

Review on the Outer Space Legislation: Problems and Prospects

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ABSTRACT

The relevance of this study is determined by the fact that in addition to the space and belonging of a part of the cosmos to a certain territory, there is also a question of responsibility and expansion of the used space as a sovereign territory. Accordingly, the issue of flights coordination and spacecraft ownership to the country or territory of use is important. We carried out the analysis of legislation on the understanding of the very essence of spacecraft belonging to a certain territory and on interactions between countries in the joint use and management of such apparatuses. We have revealed that this issue affects not only scientific aspects but also economic aspects (because of high costs of these devices) as well as ideological reasons for security and national sovereignty development. It is noted that the world has created a fairly broad reserve for integration of innovations into the overall structure of national economy, and the application of space technology

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will accelerate this growth. At the same time, the legal field regulators fully contribute to the adoption of regulatory and legal acts regarding the creation of an environment for the space industry development. It is shown that each country regulates its space law in accordance with its own tasks of scientific and technological development. It is determined that the space program is the driver of the development and structuring of the entire scientific and technical sector of the country's economy. It was revealed to be of the greatest interest because of technical possibility of improving and building space technology not only for national use but also at the commission of other states.

INTRODUCTION

New types of space relations, which require appropriate legal settlement, arise, develop and are formed in the present conditions of accelerating rate of scientific and technological progress in the sphere of space activities. At the same time, a complex of cosmic-legal relations connected with the exploration and use of outer space and celestial bodies undergoes significant changes. In this regard, it becomes of great importance to seek new possible directions and improve existing methods for solving current cosmic-legal issues to ensure progressive development of international and the national space law.

One of the most complicated and debatable issues of the legal theory and practice of international space law is the legal problem of airspace and outer space delimitation.¹ The term 'delimitation' comes from the Latin word *delimitate*, which means delineation, identification of the boundary. At the doctrinal level, contractual definition of the boundary between airspace and outer space is meant by the delimitation.

One cannot agree with the development of the appropriate practice regarding the delimitation in their national space legislation by individual states.²

The question of airspace and outer space delimitation, as JM Filho rightly notes, refers to the sphere of interstate relations requiring international legal regulation.³ It is worth sharing the opinion of Jakhu *et al.*, who note that the problem of airspace and outer space delimitation should be solved on the basis of a conditional border established by the consent of the states.⁴ Given that outer space is recognized as the international territory, the airspace and outer space delimitation should be solely determined by the norms of the international space law, rather than by the national legislation concerning space activities.⁵ The inadmissibility of the states' independent determination of the relevant borders is also confirmed by the international community's opposition

¹ F Tronchetti 'National Space Legislation' in JN Pelton (ed) *Fundamentals of Space Law and Policy* (Springer New York 2013) 25–35. F Tronchetti 'The Legal Framework Regulating International Outer Space Activities' in JN Pelton (ed) *Fundamentals of Space Law and Policy* (Springer New York 2013) 3–24.

² A Soucek, O Koudelka, C Venet, N Frischauf, G Gröomer, T Neger and W Balogh 'Outer Space – A "Real" Issue' in C Brünner and A Soucek (eds) *Outer Space in Society, Politics and Law* (Springer Vienna 2011) 31–218.

³ JM Filho 'Outer Space as Private Property and Theater of War?' in PM Sterns and LI Tennen (eds) *Private Law, Public Law, Metalaw and Public Policy in Space: A Liber Amicorum in Honor of Ernst Fasan* (Springer International Publishing Cham 2016) 123–44. See Tronchetti, above n 1.

⁴ RS Jakhu, JN Pelton and YOM Nyampong 'National Space Laws and the Exploitation of Natural Resources from Space' in *Space Mining and Its Regulation* (Springer International Publishing Cham 2017) 131–44. F Tronchetti 'Chinese Space Legislation: Current Situation and Possible Way Forward' in PM Sterns and LI Tennen (eds) *Private Law, Public Law, Metalaw and Public Policy in Space: A Liber Amicorum in Honor of Ernst Fasan* (Springer International Publishing Cham 2016) 81–107.

