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The future of international spaceport regulations: which response to expect from the international community?

Valentin DEGRANGE

Introduction

As humanity is today well into the 21st century, we witness the appearance of new prospects for the utilization and exploitation of outer space, making it increasingly “contested, congested and competitive”¹. Many aspects of our daily lives have already come to depend on our occupation of Low Earth Orbits (LEO) and Geostationary Earth Orbits (GEO). As the number of space-related activities increases exponentially though, most notably in its commercial facet, so does the need for new spaceports and adequate regulations for the increased space traffic that will follow. The “big sky” theory which protected airborne travelers for almost two decades before becoming obsolete will soon suffer the same fate in regard to space travel.

The future of space activities partially depends on the answer from the international community to this problem. Up until now, international involvement in the regulation-making process regarding space traffic management and spaceports regulations has been sparse, save for a few non-binding documents. But as the number of spaceports aimed at commercial activities grows (private satellite launching, suborbital flights/space tourism, deep space mining), the adoption of a legally binding treaty seems unavoidable. Such a document would not only need to increase the level of cooperation between spaceports, but with airports as well.

This paper will aim at proving that the establishment of space traffic rules would need to clearly define some of the terms used in the earlier space treaties, regulate launch activities and suborbital spaceflight, institutionalize information and data sharing, and offer an adequate delimitation of outer space as well as a solution to the increasingly problematic space debris issue. Finally, it is conceivable that such a treaty could establish an international organization charged with centralizing informations concerning space traffic, coordinate its actions with the International Civil Aviation Organization (ICAO) and settle disputes between members according to the 1972 Liability convention² and the new rules of space traffic.

But is the international community willing to take such a step?

1 Lt. Col. S. HUNTER, “How to reach an International Civil Aviation Organization role in Space Traffic Management” (November 5, 2014), *Space Traffic Management Conference*, 21p., p. 5. URL: <http://commons.erau.edu/stm/2014/wednesday/21>.

2 *Convention on International Liability for Damage Caused by Space Objects*, 29 March 1972, 961 UNTS 187; 24 UST 2389; 10 ILM 965 (1971) (entered into force 1 September 1972).

1. The unregulated increase in space activities and its consequences

The Cold war Space Race, which arguably began in 1957 with the launch of the first artificial satellite Sputnik 1, was more of an ideological race and involved only two real actors (the ex-USSR and the United States of America). At the time, the idea was for the USA and the USSR to assert its technical and scientific superiority over the other, which led to great advances from a technological as well as a legal point of view. The present situation is notably different.

First, the objectives have changed and the conceded goal of contemporary space exploration is mostly of a commercial nature. The preeminence of telecommunications in our modern society, and the increasing development of private activities in the space sector have highlighted the intrinsic value of the "spectrum-orbit resource" and saw the development of a real commercialization of outer space by States. Whether the manufacture and operation of satellites and launchers, the use of satellite navigation in a civilian setting and its marketing by operators of GNSS systems, projects of orbital spaceflight and space tourism or the recent appearance of deep space mining companies, the sector is growing increasingly and promises not to stop there. The exploitation of outer space for both scientific and economic purposes in the future is therefore likely to rely more on the private sector.

Second, new players have emerged alongside the traditional space powers: China, India and Japan, for example, have considerably developed their space capabilities in recent years, especially in the context of scientific missions (eg manned spaceflight program for China, sending a scientific satellite on Mars successfully on the first try for India, and the deployment of a solar sail prototype for Japan) but also for more "mundane" applications (these countries will or already have their own satellite navigation systems). They join the USA, Russia and the Member States of the European Space Agency in the fairly closed circle of spacefaring nations. Taking Europe as one "launching State", for calculation purposes, the number of states that actually engage in/license private companies to perform launches from their territory amounts to a total of 12 launching states³.

But as the number of actors involved in space exploration as well as the scope of their activities continue to increase, so does the number of spaceports. As a consequence, space traffic is increasing in a comparable way to that of air traffic during the 20th century. While aviation collision between two aircraft were extremely rare at first, as demonstrated by the "big sky" theory⁴, commercial aviation forced airways and air traffic control facilities to develop in order to keep pace with the increased activity. Accidents such as the 1956 mid-air collision between United Airlines and Trans World Airlines passenger airliners in uncontrolled airspace (resulting in 128 fatalities)⁵

3 Peter VAN FENEMA, "Legal aspects of launch services and space transportation", *Handbook of Space Law*, Frans VON DER DUNK (dir.) with Fabio TRONCHETTI, Edward Elgar Publishing, 2015, 1100 p., p. 409.

