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The Astronaut's Legal Status

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The article proposes to define the concept of "astronaut" through the four elements — specialty "astronaut," astronaut's qualification, profession "astronaut" and "astronaut" as the occupation. In this case, it is possible to define the concept of "astronaut" through the labor function of the astronaut. The legal status of an astronaut is considered as a generalization of practical activities in the field of manned astronautics. On the basis of spaceflights experience, additional rules concerning the rights and duties of the astronauts are proposed. A significant list of problems of the astronaut's legal status, which are still pending, is given. It is also proposed to introduce an international component into the astronaut's legal status, and not only to use the full range of rights and privileges of astronauts, which are provided for by international law, but also to empower the cosmonaut with the authority of a state representative at a foreign or international manned space object.

Keywords: astronaut, astronaut's labor function, professional activities of an astronaut, astronaut's rights and obligations, astronaut's legal status, contract for undertaking of a space mission, space law.

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Introduction

Now that the International Space Station is up and running and multilateral cooperation has become the norm, we sometimes forget how long and hard was the road to smooth cooperation in this strategic area affecting the interests of many countries. People have been flying to outer space for almost 60 years now, or, more accurately, their states have been sending them to do some work. The only nations capable of doing that independently are the USSR/Russia, the United States, and China. However, reaching an agreement between the spacefaring nations on joint space legal documents today proved almost as challenging as putting a man into orbit.

One of the pressing problems of international manned space exploration is the development of a common understanding of the status of an astronaut, which would become the legal basis for unification within reasonable limits of the national legal regulation of space activities.

The author sees his goal in commenting on this task, both from a legal point of view and from the professional position of an astronaut. The solution to the problem should begin with the definition of the term "astronaut" (Notice, that Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space mentions astronauts (cosmonauts) only in the Preamble, and in the normative part refers to the crew of a spacecraft. However, it is interesting to note that the English text uses the term "personnel of a spacecraft," which is now almost universally superseded by the term "crew").

First, we make a small remark about the equivalence of a number of homogeneous terms with a single meaning.

Authenticity and semantic appropriateness

For the first time in a multilateral (multilingual) treaty, the notion "cosmonaut" (in the English text — "astronaut"; is used in Anglo-Saxon countries and the Romance languages) was stipulated in the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (hereinafter — the 1967 Outer Space Treaty), namely in its Article V.

The authenticity of an international treaty text represents the ultimate embodiment of the will of the Parties, its final approval, and the impossibility of further changes. A treaty recognized as equally authentic, made in two or more languages, means that it has the same legal force for each signatory State.

By establishing the authenticity of texts in different languages, the Parties legally fix the linguistic appropriateness. The semantic appropriateness of the text is its conformity to the original translation. The appropriateness of texts means the approval by the parties of the same legal meaning in the treaty in different languages. Thus, recognizing the treaty as authentic, the Parties confirm that the terminology they have chosen is adequate to the meaning and, therefore, semantically appropriate. When making a multilingual international treaty, the main task is not simply to translate the text, but to convey the meaning of the treaty provisions adequately, that is to establish a semantic and legal compliance (Evintov, 1981: 36-38).

In view of the authenticity of the Russian and the English texts of the 1967 Outer Space Treaty both versions can be regarded as fully adequate, therefore, in the legal sense the term of "astronaut" is equivalent to the term of "cosmonaut" and the appropriate Chinese term, which appeared later. (It is noteworthy that the term "astronaut" is used in the texts of the China National Space Administration. In Chinese, a term is used, the transcription of which looks like [yuhanyuan]. The term "taikonaut" was introduced by the Chinese living outside China, and proved to be popular due to the English-language media. In Malaysian, a cosmonaut is pronounced as [angkasavan]. In Korean — [udzhuin], and so on).

Anyway problem of achieving a semantic appropriateness of terminology remains unresolved. Thus, the Outer Space Treaty considers military personnel (Article IV) as cosmonauts, and the Convention on International Liability for Damage Caused by Space Objects refers to other persons onboard a space object.

Definition of the term "astronaut"

The first multilateral treaty using the term "astronaut" was the 1967 Outer Space Treaty.