⁵ T Masson-Zwaan and R Crowther 'Legal and Regulatory Issues' in M Macdonald and V Badescu (eds) *The International Handbook of Space Technology* (Springer Berlin Heidelberg 2014) 657–75.

to the provisions of the famous 1976 Bogotá Declaration on the sovereignty of equatorial states over the geostationary orbit (GSO) sites over their territories,⁶ as it violates the fundamental principles of the international space law regarding the freedom and openness of the outer space exploration and use, as well as its non-use.

MATERIALS AND METHODS

We used an analytical method that touches upon the aspects of the legislation sources choice and forms of its development to analyze the historical development of the law concerning the outer space in the EU and US-Canada. The method of forecasting and factor analysis is used to characterize the socio-economic activity and efficiency of the space program. The prognostic method is defined in the analysis' framework of the world community countries' experience applicability for the position of the space industry development goals.

The objective of the study is comprehensive analysis of scientific and theoretical approaches to the legal problem's resolution of the airspace and outer space delimitation, as well as the expression of the author's vision of possible directions for its solution in order to improve the effectiveness of the international and national space law.

RESULTS AND DISCUSSION

The threat to space security by the proliferation of space debris has worsened to such extent that the 'Koestler effect' is already recognized as a 'sword of Damocles' for the well-being of space exploration. The question of legal responsibility for harm caused by such garbage comes up more often. It causes at least the following two problems:

- (1) 'space debris' falls within the definition of 'space object', for the harm caused by which a legally binding liability mechanism is stipulated in the Convention on International Liability for Damage Caused by Space Objects (1972) (hereinafter referred to as the Liability Convention);
- (2) how to determine the harm caused by space debris to certain objects in space and the Earth's environment. Since the answer to the first question will allow us to orient in the approaches to the mechanism of determining the amount of damage and accountability for causing harm by space debris, it seems to be reasonable to focus our research on it.

The issue of the space debris' coverage by the concept of space object is quite relevant in the doctrine of space law. In particular, Kopal *et al.* expressed their opinions on this subject.⁷

There are two points of view among the scientists. Some believe that objects created by man that clog the near-Earth space (NES) should not be considered as space object or part of it. The substantiation of this position is connected with the interpretation of

⁶ N Siemon and S Freeland 'Regulation of Space Activities in Australia' in RS Jakhu (ed) *National Regulation of Space Activities* (Springer Netherlands Dordrecht 2010) 37–59.

⁷ V Kopal, T Neger, E Walter, A Kerrest, S Stadlmeier, A Soucek and S Hobe 'Outer Space – A Legal Issue' in C Brünner and A Soucek (eds) *Outer Space in Society, Politics and Law* (Springer Vienna 2011) 219–489.

Articles C and 4 of the Liability Convention, according to which the state (or several states) that launch (es), is (are) responsible for the damage caused in any place other than the surface of the Earth based solely on the presence of guilt, which is essentially excluded, because space debris a priori mean objects the control over which is impossible. It is the integral space object that has exhausted its energy resources, its fragments, or non-technical objects that are part of the life conditions' organizing for researchers and users of space. The disadvantage of this approach is the difficulty in determining the party responsible for the harm caused by the active object, because any damage caused by such objects will literally remain outside the scope of the above-mentioned Convention, which does not mention space debris directly.⁸ In the dilemma between difficulties caused by the ambiguous interpretation and deduction of space debris from the literal content of the norms of obligatory regulation, we consider it reasonable to agree with the scientists who believe that anthropogenic objects that cause clogging of near-Earth space should be covered by the concept of space objects and their parts. At the same time, the very idea of a 'space object' is ambiguous, and therefore requires a separate study, which will be conducted in the context of its correlation with space debris.

The first case of explosion of the Ablestar space launch vehicle with three satellites on 29 June 1961 was demonstrative for laying out the foundations of understanding space debris in the concept of space object. The mission was successful, but on the 77th minute the fuel tank exploded and formed a cloud of debris of about 300 particles, 176 of which still remain in their orbits. These circumstances worked out before the adoption of the treaties regulating space activities. Therefore, it can be considered quite natural that, having learned from the experience of unsuccessful attempts to bring space objects to near-Earth space, the states established a liability regime in Article 7 of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies of 1967 (hereinafter referred to as the 'Outer Space Treaty'). They extended the concept of space object to its constituent parts. Later on, using this concept also in the following international treaties on space activities, the prerequisites for covering the content of the space object with a modern understanding of space debris were laid out.⁹

Since space debris is considered to be inactive and therefore uncontrolled objects, not all of them are available for monitoring. In the present time, it is possible to detect particles with a size of 2 mm in low Earth orbit up to 1000 km above the Earth level by radar and from 30 cm on GSO using optical devices. At the same time, the selective nature of their sounding leaves a significant part of outer space hidden for human tracing. In addition, insufficient knowledge of the properties of the small particles trajectory correlation with the factors of the space environment makes the data of space debris modeling by minute particles inaccurate.

