

BEEs in Space: Swarm Technologies' Unauthorised Deployment of Smallsats and Article VI of the Outer Space Treaty

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1. Introduction

One of the prominent events of 2018 regarding developments in the space industry is that this year marks the first known time that a private industry actor launched space objects – the so-called SpaceBEEs – without the required authorisation by the competent national authority.¹ This event signifies an incisive moment in the now 60-year history of space activities conducted from our planet. It is significant not necessarily because of the consequences that will flow from it – at the point in time of writing, the exact repercussions are still unclear and the case is still under review regarding ensuing enforcement actions.² But it is incisive because it can alert that the demands of the private space industry are influencing the nature of regulation that space activities demand and that a shift towards enforcement actions may be expected.

Over the past three decades, there has been a steady development towards commercialisation of space activities as well as an increase in the number of actors involved. Incentives for private participation in the space industry are continuously increasing and have boosted technological progress and sparked an investor landscape engaged by high-risk, high-reward capital. The increased commercialisation of the industry manifests itself in both an increase in private actors developing their own business cases (established private entities and startups alike) but also in an increased participation of the emerging private space flight industry in governmental programmes. Additionally, there is an increasing number of newcomer space-faring States,

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1 BEE here serves as an acronym for Basic Electronic Elements.

2 The paper was last updated in December 2018, including all mentioned web references.

often assisted by capacity-building programmes and facilitating services offered by private actors.

The increase in private actors involved in the space industry and the issues that this may bring about for the regulatory framework is demonstrated by the case of Swarm Technologies' unauthorised launch and deployment of its four SpaceBEEs – the subject matter of this paper. This paper argues that, although it is too early to make any solid assumptions, the case of the SpaceBEEs may indicate only the start of a developing shift towards enforcement actions and displays a need for clarified and more harmonised approach to regulation of the private space industry. Moreover, the prospective developments in enforcement action should be followed closely as they may provide us with a direction that cases like this can take.

In an effort to substantiate the arguments above, this paper considers the facts of the launch of SpaceBEE-1-4 and the underpinning legal framework. It is structured into six sections. Following this introduction, it provides for a summary of the facts of the unauthorised launch of the SpaceBEEs (section 2). Section 3 elaborates on the national legal framework of the jurisdiction under which Swarm Technologies operates. The following two sections move on to the international legal framework, which provides the foundation for national regulation of space activities: in section 4, the paper outlines the underpinning legal framework in international space law, and in section 5, the same is done for the overarching branch of law, public international law. Finally, the conclusion provides for a summary and outlook, referencing the arguments mentioned in this introduction (section 6).

2. The reported facts of the unauthorised launch of SpaceBEEs-1 to 4

It became publicly known on 9 March 2018 that in January of the same year, four small satellites (smallsats)³ were launched without the required authorisation by the competent national authority.⁴ The dimensions of these smallsats are 10×10×2,8 cm, and they are described in the launch catalogue as “two-way satellite communications and data relay”.⁵

3 Smallsats are defined as encompassing mini satellites (<1000 kg), micro satellites (<100 kg), nano satellites (<10 kg), and pico satellites (<1 kg); *cf.* the International Academy of Astronautics (IAA) Study Group on Cost-Effective Earth Observation Missions: ‘International Study on Cost-Effective Earth Observation Missions’, A.A. Balkema Publishers 2006.

4 Mark Harris, ‘FCC Accuses Stealthy Startup of Launching Rogue Satellites’, IEEE Spectrum, 9 March 2018; available at <https://spectrum.ieee.org/tech-talk/aerospace/satellites/fcc-accuses-stealthy-startup-of-launching-rogue-satellites>.

5 The launch date’s launch brochure presents the individual payloads, available at https://www.isro.gov.in/sites/default/files/flipping_book/PSLV-C40_Cartosat2SeriesMission/files/assets/common/downloads/PSLV-C40%20-%20Cartosat%20Series%20Mission.pdf.

