligence and Acts or Omissions Done with Intent to Cause Damage as Indicators of Fault

It may also be assumed that, in the context and in the light of the Liability Convention, it is the fault on the side of the victim that is the basis for exoneration from liability. If so, then in establishing fault, it can be argued that gross negligence or an act or omission done with intent to cause damage constitute fault. The doctrine supports such approach to definition of fault as “intent or negligence to cause damage in respect of someone else active in space”.¹¹

There is no difficulty in understanding what the notion of intent to cause damage means. Rather, difficulties will arise in practice when determining and proving the intent on the side of the launching state. An example of an act done with intent to cause damage would be to purposely send a command to a satellite from the ground control station to turn on the engines and change the orbital trajectory in such a way as to crash into a neighbouring satellite. Refusal to perform a technically feasible evasive maneuver to avoid an imminent collision with a space object unable to maneuver would be an example of omission.

The situation is complicated with gross negligence, which is more difficult to establish. There is a lack of common understanding of the standard of care and due diligence for activities in outer space against which the behaviour of space actors can be assessed to establish gross negligence and, consequently, fault. However, efforts are being made to define fault, and some of the developments already in place may be useful to take into account in the conduct of space activities.

11 F. G. von der Dunk, “Liability versus Responsibility in Space Law: Misconception or Misconstruction?”, Proceedings of the 34th Colloquium on the Law of Outer Space (1992): 363-371 (1992).

2.3. Considerations of the COPUOS Members and Permanent Observers

One of the agenda items of the COPUOS Legal Subcommittee is devoted to the status and application of the five United Nations space treaties. To provide a basis for discussion of this agenda item, the Chair of the eponymous working group prepared a set of questions, including on the notion of fault. Responses from the COPUOS member states and permanent observers are presented as LSC conference room papers and worth analysis.¹² In its responses,¹³ Austria suggests that space actors must be judged by their employment of care and due diligence. International principles and guidelines, such as those contained in United Nations General Assembly resolutions on outer space and in the COPUOS Space Debris Mitigation Guidelines, can be regarded as recognized standards of care and due diligence for activities in outer space. According to Austria, it may therefore be expected from space actors that they respect those standards, otherwise there would be a presumption of negligence. In this sense, Austria considers international principles and guidelines as relevant for establishing fault under the Liability Convention.

According to the Czech Republic,¹⁴ the principles adopted by the United Nations General Assembly, or any other subordinate bodies, are not legally binding and cannot give rise to claims under the Liability Convention on their own. While non-legally binding documents facilitate the application of the United Nations space treaties by reacting to current developments in outer space activities and might be very practical in their nature, they are not complementing the legally binding treaties and cannot stipulate new legal rights and obligations. At that, non-compliance with non-legally binding instruments could in some specific cases be seen as a supporting argument in establishing negligence.

Similar approach is shared by the Philippines,¹⁵ according to which non-compliance with United Nations General Assembly resolutions, or with

12 Set of Questions provided by the Chair of the Working Group on the Status and Application of the Five United Nations Treaties on Outer Space, UN Doc. A/AC.105/C.2/2011/CRP.12, 31 March 2011; for the sets of Questions provided by the Chair of the Working Group on the Status and Application of the Five United Nations Treaties on Outer Space in each successive year, refer to the annual reports of the Legal Subcommittee on its sessions.

13 Responses of Austria to the set of Questions provided by the Chair of the Working Group on the Status and Application of the Five United Nations Treaties on Outer Space, U.N. Doc. A/AC.105/C.2/2013/CRP.18, section 2.1 (2013).

14 Responses of the Czech Republic to the set of Questions provided by the Chair of the Working Group on the Status and Application of the Five United Nations Treaties on Outer Space, UN Doc. A/AC.105/C.2/2018/CRP.12, sections 1.2 and 3.1 (2018).

15 Responses of the Philippines to the set of questions provided by the Chair of the Working Group on the Status and Application of the Five United Nations Treaties on Outer Space, taking into account the UNISPACE+50 process, U.N. Doc. A/AC.105/C.2/2021/CRP.23, sections 1.1 and 3.1 (2021).

instruments adopted by its subsidiary bodies, related to space activities must not be considered to constitute fault. Nevertheless, non-legally binding principles, resolutions, and guidelines which are aimed at supplementing the five United Nations space treaties in their operation and application, provide a benchmark of minimum standards for the consideration of emergent space-faring nations.