4 In aviation, the idea is that two randomly flying bodies are very unlikely to collide, as the three-dimensional space is so large relative to the bodies.

5 Lt. Col. S. HUNTER, *op. cit.*, note 1, p. 5.

made evident the potential danger to the public and to aviation as a whole. Incidents such as the January 2007 Chinese ASAT test⁶ or the February 2009 collision between the commercial Iridium and Russian Cosmos communications satellites⁷ had a similar impact on spacefaring nations, highlighting the need to consider how best to conduct safe and responsible operations in space and to promote those practices internationally.

Unregulated space activities could however have dire consequences on humanity's ability to travel through space. An absence of regulatory framework could allow an exponential increase in the number of collisions between (potentially manned) space objects, resulting not only in the loss of materials and human lives, but cut the access to the space domain as well. Furthermore, the number of dangerous space debris present in Earth's orbit has drastically increased since the beginnings of space exploration, reaching the hundreds of thousands. It may not only cause malfunctions, sometimes beyond repair, on our satellite constellations, but also pose the threat of a potential implementation of the Kessler syndrome. Its resultant effects on world economies, information systems, and national security systems, are now fully acknowledged by spacefaring nations.

This problem has already been addressed by the Inter-Agency Space Debris Coordination Committee that was established in 1993 by the major space agencies of the world, but without leading to a solution, apart from Space Debris Mitigation Guidelines in 2002. A few other non-binding documents concerning such matters have been issued, including the International Academy of Astronautics (IAA) Cosmic Study on Space Traffic Management of 2006⁸ or the Hague Code of Conduct against Ballistic Missile Proliferation of 2002⁹, but a more radical approach seems today necessary.

Launch safety and space traffic management are not dealt with in the present body of space law and are thus left to either separate international agreements or to national laws and policies. This lack of international rules concerning space traffic management can be somewhat explained by two factors. First, there is neither a dedicated international organization, nor a trade association responsible for the creation, and perhaps implementation, of an international space code of conduct. Second, as national space launches mostly do not involve entry into foreign airspace, spacefaring nations usually apply their own national safety regulations, including navigation standards, to their governmental and/or private launch activities. The need for the coordination of these activities, as well as the harmonization of national rules and policies, has recently been emphasized by the

6 T. S. KELSO, "Analysis of the 2007 Chinese ASAT Test and the Impact of its Debris on the Space Environment", *AMOS Conference*, 2007, 10 p. URL: <https://www.celestrak.com/publications/AMOS/2007/AMOS-2007.pdf>

7 Lt. Col. S. HUNTER, *op. cit.*, note 1, p. 5.

8 IAA, *Cosmic Study on Space Traffic Management*, 2006, 96 p. URL: <https://iaaweb.org/iaa/Studies/spacetraffic.pdf>

9 UN, *Hague Code of Conduct against Ballistic Missile Proliferation*, General Assembly, 2002, URL: http://www.hcoc.at/documents/Hague-Code-of-Conduct-A_57_724-English.pdf

aforementioned incidents as well as several scientific studies¹⁰. It seems today that the adoption of an international agreement is the only viable option to ensure safety for future space activities. Such an agreement would need to address varied issues, both during the launch phase and in-orbit operations, in order to form a comprehensive and coherent legal regime for space traffic management.

2. Regulation of space activities in the Launch Phase

It is indeed necessary to first distinguish between the *transportation* of satellites, and other payloads into space and the possible return of the space vehicle concerned, and the *operations* of these satellites in orbit and beyond. The former poses different challenges from a traffic management point of view. While in-orbit operations may harmfully interfere with one another, the launch and return phases of such activities imply the use of airspace (national or international). This means potential interference with aircraft in flight, whose operations are regulated under international and national air law, and/or possible involvement of national air traffic management agencies, the International Civil Aviation Organization or, in Europe, the European Aviation Safety Agency (EASA for aviation safety) and Eurocontrol (for air navigation). In the past sixteen years, all twelve launching states needed only a total of 1,146 launches to create, in the launch phase, an annual average of -in theory- seventy-two potential interferences with aircrafts (including the thirty-three launches performed by Sea Launch from its floating launch platform in the Pacific Ocean, at a comfortable distance from the nearest airports or aircraft movements)¹¹. A Space Traffic Management Treaty would therefore also have to deal with several issues in order to guarantee the safety of launch activities during interactions between air traffic and space traffic.