The four SpaceBEE satellites constitute the first planned launch of United States of America (US), California based startup Swarm Technologies.⁶ In order to get the four SpaceBEEs into Low Earth Orbit (LEO),⁷ Swarm Technologies commissioned the US company Spaceflight, a secondary payload services provider. Spaceflight proceeded to purchase launch services with Antrix, the commercial branch of the Indian Space Research Organisation (ISRO).⁸ On 12 January 2018, ISRO launched the SpaceBEEs along with its own primary cargo, a large mapping satellite, and other secondary cargo from Canada, Finland, France, the Republic of Korea, the United Kingdom, and smallsats from other private actors in the US in a Polar Satellite Launch Vehicle (PSLV) rocket.⁹

The deployment sets a precedent, as Swarm Technologies did not possess a valid experimental authority licence under US law for this mission. Swarm Technologies had applied for a launching licence with the Federal Communications Commission (FCC), as required under US law,¹⁰ in April 2017.¹¹ The application was however dismissed without prejudice on 12 December 2017 by the chief of the FCC's experimental licencing branch, who informed Swarm Technologies that the FCC deemed the four SpaceBEEs too small to be adequately tracked from Earth through the Space Surveillance Network (SSN).¹² The Commission concluded that the SpaceBEEs' reduced size may negatively impact potentially necessary collision avoidance manoeuvres and thus, the SpaceBEEs could not be considered to be in the public's interest.¹³ However, despite the FCC's decision, the satellites were launched as scheduled on the originally intended PSLV.

6 Name as stated in experimental launch licence application of 26 April 2017; Swarm Technologies Inc., Exhibit A (Narrative Statement) to FCC Form 442; available at <https://apps.fcc.gov/els/GetAtt.html?id=191177&x>. In addition to the seat of registration in the US, Swarm Technologies' ground station locations as mentioned in the FCC experimental licence application are designed to take place from US territory; *ibid.*, p. 7.

7 The SpaceBEEs have a perigee of 494.8-495.6 km and an apogee of 509.9-510.8 km; see Swarm Technologies' application filed on 26 April 2017 and denied on 12 December of the same year, available at https://apps.fcc.gov/oetcf/els/reports/GetApplicationInfo.cfm?id_file_num=0305-EX-CN-2017.

8 For more information on Antrix, see <http://www.antrix.co.in>.

9 *Cf.* n5.

10 *Cf.* section 3 *intra*.

11 *Cf.* n7.

12 Letter by Anthony Serafino, chief of the FCC's Experimental Licensing Branch, of 12 December 2017. Available at <https://apps.fcc.gov/els/GetAtt.html?id=203152&x>. It should be noted, however, that private tracking service LeoLabs traces the SpaceBEEs in its live tracking service, see <https://platform.leolabs.space/catalog/L19943>.

13 Letter by Serafino; *ibid.* In accordance with 47 U.S.C. 308, "[t]he FCC must find that the 'public interest, convenience, and necessity' will be served in order to grant a license"; Space Debris Mitigation Standards, United States of America, p.4, available at http://www.unoosa.org/documents/pdf/spacelaw/sd/United_States_of_America.pdf.

Nearly two months later, on 8 March 2018, the FCC published a public statement containing the experimental licences it granted between 1 January and 31 December 2017.¹⁴ Swarm Technologies' SpaceBEEs are not mentioned. The incident received the public's attention when IEEE Spectrum Magazine published an article on the launch of the four SpaceBEEs one day later, titled 'FCC Accuses Stealthy Startup of Launching Rogue Satellites'.¹⁵ Currently, the SpaceBEE-1 to 4 are not registered with the United Nations (UN); however, all four SpaceBEEs have live entries in the Space Command Catalogue of the US Air Force.¹⁶

As a private corporation, Swarm Technologies is not bound by the US' legal obligations under international space law, but by the domestic regulation under US law.¹⁷ Therefore, it is of merit to ask what the regulations are that Swarm Technologies did, did not, or should follow under US law. What are the rules pertaining to experimental launch applications, and what are the consequences of disregarding the dismissal of a licence? Issues like these will be addressed in the following section.

3. The launch of the SpaceBEEs under US space law

In the case of Swarm Technologies' unauthorised launch, due to the startup being registered in California, it is US law that dictates both preconditions and enforcement.

US law requires the private launch of smallsats – or in the FCC's official wording, the launch of “non-Federal small satellites”¹⁸ – to be authorised. The national competence for authorisation is subdivided between, among

14 FCC document DOC-343780A1 available at <https://docs.fcc.gov/public/attachments/DOC-343780A1.pdf>.

15 Cf. n4.

16 UN Online Index of Objects Launched into Outer Space, see http://www.unoosa.org/oosa/osoindex/search-ng.jsp?lf_id (search results for 'SpaceBEE'); and Space Command Catalogue of the US Air Force, see <https://www.n2yo.com/database/?q=spacebee#results>.