Germany¹⁶ also considers it reasonable to attach appropriate significance to standards and soft law regulations at international level, which are often arrived at after years of consultations. Since it is nowadays almost impossible to get a piece of binding international law adopted quickly, consensus-building and updating of standards seem to take place more or less exclusively in the field of soft law. If no due significance were attached to soft law standards, including in terms of interpreting liability, there would be virtually no relevant development of the law at international level.

Belgium¹⁷ invited states parties to the Liability Convention to explore the possibility of concluding, on a voluntary basis, an additional arrangement which would provide for an objective definition of the notion of fault as featured in Articles III and IV of the Liability Convention, and suggested that such a definition would be made with reference to an identified set of norms based on recognized practices such as to ensure a sufficient level of safety, security and sustainability. According to Belgium, if such norms are complied with, space operators would be deemed as having adopted a careful and diligent behaviour.

Given that there is a general understanding that both hard-law and soft-law rules may be relevant to establishing fault, what are the prospects for safety zone rules to become either an international obligation or a well-recognized standard of care and due diligence?

3. The Concept of Safety Zones in Space

Safety zones and similar concepts are already known to other branches of international public law and international regimes.¹⁸ In the context of the regulation of space activities, the concept of safety zones appeared relatively recently.

16 Responses of Germany to the set of Questions provided by the Chair of the Working Group on the Status and Application of the Five United Nations Treaties on Outer Space, UN Doc. A/AC.105/C.2/2013/CRP.13, p. 2 (2013).

17 Responses of Belgium to the set of Questions provided by the Chair of the Working Group on the Status and Application of the Five United Nations Treaties on Outer Space, UN Doc. A/AC.105/C.2/2016/CRP.6, p. 3 (2016).

18 F. G. von der Dunk, "What's In A Name?" Legal aspects of 'safety zones' on celestial bodies and elsewhere in outer space, 73rd International Astronautical Congress, 18-22 September, 2022.

3.1. The Building Blocks

One of the first international expert projects that advocated the need to establish safety zones was the Hague International Space Resources Governance Working Group. The final outcome of its work, the Building Blocks for the Development of an International Framework on Space Resource Activities, was adopted in 2019. The Working Group suggested that this framework would permit states and international organizations responsible for space resource activities to establish safety zones around an area identified for such activities.

The Building Blocks define “safety zones” as an area-based safety measure necessary to assure safety and avoid harmful interference with space resource activities.¹⁹ According to the Working Group, such a safety measure must comply with the principle of non-appropriation under Article II of the Outer Space Treaty and must not impede the free access to any area of outer space as provided for in Article I of the Outer Space Treaty. However, subject to timely reasoned public notice, it was assumed that a state or an international organization might restrict access for a limited period of time. Such a proposed restriction of access to an area in space set by an individual space actor was subjected to sharp criticism and ongoing discussions about its non-compliance with Articles I and II of the Outer Space Treaty.

A less debatable rational kernel was contained in the proposed behaviour of space actors associated with safety zones. In particular, it was suggested²⁰ that states and international organizations give advance notification of area-based safety measures associated with space resource activities for which they were responsible through a publicly available international database, which would be established in addition to the Register of Objects Launched into Outer Space maintained by the United Nations Office for Outer Space Affairs. International consultations were proposed as a means to settle cases of possible overlap of safety zones.²¹

3.2. The Artemis Accords

Another recent document with international participation that touched upon the topic of safety zones and received both support and criticism, is the Artemis Accords.²² Its Signatories committed to contribute to the development of international practices, criteria and rules applicable to the definition and determination of safety zones.²³ The proposed definition

19 Building Blocks for the Development of an International Framework on Space Resource Activities, The Hague International Space Resources Governance Working Group, 2019, section 11.3.

20 *Ibid*, sections 14 (b), 18 (b).

21 *Ibid*, section 11.4.

22 The Artemis Accords: Principles for Cooperation in the Civil Exploration and Use of the Moon, Mars, Comets, and Asteroids for Peaceful Purposes, NASA, 2020.

23 *Ibid*, section 11 (6).

describes a “safety zone” as an area within which the Signatories conduct their activities and undertake to coordinate with other actors to protect public and private personnel, equipment, and operations by avoiding harmful interference.

According to the Artemis Accords, the size and scope of the safety zone is to be determined in a reasonable manner so as to be supported by scientific and engineering principles as well as the nature of the operations being conducted and the environment that such operations are conducted in. If the nature of operations changes, the Signatory should alter the size and scope of its safety zone accordingly so that a temporary and adjustable nature of safety zones is maintained.