In order to do so, an STM regime would first need to offer a precise delimitation of outer space. This issue has been discussed by the Committee on the Peaceful Uses of Outer Space of the United Nations (UNCOPUOS) for more than half a century (and is still on its agenda to this day) and most of the space-faring nations have set forth to give priority neither to the *functionalist*¹² nor the *spatialist*¹³ approach. The advantage of the spatialist approach is that defining the applicable law based on the area would be easier, despite the activity's nature. Moreover, this approach would allow to specify the applicable regime based only on the occupied area, whatever the nature of the object or activity may be. It is the easier way to address the issue. On the other hand, the

10 National Research Council. *Orbital Debris : A Technical Assessment*, 1995, 224 p. ; Scientific and Technical subcommittee of the UNCOPUOS. *Technical Report on Space Debris*. United Nations, New York, 1999; National Research Council. *Limiting Future Collision Risk to Spacecraft: An Assessment of NASA's Meteoroid and Orbital Debris Programs*. Washington, DC: The National Academies Press, 2011.

11 Peter VAN FENEMA, *op. cit.*, note 3, p. 409.

12 The *functionalist approach* maintains that the nature of the activity, rather than the location of the activity, should be the determinant.

13 The *spatialist approach* proposes setting a measurable physical boundary between airspace and outer space.

functionalist approach would require close observation of the activity's nature in order to determine whether it should be regulated by air law or space law. The functionalist approach seems more reasonable however, since space objects will be functionally identified by their telemetry, tracking, and control (TT&C) or operational capabilities. It may also have the flexibility of allowing any category of spacecraft or space activities within space regulations. This would greatly simplify the issue of space tourism (both orbital and suborbital spaceflight), as the vehicles used (seemingly capable of traveling in both air space and outer space) would not have to be regulated under two different regimes depending on the phase of the activity. Furthermore, Japanese Aerospace Exploration Agency (JAXA) has been developing a Super Low Altitude Test Satellite (SLATS), with high-resolution Earth observation sensor technology, which flies at a relatively low altitude of 200-300km. This altitude is comparatively lower than the orbiting altitude of a normal satellite (600 to 800km), while the International Space Station orbits at approximately 400km of Earth¹⁴. But instead, a *wait-and-see* approach has been adopted by the international community up until now, as this ambiguity has not brought practical problems as of yet. However, the issue of regulating space activities remains, especially regarding to what extent the UN space treaties govern space activities. The development of space activities is approaching a crucial point and the need for a delimitation of outer space is going to be essential in the near future.

Second, it seems important to resolve the matter of the absence of clear definition of “*space object*”. The only definition in current international states that “[t]he term of ‘*space object*’ includes component parts of a space object as well as its launch vehicle and parts thereof”¹⁵. Space objects are the only subject to the Liability Convention and Registration Convention, as well as Article VII (State liability of damage) and VIII (registration of space objects) of the Outer Space Treaty, while Article VI of the Outer Space Treaty only regulates the “*activities in outer space*”¹⁶. Therefore, it is reasonable to assume that the subject matter designated as “space object” is a dedicated description for the Liability and Registration Conventions, that is to say only a part of the body of international space law¹⁷. While the satellite, launch vehicle, and trans-orbital vehicle (including rovers), obviously fall into the definition of “space object”, space debris and suborbital spacecraft are more ambiguous. Space debris pose a problem only to in-orbit operations, and the question will be discussed hereafter, but a suborbital spacecraft can be a direct threat to air traffic as

14 Yu Takeuchi, *Legal aspects of international regime for space traffic management*, Institute of Air and Space Law, Faculty of Law, McGill University, 2014, 100p., p. 58.

15 *Convention on International Liability for Damage Caused by Space Objects*, 29 March 1972, 961 UNTS 187; 24 UST 2389; 10 ILM 965 (1971) (entered into force 1 September 1972), art 1(d), URL: http://www.unoosa.org/pdf/gares/ARES_26_2777E.pdf; *Convention on Registration of Objects Launched into Outer Space*, 6 June 1975, 28 UST 695, 1023 UNTS 15 (entered into force 15 September 1976), art 1(b), URL: http://www.unoosa.org/pdf/gares/ARES_29_3235E.pdf

16 *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, 18 UST 2410, TIAS No 6347, 6 ILM 386 (entered into force on 10 October 1967). URL: http://www.unoosa.org/pdf/gares/ARES_21_2222E.pdf

