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Regulating a revolution : small satellites and the law of outer space

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Chapter 2: Small Satellites Activities Within the Framework of International Space Law and Recent Regulatory Developments

1. Introduction

The first chapter of this study introduced small satellites and their associated activities, and explained which elements made small satellites revolutionary in the realm of space activities.

In this second chapter, small satellites will be introduced in relation to the legal framework of existing international space law and upcoming norms aimed to govern small satellites activities. The latter are currently under discussion at international forums.

The applicability of international-space-treaty-law to small satellites activities is fundamental to understanding the international legal framework governing such activities. This is due to the fact that, to date, there are no judicial products, such as ICJ cases or proceedings of other international tribunals, which concern small satellites activities. Further, customary international law relating to satellite activities is not clearly established yet, and certainly not for small satellites activities specifically, given they have only been carried out for less than two decades. This means that the UN space treaties¹ are the most relevant primary source of international law available.

Therefore, the greater part of this chapter shall be dedicated to examining small satellites activities in light of the applicable UN space treaties. Firstly, the relations between such activities and key relevant provisions of the Outer Space Treaty will be analysed. Secondly, the applicability of relevant provisions of the remaining UN space treaties will be analysed. Thirdly, small satellites activities will be examined vis-à-vis the existing relevant definitions in the UN space treaties, while explaining the legal challenges innovative small satellites pose to traditional treaty provisions.

¹ Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, (1967) 610 *U.N.T.S.* 205 (Hereinafter: 'Outer Space Treaty'); Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, (1968) 672 *U.N.T.S.* 119 (Hereinafter: 'Rescue Agreement'); Convention on International Liability for Damage Caused by Space Objects, (1972) 961 *U.N.T.S.* 187 (Hereinafter: 'Liability Convention'); Convention on Registration of Objects Launched into Outer Space, (1975) 1023 *U.N.T.S.* 15 (Hereinafter: 'Registration Convention'); Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, (1979) 1363 *U.N.T.S.* 3 (Hereinafter: 'Moon Agreement'). The five treaties are collectively referred to as the 'UN space treaties'.

Accordingly, the second section of this chapter shall focus on answering the following questions: *Which international space law provisions apply to small satellites activities? And in what ways do small satellites activities challenge such provisions?*

The following section of this chapter, will present the current discussion relating to small satellites activities in international forums. Such discussions may form binding international law or soft law, which will govern small satellites activities specifically, in the future. The recent work of the following international bodies shall be presented: firstly, the United Nations Office for Outer Space Affairs (UNOOSA), and specifically its Committee on the Peaceful Uses of Outer Space (COPUOS) and its legal sub-committee.² Secondly, the Inter-Agency Space Debris Coordination Committee (IADC).³ And thirdly, the International Telecommunication Union (ITU) and the ITU World Radio Conference (WRC).⁴

The importance of the work of the abovementioned bodies lies in the fact that it reflects the matters, which the international community finds most critical to the development of small satellites activities, meaning areas that may require specific regulation of such activities. Furthermore, the discussions complement topics that are not addressed in the UN space treaties.

All the above will be the basis for understanding the legal challenges concerning small satellites activities and the possible need to find new international norms in order to specifically regulate small satellites, beyond the existing UN space treaties.

2. Small Satellites and International Space Law- Applicability and Challenges

2.1 Applicability

Since small satellites are different from traditional satellites in many ways, some scholars, including the author, chose to reaffirm the fact that international space law applies to all types of satellites or ‘space objects’⁵ on an equal basis:

² UNOOSA’s website: <http://www.unoosa.org/>. Note: all the links provided in the notes of this chapter were last visited on 1st October 2017.

³ IADC’s website: <http://www.iadc-online.org/> .

⁴ ITU’s website: <http://www.itu.int/en/Pages/default.aspx> .

⁵ See for definition and applicability of this term to small satellites sub-section 2.3.3 *infra*.

None of the international space law treaties differentiates between space objects according to their dimensions.⁶

Under international law, small satellite missions are not treated any differently than other space activities.⁷

It seems that there is no scholarly difficulty in reaching the conclusion that existing treaty law applies to small satellites in the same manner it applies to traditional satellites.

Practically, since many small satellites missions were carried out by start-ups, technical universities and non-space-faring nations as a capacity building activity,⁸ there was a clear lack of awareness to existing international space law, and to the fact it applies to ‘small’ and ‘simple’ missions using small satellites. Some international bodies took efforts to make clear that the law’s applicability does not depend on the magnitude of the space activity in question.⁹

Thus, currently, the applicability of the UN space treaties to small satellites is not a cause for disagreement.

This section will explore the relations between the relevant provisions of the UN space treaties and small satellites activities, while identifying legal challenges relating to the treaties’ application, which will be further analysed in the following chapters of this study.

2.2 Small Satellites Under the Outer Space Treaty

The Outer Space Treaty is considered to be the *magna carta* of international space law. It is the first treaty out of the five UN space treaties, and the one, which outlines the international regime for space activities in the broadest manner. It is also the most popular one, with 105 ratifications by States, as at January 2017.¹⁰

This subsection shall review the provisions of the Treaty in the context of small satellites activities, and determine to what extent small satellites activities are in line with such provisions. Provisions

⁶ N Palkovitz, ‘Small Satellites: Innovative Activities, Traditional Laws, and the Industry Perspective’ in I Marboe (ed), *Small Satellites: Regulatory Challenges and Chances* (Brill Nijhoff 2016) 47, 48.

⁷ LJ Smith and Z Valic, *A Regulatory Roadmap for Small Satellites*, 4S Symposium, Slovenia (05 June 2012), at 5; See also: RS Jakhu and JN Pelton, *Small Satellites and their Regulation* (Springer 2014) 43.

⁸ See chapter 1, sub-section 2.4.8 for examples.

⁹ For further writing concerning this problem see: N Palkovitz and T Masson-Zwaan, *Orbiting under the Radar: Nano-Satellites, International Obligations and National Space Laws*, IISL Proceedings of the 55th Colloquium on the Law of Outer Space (2013) 566; See section 3 for international efforts to raise awareness and enhance compliance in this context.

¹⁰ Committee on the Peaceful Uses of Outer Space- Legal Subcommittee, Status of International Agreements relating to activities in outer space as at 1 January 2017, UN Doc. A/AC.105/C.2/2017/CRP.7 (2017); available at: http://www.unoosa.org/documents/pdf/spacelaw/treatystatus/AC105_C2_2017_CRP07E.pdf .

relating to human spaceflight, dispute resolution and other topics that are not relevant to assessing small satellites activities, will not be analysed.

Article I of the Outer Space Treaty embodies key principles of space activities, as they were envisaged by the member States of UN COPOUS.¹¹

Article I

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

Outer space, including the Moon and other celestial bodies, shall be free for exploration and use by all States without discrimination of any kind, on a basis of equality and in accordance with international law, and there shall be free access to all areas of celestial bodies.

There shall be freedom of scientific investigation in outer space, including the Moon and other celestial bodies, and States shall facilitate and encourage international cooperation in such investigation.

Small satellites activities usually serve the interests in Article I, to a very high degree.

The activities are carried out by various States and are more diversified compared to traditional satellites activities.¹² It is probably the space activity that promotes non-discriminatory space exploration the most. This is the case since small satellites technology is affordable and extremely accessible compared to traditional satellites activities, and of course, compared to human spaceflight activities.¹³

UNOOSA has recognised that small satellites are an effective capacity-building tool and promotes the exchange of information and development of small satellites activities. UNOOSA does this especially with developing countries and non-space-faring-nations in mind. The Basic Space Technology Initiative (BSTI) program is the best testimony to such practice.¹⁴

Moreover, small satellites promote free scientific investigation of outer space, since small satellites are frequently used by universities and research institutes in missions aimed to unlock the mysteries

¹¹ For further reading see: S Hobe, B Schmit-Tedd and K Schrogl (eds), *Cologne Commentary on Space Law* (vol. I Outer Space Treaty 27; Carl Heymanns Verlag 2009) (hereinafter: 'CoCoSL'); N Jasentuliyana, 'Article I of the Outer Space Treaty Revisited' (1989) 17/2 *Journal of Space Law* 129; UNGA Res. 51/122 Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of all States, Taking into Particular Account the Needs of Developing Countries (13 December 1996).

¹² For information and examples see chapter 1, sub-sections 2.3.8 and 2.4.8.

¹³ For more information see chapter 1, section 2.3.

¹⁴ UNOOSA website: <http://www.unoosa.org/oosa/ourwork/psa/bsti/>. For further reading on the history and creation of BSTI and about its activities see: W Balogh, 'Capacity Building in Space Technology Development: The Role of the United Nations' in I Marboe (ed), *Small Satellites: Regulatory Challenges and Chances* (Brill Nijhoff 2016) 28.

of our universe. They are also used to test new technologies in the space environment, which allow the technological development of mankind in its quest to explore outer space.¹⁵

Since CubeSats are standardised to a great extent, they are excellent cooperation enablers. The QB50 project is an example of a vast international cooperation that uses CubeSats for scientific exploration of outer space as well as technology demonstration.¹⁶

The BRITE constellation is another example for international cooperation in scientific exploration using nano-satellites. The constellation includes satellites from Canada, Poland and Austria and its mission is to carry out scientific measurements of stars' brightness.¹⁷

These types of activities truly implement the objectives in Article I of the Outer Space Treaty using small satellites. Therefore, it is concluded that small satellites activities fulfil the interests outlined by Article I.

