УДК 340.1
DOI https://doi.org/10.24144/2307-3322.2024.86.5.40

COSMIC JURISDICTIONS: *QUOD LEGE NATURAE, MORIBUS ET CONSUETUDINE INDUCTUM EST*

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Marinich V.K., Myklush M.I. Cosmic jurisdictions: *quod lege naturae, moribus et consuetudine inductum est.*

The study is devoted to organizing the legal space of the Universe based on "ius naturale," morals, and consuetudes of space activities, with the prospects for the existence of extraterrestrial intelligent beings in the Universe.

On the grounds of the results of the study, 7 natural factors and 2 technical factors are identified, the influence of which determines the spaces to which the sovereignty and jurisdiction of both states and all of humanity extend.

Based on these factors, the NMC Concept "*natura, moribus et consuetudines*" is proposed, according to which, due to natural and other factors, all outer space above the Earth`s surface is divided into a "domestic room" (our Solar System) and an "alien room" (outside the Solar System), the boundary between which are the Kuiper Belt and the center of the Sun.

At the same time, it is proposed to apply the principle of "*Res Communis Humanitatus*" to the "domestic room", and the new principle of "*Res Nullius Civitatis et Res Communis Animal Rationale*" to the "alien room".

Additionally, the authors emphasize the fact that the above factors have already formed the structure of the "domestic room" regardless of the existing intentions and suggestions, leaving the world to recognize and accept it.

Within the structure of the "domestic room", the following two types of spaces have been formed: the "unified and sovereign spatial-territorial domains of states", to which the exclusive jurisdiction of states extends, and "*Res Communis Humanitatus*", to which generally recognized international law extends.

In these circumstances, considering all natural and technical factors, the authors take notice of the allocation of two separate layers in "*Res Communis Humanitatus*": "Orbital layer" and "Ballistic space".

The authors also propose developing a "sanitary atmospheric zone" to ensure humanity`s safety from the effects of the "X" factor.

Moreover, the authors suggest applying different principles of international regulation to the "Ballistic space," the "Orbital layer" and the space beyond it, based on the mechanisms of "tacit consent," "silent disapproval", "active consent", and "active disapproval".

The result of this research is a draft Pact for the Cosmos.

Key words: space law, theory of state and law, history of law, evolution of law, jurisdictions, cosmos, international law, aerospace, outer space

Марініч В.К., Миклуш М.І. Космічні юрисдикції: *quod lege naturae, moribus et consuetudine inductum est.*

Дослідження присвячено питанню організації правового простору Всесвіту на основі «*ius naturale*», традицій та звичаїв космічної діяльності, з урахуванням перспектив існування у Всесвіті позаземних розумних істот.

За результатами проведеного дослідження виділено 7 природних факторів та 2 технічні фактори, вплив яких фактично визначає простори, на які поширюється суверенітет та юрисдикції як держав, так і всього людства.

На основі цих факторів запропоновано Концепцію NMC «*natura, moribus et consuetudines*», згідно з якою, з огляду на природні та інші фактори, весь космічний простір над поверхнею Землі ділиться на «домашню кімнату» (наша Сонячна система) та «чужу кімнату» (за межами нашої Сонячної системи), кордоном між якими буде пояс Койпера і центр Сонця.

При цьому для «домашньої кімнати» пропонується застосувати принцип «*Res Communis Humanitatus*», а для «чужої кімнати» – новий принцип «*Res Nullius Civitatis et Res Communis Animal Rationale*».

Також автори звертають увагу на те, що вказані фактори вже сформували структуру «домашньої кімнати» незалежно від існуючих бажань і пропозицій, і нам залишається лише визнати її і прийняти.

У структурі «домашньої кімнати» сформувалися два типи просторів: «єдині та суверенні просторово-територіальні домени держав», на які поширюється виключна юрисдикція держав, і «*Res Communis Humanitatus*» – на який поширюється загальноприйняте міжнародне право.

При цьому, враховуючи всі природні та технічні фактори, автори виділяють у «*Res Communis Humanitatus*» два окремі шари: «Орбітальний шар» і «Балістичний простір».

Крім того, авторами запропоновано створення «санітарної атмосферної зони» для забезпечення безпеки людства від впливу фактора «Х».

Водночас, авторами заініційовано впровадження різних принципів міжнародного регулювання для «Балістичного простору», «Орбітального шару» і простору за його межами, на основі механізмів «мовчазної згоди», «мовчазної незгоди», «активної згоди» і «активної незгоди».

Результатом цього дослідження стала пропозиція проєкту Пакту про Космос.

Ключові слова: космічне право, теорія держави та права, історія права, еволюція права, юрисдикції, космос, міжнародне право, космічний простір

Problem statement.

The formation of international space law began in the second half of the 20th century when it was trendy among most states to carry out international constructive, tolerant, and peacekeeping activities. In this regard, the provisions of international space law were generally implemented, but only because it was de rigueur rather than "*jus cogens*" (since space law, in principle, lacks international mechanisms for enforcing its implementation).

However, in the 21st century, the situation changed dramatically, and the politics of power and technological superiority became a thing among powerful world leaders.

As a result, the provisions of existing international space law appeared to be questioned or ignored. That took place not only due to a change in "political fashion", but also because of a large pool of problems that were not promptly resolved either at the international UN level or at the level of interstate agreements. According to the authors, only solving these problems can make space policy sustainable and avoid space anarchy and dictatorship of superpowers.

Currently, the main challenge for space policy and space law is the determination of aerospace jurisdictions (national, international, and others) regulating the effective and fair implementation of outer space activities. At the same time, the lack of acceptable solutions to this problem muddles space law, since international norms are observed only to the extent that they are acceptable and convenient for the main space actors. That is to say, space law is more formal than a substantial mechanism for regulating space activities, which is based on the favor of the most powerful states.

In this regard, Bleddyn Bowen made a good point that in space activities the most powerful states dictate the rules to other states, leveling international norms, since no one can hold them liable for violation [16, p. 479–480].

A distinguished example of the mentioned behavior is the US initiative to explore and develop the Moon, which was officially announced by President Donald J. Trump on December 11, 2017 [63] in Space Policy Directive-1 [65].

Ipso facto the United States of America that had previously refused to sign the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (or the Moon agreement) dated December 05, 1979 [56], announced the launch of an active space campaign for the exploration and Moon development (decipher as "for profit") in violation of generally accepted human principles stated in the mentioned Moon agreement.

At the same time, as the leader of the relevant initiative, which is somewhat similar to Shere Khan from "The Jungle Book" (Rudyard Kipling), the United States of America offered other states to join the Moon Initiative based on the Artemis Accords [51] (decipher "or remain without their share of the plunder").

As a matter of course, the call to action voiced by the superpower was not ignored by the less powerful space actors, and on October 13, 2020, the Artemis Accords, along with the United States, were signed by Australia, Canada, the Republic of Italy, Japan, the Grand Duchy of Luxembourg, the United Arab Emirates, the United Kingdom [51]. Moreover, under official data from NASA, as of this writing, a total of 50 states have already joined the Artemis Accords [38]. At the same time, most of the acceding states had previously signed and ratified the Moon agreement, which is contradicted by the Artemis Accords.

Therefore, less powerful space actors, fearing to be left without a share of the plunder, rushed after Shere Khan, who intended to jump into the fire without realizing all the consequences. The Artemis Accords have become like Niagara Falls, which drags all other actors into a dangerous trap.

However, the unfortunate thing is that the signing and ratification of the Artemis Accords by many states and space agencies marked the beginning of the collapse of existing international space law and order, creating the preconditions for the dictatorship of space law of the most powerful states.

In this respect, such a dictatorship poses huge risks for the emergence of contradictions and military space conflicts between the most powerful states, which Bleddyn Bowen also mentioned [16, pp. 415–416, 477–478].

The only way to avoid the stated conflicts is to develop a minimum of clear rules for space activities based on generally recognized aerospace jurisdictions. At the same time, the mentioned jurisdictions are the foundation for the future construction of a civilized international space policy and the formation of space law. Without the creation of the relevant foundation, politics and law are doomed to failure.

The status of the issue.

Many theories and proposals exist regarding the delimitation of aerospace above the Earth`s surface.

Academics like Csabafi I. A., Christol C. Q., Asamoah O. Y., Cheng B., Oduntan G., Ogunbanwo O. O., and many others contributed valuable insight.

However, despite such a large number of proposals and theories, all of them remained only subjects of behind-the-scenes negotiations, and none was taken as a basis since it was not considered acceptable from a scientific point of view.

Unfortunately though, without solving the main challenge of building a solid foundation for space law and policy, many scientists became bewildered by secondary issues, including those related to the implementation of private space activities, and even began to propose solutions to them, for example, on the following issues:

— commercial use of outer space [42][3][4][50];
— commercial use of international space stations [8][36][48];
— regulation of space traffic [27];
— regulation of the operation of commercial platforms for launching objects into space [43];
— liability, disputes, and insurance of space activities [33][34][67];
— commercial mining [32][44][45][57];
— space tourism [21][35][47][62];
— a form of commercial contract [2];
— ownership of objects obtained as a result of space activities, investment in space activities, participation of private companies in the militarization of space and other challenges of commercialization of space activities [46][29][61].