17 Yu Takeuchi, *op. cit.*, note 9, p. 59.

it is designed to travel through both air space and outer space, and retain a high potential to pass through air space more frequently than launch vehicles¹⁸. In the context of the ICAO, a “suborbital flight” has been loosely defined as “a flight up to a very high altitude which does not involve sending the vehicle into orbit”¹⁹, traveling “just beyond the threshold of space”²⁰, and can ultimately be used for point-to-point transportation. Moreover, suborbital spacecrafts indeed meet the definitions of aircraft²¹ and aeroplane²², as defined by the Chicago Convention²³. As a consequence, ICAO has warned the international community that suborbital spacecrafts should be regulated under international air law, at least when they share the same international air space of other aircrafts conducting international operations²⁴. This was the inevitable conclusion from the safety point of view of aviation operation, and it illustrates the need to clearly define the notion of space objects as well as the applicable regime. Since the suborbital spacecraft used for space tourism is a hybrid type, there are two options: regulating it by applying all of the existing applicable regulations, or establishing a new category for regulation. While it would be simpler to establish a new category rather than to forcibly regulate through a set of existing regulations, the current political circumstances do not allow for the establishment of a new legal regime. Therefore, the only solution is to apply both air space and outer space regulations to the suborbital spacecraft. The idea would be to regulate it as an aircraft or aeroplane while it is being operated as such, and as a space object when it does not fall under either of these categories. The international regime for outer space, including a potential STM regime, should also be applicable to the suborbital spacecraft in order to reduce the area of *lacunae* of law²⁵.

Finally, in regard to regulations during the launch phase, it seems imperative to implement a set of rules of coordination in order to allow the safe coexistence of launch activities and the usual air traffic. There are two ways to address this issue. First, a practical approach that focuses on coordination between the two authorities concerned and an exchange of informations between airports and spaceports. This is probably the best solution for years to come considering the still limited number of space-faring nations and launching states. Second, a legal approach that would

18 *Concept of Suborbital Flights: Information from the International Civil Aviation Organization (ICAO)*, UNCOPUOSLSCOR, 49th Sess, UN Doc A/AC.105/C.2/2010/CRP.9, (2010), s 1.3 [ICAO’s Concept], URL: http://www.unoosa.org/pdf/limited/c2/AC105_C2_2010_CRP09E.pdf

19 Peter VAN FENEMA, *Suborbital Flights and ICAO*, in *Air and Space Law*, Vol. XXX/6 Law (2005), p. 405.

20 *The Annual Compendium of Commercial Space Transportation: 2012*, FAA, February 2013, www.faa.gov/about/office_org/headquarters_offices/ast/media/Annual_Compndium_of_Commercial_Space_Transportation_2012_February_2013.pdf, last accessed 19 october 2016, p. 24.

21 “[A]ny machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth’s surface.”

22 “[A] power-driven heavier-than-air-aircraft, deriving its lift in flight chiefly from aerodynamic reactions on surfaces which remain fixed under given conditions of flight.”

23 *Convention on International Civil Aviation*, 7 December 1944, 15 UNTS 295, ICAO Doc 7300/6 (entered into force 4 April 1947), URL: http://www.icao.int/publications/Documents/7300_orig.pdf

24 UNCOPUOSLSCOR, *op. cit.*, note 13.

25 Yu Takeuchi, *op. cit.*, note 9, p. 64-65.

work towards amendment of the definition of aircraft to include the launch vehicle or expand the responsibilities of aviation authorities to include launch vehicle operations. This approach will be more profitable when the growth of air and space traffic has made the coordination model less effective and/or when problems of governance in the coordination process threaten the safety of air space for national and foreign users²⁶. It would theoretically be much easier to expand the competence of the national civil aviation authorities to include launch vehicle operations. For example, the German Aviation Code provides that “*Space vehicles, rockets and similar flight objects are treated as aircraft as long as they are in air space.*”²⁷. On the international level however, the legal approach might not be as easy to implement. The creation of “no fly zones” in international air space above a launch area (such as with the Sea Launch operation) would come into conflict with the principle of “freedom of overflight” over the high seas²⁸, which would have to be dealt with by ICAO²⁹. A launching state could also accept responsibility for providing the necessary air traffic services in portions of international airspace used for launch activities, but the Council of ICAO would have to approve the appropriate “regional air navigation agreement”³⁰. However, these solutions would imply many modifications of the ICAO, and the very few potential beneficiaries of such endeavor lack the political will to bring about these changes. The ICAO Council issued a working paper in 2005³¹ regarding the potential involvement of the organization in the regulation of sub-orbital flights, however no actions were taken to further its role in the coordination of launch operations with air traffic. During the Legal Subcommittee of UNCOPUOS 2010 session on the definition and delimitation of outer space, the ICAO Secretariat was asked to make a ‘comprehensive presentation on current and foreseeable civil aviation operations, with particular emphasis on the upper limit of those operations’. However the Secretariat limited itself to referring to the aforementioned working paper.

