

# Real-Time Challenges for the Registration Regime: Where to?

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## Abstract

Registration is the sole basis for “jurisdiction and control” in outer space (Art. VIII OST) and also constitutes the basis for responsibility over a space object. It is therefore evident that ambiguities regarding registration are crucial for the safety of space operations. The discussion about registration has been escalating lately as space is becoming increasingly accessible with the diversification of space subjects. Simultaneously the practice of States indicates reduced diligence in registering their space objects. Initially, the present paper briefly recapitulates the different registries and processes based on the general rule that a launching State shall register a space object set by Art. II of the 1976 Registration Convention. It then turns to current challenges concerning the registration procedure as well as its consequences. Firstly, the term “launching State” is scrutinized, aiming to address several cases of private launches where registration was omitted. Subsequently, the challenges posed by the transfer of ownership of in-orbit space objects are discussed. In this context, it is examined whether there is a rule of international law allowing for the transfer of registration where the registering State has no effective control over an object. Secondly, the paper analyses the notion of “launching State” in light of joint launching and launchings realized by international organizations. It further attempts to answer the relevant question of registration of mega-constellations. The paper concludes by reviewing the possibility of the desirable harmonization and standardization of the registration regime under the Registration Convention, the UNGA Resolution 62/101 and the newly added Guideline 6 of the Guidelines for the Long-Term Sustainability of Outer Space Activities in light of the aforementioned developments.

## 1 Introduction: The Escalating Number of Satellite Launches & Registration Failures

The registration process has long been considered a simple rule in international space law, based on a handful of prerequisites set in the 1976 Registration Convention concluded under the auspices of the UN.<sup>1</sup> However,

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1 Convention on Registration of Objects Launched into Outer Space, *entered into force* Sept. 15, 1976, 28 U.S.T. 695, 1023 U.N.T.S. 15. [hereinafter REG].

over the past few decades, the state of affairs in the space domain has undergone tremendous changes: the escalating activation of private entities,<sup>2</sup> the need for joint missions in order to effectively explore outer space and the augmentation of launches<sup>3</sup> are some developments that have put the registration procedure, as it stands today, under evaluation.

Admittedly, the link between registration and responsibility - and subsequent liability - over space activities is nowadays questioned in view of the shift in the notion of “launching State”. Specifically, a crucial problematic is posed as to the “jurisdiction and control” which is in many cases substantially lacking from the initial registering Party.

Moreover, a significant risk is posed as to Space Situational Awareness, the cornerstone of the safety of space activities, due to the disharmony between national and international law regarding the prerequisites of registration. The ambiguity of the term “space object” along with complexities arisen in the context of the launch of mega-constellations and simultaneously thousands of small satellites are gradually dragging the statistics of unregistered objects higher.

Indicatively, from the 209 objects launched in 2018 only the 19% is currently registered or under the process of registration with the UNSG.<sup>4</sup> It is quite characteristic that the US, although it has launched 43% of this year’s objects<sup>5</sup> and 63% of 2017 satellite launches,<sup>6</sup> it has not registered any launches with the UNSG since June 2017. However, China has made better efforts for the timely registration of its objects, as it has registered 31% of this year’s launches. The registration rates of the previous years show significantly better results, as the States tend to register their objects within 2 years or so after their launching.<sup>7</sup>

The “as soon as practicable” provision of Article IV REG has allowed the States to apply completely different approaches regarding the time and the way of their objects’ registration. The tactics of the States, such as the inconsistencies and delays concerning the registration of objects and the

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2 Sundahl M., *The Expansion of Private Activity in Space and its Impact on the Development Of The International Law Of Outer Space*, in Proceedings of the International Institute of Space Law, 2010.

3 Rendleman J. & Green B., *Space Traffic Management Regime Needs and Organizational Options*, in Proceedings of the International Institute of Space Law, 2015.

4 UNOOSA, Online Index of Objects Launched into Outer Space, [http://www.unoosa.org/oosa/osoindex/search-ng.jsp?lf\\_id=](http://www.unoosa.org/oosa/osoindex/search-ng.jsp?lf_id=)

5 *idem*.

6 McDowell J., *Space Activities in 2017*, <https://planet4589.org/space/papers/space17.pdf>.

7 Statistics and percentages were deduced by the parallel evaluation of the UNOOSA’s Online Index of Objects Launched into Outer Space: [http://www.unoosa.org/oosa/osoindex/search-ng.jsp?lf\\_id=](http://www.unoosa.org/oosa/osoindex/search-ng.jsp?lf_id=) and Jonathan McDowell’s website: <https://planet4589.org/space/>.

notification of their termination are to be proved unviable within the next 2 or 3 years after the massive deployment of satellites and the emergence of more space actors. Statistics show that there has been a 333% increase in the satellite launches since 2012<sup>8</sup> and the percentage is expected to escalate dramatically.