This was also reflected on the doctrinal level, because from the definition in which state space objects could be considered garbage, a discussion on the definition of the latter began. There is a need to call abandoned space objects as 'junk'. In contrast, only

⁸ M Bhatt 'Constituting Outer Space: The Governance of Planetary Settlements and Artificial Habitats' in CS Cockell (ed) *Human Governance Beyond Earth: Implications for Freedom* (Springer International Publishing Cham 2015) 149–71.

⁹ 'The United Nations and Outer Space: Celebrating 50 Years of Space Achievements' in K-U Schrogl, C Mathieu and N Peter (eds) *Yearbook on Space Policy 2007/2008: From Policies to Programmes* (Springer Vienna 2009) 237–52.

fragments can be called garbage, rather than a holistic, albeit not functional, space object. However, in order to clarify how the actual understanding of space debris and the normative definition of space object are correlated, it is necessary to analyze the immanent properties of the latter.

Scientific literature contains different approaches to understanding of the space object. The most comprehensive approach to the corresponding concept is contained in the Encyclopedia of Cosmonautics, where the space object is understood as a body located in outer space. Such objects are divided into natural and artificial. Among the artificial objects are space vehicles, the afterbodies, and their parts; and the natural are celestial bodies. The position that narrows this concept by only focusing attention on the artificial nature of these objects and therefore defines the space object as a technical device (apparatus) created by man and intended for use in outer space is considered excellent. Similar but more focused view of the designated concept, which understands space object as an artificially created object that comes out on its own or is taken out to the near-Earth orbit or farther, into outer space. It is intended for activity in outer space and on celestial bodies. Space objects include artificial satellites, space apparatuses, and their manned vehicles. Consequently, the doctrinal interpretation of the space object concept gives grounds for identifying it as an artificially created technical device intended for use in outer space.

Let us analyze the specific properties of this technical device in more detail. They identify it as a space object, based on the analysis of international documents developed for the regulation of space activities. The Convention on Liability and the Convention on Registration of Objects Launched into Outer Space (1975) (hereinafter referred to as the Registration Convention) under a notion that is not actually disclosed, specify only the items covered by this concept: the constituent parts of the space object, means of its delivery and components. That is, in order to find out what actually the space object is, one should proceed from the established practice of space activity, the results of which are fixed in international treaties and other normative acts, and carry out their system analysis.¹⁰

The specialists in the field of space law have made several attempts to define the concept of space object more clearly than defined in the existing treaties. Thus, the Convention on the Creation of European Organization for the Development and Construction of Space Vehicle Launchers (ELDO) of 1962 in Article 19 defines space object as ‘an apparatus intended to be put into orbit as a satellite of the Earth or another celestial body or for flight to other trajectories in outer space’. In the Draft Code of Principles on the Exploration and Use of Outer Space of 1962, created by the David Davis London Institute for International Affairs, space object is viewed as any spacecraft capable of orbiting or moving into outer space. 1971 World Administrative Radio Conference defines space object as a spacecraft, that is, a vehicle created by man, designed to be launched beyond the main part of the Earth’s atmosphere. The Radio Regulations of the International Telecommunication Union 1979 give a similar definition but mark it as a ‘space shuttle’ and define it as a human-made apparatus for flying beyond the main part of the Earth’s atmosphere.¹¹

¹⁰ E Walter, N-L Remuss, A Soucek, K-U Schrogl, F Tronchetti, HR Hertzfeld and Y Schmidt “Hot” Issues and Their Handling’ in C Brünner and A Soucek (eds) *Outer Space in Society, Politics and Law* (Springer Vienna 2011) 491–725.

¹¹ O de Oliveira Bittencourt Neto *Air Space and Outer Space Defining the Limits of Outer Space for Regulatory Purposes* (Springer International Publishing Cham 2015) 5–30. O de Oliveira Bittencourt Neto *National Legislation and Comparative Law Defining the Limits of Outer Space for Regulatory Purposes* (Springer International Publishing Cham 2015) 65–70.

