

International Legal Aspects on Sustainable Development of Outer Space Activities: Combine Safety and Effectiveness in the Long-Term

*Irina Chernykh**

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Introduction

The topic “Long-term sustainability of outer space activities” was considered by the Scientific and Technical Subcommittee in accordance with General Assembly resolution 64/86¹ in 2010 and had been under consideration for eight years in a particular Working Group. The primary aim of the Working Group was

to support the preparation a report on the long-term sustainability of outer space activities, the examination of measures that could enhance the long-term sustainability of such activities and the preparation a set of best-practice guidelines.²

But during the work the most important task became to draft guidelines for the actors of outer space activities to ensure safe and sustainable future use of outer space. It included such emergency issues at international and national levels as: space debris, space operations, space weather, legal regime of outer space etc. Over the last few years several draft documents of GUIDELINES have appeared and they are the following: a number of updated

* Department of International Law, RUDN University.

1 UN Doc. A/RES/64/86, para. 10 ; UN Doc. A/64/20, para. 161.

2 UN Doc. A/AC.105/958, para. 178.

GUIDELINES,³ the first set of GUIDELINES proposed by Australia, Austria, Belgium, Brazil, Bulgaria, Canada, Colombia, Costa Rica, the Czech Republic, France, Germany, Greece, Israel, Italy, Japan, Luxembourg, the Netherlands, Poland, Portugal, the Republic of Korea, Romania, Slovakia, Spain, Sweden, the United Kingdom of Great Britain and Northern Ireland and the United States of America in 2016⁴ and GUIDELINES 2018 with 21 affirmed guidelines, a preamble and 8 unapproved guidelines.⁵

It was believed that the final version of GUIDELINES would be approved and laid down in UN General Resolution in June 2018 at the UNISPACE +50 Committee on the Peaceful Uses of Outer Space, 61st session (including the high-level UNISPACE+50 segment), but the consensus on the last guidelines was not reached. If GUIDELINES were approved, it would not be legally binding as a soft law document under international law.⁶

Notwithstanding the foregoing, GUIDELINES have seemed to be the most important document in the question of sustainable development of outer space activities recently. It consists of four sections: A) Policy and regulatory framework for space activities, B) Safety of space operations, C) International cooperation, capacity-building and awareness and D) Scientific and technical research and development. These sections touch upon the main challenges on the agenda, and if it was a binding document, it would be able to fill the gaps in the international space law.

However, the tendency is that the drafting of international treaty is difficult, over the last 40 years international community has used the non-binding documents as a tool for the transformation such provisions into national legislation and supported the development of international practices and safety frameworks for conducting outer space activities. It is obviously that soft law documents are of considerable importance, but it is not allowed to use such mechanism for each occasion. Questions of major importance should be regulated with binding documents, and issues of longevity, effectiveness and safety of outer space activities are something like that.

Moreover, to comply with GUIDELINES, to our opinion, it will be necessary to modify current outer space treaties for achieving the aim of long-term sustainability of outer space activities, because of the current framework of international space law does not totally correspond to the scientific reality and technical progress made in the space domain.

3 See : UN Doc. A/AC.105/C.1/L.339, UN Doc. A/AC.105/2014/CRP.5, UN Doc. A/AC.105/L.290, UN Doc. A/AC.105/C.1/L.340, UN Doc. A/AC.105/L.298, UN Doc. A/AC.105/C.1/L.348, UN Doc. A/AC.105/L.301.

4 See : UN Doc. A/AC.105/L.308*.

5 See :UN Doc. A/73/20; UN Doc. A/71/20 and UN Doc. A/AC.105/L.315

6 Ibid., para. 15.

In spite of long-term sustainability of outer space activities according to the GUIDELINES 2018 mean

*the ability to maintain the conduct of space activities indefinitely into the future in a manner that realizes the objectives of equitable access to the benefits of the exploration and use of outer space for peaceful purposes, in order to meet the needs of the present generations while preserving the outer space environment for future generations.*⁷

we think that “sustainability of outer space activities” can broadly be defined as sustainable, guaranteed, effective and safety outer space activities on the long-term basis. In 2010 “some delegations expressed the view that efforts to ensure the long-term sustainability of outer space activities should be considered in the wider context of sustainable development”.⁸

Thus, sustainable development of outer space activities is intended to: 1) amend outer space treaties (specifically, OST, LIAB, REG), 2) accept GUIDELINES 2018 (by way of GA Resolution) and 3) combine hard and soft documents, bearing in mind States practices on transformation provisions of soft law documents in national legislation in this sphere for one unification document based on GUIDELINES.