The present paper attempts to identify the risks posed in two specific areas of interest in contemporary space law: the transfer of ownership in-orbit and the launch of extremely sized (either cubsats or mega-constellations) space objects. It then suggests possible ways to deal with these topical challenges in order to ensure space security and the prevention of damage. In the following text, the term “space object” is not used in its strict meaning, as defined by scholars, but as a term describing a “physical object of any size that circulates in outer space”.

## **2 The Fragmentation of Registries: The UN Registry under the UNGA Res. 1721 B (XVI) & the Registration Convention & the Space Registry under the Space Protocol.<sup>9</sup>**

### **2.1 The UN Registry under the UNGA Res. 1721 B (XVI)**

The need for international transparency concerning the space activities, especially in the wake of the Cold War, was firstly introduced in 1961 during the adoption of UNGA Res. 1721 B (XVI).<sup>10</sup> As aforesaid, the Resolution called upon States to furnish information concerning their launchings “into space orbit or beyond”. It also requested the establishment of a public registry under the Secretary General on which the launchings would be “promptly” registered “on a voluntary basis”. The information provided to the Registry would be in the discretion of the States as the Resolution made no reference to the details a State should provide for its registering objects.

However, the first voluntary registrations created a pattern which was later crystallized in the REG. The US, the first State to register 72 satellites under the Resolution, included information concerning the international designation, the date of launch, the launch vehicle, the nodal period, apogee, perigee and inclination of the objects as well as their general purpose.<sup>11</sup> By the same token, the objects registered by the USSR included the name of the space object, its apogee, perigee and inclination as well as its launching date and purpose.<sup>12</sup> It is to be noted that States that have not accessed the REG,

<sup>8</sup> *supra* note 6.

<sup>9</sup> This chapter will not include an elaboration of the ITU’s Master International Frequency Register as it is considered out of the scope and the economy of this analysis.

<sup>10</sup> UNGA Res. 1721 B (XVI), UN GAOR, 16th Session, Annexes, Agenda item 21, UN Doc. A/4987 (1961).

<sup>11</sup> UN Doc. A/AC.105/INF.001, “<http://www.unoosa.org/documents/pdf/inf001E.pdf>”

<sup>12</sup> UN Doc. A/AC.105/INF.006, “<http://www.unoosa.org/documents/pdf/inf006E.pdf>”

such as Luxembourg, Philippines or Egypt,<sup>13</sup> continue to register their space objects under the Res. 1721B (XVI) and the two international registries - under the Res. 1721 B (XVI) and the REG- continue to be updated and used interchangeably.

## 2.2 The UN Registry under the Registration Convention

The REG entered into force in 1976 aiming to “establish *on a mandatory basis* a central register of objects launched into outer space maintained by the Secretary-General.”<sup>14</sup> Even from Article I, the REG defines the subjects and the objects of the registration procedure. The subjects include both launching States and IGOs. These international subjects were obliged to register both national and private space objects in national registries, established under Article II REG and in the international registry under Article III REG. The information, provided on an “as soon as practicable” basis by the States, should include the name of launching State or States, an appropriate designator of the space object or its registration number, date and territory or location of launch, basic orbital parameters and general function of the object.<sup>15</sup> The content of the national registries was left in the discretion of each State but practice designated that it should contain at least the details stipulated by Article IV.

The structure of the registration procedure predicts the joint-launchings up to a certain extent. Under Article II (2) REG and Article VIII OST, the States should conclude an agreement on who registers the object and thus, retains jurisdiction and control over it. However, every launching State, as stipulated in Article I REG, cannot renounce its launching status because of that. Most of the times, the owner of the payload and the owner of the launch vehicle register their objects under their State respectively, pointing out the other launching States in their *note verbale* to the UN.<sup>16</sup> However, this practice is not always consistent.

## 2.3 The International Registry of Space Assets

The Cape Town Convention<sup>17</sup> and its three subsequent Protocols<sup>18</sup> “facilitate the sale, leasing and asset-based financing of high value mobile equipment by

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13 UNOOSA, Notifications from States & Organizations, <http://www.unoosa.org/oosa/en/spaceobjectregister/submissions/states-organisations.html>

14 Preamble, paras. 6, 8 REG

15 Article IV REG.

16 *see* Note verbale dated 6 February 2018 from the Permanent Mission of Germany to the United Nations, U.N. Doc. ST/SG/SER.E/835.