Notifications about safety zones are to be provided to Signatories and to the United Nations Secretary-General in line with Article XI of the Outer Space Treaty. The public is also to be made aware accordingly, taking into account applicable regulations for the protection of proprietary and export-controlled information. The Signatories also undertake to respect the principle of free access to all areas of celestial bodies and all other provisions of the Outer Space Treaty in their use of safety zones, although it is exactly the question whether the establishment of safety zones can be consistent with the fundamental principles of the Outer Space Treaty, in particular, its Articles I and II.

3.3. Other Proposals for Lunar Governance

The younger generation of future space experts also associate activities on the Moon with the establishment of safety zones. A call to action for the sustainable and peaceful development of the Moon from the Space Generation Advisory Council (SGAC) has found its detailed expression in the proposal for a Lunar Governance Charter.²⁴

According to SGAC, the purpose of safety zones is to avoid harmful interference among ongoing lunar operations in the concerned area. The size of safety zones is recommended to be limited to what is strictly necessary for avoiding harmful interference. To comply with the Outer Space Treaty, safety zones are not keep-out zones and other space actors have the right to enter a safety zone after consultations with the state who declared such safety zone. To foster transparency and ensure coordination, states should be invited to timely and publicly declare their safety zones to the United Nations under Article XI of the Outer Space Treaty.

24 Effective and Adaptive Governance for a Lunar Ecosystem (E.A.G.L.E.), presentation by the Space Generation Advisory Council under agenda item 4, 60th session of the COPUOS Legal Subcommittee, 2021.

3.4. Legal Challenges Related to Safety Zones in Space

All these and other similar safety-zones-related initiatives have a common goal, specifically to avoid harmful interference through the establishment of area-based special rules of conduct. They are also similar in the proposal for the exchange of information, which is aimed at ensuring transparency, predictability and sustainability of space activities and can only be welcomed. Still, the key question remains open: does the establishment of safety zones violate the fundamental principles of the Outer Space Treaty? In particular its Article I, which establishes that outer space, including the Moon and other celestial bodies, must be free for exploration and use by all states and that there must be free access to all areas of celestial bodies, and its Article II, according to which outer space, including the Moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means. Different opinions on this key question exist. For instance, during the sixty-first session of the COPUOS Legal Subcommittee in 2022, the view was expressed that the attempts of some participants in space activities to establish a special legal regime for the exploited areas of celestial bodies by means of establishing “safety zones” contradicted the existing norms of international space law.²⁵ Since the legitimacy of establishing safety zones is, in principle, not indisputable and heated discussions do not subside both on official and informal international platforms, it is unlikely that unanimity on this issue will be found in the near future and that the concept of safety zones will help in assessing the notion of fault for the purpose of the Liability Convention.

4. The Existing Analogue of Safety Zones in Space Activities

Interestingly, one of the types of space activities has long contained an analogue of safety zones, which does not cause an issue in the industry. This refers to space communications.

The speed of rotation of a satellite in the geostationary orbit (GSO) around our planet is such that it allows the satellite to maintain a constant position relative to the surface of Earth. A GSO satellite is always at the same point for a terrestrial observer. In order to maintain a satellite in its nominal orbital position despite physical effects of space, correction maneuvers are performed in short repeating cycles. The extent of a satellite’s deviation from the nominal orbital position is called the accuracy of keeping the satellite in orbit. It is measured in degrees in North-South (latitude) and East-West (longitude) directions.

The Radio Regulations of the International Telecommunication Union (ITU), the United Nations specialized agency for information and communication

²⁵ Report of the Legal Subcommittee on its sixty-first session, 28 March-8 April 2022, UN Doc. A/AC.105/1260, 19 April 2022, paragraph 224.

technologies, requires that satellites are maintained in their orbital slots with a specific accuracy. This can be explained by the primary task of the ITU which is to ensure the rational, equitable, efficient and economical use of the radio-frequency spectrum and associated satellite orbits.²⁶ The smaller the deviation of satellites from their nominal orbital positions, the closer together they can be placed, thus using more spectrum without causing harmful interference to each other.

Spacecraft which provide broadcasting and fixed-satellite services must maintain their positions within $\pm 0.1^\circ$ of longitude of their nominal slots, while other satellites must be maintained with less accuracy equal to or better than $\pm 0.5^\circ$ in the same East-West direction. Older satellites, those that were put into operation as early as in the 1980s, must be kept in orbit with an even lower accuracy of $\pm 1^\circ$. The maintenance of the tolerance in the North-South direction is recommended in certain cases but is not a requirement.²⁷

In practice, spacecraft manufacturers equip all types of GSO satellites with a better station-keeping accuracy than that required by the ITU Radio Regulations: this is $\pm 0.05^\circ$ East-West and $\pm 0.05^\circ$ North-South, or about ± 36.8 kilometres in both directions. If one draws an analogy with safety zones, it can be assumed that operators of GSO satellites establish “safety zones” in outer space having the shape of a ball with a diameter of about 73.6 kilometres where their satellites perform maneuvers. Since operators are capable of co-locating satellites from each other at a much smaller distance than $\pm 0.05^\circ$ or ± 36.8 kilometres, they coordinate their actions with operators working in the vicinity. In other words, “safety zones” in the GSO are not stay-away zones.