1.1. Challenges Regarding Space Debris and Space Traffic Management Rules

More than one thousand satellites in the earth’s orbit give billions of people on Earth significant scientific, social and economic benefits. However, the results obtained from the use of outer space are currently being exposed to several threats generated by various factors.

The first threat in the field of space activities is the increase of space debris accumulated in near-Earth space. Some scientists predict that when the amount of debris reaches a certain level, it will undergo the process of self-reproduction (Kessler effect).⁹

The second threat is the increase of space debris in the sun-synchronous orbits, located at an altitude of 700-900 km above sea level. They are used for remote sensing of the Earth. Alongside the increasing density of space debris, difficulties will arise in terms of performing various space operations aimed at exploring outer space.

In addition, even now States, whose satellites are in geostationary orbit, face high competition for receiving orbital positions in ITU as according to the article 44 ‘radio frequencies and any associated orbits, including the geostationary-satellite orbit, are limited natural resources and that they must

7 UN Doc. A/71/20 and UN Doc. A/AC.105/L.315, para. 5.

8 UN Doc. A/AC.105/958, para. 187.

9 M. La Vone, The Kessler Syndrome: 10 Interesting and Disturbing Facts, <http://www.spacesafetymagazine.com/space-debris/kessler-syndrome/>, (accessed 01.09.18).

be used rationally, efficiently and economically”.¹⁰ The dense filling the indicated orbits leads to the appearance of radio frequency interference and a reduction of the error margin to ensure a safe distance between satellites.

Increasing number of States has interest in the use of outer space for the realization of their military objectives by obtaining the necessary information from spy satellites, that affects aspects of national security. Any interference in the activities of satellites aiming at such purposes can provoke an interstate conflict, heighten tensions both on Earth and in outer space. In this regard, the space activities of States should be governed by a universal international treaty, that imposes on them the corresponding obligations based on the system of securing the space traffic.

In that regard international community must solve two problems: how to reduce the amount of space debris including its mitigation and how to make effective and safety space navigation system, considering that space debris, being a space object, is a subject to the rules of space navigation.

While the issue of the establishment a space navigation system is new, the struggle against space debris has started in the beginning of XXI century.

For at least 15 years international community has understood the importance to support sustainability of outer space and to foster the efforts by drafting soft law documents, aiming against space debris. Nowadays COPUOS drafted Recommendations on enhancing the practice of States and international intergovernmental organizations in registering space objects, which were approved in GA Resolution 62/101 of 17 December 2007; Inter-Agency Space Debris Coordination Committee approved in 2002 (rev.2007) Space Debris Mitigation Guidelines; ITU adopted in 2010 Recommendation ITU-R S.1003-2 “Environmental protection of the geostationary-satellite orbit”. European Code of Conduct for Space Debris Mitigation was taken at the European level in 2004.¹¹ In addition, upon the initiative of Canada, the Czech Republic and Germany in 2014, within the framework of the COPUOS Compendium of space debris mitigation standards was adopted by States and international organizations,¹² the Compendium is revised on a regular basis.

The problem of space debris, as well as, rational use of geostationary orbit, were also mentioned and elaborated in GUIDELINES. The following guidelines are focused on:

10 Collection of the basic texts adopted by the Plenipotentiary Conference, edition 2015, International Telecommunication Union.

11 See: European Code of Conduct for Space Debris Mitigation dated 28 June of 2004 Henry L. Stimson Center, 2004.

12 See: Compendium of space debris mitigation standards adopted by States and international organizations, 5th of September 2018, http://www.unoosa.org/documents/pdf/spacelaw/sd/Space_Debris_Compendium_COPUOS_5_sep_2018.pdf, (accessed 05.09.18).

- Promotion activities which include: the collection, sharing and dissemination of space debris monitoring information (guideline 13);
- Performance conjunction assessment during all orbital phases of a controlled flight (guideline 14);
- Investigation and consideration some new measures to manage the space debris population in the long term perspectives (guideline 28);
- Observation procedures for preparing and conducting operations on active removal [and intentional destruction] of space objects (guideline 20+21+part 22, not approved);
- Development procedures for outer space activities involving non-registered objects (guideline 22 not approved);
- Ensuring the equitable, rational and efficient use of the radio frequency spectrum and the various orbital regions used by satellites (guideline 4).