17 Convention on international interests on mobile equipment, *entered into force* Mar. 1, 2006, 2307 U.N.T.S. 285. [hereinafter Cape Town Convention]

18 PROTOCOL TO THE CONVENTION ON INTERNATIONAL INTERESTS IN MOBILE EQUIPMENT ON MATTERS SPECIFIC TO SPACE ASSETS, *signed* Mar. 9, 2012 [hereinafter Space Protocol]; LUXEMBOURG PROTOCOL TO THE CONVENTION ON INTERNATIONAL INTERESTS IN MOBILE EQUIPMENT

establishing an international framework containing a uniform set of rules for the prioritization, protection and enforcement of rights and interests in such mobile equipment”.<sup>19</sup> The Convention and the Aircraft Protocol have entered into force whereas the Protocols on Railway and Space Assets have not yet. The provisions of the Convention and the Protocol alongside the draft Space Registry Regulations determine the several aspects of the Space Registry to be established.

The Space Registry will function just like a land title registry in which a file is first created for a piece of land and then titles to that land are recorded.<sup>20</sup> The owner of the asset will first apply for a unique identification number to the Registrar, who will then issue this number -if there isn't one already- and open a unique identification file for the asset.<sup>21</sup> All the registrations concerning international interests in the asset will then be added in a first-to-file basis and be made publicly accessible.<sup>22</sup> Parties may register an international interest once an agreement is made between the creditor and debtor.

The Space Registry comes with several handy tools. One of them is the concept of “additional information”.<sup>23</sup> The asset will come with a handful of information concerning its physical identification and some technical characteristics (time and place of the launch or COSPAR's identifiers) so that people with interests in the asset be fully informed.<sup>24</sup> This tool enables the creditor to know the exact orbit the space asset is on and it can go further by obliging the debtor to submit the tracking records periodically.<sup>25</sup> Further information about the asset may be retrieved by the UN Registry, only if the launching state has provided the relevant information in a timely manner.<sup>26</sup> Irrespectively of how the two registries will interact in the end, the registration of assets could facilitate the prompt and meticulous registration of objects in the UN Registry as debtor's financing conditions and the competitiveness of the launching company could be affected by the practice of the launching state.<sup>27</sup> Besides, the fact that the Protocol also covers the

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ON MATTERS SPECIFIC TO RAILWAY ROLLING STOCK, *signed* Feb.23, 2007; Protocol to the Convention on International Interests in Mobile Equipment on matters specific to aircraft equipment, *entered into force* Mar. 1, 2006.

19 McPhillips R. et al., *Comparative analysis of aircraft, rail and space international registries and their regulatory provisions*, 5 Cape Town Convention Journal 29, 2016.

20 *idem*. 57.

21 UNIDROIT - Preparatory Commission for the establishment of the international registry for space assets pursuant to the Space Protocol, 4th Session, Summary Report, Prep. Comm. Space/4/Doc. 7 rev., 2015.

22 Article 26 Cape Town Convention.

23 *supra* note 28.

24 *idem*.

25 *supra* note 26 , 57.

26 *idem*. 63.

27 *idem*.

registration of sales in the assets could facilitate the situation of in-orbit transfer of ownership, dealing with another crucial issue of the international registration regime.

### 3 In-Orbit Transfer of Ownership

#### 3.1 The Contemporary Problematic of Spatial Transactions

In view of the complex current legal system that regulates the registration of space objects and the liability of States, that lacks any homogeneity, problems usually arise in the context of the so-called “spatial transactions” between private space operators emerging as an inevitable result of the privatization and commercialization of space activities. This system, as analyzed above, comprises the Outer Space Treaty (Articles VI, VII, VIII), the Liability Convention and the Registration Convention in which a variety of terms is used including: liability of the launching State, registration, ownership, jurisdiction and control, authorization and supervision and responsibility for national activities.

The transfer of ownership and the subsequent transfer of activities is one of the major spatial transactions addressed several times in academia due to the legal consequences that remain unresolved.<sup>28</sup> For economic and practical purposes<sup>29</sup>, a space object may be sold and bought while in outer space. Such a transfer is not excluded by the current international space law provisions.