No claims are known that satellites’ station-keeping zones are inconsistent with the Outer Space Treaty, which may be explained as follows. First, provisions relating to station-keeping accuracy are set in the international treaty, the ITU Radio Regulations. While the reason for establishing orbital accuracy is not safety but rather operational, it has a direct impact on safety by alerting operators to where adjacent satellites may actually be located compared to their nominal positions. Secondly, orbital station-keeping maneuvers are required for a technical cause, and the extent of deviation is dictated by physical properties of outer space and the current level of technological progress, in particular in the field of spacecraft manufacturing. This explanation is clear and objective while the size of orbital “safety zones” can be regarded technically and physically justified. Thirdly, satellites’ station-keeping areas are not keep-out zones and operators are not prohibited from placing their satellites within another operators’ station-keeping

26 Constitution of the International Telecommunication Union, Nos. 78, 196.

27 Radio Regulations of the International Telecommunication Union, Edition 2020, Volume I, Article 22, Section III; *Ibid*, Volume II, Appendix 30, Annex 5, No. 3.11; *Ibid*, Volume II, Appendix 30A, Annex 3, No. 3.16.

“balls”. Since no operator wants to lose its costly space asset, in practice, nearby co-location and maneuvers are usually coordinated.

Based on this already existing experience of ensuring safety in space and taking into account little hope that the concept of safety zones will any soon become a universal way to internationally coordinate space activities, primarily on celestial bodies, an alternative option could be considered. Such option is proposed to address the issue of safety of space operations at the global level. At the same time, the concept of safety zones may obviously be successfully implemented in practice between space actors of those states who recognize the legality of safety zones, for example, between the participants of the Artemis Accords and other similar operational agreements or international treaties which may be executed in future.

5. Revisiting Articles IX and XI of the Outer Space Treaty

While we are gradually moving towards generating political will and stakeholders' consensus to establish new norms relating to space activities, existing norms may be assessed for the possibility of their improved implementation and the development of uniform state practice. In particular, Articles IX and XI of the widely recognized Outer Space Treaty should be revisited, which are also referred to in the previously described safety zones initiatives.

Article XI of the Outer Space Treaty contains an agreement of states to promote international cooperation in the peaceful exploration and use of outer space by informing the United Nations Secretary-General, as well as the public and the international scientific community, to the greatest extent feasible and practicable, of the nature, conduct, locations and results of their activities in outer space. The Secretary-General is responsible for ensuring that such information is disseminated immediately and effectively.

The very few notifications by states under Article XI of the Outer Space Treaty usually concern space objects and their operation, in particular changes in orbital positions, planned decommissioning and de-orbiting.²⁸ This means that Article XI of the Outer Space Treaty has never been sufficiently used in practice and the opportunities it provides for coordinating activities in outer space are far from being exhausted. At that, the provision by states of information in accordance with Article XI of the Outer Space Treaty may, in practical terms, be very similar to the establishment of safety zones.

In an Article XI notification, a state may describe locations of its space activity in such a manner as to include not only a specific point of its core

²⁸ Index of submissions by states under Article XI, United Nations Office for Outer Space Affairs, <https://www.unoosa.org/oosa/en/treatyimplementation/ost-art-xi/index.html>, (accessed 03.01.2023).

activity, such as the place of drilling the lunar surface for extracting a rock sample, but also specifying the routes of crewed and uncrewed vehicles moving around this place and other places related to this space activity, such as a facility for storage and examination of the collected probes. Information on the planned schedule of vehicles' operations should also be communicated so that other space actors could find a time slot to cross the same operational area safely and that the stay-away status of these operational areas is avoided. This would minimize risks of physical collisions. Further notification under Article XI of the conduct and the results of space activities may be used for adjusting "safety zones" to new stages of space missions.

When providing information of the nature of its space activity in an Article XI notification, a state may also include information about locations where other actors' activities would cause negative effects to that state's space activity. Such effects would obviously depend on the nature of the space activity. For example, if solar panels are used for conducting a space activity, any close-proximity construction would shadow and prevent solar panels from operating normally. Hence, a minimum shadow-free distance from the space activity's location may be communicated. In the event that a scientific experiment should not be affected by regolith particles, the state conducting such an experiment may report areas in which the movement of space objects and astronauts will be of critical importance for the experiment. In such cases the application of Article XI would go far beyond reducing risk of physical collisions and help avoid potentially harmful interference in a broader sense.