It is important to note that all proposed solutions are based on the precarious balance of peaceful coexistence of the main space actors. Once this balance is disrupted, no one will take these studies into

account (they will simply become useless), since the rules will be set only by the strength and power of the main space actors, advancing their interests.

Moreover, the emergence of the prospect of one or more states gaining enormous profits, which could significantly upset the economic and military balance between the superpowers, threatens the immediate outbreak of hostilities in space and on Earth by those states whose goal is to prevent such superiority.

For this very reason the task of establishing generally recognized aerospace jurisdictions, based on which international rules for regulating space activities will be developed, is of paramount importance.

The article aims to organize the legal space of the Universe based on "ius naturale", morals, and consuetudes of space activities with prospects for the existence of extraterrestrial intelligent beings in the Universe.

The basic material.

1. Overall perspective of jurisdictions.

1.1. Well-established concepts and principles of jurisdictions.

With the object of discussion of the ways, situations, and those to regulate space activities, it is necessary to understand the principles of jurisdiction that could be applied in outer space and on celestial bodies.

Within the established doctrine of international law, the universal framework for the jurisdiction of a state is nationality and territory as well as the right to protection [19, p. 49–50]. Additionally, according to the existing concept of jurisdiction, the objective (actual) jurisdiction of each state is directly related to its territory. This is because "*the notion of jurisdiction finds its origin in the concept of territory, the principle of sovereign equality and non-interference with the domestic affairs of States*" [19, p. 49].

At the same time, at its core, the word "territory" comes from the Latin word "*terra*" (meaning "earth or land") and is in no way connected with air or space, implying a description of an area on the land surface [40, p. 11–13]. In this regard, any option for establishing the jurisdiction of a state in space can only be considered through the prism of the direct connection of this space with a specific area on the land surface.

It is generally accepted that jurisdiction always consists of two complementary regulatory elements, namely, "jurisfaction" (Prescriptive [legislative] jurisdiction - the power of lawmakers and the relevant competence to apply the law to certain individuals) and "jurisaction" (Prerogative [enforcement] jurisdiction - administration of justice and enforcement of law in a certain territory) [19, p. 34, 50].

For these purposes, «*the concept (doctrine) of State jurisdiction means the right of a State to regulate the rights of persons, to affect the property, things, events, and occurrences whether by legislative, executive or judicial measure*» [19, p. 34, 49].

On the same note, according to the method and scope of exercise of jurisdiction, the following types are specificated: "exclusive jurisdiction" (a state has an exclusive right to exercise jurisdiction), "concurrent jurisdiction" (more than one state may simultaneously assume jurisdiction over persons, things or occurrences), "complementary jurisdiction" (a state may under international space law assume jurisdiction supplementing the jurisdiction of a third state) [19, p. 34].

In addition, it is necessary to understand that only "exclusive jurisdiction" is a full-fledged and autonomous jurisdiction, and all other jurisdiction options are derivative elements based on interstate agreements.

On a separate note, when describing the concept of public jurisdiction, three different types of jurisdictions are often singled out: territorial, quasi-territorial, and personal [19, p. 50].

However, only in the case of territorial jurisdiction does a state have exclusive jurisdiction within its territorial domain over things, property, persons, and legal transactions done within it, including the extraterritorial activities of such persons [19, p. 51].

In other cases, the jurisdiction is not generally recognized and exclusive jurisdiction, but it is only part of individual contractual interstate agreements (id est treaty jurisdiction).

For instance, personal jurisdiction is the totality of powers of a state concerning its vehicles, natural and legal persons (objects of jurisdiction) bearing its nationality, enjoying its protection, or owing it allegiance wherever it may be [19, p. 68]. That is, what it involves is mainly objects of jurisdiction located within the territory of a foreign state (viz. outside the territory of the state of their registration). It indicates that when carrying out activities, these objects do not fall under the exclusive jurisdiction of their state but have to comply with the rules of a foreign state (in the way the foreign state permits). Accordingly, personal jurisdiction is not about the establishment by the state of registration of rules for

such objects, but it consists of establishing prohibitions on certain actions to the detriment of the state of their registration (provided that compliance with such prohibitions will not contradict joint agreements with a foreign state). Thus, we can say that personal jurisdiction is not exclusive jurisdiction but is only an element of an agreement between states. Accordingly, personal jurisdiction also cannot be automatically applied on terra nullius (outside the territorial jurisdictions of states).

Wherein, quasi-territorial jurisdiction is the total of the powers of a state in respect of embassy, ships, aircraft, and spacecraft (to the extent to which they are also granted legal personality) having its nationality [19, p. 57]. That is, quasi-territorial jurisdiction differs from personal jurisdiction in that it extends to all persons and things on board, including the activities of such persons, whether on board the craft or elsewhere [19, p. 57]. Thereafter, the theory of quasi-territorial jurisdiction considers the vehicle and embassy as the territory of a state of their registration located outside its internationally recognized territorial boundaries (within the territory of a foreign state or terra nullius). However, in this case, quasi-territorial jurisdiction is also not exclusive jurisdiction, but it is only an element of an agreement between two states or within a group of states and can only apply to objects located on the territory of one contracting state, but which are the property of another contracting state. Accordingly, quasi-territorial jurisdiction also cannot automatically apply beyond the territorial jurisdictions of all states (terra nullius).

That is to say, personal jurisdiction and quasi-territorial jurisdiction do not entail absolute competence for any state but are only elements of agreements and concessions between two or more states – in other words, they regulate the relations between or among these states.

Only territorial jurisdiction provides a state with an absolute and independent right to regulate any activity (but only within its territory).

1.2. Historical principles of formation of sovereignty and jurisdiction of states.

Over a long time horizon states have protected their territorial integrity (that is, access to natural, human, and tax resources within a certain territory), including by adopting and signing relevant legal acts and international treaties [30, p. 577]. Gradually, from the seventeenth century AD, the doctrine of jurisdiction began to emerge from the concepts of sovereignty and territoriality, which was finally established in the nineteenth century [19, p. 49]. The mentioned doctrine, on the one hand, asserted the rights of states in the territories they occupied, and on the other hand, limited their rights only to these territories.

Therefore, states have established the principles of jurisdiction under which they have legal competence and can use resources only within their borders, and, accordingly, not possessing the competence and right to use objects (resources) outside their territory [30, p. 577].

In turn, to date, the boundaries of state territories (exclusive jurisdiction boundaries), in most cases, had already been determined, both on land and in water. Within these borders, a state has exclusive jurisdiction, and beyond them (terra nullius or on the high seas) the exclusive jurisdiction of a state ends [24, p. 4].

Wherein, the provisions of Article 1(1) of the Chicago Convention on International Civil Aviation (7 December 1944) established as follows, "*The contracting States recognize that every State has complete and exclusive sovereignty over the airspace above its territory*". In such a way, the spatial-territorial jurisdiction of states is not limited to the surface of the Earth but is directed up into space and down to the center of the Earth, somewhat reminiscent of the shape of an inverted cone with uneven sides that coincide in shape with the borders of states on the surface of the Earth [24, p. 4].

And if the issue of the lower limit of state jurisdiction has not yet been raised, then the question of the need to determine the upper limit of the spatial-territorial jurisdiction of states, as well as the establishment of the legal status of outer space and celestial bodies has been discussed for a very long time. However, to this day, the discussed challenge remains unresolved.

2. Legal status of outer space: analysis of existing theories and proposals.

2.1. Theories of outer space legal status.

The matter of regulating space activities, human relations, and state-to-state regulations (including those related to the jurisdiction of states) in outer space and on celestial bodies has existed from the very beginning of the development of outer space law.

Attempts to solve the problem have led to the emergence of many concepts, theories, and proposals for determining the competence (jurisdiction) of subjects of space activities in outer space and on celestial bodies.

According to one of the most popular concepts of international public law, the state can act wherever direct prohibitions and restrictions are not established for it under international law, and in certain circumstances, it can even fall outside the scope of the international law framework [18, p. 146]. The discussed concept appears sui generis a colonizer concept since it invites states to act on the principle of "everything that is not prohibited is permitted" as well as make decisions and act outside their territory based on their interests regardless of the interests of humanity.

However, in respect of this concept, three theories arose for the regulation of activities in neutral territories, which can be described as follows: "*Res Communis*" (or "*Res Communis Omnium*"), "*Res Nullius*", and "*Res Communis Humanitatus*" (or "the Common Heritage of Mankind") [18, p. 147].

According to the first theory of "*Res Communis*", outer space and celestial bodies are considered a common territory [18, p. 147]. Therefore, all states, their citizens, and legal entities are free to explore, use, and develop the "commons" area. Precedently this theory was especially popular among underdeveloped states willing to profit from the use of raw materials outside their territory (terra nullius or on the high seas). However, when it came to outer space and celestial bodies technologically developed states supported this theory since it allowed them to operate in space as if on equal terms but enrich faster than underdeveloped states that are unable to get to space [18, p. 147]. Moreover, there is an opinion that after the signing of the UN GA Resolution 1721 states recognized outer space and celestial bodies as the territory of "Res Communis Omnium" [41, p. 12].

