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Status of the Natural Resources of Celestial Bodies: Legal Positions of the USA and Luxembourg

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Abstract: The outer space legal acts adopted by the USA and by Luxembourg provide for the rights of natural and juridical persons to use natural resources of celestial bodies. These acts are considered in the context of applicable rules of international law with references to the relevant teachings. General scientific methods of cognition and methods of legal sciences are used. The USA and Luxembourg space legal acts in many aspects correspond to the applicable international law while in some do not. The two States have suggested a new legal approach to the future development of international outer space law that further exacerbates the interstate competition for a more favorable legal environment for private persons to invest in economic activities in outer space. The legal regime of such activities have long been regarded as regulated exclusively on the basis of five general multilateral treaties elaborated within the UN the core of which is the Outer Space Treaty of 1967. The situation has now changed with the separate legal regime of outer space activities promoted by the USA and Luxembourg.

Such a “parallel” legal regime while creating a favorable environment for investments by individuals and non-governmental entities in the development of the natural resources of celestial bodies, has at the same time negative legal consequences for the community of States as a whole: the USA and Luxembourg pursue a separate policy aimed at revising the universal international outer space law according to which the exploration and use of celestial bodies are the “province of all mankind”.

Keywords: international outer space law; natural resources of celestial bodies; commercial space activities; space mining; USA laws on space resources; Luxembourg laws on space resources; Artemis Accords

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I. Introduction

Outer space is the largest object of modern international law (Vylegzhanin and Kolosov, 2012; Kolosov and Yuzbashyan, 2015). As early as in the mid-twentieth century, activities in outer space became also an object of national legislation in a number of States. France in 1959 adopted a decree establishing the Committee on Outer Space Research within the Prime Minister's Office; and French Law of 1961 established the National Center for Outer Space Research (Silvestrov, 1992b). The Swedish Outer Space Activities Act of 1982 stipulated that any outer space activities carried out from the territory of Sweden (except those carried out by Swedish governmental organizations) were subject to licensing (Silvestrov, 1992c). According to the British Outer Space Act of 1986, in order to obtain the right to operate in outer space, any juridical or natural person of the United Kingdom, of its "dependent" or "overseas" territories must obtain a license for such activities in the prescribed manner (Kamenetskaya, 1992a). In accordance with the 1988 Italian law establishing the outer space agency, five-year national plans for the development of the national outer space industry are developed, and the mechanism for financing outer space scientific research is determined (Silvestrov, 1992a).

The largest number of national legal acts regulating activities in outer space has been adopted in the USA; among them there are: the Communications Satellite Act of 1962 (Kamenetskaya, 1992b); the National Science and Technology Policy, Organization, and Priorities Act of 1976; the Commercial Space Launch Act of 1984 (Silvestrov, 1992e); the Florida Spaceport Administration Act of 1989 (Silvestrov, 1992e); the National Science and Technology Policy, Organization, and Priorities Act of 1976; the Commercial Space Launch Act of 1984 (Silvestrov, 1992e); the Florida Spaceport Administration Act of 1989 (Silvestrov, 1992d); the Commercial Space Launch Competition Act of 2015; the U.S. Executive Order Encouraging International Support for the Exploitation and Utilization of Space Resources of 2020 (Vylegzhanin et al., 2023).

The adoption by States of national legislative documents on space activities *per se* is not contrary to international law; indeed, it provides

for the necessity of such national regulation. According to Art. VI of the 1967 Outer Space Treaty,¹ the activities of “non-governmental entities in outer space” shall require “authorization and continuing supervision by the appropriate State Party”. The 1967 Outer Space Treaty thus provides for a general obligation of a Stateparty (which allows its persons to conduct outer space activities) to establish the relevant national legislation. Moreover, the appropriate national legislation on outer space activities is in the interest of natural and juridical persons of State, as they invest in space activities only when they see a favorable legal environment to benefit from such activities.²

That being said, the outer space legal acts of the USA of 2015 and 2020 and Luxembourg Law on the Exploration and Use of Space Resources of 2017 and Law on Space Activities of 2020 are to be characterized individually in the context of applicable international law. The reason for such individual legal analysis, as will be shown further, is that the USA started to create from 2015 the legal basis parallel to the UN-created outer space treaties and contradictory to them in some aspects. Luxembourg by its national law of 2017 was the first State in the world which has supported the USA separatist outer space legal policy.

In this light this paper focuses after the introduction, firstly, on the USA legal policy regarding the natural resources of celestial bodies. Next section addresses the Artemis Accords reflecting the U.S. supported by Luxembourg. The following sections are devoted to the analysis of Luxembourg Outer Space Laws of 2017 and 2020. In the final section the legal positions of the USA and Luxembourg are compared. Afterwards the authors concluding remarks are suggested.

¹ This is the main source of international space law. Its full name is as follows: The 1967 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies. Available at: https://www.un.org/ru/documents/decl_conv/conventions/outer_space_governing.shtml [Accessed 05.05.2024].

² The issue of commercialization of space activities has been discussed for many years in the Legal Subcommittee of the UN Committee on the Peaceful Uses of Outer Space.

II. The USA Legal Position on the Natural Resources of Celestial Bodies

The discussion and adoption in 2015 of the USA Commercial Space Launch Competition Act demonstrated that long-term investments in natural resource activities on celestial bodies are recognized by the U.S. legislator as promising benefits. The USA has promptly reacted at the legislative level to the relevant scientific data: about the share of platinum group metals in some asteroids, which is about a thousand times higher than the density of their occurrence in the Earth's interior; about such a sought-after substance as "helium-3", which can be found in large quantities on the Moon, etc. (Vylegzhanin and Yuzbashyan, 2024, p. 148). Taking advantage of the fact that the 1967 Outer Space Treaty³ does not provide for special norms on the procedure for the use of natural resources of celestial bodies, the USA has individually established such a procedure — for the entities under the U.S. law. The legal literature in the Russian language has already described the U.S. legislation on natural resources of celestial bodies, including the U.S. Space Resources Exploration and Use Act of 2015, in the context of the history of the U.S. national regulation of space activities (Yuzbashyan, 2017; Vylegzhanin and Yuzbashyan, 2024). This U.S. legislation for the first time in the world provided national legal opportunities for the U.S. companies to invest in the extraction of natural substances from the surface and interior of celestial bodies, despite the fact that the use of celestial bodies is qualified by the 1967 Outer Space Treaty as the "province of all mankind" (Art. 1), and in accordance with the 1979 Moon Agreement, celestial bodies and their natural resources are "the common heritage of mankind" (Art. 11, Para. 1). Thus the 2015 Act encourages commercial extraction of the natural resources of celestial bodies by the U.S. citizens, while substituting (with the new term "space resources") the term that was previously considered to be established in international space law — "the natural resources of celestial bodies". The term "space resources" is not used in the 1967 Outer Space Treaty nor in any other universal international treaty on space activities adopted

³ Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and other Celestial Bodies of 27 January 1967.

by the UN.⁴ Let us recall for what reasons the American legislator tried to replace with this term the concept of “natural resources of celestial bodies”, previously established in international space law. One of the five universal international treaties on space activities mentioned, the 1979 Agreement on the Moon and Other Celestial Bodies, clearly distinguishes between two concepts, namely between “natural resources” of celestial bodies *in situ* (in place) and “mineral and other substances” collected on celestial bodies. The 1979 Agreement prohibits national appropriation of the former, while the latter is allowed to be extracted from celestial bodies, albeit only “in the course of scientific research”. The legislators of the USA (2015 Act) and Luxembourg (2017 Act) replace both the first and the second term with a new one — “space resources”; thus, the USA and Luxembourg establish national procedures for commercial exploitation of natural resources of celestial bodies (though changing their names) contrary to the prohibition of such exploitation under the 1979 Agreement. This is an additional preventive move of the USA and Luxembourg, aimed at not being accused of violating the norm of international space law. The 1979 Agreement, however, does not prohibit *expressis verbis* the exploitation of the natural resources of celestial bodies, but it makes such exploitation conditional on the establishment of an internationally agreed regime. The main arguments put forward by both the USA and Luxembourg is that both these States are not parties to the 1979 Agreement. However, even in the sense of the 1967 Treaty the use of natural resources of celestial bodies constitutes “the province of all mankind” (Vylegzhanin and Yuzbashyan, 2021).

According to the 2015 USA Act, the U.S. persons are entitled to exploit natural resources of celestial bodies and own the resources thus extracted. At the same time the USA Act provides, that “the United

⁴ Within the framework of the United Nations, in addition to the 1967 Outer Space Treaty, a number of other treaties were developed and adopted: Agreement on the Rescue of Astronauts, Return of Astronauts and Return of Objects Launched into Outer Space, 1968; Convention on International Liability for Damage Caused by Space Objects, 1972; Convention on Registration of Objects Launched into Outer Space, 1975; Agreement on Activities of States on the Moon and Other Celestial Bodies, 1979. On these international treaties see: Kolosov, Y.M. and Yuzbashyan, M.R. International Space Law. In: Vylegzhanin, A.N., (ed.) (2016). *International Law: textbook for the academic Bachelor degree*. In 2 vol. V. 2, pp. 91–107.

States does not thereby assert sovereignty or sovereign or exclusive rights or jurisdiction over, or the ownership of, any celestial body". The provisions of the 2015 USA Act were further clarified in the U.S. Executive Order 2020.⁵

According to this U.S. legal document, the international legal regime of exploitation of "space resources" is not defined in the 1967 Outer Space Treaty. As for the Agreement of 1979⁶ where such a regime is generally defined, the legal position of the USA is that this Agreement, to which the U.S. is not a Party, does not reflect customary international law. The 2020 U.S. Act instructs the State Secretary to provide international support of the new U.S. legal policy in outer space. Such a "support" was organized primarily through the conclusion of the so-called Artemis Accords.

III. USA and Luxembourg as Parties to the Artemis Accords

The legal teachings cited above have given a detailed analysis of the Artemis Accords as an international treaty initiated by the U.S. in October 2020, which outlined a separate legal regime for the natural resource activities in outer space; the official U.S. position, however, is that the Artemis Accords are not an international treaty in the sense of the 1969 Vienna Convention on the Law of Treaties; they are only a high-level "political commitment".

Luxembourg was among the first seven States that signed the Artemis Agreement in October 2020 (in addition to the United States and Luxembourg, this separatist Seven included Australia, Canada, Italy, Japan, the UAE, and the United Kingdom). The gradual increase in the number of parties to these agreements changing the legal understanding at the level of states as to the acceptable legal basis for the use of the natural resources of celestial bodies: should they be strictly guided by

⁵ Executive Order on Encouraging International Support for the Recovery and Use of Space Resources. Available at: <https://trumpwhitehouse.archives.gov/presidential-actions/executive-order-encouraging-international-support-recovery-use-space-resources/> [Accessed 05.07.2023].

⁶ Agreement Governing the Activities of States on the Moon and other Celestial Bodies of 18 December 1979.

international space law or rather by a separate treaty created by the USA, Luxembourg, and other parties to the Artemis Agreements? By mid-2025, the number of such Parties already reached more than 50, with some additional Asian and Latin American countries, not just European ones, joining the list.⁷ This list of U.S.-chosen states is projected to increase. In the text of the Artemis Accords, firstly, the Parties emphasize “the importance of existing bilateral agreements on cooperation in outer space”; secondly, they confirm their intention to act in accordance with the 1967 Outer Space Treaty and other universal international treaties in the field of regulating activities in space (however, the 1979 Agreement is not mentioned).