Although there is no requirement to register possible transfer of ownership of space objects<sup>30</sup> in outer space<sup>31</sup>, it is desirable to notify the UNSG of the effectuated transaction to accept the transfer of registration under précised conditions (i.e absence of harm to the rights of potential victims)<sup>32</sup>. However,

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28 Kerrest A., *Legal Aspects of transfer of Ownership and transfer of activities*, IISL/ ECSL Symposium COPUOS Legal Subcommittee <http://www.unoosa.org/pdf/pres/lsc2012/symp-01E.pdf>.

29 There many reasons requiring the transfer of ownership of space objects ranging from public procurement schemes, PPPs, a SPV Company, privatizations of public bodies, the sale of assets, bankruptcy proceedings (such as in the *Iridium LLC case*). There is, also, the case of in-orbit delivery in a turnkey contract: the manufacturer of the satellite not only assumes the construction of the satellite, but signs the launching contract with the launching provider as well and concludes the contract with the subcontractors involved in the satellite’s ground stations, in *Registration of Space Objects and Transfer of Ownership in Orbit*, Chatzipanagiotis Michael, ZLW 56, 2007.

30 In the case of transfer of ownership by ESA either to a private entity (Artemis case) or to a contractor (Artes 5,7,20,21), EUMETSAT or the EU, there is a transfer agreement and for registration.

31 Viikari L., *Environmental aspects of space activities*, 717, 738 in the *Handbook of Space Law* (Frans G. Von Der Dunk & Fabio Tronchetti eds. 2015).

32 Regarding for instance : the date of change in supervision of satellite, the identification of the new owner or operator, any change of orbital position, any

this does not result to a concomitant transfer of the launching quality since the state of the new owner cannot retroactively become the launching state. The question of the transfer of registration is open, and subsequently the transfer of jurisdiction and control. There must be always a legal agreement between the original and the “incoming” state and in certain cases national space legislation<sup>33</sup> may require governmental authorization for in-orbit transfer- however, this may block many transfers and jeopardize the selling of second-hand satellites.<sup>34</sup>

There are 3 possible cases for the transfer<sup>35</sup>. Case *one* refers to the transfer of ownership between launching States. In this case both the former owner and the present one have had active substantial participation in the launching. They are forever launching states and thereby, they are all jointly and severally liable. Case *two* presents the transfer between unclear launching states and raises the question whether the State whose national procured the foreign launch shall be regarded as a launching state. In case no. *three* there is a pure commercial transaction between companies: the former owner that is the state of registry remains as such and thereby for liability issues it is considered as the launching state<sup>36</sup>.

By principle, there is no objection for the *transfer of registration*.<sup>37</sup> The legal solution is hard to be found; especially due to the inconsistent and heterogeneous State practice. There are different approaches, an insufficient number of instances, different terminology (transfer of ownership, bought in orbit, change in supervision). However, there needs to be a distinction for the transfer (1) between two launching States, and (2) the transfer occurring between the State and an “unoriginal” launching State.

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change of function of the space object in accordance with article 4(a) of UN Resolution 62/101 on the “Recommendations on enhancing the practice of States and international intergovernmental organizations in registering space objects.”

33 National space legislation is indispensable among space-faring nations to set the standards for transfer authorization and guarantee the conclusion of the intergovernmental agreements.

34 “The transfer to a third party of authorized activities or real or personal rights, including guarantee rights, which transfers the effective control of the space object may not be carried out without the Minister’s prior authorization”, *Article 13.1 Belgian Law on the Activities of Launching, Flight Operation or Guidance of Space Objects (2005)*.

35 However, this transfer can be in various ways: on-orbit purchase of a satellite not followed by the change of control, transfer of ownership by the acquisition of a company, transfer of ownership by the change of the legal status of an entity, no transfer of ownership but State succession etc.

36 In the case of a *joint launch*, the transferee shall accept any prior agreements signed by the joint launching states.

37 The real example of on-orbit purchase of a satellite followed by the transfer of registration is that of *Sirius 1* (Sweden, UK).