Under the second theory, "*Res Nullius"*, outer space and celestial bodies are the territory that belongs to no one. However, this theory does not prohibit states or other actors from taking possession or control of the territory of "Res Nullius" for their exclusively sovereign purposes by right of first discovery or use [28, p. 38]. In this regard, this theory, which has imperialist and colonial motives, is attractive to states that claim world hegemony.

According to the third theory, "*Res Communis Humanitatus*", outer space and celestial bodies are the common territory of all humanity. Therefore, all states, their citizens, and international entities are free to explore, use, and develop the common territory but only in the interests of humanity and on the condition that they share the resulting benefits with other participants (that is, there is a joint use aspect) [18, c. 147].

However, despite high popularity, all these theories remain only theories, and the very concept of colonizer cannot be called perfect and acceptable, because it does not consider the element of equality for everyone and the possibility of the existence of alien intelligent beings in the Universe. Moreover, we can say that an attempt to extend this concept to outer space and celestial bodies is a dangerous process that could provoke a new space race and lead to a new type of armed conflict - space warfare.

Under all circumstances, given that all three theories describe the legal status of Outer space, to apply them it is necessary to define the boundaries from which Outer space begins and the boundaries within which it ends. That is, these theories rest on the need to delimit the aerospace above the Earth`s surface and related jurisdictions.

2.2. Theories and proposals for the delimitation of aerospace above the Earth`s surface.

Most scholars attempt to determine the upper limit of spatial-territorial jurisdiction by dividing aerospace into two separate spaces (airspace and outer space), explaining this approach by the different physical characteristics and legal regimes of these spaces [40, p. 282–284].

As of today, there are many theories and proposals concerning the delimitation of aerospace above the Earth`s surface.

Most of them were classified by McDougal, Lasswell, and Vlasic, namely: (1) proposals based upon prescriptions of the Air Conventions, (2) proposals based upon varying physical characteristics of space, (3) proposals based upon varying natures of flight instrumentalities, (4) proposals based upon the factors of effective control, (5) proposals based upon the earth`s gravitational effects, and (6) proposals based upon arbitrarily chosen altitudes [31].

One of the most popular proposals based upon the earth`s gravitational effects is to limit the airspace of states to the upper limit at which the force of gravity influences. However, it is very difficult to implement this proposal, since it turns out to be challenging to determine an object of ideal shape, weight, and density on which the relevant experiment can be carried out. Unless the experiment could be run with an international prototype kilogram made of a platinum-iridium alloy (90% platinum, 10% iridium) and stored at the Bureau International des Poids et Mesures (in the city of Sèvres, France). However, to date, there are no agreements on this issue.

Additionally, there is a proposal to limit the airspace of states based on the geophysical meaning of the term "airspace" (proposal based upon varying physical characteristics of space). Under this proposal, airspace ends where the air is exhausted [24, p. 5]. However, it is necessary to remember that "air is a mixture of gases and is not a chemical compound". At the same time, there is no clear boundary between airspace and space without air (filled with vacuum), since the content of gases in near-Earth space is observed from the surface of the Earth and further hundreds and thousands of kilometers upward. In this regard, some scientists proposed considering the upper limit of the airspace to be a height of 5.8 kilometers (approximately 3.6 miles) above sea level, below which is half of the air in the Earth's atmosphere [24, p. 5].

In addition, there is a theory of determining the upper limit of airspace at an altitude of 60 miles (approximately 100 kilometers), above which a relative vacuum can begin [24, p. 5]. However, there were also versions that the vacuum could only begin above 400 miles (about 644 kilometers) [24, p. 5].

In turn, one of the most promoted proposals for the delimitation of air area and outer space is to consider the upper limit of the airspace to be the maximum altitude at which there is enough air for there to be a "'lift' from the air" for aircraft flights and balloons [24, p. 6].

There are also other theories, namely, "*usque ad infinitum"* (extending jurisdiction upwards over the territory of the state to add infinitum), "the national security and effective control theory" (links jurisdiction to the security of a state), "the lowest point of orbital flight theory", "theories of arbitrary distances" (different jurisdictional boundaries depending on various civil cases and court cases) [40, p. 305–310].

Additionally, Gbenga Oduntan proposed the following very compelling theory – "a staggered demarcation regime in international law to regulate jurisdiction over spatial territories" [40, p. 310–311]:

1. A lower demarcation line for territorial airspace of approximately 55 miles to be considered as the maximum height for the airspace, which will be subject to the complete and exclusive sovereignty of the subjacent state;

2. A buffer zone for the next 45 miles (from 56 to 100 miles), which should be recognized as an area of innocent passage for all states;

3. An outer space demarcation line of 100 miles, which should mark the beginning of outer space (completely free from all claims of sovereignty and jurisdiction).

In general, it can be noted that there are many theories and proposals regarding the delimitation of aerospace above the Earth`s surface.

However, despite such a large number of proposals and theories, all of them remained only subjects of behind-the-scenes negotiations, and none was taken as a basis since it was not considered acceptable from a scientific point of view [11, p. 138].

The issue of delimitation of outer space may have remained unresolved to this day because the expansion of the exclusive jurisdiction of states upward into outer space depends on it - that is, the expansion of political influence. Either way, since the states failed to agree on such delimitation of space, it remains unclear how far the jurisdiction of a state extends in aerospace over its territory and where the lower demarcation line of outer space is [11, p. 137].

2.3. The UN General Assembly opinion.

Pending a decision on the issue of delimitation of aerospace as well as due to the urgent need to define the competencies (jurisdictions) of both the main space actors and the UN, by the end of 1963, the UN General Assembly announced several statements on this subject in the UN GA Resolution 1721 [58] and the Declaration of Legal Principles [59], which could be formulated as follows:

"*Outer space and celestial bodies are not subject to national appropriation by claim of sovereignty, through use or occupation, or by any other means.*

The jurisdiction of States extends to all objects registered by them located in outer space and to astronauts thereon.

The activities of States in the exploration and use of outer space and celestial bodies shall be carried on following international law, including the Charter of the United Nations" [30, p. 579].

From that moment until the present day, the principles of determining jurisdiction have not changed and have only been repeatedly supported in various international acts.

However, these statements did not provide answers to questions concerning the delimitation of aerospace, the legal status of outer space, and the actual competence of subjects of space activities.

On the contrary, having announced these provisions, the UN General Assembly immediately faced the need to solve new problems related to the regulation of activities in outer space and on celestial bodies:

— determining the possibility of states applying national law in outer space and on celestial bodies;

— determining the limits of the competence of states to apply national law regarding their Cosmic artificial objects [31, p. 87];

— determining the limits of the competence of states to apply national law regarding astronauts in the Cosmic artificial objects of these states [31, p. 87];

— determining the possibility of states and international bodies applying international law in outer space and on celestial bodies;

— and many other issues.

However, like previous tasks to define the boundaries of outer space and the outer space competencies of states, none of these tasks have been solved.

Thus, to date, the task of defining aerospace jurisdictions remains unresolved.

According to the authors, one of the causes commonly cited is the use of standard approaches to determining jurisdictions that are usually applied on Earth.

In turn, for an effective and positive solution to this issue, it is necessary to form a concept of the legal status of outer space and the limits of the aerospace jurisdictions of states, taking into account all factors that influence or may influence space activities, as well as the security of states and all of humanity as a whole.

3. Factors in the development of aerospace jurisdictions.

3.1. Overall perspective.

Any researcher who explores the processes of regulating space activities understands that outer space law is a unique type of law. It cannot be compared with other types of law such as maritime or air law due to the regulating relations within Earth.

For this very reason, all attempts to determine the jurisdictions and sovereignty of states based on the division of aerospace into air and outer space from a physical point of view are meaningless. This is due to the fact that air is not a separate neutral substance but is a mixture of gases, which by nature is integrated into the composition of the entire aerospace. That is, air cannot be ideally isolated and separated from the entire aerospace.

Moreover, such a division of space for establishing jurisdictions is rather wanton from a legal point of view.

Taking into account the development of technology and possible contact with alien intelligent beings, it falls into place that jurisdictions can be established not only over the surface of the Earth but also over the surfaces of other planets and celestial bodies.

However, if the mixture of gases above the surface of the Earth can notionally be named air (which consists of 98-99% nitrogen and oxygen, as well as small amounts of argon, carbon dioxide, and hydrogen), then the same notion can hardly be applied to the mixture of gases above the surfaces of most other celestial bodies.

Accordingly, the principle of determining jurisdictions based on the division of common space into air and outer space will not apply to other celestial bodies.

In this regard, it has to be noted that we are surrounded by outer (cosmic) space (and not aerospace), including above the surface of the Earth. At the same time, outer space near the Earth has only one feature which is about a large content of a mixture of gases that we call air.

In turn, the determination of jurisdictions within outer space depends on many “natural factors”, both in near-Earth space and throughout our solar system, affecting both the safety of the existence of humanity and the safety of the existence of individual states.

