Capacity-Building of the International Legal Framework for Mitigating Consequences from Non-Operational Small Satellites

Advancing Space Law towards NewSpace Paradigm

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Abstract

Current growth tendencies of NewSpace companies are largely based on small satellites, allowing affordable access to space for commercial services. They are economically-viable as they use commercial off-the-shelf (COTS) components and standard architectures, and are easy to launch. As a result, more than 2000 small satellites to be launched till 2020 with focus on telecommunications, Earth observation and technology testing. Lifetime of such satellites usually does not exceed two years, while they can stay in orbit much longer than this. Non-operational or non-cooperative satellites are generally seen as space debris. However, in comparison to big spacecraft the small satellites are difficult to detect with today's available technical means that potentially can result in a situation where "dead" smallsats can cause damage to valuable space assets. So far no special requirements are imposed on the operators of this category of satellites.

The existing legal instruments regulating space debris mitigation deal with the problem from a general perspective, not foreseeing any differentiated approach.

However just the development of international regulatory framework is not sufficient anymore. Being primarily of a non-binding nature, the regulations shall be implemented through national legislation by changing national rules of licensing for small spacecraft manufacturers and operators. Keeping this in mind, the paper will aim to analyze the possible implementation mechanisms for mitigating consequences from non-operational small satellites ("Debris"-Sats). The "Debris"-Sats issue requires comprehensive analysis as it has direct impact on SSA, long-term sustainability of space, space security and access to space.

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Appropriate legal framework must ensure the sustainability of space activities without causing any damage to a growing NewSpace industry based on utilization of small satellites.
The paper will analyze the necessity of a special regulatory framework to be developed for small satellites missions. Particularly it will examine the regulation on certain types of orbit for small spacecraft, ensuring their deorbiting upon the end of exploitation. It will also consider the mandatory installation of special devices on small spacecraft (electrodynamic tethers, solar sails etc.) to reduce their orbital lifetime. Finally, the paper will examine the possibility of increasing visibility and traceability of such kind of spacecraft to monitoring systems (such as NORAD and ASPOS OKP enabling the tracking of small satellites even if the contact with ground station is lost).

1. Introduction

Over the last decade we were talking more and more about the 'NewSpace' paradigm that changed the politics and philosophy of international and national space activities, revolutionizing space by providing opportunities to private investors and reflecting the growing significance of the role played by non-traditional space actors.
This paper focuses on small satellites, one of the main drivers of 'NewSpace' economy, and importance to develop a differentiated governing legal framework to mitigate possible threats posed by deployment of megaconstellations of small satellites, while not de-stimulating the private space activities.

2. NewSpace and Small Satellites – Why Is It So Important?

The 'NewSpace', also called 'entrepreneurial space', is not clearly defined and mainly used to describe non-governmental companies, very often start-ups, that are developing a lower cost concept for a commercially-viable use of space. Currently 'NewSpace' is a dynamic, fast growing ecosystem of start-ups, major industry players and investors. The NewSpace actors target different pieces of the space industry value chain – new launch vehicles, satellites united in constellations and new services, based on space data.
The space start-ups still consider development and operation of their own satellite constellations as a crucial component for providing value added services and to disrupt the existing markets. It is non-typical situation for the venture industry, as usually investors demand the start-ups to remain focused on the development of a single product, which can provide an immediate cash-flow.
To ensure the broader coverage and to compete with traditional space actors, most of the NewSpace companies started to focus on large constellations of small satellites, affordable, fast to manufacture and easy to replace.
The companies, developing the products and services based on satellite data, such as 'Planet' (ex-'Planet Labs'), Terra Bella (ex-'Skybox') and 'Astro

Digital' are planning the development of their own large satellite constellations. This model of vertically integrated company becomes typical for NewSpace economy and was enabled by fast development of small satellites. The capacities of smallsats are growing, while its price per unit is drastically decreasing.[1]

The small satellite market is emerging and it is anticipated to reach $22 billion in the next decade (manufacture and launch), constituting 76% increase over that of 2006-2015.[2] The small satellites usually use commercial off-the-shelf (COTS) components and standard satellite architecture (such as cubesat units). By producing large number of serial satellites the NewSpace companies reduce their cost with the effect of scale. Moreover, large constellations of serial spacecraft move the issue of redundancy from the level of single spacecraft to a systematic level of whole constellation. In other words, even if a single spacecraft using commercial components ceases functioning, it can be easily replaced by another spacecraft in constellation.