On 13 October 2020, Luxembourg’s Minister of Economy Fayon signed the Artemis Accords on behalf of the Grand Duchy; despite the fact that there is a series of separate international rules aimed at regulating the use of the natural resources of the Moon, Mars, asteroids, and comets in a way that is not fully consistent with the text of the 1967 Outer Space Treaty and directly contradicts the 1979 Agreement (for more details see Vylegzhanin et al., 2023, pp. 6–30). According to the official statement by the Luxembourg Embassy in the United States on 14 October 2020, “the Artemis Agreements integrate very well with the strategy of the Grand Duchy” and Luxembourg is “proud to be one of its” founding members.⁸

IV. Is the Separatist Outer Space Policy of USA and Luxembourg Acquiesced?

In Europe it was Luxembourg that by its national legislation unequivocally supported the US legal policy aimed at allowing private companies and other persons to develop natural resources of celestial

⁷ The list of States that have signed the Artemis Agreements includes Angola, Argentina, Armenia, Australia, Bahrain, Belgium, Brazil, Bulgaria, Canada, Colombia, Czech Republic, Ecuador, France, Germany, Greece, Iceland, India, Israel, Italy, Japan, Lithuania, Luxembourg, Mexico, Netherlands, New Zealand, Nigeria, Peru, Poland, Republic of Korea, Romania, Rwanda, Saudi Arabia, Singapore, Slovakia, Slovenia, Spain, Sweden, Switzerland, Ukraine, United Arab Emirates, United Kingdom, United States, and Uruguay.

⁸ Luxembourg joins the Artemis Accords. Available at: <https://washington.mae.lu/en/actualites/2020/Artemis.html> [Accessed 05.05.2024].

bodies. Later in 2019, the United Arab Emirates (UAE) adopted the Law on the Regulation of the Space Sector. Its stated purpose is to promote the development of “commercial mining beyond the Earth”.⁹ In 2021, the Commercial Space Activities Act was enacted in Japan.¹⁰ In this regard, the scientific and legal literature notes that no States have protested the laws of the United States or Luxembourg on natural resource activities on celestial bodies. On the contrary, most comments on such laws (including those within the United Nations Committee on Outer Space) are generally positive (Vylegzhanin and Yuzbashyan, 2024).

Moreover, the innovativeness of the USA and the State of Luxembourg in creating space legislation has been praised by the European Space Agency (ESA),¹¹ in particular in the ESA Strategy for Environmental Activities in Space (until 2030). This document reaffirms the “proactive and pioneering approach” by these States.¹² It is therefore argued that the new Luxembourg law will make the country “a desirable HQ for space exploration and mining ‘and such favorable conditions are’ not available in most other States on the planet” (Mukunth, 2017). Another analyst notes, “This recent development makes Luxembourg the first European country to adopt a legal framework for private companies to extract resources from space” (Soo Yun, 2017).

However, not all States follow this legal policy of the United States and Luxembourg. Firstly, the Agreement between the Government of

⁹ United Arab Emirates Federal Law No. 12 of 2019 on the Regulation of the Space Sector. Available at: <https://www.moj.gov.ae/assets/2020/Federal%20Law%20No%2012%20of%202019%20on%20THE%20REGULATION%20OF%20THE%20SPACE%20SECTOR.pdf.aspx> [Accessed 05.05.2024].

¹⁰ Japan’s Act on Promotion of Business Activities Related to the Exploration and Development of Space Resources. Act No. 83 of 2021. Available at: <https://kanpou.npb.go.jp/old/20210623/20210623g00141/20210623g001410004f.html> [Accessed 05.05.2024].

¹¹ ESA is an intergovernmental space organization operating under the 1975 Convention establishing the European Space Agency. The Convention entered into force in 1980. ESA was created by the merger of two pre-existing international organizations of Western states: 1) the European Space Research Organization and 2) the European Space Launch Vehicle Development Organization.

¹² ESA’s Space Resources Strategy. 2019. Available at: <https://exploration.esa.int/web/moon/-/61369-esa-space-%20resources-strategy> [Accessed 05.05.2024].

the Russian Federation and the Government of the People's Republic of China on the Cooperation on the Construction of International Lunar Research Station was signed in November 2022. China and Russia while implementing this agreement continue to maintain national legislation in such a way that activities in outer space are carried out strictly within the framework of their international obligations. Secondly, since 2021, the issues related to the new outer space legal policy initiated by the USA and supported by Luxembourg have been the subject of discussion established under the Legal Subcommittee of the Outer Space Committee (Vylegzhanin et al., 2025, p. 23). Such discussions continue and nowadays it is difficult to predict whether the US/Luxembourg separatist outer space legal policy will be acquiesced or not. So, the analysis of the current laws of Luxembourg on outer space commercial activities is needed from the perspective of international law.

V. The First Luxembourg Outer Space Law

As noted of all the European Union Member States, it was Luxembourg that was the first to support the U.S. separate legal space policy reflected in the said U.S. Act of 2015. The analyst comments on Luxembourg's choice of a legislative approach similar to the U.S. one as follows: as early as "in February 2016, Luxembourg announced its intention to develop measures that will position this State as a European center for research and use of natural resources of celestial bodies".¹³ In 2017, Luxembourg adopted the Law on the Exploration and Utilization of Space Resources¹⁴ and in 2020 — the Law on Space Activities.¹⁵

¹³ Luxembourg to launch framework to support the future use of space resources. 2016. Available at: <http://www.gouvernement.lu/5653386/03-space-resources> [Accessed 05.05.2024]. See more on this topic: Leterre (2017).

¹⁴ Loi du 20 juillet 2017 sur l'exploration et l'utilisation des ressources de l'espace. Available at: <https://legilux.public.lu/eli/etat/leg/loi/2017/07/20/a674/jo> [Accessed 05.05.2024]. Since the official language of Luxembourg is French, in the official publication of legal acts of this State — *Journal officiel* — this law is presented only in French.

¹⁵ Loi du 15 décembre 2020 portant sur les activités spatiales et modifiant. Available at: <https://legilux.public.lu/eli/etat/leg/loi/2020/12/15/a1086/jo> [Accessed 05.05.2024].