In this study, the authors can only offer their vision of such “natural factors” and jurisdictional options, which are subject to further discussion by the scientific community as well as representatives of states and international organizations.

At the same time, to determine the jurisdictions in outer space consideration must be given not only to natural factors but also to technical factors that affect the security of each state individually together with the safety, equality, and efficiency of all space activities of mankind.

Such factors include, for example, the military use of aerospace by the most powerful states (military cosmic reconnaissance activities of satellites, launching and testing of intercontinental ballistic missiles, etc.).

Therefore, to determine the types and bounds of jurisdictions, it is necessary to take into account at least two kinds of factors (natural and technical), as well as their impact on three modes of security (state security, security of humanity as a whole, and security of space activities).

3.2. Natural factors.

3.2.1. The factor "*Vita elementis*".

Analyzing natural factors that can influence the formation of cosmic jurisdictions, the authors note that this study is not geographical, biological, or geophysical but is a purely political and legal study. Therefore, information about natural factors for this study is taken from open sources. In this regard, it would also be quite acceptable to use information obtained by other scientists in the formation of existing theories of aerospace delamination.

At the same time, regarding natural factors, attention shall be paid to natural objects that have a direct impact on the existence, safety, and activities of humans on Earth.

First and foremost, it is subject to the four basic elements on which human life on Earth depends: earth, water, fire, and air.

In this respect, to determine high-altitude jurisdictions (in cosmic space), an important aspect is the altitude above sea level at which all these elements can be relatively stable (constant) and in a useful state for humans.

In turn, it is a fact of common knowledge that the highest point of the stable earth`s surface (the first element) on our planet is the mountain peak Zhumulangma (or Everest) on the crest of the Great Himalayas that lies on the border between Nepal and the Tibet Autonomous Region of China (at 27°59′ N 86°56′ E) [14].

In December 2020, the authorities of China and Nepal, when signing a boundary demarcation protocol, agreed on the official height of this mountain peak which is 8848.86 meters (about 29031.69 feet) above sea level [15].

At one time, it is a matter of common knowledge that there is a large amount of water (the second element) on this mountain that is almost always found at the top of the mountain in a crystalline state in the form of snow and ice.

For its part, the possibility of the existence of a stable fire (the third element) at such a height was proven by a multinational expedition from China, which on May 8, 2008 raised the Olympic flame to the mountain peak of Zhumulangma [12][66].

As for air (the fourth element), in this case, it is important to know the height at which air can be conditionally defined as "*sanus et utilis aerem*".

For example, scientists have established the fact that half of the air in the Earth`s atmosphere turns out to be in a layer up to 5.8 kilometers (about 3.6 miles) above sea level [24, p. 5]. Maintaining the saturation of the lower layers of the atmosphere with air to such a level is of great importance both for the existence of all humanity as a whole and the existence of people in a particular state. Reducing saturation levels can harm people`s safety.

In turn, when rising higher, it is necessary to regard the ability to carry out in general minimum life activities on the surface of the Earth rather than the comfortable existence. At the same time, an ability to exist at appropriate heights is most often determined by historical experience. To be sure, history provides evidence of the conquest of the mountain peak Zhumulangma (or Everest) by people without using additional oxygen cylinders (in May 1978, it was fulfilled by Reinhold Andreas Messner and Peter Habeler). Subsequently, this achievement was repeated by many other climbers. In this context, the highest results in terms of duration of stay on Mount Everest were achieved by climbers from the Shar Pa. That is, we can conclude that at the height of the Zhumulangma mountain peak, there is such an amount of air that can be considered relatively sufficient for the short existence of a human.

Thuswise, it may be said that the four elements on which human life on Earth depends (earth, water, fire, and air) form the first natural factor, which can conventionally be called "*Vita elementis*". Whereas, this natural factor specifies the "*Vita elementis*" layer of the atmosphere and the "*Vita elementis*" stratum at an altitude of 8848.86 meters (or 29031.69 feet) above sea level (this layer almost corresponds to the troposphere [55]. In these circumstances, within this layer, a human can carry out activities relatively comfortably. In this regard, the discussed factor is critical both for the security of humanity as a whole and for the security of people in a particular state (that is, for the security of the state), but it does not have a critical impact on the safety of space activities.

3.2.2. The factor "*Tectum vitae*".

Such a critical natural object as the Earth`s ozone layer, the bulk of which is located in the atmospheric layer up to 50 kilometers (31 miles) above sea level, lies right around the "*Vita elementis*" layer [53][22].

Ozone absorbs the most energetic wavelengths of ultraviolet light, known as UV-C and UV-B, wavelengths that harm living things [53]. Ozone molecules protect life on Earth - they help shield our planet from harmful solar radiation [53]. Oxygen molecules absorb other forms of ultraviolet light, too. Together, ozone and oxygen molecules can absorb 95 to 99.9% of the ultraviolet radiation that gets to our planet [53].

Accordingly, its destruction over any territory of the Earth can lead to the destruction of nature and population in this territory, at least from solar radiation.

C'est-a-dire, the thickness and composition of the ozone layer in the Earth`s atmosphere shall remain that way to effectively protect the Earth`s surface (as well as people, plants, and animals) from harsh and excessive solar radiation.

The ozone layer serves as a kind of "roof" that protects the Earth and humanity from hard solar radiation.

One can say that the ozone layer determines the second natural factor, which can be conditionally called "*Tectum vitae*". In turn, this natural factor shapes the "*Tectum vitae*" atmospheric layer and the "*Tectum vitae*" stratum at an altitude of 8848.86 meters (or 29031.69 feet) to 48 kilometers (or 30 miles) above sea level (this layer almost corresponds to the stratosphere [54]. In this context, such a layer is critical for a human to comfortably carry out life activities. Due to this, the mentioned factor is critical both for the security of humanity as a whole and for the security of people in a particular state (that is, for the security of the state), but it does not have a critical impact on the safety of space activities.

3.2.3. The factor of "Acceptable atmospheric pressure".

As mentioned above, the presence of air and ozone in the atmosphere has a great influence on a human's ability to exist. However, not only the chemical but also the physical characteristics of the atmosphere are important for human life.

For example, every person on Earth, at least once, has encountered the concept of atmospheric pressure (the force with which the mass of the atmosphere exerts pressure on a man), which is often classified as a meteorological factor.

At the same time, as of today, the influence of atmospheric pressure, as a meteorological factor, on patients with cardiovascular diseases is a generally accepted fact and is based on a large number of studies. The research results indicate that weather changes such as a sharp increase or decrease in ambient temperature, fluctuations in atmospheric pressure, and increased air humidity lead to an increased risk of developing acute myocardial infarction, cerebral stroke, and increased mortality of patients [26, p. 670–673][9, p. 1109–1116][7, p. 1074–1082][6, p. 139–140][5, p. 93–100].

Therefore, given that the organism of contemporary man is adapted to a comfortable existence only at a certain stable atmospheric pressure, such pressure is an important factor for the life of mankind.

In this regard, since the beginning of the 17th century AD, scientists Vincenzo Viviani and Evangelista Torricelli carried out the first measurements of atmospheric pressure using a mercury barometer. For this purpose, "millimeters (inches) of Hg" was used as a unit of measurement of atmospheric pressure.

As of today, science uses several units of measurement of atmospheric pressure, the ratio of which is approximately the following: 1 atmosphere = 1013.25 millibars = 760 millimeters (29.92 inches) of Hg = 101325 Pascals. From these ratios of measured quantities, it can be seen that Pascal is the minimum one and, accordingly, the most accurate unit of measurement of atmospheric pressure.

It is also generally known fact that the average and most acceptable atmospheric pressure on the surface of the Earth is considered to be a pressure of 1 atmosphere [13][64, p. 38, 112][1, p. (12)10].

The stated atmospheric pressure is created by the volume and mass of the atmosphere (atmospheric column), which is located above the Earth`s surface to a height at which the density of the atmosphere is as low that the pressure created by the atmosphere is zero and as close as possible to zero.

That is, the mass of the atmosphere and the force with which it presses on the surface of the Earth are very important indicators for human life. In this regard, to ensure comfortable human life, it is necessary to measure and maintain the maximum height of the atmospheric column in cosmic space, which creates an acceptable atmospheric pressure of 1 atmosphere (or 101325 Pascals) on Earth.

At the same time, taking into account the fact that it is almost impossible to determine absolute zero, the atmospheric pressure that is closest to zero can be considered the atmospheric pressure that is less than the smallest legal unit of measurement, meaning, less than 1 Pascal.

In turn, according to the COSPAR and U.S. Standard Atmosphere, atmospheric pressure below 1 Pascal begins above a geometric altitude of about 80 km (about 50 miles) above sea level [1, p. (12)9] [64, p. 52, 136].

Thus, we can say that atmospheric pressure determines the third natural factor, which can be conditionally called the "**acceptable atmospheric pressure**" factor. In turn, this natural factor determines the layer of the atmosphere of "**acceptable atmospheric pressure**" and the "**acceptable atmospheric pressure**" stratum from the Earth`s surface to an altitude of about 80 km (about 50 miles) above sea level (the upper limit of this layer almost coincides with the upper limit of the mesosphere [52]**.** In this context, the factor of **"acceptable** atmospheric pressure" is critically important for a human to comfortably carry out life activities. Pursuant thereto, the described factor is critical both for the security of humanity as a whole and for the security of people in a particular state (that is, for the security of the state), but it does not have a critical impact on the safety of space activities.