The second Article of the Outer Space Treaty sets the non-appropriation principle:

Article II

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.

Small satellites activities do not seem to challenge the non-appropriation principle and thus, are in line with Article II.

The third Article of the Outer Space Treaty applies general international law on space activities and outlines related key principles in a somewhat repetitive manner to Article I:

Article III

States Parties to the Treaty shall carry on activities in the exploration and use of outer space, including the Moon and other celestial bodies, in accordance with international law, including the Charter of the United Nations, in the interest of maintaining international peace and security and promoting international cooperation and understanding.

As mentioned above,¹⁸ small satellites activities do promote international cooperation in space. There is no evidence that the activities challenge the provisions of the UN Charter either. Therefore,

¹⁵ For information and examples see chapter 1, section 2.4.

¹⁶ See chapter 1, section 2.4 for more details and the Project's website: <https://www.qb50.eu/>.

¹⁷ See chapter 1, section 2.4 for more details, and the Project's website: <http://www.brite-constellation.at/>.

¹⁸ See *supra* in this section 2.2.

it is concluded that small satellites activities conform to the legal framework introduced by Article III.

The fourth Article of the Outer Space Treaty elaborates on the de-weaponisation of outer space. Its first paragraph is potentially relevant to satellites activities:

Article IV

States Parties to the Treaty undertake not to place in orbit around the Earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons on celestial bodies, or station such weapons in outer space in any other manner.

A small satellite, which orbits Earth while carrying nuclear weapons or other weapons of mass destruction, would be contrary to Article IV.¹⁹ Since small satellites are small and light, and their power budget is rather limited, it is improbable that such satellites will be chosen to carry powerful weapons in orbit.²⁰ Therefore, the likelihood of a small satellite mission that would violate Article IV is rather low.

Chapter 3 of this study comprehensively analyses small satellites activities in light of Article VI, which elaborates a specific State responsibility regime for space activities.²¹

Article VI

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

¹⁹ Currently there is no one internationally agreed definition to the term 'weapons of mass destruction', however several legal instruments use this term, which refers to nuclear, biological and chemical weapons: *Legality of the Threat or Use of Nuclear Weapons*, Advisory Opinion, I.C.J. Reports (1996) 226; see discussion at paras. 35, 55, and 57-58.

²⁰ See chapter 1, section 2.3, for the special characteristics of small satellites compared with those of traditional satellites.

²¹ See for analysis of the difference between State responsibility under Article VI and in general international law, chapter 3, section 2.2.

For the purpose of the assessment in this section, it is submitted that small satellites activities are in line with Article VI, as is any other satellite activity, as long as the ‘appropriate State’²² ensures that the ‘national activity’²³ is in line with the provisions of the Outer Space Treaty.

In cases where the activity is carried out by non-governmental organisations, the appropriate State must authorise and continuously supervise it. In many cases, such authorisation and supervision requirements take the form of domestic space legislation, which sets license criteria.²⁴

The seventh Article of the Outer Space Treaty sets forth the general liability regime for space activities. This regime is further developed by the Liability Convention.

Article VII

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.

Chapter 4 of this study analyses the developed provisions relating to liability in the context of small satellite activities. Small satellites activities pose a challenge in connection to the phrase: ‘procures the launching’.²⁵

Since small satellites operators are often non-governmental entities, and since they often sign launch contracts for piggy-back launches with third parties such as launch brokers,²⁶ the connection between a ‘State Party’ and the launch procurement process is severed.²⁷

The Outer Space Treaty does not define the level of involvement that a State has to take in launch procurement to become liable for damage caused by the launched object, and thus, each State may interpret its obligations in a different manner. This is an unwanted situation as the rationale behind Article VII is to set a uniform and certain international liability regime.²⁸ While some States see their international obligations under Article VI, prescribing State responsibility, as sufficient to establish liability per Article VII, other States separate these two legal matters.²⁹

²² See further, chapter 3 subsection 2.1.2.

²³ See further, subsection 2.3.4 *infra* and chapter 3, subsection 2.1.1.

²⁴ For general State practice in this context see: *CoCoSL* 117-122.

²⁵ See chapter 4, section 3.4.

²⁶ See chapter 1, sub-section 2.5.2.

²⁷ See chapter 4, section 3.4.

²⁸ *CoCoSL*, 129.

²⁹ For the case of The Netherlands as an example see: N Palkovitz and T Masson-Zwaan, *Orbiting under the Radar: Nano-Satellites, International Obligations and National Space Laws*, IISL Proceedings of the 55th Colloquium on the Law of Outer Space (2013) 566.

To this end, it may be challenging to identify and determine the State or States that may be liable for damage caused by a small satellite. In addition, it may be difficult for an operator to find the State that is legally entitled to claim damage from other States in the case that a small satellite is damaged and compensation is due.³⁰

The eighth Article of the Outer Space Treaty sets forth the obligation to register space objects and clarifies that States have jurisdiction and control over such registered objects:

Article VIII

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

The Registration Convention includes further details relating to this topic and its provisions are analysed in chapter 5 of this study, in the context of small satellites' registration. For the purpose of the assessment in this section, the obligation to register small satellites is the same as the obligation to register any other satellites or space objects. While this is the case, there are some inconsistencies in State practice relating to the registration of small satellites.³¹

One of the difficulties originates from the legal relations between Articles VI, VII and VIII of the Outer Space Treaty.³² The partial separation that the Treaty sets between State responsibility per Article VI, liability per Article VII and jurisdiction and control per Article VIII combined with the non-governmental nature of small satellites activities, has again led to different interpretations and *opinio juris* with respect to a State's obligation to register small satellites with the UN as prescribed by the Registration Convention.³³

The ninth Article of the Outer Space Treaty includes several different obligations relating to the protection of the outer space environment. Most are not relevant to small satellites activities, for example, provisions on inter-planetary contamination. The first sentence of the Article may be relevant to small satellite activities:

³⁰ See chapter 4.

³¹ N Palkovitz and T Masson-Zwaan, *Orbiting under the Radar: Nano-Satellites, International Obligations and National Space Laws*, IISL Proceedings of the 55th Colloquium on the Law of Outer Space (2013) 566; T Masson-Zwaan, 'Registration of Small Satellites and the Case of the Netherlands' in I Marboe (ed), *Small Satellites: Regulatory Challenges and Chances* (Brill Nijhoff 2016) 174, 187-194.

³² *CoCoSL*, 115-116.

³³ See *supra* note 29.

Article IX

In the exploration and use of outer space, including the Moon and other celestial bodies, States Parties to the Treaty shall be guided by the principle of cooperation and mutual assistance and shall conduct all their activities in outer space, including the Moon and other celestial bodies, with due regard to the corresponding interests of all other States Parties to the Treaty.

As mentioned with respect to Article I, small satellites activities promote international cooperation in space, and therefore, the first element of this provision will generally be met by small satellites activities.³⁴

The second element of paying ‘due regard to the corresponding interests of all other States Parties to the Treaty’ is vague and abstract.³⁵ As such, it is difficult to determine what kind of space activity corresponds to the potentially various interests of over than 100 State parties.

Other branches of public international law may shed light on the notion of conducting activities with ‘due regard’. This notion exists in public international air law, as included in the Chicago Convention,³⁶ specifically relating to safety; in international maritime law, when referring to the high seas, as embodied in UNCLOS³⁷; and in the context of environmental law in the Stockholm Declaration on Human Environment.³⁸

Additionally, the Outer Space Treaty, including Article IX, was a product of the geo-political situation at the time of the Cold War and in the lead-up to the highly anticipated first Lunar landing.³⁹ The emphasis on the need to take into account interests of all other States parties to the Treaty protected most of the States parties, since only a few of them were space-faring half a century ago.⁴⁰ Additionally, the principle of due regard was linked to the concept of *res communis omnium*.⁴¹

³⁴ See for example Article I in this section.

³⁵ *CoCoSL*, 170, 175-176.

³⁶ Convention on International Civil Aviation, 1944 15 *U.N.T.S.* 295.

³⁷ United Nations Convention on the Law of the Sea, 1982 1833 *U.N.T.S.* 3.

³⁸ Declaration of the United Nations Conference on the Human Environment U.N. Doc. A/Conf.48/14/Rev. 1 (1973); 11 *ILM* 1416 (1972).

³⁹ J Gabrynowicz, ‘Article IX of the Outer Space Treaty: Context and Considerations’ 5th E. Galloway Symposium on Critical Issues in Space Law (Washington, 2 December 2010), available at: <http://www.olemiss.edu/programs/spacelaw/events/pdfs/2010/galloway-gabrynowicz-presentation-2010.pdf>.

⁴⁰ L Tennen and PM Sterns, ‘Consideration of ‘Heavenly Matters’ and the Evolution of Article IX’ 5th E. Galloway Symposium on Critical Issues in Space Law, slide 26 (Washington, 2 December 2010), available at: <http://www.olemiss.edu/programs/spacelaw/events/pdfs/2010/galloway-sterns-tennen-presentation-2010.pdf>.

⁴¹ S Marchisio, ‘Article IX of the Outer Space Treaty: An Overview’ The Fifth Eilene M. Galloway Symposium on Critical Issues in Space Law: Panel – Art. IX Background, 5th E. Galloway Symposium on Critical Issues in Space Law (Washington, 2 December 2010).

On the one hand, it is reasonable to argue that since small satellites missions are very diverse, and originate from a large number of States, they meet the objective set by this provision.