According to the understanding of the ongoing space debris problem, it is evident that it also deals with conscientious registration of space objects, its safety removal and sharing information. This is the place where the problem of space debris is connected with the requirement on space traffic rules.

Concerning space navigation and space traffic management, in 2015 the Dutch scientist P. Fenema wrote:

The absence of international space traffic management rules can at least partially be explained by the fact that there is neither an intergovernmental organization or specialized agency, nor a trade association that feels responsible for the creation of international 'rules of the road'.¹³

Soon, the same year, COPUOS decided to include into agenda the issue of space traffic management. The importance of the topic is obvious: 1) the need for cleansing of outer space from space debris (one of the variant is taking it from the orbit back to the Earth by partial combustion in dense layers of the atmosphere); 2) periodic collisions of space debris with the ISS and the threat of space objects' collision;¹⁴ 3) the increase of space activities' actors; and 4) development a new activity – suborbital flights, which are supposed to be regulated by both international air law and space law.

Otherwise, article III of LIAB doesn't work. How to decide who will be internationally liable for the damage occurred in outer space in the process when two space objects collide with each other? Nobody violates anything

13 P. Fenema, Legal aspects of launch services and space transportation, in F. Dunk, F. Tronchetti (ed.), Handbook of Space Law, Edward Elgar Publishing, Cheltenham, 2015, p. 405.

14 Secure World Foundation report, Space Sustainability – a practical guide. (8) 2012.

since space traffic management does not exist. The cause of the collision should be the fact of violation of the rule of law, if there is no such rule, then any activity will be lawful.

Today the discussion of that problem raises many concerns and even rage. Some suggest that ICAO should regulate space traffic, others think about creating system of monitoring space objects and space debris on the basis current international hard and soft law documents and mechanisms, somebody offers to think about something new or in the COPUOS's framework.

Nevertheless, the outer space treaties and soft law documents should be used for building up such space navigation system, which will be safe in the long-term basis outer space for us and future generations, or with the passage of time we will lose what we have. Can we imagine if planes fly without air navigational rules? Of course not! Therefore, outer space activity requires space traffic management.

1.2. "Launching State" v. "State of Registry"

One of the most controversial issues in the doctrine of international space law to date are questions about the responsibility of States for national space activities (Article VI of OST) and for damage caused by their space objects (liability, Article VII OST and articles II-III LIAB).¹⁵

International space law to determine the relationship between State and commercial activities of non-governmental entities contains "identification features": launching and registration, which should be regulated with national legislation, not inconsistent with the applicable international space law.

Evidence of the launching, including attempted launching is disclosed on the notion of launching State, which means according to LIAB and REG: 1) A State which launches or procures the launching of a space object; 2) A State from whose territory or facility a space object is launched.

Evidence of the registration according to article VIII OST grants rights and obligations to the State of registry to retain jurisdiction and control over such object, and over any personnel thereof, while in outer space or on a celestial body. At the same time article II REG discloses this evidence as an obligation of a launching State to register a space object, which it is going to launch, and the State shall register the space object by means of an entry in an appropriate registry which it shall maintain.

Therefore, we can provide some legal examples to illustrate different situations on the question of causality responsibility/liability and evidences of the launching and the registration.

15 G.P. Zhukov, O.A. Volynskaya, Current Problems of International Responsibility and Liability in the Domain of Space Activities, Moscow J. of International Law, 91 (2013) 92–103.

- 1) If the State is only a State-party to OST, it will be responsible or liable, depending on the following situation:
 - a) according to the article VI it will bear international responsibility for national activities in outer space;
 - b) according to the article VII it will be internationally liable for damage by such object or its component parts on the Earth, in air space or in outer space, including the Moon and other celestial bodies;
 - c) if the State violates the provisions of OST and cause damage, it will be responsible and liable.

The evidence of a liable State coincides with the definition of a launching State. Responsibility and fact of the registration are not interconnected by yourself.