3.2.4. The factor of "atmospheric density".

Just like the mass (m) of the atmosphere, the volume of the atmosphere (V) has an important influence on the physical characteristics of outer space, which together with its mass forms such an important value as the physical density of the atmosphere ($\rho = m*V$). Therefore, the density of the atmosphere affects the movement of air masses and atmospheric precipitation, evaporation, and many other natural phenomena on which human life depends.

Furthermore, the density of the atmosphere determines the force with which it resists the movement of solid objects (humans, objects of fauna, or technical means). Such interaction of an object and space is described by Newton`s third law (for every action, there is an equal and opposite reaction).

According to the U.S. Standard Atmosphere, the density of the atmosphere (the cosmic space near the Earth`s surface) is approximately 1.225 kg/m³ (or 0.0765 lb/ft³) [64, p. 39, 112].

At the same time, taking into account the high hardness of the Earth`s surface and objects located on its surface, as well as the fragility of the human body to such objects, it can be said that the density of outer space near the Earth`s surface does not create any particular obstacles for human movement at a speed that is safe for one.

Moreover, the density of the atmosphere, combined with atmospheric pressure, allows birds to fly, which are important elements of the earth`s ecosystem that ensure human life.

With the development of technological progress, humanity has also been able to lift and move objects above the Earth`s surface that are heavier than air and have a reflective surface (wing), using primarily Newton`s third law and Bernoulli`s principle (on the pressure difference).

The main characteristic that describes the ability to fly is considered to be "the aerodynamic lift force" or "the lift from the air" [10, p. 84, 390].

In this case, one of the formulas by which one can calculate "the aerodynamic lift force" is: $L= ½ p*v^2*S*CL$ (L - is the lift force, p - is the air density, v - is the velocity or true airspeed, S - is the planform (projected) wing area, CL - is the lift coefficient at the desired angle of attack, Mach number, and Reynolds number) [10, p. 369, 377].

From this formula, it is born in upon that the density of the atmosphere plays a key role in creating "the aerodynamic lift force" that allows a human to fly using a wing (i.e., airplanes). However, at the same time, the density of the atmosphere also creates resistance and a certain amount of friction, which negatively affects the ability to fly at high speed.

Hence, we can understand that with a decrease in the atmospheric density (which decreases with the height of ascent above the Earth`s surface), the resistance will decrease and the flight speed will increase, but also "the aerodynamic lift force" that allows flight will decrease.

Accordingly, at certain altitudes, where the density and pressure of the atmosphere will be minimal, the ability to fly with the help of a wing will be completely lost.

In scientific discourse, it is argued that as of today flights using the "aerodynamic lift force" are possible up to an altitude of 25 miles (132,000 feet) or about 40 kilometers above sea level [40, p. 298], where the density of the atmosphere is about 0.004 kg/m³ (or 0.000244 lb/ft³) ³) [64, p. 50, 121]. However, hypothetically speaking, future wing-based flights could be possible at altitudes of up to 50 miles (264,000 feet) or about 80 kilometers, where "the aerodynamic lift force" is minimal [40, p. 298], and the density of the atmosphere is about 0.00001 kg/m³ (or 0.000001 lb/ft³) [64, p. 53, 137].

In turn, the ability to carry out civil (peaceful) transportation of people and cargo using aviation, which applies "the aerodynamic lift force", is also the basis for the consistence human activity and economic security of each state.

Accordingly, it can be stated that the "atmospheric density" determines the fourth natural factor, which can be conditionally called the "**aerodynamic density of the atmosphere**" factor. For its part,

this natural factor specifies the layer of "**aerodynamic density of the atmosphere**" (which allows for the creation of "the aerodynamic lift force") and the bounds of this layer (stratum) from the Earth`s surface to a height of about 80 km (about 50 miles) above sea level. Therefore, the upper limit of this layer almost coincides with the upper demarcation line of the mesosphere [52] and the limits of the layer of "**acceptable atmospheric pressure**".

At the same time, the factor of "**aerodynamic density of the atmosphere"** has a great influence both on the implementation of human life activities and on the economic security of each individual state. However, this factor does not have a strong impact on the safety of space activities.

3.2.5. The factor "X".

Notwithstanding, the most important aspect of atmospheric security (both for humanity and each state) is the risk of a potentially dangerous "object X" (a new active chemical element, a virus, an intelligent biological organism, or a similar object) entering the atmosphere from outer space, which if it gets the Earth is capable of destroying flora, fauna, and even the people. For example, while passing through the atmosphere, when a spacecraft returns to Earth, some unknown space "object X" (previously attached to the spaceship in outer space or on a celestial body) may detach from it. We can say that at this moment the "X factor" arises - the factor of "object X" entering the Earth`s atmosphere. Picture that this "object X" is an unknown chemical element that is inactive in a vacuum, but when combined with oxygen it could influence the atomic structures of known chemical elements (for example, turn steel into powder). After such "object X" gets the Earth, our civilization may return to its primitive state. After all, the alchemists` legends about the philosopher`s stone may be based precisely on such a cosmic "object X".

Unfortunately, terrestrial technologies can identify in space those objects that they have already encountered and identified on Earth. That is, there is a high risk that none of the space researchers would simply be able to detect this new "object X" and it could be introduced into the atmosphere of a state that does not carry out space activities and does not have technologies capable of protecting it from "object X". Accordingly, the question arises at what height (the height of the "factor X") the density and/or composition of the Earth`s atmosphere is sufficient so that, upon entering the Earth`s atmosphere, this "object X" could further move into the life safety layer «***Vita elementis***» and cause catastrophic damage.

As of today, there is no answer to this question, and it requires additional scientific experiments to determine the height of the sanitary atmospheric zone around the Earth.

It can be said that the risk of a dangerous object "**X"** entering a vital part of the Earth`s atmosphere is determined by the fifth natural factor, which can be conventionally called the factor "**X"**. At the same time, the factor "**X"** is of great importance both for the human life activities and for the security of each state. In this regard, the presence of the "**X"** factor requires the definition of the limits of the "**sanitary atmospheric zone"** layer to ensure the safety of humanity, which still needs to be established. In this respect, it shall be noted that this factor does not have a significant impact on the safety of space activities.

3.2.6. The Orbital factor.

The so-called geostationary orbit (GSO) is located at an altitude of about 36,000 kilometers (about 22,370 miles) above sea level [40, p. 301]. The mentioned orbit is crucial for satellite telecommunications because an object in that orbit over the equator travels at the same speed as the Earth [23, p. 53] – that is, the movement of the satellite in this orbit is synchronized with the rotation of the Earth around its axis.

Such natural features of the Earth as gravity and axis-turning (the origin of which currently does not yet have an exact scientific explanation) create a unique and effective "O**rbital layer**" around the Earth and determine the sixth natural factor, which can be conditionally called the **"Orbital layer"** factor.

The discussed layer is above the "**aerodynamic density of the atmosphere"** layer (where atmospheric density and friction are as low that they do not have a destructive effect on spacecraft) and extends to an altitude of 36,000 kilometers (about 22,370 miles) above sea level (where the most effective geostationary orbit is observed).

At the same time, the **"Orbital layer**" factor does not have a critical impact on human life and state security, but it is a very important factor for the implementation and safety of space activities in general. For this very reason, today, the **"Orbital layer**" contains the largest part of spacecraft launched from Earth.

3.2.7. Factor of gravitational and other natural interactions of objects in the Solar System.

Up to date, it is a fact of common knowledge that the Sun has a tremendous influence on normal human life and activities, warming the Earth and providing the necessary radiation for growing crops.

Additionally, it is of general knowledge that the Moon influences human life: ebbs and flows, currents, dependence of living beings and plants on lunar cycles, and much more besides.

Less known but of equal importance is the influence of the gravitational forces of the Sun and Moon on the process of oscillatory and intermittent rotation of the Earth around its axis, namely, on the processes called Nutation and Precession [39][20, p. 19–20, 199–200].

Moreover, gravitational forces permeate our entire Universe and have a huge influence on its formation.

In addition, Kepler`s laws reflect that gravitational forces have a strong mutual influence on all objects of the Solar System, on their orbital motion, rotation, and location within the Solar System [17] [20, p. 1–2, 30–33].

Therefore, it is safe to assume that damage to any celestial object in our Solar System (the Moon, planets, or others) can lead to a change in its orbital motion, rotation, and location within the Solar System and, as a consequence, to a change in the existing balance of gravitational forces in the Solar System.

In turn, a modification in the orbit of any celestial object or a change in the balance of gravitational forces in the Solar System can lead to a catastrophe on Earth (from a collision of celestial bodies to a change in the conditions of the Earth`s rotation both around the Sun and around its axis).

Thus, a balanced and stable Solar System is the basis for the sustainable existence of all humanity on Earth and the consistent implementation of space activities.