On the other hand, since the context of Article XI is environmental,⁴² and since small satellites numbers are increasing rapidly,⁴³ the creation of space debris is a concern. Arguably, the sustainable use of certain popular orbits may be a common interest to all State parties to the Treaty.

Scholars agree that the provisions of Article IX are rather weak, and in any case do not create any absolute obligations.⁴⁴ Thus, Article IX should be read in conjunction with Article I of the Outer Space Treaty, which stipulates the freedom of exploration and use of outer space. The latter freedom or right is not absolute either: it is limited by other provisions of the Treaty, most significantly in the context of non-peaceful use of outer space, as clearly provided under Article IV.⁴⁵

Therefore, the freedom of exploration in Article I must be balanced with the guideline to pay due regard to a wide range of interests other States may have, some in the environmental context. The author had previously phrased this dilemma as follows:

Taking the above into mind, the following question arises: would it be beneficial to limit the freedom of exploration and use in order to promote environmental protection of outer space?

On the one hand, studies have shown that we are facing risks of over congesting certain orbits by creating space debris. These risks are connected to the safety of astronauts (as vividly illustrated by the film Gravity), potential liabilities in collision cases, and generally, to the sustainability of the outer space environment. On the other hand, the existing international legal framework for space activities generally favours the freedom of exploration and use, and includes only a set of non-binding guidelines that expressly promote environmental interests in space.⁴⁶

⁴² *CoCoSL* 176-179.

⁴³ See chapter 1, sub-section 2.6.2; N Palkovitz, 'Dealing with the Regulatory Vacuum in LEO: New Insurance Solutions for Small Satellites Constellations' IISL Proceedings of the 59th Colloquium on the Law of Outer Space (2017) 419 .

⁴⁴ See for example: PJ Blount, 'Renovating Space: The Future of International Space Law' (2012) 40/1 Denver Journal of International Law and Policy 515, 525; MC Mineiro, 'FY-1C and USA-193 ASAT Intercepts: An Assessment of Legal Obligations Under Article IX of the Outer Space Treaty' (2008) 34/2 Journal of Space Law 321.

⁴⁵ *CoCoSL* 27; N Palkovitz, 'Exploring the Boundaries of Free Exploration and Use of Outer Space –Article IX and the Principle of Due Regard, Some Contemporary Considerations' IISL Proceedings of 57th Colloquium on the Law of Outer Space (2015) 93.

⁴⁶ N Palkovitz, 'Gaining Freedom, Losing Space' (*Leiden Law Blog*, 26 August 2014), available at: <http://leidenlawblog.nl/articles/gaining-freedom-losing-space> .

The author argues that the legal ambiguity presented by the above analysis exists in a broader context than small satellites activities, since the problem of space debris was introduced to the scientific community prior to the genesis of modern small satellites activities.⁴⁷

Arguably, if it were to be accepted that traditional satellites activities are not in line with the provisions of Article IX, small satellites activities would also be considered to be incompatible. While this is evidently not the case, over the years legal instruments have been drafted in order to attempt to reach an appropriate balance between Articles I and IX. Nevertheless, none of the instruments are primary sources of international law and are instead generally considered ‘soft law’. The most cited example is the IADC Space Debris Mitigation Guidelines.⁴⁸

With the realisation that the IADC Guidelines were not updated to deal with very large numbers of small satellites in LEO, the IADC is currently discussing the need to have specific guidelines, which aim to limit debris creation by small satellites activities. This interesting discussion will be addressed in subsection 3.3, below.

Regardless of the specific guidelines, which may materialise as soft law, it would be hard to argue that small satellites activities are in violation of binding treaty law, namely, Article IX.⁴⁹

To conclude this subsection, small satellites activities are generally in line with the provisions of the Outer Space Treaty, albeit States differ in the way in which they implement the provisions. The next subsection will outline the legal link between small satellites activities and the remaining four UN space treaties.

2.3 Small Satellites and the Other UN Space Treaties

The next UN space treaty, which entered into force only one year following the Outer Space Treaty, is the Rescue Agreement.⁵⁰ The most important objective of this instrument is to protect astronauts in case they fall into foreign hands. Since the Rescue Agreement was drafted during the Cold War era, both superpowers wanted to make sure their astronauts would not be treated as war prisoners in case they land in hostile territories, and that their safe return would be ensured.⁵¹ Other than the protection and return of astronauts, there are obligations relating to the return of space objects,

⁴⁷ The theory of NASA’s scientist, DJ Kessler, which is widely known as the ‘Kessler Syndrome’, was published in 1978, decades before the modern concept of small satellites saw light. For more information about the Kessler Syndrome see: M La Vone, ‘The Kessler Syndrome: 10 Interesting and Disturbing Facts’ (*Space Safety Magazine*, 15 September 2014): <http://www.spacesafetymagazine.com/space-debris/kessler-syndrome/> .

⁴⁸ Inter-Agency Space Debris Coordination Committee (IADC), Space Debris Mitigation Guidelines (2002, as revised in 2007), IADC-02-01, Revision 1 (Hereinafter: ‘IADC Guidelines’).

⁴⁹ See chapter 4, subsection 3.3.2 for legally-constructing the violation of IADC Guidelines as a trigger for liability in the context of small satellites.

⁵⁰ *Supra* note 1.

⁵¹ For further reading see: G Lafferranderie and S Marchisio (ed), *The Astronauts and Rescue Agreement: Lessons Learned* (ECSL/ESA Publication 2011).

including their remains after re-entry to Earth.⁵² Since most small satellites are low in mass and are not designed to survive re-entry to Earth, they usually burn in the atmosphere.⁵³ As such, it is unlikely that States will invoke the provisions of the Rescue Agreement in the context of small satellites.

The Liability Convention⁵⁴ is the third UN space treaty that came into force. As mentioned in the previous subsection, relating to Article VII of the Outer Space Treaty, small satellites activities challenge the concept of State-launch procurement and hence, the concept of the ‘launching State’. Further, the Convention sets two different liability regimes for damage caused by space objects, Article II prescribes absolute liability for damage caused on Earth and in the airspace, while Article III prescribes fault liability for damage which was caused in outer space. Chapter 4 of this study analyses the difference between these two standards of liability, and evaluates their relevance and applicability to damage caused by and to small satellites. In summary, damage according to Article II is less relevant for small satellites, and damage according to Article III is the most relevant, since the probable risks connected to small satellites activities are related to collisions in outer space. This means that fault liability is the legal standard that applies. As the author elaborates in chapter 4, there is a great uncertainty in relation to the kind of events that establish ‘fault’ in the context of Article III. The author concludes that since the language of the Convention is due for clarification, and since currently there are no ICJ cases or other relevant judicial decisions which clarify the term ‘fault’, parties that rely on Article III in the context of small satellites activities may not reach a legal indication as to which party is obliged to compensate the other for the damage which was caused.⁵⁵

In this sense, it is concluded that applying the Liability Convention to small satellites activities may not be legally effective, at least until further interpretation is available through the development of case law or customary law.⁵⁶

The Registration Convention⁵⁷ is the fourth UN space treaty to enter into force. As mentioned in the previous sub-section relating to Article VIII of the Outer Space Treaty, there are inconsistencies relating to the registration of small satellites in practice. The challenges which result from these inconsistencies are further elaborated in chapter 5 of this study. For now, it is sufficient to state that the nexus created by Article II of the Registration Convention, between the ‘launching State’ and ‘State of registry’, is a cause for confusion and discrepancies in the case of small satellites activities. At times, States that are parties to the Registration Convention are reluctant to properly register small satellites under their jurisdiction, arguing that while they accept international responsibility for the satellite in question, they are not a ‘launching State’ and thus, should not register it with the

⁵² See Art. 5 of the Rescue Agreement.

⁵³ See chapter 4, section 3.1.

⁵⁴ *Supra* note 1.

⁵⁵ See conclusions of chapter 4.

⁵⁶ *ibid.*

⁵⁷ *Supra* note 1.

UN.⁵⁸ Another example is the opposite case, where a State accepts to register small satellites even when a certain satellite is not owned by a State national, and therefore, presumably is not naturally subject to its jurisdiction and control.⁵⁹

To conclude, while small satellites should be registered just like traditional satellites, the practices related to their launch challenge the legal links between responsibility, liability and jurisdiction and control in the context of the duty to internationally register them.

The fifth, and so far last UN space treaty is the Moon Agreement.⁶⁰ This Agreement is the least popular out of the five treaties and has only 17 ratifications as of January 2017.⁶¹ Small satellites have yet to reach the Moon, or other celestial bodies, even though there are missions aspiring to deploy small satellites in Lunar orbits.⁶² Regardless, it seems that the Moon Agreement will not apply to small satellites as they will not be active on the Lunar surface and it is unlikely that they will cause a change to the Lunar environment by orbiting it and collecting data.⁶³

To conclude this subsection, small satellites activities are generally in line with the provisions of the UN space treaties, but much like in the case of the Outer Space Treaty, the treaties' provisions suits traditional governmental space missions better than commercial small satellites missions. The provisions of the Liability Convention are the most challenging to implement in this context, as will be elaborated in chapter 4 of this study.

The next subsection will examine the challenges in applying key notions of the UN space treaties to small satellites missions.

2.4 Challenges in the Application of Key Notions of the UN Space Treaties to Small Satellites Activities

2.3.1 Key notions- an overview

The following terms and phrases are brought in this subsection since they are relevant to more than one treaty provision. These are key notions with cross-treaty relevance in the context of space activities in general, and small satellites in particular. Some notions should be read in the same way

⁵⁸ For the case of The Netherlands as an example see: N Palkovitz and T Masson-Zwaan, *Orbiting under the Radar: Nano-Satellites, International Obligations and National Space Laws*, IISL Proceedings of the 55th Colloquium on the Law of Outer Space (2013) 566.