Article IX of the Outer Space Treaty establishes a mechanism of international consultations which can be initiated in cases of potentially harmful interference. On the one hand, a state must undertake international consultations before proceeding with an activity in space, which is planned by this state or its nationals, in case it has reason to believe that such an activity would cause potentially harmful interference with peaceful space activities of another state(s). On the other hand, a state which has reason to believe that an activity planned by another state would cause potentially harmful interference with other peaceful space activities may request consultation concerning such an activity. To date, international consultations have never been used in real life. This leaves room for the development of state practice, including on the combined application of Articles IX and XI of the Outer Space Treaty.

Consider the example where, in reporting on its space activities under Article XI, a state further notifies, with reference to Article IX, that it has reason to believe that another state's activities in that same location may cause potentially harmful interference and that, on this basis, it requests international consultations from any state that plans, or will plan, to carry out such activities in that same location. Since the cause of potentially harmful interference is not yet known, and Article IX of the Outer Space Treaty does not contain a consultation procedure, such notification can be

disseminated immediately and effectively with the assistance of the Secretary-General of the United Nations, which in practice can be done with the assistance of the United Nations Office for Outer Space Affairs.

Thus, for example, when describing a scheduled crewed mission to the Moon, a state may not only inform about the nature and locations of this space activity under Article XI, but also request consultations from other states planning space activities near the reported landing sites in accordance with Article IX. In the event of non-consultation and causing damage to a lunar lander by another state's space object, a compensational claim under Article III of the Liability Convention may allege that another state's failure to consult constitutes failure to adhere to the legal obligation of that state and therefore indicate fault. State practice may develop in such a way that failure to inform about the nature and locations of space activity would be indicative of a failure to comply with either the obligation under Article XI of the Outer Space Treaty or a standard of care and due diligence, leading to the establishment of fault in the event of an accident in space. It can be assumed that, in the event of a collision between two objects in space, it would be more likely to establish fault on the side of the state that did not report its space activities than on the side of the state that provided comprehensive information under Article XI.

Notifications under Articles IX and XI of the Outer Space Treaty may relate not only to space activities conducted by governmental agencies, but also by non-governmental entities whose national activities the state is responsible for under Article VI of the Outer Space Treaty. On the one hand, such notifications can help protect private space actors from potentially harmful interference, including physical damage. On the other hand, notifications will link the notifying state with the relevant non-governmental entities. Such a link has legal significance not only in the context of international responsibility for national activities in outer space under Article VI of the Outer Space Treaty, but also in the context of Articles III and IV of the Liability Convention which establish fault-based liability, including the fault of persons whom a state is responsible for. If there is fault on the side of such private actors, the appropriate state may be held liable for damage caused by space objects operated by such private actors.

6. Conclusions

The Outer Space Treaty laid the foundations for the exploration and use of outer space, which were further developed in subsequent United Nations space treaties. This widely accepted regulation of the exploration and use of outer space continues to provide a solid legal basis. However, the rapid development of space technology, the emergence of new types of space activities and the flourishing commercialization of the space sector challenge these foundations of international space law.

The rules in force must remain relevant, sufficient and reflect the interests of all stakeholders, and their application in practice must be transparent and predictable. Only in this case, regulation can be beneficial for the industry: it must ensure the continuous development of the industry by attracting investments and making the industry even more attractive for new investments, continuing to repeat each subsequent round of attracting investment and development. Otherwise, new rules must be adopted.

While the intentions are reasonable, it is clear that the debate about safety zones will continue. Since the parties to the dispute are space powers already carrying out or planning space missions, including to the Moon and other celestial bodies, it does not seem possible to resolve the issue of coordination of space activities and prevention of potentially harmful interference on a global scale based on the concept of safety zones. At the international level, safety zones will be unable to bring clarity to the issue of liability for damage and the establishment of fault until all states are bound to respect safety zones as their international obligation, or until a new universal standard of care and due diligence is crystalized.

If space actors are united by the common goal of reducing the risks of causing damage and obtaining adequate and prompt compensation if damage is caused, then legal disputes should be set aside. In a situation where the conclusion of legally binding documents is not expected and a more realistic adoption of non-binding norms is stalled, space actors are left to rely on existing norms and jointly develop the practice of their implementation. In this sense, Articles IX and XI of the Outer Space Treaty can gain a second wind.