- In the first case (transfer between original launching states), the property is transferred, including the rights and obligations which are connected to it in every legal system. The responsibility for “national activity” according to article VI OST is transferred, as well, because it is related to a fact: the link of nationality of the operator. This activity must be authorized and continuously supervised by the “appropriate State”. The State of the new owner can register and have jurisdiction and control over the object *only* if it is a launching State (Article II REG).
- The problem occurs at the in-orbit transfer of a space object from State A or nationals of it (State of Registry) to State B or its nationals (non-launching state). The provisions in question with regards to State A are Articles VIII of the Outer Space Treaty providing for the “jurisdiction and control” over the space object to rest in the State of Registry, and Article I (c) of the Registration Convention, according to which the State of Registry must be exclusively one of the launching states. In any case, relevant to State B is Article VI of the Outer Space Treaty according to which the “appropriate state” (the State with actual jurisdiction and control over the operator or owner of the space object) bears obligation to supervise and authorize national space activities. In the second case, the “original” launching State stays liable even if it cannot in practice have any control over the satellite. Therefore it must control or even block every change of ownership to a foreign person. The State of the “national activity” is responsible according to Article VI OST but cannot register it, cannot have jurisdiction and control over it even if it must authorize and supervise this activity.

### 3.2 Case Studies & Possible Solutions

#### 3.2.1 Case 1: Privately Owned Space Assets & Cause of Damage

Supposing Company A, incorporated in State B, has launched satellite X from B's facilities. B is a State Party to the OST and the REG and maintains a national registry of space objects. Accordingly, B has registered satellite X both on its national registry and with the UN Secretary-General. X's signal interferes with the signal of satellite Y of Company C, a national of State D, causing financial losses to said Company's broadcasting business. In this case, the link of liability and responsibility undoubtedly lies with the initial launching and registering State, *id est* B.

Now, assuming that A went bankrupt and its assets have been foreclosed by E, a bank incorporated in State F. E has no interest in keeping up the operation of X but rather auctions said satellite and its ownership passes through to Company G, also established in F. If the aforementioned interference took place after the transfer of the ownership or not, this is of no relevance for the subsequent compensation obligations deriving from



responsibility and liability according to the prevalent interpretation of the term “launching State” which is the criterion for the liability link as it stands today. Namely, registering State B is also undoubtedly the launching State of the object that caused the damage and shall be burdened with the obligation to compensate C.

In light of the New Space era though, this solution seems inefficient and obsolete and might constitute a significant barrier to future spatial transactions due to unjust results. In the aforementioned case, after the transfer of the satellite’s ownership to G, B has no link whatsoever to X: it does not control its operation, nor do its nationals and it cannot properly exercise its jurisdiction over it. In this series of events, the wording “shall retain jurisdiction and control” of Art. VIII OST may stand as a reminder that jurisdiction and control are not just the legal consequences of the registration of a space object; quite the opposite, registration is a means to acquire them and, thus, ensure the safe and harmonious operation of space devices.

The criterion of “actual control” could instead allow a more efficient application of the registration regime and, therefore, a more solid foundation for liability and responsibility in view of the rise of the space market. Specifically, ownership can be a more effective criterion, although it is still not definite.<sup>38</sup> This is used, for example, in the legal regime for ship nationality in the UK. The ownership of an object is a fairly more efficient way to tie a State’s registering obligation with jurisdiction and control and subsequent responsibility.<sup>39</sup> It is clear instead that *impossibilium nulla obligatio est* and thus imposing on a State the obligation to compensate for a damage caused by an object which is registered with it where the State does not exercise any kind of prescriptive jurisdiction or physical control over the object is absurd.

In this context, the rule “once a launching State, always a launching State” could also be revisited via discussing the possibility of transferring the legal rights and obligations deriving from registration along with the transfer of ownership of the space object. Indeed, registration presupposes that the registering Party does exercise some jurisdiction and control over the object<sup>40</sup>. When this is nullified, the basic features of registration cannot be fulfilled. Specifically, the State cannot control the operation of the object; consequently, it cannot provide the information needed to the UN even when

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38 *Indicatively* Advisory Opinion of 21 June 1971, Legal Consequences for States of the Continued Presence of South Africa in Namibia (South West Africa) notwithstanding Security Council Resolution 276 (1970), ICJ Reports 1971, para 118: “*Physical control of a territory, and not sovereignty or legitimacy of title, is the basis of State liability for acts affecting other States*”.

39 Aoki S., *In Search Of The Current Legal Status Of The Registration Of Space Objects*, in Proceedings of the International Institute of Space Law, 2010.

40 See the wording “retain jurisdiction and control” of Art. VIII OST.

there is no risk of collision or re-entry. Namely, the State cannot surveil the location and parameters of the use of said object. It follows that responsibility imposed on the registering State based only on its launching status (which is practically admitted via registration) is neither rational nor fair.