However, despite the numerous competitive advantages, there are "certain uncertainties", including regulatory and legal ones that have to be analysed and adjusted to the needs of the market.

In order to mitigate the risks posed by small satellites constellations, immediate measures have to be taken, comprising all types of action: from increasing technological readiness of methods for space debris mitigation and removal, to improvement of a regulatory and legal framework of space activities, with particular focus on operations of small spacecraft.

Here it is worth noting that efforts should have systemic character, supporting sustainability and involving all types of space actors – from agencies to space industry, academia and international organizations.

In our opinion it is important to analyse the main directions for progressive development of the regulatory and legal framework for small satellites in order to stimulate the NewSpace companies while ensuring that rights and interests of other actors, with due regard to the common interest of all mankind in the exploration and use of outer space, are respected.

3. Existing Regulatory and Legal Framework for Small Satellite Activities

First of all, the question that logically arises is what is the current regulatory and legal framework in place? Does it differ from the one applicable to conventional satellites? If the same one, is there a need for a differentiated approach? If yes, which aspects require the biggest attention? And last but

1 See Ivan Kosenkov. A boom and a (possible) bust in small spacecraft production, March 2015, available at: https://room.eu.com/article/A_boom_and_a_possible_bust_in_small_spacecraft_production.

2 Euroconsult: $22 Billion Market Value for Small Satellites over Next Ten Years, available at: http://www.euroconsult-ec.com/7_July_2016.

not least, what is the best way to ensure that these aspects will get their appropriate legal governance?

3.1. Current Regulatory and Legal Framework

International legal regime of small satellite activities in space is primarily defined by the UN space treaties and topical UN GA resolutions. Those have been elaborated and adopted at dawn of the space era with no particular international law developments observed further in that area that could have resulted in a formation of the new block of 'hard' law (binding norms). Mentioned legal instruments have been mainly complemented by guidelines, codes of conduct, policies, standards, instructions that today used to be qualified as so called 'soft' law.[3] Taking into account the paradigm change occurred in the transition from cold war times to international cooperation (ISS) and commercial space / new space economy (Space 2.0) the legal framework requires adjustments to the changing requirements of the 21st century. Security issues, global climate change, sustainable energy and water management, food security and health are the driving forces on earth and in space to guarantee the prosperity, wealth and survival of humankind. The dimension of space in this context is exponentially growing and we are facing unexpected challenges in such a contested environment.

To meet these challenges certain space-faring countries, emerging space-faring countries and simply space-oriented countries (with no specific space capabilities but strong will of getting involved in space activities) have adopted domestic space legislation transposing international space law provisions into their national legal context reflecting their own needs and making them legally binding within the scope of their jurisdiction.

As mentioned before, the biggest scope of pertinent provisions is enshrined in the UN space treaties, namely in the Outer Space Treaty (1967),[4] Registration Convention (1975)[5] and Liability Convention (1972).[6, 7] However, none of

3 See Marco Ferrazzani "Soft law in space activities" in an Outlook on Space Law over the Next 30 Years: Essays Published for the 30th Anniversary of the Outer Space Treaty, Kluwer Law International, 1997; Setsuko Aoki "The Function of Soft Law in the Development of International Space Law" in Soft Law in Outer Space, Böhlau, 2012.

4 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, 27 January 1967, 610 UNTS 205.

5 Convention on Registration of Objects Launched into Outer Space, 14 January 1975, 1023 UNTS 15.

6 Convention on International Liability for Damage Caused by Space Objects, 29 March 1972, 961 UNTS 187.

7 See Sergio Marchisio. "International legal regime on outer space: Liability Convention and Registration Convention", in Meeting international responsibilities and addressing domestic needs, Proceedings UN / Nigeria Workshop on Space Law, Vienna, United Nations, 2006, pp. 18-27.

these legal documents provides for a definition of small satellites or of satellites as such. Current international space law refers to a more general category, namely to a 'space object', which according to Liability Convention includes component parts of a space object as well as its launch vehicles and their component parts.

Generally accepted by space community technical definition of small satellites[8] is based on the criteria of the satellite mass, meaning any satellite with mass under 500 kg. However, in our opinion, there is something more than just the mass characteristics of a space object – many of the space objects launched by space-faring nations since the dawn of the space era are technically small satellites, which does not explain, why do we need any special regulatory framework for this type of a spacecraft. Some of the reasons for this are described in the text above. Yet, it is to be considered if the proposed legal definition of the small satellite should mention such aspects of modern satellite missions as the 'piggyback launch', 'commercial off-the-shelf components', 'large constellations' or something else – here we risk to propose a definition that will quickly become outdated or stillborn.