17 Although there is no international legal requirement for space-faring States to pass national legislation on space activities, the specific regulations and requirements that need to be followed by the private space industry will in most cases be stipulated in the national space legislation of a space-faring country. This facilitates the State's own observance of its international legal obligations, and positively contributes to the consistency and predictability of the legal system, supporting the development of the national space industry; Report of the Working Group on National Legislation Relevant to the Peaceful Exploration and Use of Outer Space on the work conducted under its multi-year workplan, 3 April 2012, UN Document A/AC.105/C.2/101, para. 15, available at http://www.unoosa.org/pdf/reports/ac105/C2/AC105_C2_101E.pdf.

18 FCC, 'Guidance on Obtaining Licenses for Small Satellites', Public Note, News Media Information 202/418-0500, DA: 13-445, 15 March 2013, available at <https://www.fcc.gov/document/guidance-obtaining-licenses-small-satellites>.

others, the Federal Aviation Administration (FAA) of the Ministry of Transport and the FCC, an independent agency of the US government.¹⁹ While the former licences commercial launches and re-entries with regard to the protection of US assets,²⁰ the latter is concerned whenever there is communication to and from the United States including the transmission of satellite radio communication.²¹

The FCC licences satellites according to three different procedures: under the Part 25 rules, a wide range of satellite operations is licenced including commercial communication and remote sensing satellites – this is the primary way of licencing under the FCC rules; experimental operations are covered by the FCC's Part 5 rules; and finally, its Part 97 rules cover amateur radio service satellite operations.²² Swarm Technologies' application for "experimental authority to demonstrate the capabilities of these microsatellites" was submitted under the FCC's regulation of experimental operations covered by Part 5 of its rules.²³ With their SpaceBEEs, Swarm Technologies are positioning themselves to be a substantive service and network provider to the high growth sector for the Internet of Things (IoT); as such, they fall within the mentioned category.

19 Other bodies tasked with licencing of space activities under US jurisdiction are the National Oceanic and Atmospheric Administration of the US Department of Commerce (NOAA) and the Department of Commerce issuing satellite export licences.

20 A Fact Sheet on Commercial Space Transportation Activities of August 2018 states that "[a]n FAA license is required for any launch or re-entry, or the operation of any launch or re-entry site, by U.S. citizens anywhere in the world, or by any individual or entity within the United States"; see Fact Sheet – Commercial Space Transportation Activities, For Immediate Release, 17 August 2018, available at https://www.faa.gov/news/fact_sheets/news_story.cfm?newsId=19074.

21 The FCC was created by the 1934 Communications Act, 47 U.S. Code § 151. The Act further provides for the commissioning of licences by stating that "[i]t is the purpose of this Act, among other things, to maintain the control of the United States over all the channels of radio transmission; and to provide for the use of such channels, but not the ownership thereof, by persons for limited periods of time, under licenses granted by Federal authority, and no such license shall be construed to create any right, beyond the terms, conditions, and periods of the license"; Communications Act of 1934 as amended by the Telecom Act of 1996, 47 USC § 301. It further specifies that licences are required for operation of communication which extends beyond the borders of a US State or engages with mobile stations within the jurisdiction of the US; *ibid.* 47 USC § 301 (d), (f).

22 *Cf.* n18.

23 *Ibid.* The Public Note further mentions that "[f]or experimental operations, the applicant should be the party that ultimately controls decisions about the satellite's mission objectives, design, construction, tendering of the satellite to a launch service provider or designated launch integrator, and operations of the satellite once on orbit. This is in most cases a university or research institution, but may also be a commercial venture seeking to test equipment for developmental purposes".

If a private actor of the space industry acts in breach of national space legislation of a given jurisdiction, it will be that State's available body of sanctions that applies to the situation.²⁴ In the case of Swarm Technologies, it is thus up to the competent national authority – likely, the FCC, since it has its own integrated enforcement bureau – to review and sanction the unauthorised launch.