Supposing for example that State B of the aforementioned case study has revoked the license of the activity undertaken in the operation of X. B has no power to enforce its decision even if it is legally prescribed in its territory as G (the operating entity and a national of F) is not subject to its jurisdiction. In this case, the damage caused from this activity to Company C is still due by B. This absurd result will admittedly boost the fear of spacefaring States to provide launching or building services to non-spacefaring States if the former are under the constant threat of responsibility and liability obligations even though they do not derive any profit from the objects' operation. This will unavoidably lead to slower development of non-space faring nations in the exploration of space and generally to a more stagnant space economy.

### **3.2.2 Case Study 2: Further Issues of the In-Orbit Transfer of Ownership**

Supposing that the private company A, based on State S, owns the satellite Z positioned in the LEO and launched from the facilities of S. S, a member state of the OST, the LIAB and the REG, has not registered the satellite Z neither in its national registry, nor in the UN Registry of Space Objects. The company A sells the satellite Z, while in orbit, to the private company B, based on State T. The satellite Z, due to a conjunction warning maneuver, collides with the satellite X, owned by State U. Both satellites suffer irreparable damage and have to be disposed to a graveyard orbit. T, a state party only to the OST and the LIAB, never registered the satellite Z under the UNGA Res. 1721 B (XVI).

As it was clearly illustrated before, the registration and the liability regimes lead to a paradox in cases of in-orbit transfer of ownership of space objects, an action generally allowed by international space law. In the case at hand, the launching State of the object, S, remains the launching and the only State liable for the damages the satellite Z caused to the satellite X under the Articles VII, VIII OST and Article I (c) and III LIAB . Although T is the State that currently exercises jurisdiction and control over the object, pursuant to the current space regime it evades any international responsibility and liability for the damages incurred towards State U.

Supposing now that the owner of the satellite Z, company B, before the disposal of the satellite had granted an international interest in the satellite for a company's loan and the company is sufficiently a debtor under the scope of private international law. The Cape Town Convention and the Space Protocol, which apply in the case of space assets, only set up a basic legal framework and does not establish a self-sufficient legal system settling all issues which may emerge. As a result, the system leaves blanks to be filled

in by national substantive law rules. Since special private international law rules for proprietary issues relating to space assets are absent, the *lex loci situs* (the law of the country where the asset is registered) may apply. The latter seems to work for the assets that have been registered under the State that exercises the jurisdiction and control over them.

As for the objects that are unregistered, it has been proposed that when in orbit the *lex domicilii debitoris* (the law of the country of the debtor) would apply.<sup>41</sup> This is an approach which links the issues related to the asset with the entities that have actual control over it and not with the original launching State which may not have anything to do with the asset except for its launching. In the case at hand it is quite interesting to see how the same object will be treated under the public and private international law. For the damages incurred to the satellite of the State U, the State S is held liable although it does not exercise any jurisdiction and control over the asset. For the possible defaults between the creditor and the debtor emanating from the damage and the disposal of the asset, the debtor's domicile laws, namely the controlling State T's law, will apply in the judicial resolution of the issues.

Nevertheless, this is a quite theoretical presupposition for a regime that it is unknown when and how it will apply. Moreover, we cannot make any connection between the rules of public international law and private international law. However, the practice of the latter may become a direction towards which the hot issues of the international space regime, such as that of the "controlling state", can move.

#### **4 From Mega-Constellations to Chipsats: Size Matters**

##### **4.1 The Radical Shift in the Number of Launches**

Up to now 8,206 objects appear in the official UN index of objects as launched into outer space since 1957.<sup>42</sup> The majority of them (about 80%) have been launched into LEO, while the rest extent to other orbits or beyond.<sup>43</sup> However, these numbers, especially these of the LEO, are to augment in the next few years with the massive deployment of new satellites. According to Euroconsult, about 7,000 small satellites will be launched, at an average of 580/year by 2022, growing to an average of 820/year by 2027,

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41 Kreuzer K.F., *Jurisdiction and choice of law under the Cape Town Convention and the Protocols thereto*, 2 Cape Town Convention Journal 1, 149, 163, 2013.

42 Zheng Pai, *A Legal Analysis of "Space Asset" Under the 2012 Space Protocol to the International Interests in Mobile Equipment*, "[http://www.nyulawglobal.org/globalex/Space\\_Asset\\_Protocol\\_Cape\\_Town\\_Convention1.html](http://www.nyulawglobal.org/globalex/Space_Asset_Protocol_Cape_Town_Convention1.html).