- 2) If the State only a State-party to LIAB, which solely regulates cases of liability for the damage, such State will be a launching State according to the conventional definition.¹⁶ Liability and fact of the registration are not connected between by yourself.
- 3) If the State is only a State-party to REG, for the meaning of the Convention a State of registry will be a launching State. Fact of space object's registration assumes that a State of registry is a launching State.

Consequently, if the State is a State-party to all three international space treaties, bringing to responsibility will be based on attributes of the launch or procuring the launching, the territory or facility a space object is launched. All attributes are equal, and one can bring to responsibility using any of them.¹⁷

The result is that registration as a necessary action for retaining jurisdiction and controlling over activities, carrying on by governmental agencies or by non-governmental entities, has no connection with the responsibility of that State for the damage.

At the same time, in the field of commercial space activities are being carried out also at the international level and involve several States, the evidences of a launching State and the possibility of the State, that registered a space object to ensure jurisdiction and control, do not solve the main issue: which State is *de facto* controller of a space object and will be liable for the damage.¹⁸ According to the article VII it is a launching State.

16 For example, Bosnia and Herzegovina, Croatia, Gabon, Malta, Senegal // Status of international agreements relating to activities in outer space as at 1st January 2017 // UN Doc. A/AC.105/C.2/2017/CRP.7, item 5 of the provisional agenda.

17 I. Diederiks-Verschoor, *An Introduction to Space Law*, second revised ed., Kluwer Law International, Alphen aan den Rijn, 1999, p. 38.

18 R.L. Spencer, *International Space Law: A Basis for National Regulation*, in Ram S. Jakhu (ed.), *National Regulation of Space Activities*, Space Regulations Library, 2010, p. 3.

The question about safety has not been solved too: how a launching State will ensure safety if it doesn't control the space object? The State of registry controls such object according to the article VIII OST, not a launching State. If we take a look at the drafting history of the LIAB, we will see that there were lots of contradictions between State delegations: include or did not include fault-based liability (USA), liability limits (USA), indirect damage (India, Japan, France, Canada – supported it; USA and UK – partially) or place the onus on a State, which territory was used for the launch (France and Argentina were disagree).¹⁹ One can suggest that it had to be necessary more precisely to discuss the project. To our opinion the main inconsistency of LIAB in the circumstances of the modern realities is the concept of the launching state, implying that the State of registration is the launching State. Indeed, such practice existed at the dawn of space exploration, when only two States, the USSR and the USA, could develop and launch space objects into outer space. All activities for the manufacture and launch of a space object from the beginning to the end were under the control of one State, from whose territory or facility a space object was launched.

Today different States are responsible for the manufacture, preparation of facilities for launch and launch a space object, further jurisdiction and control over it, including many non-governmental legal entities. There is a situation in which, for example: the first State provides facilities for launch a space object and launches; the second State, whose satellite is to be put into orbit, registers this space object, the third State provides the territory from which the object is launched (for instance, Russia and Kazakhstan),²⁰ or in particular stages that may remain in orbit after the launch, are often registered separately from the space objects they deliver into orbit, or any third State registers a space object.²¹ Otherwise, the concept of launching State doesn't include sea launch²² or air launch (from the aircraft)²³ and future transfer of right to ownership or control over the in-orbit space object.²⁴

19 A.S. Piradov, G.P. Zhukov, V.G. Emin, V.V. Aldoshin, *Tendency of space law developing*, Science, Moscow, 1971, p. 21.

20 See: G.P. Zhukov, 40 years 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, *Russian Yearbook of International Law* 2007 215–216; Agreement between the Russian Federation and the Republic of Kazakhstan on the basic principles and conditions of use of the cosmodrome “Baikonur” (Moscow, 10 December 1994).

21 UN Doc. A/AC.105/768.

22 I. Diederiks-Verschoor, *An Introduction to Space Law*, second revised ed., Kluwer Law International, Alphen aan den Rijn, 1999, p. 38–39.

23 Examples of multinational companies providing launch services are the Russian-French project Starsem or the Russian-German Eurocot project.