The approaches to the concept of space object interpretation in the national legislation of space countries are even more differentiated. So, in particular, according to the Royal Decree No. 278/1995 of 24 February 1995 in Article 4 in Spain, the definition of space object is identical to that stated in the Registration Convention. While in China, in accordance with the Regulation on Registration and Management of Objects in Space, only a specific list of names of space technology is defined that is included or not included in the objects in space, namely containing those that enter the post-atmospheric space: artificial satellites of the Earth, passenger space vehicles, instruments for Earth sounding from space, stations in space, vehicles and their components, as well as other artificial objects launched into space. At the same time, missiles and guided ballistic missiles passing through the near space for high-altitude sounding for a short time do not belong to objects in space.

The standards enshrined in the legislative acts of other countries are more substantial in this context. In particular, Article 1 of the Law of Ukraine ‘On Space Activities’ dated 15 November 1996 No. 502/96-BP contains the following concept of space activity objects (space technology)—material items of artificial origin that are designed, manufactured, and operated both in outer space (space segment, space infrastructure), and on the surface of the Earth (ground segment, ground infrastructure) for the purpose of outer space exploration and usage. A similar definition of space technology is provided in the Rules of Space Activities in Ukraine (URKT-11.03). Near-Earth space contamination during the usage of space technology is also restricted. In contrast, in the National Standard of the Russian Federation ‘Space Environment (Natural and Artificial). Model of the Space-Time Density of Flows of Anthropogenic Substance Distribution in Outer Space’—GOST R 25645.167-2005 dated 1 January 2006 directly defines the concept of space object as a body of technogenic origin that is located in near-Earth space.¹² Another RF standard ‘General Requirements for Space Facilities for Limiting Technogenic Clogging of Near-Earth Space’ No. 120 dated 9 June 2008 contains the definition of the space vehicle concept as a technical means, which includes orbital and launching means intended for solving tasks of development and use of outer space. According to the Law of the Republic of South Africa ‘On Space Affairs’ No. 84 of 6 September 1993, the launch vehicle is defined as any device manufactured or adapted for launching a spacecraft. The latter is understood as any object that is launched into the space and implements control there. The SENA Code, Section 49—Transport, Subsection 9—Commercial Space Transport, Chapter 701—Commercial Activities Concerning Space Launches, Article 70102, Paragraph 7, contains definitions of the trigger, which means the following:

- any vehicle manufactured for operation in outer space or for the delivery of payload to outer space;
- any suborbital rocket, and also in accordance with Clause 8, defines the payload as an object that a person tries to bring into outer space by means of a launch vehicle or apparatus that returns, and includes components of a launch vehicle specially designed or adapted to this object.

¹² The International Legal Framework *Legal Basis for a National Space Legislation* (Springer Netherlands Dordrecht 2004) 1–71.

The Australian Law 'On Space Activities and for the Purposes Related to It' No. 123 of 21 December 1998 defines space object as objects consisting of:

- (1) launch vehicle;
- (2) the payload (if any) that the launch vehicle delivers to or from outer space or any part of such an object, even if:
 - the part is sent only to outer space or vice versa;
 - the part was formed as a result of payload separation or load from the launch vehicle after launch.¹³

Based on the definitions given above, there is no doubt about the characterization of space object as an artificially created vehicle, which follows from the phrases, 'designed to be put into orbit or to flight', 'able to move', 'vehicle intended for launch' and 'created by man for flying'. At the same time, the controversial element of this concept definition is ambiguity in the question as to which category designates its generic property—'apparatus' or 'ship'. The difference is that spacecraft is the common name of various technical means designed to fulfill targets in space, and spaceship is only a manned space apparatus.¹⁴ This distinction follows from the logic of the standards of the 1968 Agreement on the Rescue of Astronauts and the Return of Objects Launched into Outer Space, Articles 1–4 of which are devoted to the return of the crew and its spaceship, and Article 5 regulates the specifics of the return procedure of an unmanned space object. Thus, the definition of a space object, using the category 'ship', narrows its content, and therefore a broader category of 'apparatus' should be used.