Various types of interactions of celestial bodies within the Solar System (from gravitational forces to radiation), which strongly influenced the stable and safe development of life on Earth, determine the seventh natural factor, which can be conventionally called the **Factor of gravitational and other natural interactions of objects in the Solar System**.

In this context, the outer limits of the space occupied by the **Solar System** can be combined with the outer bounds of the Kuiper Belt, which is home to the most ancient asteroids. In such a way, the Solar System includes the Sun, which is the star and center of the system, as well as eight planets: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune [49]. Some of these planets are orbited by one or more moons same as the Earth is orbited. In addition, there are five officially recognized dwarf planets in our Solar System: Ceres, Pluto, Haumea, Makemake, and Eris, hidden among the Asteroid Belt and at the very edges of the Solar System near the Kuiper Belt [49]. Some scientists suggest that even further beyond that, there is the mysterious Oort Cloud, a collection of icy objects that gives birth to dazzling comets with long tails. However, due to its significant distance from the Sun (1 light year or 50,000-100,000 astronomical units), this cloud does not have any effect on human life and space activities, and it can hardly be attributed to the Solar System.

The inner limit of the Solar System can be conventionally designated as the center of the Sun. However, taking into account the paradigm of the space-time continuum, each part of the Universe (including the Solar System) can supposedly have both outer and inner sides, and the beginning of space can simultaneously be its edge. Accordingly, under certain conditions, the inner limit of the Solar System can be considered its outer demarcation limit. As a result, the mentioned limit could be very conditional, built on the principles of classical geometry.

However, at this stage, the main aspect is not determining the exact demarcation lines of **the Solar System**, but understanding that the **Factor of gravitational and other natural interactions of objects in the Solar System** exerts a strong influence on all aspects of human activity: from ordinary existence to space activities.

3.3. Technical factors.

3.3.1. The factor of "Permanent civil space orbital transportation".

As of today, the plans of companies such as "Blue Origin" and "SpaceX", as well as some other space companies, to organize space tourism and permanent space transportation of passengers and cargo between different locations on Earth are widely blazed. In this case, it refers to transportation for which spacecraft will be used, that is, a technical means capable of rising above the layer of "**aerodynamic density of the atmosphere**" and carrying out a controlled flight in the "**Orbital layer**".

In turn, it is obvious that such transportation the likes of regular air transportation will pose a security threat to the population of both transit countries and countries of departure and destination. Therefore, any attempts to create permanent civil space transportation between different destinations located on the territory of different states will require the development of uniform international standards and addi-

tional state and international control over the safety of such transportation (uniform launch and landing standards, transit corridors, passenger safety standards, and much more).

Accordingly, the moment deriving from technical progress one of the space companies announces the organization of permanent space orbital transportation up to a certain orbital altitude, this will automatically lead to the emergence of such a technical factor as "**Permanent civil space orbital transportation**". The result of the introduction of the mentioned factor will be the emergence of a layer of "**Permanent civil space orbital transportation**", the lower limit of which will be the upper bound of the layer of "**aerodynamic density of the atmosphere**", and the upper limit will be the maximum orbital flight altitude of the spacecraft that will be used for such transportation.

3.3.2. The Ballistic factor.

The main task in the field of international security in space is to solve problems that can become a source of conflict between states. One of these problems is the unsolved issue of jurisdictions in outer space.

For over 60 years, scientists and lawyers have been trying to tackle the challenge without success, and being carried away by it they missed the fact that the military had already solved this problem in a radical and rigid way by creating Intercontinental Ballistic Missiles.

As far as the case is concerned, it is not about launches of combat-loaded Intercontinental Ballistic Missiles, since this fact in itself is a catastrophe for all of humanity.

The issues at hand are only test or demonstration launches of Intercontinental Ballistic Missiles, which pose a threat to space activities.

An example of this is the test launches of intercontinental ballistic missiles by the United States, Russia, and North Korea during 2020-2024.

The peculiarity of these launches is the altitude to which Intercontinental Ballistic Missiles can rise.

Thus, already at the end of the 20th century, the military defense complexes of the world`s leading players determined the maximum effective flight altitude of Intercontinental Ballistic Missiles to be 400 kilometers (about 250 miles) above sea level [60, p. 158]. At the same time, some types of Intercontinental Ballistic Missiles can reach an altitude of up to 7,000 km (4,350 miles) above sea level as confirmed by tests conducted by North Korea in 2024 [37]. However, reaching such an altitude significantly increases the flight time and accordingly makes the mentioned missiles more vulnerable and ineffective.

In this regard, it makes no sense to consider the altitude above 400 kilometers (about 250 miles) above sea level, within which the main tests of ballistic and hypersonic-guided missiles are conducted.

At the same time, even though test or demonstration launches of such missiles pose a serious threat to space activities, no one can prohibit these states from carrying out such launches.

De facto, the world has appeared under circumstances where intercontinental ballistic missiles have given rise to a technical factor that can be conventionally called a "**Ballistic factor**".

The result of this factor is the emergence of a "**layer of Ballistic space"**, the lower limit of which is the surface of the Earth, and the upper bound is the maximum effective flight altitude of Intercontinental Ballistic Missiles (that is, 400 kilometers or about 250 miles above sea level).

Moreover, the "**Ballistic factor**" carries great risks for the life of humanity and the security of states (the risk of air crashes, falling debris, and much more), and also carries a visible threat to the safety of space activities in general, since the flight trajectories of Intercontinental Ballistic Missiles at high altitudes intersect with the flight trajectories of space satellites in the "**Orbital layer**".

In addition, it is necessary to take into account the fact that further development of technologies may lead to an increase in the effective flight altitude of such missiles, which will automatically affect the increase in the height of the "**layer of Ballistic space"**.

4. Definition of space (cosmic) jurisdictions based on the concept "*natura, mores et consuetudines*".

4.1. Basic principles of the concept «*natura, mores et consuetudines»* (nature, morals, and consuetudes) (NMC).

As discussed above, multiple theories, concepts, and suggestions exist for determining jurisdictions in space activities. Even the authors previously proposed the option of developing aerospace jurisdictions based on dividing the aerospace around the Earth into four layers: "the layer of life safety of the State" (9 kilometers or 5.6 miles above sea level), "the layer of economic security of the State" (60 kilometers or about 37.3 miles above sea level), "the layer of atmospheric (natural) security of the State" (1000 kilometers or about 621 miles above sea level), "the layer of spatial security of humanity" (up to an altitude of 36,000 kilometers or 22,370 miles above sea level) [30][31].

However, considering the results of this study and identifying factors that influence or may influence the formation of jurisdictions, the authors concluded that the proposed concept should be revised.

It is necessary to understand that cosmic jurisdiction is connected not only with the operation and use of outer space but also to the safety of space activities and the safety of the existence of states and their people [40, p. 306]. Thus, this issue is not only legal or technical-physical but also political.

It is safe to say that one of the most important issues of space jurisdiction is not about the limit between outer space and airspace but concerning the demarcation of the upper limits of the spatial-territorial jurisdiction of a state – in other words, where is the upper limit of the state`s political space. To determine this bound, the essential thing one should understand is that the political space of a state ends where the threat to the security of its existence (sovereignty) disappears. However, when developing the law of jurisdictions, it is important not to lose sight of the fact that "*ius dicitur locus in quo ius redditur*" (law is the place where the right/decision is exercised/made) [25, p. 87] and "*legis virtus haec est imperare vetare permittere punire"* (the power of the law is to command, prohibit, permit, punish) [25, p. 87]. That is when it comes to the legal formation of the security of states and humanity, it is to be understood that the law is rendered useless provided it is established in those places where there is no opportunity to control its observance.

At the same time, to avoid conflicts when forming official jurisdictions, it is important to remember the words of ancient Roman jurist *Ulpianus,* quoting the Greeks, "*των νομων οι μεν εγγραφοι, οι δε αγραφοι*" (some laws are written, while others are unwritten) [25, p. 85].

In this context, the question is about already-established morals and consuetudes.

Some of these morals and consuetudes (appropriation of orbits, launching unidentified objects into space, using satellites for military purposes, etc.) are carried out by separate actors with the tacit consent and failure to combat from other actors.

Other morals and consuetudes (nuclear tests, ballistic missile launches, wars, the death penalty, etc.) are performed by separate actors with vociferous objections and condemnation from other subjects but without their real opposition to such actions.

In turn, as another ancient Roman lawyer *Iulianus* said, "*Invetarata consuetudo pro lege non inmerito custoditur, et hoc est ius quod dicitur moribus constitutum*" (the former vested consuetude appears to be law on merit, and this law is called the law established within morals) [25, p. 113].

Therefore, it is essential to figure out which of these morals and consuetudes can be conditionally recognized and accepted as a fact for determining space jurisdictions, and which cannot be accepted under any circumstances. In this context, would be appropriate words of ancient Roman lawyer *Paulus*, "*optima enim est legum interpres consuetudo*" (the best commentator of law is consuetude) [25, p. 115].