24 UN Doc. A/AC.105/763.

In the case of sea launch, which is located on the high seas, there is a collision between facilities from which a space object is supposed to be launched; the launching State, which procures it; as well as the absence of the state's territory and the existence of several States that organize the launch. The self-propelled submersible *Odyssey* launch platform and the *Sea Launch Commander* vessel were developed by the Norwegian company *Kvaerner*, the *Zenit-3SL* launch vehicle manufactured by Ukraine; production and delivery of the *DM-SL* upper stage, the *RD-17* rocket engine and the launch facilities were carried out by Russia; and the ground complex itself was in the American port of *Long-Beach*.²⁵

The above-mentioned and several other innovations were due to significant changes in cosmonautics, and the expansion of the space activities scale. As a result, LSC established Working Group under the chairmanship of Kai-Uwe Schrogl (Germany) was providing for review of the concept of the "launching State" in 2000-2002 years.²⁶ The result is that GA Resolution 59/115 of 10 December 2004 "Application of the concept of the «launching State»"²⁷ was accepted. According to the Resolution it "recommends that States consider the conclusion of agreements in accordance with the Liability Convention with respect to joint launches or cooperation programmes". This approach seems to be a good way out of the current situation but does not provide guarantees for drafting by all States involved in space activities, at present and in the future, such national legislation in accordance with existing international norms in the field of international space law. The analysis of national space legislation has shown that some States (most of them) have already had national legislation, regulating joint launches, licencing, types of space activities which are under control etc.²⁸ However, despite the existence at the national level of some regulatory and legal framework in the field of space activities, it is quite diverse and does not exist in all States-parties to the outer space treaties. Moreover, this does not contribute to the formation of a uniform practice that would ensure the safety of space activities.

In this regard, to develop a unified approach to the concept of the "launching state", we see it expedient to develop and consolidate the renewed concept of the launching State at the international level, the key elements of which will not be the territory or facilities of the State, or the launch or procuring of the launch a space object, but the fact of registration of a space object. This approach is caused by the following facts:

Firstly, States should register space objects in a national registry in accordance with REG and due to GA Resolution 62/101 of 17 December

25 A. Greek, A man who bought a cosmodrome, *Popular Mechanic* (11) 2017 p.48–54.

26 UN Doc. A/AC.105/787.

27 UN Doc. ST/SPACE/61/Rev.2. p. 76–77.

28 See: Australian Space Activities Act No. 123 dated 1998 (amended by Act No. 100 of 2002) or UN Doc. A/AC.105/768.

2007 “Recommendations on enhancing the practice of States and international intergovernmental organizations in registering space objects”. However, according to the statistics, not all space objects launched into outer space have been registered/are being registered in the UN Register of Space Objects.

Secondly, the evidence from practice shows, even in the case of furnishing information about the launched object to UN Register of Space Objects, it often happens that these data does not contain all necessary characteristics. For example, the Chilean State in the “orbit parameters graph” for the FASAT-A satellite launched on August 31, 1995, did not specify such parameters, citing an unsuccessful launch due to the problems of undocking from the Ukrainian satellite Sich-1, to which it was attached to this day.²⁹ The Ukrainian side, in turn, on the 22th of September, 1995, gave information about the successful launch of the Sich-1 satellite and its orbital parameters, without indicating the presence of a satellite of Chile.³⁰ According to information provided by Italy on November 7, 2014 about its launched objects on the satellite UniSat-5, there was the space object of Spain HumSat-D514,³¹ but Spain has not provided full information about this satellite yet.

The above examples show that there is confusion in terminology both for the States providing such information: who should send such information – the launching State or the State, in whose national registry this object has entered.

That is why, it is proposed to abandon the concept of the launching State as responsible for damage caused by a space object and obliged to register it, since in practice it is the State of registry of a space object, that controls it and is responsible for it.

An exception will be liability for damage caused due to an unsuccessful launch of a space object from the territory of another State. In this case, the liable State will be a State providing launch services or its launchers, unless it can be proved that the damage was caused by the fault of the contracting State, for example, if such a State provided its defective space object.

To implement our proposal, it will be necessary to amend Art. II of LIAB, replacing for the concept of the “launching State” with the “State of registration” of the space object and then everywhere in the text, change in REG the concept of a “launching State” to “the State of registry”, and Art. VII of OST replacing all the features that initially characterize the “launching State”, to the “State of registry of the space object”.