In conclusion, it seems as though the making of international regulations for launch activities is bound to be delayed for some time. While there is a need for a clarification of the

26 Peter VAN FENEMA, *op. cit.*, note 3, p. 411.

27 I.e. ‘Raumfahrzeuge, Raketen und ähnliche Flugkörper gelten als Luftfahrzeuge, solange sie sich im Luftraum befinden’: German Aviation Code (*Luftverkehrsgesetz*), Chapter 1, Subch. VI, *Arten von Luftfahrzeugen* (‘types of aircraft’), www.gesetze-im-internet.de/luftvg/index.html, last accessed 15 October 2016.

28 Cf. Art. 87(1), United Nations Convention on the Law of the Sea, Montego Bay, done 10 December 1982, entered into force 16 November 1994; 1833 UNTS 3 and 1835 UNTS 261; UKTS 1999 No. 81; Cmnd. 8941; ATS 1994 No. 31; 21 ILM 1261 (1982); S. Treaty Doc. No. 103-39: ‘Freedom of the high seas ... comprises, *inter alia* ... (b) freedom of overflight’.

29 Peter VAN FENEMA, *op. cit.*, note 3, p. 416-417.

30 IAA, *Cosmic Study on Space Traffic Management*, chs 2.2.5 (provisions of air law) and 2.3.1 (air traffic), 2006. URL: <https://iaaweb.org/iaa/Studies/spacetraffic.pdf>

31 The ICAO Secretariat study, prepared for the Council’s 175th session, entitled ‘Concept of sub-orbital flights’, concluded *i.a.*: ‘6.3 *The Chicago Convention applies to international air navigation but current commercial activities envisage sub-orbital flights departing from and landing at the same place, which may not entail the crossing of foreign air spaces. Should however foreign air space(s) be traversed, and should it be eventually determined that sub-orbital flights would be subject to international air law, pertinent Annexes to the Chicago Convention would in principle be amenable to their regulation*’; ICAO Working Paper C-WP/12436 of 30/05/05. URL: http://www.unoosa.org/pdf/limited/c2/AC105_C2_2010_CRP09E.pdf

definition of “space object” as well as the delimitation of outer space, the redaction of official rules concerning suborbital flights as well as the coordination of air and space traffic implemented by the ICAO, or at least a more active role in cooperation between states, is still pending. Political momentum as well as the small number of directly concerned states seems to prevent any international legal action. In the meantime, domestic coordination between the authorities respectively responsible for air traffic and space activities might be an ideal short-term solution. However, a Space Traffic Management Treaty could still be of use for several issues, mostly involving operations taking place in orbit and beyond.

3. Regulation of space activities in orbit

While the question of the interaction between air space and outer space during the launch phase pose a certain number of questions about delimitation, the nature of vehicles traveling through them and the coordination of traffic in both these domains, most contemporary issue on Space Traffic Management concern in-orbit operations. These issues mainly focus on the establishment of sustainable space activities into a precious environment. A few key items have already been the subject of several attempts to formulate rules of different shapes, including a variety of recommendations, charters, guidelines, and codes of conduct but might benefit from being integrated into a more compelling international STM regime.

The first issue to address is the need for a comprehensive Space Situational Awareness Information and Data Sharing legal framework, in order to settle political challenges and assure the effective and transparent provision of unified SSA information and data to spacecraft or space object operators on a global scale. To accomplish that, it seems crucial to consider the establishment of an international clearinghouse for data and information sharing, based on article X of the Outer Space Treaty of 1967 which promotes international cooperation by asking States Parties to consider requests to observe space objects launched by other States Parties. The Space Data Association Limited (SDA), founded by the three major worldwide satellite operators (Inmarsat, Intelsat and SES) could be used as a model for such a clearinghouse, inasmuch as the necessity of this type of structure is widely recognized by both commercial and civil governmental operators. While in Air Traffic Management the provision of services from States is achieved by dividing airspace into multiple flight information regions (FIR), the nature of space activities does not allow for the same system. Indeed, satellites in LEO can go around the Earth in about ninety minutes, passing over a country merely in a few seconds. Using a similar technique as flight information regions for STM would not be realistic, especially since the concept implies the mutual recognition of every State having “complete and exclusive sovereignty over the airspace above its territory”³², which does not