Neither there is a clear definition of what stands for space activities or more precisely activities in outer space. This is important, since space law makes direct reference exactly to it when imposing number of obligations on space actors. However, the years that have passed since the beginning of space era did not result in any legal definition of these terms. We are of the view that 'soft law' can become an instrument for slowly crystallizing needed key definitions for the 'hard law' documents that might be adopted later.

3.2. Small Satellites and Obligations Associated with Their Operation

Implicitly launching of small satellites and their operation in space falls under the scope of space activities as it is generally understood. States, undertaking national space activities, bear international responsibility for them, irrespective of whether they are carried on by governmental or non-governmental organizations. They are also charged with authorizing and continually supervising space activities conducted under their jurisdiction. As the enforcement mechanism is not specified within the space treaties, the latter is left at the discretion of respective states. Mainly the authorization gets a form of licenses / permits / certificates depending on the legal tradition and practices of those states. Actually the authorization is the main, if not the only, tool that enables the state to shape national space debris mitigation culture in accordance with national regulations and standards. Continuous supervision, in its turn, is primarily ensured by technical means, namely through monitoring, tracking, remote control as well as teleoperations and maintenance. This is also related to space debris mitigation philosophy,

8 See Ram Jakhu and Joseph Pelton, Small Satellites and their Regulation, 2013, Springer Press, NY.

however is heavily dependent on technical capacities (in particular ground segment) and satellite features foreseen at the design stage (possibility of maneuvering, de-orbiting, on-orbit servicing / lifetime prolongation). Taking into account the conceptual idea of small satellites, most of them are designed in the simplest way, to be deployed and perform the programmed short-mission that limits on-orbit control capabilities. Thus it might be difficult to foresee additional 'space – environmentally friendly' but also economically viable technologies for those space actors that aim at making access to space affordable and easy.

3.3. Obligation to Register a Small Satellite

For linking the space object to a certain state another legal mechanism comes in play, i.e. the institute of registration. Pursuant to the Registration Convention the launching states associated with a space object have to decide which state will register the object nationally and internationally. If the states are not party to the Convention they can still and some of them voluntarily do submit the notification to the UN OOSA based on the UN GA Resolution 1721B (XVI).[9] It can also be the case that certain states, that did not establish a national registry, are passing directly to the international level through registration with the UN via their diplomatic channels.

To register the space object and to make this info publicly available is extremely important since registration helps to identify at least one state that was involved in the space mission and has a legal link to a space object. What would be even more important is to have information about planned launches subsequently updated with more accurate and precise information. For the purposes of space debris management, it is also important to provide information about technologies available on a satellite for deorbiting as well as a change of status in orbit as such. Currently the information provision about the change of status of space objects depends strongly on the will of a satellite operator and the state of registry. However, there are proposals to amend the Registration convention, making the provision of such information mandatory. In addition to registration, visible designation number and marking on the space object could play certain role in a capacity-building of space debris mitigation policy.

3.4. Liability Issues and Environmental Concerns

In case of damage caused by a space object, the state of registry can be easily identified through the UN register (if the registration requirement has been duly fulfilled by the launching states). Pursuant to provisions of the Outer Space Treaty, further elaborated in the Liability Convention, the States are

9 UN GA Resolution 1721B (XVI) International co-operation in the peaceful uses of outer space, available at: http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/resolutions/res_16_1721.html.

internationally liable for damage caused by a space object they launch or procure the launching of or from whose territory or facility an object is launched. Here it is worth noting that over the last decade the International Law Commission (ILC) has developed a number of draft articles focusing on responsibility, liability and environmental protection related to space activities. However, for the purposes of this paper, of particular relevance are the Draft Articles on Prevention of Transboundary Harm from Hazardous Activities (ILC Draft Articles, 2001).[10] The prevention of transboundary harm is envisaged therein through authorization and regulation of hazardous activities.