⁵⁹ For the case of Belgium as an example see: JF Mayence, 'QB50: Legal Aspects of a Multinational Small Satellites Initiative' in I Marboe (ed), *Small Satellites: Regulatory Challenges and Chances* (Brill Nijhoff 2016) 195.

⁶⁰ *Supra* note 1.

⁶¹ Committee on the Peaceful Uses of Outer Space- Legal Subcommittee, Status of International Agreements relating to activities in outer space as at 1 January 2017, UN Doc. A/AC.105/C.2/2017/CRP.7 (2017); available at: http://www.unoosa.org/documents/pdf/spacelaw/treatystatus/AC105_C2_2017_CRP07E.pdf .

⁶² See chapter 1, subsection 2.6.3.

⁶³ See Art. 7 of the Moon Agreement.

with relation to any and all space activities, such as ‘outer space’, while others invite specific interpretation which take practices connected to small satellites activities in particular, such as ‘launch’.

The legal uncertainty around these terms and notions are not limited to the case of small satellite activities:

Clarifications concerning the interpretation of several other notions contained in the OST are also needed. With regard to the concept of ‘national’ activity in outer space, in Art. VI, the practice of States shows that without a rigid definition in the Treaty of 1967, States are free to interpret the concept of national activities in a broader sense, which includes not only activities carried out by nationals, but also activities carried out from their territory by foreigners. Another aspect concerns the identification of the appropriate state, that is to say, the State has an obligation to authorize and supervise continuously the national activities of private entities in outer space. Not to speak of the notion of ‘space object’.⁶⁴

2.3.2 ‘Outer Space’

Even though the term ‘outer space’ is used in the UN space treaties, there is no legally accepted definition of where outer space is, or at least, where it begins. Discussions related to the definition and delimitation of outer space are on-going at COPUOS, and have been so for decades, and vast scholarly work was written on the topic.⁶⁵ In light of this, it is clear that the boundary question exceeds the scope of the intended examination in this section.

Small satellites are typically deployed into Low Earth Orbit (LEO), and hence, the lower potential orbits around Earth are relevant. Since the satellites do achieve orbit around Earth and maintain it, they are assumed to be somewhere outside of Earth’s atmosphere, and hence, in outer space. This

⁶⁴ S Marchisio, ‘Contribution of Space Law and Policy to Space Governance and Space Security in the 21st Century’ 10th United Nations Workshop on Space Law, Vienna, 5-8 September 2016, Opening Panel: Welcome Addresses and Key Note Speeches Space Law and Governance, available at: http://www.unoosa.org/pdf/SLW2016/Opening/2_Marchisio_MARCHISIO_10th_United_Nations_Workshop_on_Space_Law.pdf.

⁶⁵ See for examples: O de Oliveira Bittencourt Neto, *Defining the Limits of Outer Space for Regulatory Purposes* (Springer 2015); B Cheng, *Studies in International Space Law* (Clarendon Press 1997) 425; B Cheng, ‘The legal Regime of Airspace and Outer Space; The Boundary Problem, Functionalism versus Spatialism: The Major Premises’ (1980) 5 *Annals of Air and Space Law* 323; M Benko and E Plescher, *Space Law- Reconsidering the Definition/Delimitation Question and the Passage of Spacecraft through Foreign Airspace* (eleven international publishing 2013) 41; S Hobe and J Cloppenburg, *Towards a New Aerospace Convention?- Selected Legal Issues of ‘Space Tourism’* IISL Proceedings of the 47th Colloquium on the Law of Outer Space (2005) 377; S Freeland, *The Impact of Space Tourism on the International Law*, IISL Proceedings of the 48th Colloquium on the Law of Outer Space (2006) 187.

is the reason that scholars do not see the boundary question as a legal challenge in the context of satellite activities in general.⁶⁶

Therefore, as long as the satellites maintain orbit around Earth it is concluded they are in space, without the need to further investigate where outer space begins.

2.3.3 Small Satellites as ‘Space Objects’

The term ‘space object’ includes two words. ‘Space’ with reference to ‘outer space’ as was addressed above, and ‘object’, as shall be addressed herein. The Outer Space Treaty includes the following wording: ‘launching of an *object* into outer space’ to describe, for example, a small satellite launch.⁶⁷ Similarly, ‘A State Party to the Treaty on whose registry an *object* launched into outer space is carried shall retain jurisdiction and control over such *object*’.⁶⁸

The Rescue Agreement has the terminology of a ‘space object’, which may be regarded as a more specific term than just any kind of ‘object’, which found its way to outer space.⁶⁹ Moreover, the Agreement uses the words ‘a space object or its component parts’ to describe the kind of items a State must return to its launching authority.⁷⁰

The Liability Convention includes a definition of the term”:

‘The term “space object” includes component parts of a space object as well as its launch vehicle and parts thereof.’⁷¹

The Registration Convention includes the same term and repeats the definition above as it appears in the Liability Convention.⁷²

Therefore, in order to determine whether these legal instruments apply to small satellites activities, there is a need to examine whether small satellites are ‘objects launched into outer space’ and whether they are ‘space objects’.

It would be difficult to argue that a small satellite is not an object. Its presence in ‘outer space’ poses the question addressed in the subsection above, that is, where is outer space? Regardless of the exact answer, it is argued that since the activities in question depend on a satellite’s ability

⁶⁶ And some have already concluded the same, particularly in the case of small satellites: F von der Dunk, ‘Liability for Damage Caused by Small Satellites- A Non-issue?’ in I Marboe (ed), *Small Satellites: Regulatory Challenges and Chances* (Brill Nijhoff 2016) 154.

⁶⁷ Art. VII Outer Space Treaty.

⁶⁸ Art. VIII Outer Space Treaty.

⁶⁹ Art. 5 Rescue Agreement.

⁷⁰ *ibid.*

⁷¹ Art. I(ii)(d) Liability Convention.

⁷² Art. I(ii)(b) Registration Convention.

to enter into Earth's orbit, and maintain such orbit for a minimal period of time, it would only be reasonable to conclude that such an orbiting object is in outer space.⁷³

Further, small satellites are arguably 'space objects'. Although the term's definition is tautological, since it was established that they are objects, and their active life cycle is in orbit, which is outside of Earth and hence in outer space, there should be no difficulty in agreeing that they are included in such definition.

Subsequently, the UN space treaties apply to small satellites, as they are space objects. Scholars agree with this conclusion, and there is no evidence to support the contrary.⁷⁴

2.3.4 Small Satellites Operations as 'Activities' and 'National Activities'

Article VI of the Outer Space Treaty, which introduces the *lex specialis* relating to State responsibility, stipulates:

States Parties to the Treaty shall bear international responsibility for national activities in outer space [...]

Firstly, there is a need to assess what is regarded as 'activities in outer space' in the context of small satellites operations. The main difficulty is that most small satellites are non-maneuvrable, and hence, orbit Earth in a manner that excludes the possibility of changing their orbit significantly and effectively after their deployment. This is in contrast to most traditional satellites, which include propellant systems, allowing their operators to change or adjust their orbits.⁷⁵ It was suggested that space activities are associated with elements such as control or navigation of a certain space object.⁷⁶

Since the Outer Space Treaty does not define the term 'space activities', and since the notion of State responsibility for space activities was not developed in a following treaty, this term is subject to interpretation by State parties, as reflected in their national space laws. With the emergence of small satellites operations in the Netherlands and Belgium, both States amended or extended the scope of their already existing national space acts to include 'unguided satellites' under the respective acts. This was done since the legislators had initially understood that a State is responsible, and therefore, should regulate by domestic law, space activities which include guidance of space objects. They therefore, concluded that unguided objects were excluded from

⁷³ Since the laws of physics do not allow for objects to orbit around Earth in a manner that satellites do, unless these objects are positioned outside of Earth.

⁷⁴ LJ Smith and Z Valic, *A Regulatory Roadmap for Small Satellites*, 4S Symposium, Slovenia (05 June 2012), at 5; See also: RS Jakhu and JN Pelton, *Small Satellites and their Regulation* (Springer 2014) 43; F von der Dunk, 'Liability for Damage Caused by Small Satellites- A Non-issue?' in I Marboe (ed), *Small Satellites: Regulatory Challenges and Chances* (Brill Nijhoff 2016) 154, 157-158 and note 15; N Palkovitz, 'Small Satellites: Innovative Activities, Traditional Laws, and the Industry Perspective' in I Marboe (ed), *Small Satellites: Regulatory Challenges and Chances* I. Marboe (Brill Nijhoff 2016) 47, 48.

⁷⁵ For more information see: chapter 1, sub-section 2.3.6 and chapter 4, section 2.

⁷⁶ See for example a list of space activities: 'The operation and control of a satellite [...]' *CoCoSL*, 109.

the original versions of their acts.⁷⁷ These interesting case studies illustrate the difficulties in applying key space treaties' provisions to small satellites activities, and the need to adapt legal instruments as technology progresses and insight is gained.