³² *Convention on International Civil Aviation*, 7 December 1944, 15 UNTS 295, ICAO Doc 7300/6 (entered into force 4 April 1947), art. 1, URL: http://www.icao.int/publications/Documents/7300_orig.pdf

exist in international space law³³. Therefore, it seems more efficient to designate a clearinghouse as the central data provider for STM, instead of requiring each State to directly provide information for their own space operations³⁴. This Data Sharing Center³⁵ would be charged with gathering observation and operation data from SSA entities and operators in order to then provide the information necessary for space activities to the operators concerned with space traffic. This clearinghouse could also delete, or anonymize sensitive information and data (for example relative to matters of national security) upon request from data providers as well. For now, only the respective militaries of the US and Russia can provide comprehensive information and data for SSA, but the limited ability of other states (such as Australia, China, France, Germany or Japan) could still be used to increase their accuracy. The data provision from concerned States could be on a voluntary basis at first but it would have to become a legal obligation eventually in order to achieve constant data gathering with equal basis among all spacefaring nations. A new international treaty would be needed to impose such obligations to States.

The second question an international STM regime would have to answer is that of the space debris mitigation problem. These “*man-made objects, including fragments and elements thereof, in Earth orbit or re-entering the atmosphere, that are non-functional*”³⁶ constitute a problem because of their high velocity (7,500 m/s or much higher). They can represent a threat to functional space objects and, although it is relatively rare, even to structures or people on the ground when they de-orbit if they are large enough or contain hazardous materials³⁷, such as radioactive substances. This phenomenon can be assimilated to the “tragedy of the commons” theory, as benefits of individual space missions accrue primarily to the entities conducting these activities while the detrimental impact of space exploitation can have negative consequences for all those involved in the sector and even others³⁸. As a consequence, regulations adopted by a single or multiple states to fight off the harmful environmental effects of space activities would be ineffective. Space-faring nations adhering to debris mitigation requirements may find themselves at a competitive disadvantage against those who do not observe similar measures. On the international scale, the U.N. space treaties do not address the issue of space debris, mostly because there was no issue at the time the treaties were adopted. Actual international dialogue concerning the regulation of space debris started in the early 1980s, and the Inter-Agency Space Debris Coordination Committee (IADC) was

33 *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, 18 UST 2410, TIAS No 6347, 6 ILM 386 (entered into force on 10 October 1967), art. 2, URL: http://www.unoosa.org/pdf/gares/ARES_21_2222E.pdf

34 Yu Takeuchi, *op. cit.*, note 9, p. 52-53.

35 *Ibidem*.

36 Technical Report on space debris, United Nations General Assembly. Technical report of the Scientific and Technical Subcommittee on space debris. UN Doc. A/AC.105/720, 1999.

37 https://en.wikipedia.org/wiki/Space_debris#To_Earth

38 Lotta VIKARI, "Environmental aspects of space activities", *Handbook of Space Law*, Frans Von Der DUNK (dir.) with Fabio TRONCHETTI, Edward Elgar Publishing, 2015, 1100 p., p. 717.

established in 1993 upon the initiative of the world's major space agencies. After several years, the IADC developed space debris mitigation guidelines in 2002, which served as the basis for the space debris mitigation guidelines developed and adopted by UNCOPUOS in 2009³⁹. These guidelines are not legally binding under international law and work only on a voluntary basis. Still, most national space agencies have been implementing the guidelines for years. Moreover, several states have included provisions on space debris mitigation and prevention in their national space legislation, such as the US Debris Mitigation Standard Practices⁴⁰, based on the NASA Safety Standard, developed by NASA and the Department of Defense. These standard practices have four objectives: control of debris release during normal operations; minimization of debris generated by accidental explosions; choice of safe flight profile and operational configuration; postmission disposal of space objects, either by re- or de-orbiting. The European Union Draft Code of Conduct for Outer Space Activities⁴¹, which was published by the EU in 2008 with a revised draft released in September 2010, is an instrument meant to be applicable to the space activities of the subscribing states and nongovernmental entities under their jurisdiction. It also addresses the issue of space debris and contains several measures aiming to prevent, reduce and mitigate the creation of space debris. While these various national regulations have helped to improve the mitigation of space debris, they might not constitute an optimal solution in the long run. The moment might be for space-faring nations to agree on a set of harmonized binding measures of both technical and legal nature to prevent and manage the multiplication of space debris during space activities. This might represent the only viable solution to ensure that all actors of the space sector, governments and private entities alike, act in such a way so as to ensure the protection of the space environment as well as the safety of space objects.