The development of the 2017 Law and the political and legal background of its adoption are remarkable, as are the related statements of Luxembourg politicians. Luxembourg's Deputy Prime Minister E. Schneider stated in 2016, "Luxembourg is ready to invest in relevant Research and Development projects; the Luxembourg government is even considering direct investment in companies working in the field of environmental activities on celestial bodies".¹⁶ Another senior official distinguished between the Luxembourg law's regulation of the natural resources activities on celestial bodies and the issuance of "mining permits for asteroids, as the U.S. does".¹⁷ However, the Council of State and a group of Luxembourg citizens who are working with the Chamber of Deputies to develop space legislation, noted that "claims to private ownership of natural resources on celestial bodies are illegal, or at least unenforceable in most countries of the world".¹⁸ In response to this, E. Schneider explained that Luxembourg law "did not suggest to either establish or imply in any way sovereignty over a celestial body"; that the law allowed "only the appropriation" of natural resources of celestial bodies and that "we are all aware that there is no way to hold the private exploitation of natural resources of celestial bodies back".¹⁹

When considering the draft law for the first time, the Luxembourg Council of State did not find it acceptable for two reasons: 1) "there is no doubt that international law takes precedence over domestic law" and the former does not provide for a clear right to appropriate the natural resources of celestial bodies; and 2) the Council of State was of the opinion that such detailed regulation "would weaken the law".²⁰

At the end, despite all these doubts, the text of the Law was adopted (Leterre, 2017), although the Council of State noted that there remained "unanswered questions: such as the recognition by other States of

¹⁶ See about this: Mukunth (2017).

¹⁷ *Ibid.*

¹⁸ *Ibid.*

¹⁹ *Ibid.*

²⁰ Conseil d'État. Projet de loi sur l'exploration et l'utilisation des ressources de l'espace. No. 51.587, p. 9 (7 Avril 2007) (Lux.) (hereinafter Opinion of the Conseil d'Etat).

property rights granted by Luxembourg law” over the natural resources of celestial bodies.²¹

The purpose of the 2017 Luxembourg Law on the Exploration and Use of Space Resources is broadly defined to create favorable conditions for the development of a commercial space industry in the country. The law establishes the rights and obligations of the entities involved in the use of natural resources of celestial bodies, providing private companies working in this field with legal certainty, primarily in terms of a favorable investment climate. Structurally, the 2017 Luxembourg Law can be divided into three conditional blocks: property rights to so-called space resources (meaning “natural substances” extracted from celestial bodies); licensing such extraction; state control over natural resource activities in outer space and other provisions.

V.1. Property Rights to Natural Substances Extracted from Celestial Bodies

As already noted, the 2017 Luxembourg Law adopts the American conceptual and terminological apparatus: it introduces the term “*les ressources de l’espace*”, which is a calque of the English language term “space resources” provided for in the American Law of 2015 described above.

The 2017 Luxembourg Law provided that “*les ressources de l’espace*” may be exploited by persons in accordance with the Law. The first article of the Law provides that such resources are “susceptible to appropriation” (“*sont susceptibles d’appropriation*”). Private entities under Luxembourg’s jurisdiction may obtain ownership of such resources, but they are required to obtain the official consent (“*agrément de mission*”) of the authorized public authorities, provided that such activities comply with the international obligations of Luxembourg (“*les obligations internationales du Luxembourg*”). In analyzing the 2017 Law, it is suggested that Luxembourg is more focused on attracting investment in the development of the natural resources of celestial bodies than on developing the technical aspects of national outer space activities; that “this becomes evident from Article 4, which determines

²¹ Opinion of the Conseil d’État. No. 189, p. 6.

that only commercial companies can obtain the said official consent of Luxembourg public authorities” (Leterre, 2017). Without this consent, such companies cannot obtain ownership of natural substances extracted from celestial bodies, and the very mechanism of obtaining “official consent” is reduced primarily to the company applying for and obtaining a license.

V.2. Licensing of Space Activities

The Law under consideration regulates in the most detail the issues related to the application by the interested companies for official consents (permits) and their issuance. According to the procedure of licensing space activities under Luxembourg 2017 Law, private companies intending to exploit the natural resources of celestial bodies must obtain the formal consent of the authorized Luxembourg public authorities. The 2017 Law establishes the procedure for a company to apply for such consent, defines the conditions for its execution, and prescribes obligations associated with the development of such resources.

The financial dimension of the legal mechanism of commercialization of space environmental activities is demonstrated by Art. 13, “For each application for approval, Ministers shall establish a fee to cover the administrative costs incurred in the examination of the application. This fee shall be calculated between 5,000 and 500,000 euros, depending on the complexity of the request and the amount of work involved. The manner in which it is to be charged shall be laid down in the regulation of the Grand Duchy of Luxembourg”.²² According to Art. 15 of the Law, the designated ministers must exercise permanent supervision over the space missions of companies for which formal consent has been obtained.²³

²² According to the French authentic text of the Law, “Pour chaque demande d’agrément, une redevance est fixée par les ministres pour couvrir les frais administratifs occasionnés par le traitement de la demande. This redemption varies between 5,000 and 500,000 euros suivant la complexité de la demande et le volume du travail. Un règlement grand-ducal détermine la procédure applicable à la perception de la redevance” (Art. 13).

²³ “Les ministres sont en charge de la surveillance continue des missions pour lesquelles un agrément a été accordé” (Art. 15).

V.3. Insurance of Private Space Activities and Other Significant Provisions of the Law

The 2017 Law provides for insurance of space activities of companies, as well as their liability for damages caused by such activities. According to Art. 10 of the Act, “(1) the application for formal consent must be accompanied by a mission risk assessment. It specifies the coverage of these risks by its own financial means, by an insurance policy of an insurance company not belonging to the same group as the approved operator, or by a guarantee of a credit institution not belonging to the same group as the approved operator; (2) formal consent shall be granted if there is a financial basis appropriate to the risks associated with the mission”.²⁴

According to Art. 16 of the Law, a company that has been given formal consent to conduct an environmental mission in space is fully liable for any damage caused during the mission, including all preparatory work.