43 Lal et al., *Global Trends in Space Situational Awareness (SSA) and Space Traffic Management (STM)*, 9, Science & Technology Policy Institute (IDA), IDADocument D-9074, 2018.

with constellations accounting for the 82% of them.<sup>44</sup> About 3,000 satellites over 50kg are to be deployed by 2026 adding up to the already tremendous estimated increase in the number of the launched items.<sup>45</sup> It becomes quite clear that an -at least- 121% increase in the objects launched will take place within the next decade.

Along with the booming numbers in the space objects launches, the objects' collisions in the orbits is expected to increase, too. After evaluating the positioning of the two projected (SpaceX's and OneWeb's) and the three current (Iridium, Orbcomm, and Globalstar) constellations in LEO, simulations have estimated that one constellation can cause one collision per year in the first 20 years in orbit and this number increases to 8 per year, at its peak collision rate, namely 190 years after launch.<sup>46</sup> Apart from the congestion of LEO, objects' collisions may be triggered by the increasing maneuvering of satellites due to conjunction warning messages. It has been predicted that SpaceX's 4,425 satellites constellation will receive about 7.2 million conjunction warnings annually. Although most of the operators do not pay attention to these warnings, they will be some who will manoeuvre their objects to avoid a possible collision thus, increasing the uncertainty of the objects' position and the potentiality for more collisions.<sup>47</sup>

## 4.2 Case Studies & Possible Solutions

### 4.2.1 Case 1: Mega Constellations & Joint Launchings

In this context potential implications may be reviewed through the following case study. Assuming there is a mega-constellation comprised of many small satellites launched in outer space. All the individual parts of the constellation are separately registered on the national registers of different States (where the private entities -owners of the satellites- are incorporated). Thereby, the UN registry, on which the national entries are transferred does not bear any mention of the rest launching States, although in accordance with the OST and the LIAB, the owners of the parts composing the mega-constellation are considered as procuring the launching, and the State of which they are nationals is therefore a launching State. This mega-constellation causes damage to another space object, by provoking a collision. Which States are to be held liable and internationally responsible under Articles VII OST, III LIAB and VI OST respectively is a question that has not been addressed.

Article II (2) REG regulating joint launching does not provide a satisfactory solution, since in our case the States of registry are multiple and thus the

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44 Euroconsult, Prospects for the small satellite market - Report, 2018, "<http://www.euroconsult-ec.com/research/smallsats-2018-brochure.pdf>".

45 Euroconsult, Satellites to be built & launched by 2026 - Report, 2017, "<http://euroconsult-ec.com/research/satellites-built-launched-by-2026-brochure.pdf>".

46 *supra* note 64

47 *idem.*, 19 - 20.

damaged State cannot trace back one appropriate State in order to seek compensation. *In casu*, the current situation where satellite providers register parts of the constellation and disregard the issue of registration of the rest space object is not sufficiently regulated under the contemporary legal framework.

One solution could be that one satellite provider (State of Launch) should be given the responsibility to register the mega-constellation as a whole, an inseparable space object. We propose that the registration of the small satellites would be based on their operators' license certificate which would identify the State of Launch. This double registration would then be transmitted onto the UN Registry. In effect, the State of Launch would register the mega-constellation and its different parts on behalf of the States of Operation. We would however limit this obligation of registration by the State of Launch to those payloads owned/ operated by a non-governmental entity. The "registration on behalf" could encounter some problems when it comes to satellites launched by States such as surveillance satellites or other defence related payloads. The State of Launch, as we called it, would also retain jurisdiction and control over the constellation during its presence in outer space (Article VIII OST) and would be held liable (Article VII OST, III LIAB) and internationally responsible (Article VI OST) for any damage caused by it. As to the apportionment of compensation, this should be allocated between all the launching States (of the different satellites-parts of the mega-constellation). This would mean that although the State of Launch would pay the whole amount of compensation to the damaged Party, the rest of the launching States should then contribute their equal shares.

#### **4.2.2 Case 2: The Issue of Registration Prerequisites as a Standard of Diligence in Space Activities**

Although both the OST and the REG impose an obligation on States Parties to register their space objects, it is not undisputed that a general obligation of registration exists in international space law, especially as a customary rule. Therefore, a State cannot be held responsible for simply omitting the registration of an object which is not unambiguously a space object according to differing interpretations of the term.

Supposing a group of students at the Faculty of Engineering of State University A, a national of State B, designs, builds and launches a chipsat, the size of a credit card, as an experiment for a project on space monitoring. State B is a State Party to the REG and maintains a national registry of space objects. However, according to its National Space Act, said object does not fall into the scope of application of the registering procedure due to its size and function. As a result, University A does not register this chipsat and, B subsequently omits its registration with the UNSG.