The additional legal complication originates from the term 'national' in Article VI. As mentioned in subsection 2.2, the non-governmental nature of small satellites activities, combined with their launch practices, may challenge the notion of the 'appropriate State' which is the State internationally responsible for small satellites activities of its nationals. This problem worsens when considering international-collaborative small satellites missions. These difficulties will be further addressed in chapter 3 of this study.⁷⁸

For the purpose of this section, it is submitted that small satellites operations should be considered as space activities. Firstly, the UN space treaties do not exclude certain satellite activities from their scope. Secondly, some historical satellites were 'unguided' or non-manoeuvrable, and it was never doubted whether they were included in the scope of Article VI. Thirdly, and most importantly, the rationale behind Article VI is to establish a strong link of responsibility between State parties and their activities in space, whether these are performed by the States directly, or by non-governmental organisations carrying their nationality.⁷⁹ In light of the foregoing, there is no legal sense in excluding small satellites operations from the scope of Article VI.

2.3.5 The 'Launching' of Small Satellites into Outer Space

As mentioned in chapter 1 of this study, small satellites have special launch practices, which were developed to accommodate market needs.⁸⁰ The piggy-back practice, where small satellites are launched as auxiliary payloads, is innovative in launch logistics, accessibility and affordability terms; however, the launch itself is done in a very traditional way on board a launch vehicle. In this sense, the 'launching' of small satellites is not very different to the launching of traditional satellites and it may be reasonably concluded that this practice does not challenge the notion of 'launching' objects into outer space as provided by the UN space treaties.

On the other hand, the practice of launching small satellites to the ISS and deploying them into space in a separate activity may be legally-challenging in this context.⁸¹ This is because at the first stage the satellites are launched to the ISS on a launch vehicle and at the second stage they are deployed from the ISS to outer space. Are both activities part of the 'launching' phase? Perhaps

⁷⁷ N Palkovitz and T Masson-Zwaan, *Orbiting under the Radar: Nano-Satellites, International Obligations and National Space Laws*, IISL Proceedings of the 55th Colloquium on the Law of Outer Space (2013) 566; N Palkovitz and T Masson-Zwaan, *Small but on the Radar: The Regulatory Evolution of Small Satellites in The Netherlands*, IISL Proceedings of the 58th Colloquium on the Law of Outer Space 601, under section 4 'Regulatory Changes' (2016); JF Mayence, 'QB50: Legal Aspects of a Multinational Small Satellites Initiative' in I Marboe (ed), *Small Satellites: Regulatory Challenges and Chances* (Brill Nijhoff 2016) 195.

⁷⁸ Chapter 3, section 2.1.

⁷⁹ For legal analysis of State responsibility in international space law and its strength compared to State responsibility in general international law, see chapter 3 section 2.2.

⁸⁰ Chapter 1, section 2.5.

⁸¹ *ibid.*

once the satellites have departed Earth their launching phase has terminated and any subsequent action, such as their deployment, should be considered under different wording?

These questions introduce legal implication relating to liability,⁸² however, it is submitted that since the satellites are being launched to the ISS, which is in outer space, and subsequently deployed ‘freely’ to orbit in outer space as well, it would not make sense to exclude this launch practice as a ‘launch’ as provided in the UN space treaties. In other words, even if it is not clear when the launch phase ends, the fact that there is a ‘launch’ is sufficient to determine that small satellites fall under the treaty provisions which relate to the launching of space objects into outer space.

2.5 Intermediary Conclusions

Small satellites activities do not violate the spirit and provisions of the UN space treaties. However, it is clear that some practices relating to small satellites do challenge traditional concepts, which the treaties include.

The option to amend the treaties in order to better adjust some provisions is not a practical one. Further, there is no real need to do so since their provisions are general enough to regulate small satellites activities, even if not in an ideal manner.

Instead of putting all the attention on the primary source of applicable law, that is, the UN space treaties, current discussions in international forums aim to create supplemental legal instruments or soft law to capture the regulatory needs in a more agile manner and address the special characteristics of small satellites activities.

The next section will therefore present the current examination and efforts of international bodies to deal with the special characteristics of small satellites activities, in legal territories, which exceed the scope of the UN space treaties.

3 Small Satellites and the Regulatory Discussion at International Forums

3.1 Overview

This section aims to present the current on-going discussions relating to the need to regulate small satellites activities further to existing international law. Special treatment to small satellites

⁸² F von der Dunk, ‘Liability for Damage Caused by Small Satellites- A Non-issue?’ in I Marboe (ed), *Small Satellites: Regulatory Challenges and Chances* (Brill Nijhoff 2016) 154, 158-161.

operators, space debris mitigation and remediation and ITU radio frequency allocation regimes are not addressed in the UN space treaties. Nevertheless, these topics are imperative to the comprehensive regulation of small satellites activities, and therefore, will be analysed in this section.

Three important international forums will be addressed, as they are most relevant to small satellites activities and already host discussions concerning them. These are: UNOOSA and specifically COPUOS and its legal subcommittee, the same birth place of the UN space treaties; the Inter-Agency Space Debris Coordination Committee (IADC), which created the widely-adopted Space Debris Mitigation Guidelines;⁸³ and, the ITU and specifically the ITU World Radio Conferences (WRC), which has had small satellites frequency allocation procedures on its agenda in recent years, and is expected to continue the discussions in the next WRC.

3.2 United Nations Office for Outer Space Affairs and Committee on the Peaceful Uses of Outer Space

The United Nations Office for Outer Space Affairs (UNOOSA) started with a small expert unit within the UN Secretariat to service the *ad hoc* Committee on the Peaceful Uses of Outer Space (COPUOS), established by the General Assembly in its resolution 1348 (XIII) of 13 December 1958.⁸⁴

COPUOS' responsibilities are to:

‘Consider the activities and resources of the United Nations, the specialized agencies and other international bodies relating to the peaceful uses of outer space, organizational arrangements to facilitate international cooperation in this field within the framework of the United Nations and legal problems which might arise in programmes to explore outer space.’⁸⁵

In 1958 COPUOS had 18 member States, and currently has over 84 member States.⁸⁶ COPUOS usually drafts, negotiates and adopts treaties by consensus, which means that relevant treaty wording is revised by the member States until all the members consent to it.⁸⁷

⁸³ Inter-Agency Space Debris Coordination Committee (IADC), Space Debris Mitigation Guidelines (2002, as revised in 2007), IADC-02-01, Revision 1 (Hereinafter: ‘IADC Guidelines’).

⁸⁴ UNGA Res. 1348 (XIII) Question of the Peaceful Use of Outer Space (13 December 1958), available at: <https://documents-dds-ny.un.org/doc/RESOLUTION/GEN/NR0/747/92/IMG/NR074792.pdf?OpenElement>. For further information see UNOOSA's website: <http://www.unoosa.org/oosa/en/aboutus/history/index.html>.

⁸⁵ UNOOSA's website: <http://www.unoosa.org/oosa/en/ourwork/copuos/history.html>.

⁸⁶ UNOOSA's website- membership evolution: <http://www.unoosa.org/oosa/en/ourwork/copuos/members/evolution.html>.

⁸⁷ For more information about this process see: RG Steinhardt, ‘Outer Space’ in O Schachter and CC Joyner (eds), *United Nations Legal Order* (vol. 2; CUP 1995) 753, 759.

COPUOS has two subcommittees, the first is the ‘Scientific and Technical’ one and the second is the ‘Legal’ one.⁸⁸ The Legal Subcommittee is the birthplace of the UN space treaties, and many outer space related UN Resolutions, and hence it is important in the context of reviewing the international regulatory discussion on small satellites activities.

In 2014 the Legal Subcommittee hosted an IISL⁸⁹/ECSL⁹⁰ Symposium titled: ‘Regulatory Needs for Very Small Satellites’.⁹¹ This event helped to raise awareness among COPUOS delegates of small satellites activities, and the regulatory challenges they pose. In many ways, this occasion marked the start of the international discussion at COPUOS regarding the regulation of small satellites activities.

In the following year, and in parallel to discussions at the ITU,⁹² UNOOSA, at the request of COPUOS, and the ITU jointly issued a document titled: ‘Guidance on Space Object Registration and Frequency Management for Small and Very Small Satellites’. It was presented to COPUOS delegates at the Fifty-fourth session of the Legal Subcommittee.⁹³

The document does not provide any new ways to treat small satellites’ registration or radio frequency notification, but rather, guides new actors, operators and regulators on these matters referring to existing laws and regulations, to encourage awareness and compliance.

The scope of the document was defined as follows:

For the launch and operation of satellites, certain requirements under international law exist. These include:

1. Notification and recording of the radio frequencies used by a satellite at the International Telecommunication Union (ITU);
2. Consideration of space debris mitigation measures in the design and operation of a satellite;
3. Registration of a satellite with the Secretary-General of the United Nations.

Presently, a legal or regulatory definition of a small satellite does not exist. The information in this handout relates to all satellites, including small and very small satellites. Under the United Nations treaties, principles and resolutions relating to

⁸⁸ UNOOSA’s website: <http://www.unoosa.org/oosa/en/ourwork/copuos/comm-subcomms.html> .

⁸⁹ IISL website: <https://iislweb.org/> .

⁹⁰ ECSL website: http://www.esa.int/About_Us/ECSL_European_Centre_for_Space_Law .

⁹¹ The Symposium’s presentations and additional information are available on UNOOSA’s website: <http://www.unoosa.org/oosa/en/ourwork/copuos/lsc/2014/symposium.html> .

⁹² See section 3.4, *infra*.