Moreover, it is necessary to bear in mind GUIDELINES’ provision – guideline 6 “Enhance the practice of registering space objects”, especially in

29 UN Doc. ST/SG/SER.E/660.

30 UN Doc. ST/SG/SER.E/291.

31 UN Doc. ST/SG/SER.E/734.

the context ‘to provide timely information that contributes to the long-term sustainability of outer space activities and should consider also providing information on space objects’.³² To ensure safety at all stages of space activities, from pre-launch events to the launch of a space object into its orbit and its descent, it is also necessary to amend REG by determining the time when information about the launch of a space object is transferred to both the national registry and the register of UNOOSA.

The information on the launch of a space object must be transmitted by the State of registration and must be preceded by the launch. In case of unsuccessful launch, when the space object was not put into orbit or was launched into the declared orbit, it is necessary to transfer new information immediately. Also, it seems appropriate to change the name of the document, which is maintained by UN Secretary-General, with the Registry to “the International Registry”.

1.3. Convention for the Unification of Certain Rules for Outer Space Activities

Analyzing GUIDELINES we can see that its provisions provide minimum specific recommendations for States concerning national legislation, the safety of space operations, international cooperation, scientific research and development. It contains references to the already adopted principles, GA resolutions and the existing outer space treaties.

Whereas as it said in item. 11 of GUIDELINES,

it addresses the policy, regulatory, operational, safety, scientific, technical, international cooperation and capacity-building aspects of space activities and is based on a substantial body of knowledge, as well as the experiences of States, international intergovernmental organizations and relevant national and international non-governmental entities.

The State’s practice has shown that national legislation is very different in questions of national space activities, so the harmonization of the norms with minimum requirements to national space activities’ actors at international level can lead to the common practice in that sphere.

GUIDELINES could be used as a base for such treaty, regulating space activities, carried out by non-governmental entities. Although, in the GUIDELINES said that “it is relevant for both governmental and non-governmental entities”.³³

Article VI of OST, surely, establishes international responsibility of States-parties for national activities [...], whether such activities are carried on by governmental agencies or by non-governmental entities, and for assuring that national activities are carried out in conformity with the provisions set forth

32 UN Doc. A/AC.105/L.315.

33 UN Doc. A/AC.105/L.315, item. 11.

in OST”, but in connection with the ever-increasing commercialization of space (corporations, concerns, enterprises and other commercial organizations), we believe that it is necessary to adopt a special international treaty with a working title – the Convention for the Unification of Certain Rules for the Implementation of Space Activities, similar to the conventions in the field of international air law, such as: Convention for the Unification of Certain Rules Relating to International Carriage by Air in 1929 (Warsaw Convention) and the Convention for the Unification of Certain Rules international air traffic in 1999 (Montreal Convention).

Since abovementioned documents regulate carriage of persons, baggage or cargo performed by aircraft for reward performed by the State or by legally constituted public bodies (articles I and II of Warsaw Convention and Montreal Convention), the new treaty will have the same aim. It will regulate such questions as: licensing, ensuring, space carriage of persons (future suborbital and orbital flights, requirements to space tourists), Earth remote sensing, direct television broadcasting etc. Therefore, it will be rationally to use GUIDELINES, as “they are also relevant for all space activities, whether planned or ongoing, as practicable, and for all phases of a space mission, including launch, operation and end-of-life disposal”.³⁴

The minimum requirements for the implementation of space activities established by the proposed Convention can guarantee the safety and long-term nature of space activities, especially in the field of certification processes, namely, using of nuclear power sources. In addition, a special international treaty will resolve the issue of the increasing share of legal entities (corporations, concerns, enterprises and other commercial organizations) in the commercialization of space activities.

1.4. Certification Requirements in the Sphere of Use Nuclear Power Sources

The use of nuclear power sources is not an applied type of space activity, but plays an important role in the possibility of carrying out space operations.

A.D. Terekhov wrote the following rightly:

*The use of nuclear power sources in space should not in itself be attributed to the application of space technology. The nuclear power plant is designed to power the equipment of an object that can perform a variety of functions – research, application or any other.*³⁵

Until 1983, there were no ideas on the prohibition of the usage of nuclear energy for space flight in international space law, in principle. Still, some delegations express a desire to impose a moratorium on their use until appropriate mandatory international standards or an international legal

34 Ibid.

35 A.D. Terekhov, International legal aspects on using of nuclear power sources in outer space, Moscow, 1984, p.7–8.

regime designed to protect the Earth and outer space from possible damage when using nuclear power sources.³⁶

The appearance of a new type of energy is connected with the replacement of sources of hydrocarbon energy and limited resources of batteries with photoelectric elements and nuclear power sources. As a general rule, satellites use either nuclear reactors³⁷ operating on highly enriched uranium-235, or radioisotope thermoelectric generators (RTG) and radioisotope heating units (RHUs).