The FCC reacted to the unlicensed launch *i.a.* by setting aside Swarm Technologies' follow-up application for a licence to launch larger satellites²⁵ and published an advisory notice entitled "Compliance with Satellite Communications Licensing Requirements is Mandatory and Failure to Comply Can Result in Enforcement Action".²⁶ The document provides detailed advice to commercial satellite system operators on how to behave when a required licence by the FCC has not been granted (yet).²⁷ The internal review of the case for possible enforcement action is still ongoing; however, in the meantime Swarm Technologies did receive another licence to launch further probes.²⁸

24 This means that from the perspective of the commercial actor, the activity which was not in conformity with national space laws does not constitute an act in contravention of international law, but it was an act that contravened the national legislation it is bound by.

25 The FCC's chief of experimental operations wrote in an email: "The grant for STA 0026-EX-ST-2018 has been set aside and is now in a pending status for further review. The International Bureau requested that the grant be set aside in order to permit assessment of the impact of the applicant's apparent unauthorized launch and operation of four satellites, and related statements and representations, on its qualifications to be a Commission licensee"; email by Anthony Serafino to Sara Spangelo and Craig Scheffer, 7 March 2018, available at <https://apps.fcc.gov/els/GetAtt.html?id=205987&x>.

26 FCC, 'Compliance with Satellite Communications Licensing Requirements is Mandatory and Failure to Comply Can Result in Enforcement Action', Public Note, News Media Information 202 / 418-0500, DA 18-368, 12 April 2018, available at <https://www.fcc.gov/document/enforcement-advisory-satellite-communications-licensing>. The FCC furthermore "delayed permission for a market trial of the Internet of Things System, and started an investigation into the company"; Mark Harris, 'Swarm Asks FCC for Permission to Have Its Rogue Satellites Phone Home', IEEE Spectrum, 10 July 2018, available at <https://spectrum.ieee.org/tech-talk/aerospace/satellites/swarm-wants-you-to-know-where-its-rogue-satellites-are>.

27 For instance, the document "reminds participants" that "[o]perations without a licence are subject to the full range of FCC enforcement actions" and maps out that other – foreign or U.S. American – licences may be needed in addition to the FCC's licence; *ibid* p. 1f. Satellite system operators should ensure "sufficient control" over their satellite(s) at all times and not assume the FCC granting the licence based on other factors such as government funding of the project or licences granted by other (national or international) bodies; *ibid*. p. 2f.

28 Loren Grush, 'Company that launched satellites without permission gets new licence to launch more probes', The Verge, 4 October 2018, available at

National space laws including a system of licencing find their basis in international space law. This is a common way to ensure that legal norms become binding for actors that are not subjects of international law, customary also to many other branches of public international law.²⁹ It is therefore requisite to turn to the international norms of space law applicable to the US.

4. Enforcement of obligations under international space law

It should be noted at the outset that when moving on to a consideration of the applicable international legal framework, the perspective changes fundamentally in two ways. Firstly, while in the previous section, the concrete legal framework of the US was considered as part of a pronounced domestic legal order, international space law sets forth principles that guide the carrying on of space activities and were envisioned to apply on a global scale. International space law is therefore more of a principles character. Secondly, the subject addressed by the legal order changes with the transition to international law. While the previous section was occupied with the legal framework applicable to one private entity engaging in space activities – Swarm Technologies, in the following two sections the State is at the centre of attention with the question of whether it can be held internationally responsible for its conduct. How this conduct was brought about internally, *i.e.*, within the internal jurisdiction of the State, is subordinate information from this perspective.

Consequently, the nature of considerations reflects the changing character of the legal order being considered, and it will become evident below that here, questions can be asked but much less straightforwardly answered. Nevertheless, there is value in asking those questions, as it is the pursuit of an international understanding that contributes to a more harmonised, more fair and equal application which is indispensable considering the international nature of space activities themselves.

The Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies,³⁰ or

<https://www.theverge.com/2018/10/4/17928452/swarm-technologies-spacebees-satellites-spacex-falcon-9-fcc-license>.

29 The classic international legal order recognises the legal personality of States in accordance with the principle of sovereignty and international organisations, for the latter see *e.g.* the 1949 Reparations Advisory Opinion; Reparation for injuries suffered in the service of the United Nations, Advisory Opinion: I.C.J. Reports 1949, p. 174.