3.5. Applicability of Space Debris Mitigation Guidelines to Small Satellite Missions

As a constituent element of and prerequisite for authorization of conducting space activities, certain states foresee the requirement to submit an end-of-life / post-mission disposal plan (space debris mitigation plan) as an implementation of the IADC and UN COPUOS Space Debris Mitigation Guidelines.[11] These Guidelines, that are applicable to mission planning, the design and operation of spacecraft and orbital stages to be injected into Earth orbit, found a 25-year period to be a reasonable and appropriate lifetime limit. However as regards the small satellites, most of them are operated for less than 5 years and therefore that period is unjustifiably too big. We believe that environmental concerns should not be underestimated when conducting space activities since space objects that turn to be space debris and are not any longer controlled pose significant threat as to the functional space objects but also to the environment as such making it a high-risk zone.[12] The problem with smallsats is a general perception of them as 'debris sats' and this sometimes wrong perception can be destroyed only if a uniform minimum set of standards / requirements is developed and a special verification mechanism is put in place.

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10 ILC Draft Articles on Prevention of Transboundary Harm from Hazardous Activities, 2001, available at: http://legal.un.org/ilc/texts/instruments/english/commentaries/9_7_2001.pdf.

11 Inter-Agency Space Debris Coordination Committee Space Debris Mitigation Guidelines, 2002, revised in 2007, available at: http://www.iadc-online.org/index.cgi?item=docs_pub; Space Debris Mitigation Guidelines of the United Nations Committee on the Peaceful Uses of Outer Space, endorsed by the United Nations General Assembly in its Resolution 62/217 of 22 December 2007, available at: http://www.unoosa.org/documents/pdf/spacelaw/sd/COPUOS-GuidelinesE.pdf.

12 See Ulrike M Bohlmann and Steven Freeland, 'The Regulation of Space Activities and the Space Environment' in Shawkat Alam, Md Jahid Hossain Bhuiyan, Tareq MR Chowdhury and Erika J Techera (eds), Routledge Handbook of International Environmental Law, Routledge, 2013.

The new business-model using disruptive small satellite technology has an inherent vice. Cheap small spacecraft without any maneuverability have a reduced lifetime, compensated by the large production numbers for replacement and the system architecture implying megaconstellations. Consequently, it is natural that the growth of NewSpace companies using smallsats will cause serious aggravation of space debris problem. Moreover, the majority of 3600 small satellites, to be built and launched till 2025,[13] will use the low-Earth orbit (LEO) with inclination and orbit height quite risky for causing collisions. Already this, combined with limited deorbiting capabilities, shows how far are those Guidelines from realities that face small satellite missions.

4. Regulatory Opportunities for Small Satellite Missions

In this part of our article we will briefly describe the main directions for capacity-building of a regulatory framework for small satellites.

4.1. Possible Regulation for LEO Limited Resource

The absence of propulsion systems and short lifetime of small satellites may cause the drastic increase of space debris population with the greater risk of 'Kessler syndrome' as the probability of collision for these spacecraft will increase several times, initiating the chain reaction of debris multiplication.

It is evident that deployment of the megaconstellations of small satellites, that are announced by multiple new comers, including numerous start-ups trying to grasp the holy grail of 'NewSpace' industry, radically enlarge the space market by satisfying the end-user needs and creating demand on space products and services for everyone. Thus, one of the most important issues to be considered is the accessibility of the orbital resource. Currently, it is acknowledged, that certain orbits constitute a limited resource, which use should be managed by an international organization in order to ensure equal access and possibility of utilization of it by all states.

The geostationary orbit (GSO) is well recognized example of such limited resource – thin line in 36000 km over Earth surface in the ecliptic plane is the only place where satellites can hover over one point of the Earth. Its utilization is well managed by ITU. However, ITU or any other international organization does not have regulations concerning other orbits, which was not topical a decade ago. Considering the plans of multiple actors to launch megaconstellations of small satellites in LEO, there is a need to elaborate an appropriate regulatory framework for managing a limited resource which LEO will become soon enough. We have to admit that the rule "first come –

13 Euroconsult: $22 Billion Market Value for Small Satellites over Next Ten Years, available at: http://www.euroconsult-ec.com/7_July_2016.

first served" might cause the major trouble if it continues to be applied to large constellations of small (or even bigger) spacecraft in LEO.
Yet, the new regulations must not de-stimulate the space industry and start-ups. We propose the following general principles for the management of limited orbital resource. First of all, we have to define the international authority responsible for operational LEO management. In our opinion, ITU would be the most reasonable choice, as it has the significant expertise and practice in managing the GSO resource. The use of LEO must be managed in accordance with the provisions of existing *corpus juris spatialis*, i.e. use should be non-discriminatory, equal and opened to all space-faring nations. It is clear that the new prospective regulations must be flexible enough, only affecting the commercial large constellations consisting of dozens of satellites, which significantly increase the probability of collision. In the same time, the regulations must not affect the mission of single small satellites for educational purposes and technology testing, launched by universities and start-ups. Further assessment must be made in order to define which satellite constellations on which orbits are subject to additional regulation. It is possible that in the absence of practice, such assessment will be made on case by case basis.