If the provisions of the Law are violated by the company, Art. 18 provides penalties:

(1) if the provisions of Art. 2 are violated, the official “shall be punished by imprisonment from eight days to five years and a fine from 5,000 to 1,250,000 euros or only one of these penalties”;

(2) in case of violating the provisions of Art. 5, “imprisonment for a term of eight days to one year and a fine of 1,250 to 500,000 euros”.²⁵

The 2017 Law includes provisions aimed at promoting Luxembourg’s cooperation with other States and international organizations in the exploration and use of the natural resources of celestial bodies and also declares the Grand Duchy’s commitment to promote the commercial

²⁴ “(1) La demande d’agrément doit être accompagnée d’une évaluation des risques de la mission. Elle précise la couverture de ces risques par des moyens financiers propres, par une police d’assurance d’une entreprise d’assurances n’appartenant pas au même groupe que l’exploitant à agréer ou par une garantie d’un établissement de crédit n’appartenant pas au même groupe que l’exploitant à agréer. (2) L’agrément est subordonné à l’existence d’assises financières appropriées aux risques associés à la mission” (Art. 10).

²⁵ “L’exploitant qui a obtenu un agrément pour une mission est pleinement responsable des dommages causés à l’occasion de la mission, y inclus à l’occasion de tous travaux et devoirs de préparation” (Art. 16).

development of activities for the exploration and use of the natural resources of celestial bodies through an “advanced” national regulatory framework for the interested private enterprises, creating favorable conditions for attracting investment in the commercial development of the natural resources of celestial bodies.

VI. Luxembourg Outer Space Act of 2020

The 2020 Law supplements and develops Luxembourg’s legislation on space activities. An official Luxembourg document states that this law strengthens the legal framework of this State, especially in the field of conditions for the admission of persons to space activities, as well as in the supervision of such activities.²⁶

The Law on Space Activities 2020 does not apply to those missions for the exploration and utilization of natural resources of celestial bodies that fall under the scope of the Law on Exploration and Utilization of Space Resources.²⁷

The 2020 Act has a clear structure, represented by chapters: (1) “Scope of application and general provisions” (Champ d’application et dispositions générales); (2) “Authorization of space activities” (Autorisation des activités spatiales); (3) “Surveillance of space activities” (Surveillance des activités spatiales); (4) “Transfer of space activities” (Transfer d’activités spatiales); (5) Change of control (Changement de contrôle); (6) Sanctions (Sanctions); (7) Registration of launched space objects (Immatriculation des objets spatiaux lancés); (8) Modifying, transitional and final provisions (Dispositions modificatives, transitoires et finales).

²⁶ “The Law on Space Activities of 2020 does not apply to missions for the exploration and use of space resources covered by the Law of 20 July 2017 on the Exploration and Utilization of Space Resources”. Official report — “Contribution of the Grand Duchy of Luxembourg on the Mandate and Purpose of the Working Group on Legal Aspects of Space Resource Activities”. 2022. Available at: https://www.unoosa.org/documents/pdf/copuos/lsc/space-resources/LSC2023/StatesResponses/Luxembourg_-_20221216_WG_SR_LU_Contribution.pdf [Accessed 05.05.2024].

²⁷ Official report — “Contribution of the Grand Duchy of Luxembourg on the Mandate and Purpose of the Working Group on Legal Aspects of Space Resource Activities”. 2022.

The glossary provided with the Act defines legally relevant terms, including “space activities”, “damage”, “space object”, “operator” and “qualified participation”.

Let us compare, for example, the definition of “space activities” under the Luxembourg 2020 Law and the corresponding definition provided for in the Russian Federation Law No. 5663-I of 1993 (as amended) “On Space Activities”. The 2020 Luxembourg Law defines “space activities” as any activity to launch or attempt to launch one or more space objects into outer space, or to provide control of one or more space objects, or to use them while in outer space, including its return to Earth, as well as any other activity carried out in space above the atmosphere for which the Grand Duchy of Luxembourg may be internationally responsible.²⁸ The current Russian law defines space activities as “any activity related to the direct conduct of work on the exploration and use of outer space, including the Moon and other celestial bodies”. It is possible to offer various comments on this difference in the legislative definitions of the two States. All the more so because authoritative domestic researchers of international space law have proposed a different definition of space activities from the one provided for in the Russian law. In their view, space activities are “the exploration and use activities in outer space, including the Moon and other celestial bodies”. It “should be distinguished from activities related to the exploration and use of outer space, since the latter is much broader in scope and is not always regulated by international law” (Kolosov, 1992). This very fine doctrinal distinction between (1) the exploration and use in outer space and (2) activities related to exploration of outer space and its use is not made in Russian law. The law of the Russian Federation proceeds only from the second, broad approach.

²⁸ In the original 2020 Law it is provided as follows, “Toute activité consistant à lancer ou tenter de lancer un ou plusieurs objets spatiaux dans l’espace extra-atmosphérique ou à assurer la maîtrise d’un ou de plusieurs objets spatiaux ou à les utiliser pendant son séjour dans l’espace extra-atmosphérique, y compris son retour sur Terre, ainsi que toute autre activité qui se déroule dans l’espace extra-atmosphérique pour laquelle le Grand-Duché de Luxembourg est susceptible d’être tenu internationalement responsable”.

Prior to the 2017 Law, Luxembourg did not have any basic legislative regulation of core space activities. It was in 2020 that the main types of space activities were regulated for the first time at the legislative level in the Grand Duchy of Luxembourg.

The Luxembourg 2020 Law details the requirements for operators carrying out space activities and describes the mechanism of authorization of such activities. According to Art. 5 of the 2020 Law, no person “may carry out space activities without the prior authorization of an authorized minister” (“Aucun opérateur ne peut exercer une activité spatiale sans y avoir été préalablement autorisé par le ministre ayant la politique et législation spatiales dans ses attributions”). According to Art. 6 of the Law, “the approved operator confirms that it has its registered office and management center, including its administrative and accounting structure, in the Grand Duchy of Luxembourg”. To date, three private operators have already been authorized by the Luxembourg authorities to conduct space activities.²⁹

The commentary to the 2020 Law states that the favorable investment regime it creates “will further expand and diversify the activities of space actors, especially from the private sector, in Luxembourg”.³⁰ In other words, although the Law in question is called a law “on space activities” (rather than “on commercial activities”), it still focuses its regulation on licensing private investors in such activities. The commentary also notes the focus of the Luxembourg law on the involvement of representatives of the fuel and energy sector in the development of celestial resources. Back in 2012, the opinion was expressed that large representatives of the “mining industry” will not participate in such development projects unless “there is some certainty that they will be able to make a profit. And they will not be able to make a profit unless there is a regulatory regime in place to allow them to do so”, whether that be “tax incentives or the concept of extracted mineral rights (Mukunth, 2017).