30 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, opened for signature 27 January 1967, entered into force 10 October 1967.

Outer Space Treaty for short, in its Article VI sets out the principle of international responsibility of States for their national activities in outer space.³¹ State parties to the Outer Space Treaty commonly base their national space legislation on Art. VI of the Outer Space Treaty.³² The activities of private entities are foreseen under international space law and addressed in the second sentence of Art. VI of the Outer Space Treaty. It provides that “[t]he activities of non-governmental entities in outer space [...] shall require *authorization* and *continuing supervision* by the appropriate State Party to the Treaty”.³³ Authorisation in practice appears to best be served by a system

31 Art. VI Sentence 1 Outer Space Treaty submitting that “States Parties to the Treaty shall bear international responsibility for national activities in outer space [...] whether such activities are carried on by governmental agencies or by non-governmental entities”. The first sentence of Art. VI of the Outer Space Treaty warrants consideration of what it meant by *national* activities – especially, since the second sentence of the provision addresses *activities* more generally. It is commonly understood that the reference of *national* in Art. VI of the Outer Space Treaty references activities which are under the jurisdiction of a given State; *cf.* Bin Cheng, *Studies in International Space Law*, Clarendon Press 1997, p. 238. This expands as to encompass territorial, personal, and quasi-territorial jurisdiction; *ibid.* Moreover, *national* aims to differentiate activities carried on by governmental agencies and non-governmental entities from activities of international organisations as referred to in Art. VI Sentence 3 of the Outer Space Treaty; *cf.* Michael Gerhard, Article VI, in: Stephan Hobe, Bernhard Schmidt-Tedd, Kai-Uwe Schrogl (eds.), Rada Popova, Martin Reynders (ass.ed.s.), *Cologne Commentary on Space Law – Outer Space Treaty* (Russian translation), BWV 2017, p. 391.

32 Art. VI Outer Space Treaty is usually regarded as the main basis for national space legislation; however, possibly to be combined with other provisions such as Art. VII Outer Space Treaty on international liability and Art. VIII Outer Space Treaty on registration. See for instance Sweden’s space legislation which is based on Art. VI, Art. VII. and Art. VIII of the Outer Space Treaty; see Niklas Hedman, ‘Swedish Legislation on Space Activities’, in: Christian Brünner, Edith Walther (eds.), *National Space Law – Developments in Europe – Challenges for Small Countries*, Böhlau 2008, p. 74. *Cf.* also Annette Fröhlich, Vincent Seffinga (eds.), *National Space Legislation, A Comparative and Evaluative Analysis*, Springer 2018, p. 16. There exists other relevant international regulation: international space legislation covers a range of aspects of space activities, from the preconditions of exploration and use to the administration of radio frequencies. The international legal basis of the FCC’s licencing requirement for use of radio frequencies is found in the Radio Regulations of the International Telecommunication Union (ITU) – the oldest international organisation. Art. 18.1 § 1 of the ITU Radio Regulations reads: “No transmitting station may be established or operated by a private person or by any enterprise without a licence issued in an appropriate form and in conformity with the provisions of these Regulations by or on behalf of the government of the country to which the station in question is subject [...]”; ITU Radio Regulations (Edition 2016), available at <http://search.itu.int/history/HistoryDigitalCollectionDocLibrary/1.43.48.en.101.pdf>.

33 Art. VI Sentence 2 Outer Space Treaty (emphasis added).

of licencing,³⁴ as is also the approach adopted by the US. The meaning of continuous supervision is already harder to grasp, especially as it is closely tied to the specific national legal system where it is implemented.

There are several questions that could be asked, pertaining to the launch of the SpaceBEEs and its pioneering significance for international space law, that aim to discuss a more detailed meaning of Article VI Sentence 2 of the Outer Space Treaty. Even though these questions remain without an answer for the time being, reflecting on different aspects raised by the text of the provision may prove useful for clarity and harmonisation.

One initial question concerns the appropriate State to supervise Swarm Technologies. It appears to be straightforward to assume that because Swarm Technologies is under US jurisdiction, the US would be the appropriate State to supervise them. Supervision is regulated under national space law, and it is up to the respective State to choose the specific model under which continuing supervision occurs. However, can there be more than one appropriate State at a time? Could India be seen as an appropriate State that should have supervised the launch more closely – for instance, by ensuring that the satellites launched from its territory are in possession of a valid licence, including a licence from the FCC for the SpaceBEEs? Furthermore, are there other States that in the case of the launch of the SpaceBEE-1 to 4 could qualify as appropriate State under Article VI of the Outer Space Treaty?