4.2. Regulation of Orbital Lifetime Reduction for Small Satellites

Another issue to be discussed in relation to space debris problem aggravation by small satellites is a mandatory installation of special devices on small spacecraft (electrodynamic tethers, solar sails etc.) to reduce their orbital lifetime. Currently, several teams are working on low-cost, redundant devices, allowing to decrease an orbital lifetime of spacecraft once its activity is ceased.
The passive devices aim at increasing the atmospheric drag of the spacecraft by increasing its efficient surface or by using the electromagnetic drag force caused by Earth's magnetic field. The other approach implies active use of propulsion, which is frequently not feasible for small satellite missions. However, some start-ups are currently developing the propulsion technologies for such type of a spacecraft, e.g. 'Accion Systems' that have recently raised $7.5 Mln for electric propulsion system for smallsats.
The challenge here is to ensure the exploitation of such system after the end of spacecraft active operations. It is quite evident that after the loss of control over the satellite, it is hard or impossible to ensure the deployment of passive devices or functioning of active propulsion systems. Probably, such devices must begin their deorbiting actions while the satellite is still controllable. In any case, even if part of deorbiting devices is not deployed after the end of life of a satellite, the operation of remaining devices will already significantly reduce the probability of collision.
The regulatory challenge here is to make the installation of such devices on spacecraft mandatory. The small spacecraft might become the testbed for

such kind of devices. In addition, the problem of space debris is seriously aggravated particularly with large constellations of small spacecraft, which tend to become the space debris after several years of exploitation, making a quick deorbiting of such a spacecraft a common interest.
On the other hand, there is understanding that signature and ratification of the binding agreement on this topic is barely possible, which is evident from experience in developing the Space Debris Mitigation Guidelines by the Inter-Agency Space Debris Coordination Committee (IADC) with further endorsement by the UN COPUOS. They were implemented into the national legislations of certain countries, yet they are far from become mandatory, as the states are not motivated to limit themselves by binding norms.
We are of the view that it would be logical to advance the regulations by adopting another soft law document, which might pave the way for the practice of using the deorbiting devices. This document might take the form of amendment to the IADC and UN COPUOS Space Debris Mitigation Guidelines including the provisions on de-orbiting devices.
The consultations regarding amendments to the Space Debris Mitigation Guidelines have to begin now in order to ensure a well-developed version of the document at the point when technical means for de-orbiting reach higher Technology Readiness Levels (TRLs) and are well flight-proven.

4.3. Debris Tracking as a Regulatory Challenge

Another issue for small satellites is tracking of operational and dead spacecraft for mitigating the risks of collision by changing the orbit of other spacecraft. The possibility of increasing visibility and traceability of this type of a spacecraft to monitoring systems (such as NORAD and ASPOS OKP) is to be considered, enabling the tracking of small satellites even if the contact with ground station is lost.
Currently the capacities of existing tracking systems are enough to identify and track the small satellites up to 1U (10*10*10 cm) size. However, the problem of interoperability and sharing of the information persists, especially taking into account current political hurdles between the US and Russia. Other control and tracking systems do not have the same capabilities yet. Plus, the international community needs installations throughout the world to ensure global coverage of tracking systems for receipt of reliable information.
Another facet of the program – the possible emergence of the satellites smaller than 1U cubesats – pico- and femtosatellites, which are basically space microchips hard to detect with existing means of space situational awareness. In the meantime, these super small satellites remain potentially harmful for other space assets and have to be tracked.
The technical idea here could be the inception of passive devices, allowing the tracking of such space objects after the end of its lifetime. These devices are theoretically feasible and their utilization could be also prescribed in the amendment of space debris mitigation guidelines.

4.4. Radiofrequency Attribution for Small Satellites – Another Challenge

As regards more recent law developments related to small satellites, most of them took place either under the aegis of the UN OOSA, or ITU as it deals with another problem caused by increasing number of space objects – scarcity of radio frequency spectrum resource.