Simultaneously, Company C, a national of State D, maintains a cartographic satellite X for the provision of GPS services to its subscribers. Three months

after its launching, A's chipsat crashes onto X damaging an operational part of its monitoring system and, thereby, rendering X inappropriate for its projected use. It is concluded by experts though that had Company C been informed about the orbital parameters of the chipsat, it could have prevented the collision via a costless maneuver.

The aforementioned example begs the question whether B is at fault and, thus, liable to D for the damage caused to its space object. Under international law, there is not an adequately specified rule regarding the obligation of registration of space objects. The matter presents two significant ambiguities: firstly, the definition of "space objects" which have to be registered and, secondly, the timely notification from the registering Party. Both issues are left to the initiative of the launching State. This being the case, *in casu*, B is not at fault if it contends that it does not consider the chipsat to be a space object or that the "soonest practicable" time for registration had not been exceeded.

This solution though seems inequitable since it apportions the entire risk of the undertaken space activities to D and its national C. A more appropriate solution would be based on establishing some minimum standards of due diligence regarding space activities. In this regard, it must be noted that registration has been characterized as "the most primitive measure of Space Situational Awareness".<sup>48</sup> Indeed, registration is a basic form of cooperation in outer space which ensures the safety of operations by playing a preventive role. It can therefore be set as the minimum standard of diligence in the context of the general principle "*sic utere tuo ut alienum non laedas*". Specifically, it cannot be disputed that B has the right to freely explore and use outer space; but it cannot exercise its right in a way that impedes or excessively burdens other States or space operators. Establishing registration as a minimum standard of care would entail that omission of registration – even if not a breach of an explicit obligation – is a breach of the standards internationally set by soft law rules and practice and does entail B's fault in this case. As a result, B can be held liable for the damage caused to D's national.

This solution ensures the awareness of States about the possible risks from uncontrolled space activities by their nationals. Subsequently, licensing regimes followed by the registering procedure can also lead to a more efficient use of orbits, a limited natural resource, and also to a lighter degree of space congestion. Thus, the risk of collision and accidents can be restricted to cases of *force majeure* and unexpected events.

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48 *Supra* note 43.

## 5 Conclusion

It cannot but be admitted that the challenges posed by ongoing developments in the space sector are numerous. It is apparently more desirable to establish a new regime rather than to forcibly regulate through a set of existing regulations.<sup>49</sup> But in light of a realistic overview of the circumstances the establishment of a fresh legal regulation is not achievable, at least within the following year. However, these challenges should not be the reason to neglect further enhancement of space technology and operations.

As deduced from the previous analysis, the main issue nowadays is to finally disconnect the registration obligation from inconsequential terminal attachments (such as the strict interpretation of the terms “space object”, “launching state”, etc.) and relate it to space traffic so as to ensure safety and sustainability in space activities. Monitoring and controlling activities therefore (which presupposes a registration link) should not be seen as a result of registration but as a reason to register appliances that under different approaches could be dealt with as not being “space objects”.

It should be pointed out that an extraordinary legal reconstruction of the current international space law is not required for establishing a trustworthy STM regime. Suffices to make good use of the existing legal framework and explore its full potential via a few reinterpretations.<sup>50</sup> What is more urgent at this moment is a coordinated effort to standardize the registration procedure and harmonize its basic features in the various national legislations.<sup>51</sup> Besides, the Registration Convention, the UNGA Resolution 62/101 and Guideline 6 of the Guidelines for the Long-Term Sustainability of Outer Space Activities along with an efficient application of the Protocol to the Convention on International Interests in Mobile Equipment on Matters specific to Space Assets provide sufficient tools for a contemporary interpretation of the international notion of “due diligence” seen through the goal of maintaining space safe for peaceful purposes and developing its prospects for mankind as a whole.

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49 Yu Takeuchi, *Toward the International Regime for Space Traffic Management - What to Fix the Current International Regulations*.

50 Schmidt-Tedd B., *How To Adapt The Present Regime For Registration Of Space Objects To New Developments In Space Applications?*, in Proceedings of the International Institute of Space Law, 2005.

51 Morozova E. & Vasyanin Y., *Glances at Currently Debated Issues to the Registration of Secondary Payloads and the Future of Registration*, in Proceedings of the International Institute of Space Law 746, 2016; Aoki S., *Efficient and Equitable Use of Orbit by Satellite Systems: “Paper Satellite” Issues Revisited*, in Proceedings of the International Institute of Space Law, 2013.