Other aspects concern the meaning of continuing supervision. For instance, what is an appropriate time interval that ensures that supervision is indeed continuing? Is it sufficient for a corporation to report back to the competent national supervisory body at specific time intervals?³⁵

Furthermore, does the obligation of continuous supervision extend after a State has dismissed the application for a licence? In other words, should the US have actively ensured that Swarm Technologies was not going to go ahead with the launch of the SpaceBEEs in order to fulfil its international obligations under Article VI of the Outer Space Treaty?

Asking questions as to the meaning of specific elements of Art. VI of the Outer Space Treaty may help to further an understanding of how the provision can be interpreted, and to strengthen a more global understanding and therewith, a more harmonised application of its content.

34 See *e.g.* the Report of the Working Group on National Legislation Relevant to the Peaceful Exploration and Use of Outer Space on the work conducted under its multi-year workplan in n17 and the literature referenced in n31.

35 *E.g.*, the Swedish Space Corporation (SSC) carrying out space activities reports back to the Swedish National Space Board (SNSB) on an annual basis; *cf.* Hedman n31, p. 80. It has to be noted though that this is not a private corporation in the same sense as Swarm Technologies is in the US.

Finally, the relationship between international State responsibility under Art. VI of the Outer Space Treaty and the notion of State responsibility under public international law should be given attention. One of the central questions that Art. VI of the Outer Space Treaty, including the parts of the provision addressing non-governmental entities, poses, is whether or not what is referred to as international responsibility is congruent with what is understood as international responsibility under public international law in general. Analysis of this warrants a comparison of the simultaneously developing concepts in both areas of law, international space law and public international law in general.

5. Enforcement of obligations under public international law

International space law forms part of (public) international law. In its Art. I, the Outer Space Treaty expounds that outer space shall be free for exploration and use by all States in accordance with international law. Furthermore, Article III of the Outer Space Treaty stipulates that “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”.

Under international law in general, international responsibility encompasses the general principle underlying the international legal order that States are bound by the international obligations which they have committed to, and that non-observance of these international obligations may lead to legal answerability on the part of those States.³⁶ It is thus strongly linked to the enforcement of international legal obligations, and in the eyes of some even constitutes a defining feature that differentiates law from other, non-legally binding, orders of rules.³⁷

The obligation of States under international law to make reparation can be traced back to the early days of international law. In 1927, when the Permanent Court of International Justice of the League of Nations ruled in the *Chorzów Factory* case that “[i]t is a principle of international law that the breach of an engagement involves an obligation to make reparation in an adequate form”.³⁸ In its early days, the law on international responsibility was linked to the protection of foreign nationals and property abroad and to

36 Note that the term ‘responsibility’ derives from the idea of a response to, in this case, an internationally wrongful act.

37 See e.g. Robert Kolb, *The International Law of State Responsibility*, Elgar 2017.

38 Permanent Court of International Justice, Series A: Collection of Judgments (1923-1930), Document A09, *Case Concerning the Factory at Chorzów*, Judgment of 26 July 1927, p. 21.

diplomatic protection. After the establishment of the UN, the International Law Commission (ILC) – the UN's commission tasked to progressively codify international law³⁹ – commenced the work of its working group on the law of international responsibility in 1956 and concluded in 2001 by adopting the ILC Articles on State Responsibility, which were commended to governments by the UN General Assembly.⁴⁰

For the most part customary law, the ILC's Articles on State Responsibility codify the applicable law on State responsibility under (general) public international law.⁴¹ The rules codified herein thus constitute a *lex generalis* to which recourse can be had in the absence of more specific applicable rules. The Articles have been well-received since their commendation to governments and enjoy a wide practice of reference in judicial decisions.⁴² Although codification undertakings by the ILC in many cases result in the negotiations and conclusion of an international convention, in the case of the Articles on State Responsibility it was recommended to keep the unitary system of the instrument intact by adopting them as a UN General Assembly resolution. As such, they are not legally binding; however, many provisions are recognised to possess the status of customary international law, and are thus binding in the sense of Article 38(1)(b) of the Statute of the International Court of Justice.⁴³

39 The ILC was created by the UN General Assembly under Art. 13(1)(a) of the UN Charter which reads: "1. The General Assembly shall initiate studies and make recommendations for the purpose of: a. promoting international cooperation in the political field and encouraging the progressive development of international law and its codification". The ILC is the successor of the Committee of Experts for the Progressive Codification of International Law established by the League of Nations.