In space flight practice, the term "astronaut" is used in different contexts to denote the corresponding specialty, qualification, position, and profession (in Russian labor law, these four components describe as the labor function). Considering the concepts of "cosmonaut" and "astronaut" as equivalent, we will understand these components as follows:

a) specialty "astronaut" is a combination of knowledge and special skills obtained as a result of special professional training for spaceflight activity for design, testing (including flight-design tests) and the operation of space technology, research (including scientific research in space flight), as well as the use of outer space and celestial bodies;
b) astronaut qualification[1] is the level of preparedness and professional skill that characterizes the degree of suitability of an astronaut for carrying out professional activities for the position "test-cosmonaut," or "cosmonaut-researcher," or "astronaut-pilot," or "astronaut-specialist in-flight" etc.;
c) the position "astronaut"[2] is a full-time unit intended to be replaced by an employee fit for performing the professional activities of an astronaut, and is characterized by a range of professional duties, a set of professional rights and a scope of responsibility (professional status of an astronaut), which determines the type and professional workload of an astronaut in accordance with qualifications;
d) profession "astronaut" is a type of activity of a person who owns the specialty "astronaut" and replaces (has ever replaced) the full-time position "astronaut" (see the previous definition).

Then the basic definition of "astronaut" in a proposed international convention could look like this:

An astronaut of state N is a citizen of this state, selected in accordance with professional requirements for space flight activity for design, testing (including flight-design tests) and operation of space technology, research (including space research flight), as well as the use of outer space and celestial bodies, owning a set of theoretical knowledge and practical skills acquired as a result of special training, and replaces (has ever replaced) the full-time position of the astronaut in the National Space Agency.

No matter what the concept of "astronaut" is considered, it all comes down to the concepts of "profession," "professionalism," that are professional requirements, professional selection, professional training, professional activity, and finally, the professional status of an astronaut. In Cologne's commentary on space law, an astronaut is even considered as "human beings traveling into outer space for professional reasons" (Hobe et al., 2017).

Therefore, a number of additional definitions are required:

[1] Russian cosmonauts can obtain one of the two qualifications — "test-cosmonaut" or "cosmonaut-researcher".

[2] We may refer to the practice of the Soviet / Russian cosmonautics: "test-cosmonaut," "cosmonaut-researcher." Flight positions (roles, functions) of cosmonauts change: "commander of the crew", "flight engineer", "cosmonaut-researcher". In the US national legislation they use of the term "astronaut" to refer to those selected to join the NASA corps as well as the corresponding gradation of space crew members: "commander", "pilot", "mission specialist", "flight engineer" and "payload specialist".

a) professional requirements — a set of conditions, including the availability of professional training in the specialties required in the field of space activities, the length of service in at least one of these specialties, and the state of health of a person participating in a competition for filling positions of candidates for astronauts or astronauts announced by the authorized body for space activities, suitable for carrying out professional activities of an astronaut;

b) professional selection — a procedure for assessing a person's compliance with established professional (including medical) requirements, in order to allow him access to professional activities of an astronaut;

c) professional training of an astronaut is a set of knowledge and special skills acquired in the course of preparation for spaceflight activities under the programs approved by the authorized body for space activities;

d) professional activity of an astronaut is spaceflight activity for design, testing (including flight-design tests) and operation of space technology, research (including scientific research in space flight), outer space and celestial bodies;

e) professional status of an astronaut is an established set of rights, duties, and responsibilities of an astronaut.

When discussing the prospects of legal regulation of the cosmonaut's work at the level of international law, it is useful to specify the concept of "professional activity." We emphasize that professional activity is not only performing a space flight, but also preparing for it. We detail the components of the cosmonaut's professional activity as participation:

a) in the development of samples of space technology (avionics), their expertise in the design, creation and testing;
b) in the development of on-board documentation;
c) in the development of reporting documentation on the results of a manned space flight, the formulation of conclusions, assessments, proposals and recommendations on the results of the flight;
d) in the analysis of the results of experiments, studies and applied work carried out both by himself and by the astronauts of other crews in manned space flights;
e) in ground (flight, sea) tests of space technology and equipment (installations, apparatus, systems, devices) for target and special experiments, research and applied work onboard a manned space object;
f) in conducting research and testing on space topics;
g) in conducting and organizing the training of candidates for astronauts, astronauts and crews;
h) in the mission control of manned spaceflights and operations of the rescue service when the crews return to Earth;
i) in other works entrusted to the astronaut and/or stipulated by the contract for the preparation for the execution of a manned space flight (if any), the contract for the implementation of a manned space flight, and by the professional standard of the astronaut.

Russian cosmonaut's legal status

The Law of the Russian Federation of August 20, 1993, No. 5663-I "On Space Activities" (On Space Activities, 1993) established that the legal status of astronauts is determined by the Government of Russia. By the Decree of the Government of the Russian Federation dated May 10, 2017 No. 551, the Regulation on the Cosmonauts of the Russian Federation (On approval, 2017) was approved, aimed at filling the gaps in the legal regulation of the professional activities of astronauts. This was not fully successful.