²⁹ The register of authorizations granted under the Law of 15 December 2020 on Space Activities. Available at: <https://space-agency.public.lu/dam-assets/publications/2023/20230412register-authorisations.pdf> [Accessed 05.05.2024].

³⁰ Official website of the Luxembourg Space Agency. Available at: <https://space-agency.public.lu/en/agency/legal-framework.html> [Accessed 05.05.2024].

VII. Comparison of the Legal Positions of the USA and Luxembourg on Outer Space

It has already been noted that from the point of view of the essence of the national legal regime, the laws of Luxembourg analyzed reproduced the main postulates of the above-mentioned acts of the U.S. legislation on natural resource activities in space: such activities are permissible in the order defined in the national law; the law gives a private company the authority to appropriate natural substances extracted from a celestial body; the law assumes that such appropriation is in full compliance with the State's obligations under the Outer Space Treaty, including the treaty's "permanent" clause. While the Luxembourg legislative model in question is legally identical to the United States legislation on the commercial exploitation of the natural resources of celestial bodies, there are, of course, differences in the legislative approaches of the two States. In terms of investment treatment, for example, Luxembourg's legislation looks more attractive.

Comparing U.S. and Luxembourg commercial space laws, the foreign analyst notes that, following the 2017 passage of the Luxembourg Act, two U.S. companies — Deep Space Industries and Planetary Resources — "are already planning to move to Luxembourg"; the government of that State is also working with Japan's Ispace and Germany's Blue Horizon (Mukunth, 2017). The choice to opt for Luxembourg's legislation by private investors in the space sector is indicative in itself: they have found that the Grand Duchy's legislation provides operators registered under that legislation with a more favorable environment for commercial space activities than in the United States.

The Strategy for the Development of Natural Resources of Celestial Bodies of the already mentioned ESA (Luxembourg, it should be recalled, is a participant) stipulates that in the USA, "a renewed emphasis on lunar exploration has ignited interest in the field of natural resources of celestial bodies", this activity being carried out by public and private actors. It also noted that future investment in this area is "expected from NASA", ³¹ which is building on its prior experience. The utilization

³¹ NACA (NASA) is the National Aeronautics and Space Administration of the USA. This federal executive branch agency reports directly to the President of the United States.

of natural resources of celestial bodies is considered in the context of “future human missions to the Moon” to explore their potential utility. U.S. legislation is created to designate the rights of those U.S. “actors who would seek to develop natural resources in space and utilize them”.³²

As for positions of the USA and Luxembourg in the UN Committee on Outer Space, they are in substance similar. Luxembourg’s position on the legal regime of natural resources of celestial bodies, promoted in the Committee on Space, is characterized by a proposal of this State (most likely agreed with the United States) to create an “International Framework”, which, as proposed, should reflect the following provisions, “The International Framework” should provide that rights to minerals and volatile materials extracted from the natural resources of celestial bodies, as well as to the products derived from them, may be acquired legitimately, in accordance with the provisions of the universal Outer Space Treaty of 1967 on the “province of all mankind”. In other words, this legal “vinaigrette” relegates the “province of all mankind” provisions of the 1967 Universal Outer Space Treaty to the background. Further, according to Luxembourg’s position, “the International Framework should allow for mutual recognition by States of rights” to natural resources of celestial bodies, i.e., simplifying, exploitation of natural resources of celestial bodies under this approach is legitimate if the U.S. and Luxembourg “mutually recognize each other’s right to such exploitation”. Nevertheless, according to the “International Framework”, it is necessary to ensure the use of natural resources of celestial bodies “in accordance with the principle of non-appropriation enshrined in Art. II of the Outer Space Treaty”.³³ But in this case, the rights to the extracted natural materials are acquired *de facto* under the national laws of the United States and Luxembourg. Does this contradict international space law? According to it, the acquisition of rights to extracted substances from celestial bodies must be in the interests of all

³² ESA’s Space Resources Strategy. 2019. Available at: <https://exploration.esa.int/web/moon/-/61369-esa-space-%20resources-strategy> [Accessed 05.05.2024].

³³ Working paper submitted by Luxembourg and the Netherlands “Building blocks for the development of an international framework on space resource activities” (A/AC.105/C.2/L.315). Available at: https://www.unoosa.org/oosa/oosadoc/data/documents/2020/aac.105c.2l/aac.105c.2l.315_0.html [Accessed 05.05.2024].

States.³⁴ Is it currently possible to harmonize at the universal level the system of legal regulation of the commercial use of natural resources of celestial bodies? It is necessary to take into account the fact that a number of countries, including Luxembourg, have settled this issue at the national legislative level, without harmonizing these issues at the universal level, though the development of the relevant universal regime is envisaged by the Moon Agreement. With further realization of such a separatist approach initiated by the USA and supported by Luxembourg, the provisions of the 1967 Treaty on the “interests of all countries” and on the “patrimony of all mankind” will be replaced by the national legislation of these developed States, as well as by their separatist international agreements. It has to be stated that the current universal international legal regime of natural resources of celestial bodies, outlined in general terms in the 1967 Outer Space Treaty and the 1979 Moon Agreement, has already been challenged by those significant novelties proposed by the space policies of the United States, Luxembourg, and their other followers (Vylegzhanin and Yuzbashyan, 2024, pp. 152–155).

The following provision of Luxembourg’s proposed “International Framework” is also interesting: it “shall not contain requirements for mandatory benefit-sharing”.³⁵ Here Luxembourg is trying to avoid in advance the creation of mechanisms of “common heritage of mankind” similar to those provided for in the 1982 UN Convention on the Law of the Sea, including provisions according to which developed States are obliged to provide developing States with the relevant scientific and technical assistance.