First of all, the ITU in its Radio Regulations 2012 in para. 1.179 gave a definition of a satellite 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".[14] The same year the ITU released Resolution 757 (WRC-12) Regulatory aspects for nanosatellites and picosatellites[15] that acknowledged the difference in physical characteristics of this category of satellites from conventional ones. In document it was recognized that small satellites typically have a short (1-2 years) development time, depending on the mission their operational lifetime ranges from several weeks up to a few years and they operate under various radiocommunication services. Not being specifically of a regulatory nature, the Resolution encouraged further development of regulatory procedures to facilitate the deployment and operation of small satellites. It was explicitly stated that the nature of this category of satellites should be considered when revising current provisions of the ITU Radio Regulations for purposes of coordination and notification of satellites.

In 2015 the UN OOSA together with ITU issued the Guidance on Space Object Registration and Frequency Management for Small and Very Small Satellites[16] targeting small satellite developers and operators. This Guidance is a joint effort of two space-related institutions to assist actors new to space activities with understanding the legal scope in which they operate, in particular with regard to registration, authorization, debris mitigation and frequency management of small and very small satellites. The Guidance among other outlined typical characteristics of small satellite missions to which it referred the reasonably short development times, relatively small development teams, modest development and testing infrastructure requirements and affordable development and operation costs for the developers, in other terms "faster, cheaper and smaller".

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14 International Telecommunication Radio Regulations, 2012, available at: http://www.itu.int/pub/R-REG-RR-2012.

15 Resolution 757 (WRC-12) Regulatory aspects for nanosatellites and picosatellites, 2012, available at: https://www.itu.int/dms_pub/itu-r/oth/0c/0a/R0C0A00000A0025PDFE.pdf.

16 UN OOSA & ITU Guidance on Space Object Registration and Frequency Management for Small and Very Small Satellites 2015 available at: A/AC.105/C.2/2015/CRP.17 available at: http://www.unoosa.org/pdf/limited/c2/AC105_C2_2015_CRP17E.pdf.

Also that year the Prague Declaration on Small Satellite Regulation and Communication Systems[17] was adopted as the outcome of the ITU Symposium on Small Satellite Regulation and Communication Systems. Not constituting an additional legal instrument, it however underlined the necessity of the small satellite community to comply with international law requirements set for registration of space objects, radiofrequency coordination and registration of satellite network frequency assignments, and space debris mitigation. All these elements have been seen as premises for sustainability of small satellite missions, avoidance of harmful interference and space debris management.

Today the small satellites usually operate on the frequencies prescribed for the radio amateurs. However, even if small satellite operators comply with ITU regulations for amateur-satellite bands, which is not always the case, the problem of the limited resource of radio frequency spectrum persists.

On one hand, there is an articulated demand from the satellite industry for 'relaxation' of regulation procedure for operating frequencies for non-GSO small satellites. On the other hand, there is an understanding, that small satellites today are not the same spacecraft as they were dozen years ago in terms of capabilities and functionality. Now small satellites constellations are being planned for provision of commercial services rather than for pure educational, experimental use. Consequently, it is unfair to use the "free ham frequency band" and apply the corresponding regulations for the operators of constellations aiming at providing commercial Earth observation or telecommunication services.

Thus, it might be inappropriate to talk about special frequency regulations for small satellites. We should rather consider the clear criteria of distinction between the constellations launched for research, educational and scientific purpose and commercial satellites. Yet, the simplification procedure for radio spectrum frequency allocation must be made for the start-ups, aimed at proposing potentially disruptive and innovative solution with their services.

5. Concluding Remarks

The analysis shows that there is no special legal framework governing operation of small satellites. All those developments that were observed over the last five years are mainly general in their nature however the fact that this issue gets more attention is already a good sign. In addition, the effort to define a small satellite, describe its main characteristics and provide their categorization, is a small step towards designing of an appropriate legal

17 Prague Declaration on Small Satellite Regulation and Communication Systems "Prague Declaration on Small Satellite Regulation and Communication Systems", 2015, available at: https://www.itu.int/en/ITU-R/space/workshops/2015-prague-small-sat/Documents/Prague%20Declaration.pdf.

framework governing this new niche of a satellite market. It is hard to believe that in the near future a tailored block of the legally binding norms focused on small satellites will appear, more likely this will be a scope of soft law provisions shaped as guidelines but even this is better than to bring them under the regulatory umbrella that does not consider different nature of small satellite mission from conventional ones.