In addition, consideration must be given to the fact that regardless of the level of technological progress, a human remains part of the Universe, for which the basis of development is "*Ius naturale, quod natura omnia animalia docuit*" (natural law that all the creatures were taught by the nature) [25, p. 83]. For this very reason, when establishing any jurisdictions, it is necessary to take into account not only technical and political factors but also natural factors that affect the stability of the surrounding outer space and the safety of the existence of all humanity as a whole.

At the same time, it should be noticed that the basic "*lex naturae*" (law of nature) states "*cum iure naturali omnes liberi nascerentur*" (under natural law, everyone is born free) [25, p. 85]. Accordingly, outside the jurisdictions, there can be no laws other than "*leges naturae*" and all attempts by states to establish laws for a free man outside their jurisdictions (in outer space) can deliver the only result - a cosmic revolution.

Consequently, the NMC concept involves the development of space jurisdictions with the consideration of natural and technical factors, established morals and consuetudes along with the safety of space activities, states, and humanity as a whole.

Hence a preliminary finding is that we can recognize and adhere to some delimitations of jurisdictions (by this medium jurisdictions "*quod lege naturae, moribus et consuetudine inductum est*" have existed for a long time), while states can only agree on other demarcation limits, and when some boundaries are generally found beyond the competence of people and states.

4.2. "Domestic room" and "alien room" of outer space.

Planet Earth and its nature are the natural habitat of humans, where one is born, grows up, and lives, and where all natural environments are interconnected with each other and with humans. The Earth and the space surrounding it are a kind of "domestic room" of humanity. At the same time, the dimensions,

bounds, and structure of the "domestic room" depend on the natural objects of the Solar System, which affect the existence of mankind and their modification can negatively affect the safety of humanity. Therefore, people have every right to explore and develop such natural objects, since this is of paramount importance for the existence of all mankind.

At another point, aerospace and celestial bodies outside the "domestic room" of mankind, which are not the natural habitat of humans and do not affect the safety of the existence of mankind, are an "alien room", where a human is only a guest who does not have no rights. In addition, it is necessary to take into account the existence probability of extraterrestrial intelligent beings outside the "domestic room", to whom humanity cannot lay down the rule but can only negotiate with them. That is to say, people cannot set rules in the "alien room" but can only offer formats of cooperation, both for themselves and for extraterrestrial intelligent beings.

Given this fact, the only solution for determining jurisdictions will not be the delamination of air and outer space, but the definition of the boundary between the "domestic room" and the "alien room" to delimitate the outer limits of human security.

In turn, as stated earlier, the **Factor of gravitational and other natural interactions of objects in the Solar System** has the most large-scale (in terms of space) influence on the stable and safe development of life on Earth, determining the size of the "domestic room" within the Solar System.

Taking this factor into account, the Kuiper Belt can be considered the spatial-geometric outer boundary between the "domestic room" and the "alien room", and the center of the Sun is the spatiotemporal boundary between these rooms.

Thus, beyond the Kuiper Belt and the center of the Sun, there is the "alien room" for humanity.

At the same time, considering that the **Factor of gravitational and other natural interactions of objects in the Solar System** influences the life activity of all humanity, the basis for space activities throughout the **Solar System** will always be international law, common to all states and inhabitants of the Earth, except spaces that are within the exclusive jurisdiction of individual states.

In turn, it`s most likely that the activities of any state or person outside the Solar System (within the "alien room") will not have any impact on the existence of another state or all of humanity on Earth. In this regard, there can be no international or national rules or jurisdictions outside the Solar System. In the "alien room", actors of space activities cease to be subjects of international and national space law and can independently and from choice enter into agreements and contracts for cooperation outside the Solar System. In such case, because by natural law every person is born free, neither states nor international organizations can establish mandatory rules for actors of space activities outside the "domestic room".

That is, any cooperation agreements cannot establish any rules in the "alien room" for space actors that are not parties to such agreements.

However, it is necessary not to forget about the possibility of existing outside the "domestic room" of alien intelligent beings and civilizations, with whom it will be necessary to agree on the exploration and exploitation of outer space.

Accordingly, despite the absence of the need to develop international mandatory rules of behavior in the "alien room", the authors propose already at this stage to outline general principles of such behavior that are common to all humanity. Representatives of humanity will be able to adhere to these principles (at their own discretion) outside the Solar System, both in relations with alien intelligent beings and in relations with each other.

For example, the authors propose to abandon the colonial principles of "*Communis*", "*Res Nullius*", and "*Res Communis Humanitatus*", and adopt a new principle as the basis for behavior in the "alien room" - "*Res Nullius Civitatis et Res Communis Animal Rationale*".

Under the proposed principle, any activity of states and people in the "alien room" cannot be in the interests of one or several states but shall consider the interests of all humanity and extraterrestrial intelligent beings.

4.3. The structure of the "domestic room".

Until the time when humanity learns to independently create solar systems similar to our system and repair and restore them, states and people on Earth can only recognize their dependence on the **Factor of gravitational and other natural interactions of objects in the Solar System** and acknowledge the influence of space activities on the Solar System stability.

This is precisely why, any space activity of any actor within our Solar System can only be carried out considering the mentioned factor, which affects the stability and safety of life of all humanity.

That is, such space activities can only be performed in the parts of our Solar System and in such ways that do not and cannot cause damage to any person, state, or all of humanity.

In turn, the only way to regulate the interests and ensure the security of all mankind is to establish and comply with the provisions of international law developed in the interests of all mankind (since no state has yet created a single legal act in the interests of all mankind).

That is to say, the **Factor of gravitational and other natural interactions of objects in the Solar System** establishes a rule according to which the provisions of international law developed in the interests of all humanity automatically apply to the entire "domestic room" within the **Solar System**, except for spaces of national jurisdiction and those regarding which a single rule will be established by all states on Earth, applicable in the interests of individual states and not humanity.

At the same time, provided all people were *Animal Rationale*, and strived for common security and common goals, without attempts to single out the spheres of security and influence of separate states, then there would be no need for division and structuring of the "domestic room".

However, the desire of separate states and people for superiority over others requires ensuring the security of all humanity from the unpredictable activities of such states and people, by determining the internal boundaries, size, and structure of the "domestic room".

Therefore, the internal boundaries, dimensions, and structure of the "domestic room" depend not only on the **Factor of gravitational and other natural interactions of objects in the Solar System** but also on many other "natural factors" that affect the safety of existence of all humanity, states, and individuals both in near-Earth space and throughout our entire Solar System.

Moreover, in addition to "natural factors", it is also necessary to take into account "technical factors" that affect the security of each state, as well as the safety, equality, and efficiency of space activities of all actors.

The influence of many of these factors on the security of states, their populations, and humanity as a whole has already determined the boundaries, sizes, and locations of spaces and jurisdictions within the "domestic room" regardless of the existing intentions and requirements. It only remains to recognize and accept this fact.

Thus, according to the previously discussed research results, only the layers "***Vita elementis***" and "***Tectum vitae***", the "**layer of acceptable atmospheric pressure",** and **the "layer of the aerodynamic density of the atmosphere**" which are above the territory of each specific state turns out to be the critical basis for the life of the population of the state. At the same time, these layers do not exert a critical impact on the livelihoods of the population of other states, including their space activities.

In this regard, together with the territory of the corresponding state, these layers create a spatial-territorial unit (domain), which will always be subject to the sovereignty of such a state, since the existence of the state itself depends on it.

Accordingly, it is necessary to recognize the fact that due to natural law and existing natural factors, there is a **single and sovereign spatial-territorial domain** for each state, which includes the surface of the Earth (on which the territory of this state is located), underground space (to a safe depth), and outer space (up to an altitude of about 80 km or about 50 miles above sea level).

Since the existence of a particular state completely depends on the stability and security of each such domain, the exclusive spatial-territorial jurisdiction of only this state will operate within its limits.

In turn, outside its domain, no state can have exclusive jurisdiction. Considering this fact and the influence of the **Factor of gravitational and other natural interactions of objects in the Solar system** on the safety of all mankind, no actor can carry out space activities that may pose risks to the existence of all mankind. That is, each subject is obliged to carry out space activities outside the spatial-territorial domains of states only taking into account the interests of all humanity.

Actually, the above natural factors have already established the rules according to which throughout the Solar System, outside the spatial-territorial domains of states (above 80 km or about 50 miles above sea level), only the jurisdiction of international law, supported by the majority of the population and subjects of international law, applies.

One can only recognize and accept the fact that the space of the Solar System beyond the spatial-territorial domains of states is "***Res Communis Humanitatus***".

In this regard, any actor that conducts space activities in violation of generally recognized international law (including without the permission of generally recognized international bodies) will always be considered to be committing an unfriendly act towards other states and all humanity.

In this respect, it is to be understood that the international organization of space activities in "***Res Communis Humanitatus***" has its characteristics, including those related to the security and equality of states (although not directly).

Thus, the risk of the appearance of a natural factor "**X**" requires the determination of the limits of "**the sanitary atmospheric zone**" to ensure the safety of both all humanity and individual states. At this stage, the authors propose to define the demarcation limits of "**the sanitary atmospheric zone**" by the boundaries of the "**Orbital layer**", within which artificial space objects and natural space objects [31] comparable in size are subject to Earth`s gravitational forces, making them "fall" to Earth.