On the platform of the UN Committee on Outer Space, Luxembourg is also proposing a definition of the term “space resources” previously provided for in the 2015 US Law. This refers primarily to a document such as the “International Framework” — proposed by Luxembourg

³⁴ Recall that under the 1967 Outer Space Treaty, the exploration and use of space is “the heritage of mankind as a whole”; under the Moon Agreement, “celestial bodies and their natural resources are the common heritage of mankind”.

³⁵ Working paper submitted by Luxembourg and the Netherlands “Building blocks for the development of an international framework on space resource activities” (A/AC.105/C.2/L.315).

at the fifty-ninth session of the Legal Subcommittee of the UN Committee on Outer Space in 2020.³⁶ Among the definitions proposed by Luxembourg, we highlight the following, “space resource” is “an abiotic resource located directly in outer space that is recoverable and/or extractable”. In other words, Luxembourg relies on a term previously introduced by the 2015 U.S. Act. At the same time, Luxembourg’s representatives on the Space Committee (like the U.S. previously) are not embarrassed by the fact that such a term does not exist in any of the five multilateral space treaties developed at the UN.³⁷ As in American law, the Luxembourg documents submitted to the UN Committee on Outer Space deliberately mix the concepts of “natural resources” (those natural resources that are *in situ* — on or under the surface of celestial bodies) and the concept of “extracted natural substances” (“mined minerals”). But, as already noted, the legal regimes of the former and the latter are different (Vylegzhanin, 2007, p. 237). Let us refer, for example, to the Luxembourg document, which defines that “activities related to natural resources of celestial bodies” are activities “carried out in outer space for the purpose of searching for space resources and extracting these resources”.³⁸ Again, if an *in situ* “resource” has already been extracted from a location, it is legally no longer a “natural resource” of celestial bodies, but “matter” (in terms of the conceptual apparatus adopted in the named universal sources of international space law).

At the same time, it should be noted that Luxembourg’s active position in the UN Committee on Outer Space can be explained not only in the context of the 2017 and 2020 Acts; this state has ratified the 1967 Outer Space Treaty; the 1972 Convention on International

³⁶ *Ibid.*

³⁷ Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, 1967; Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, 1968; Convention on International Liability for Damage Caused by Space Objects, 1972; Convention on Registration of Objects Launched into Outer Space, 1975; Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, 1979.

³⁸ Working paper submitted by Luxembourg and the Netherlands “Building blocks for the development of an international framework on space resource activities” (A/AC.105/C.2/L.315).

Liability for Damage Caused by Space Objects; Luxembourg joined the 1975 Convention on Registration of Objects Launched into Outer Space. Moreover, Luxembourg participates in a number of international space-related programs, including those of the European Space Agency: Horizon 2020 Space; Global Navigation Satellite System; European Space Surveillance and Tracking; and others.

In the Legal Subcommittee of the UN Committee on Outer Space, Luxembourg's position is expressed, for example, as follows, "In order to achieve legal certainty and predictability for all public and private actors intending to explore, exploit and/or use" natural resources of celestial bodies, to ensure that such activities comply with "applicable international law", to provide "a framework to incentivize future investment by public and private investors in the exploitation" of natural resources of celestial bodies, it is important to include "as core themes" those described in the final sections of the Hague Governance Working Group, and to ensure that such activities comply with "applicable international law", in order to provide "a framework to incentivize future investment by public and private investors in the exploitation" of natural resources of celestial bodies.³⁹ Such themes include the designated priority rights of States, as well as compliance with "safety zones" in the utilization of such resources.⁴⁰

Luxembourg is also active in addressing issues of international legal regulation of exploration and exploitation of natural resources, especially in the Legal Subcommittee of the UN Committee on Outer Space. This subcommittee has a Working Group on Legal Aspects of Activities Relating to Natural Resources of Celestial Bodies.⁴¹ The Group met in 2023, but was unable to reach consensus on the adoption

³⁹ The Hague International Space Resources Governance Working Group.

⁴⁰ On "safety zones" on celestial bodies, see below, in the section on the Artemis Accords. Responses to the set of questions provided by the Moderator and Vice-Moderator of the Scheduled Informal Consultations on Space Resources (A/AC.105/C.2/2021/CRP.8). Available at: https://www.unoosa.org/oosa/oosadoc/data/documents/2021/aac.105c.22021crp/aac.105c.22021crp.8_0.html [Accessed 05.05.2024].

⁴¹ The official title of this Working Group already reflects the American conceptual apparatus, which is based on the term "space resources": Working Group on Legal Aspects of Space Resource Activities.

of its report. This also shows that, to date, not all States represented on the Outer Space Committee are willing to move in the direction of the commercial utilization of natural resources of celestial bodies as proposed in the laws of the United States and Luxembourg, i.e., outside the format universally agreed upon in the 1967 Outer Space Treaty, including its “province of all mankind” provision. Moreover, the Space Committee reaffirmed the view that “the exploitation of natural resources of celestial bodies and other activities for the exploration of extraterrestrial objects should be consistent with the fundamental principles of international space law as set out in the Outer Space Treaty”.⁴²

On 26 March 2024, Luxembourg hosted a Meeting of Experts to gather preliminary inputs to be considered at an international conference in Vienna (the Meeting is organized by Belgium and Luxembourg in cooperation with the UN).⁴³

In general, the mechanism promoted by Luxembourg for the commercial utilization of the natural resources of celestial bodies does not take into account that such utilization is, according to the 1967 Treaty, “the province of all mankind” and “the common heritage of mankind”, according to the Moon Agreement. The latter implies, *inter alia*, gratuitous relevant assistance to the economies of developing countries.

Moreover, the approach promoted by the United States, Luxembourg and their followers tends to impose additional technical, environmental and other requirements for space activities, including the launching of space objects, that are beyond the capacity of some developing countries, and, in the long term, increasingly stringent international oversight of space activities. These factors, taken together, will limit the ability of developing States to conduct space activities, much less natural

⁴² Report of the Committee on the Peaceful Uses of Outer Space (A/78/20). Available at: https://www.unoosa.org/oosa/oosadoc/data/documents/2023/a/a7820_o.html [Accessed 05.05.2024].