Finally, the last issue a dedicated international treaty would need to address is that of State responsibility and liability in STM. The current liability system of international space law establishes fault-based liability for in-orbit damages and absolute liability for ground damages⁴². But both proposition present gaps in regard to contemporary space activities. First of all, the gap between the State exercising jurisdiction and control over a space activity (or State of registry), as per article VIII of the Outer Space Treaty, and the State authorizing and supervising the activity, as per article VI of said Treaty. For example, if a private company in State A were to contract with a launch operator from State B to launch a space object, State A would normally consult with State B

39 UNCOPUOS, *Space Debris Mitigation Guidelines*, United Nations Office for Outer Space Affairs, 2010, http://www.unoosa.org/pdf/bst/COPUOS_SPACE_DEBRIS_MITIGATION_GUIDELINES.pdf.

40 US Government, *Orbital Debris Mitigation Standard Practices*, december 2000, URL: https://orbitaldebris.jsc.nasa.gov/library/usg_od_standard_practices.pdf

41 *DRAFT International Code of Conduct for Outer Space Activities*, European Union (September 16, 2013). URL: <http://www.consilium.europa.eu/uedocs/cmsUpload/st14455.en10.pdf>

42 *Convention on International Liability for Damage Caused by Space Objects*, 29 March 1972, 961 UNTS 187; 24 UST 2389; 10 ILM 965 (1971) (entered into force 1 September 1972). URL: http://www.unoosa.org/pdf/gares/ARES_26_2777E.pdf

regarding the object's registration in accordance with Article II.2 of the Registration Convention⁴³. However, a problem could occur if State B were to transfer the satellite's operation to a third State (State C) after having operated it for a certain amount of time. Since the State of registry is assumed to be the launching State⁴⁴, how can State C exercise its jurisdiction and control over the satellite? The problem with the concept of "launching State" is that the liability regime of the UN space treaties does not seem to consider that the operation of a spacecraft could be conducted by a different State. Its discrepancy with the role of "operating State", as well as generally insufficient coordination among launching States, highlight the need to entrust certain responsibilities to the appropriate States⁴⁵. Furthermore, concerning ground damages, the Liability Convention of 1971 doesn't address the case of sub-orbital spaceflights. As mentioned before, the ICAO suggested that these spacecrafts should be regulated under international air law, at least while they share international air space with aircrafts, but does that also apply to liability in case of damages to third parties? The Rome Convention of 1952⁴⁶ designates strict liability to the operator of the aircraft against third-party damage, and States eventually accepted the *de facto* unlimited liability of the airlines for the damage inflicted on passengers. However, the lack of major accidents with a third party's casualties on ground have kept this issue from being resolved by the international community. An STM treaty could be able to clarify the situation as well as the responsibility and liability regime that weighs on sub-orbital spacecrafts. As for in-orbit damages, as the case of Cosmos-Iridium pointed out, identifying the liable state is relatively difficult because of the laboriousness of collecting objective data on the circumstances of the collision. The implementation of a SSA data sharing regime, part of an STM treaty, could help determine liability more easily. Furthermore, the potential risk of damaging daily activities on the ground gradually rises as - sometimes critical- systems malfunction due to in-orbit collision. Should ground damages be considered fault liability, or should in-orbit damages considered absolute liability? The question calls for an answer, preferably from the international community as a whole.

It seems that most issues contemporary space activities suffer from could be resolved by the adoption of an international STM regime. Not only would it help to develop international cooperation regarding the exchange of information and data on Space Situational Awareness, but concerning space debris mitigation as well, allowing for safer orbits for all space activities and actors. Moreover, developing the liability system of the UN space treaties to incorporate Space Traffic Management would enable States to conduct their space operations without fear of not being

43 *Convention on Registration of Objects Launched into Outer Space*, 6 June 1975, 28 UST 695, 1023 UNTS 15 (entry into force 15 September 1976). URL: http://www.unoosa.org/pdf/gares/ARES_29_3235E.pdf

44 *Ibid.*, art. I.

45 Yu Takeuchi, *op. cit.*, note 9, p. 68.

46 *Convention on Damage Caused by Foreign Aircraft to Third Parties on the Surface*, 7 October 1952, ICAO Doc. 7364; 310 UNTS 182 (entered into force 4 February 1958) [*Rome Convention*].

compensated for potential damages. An STM Treaty would make outer space safe enough to allow further development of space activities.