⁹³ UNOOSA and ITU, ‘Guidance on Space Object Registration and Frequency Management for Small and Very Small Satellites’ UN Doc. A/AC.105/C.2/2015/CRP.17 (13 April 2015), available at: http://www.unoosa.org/pdf/limited/c2/AC105_C2_2015_CRP17E.pdf .

international space law, the term ‘space object’ refers to satellites, launch vehicles and their component parts.

The ITU Radio Regulations refers to spacecraft (RR No. 1.178) as ‘a man-made vehicle which is intended to go beyond the major portion of the Earth's atmosphere’; also to satellite (RR No. 1.179) as ‘a body which revolves around another body of preponderant mass and which has a motion primarily and permanently determined by the force of attraction of that other body’.

This handout serves as a guideline for small satellite developers and operators on issues related to registration, authorization, debris mitigation and frequency management of small and very small satellites.⁹⁴

The document highlights certain provisions and notions of international space law, and includes practical, easy to implement recommendations, such as:

Legal issues relating to responsibility and liability at a national and international level should be considered at the ‘Project Definition’ stage of a satellite mission design process.⁹⁵

Implementation of space debris mitigation measures should be considered at the ‘Preliminary Design Review’ stage, especially for missions that require deorbiting/passivation of onboard systems during the mission termination phase.⁹⁶

IMPORTANT: Registration information submitted directly to the United Nations by national agencies, private corporations, academic institutions or individuals will not be considered valid submissions. Only information provided through Diplomatic Missions accredited to the United Nations will be considered valid registration submissions.⁹⁷

The remainder of the document includes a digest of relevant provisions of the ITU Radio Regulations and related ITU procedures.⁹⁸

To conclude, the described efforts were first aimed to raise awareness and guide operators and regulators as to what the current legal and regulatory situation governing small satellites activities is, as well as to provide recommendations to increase compliance as far as small satellites’ registration with the UN and frequency notification with the ITU goes.

The second step was examining whether the current regulatory situation is well adjusted to successfully deal with current and upcoming small satellites activities. This examination was

⁹⁴ *ibid.*, at 2-3.

⁹⁵ *ibid.*, at 3.

⁹⁶ *ibid.*, at 4.

⁹⁷ *ibid.*, at 6.

⁹⁸ For more information relating to the ITU and its Radio Regulations see subsection 3.4 *infra*.

promoted at the COPUOS Legal Subcommittee by adopting agenda item 13, in 2016: ‘General exchange of views on the application of international law to small satellite activities.’ As part of this agenda item a questionnaire was drafted for distribution to member States, titled: ‘Questionnaire on the application of international law to small satellite activities.’⁹⁹ The questionnaire was adopted and presented at the Fifty-sixth session of the Legal Subcommittee, held in April 2017. The document presents 6 questions to COPUOS member States:

1. Overview of Activities on Small Satellites

1.1 Are small satellites serving the needs of your society? Has your country determined whether small satellites could serve an identified technological or development need?

1.2 Is your country involved in small satellites activities such as designing, manufacturing, launching and operating? If so, please list any projects, as appropriate. If not, are there any future plans?

1.3 Is there a focal point in your country responsible for coordinating small satellites activities as part of your national space activities?

2. Licensing

2.1 Do you have a legal or regulatory framework to supervise any aspect of small satellite activities in your country? If so, are they general acts or specific rules?

3. Responsibility and Liability

3.1 How are liability and insurance requirements enforced on an operator in your country, for a small satellite under your country’s responsibility in the event that ‘damage’ occurs on the surface of Earth, to aircraft in flight, or to another space object in orbit?

4. Launching State and Liability

4.1 Since small satellites are not always deployed into orbit with dedicated rockets as in the case of larger satellites, there is the need for clarification in the understanding of the definition of ‘launch’. When a launch of a small satellites requires two steps, first, launching from a site to an orbit and, second, deploying the small satellite to another orbit, in your view would the first step be regarded as the ‘launch’ within the meaning of the United Nations treaties on outer space?

⁹⁹ UNOOSA, ‘Draft Questionnaire on the Application of International Law to Small Satellite Activities’ UN Doc. A/AC.105/C.2/2017/CRP.11 (27 March 2017), available at: http://www.unoosa.org/res/oosadoc/data/documents/2017/aac_105c_22017crp/aac_105c_22017crp_11_0_html/AC105_C2_2017_CRP11E.pdf .

4.2 Do you think there should be a new, or different, international regulatory approach to address small satellite operations?

5. Registration

5.1 Does your country have a practice of registering small satellites? If so, does your country have a practice of updating the status of small satellites? Is there any legislation or regulation in your country that requires non-governmental entities to submit to the government information for the purpose of registration, including updating of the status of small satellites they operate?

6. Space Debris

6.1 Could the notion of ‘damage’ be used to cover loss resulting from a manoeuvre performed by an operational space object in order to avoid collision with a space object not complying with the Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space?

6.2 Do you think there is a need for a specific orbit for small satellites and megaconstellations?

These questions will be examined in the present study as well, and especially noting question 4.2 regarding the need to find different ways to internationally regulate small satellites activities. Since the procedures at COPUOS are lengthy, the author hopes to contribute to the discussion and perhaps help to shape any future conclusions this draft questionnaire may lead to.

International regulatory aspects of small satellites activities are also under discussion in the context of a Working Group of the COPUOS Scientific and Technical Subcommittee on the ‘long-term sustainability of outer space activities.’ The Working Group drafted a set of ‘Guidelines for the long-term sustainability of outer space activities.’ The guidelines were approved by approved by the Scientific and Technical Subcommittee of COPUOS in February 2018.¹⁰⁰ Guideline B.8 addresses approaches to the design and operation of ‘small-size space objects’:

Guideline B.8

Design and operation of space objects regardless of their physical and operational characteristics

1. States and international intergovernmental organizations are encouraged to promote design approaches that increase the trackability of space objects, regardless of their physical and operational characteristics, including small-size space objects, and those that are difficult to track throughout their orbital lifetime, as well as facilitate the accurate and

¹⁰⁰ J Foust, ‘UN committee approves space sustainability guidelines’ (*SpaceNews*, 15 February 2018); available at: <https://spacenews.com/un-committee-approves-space-sustainability-guidelines/>.

precise determination of their position in orbit. Such design solutions could include the use of appropriate on-board technology.

2. States and international intergovernmental organizations should encourage manufacturers and operators of space objects, regardless of their physical and operational characteristics, to design such objects to implement applicable international and national space debris mitigation standards and/or guidelines in order to limit the long-term presence of space objects in protected regions of outer space after the end of their mission. States and international intergovernmental organizations are encouraged to share their experiences and information on the operation and end-of-life disposal of space objects, in furtherance of the long-term sustainability of space activities.

3. Due to the importance of small-size space objects to all space programmes, in particular, for developing countries and emerging spacefaring countries, the implementation of the present guideline supports the development of space programmes, including the launching and operation of small-size space objects or any other space objects that are difficult to track, in a way that promotes the long-term sustainability of outer space activities.¹⁰¹

The text touches upon several identified regulatory challenges relating to small satellites in the context of space debris and State responsibility as an international law mechanism to ensure compliance with debris mitigation norms, and other relevant provisions of international space law. Finally, it emphasises the international collaborative nature of small satellites missions and the challenge of finding the responsible State or States for such missions.¹⁰²

It remains to be seen to what extent these non-binding guidelines will be observed by States in practice.

The discussion on small satellites in the realm of space debris and sustainability leads to further examination of the international discussion at the IADC in the next subsection.

3.3 Inter-Agency Space Debris Coordination Committee

The Inter-Agency Space Debris Coordination Committee (IADC) is an international governmental forum for the worldwide coordination of activities related to the issues of man-made and natural

¹⁰¹ See: UNOOSA ‘Guidelines for the Long-term Sustainability of Outer Space Activities- Conference room paper by the Chair of the Working Group on the Long-term Sustainability of Outer Space Activities’ UN Doc. A/AC.105/2018/CRP.20 (27 June 2018) at 15, available at: http://www.unoosa.org/res/oosadoc/data/documents/2018/aac_1052018crp/aac_1052018crp_20_0_html/AC105_2018_CRP20E.pdf.

¹⁰² These challenges will be legally analysed in chapter 3 of this study.

debris in space.¹⁰³ Its members are representatives of space agencies, and it was founded in 1993.¹⁰⁴ The IADC is one of the most important entities that generate international guidelines designed to deal with the ever-increasing space debris problem. The Space Debris Mitigation Guidelines drafted by the IADC are widely accepted as a non-legally binding set of standards and best practices for debris mitigation.¹⁰⁵

After becoming aware of initiatives to launch multiple small satellites constellations to LEO, the IADC released a ‘Statement on Large Constellations of Satellites in Low Earth Orbit’, in September 2017.

The most dramatic finding in the statement is the concern that the existing Space Debris Mitigation Guidelines may not be sufficient in order to deal with the many foreseen satellites in LEO:

At this initial stage, it is clear that the significant numbers of satellites envisaged in the planned constellation architectures represent a step change in the number of satellites operating in the low Earth orbit regime, and may question the validity of the assumptions used to derive the existing space debris mitigation guidelines (e.g. launch traffic models and the numbers of objects in orbit). There is also a question regarding the robustness of the existing debris mitigation guidelines to effectively manage the new constellations and their impact on the orbital environment in a sustainable manner (e.g. limit residence times in orbit).¹⁰⁶

The statement also specifies preliminary space debris considerations for the development of large constellations of satellites in LEO.¹⁰⁷ These considerations bear many similarities to the existing IADC Guidelines, and repeat the need to limit spacecraft lifetime to no more than 25 years, avoid potential spacecraft breakups, and de-orbit spacecraft so they re-enter Earth while taking measures so that damage to persons or property will not be caused.¹⁰⁸

An important consideration is the following:

In developing the design and mission profile of a spacecraft or orbital stage, a program or project should estimate and limit the probability of accidental collision with known

¹⁰³ IADC website: <https://www.iadc-online.org/> .