⁴³ Intervention du Luxembourg à la 63e session du Sous-Comité juridique du CUPEEA. Vienne, du 15 au 26 avril 2024. Item 4. “Débat général”. Available at: https://www.unoosa.org/documents/pdf/copuos/lsc/2024/Statements/4_Luxembourg.pdf [Accessed 05.05.2024].

resource activities. As part of this trend, once Western companies from the United States, Luxembourg, and their partners begin to develop natural resources, for example, on asteroids that have already been explored, the economic gap between such technologically advanced countries and most developing States will, as is easy to predict, widen even more sharply.

VIII. Concluding Remarks

As shown above, Luxembourg's legislation on the commercial utilization of natural resources of celestial bodies is fundamentally supportive of the new U.S. international legal space policy, although it does not fully replicate all the prescriptions of the 2015 USA Act and the 2020 U.S. Executive Order. Nevertheless, as far as the examination of the space legislation of the Grand Duchy of Luxembourg is concerned, the study of the U.S. space environmental legislation (for its compliance with international law) is also applicable in its main conclusions to the assessment of the Luxembourg legislation. First of all, we are talking about assessments of its compliance and non-compliance — in terms of the status of natural resources of celestial bodies — with the 1967 Outer Space Treaty. The fact that in this part the 2017 Luxembourg law contradicts the Moon Agreement, to which this State is not a party, is not a matter of debate. To add to this, experts' opinions on the general international legal assessment of Luxembourg's legislation vary, but several key characteristics can be emphasized.

Some experts praise Luxembourg's "pioneering" efforts to create a legal framework for companies to utilize the natural resources of celestial bodies (Mukunth, 2017). They see the Luxembourg legislation as a "progressive step" towards encouraging private investment in the complex technological process of exploiting the natural resources of celestial bodies.

Others in the scientific community, however, have expressed concern about the possible negative international legal implications of the legislation. One of the main areas of criticism is that Luxembourg's legal policy contradicts the principle of the "common heritage of mankind" enshrined in the 1979 Moon Agreement. Critics argue that

the 2017 Luxembourg Law, by granting property rights to natural substances extracted from celestial bodies, contradicts this principle by allowing the “privatization” of what should be the province of all mankind (Art. I of the 1967 Outer Space Treaty). As noted, Luxembourg’s legislation could potentially contradict Art. II of the Outer Space Treaty: “Outer space, including the Moon and other celestial bodies, shall not be subject to national appropriation, whether by claim of sovereignty, by use or occupation, or by any other means”. In this regard, a foreign expert notes that “in fact, Luxembourg’s argumentation concerning the principle of non-appropriation does not comply with the clear wording of Art. II of the Outer Space Treaty, since it substitutes a focused analysis of the applicable principles of international space law for a dispassionate reading of the national legislation” of that State, adopted specifically as a regulatory framework for the exploitation of mineral resources of celestial bodies (De Man, 2017).

To add to this, the U.S. Law mentioned above (adopted two years earlier than the 2017 Luxembourg Law) has also been criticized. Thus, the editor-in-chief of the *New England Law Review*, a fairly authoritative legal journal, argues that the US Law violates the first two articles of the 1967 Outer Space Treaty because “the USA government sought to benefit at the detriment of others and to grant rights to objects it could not have originally claimed”. Another international law expert (University of Kent) described the fact that the US companies are able to operate on celestial bodies solely on the basis of national law as “the audacity of greed” (Mukunth, 2017).

The representatives of Luxembourg nevertheless fully support the U.S. space natural resources policy, including in discussions in the scientific community, international organizations and the Legal Subcommittee of the United Nations Committee on the Peaceful Uses of Outer Space. At the same time, the Luxembourg authorities emphasize the need for an internationally coordinated universal approach to the use of natural resources of celestial bodies. This somewhat distinguishes Luxembourg’s position in this special area from the U.S. space natural resources policy.

The extraction of minerals beyond the Earth belongs, in the terms of the Outer Space Treaty, to “national activities in outer space”.⁴⁴ It is the responsibility of States under existing international space law. Its principles are applicable to natural resource activities in space. However, the current international space law does not provide for a special regime for the exploitation of natural resources of celestial bodies.

Luxembourg’s space environmental legislation, on the one hand, can be seen as an invitation to support investment in commercial space activities. On the other hand, objectively, this legislation like the U.S. legislation is inconsistent with the provisions of the Outer Space Treaty that celestial bodies are not subject to national appropriation by any means (Art. II) and that the exploration and use of celestial bodies is “the province of all mankind” (Art. I). In this context, it will be of practical political and legal significance to continue discussions on the legal regime of celestial bodies, including their natural resources, at the level of scientific and legal concepts, as well as within the framework of cooperation at the interstate level, including in the UN Committee on Outer Space since the UN Committee on Outer Space Documents already stated that in order to ensure safe and orderly implementation of natural resource activities in space, as well as to promote “rational management” of natural resources of celestial bodies, it is necessary to “develop a legally binding international legal framework to regulate such activities”, i.e., at the universal level.⁴⁵

At the same time, within the framework of a cautious international legal forecast, we have to state that the new natural resource activities of the USA, Luxembourg and other partner States under the Artemis Agreements have already become a modern international legal reality. Moreover, the reality is that the number of supporters of the qualification of natural resources of celestial bodies as “common heritage of mankind” (Art. 11 of the Moon Agreement) is decreasing, while the number of the U.S. partner States under the Artemis Agreement is increasing. This

⁴⁴ 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.

⁴⁵ Report of the Committee on the Peaceful Uses of Outer Space (A/78/20). Available at: https://www.unoosa.org/oosa/oosadoc/data/documents/2023/a/a7820_o_o.html [Accessed 05.05.2024].

reality dictates the need to respond to it by the timely development of the concept of improving Russian legislation on space natural resource activities. The point is that Russia, which retains its status as a leading space power, is to create an even more favorable legislative environment for investment, taking into account the new political and legal factors considered.

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