The main problem of the safe use of nuclear power sources is the provision of radiation safety, not only on Earth, but also in outer space. In this case, A.D. Terekhov suggests that

*the probability that an object with a nuclear installation, being in space, will cause another space object, or its crew, the damage caused precisely by the finding of a nuclear power source on board the first object, is so small that it can be neglected.*³⁸

The increasing number of participants in space activities tells us the opposite. Due to the fact that nuclear power sources are a reliable and durable source of energy for the spacecraft, but there were also concerns about safe use of it, in 1978 the topic on the use of nuclear power sources was placed on the agenda.

More than 20 years the Principles Relevant to the Use of Nuclear Power Sources in Outer Space have been developed in the STSC in conjunction with its LSC. This document includes 11 principles. The most important for the questions of safety are the principles from 3rd to the 5th, that ensure safety of nuclear power sources use.

However, the Principles Relevant to the Use of Nuclear Power Sources in Outer Space is a document of “soft law”, without binding force. At the same time there is not enough *opinio juris* for acquiring the status of an international legal custom.³⁹

36 G. Goh Escolar, M. Reynders, Historical Background and Context, in S. Hobe, B. Schmidt-Tedd, K.-U. Schrogl (eds.), Cologne Commentary on Space Law. Volume III, Heymanns, Cologne, 2015, p. 198.

37 It works on Uranium-235; it is “small fission reactors that are in principle similar to terrestrial reactors but with different retained design options, especially for reactors cores, cooling, moderation and control system”. L. Summerer L., B. Gardini, ESA’s Approach to Nuclear Power Sources for Space Applications, Proceedings of ICAPP, 2007.

38 A.D. Terekhov, International legal aspects on using of nuclear power sources in outer space, Moscow, 1984, p. 52.

39 G. Goh Escolar, M. Reynders, Historical Background and Context, in S. Hobe, B. Schmidt-Tedd, K.-U. Schrogl (eds.), Cologne Commentary on Space Law. Volume III, Heymanns, Cologne, 2015, p. 196–199.

The impossibility of recognizing the Principles Relevant to the Use of Nuclear Power Sources in Outer Space as customs, is confirmed by a small and different practice of States. For example, the USA uses its own standards and certification procedures, which are basically similar to the Principles. A principle, like conducting a thorough and comprehensive security assessment before launching,⁴⁰ was applied by Russia and the USA only twice, for example, in accordance with its own standards in the field of environmental safety.⁴¹

In addition to the existing Principles Relevant to the Use of Nuclear Power Sources in Outer Space in 2009, STSC within the framework of the established Working Group on the Use of Nuclear Power Sources in Outer Space, with the assistance and active cooperation with the IAEA adopted the Safety Framework for Nuclear Power Source Applications in Outer Space 2009.⁴²

The main objective of this document is to improve the safety of nuclear power sources in outer space, as well as its use as a voluntary guide for national purposes.⁴³ The document contains such important sections as recommendations for the governments of States, recommendations regarding the management of organizations participating in space activities, as well as recommendations of a technical nature.

The importance of developing an international legal regime for the use of nuclear power sources is undoubtedly associated with their advantages for long-range space exploration and for the exploration of the solar system as a whole. It should also be noted that the States returned to the idea of using of nuclear engines for interplanetary flights. There are even ideas on the development of super-powerful fuels capable of delivering a spacecraft to Mars and back in 2-4 months.⁴⁴

Proceeding from the objectives of achieving the sustainability of outer space activities, the use of nuclear power sources is necessary, because they provide

40 Principles Relevant to the Use of Nuclear Power Sources in Outer Space 1992, principle IV.

41 See: I.A. Chernykh, Soft law realisation in the context of “Principles relevant to the use of nuclear power sources in outer space”: case study the Russian Federation, the United States of America and the European Union States, *Vestnik Rossiiskogo universiteta druzhby narodov. Seriya: Yuridicheskie nauki*, (3) 2017, p.436–450.