Conclusion

To conclude this paper, it should be reminded that the body of international space law established by the UN space treaties holds some *lacunae* of law. While various new issues did not exist at the time of negotiation of these treaties, the recent development of telecommunications and the promise of new prospects for the exploration and exploitation of outer space (space tourism, deep space mining, etc.) reveal the gaps left by States during the first Space Race and the need for an update of international space law. The subsequent increase in space traffic therefore has to be dealt with in an efficient manner, preferably with the participation of all space-faring nations. The development of national regulations hold out until now and will probably still hold for at least a few years on specific issues, but a STM treaty would be ideal to deal with other issues that can't be settled by individual States such as the need to ensure the sustainability of Earth's orbits and to make outer space in general a safer environment to conduct operations.

But, is an STM Treaty sufficient to ensure that these requirements are met with? Could a dedicated international organization be created with the purpose of implementing the principles of an STM Treaty? Should it be? The idea of World Space Organization was proposed for the first time in 1968 in Vienna at the UNISPACE-I, then finally postponed in 1982 (UNISPACE-II). The subject appeared again in 1999 during UNISPACE-III, when the representative of the Greek delegation, M. Vasily Cassapoglou, raised the fact that space activities and space exploration was escaping more and more to the effective control of international institutions and that one could almost called this "*new global neo-colonialism*"⁴⁷. Ms. Simone COURTEIX was partisan of the creation of a WSO in the creation of which States would participate and under which they would continue to work together to establish long-term goals. The CERDE has already identified several areas and themes that might require the creation of such an organization, including the coordination and control of the growing and sometimes alarming number of objects launched into space, as well as the implementation of programs of launch services that could benefit developing countries (transfer of technology, creation of spatial data bank or specialized staff training)⁴⁸.

The idea here would be to establish an organization competent with all aspects of space traffic management. Such an organization could not only act as a clearinghouse charged with collecting and redistributing SSA information and data, but could actively coordinate the launches of spaceports around the world, as well as cooperate with the ICAO, in order to avoid collisions with space debris or other spacecrafts (or aircrafts). If appropriate, it could also settle disputes between States according to new rules of responsibility and liability in STM and, ultimately, enact regulations relevant to its domain of competence. As part of the development of the exploitation of

47 Juan Manuel de FARIMINIÑAN GILBERT et Claudio ZANGHI, « L'organisation mondiale de l'Espace, un défi oublié ? », in Armel KERREST, *L'adaptation du droit de l'espace à ses nouveaux défis*, A. PEDONE, 2007, 318 p..
48 *Ibidem*.

resources in outer space, project OASIS⁴⁹ has developed the idea of a spaceport network infrastructure allowing, in the long term, for the exploitation of resources on planet Mars. The first step of the project would be to build a “node” in LEO, otherwise capable of offering in-orbit services (refueling, reparation, etc.), that would work under the authority of an International Spaceport Authority (ISPA) and offer services *via* a Spaceport Company (SCP). The ISPA would be created through a public-private partnership (PPP), taking example on Arianespace, and the SCP would have member States as shareholders⁵⁰. Such an Authority could be able to fulfill the role of the aforementioned WSO. However, the idea of creating this ISPA through a PPP could be detrimental: while the example of Arianespace offers some hope, it should be reminded that the European Union failed to finance the GALILEO GNSS program through private-public partnership, and was even slowed down by the subsequent disagreements that sprung from the discussions⁵¹.

The creation of such an organization would encounter some difficulties of course as the fact that such programs are generally fulfilled by individual States, or that such activities can concern important economic and industrial interest, but also national security, etc. All these considerations explain the reluctance so far of States to participate in a large-scale cooperation in this area and the preference for international agreements of limited scope. For all these reasons, it now seems important to focus on contemporary and future forms of cooperation in space and their influence on Space Law, both domestic and international.

49 CLEGG, et. al, ISU Team OASIS (September 2012) *Operations and Service Infrastructure for Space. Team Project: Spaceports*, Final Report Edition, SSPI2, Strasbourg, France, International Space University (ISU), 105 pages.

50 MUELLER, et. al, "Effective Utilization of Resources and Infrastructure for a Spaceport Network Architecture", American Institute of Aeronautics and Astronautics, 2012, 26 p., p. 15. URL: <https://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20120003443.pdf>

51 Martin Caudron, « Galileo : Le Partenariat Public-Privé à l'Épreuve du Juste Retour », *Bruges Political Research Papers / Cahiers de recherche politique de Bruges*, No 11 / février 2010.