Separately, consideration should be given to the implementation of space activities within the "**Orbital layer**" (above 80 km or about 50 miles above sea level and up to an altitude of 36,000 kilometers or about 22,370 miles above sea level) and beyond. As we have mentioned before, such activities can only be carried out on the basis and within the framework of generally recognized international law. However, it is necessary to take into account the risks for humanity posed by space activities within the "**Orbital layer**", as well as the need to develop space technologies, the possibility of the emergence of the layer of "**Permanent civil space orbital transportation**", and the equal rights of states to carry out space activities.

Given these factors, the authors propose to apply different principles of international regulation for space activities within the "**Orbital layer**" and beyond based on the mechanisms of "tacit consent", "silent disapproval", "active consent", and "active disapproval".

Thus, to carry out space activities within the "**Orbital layer**", the authors propose to use the mechanisms of "active consent" and "tacit consent".

The "active consent" is determined by the development of an international legal "Act of Active Consent", which establishes the right for all actors to conduct space activities within the "**Orbital layer**", rules, responsibilities, as well as mechanisms for monitoring such activities and mechanisms for bringing to responsibility.

The "tacit consent" is determined by the right of subjects to perform their space activities within the "**Orbital layer**" based on the "Act of Active Consent" without additional permissions from international and national authorities of the state of registration for each launch of an artificial space object into space.

In turn, to carry out space activities outside the "**Orbital layer**" but within the orbit of the Moon (approximately 378,000 kilometers or 235,000 miles from the Earth) and on the Moon itself, the authors propose to use the mechanisms of "silent disapproval" and "active consent".

The "silent disapproval" means the initial prohibition for actors to carry out their space activities outside the "**Orbital layer**" but within the orbit of the Moon and on the Moon itself.

The "active consent" in this case is determined by obtaining separate permission from generally recognized international bodies to carry out space activities outside the "**Orbital layer**" but within the orbit of the Moon and on the Moon itself.

At the same time, to perform space activities beyond the "**Orbital layer**" and beyond the orbit of the Moon, the authors propose to use the mechanisms of "tacit consent" and "active disapproval".

In this context, the "tacit consent" implies the initial permission for actors to carry out their space activities beyond the "**Orbital layer**" and the orbit of the Moon. However, the subject cannot carry out such space activities in the event of "active disapproval" being expressed to one.

The "active disapproval" in these circumstances is determined by the prohibition of generally recognized international bodies or the majority of subjects of international law on the implementation by a specific subject of specific space activities outside the "**Orbital layer**" and beyond the orbit of the Moon.

According to the authors, such a mechanism for regulating space activities within the "**Orbital layer**" and beyond will make it possible to protect humanity from danger and, at the same time, ensure equal rights of states without slowing down the development of space activities.

In addition, when regulating space activities within the "**Orbital layer**", it is necessary to take into account the technical "**Ballistic factor**", which exists due to modern mores and customs and no one can exclude it. This "**Ballistic factor**" carries great risks for the life of humanity and the security of states and today has already formed a conditional layer of "**Ballistic space**" (from the surface of the Earth to 400 kilometers or about 250 miles above sea level), leaving the world to recognize and accept this fact.

Considering that, on the one hand, the jurisdiction of international law operates in the "**Orbital layer**", and on the other hand, as of today, no one can exclude the "**Ballistic factor**", the authors propose to apply an "inclusive military jurisdiction of states" within the "**Ballistic space**".

The essence of the "inclusive military jurisdiction of states" will be that each state possessing Intercontinental Ballistic Missiles has the right to launch such missiles for test purposes (but with mandatory prior notification to international space authorities) or to destroy an object that threatens the security of such a state and is located within the "**Ballistic space**".

At the same time, already at this stage, the authors propose that the UN initiate the signing of an international agreement to limit the altitude of the use of Intercontinental Ballistic Missiles to a maximum altitude of 400 kilometers or about 250 miles above sea level, with the prospect of further reducing this altitude.

Conclusions. In order to determine space jurisdictions, this study analyzes natural and technical factors that have or may have a critical impact on the existence and security of states, the life of humanity, and the implementation of space activities.

According to the results of the study, as of today, it is possible to identify 7 natural factors and 2 technical factors, the influence of which actually determines the spaces to which the sovereignty and jurisdiction of both states and all of humanity extend.

The following factors can be attributed to natural factors: "*Vita elementis*", "*Tectum vitae*", "factor of acceptable atmospheric pressure", "factor of the aerodynamic density of the atmosphere", "factor X", "Orbital factor", "Factor of gravitational and other natural interactions of objects in the Solar System".

Among the technical factors, the "Ballistic factor" and the "Factor of Permanent Civil Space Orbital Transportation" are highlighted.

Based on these factors, the NMC Concept "*natura, mores et consuetudines*" is proposed, according to which, due to natural and other issues, all outer space above the Earth`s surface is divided into a "domestic room" (our Solar System) and an "alien room" (outside the Solar System), the boundary between which is the Kuiper Belt and the center of the Sun.

At the same time, it is proposed to apply the principle of "*Res Communis Humanitatus*" to the "domestic room", and the new principle of "*Res Nullius Civitatis et Res Communis Animal Rationale*" to the "alien room".

Additionally, the authors draw attention to the fact that the above factors have already formed the structure of the "domestic room" regardless of the existing intentions and suggestions, remaining the world to recognize and accept it.

Thus, in the structure of the "domestic room", two types of spaces are formed: the "unified and sovereign spatial-territorial domains of states", to which the exclusive jurisdiction of states extends, and "*Res Communis Humanitatus*", to which generally recognized international law extends.

Moreover, considering all natural and technical factors, the authors address the allocation in "*Res Communis Humanitatus*" of two separate layers: "Orbital layer" (above 80 km or about 50 miles above sea level and up to an altitude of 36,000 kilometers or about 22,370 miles above sea level) and "Ballistic space" (up to 400 kilometers or about 250 miles above sea level).

The authors also propose the creation of a "sanitary atmospheric zone" to ensure the safety of humanity from the impact of the "X" factor. The outer limits of the zone will coincide with the outer boundaries of the "Orbital layer".

Understanding the need to develop space technologies and ensure the safety and equal rights of subjects to carry out space activities, the authors propose the application of different principles of international regulation for "Ballistic space", "Orbital layer" and space beyond it.

These principles are based on the mechanisms of "tacit consent", "silent disapproval", "active consent", and "active disapproval".

To implement the NMC Concept and avoid conflicts in Space, the authors propose the following draft of the Pact for the Cosmos.

PACT FOR THE COSMOS

The States Parties to this Pact,

Recognizing the common interest of all mankind in furthering the exploration and exploitation of outer space for peaceful purposes and the benefit of all mankind,

Willing to prevent the Cosmos from becoming an area of international conflict,

Declare the following:

1. The objective of this Pact is to safeguard the interests of States and all humanity on Earth.
2. In this regard, the Parties to the Pact acknowledge as follows

2.1. All outer space from the surface of the Earth to an altitude of 80 kilometers 467 meters (or 50 miles) above sea level that lies above the sovereign territory of each State is part of the single and sovereign spatial-territorial domain of the State concerned, to which its national exclusive jurisdiction extends.

2.2. Every object in the Solar System located outside the sovereign spatial-territorial domains of States and within the Kuiper Belt is the common space heritage and domestic room of humanity, to which the generally recognized international law applies, based on the principle of *Res Communis Humanitatus*.

2.3. All objects in outer space outside the Solar System are the alien room for States and all humanity, which adopt the principle of *Res Nullius Civitatis et Res Communis Animal Rationale.*

2.4 Ballistic space (from the Earth`s surface to 403 kilometers or 250 miles above sea level) and the Orbital layer (above 80 kilometers 467 meters or 50 miles above sea level and up to an altitude of 36,000 kilometers or about 22,370 miles above sea level) along with the space beyond them are part of the domestic room, and any activity in these spaces is regulated based on generally recognized international law by virtue of such legal instruments as:

a) active consent – a consent international act;

b) tacit consent – the initial permission for any subject to act within the framework of a consent international act;

c) active disapproval – a prohibitive international act;

d) silent disapproval – an initial prohibition on any activity.

2.5. The Parties to the Pact undertake to revise the upper limit of the Ballistic space each calendar year in the direction of its reduction.

2.6. The Parties to the Pact shall be obliged to establish by 2030 a sanitary atmospheric zone up to an altitude of 36,000 kilometers or approximately 22,370 miles above sea level, as well as mechanisms for its control and protection of humanity from any objects that may be harmful.

3. The United Nations has exclusive jurisdiction over the common space heritage of mankind, which takes precedence over any national jurisdiction.

4. Any lawful activity concerning the common space heritage of mankind shall be carried out with the authorization of the United Nations and in compliance with international agreements.

5. Any actor (state, company, or individual) that has engaged in unlawful activities to the common space heritage of mankind shall be considered to have committed an unfriendly or hostile act towards humanity and each state signatory to the Pact.

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