42 UN Doc. A/AC.105/934; L. Summerer, U.M. Bohlmann, The STSC/IAEA Safety Framework for Space Nuclear Power Source Applications – Influence of Non-Binding Recommendations, in I. Marboe (ed.), *Soft Law in Outer Space. The Function of Non-binding Norms in International Space Law*, Böhlau, Vienna, 2012, p. 233–265.

43 A.M. Solntsev, International legal framework for the safe use of nuclear power sources in outer space, *Vestnik Rossiiskogo universiteta druzhby narodov. Seriya: Yuridicheskie nauki*, (2) 2011, p.107 –114.

44 G. Goh Escolar, M. Reynders, Historical Background and Context, in S. Hobe, B. Schmidt-Tedd, K.-U. Schrogl (eds.), *Cologne Commentary on Space Law. Volume III*, Heymanns, Cologne, 2015, p. 263.

efficiency and long-term, allowing planning and implementation of complex and multi-year space operations in case of compliance with the rules which guarantee safety. According to this, we can infer that the abovementioned Principles and Safety Frameworks should be consolidated and become a part of Convention for the Unification of Certain Rules for Outer Space Activities to unify minimal certifications requirements.

1.5. UN Convention on International Space Law

Talking about international space law branch, international lawyers often compare it with the international sea law: both of them deal with the limits of sovereignty; have zones, that are not controlled by any State (high seas, outer space), and are based on the concept of human heritage. However, the most interesting case in the framework of this research, is a history of drafting the main document of the international sea law and its significance for international space law.

Today branch of international space law is considered to have outdated provisions or is committed to the use of soft law documents. Also there are lots of new challenges: space debris, rational use of geostationary orbit, using of nuclear power sources, space mining etc., that require a new or renewed international regime.

In the 1960s international sea law was in the similar situation. In 1967 Malta's Ambassador, Arvid Pardo, to the UN was calling international community for "an effective international regime over the seabed and the ocean floor beyond a clearly defined national jurisdiction", because of numerous pollution of the seas and States wishes to explore seabed. "Pardo's urging came at a time when many recognized the need for updating the freedom-of-the-seas doctrine to take into account the technological changes that had altered man's attitude to the oceans".⁴⁵ Then the number of documents were drafted: treaty banning nuclear weapons on the seabed, GA declaration about that all resources of the seabed beyond the limits of national jurisdiction are common heritage of mankind etc. Finally, in 1973 the Convention on the law of the Sea was convened and came into force in 1982. To our opinion, international space law requires the same.

For at least 35 years COPUOS has been drafting different types of soft law documents, States, in its turn, have been enacting national legislation on space activities, so international community has miscellaneous practice and wants to maintain outer space for future generation. It is time to make the step forward.

Firstly, States have to continue working within the framework of COPUOS. Secondly, States have to either develop the necessary changes in the existing

45 The United Nations Convention on the Law of the Sea (A historical perspective), International Year of the Ocean, 1998, http://www.un.org/depts/los/convention_agreements/convention_historical_perspective.htm (accessed 01.09.18).

outer space treaties or, more appropriately, consolidate these treaties taking into account acts of “soft law”. Thirdly, the result will be in the form of a new international universal treaty with the provisional title the United Nations Convention on Space Law. The development and adoption of such a treaty should be carried out in the same way as the United Nations Convention on the Law of the Sea of 1982.

Conclusions

After having analysed the main key elements of sustainable development of outer space activities, it is necessary to notice that international legal aspects on such sustainable development combine safety and effectiveness in the long-term. This combination includes working registration mechanism of space objects, safety use of nuclear power sources, rational use of geostationary orbit and the other types of orbits, struggling with space debris, space debris mitigation and remediation, building up a system of space traffic management as a part of global governance and space navigation, as well as, working international legal regime of the outer space activities.

The significance of the research is that we have conducted a multifarious analysis of the key elements of the outer space sustainability and suggested our own vision on how to improve and make more available to the realities the branch of international space law.

Moreover, we have found out that international community has already had all equipment for a renovation of international legal regime of outer space activities: through a consolidation of hard and soft documents or an adaption of two international treaties – United Nations Convention on Space Law and Convention for the Unification of Certain Rules for the Implementation of Space Activities.

It would be a breakthrough for international community to adopt only one of the proposed “projects of new international treaties” or to amend some of the current outer space treaties.

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