Specific feature in the above definitions shows the essence of the space object as one that is only created and intended for output or launch, and therefore may include those not yet put into orbit. However, the spatial characteristics of its location are oriented beyond the main part of the Earth's atmosphere, which in certain definitions can be concretized by dividing the latter into the Earth's orbit and other trajectories in outer space. It provokes the question regarding the location and movement of the technical means for its identification as space object.

It is also indicative that in the resolution of the UN General Assembly 1721 (16) 'International Cooperation in the Use of Outer Space for Peaceful Purposes' of 1961, which sets out the basic requirements for the registration of space objects launched into outer space, 'space objects' were called 'apparatuses'.¹⁵ The first thing that provokes the question is the linkage of the mode of space object to the moment of launch. Because according to Article 8 of the Outer Space Treaty, the mode of space objects is established from the moment of launch and entry into the relevant registers. Actually, the launch can only relatively be called a moment. In fact, it is a process that lasts from the beginning of the ignition switch to the object's exit to the planned space orbit, that is, before it makes

¹³ MS Kozyrev 'Order Adoption of Normative Legal Acts of the Federal Bodies of Executive Power' [2016] *Materials of the Afanasiev Readings* 3, 52–60.

¹⁴ P Tarikhi 'Legislation, Managerial and Administrative Turmoil' in DM Harland (ed) *The Iranian Space Endeavor: Ambitions and Reality* (Springer International Publishing Cham 2015).

¹⁵ RJ Lee 'State Responsibility and Liability for Compliance with International Space Law' in RS Jakhu (ed) *Law and Regulation of Commercial Mining of Minerals in Outer Space* (Springer Netherlands Dordrecht 2012) 95–151.

a motion along the trajectory around the Earth or another celestial body. In addition, according to Clause b of Article 1 of the Liability Convention, the launch includes the attempt. The attainment of legal certainty in the matter of the moment, from which the space object should be identified as such, in the context of the conditioning of this process by the point of its spatial location, is to a certain extent promoted by the provisions of the Liability Convention. Article 2 provides for absolute responsibility for causing damage to a space object on the Earth surface, which can be understood both before the flight, and after its return, as well as during the flight. This allows us to separate the space object from the bases, structures, other technical devices created in outer space and on celestial bodies, which are not covered by its immanent attributes.

CONCLUSIONS

Based on the analysis, it is reasonable to define the space object as a spacecraft intended for launching into the Earth's orbit, another celestial body or for flight along another trajectory regardless of the location, for which the launch was conducted.¹⁶ Such clarification will make it possible to separate international responsibility for damage caused by space object from damage caused by equipment which was not attempted to launch into outer space.

Taking into account the specifics of the design and operation of space objects which provides separation of their parts, one should not abandon the expansion of the space object mode on its components, fixed in the existing treaties. However, purely technogenic understanding of space object with a variety of types of artificial objects that pollute near-Earth space, in particular due to working tools or elements of cosmonaut equipment, limits the latter's coverage to the phrase 'constituent parts of space object'. It etymologically assumes the property of forming the whole, without which the latter cannot exist as such. It should be noted that some scientists dispute the advisability of including any anthropogenic objects in the concept of space debris only on the grounds that they are derived from cosmic objects, in particular, its small particles, such as paint peeling. We cannot agree with this position, it is obvious that the items of everyday use of manned spacecraft occupy, although not a large, but dangerous segment in space debris, but they cannot be considered as an integral part of the space object. Therefore, for a clearer legal understanding of space objects in the context of the prospect of their transformation into space debris, we consider it expedient to replace the phrase 'component parts' with the wider 'derived elements', which will remove this issue.

The concept of the space object origin is the key to substantiating the connection between it and space debris. Space debris constitutes integral inactive space objects, which cannot be used for their intended purpose, and derivations from such objects, as well as from active space objects. Since all space debris is delivered to near-Earth space by space objects, this concept establishes an objective (and not only a utilitarian) ground for spreading the norms governing activities related to space objects, to space debris.

Consequently, based on the existence of an active period of a space object existence, as well as on the use of reusable space vehicles, not every space object becomes space debris, while the latter necessarily comes from it. Therefore, summing up the conducted research, it is necessary to offer consideration of space object in the definition of space debris as its generic cluster.

¹⁶ Domestic Launch Legislation and Regulations *Launching Space Objects: Issues of Liability and Future Prospects* (Springer Netherlands Dordrecht 2001) 77–147.