40 The first reading saw the reports of Special Rapporteurs García Amador (Cuba), Roberto Ago (Italy), Willem Riphagen (The Netherlands), and Gaetano Arrangio-Ruiz (Italy). The second reading was completed within four years under Special Rapporteur James Crawford and resulted in the Articles on the Responsibility of States for Internationally Wrongful Acts. The ILC report, which also contains commentaries on the draft articles, appears in *Official Records of the General Assembly, Fifty-sixth Session, Supplement No. 10 (A/56/10)*. Note that when the Outer Space Treaty was adopted, the ILC had already advanced its work regarding a conceptualisation of State responsibility under public international law.

41 Responsibility of States for Internationally Wrongful Acts, annex to General Assembly Resolution 56/83 of 12 December 2001, and corrected by United Nations Document A/56/49(Vol. I)/Corr.4.

42 Cf. e.g. Simon Olleson, 'Internationally Wrongful Acts in the Domestic Courts: The Contribution of Domestic Courts to the Development of Customary International Law Relating to the Engagement of International Responsibility', 26 LJIL 3.

43 This provision lists the sources of international law as international conventions, international custom, and general principles of law recognised by civilised nations (primary sources), as well as judicial decisions and teachings of the most highly qualified publicists (subsidiary means).

The Articles on State Responsibility as an instrument of international law feature several significant characteristics. First of all, they constitute secondary norms; as such, they apply in consequence to the breach of a primary obligation.⁴⁴ Secondly, State responsibility exists when an internationally wrongful act has been committed.⁴⁵ The act may be an act or an omission and can be committed by one or many States.⁴⁶ Two criteria determine the conduct as internationally wrongful: the act was a breach of an international legal obligation of the State or States in question, and that breach is attributable to that State or States.⁴⁷ Regarding the breach, the State's or States' internal (domestic) legal regulation is not decisive.⁴⁸ The Articles on State Responsibility do recognise so-called circumstances precluding wrongfulness (CPWs): consent, force majeure, necessity, distress, counter measures, and self-defence.⁴⁹ The requirement of breach of an international legal obligation in Article 2 of the Articles on State Responsibility will be settled with reference to the respective suitable branch of law. If the breach concerns a treaty obligation, in the absence of more specific provisions on the interpretation of the legal obligation in question, the law of treaties applies.⁵⁰ Thirdly, attribution of the breach of an international legal obligation to a given State is guided by the distinction of acts that are tied to the State and private acts, which cannot be attributed to

44 Primary obligations identify certain conduct that a State has agreed to commit to and may be actions or omissions. Secondary norms are norms that address primary norms either through addressing the content of a specific norm, or the consequences of its breach.

45 Art. 1 Articles on State Responsibility.

46 Art. 2 *ibid.*

47 Art. 2 *ibid.*

48 Art. 3 *ibid.* However, international law may be of relevance for *e.g.* the determination of status of a State organ.

49 Art.s 20-25 Articles on State Responsibility. While the first four CPWs are relatively self-explanatory (although the standard for fulfilling the requirements may in some cases be very high), the latter two each encompass a whole set of rules on their own. Counter measure require the fulfilment of a set of conditions, among which are the requirement that the countermeasure must be readily reversible and that it cannot serve the purpose of retaliation. The law of self-defence as referred to in Art. 21 of the Articles on State Responsibility refers to the regulation of self-defence under the UN Charter's Art. 51. In this regard, Art. 21 Articles on State Responsibility constitutes a primary norm and it becomes clear that the distinction of primary and secondary norms is complex in nature and can best be understood as a tool towards a specific end.