¹⁰⁴ IADC website- members: <https://www.iadc-online.org/index.cgi?item=members>. The members are: 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), National Aeronautics and Space Administration (NASA), Russian Federal Space Agency (ROSCOSMOS), State Space Agency of Ukraine (SSAU), and the United Kingdom Space Agency (UKSA).

¹⁰⁵ Inter-Agency Space Debris Coordination Committee (IADC), Space Debris Mitigation Guidelines (2002, as revised in 2007), IADC-02-01, Revision 1 (Hereinafter: ‘IADC Guidelines’).

¹⁰⁶ *IADC Statement on Large Constellations of Satellites in Low Earth Orbit* issued by the IADC steering group IADC-15-03 September 2017, at 6, available at: <http://www.iadc-online.org/Documents/IADC-15-03%20Megaconstellation%20Statement.pdf> .

¹⁰⁷ *ibid*, at 5-6.

¹⁰⁸ *ibid*.

objects during the spacecraft or orbital stage's orbital lifetime. If reliable orbital data is available, avoidance manoeuvres for spacecraft and co-ordination of launch windows may be considered if the collision risk is not considered negligible.

To date, there is no binding legal instrument that specifies such duty. As elaborated in section 2 of this chapter, the UN space treaties do not limit or oblige States to carry out such specific efforts to avoid collisions. It remains to be seen whether this statement and considerations will take a more binding form and be considered as soft law at the least. If they do, it seems that small satellites operators would be under such duties, and possibly liable by negligence in the case that they failed to coordinate the launch of their satellites and a collision occurred. This potential emerging duty may also have great implications on the application of the Liability Convention in cases where uncoordinated launches cause collisions in LEO.¹⁰⁹

While the above-mentioned statement refrains from using the term 'small satellites', the IADC has presented its new agenda items at COPUOS in February 2017, this time naming the large constellations problem interchangeably with the proliferation of small satellites.¹¹⁰ The new item was presented as follows:

Small Satellites and Large Constellations

New Action Item agreed in Houston involving WG2/WG4:

- Identify the trend in the proliferation of small satellites and review plans for large constellations.
- Determine the potential inadequacies of the existing IADC Space Debris Mitigation Guidelines for the proliferation of small satellites and those large constellations.
- Consider the potential risks presented by such systems.
- Propose possible additional measures to mitigate the identified risks.
- Work is ongoing and will take several years to complete.¹¹¹

To summarise, it is clear that there is awareness of the challenges that large numbers of small satellites pose in connection with space debris mitigation efforts. As is evident, this subject is only at its first stages of technical investigation, and it is foreseen that the work of the relevant IADC working groups will carry on for some years.

¹⁰⁹ For the legal challenges connected to the application of the Liability Convention on small satellites activities see chapter 4 of this study.

¹¹⁰ H Krag, *The Inter-Agency Space Debris Coordination Committee (IADC) – An overview of the IADC annual activities*, 54th Session of the Scientific and Technical Subcommittee United Nations Committee on the Peaceful Uses of Outer Space (01 February 2017), available at: http://www.iadc-online.org/index.cgi?item=docs_pub .

¹¹¹ *ibid*, slide 16.

3.4 International Telecommunication Union

The International Telecommunication Union (ITU) is a UN specialised agency for information and communication technologies. Part of the ITU's responsibilities is to allocate certain radio frequency bands for various purposes, including satellites communication. As such, it is the exclusive authorised international entity to allocate these communication bands.

In the past years the ITU observed a number of challenges in the context of small satellites. One of the main matters was lack of small satellite operators' compliance with the ITU Radio Regulations¹¹² and their associated procedures. Since many small satellites projects are based on low-cost and fast development themes, the operators found some of the ITU frequency notification and coordination procedures to be too lengthy, bureaucratically cumbersome and expensive. Since there are relaxed and simplified procedures available to amateur satellite missions, small satellites operators soon began to adopt these practices. While this accommodates the case of radio-amateur satellite missions, many of the notifications originated from operators carrying out other types of satellite missions, which were not of the amateur kind. This led the ITU to start raising awareness among small satellites operators and regulators, so that the limited allocated amateur frequencies would not be abused.¹¹³

¹¹² The Radio Regulations, edition of 2016, contains the complete texts of the Radio Regulations as adopted by the World Radiocommunication Conference (Geneva, 1995) (WRC-95), subsequently revised and approved by the World Radiocommunication Conference (Geneva, 1997) (WRC-97), the World Radiocommunication Conference (Istanbul, 2000) (WRC-2000), the World Radiocommunication Conference (Geneva, 2003) (WRC-03), the World Radiocommunication Conference (Geneva, 2007) (WRC-07), the World Radiocommunication Conference (Geneva, 2012) (WRC-12) and the World Radiocommunication Conference (Geneva, 2015) (WRC-15), available at: <http://www.itu.int/en/publications/ITU-R/pages/publications.aspx?parent=R-REG-RR-2016&media=electronic> .

The following terms, which are included in ITU referenced resolutions in this section, have the following meaning according to the Radio Regulations: 'Geosynchronous satellite': An earth satellite whose period of revolution is equal to the period of rotation of the Earth about its axis. (Radio Regulations No. 1.188); 'Geostationary satellite': A geosynchronous satellite whose circular and direct orbit lies in the plane of the Earth's equator and which thus remains fixed relative to the Earth; by extension, a geosynchronous satellite which remains approximately fixed relative to the Earth. (Radio Regulations No. 1.189); 'Geostationary-satellite orbit': The orbit of a geosynchronous satellite whose circular and direct orbit lies in the plane of the Earth's equator. (Radio Regulations No. 1.190).

¹¹³ See text of: Resolution 659 (WRC-15), '*Studies to accommodate requirements in the space operation service for non-geostationary satellites with short duration missions*' (Geneva, 2015) at 1 under (g): 'some non-amateur satellites have used frequencies for telemetry, tracking and command in the frequency bands 144-146 MHz and 435-438 MHz which are allocated to the amateur-satellite service, and that such use is not in accordance with Nos. 1.56 and 1.57'. The full text of the resolution is available at: https://www.itu.int/dms_pub/itu-r/oth/0c/0a/ROCOA00000C0007PDFE.pdf; For further reading see: A Matas et al, 'The ITU Radio Regulations Related to Small Satellites' in I Marboe (ed), *Small Satellites: Regulatory Challenges and Chances* (Brill Nijhoff 2016) 237.

In 2015 the ITU Radiocommunication Assembly adopted the Resolution on ‘Improving the dissemination of knowledge concerning the applicable regulatory procedures for small satellites, including nanosatellites and picosatellites.’¹¹⁴ It was resolved:

to develop material, such as Recommendations, Reports or a Handbook on small satellites (in particular, satellites whose mass is less than 100 kg), containing detailed information that would help to improve knowledge of the applicable procedures for submitting filings of satellite networks to ITU.¹¹⁵

Accordingly, the ITU increased its activities aimed to raise awareness among the small satellites community and regulators. As mentioned above, UNOOSA and the ITU issued a document titled: ‘Guidance on Space Object Registration and Frequency Management for Small and Very Small Satellites’.¹¹⁶ Tutorials and supporting documents addressed to small satellites operators and radio amateurs were made available at the ITU’s website.¹¹⁷ Further, reports and studies were carried out by the ITU to study the challenges that small satellites pose and ways to improve compliance with the Radio Regulations in this context.¹¹⁸

Moreover, ITU symposiums and workshops targeting the small satellites industry were launched. The first event was the ‘ITU Symposium and Workshop on small satellite regulation and communication systems’ which was held in Prague, Czech Republic, 2-4 March 2015.¹¹⁹

The event hosted the adoption of the ‘Prague Declaration on Small Satellite Regulation and Communication Systems’:

Recognizing

- the increasingly growing interest by universities, educational and research institutes, governments, private industry, space agencies and radio amateurs, in utilizing the potential benefit offered by small satellites, in particular nano satellites and pico satellites;
- the urgent need for the small satellite community adherence to international laws, regulations and procedures, in particular those established by the UN General

¹¹⁴ Resolution ITU-R 68 (2015), ‘*Improving the Dissemination of Knowledge Concerning the Applicable Regulatory Procedures for Small Satellites, Including Nanosatellites and Picosatellites*’, available at: <http://www.itu.int/en/ITU-R/space/Documents/R-RES-R.68-2015-PDF-E.pdf> .

¹¹⁵ *ibid*, second page.

¹¹⁶ See section 3.2, *supra*.

¹¹⁷ ITU’s website, Amateur-satellite service regulatory documents:

<http://www.itu.int/en/ITU-R/space/Pages/SupportAmateur.aspx> .

¹¹⁸ Report ITU-R SA.2312-0, ‘*Characteristics, definitions and spectrum requirements of nanosatellites and picosatellites, as well as systems composed of such satellites*’, SA Series Space applications and meteorology (September, 2014); Report ITU-R SA.2348-0, ‘*Current practice and procedures for notifying space networks currently applicable to nanosatellites and picosatellites*’ SA Series Space applications and meteorology, (May 2015).

¹¹⁹ ITU’s website, news room: http://www.itu.int/net/pressoffice/press_releases/2015/CM04.aspx#.WbKB_cgjGUK .

Assembly, the UN COPUOS and ITU in respect to registration of objects launched into outer space, radiofrequency coordination and registration of satellite network frequency assignments, and compliance with the space debris mitigation guidelines;

- the importance for small satellite community to be prepared for implementing existing and newly developing recommendations and practices supporting the long-term sustainability of outer space activities,

Noting, the specific nature of small satellite space stations in the amateur-satellite service and the frequency coordination process within the International Amateur Radio Union (IARU) to avoid harmful interference to amateur and amateur-satellite stations,

Confirm and strengthen, the importance of implementing national legal and regulatory frameworks in conformity with the above international instruments, clearly defining rights and obligations of every stakeholder participating in small satellite initiatives,

Urge, the small satellite community to comply with the applicable international and national laws, regulations and procedures, indispensable to guarantee the long-term sustainability of small satellite projects, the avoidance of harmful interference and proper management of space debris,

Recommend, to continue capacity-building activities on small satellite regulation and communication systems, by regularly organizing symposia and workshops, including the use of web-based training tools, and by providing handbooks, guidelines and support, to facilitate the accomplishment of the above.¹²⁰

This declaration does not suggest any new norms or standards for small satellites missions; it simply enhances stakeholders' awareness to the existing problems related to frequency usage by small satellites operators, and urges them to comply with existing laws.

The second event was the Small Satellite Symposium and Workshop on small satellite regulation and communication systems, which was held in Santiago, Chile, 7-9 November 2016. This event aimed to cover the following subjects:

Sustainable development of small satellite systems; The Outer Space Legal Regime; The ITU Radio Regulations and the WRC-15 outcomes related to small satellites; Authorization of small satellites under National Space Legislation; Small satellites projects in the region; and Advance future small satellite systems.¹²¹

¹²⁰ 'Prague Declaration on Small Satellite Regulation and Communication Systems' ITU Symposium and Workshop on small satellite regulation and communication systems, Prague, Czech Republic, 2-4 March 2015, available at: <http://www.itu.int/en/ITU-R/space/workshops/2015-prague-small-sat/Documents/Prague%20Declaration.pdf> .

¹²¹ ITU's website- ITU Symposium and Workshop on small satellite regulation and communication systems, Santiago de Chile, Chile, 7-9 November 2016: <http://www.itu.int/en/ITU-R/space/workshops/2016-small-sat/Pages/default.aspx> .

In parallel, additional efforts took place at the ITU WRC. The WRC are held every three to four years and they are the forums to review and revise the Radio Regulations which is the international treaty governing the use of the radio-frequency spectrum and the geostationary-satellite and non-geostationary-satellite orbits. Revisions are made on the basis of agenda items, which are set by the ITU Council, and these items are established four to six years in advance of the relevant WRC.¹²²

In 2012 the WRC adopted a Resolution titled ‘Regulatory aspects for nanosatellites and picosatellites’:

resolves to invite WRC-18, to consider whether modifications to the regulatory procedures for notifying satellite networks are needed to facilitate the deployment and operation of nanosatellites and picosatellites, and to take the appropriate actions,

invites ITU-R, to examine the procedures for notifying space networks and consider possible modifications to enable the deployment and operation of nanosatellites and picosatellites, taking into account the short development time, short mission time and unique orbital characteristics,

instructs the Director of the Radiocommunication Bureau, to report to WRC-15 on the results of these studies.¹²³

The next WRC held in 2015 adopted the view that there is no need for special regulatory procedures to facilitate the deployment and operation of nano- and pico-satellites within the context of the ITU.¹²⁴ Instead, Resolution 659 (WRC-15) was adopted to perform: ‘Studies to accommodate requirements in the space operation service for non-geostationary satellites with short duration missions’.¹²⁵

This means that instead of developing new and specific regulations or procedures for small satellites missions, it was decided to leave the regulatory situation as it is, and study the subject further. Therefore, the course of action that was chosen was, not to amend the Radio Regulations in order to better accommodate small satellites activities, but rather to study ways to accommodate these activities by technical frequency allocation solutions:

resolves to invite the 2019 World Radiocommunication Conference, to consider the results of ITU-R studies and take necessary action, as appropriate, provided that the

¹²² <http://www.itu.int/en/ITU-R/conferences/wrc/Pages/default.aspx> .

¹²³ Resolution 757 (WRC-12) ‘Regulatory Aspects for Nanosatellites and Picosatellites’ (Geneva, 2012), available at: https://www.itu.int/dms_pub/itu-r/oth/0c/0a/ROC0A00000A0025PDFE.pdf .

¹²⁴ For further information see: A Matas, ‘Small Satellite Regulation WRC-15 Outcome and Results of the ITU-R WP7B Studies’ Small Satellite Symposium, Santiago, Chile, 7-9 November 2016, slide 11, available at: http://www.itu.int/en/ITU-R/space/AmateurDoc/ITU-small_sat-WRC-15.pdf .

¹²⁵ Resolution 659 (WRC-15), ‘Studies to accommodate requirements in the space operation service for non-geostationary satellites with short duration missions’ (Geneva, 2015), available at: https://www.itu.int/dms_pub/itu-r/oth/0c/0a/ROC0A00000C0007PDFE.pdf .

results of the studies referred to in invites ITU-R below are complete and agreed by ITU-R study groups, invites ITU-R,

1. to study the spectrum requirements for telemetry, tracking and command in the space operation service for the growing number of non-GSO satellites with short duration missions, taking into account No. 1.23;
2. to assess the suitability of existing allocations to the space operation service in the frequency range below 1 GHz, taking into account recognizing a) and current use;
3. if studies of the current allocations to the space operations service indicate that requirements cannot be met under invites ITU-R 1 and 2, to conduct sharing and compatibility studies, and study mitigation techniques to protect the incumbent services, both in-band as well as in adjacent bands, in order to consider possible new allocations or an upgrade of the existing allocations to the space operation service within the frequency ranges 150.05-174 MHz and 400.15-420 MHz.¹²⁶

The next WRC will be held in 2019, on which occasion international discussions within the context of the ITU under agenda item 1.7 will continue. Such discussions include the spectrum needs for telemetry, tracking and command in the space operation service for non-geostationary satellites with short duration missions, assessing the suitability of existing allocations to the space operation service and, if necessary, considering new allocations in accordance with Resolution 659 (WRC-15). These actions were assigned to Working Group 7B.¹²⁷

This examination showed that the ITU members preferred to err on the side of caution when given the opportunity to decide to create new regulation and ITU procedures for small satellites radio frequency allocation. It remains to be seen whether a new frequency allocation will be decided for small satellites, after the WRC of 2019.

3.5 Intermediary Conclusions and Future International Regulatory Discussions

It seems that the awareness of small satellites activities and the question of their regulation was brought to international forums in recent years. The UN COPUOS, IADC and the ITU are the most relevant international bodies that may affect such regulation substantially.

The terminology for ‘small satellites’ is different when examining international forums as done in this section 3. The different terminology reflects the different perspective each organisation has, and the changing scope of the discussions regarding small satellites regulation.

¹²⁶ *ibid*, at 380.

¹²⁷ The Working Group’s schedule is available at the ITU’s website: <http://www.itu.int/en/ITU-R/study-groups/rsg7/rwp7b/Pages/default.aspx>.

Will the discussions in such forums and work of the mentioned working groups lead to new duties or obligations? Will these potential duties apply solely to the operations of small satellites, thus, making them unique in the context of international space law? The answers to these questions lie in the future.

One thing is certain, small satellites technology is already in use for the last decade and the plans for large constellations and new launch vehicles are already being executed. Therefore, it is reasonable to assume that any new legal norms, which the current discussion may lead to, would apply to a next generation of small satellites operations since international law-making in the mentioned forums is a lengthy process.

4 Conclusions

The second section of this chapter may be concluded as follows: *Nothing in small satellites operations is contrary to the existing binding UN space treaties, as small satellites are treated as 'space objects' under these treaties.*

Nevertheless, the introductory examination points out that these treaties do not fit ideally to small satellites activities, and there are challenges in applying them. This finding will be further analysed in depth regarding international State responsibility, liability and registration of space objects in the following chapters of this study.

An additional difficulty stems from the fact that the treaties do not address important interests such as sustainability, while it is clear that multiple small satellites constellations in LEO will have a negative effect on the future of the sustainable use of this region. The sustainability of outer space is an overall challenge to the space industry, and in any case, is yet to be based on international legally-binding norms. Therefore, the study will focus on the challenges posed by applying existing international law to small satellites activities, in order to answer the questions at the core of this study. Matters relating to sustainability will be further addressed only as far as they promote the investigation of the main research question of this study.

These two observations, relating to the difficulty in applying existing space treaty-law to small satellites activities, and the need to legally address matters such as sustainability, space debris mitigation and ITU radio frequency allocations for small satellites missions, may already indicate a need to approach small satellites activities in a special manner from the international regulatory point of view. And indeed, as seen in section 3 of this chapter, international forums are at the inception of evaluating this exact need, each from its own perspective.

As matters related to State responsibility have been identified as potential legal obstacles to non-governmental or multinational small satellites projects, and as State responsibility is such a

fundamental concept in general international law, and *lex specialis*, the next chapter will examine the current legal environment relating to State responsibility for small satellites activities. This examination will address the question of the need to regulate small satellites activities in a special way as far as State responsibility goes, and thus, will bring this study one step further towards finding the answers to the questions presented.