50 It should be noted here that the 1969 Vienna Convention on the Law of Treaties, although it entered into force in 1980 (and thus after the entry into force of the Outer Space Treaty), is composed of many provisions that enjoy the status of customary international law and are thus binding on the subjects of the international legal order; Vienna Convention on the Law of Treaties, concluded at Vienna on 23 May 1969, entered into force on 27 January 1980.

the State. The primary rule is a State is responsible for the conduct of its organs.⁵¹ It is furthermore responsible for some conduct of private entities, if it possesses a close enough link to those entities.⁵²

The key question when discussing international responsibility for space activities is if Article VI of the Outer Space Treaty can be considered *lex specialis* in relation to State responsibility under public international law, especially since the rules on attribution diverge.⁵³ This paper, however, adopts the position that there are many consonances, too, such as the secondary nature of the legal obligations, the relationship to other fields of law, the nature of the breach, and last but not least the existence of an internationally wrongful act as a prerequisite for State responsibility; and therefore argues that the conceptualisation of State responsibility under public international law forms part and parcel of the equivalent concept under international space law.

This position entails that the clarifications of conceptualisation that apply to the law of State responsibility are equally relevant to State responsibility under international space law, and can thus provide for guidance in answering the questions posed above (*cf.* section 4 *infra*).

6. Concluding remarks

This paper has adopted a zoom-out approach on the case of the unauthorised deployment of the four SpaceBEEs by Swarm Technologies, ranging from the facts of the case to the relevant legal regulation. It discussed the domestic regulations under US law, as well as the relationship of US space law with international space law and public international law.

Swarm Technologies' launch of the four SpaceBEEs is the publically first known case in the history of space exploration in which the dismissal of a licence was evidently disregarded. However, it may be the first unauthorised launch of a space object by a private actor, but it might not be the last. It is not (yet) clear what the direct consequences of this conduct may bring for the space industry. Due to the apprehension of a stricter legal regulation of space activities for the private industry, the initial reaction to Swarm Technologies' action by the NewSpace space industry was rather unfavourable.⁵⁴

51 Art. 4 Articles on State Responsibility; even if the organ acts in excess of its authority; *ibid.* Art. 7.

52 *E.g.* the conduct of persons or entities exercising elements of governmental authority (Art. 5 *ibid.*), the conduct of organs placed at the disposal of a State by another State (Art. 6 *ibid.*), and conduct directed and controlled by a State (Art. 8 *ibid.*).

53 Under Art. VI Outer Space Treaty, the State is responsible both for the conduct of its governmental agencies and non-governmental entities; *cf.* section 4 *infra*.

54 *Cf. e.g.* Marina Koren, 'Launching Rogue Satellites Into Space Was a 'Mistake'', *The Atlantic*, 7 September 2018, <https://www.theatlantic.com/technology/archive/2018/09/spacebees-swarm-unauthorized-satellite-launch/569395/>.

With regard to the domestic legal regulation, it was clarified that it is in the hands of the competent national authority to ensure the compliance with its regulations. The FCC took on this task when it opened an internal investigation of the incident, dismissed follow-up experimental applications by Swarm Technologies, delayed permission for a market trial of the IoT system, and published the advisory notice for the industry mentioned above.⁵⁵ However, things seem to have calmed down since.⁵⁶

It should be noted that it is cases like this one which bring about clarification of legal regulation applicable to the private industry; as can for instance be seen in the FCC's advisory notice on compliance with satellite communications licencing requirements.⁵⁷ And clarification of the legal framework contributes to a more stable and predictable climate which in turn fosters new inventions. It is the view adopted in this paper, that the importance of the unauthorised launch and deployment of the SpaceBEEs lies in its precedent role as marking the beginning of a shift towards enforcement action, brought about by the mere increase in actors in and commercialisation of the space industry, and that this shift in turn contributes towards clarification and harmonisation of the legal regulation of the (private) space industry. This is of importance given the international and cooperative nature of space activities. Space activities may (and in most cases, do) span across several jurisdictions and involve many different actors simultaneously – public and private alike, demonstrating the factual and legal complexity of satellite launch and operation. An exactly demarcated allocation of tasks and competencies may not always be straightforward, so that overlaps and/or gaps in the execution of working steps may occur. The question is warranted if an international effort could help simplify the applicable procedures.

55 *Cf.* Harris n26.

56 *E.g.* the mentioned approval of a licence to launch further SpaceBEE satellites, *cf.* n28.

57 *Cf.* FCC n26.