The logic of the previously proposed legal model (Baturin, 2019) proceeds from the idea of the legal status of an astronaut as a combination of his labor status (labor function and terms of an employment contract), as well as his other rights, duties and responsibilities (professional status), acquired by him and assigned to him in accordance with national law and/or an international treaty, as well as a flight contract (and maybe a flight preparation contract).

The list of cosmonaut rights provided for in the Regulations on Cosmonauts of Russia is extremely short.

It would be logical to start the list of the astronaut's rights with the main thing for him — the right to participate in space flight. Albert A. Harrison absolutely rightly remarked, "once chosen, and candidates must be prepared for their missions" (Harrison, 2001: 99), as well as the right to refuse manned space flight before concluding a contract for its implementation.

It is also advisable to supplement the list with the following rights of the astronaut:

a) be adopted on the preparation and implementation of manned space flight by the relevant officials;
b) appeal against unlawful actions of the administration that infringe on his rights;
c) engage in scientific, pedagogical, and other creative activities, provided that it does not impede the fulfillment of his professional duties.

In order to strictly observe the rights of the astronaut, it is necessary to give a closed list of grounds for his dismissal — the astronaut can be relieved of his position:

a) at his personal request, submitted in writing;
b) for health reasons based on the conclusion of the State Medical Commission on the unsuitability for special training;
c) according to the results of certification in connection with the decision on the of impossibility his (her) use for the preparation and implementation of manned space flights;
d) in case of closure or reduction of manned space programs.

It seems that the above set of rights of the astronaut will be sufficient, provided that some special "flight rights" will be fixed in the Model Contract for space flight.

The list of duties (as opposed to the list of rights) in Russia is never incomplete. Therefore we refer the reader to the Regulations on the cosmonauts of Russia.

The Regulations on Cosmonauts of Russia do not fully regulate the rights and obligations of astronauts related to their professional activities. In particular, it lacks norms on protecting the health of astronauts in flight, ensuring their life and health, taking into account the characteristics of their professional activities. Meanwhile, since the medical component is an important part of the astronaut's professional activity, it should be presented systematically. The astronaut's medical support includes a medical examination and dynamic medical monitoring

of the astronaut's health during his professional activities, as well as the provision of necessary medical assistance.

Especially important are state guarantees of the astronaut's professional activities. An approximate legal norm might look as follows: "The state guarantees the astronaut the unhindered implementation of his professional activities. The state guarantees the astronaut, in connection with the implementation of his professional activities, assistance, and protection as a person performing professional duty in conditions of particular risk. The authorized body for space activities, the organization in charge of the astronaut corps, and their officials are required to:

a) provide professional activities of the astronaut;
b) monitor compliance with the terms of the professional activity of the astronaut.

The administration of the organization, which is in charge of the cosmonaut corps, is obliged to coordinate with the astronaut their actions affecting the essential conditions and the procedure for carrying out the professional activities of astronauts".

A Model Contract

The Russian Law "On Space Activities" establishes that the procedure for training cosmonauts, the formation of crews, the approval of a manned space flight program, as well as the professional rights and obligations of cosmonauts are determined by contracts (clause 2 of Art. 20). However, the Law is silent about which body should develop such contracts, and in accordance with which laws and regulatory legal acts, these contracts should be prepared.

The form of a contract for the implementation of a space flight, adopted in Russia now, has developed historically in the first years of the emergence of new Russian statehood, in a difficult economic situation and in the face of multitaps within legislation. Thus, the form and content of the space flight contract are not approved today by any regulatory legal act, in connection with which the legal force of the concluded contracts is flawed, and the contracts themselves are easily disputable. Therefore, space practice really needs a Model Contract for the implementation of a space flight, which would be approved by the authorized body for space activities. On its basis, a contract for a manned space flight for each crew member could be developed.

The Model Contract for the performance of a space flight should regulate the standard stages and situations of astronaut's activities in the implementation of the Space Flight Program that have taken shape in practice. The Model Contract must include provisions on the astronaut's flight activities, list his rights and obligations in flight, establish a procedure for calculating and paying cash compensation. The Model Contract should extend to the period of the manned space flight, which starts from the moment the astronaut was equipped at the launch complex to perform the manned space flight and ends on the day the stationary stage of the astronaut's rehabilitation is completed after he returns to Earth, determined by the conclusion of an expert medical commission.

The Model Contract should provide for the procedure for concluding a separate contract for astronaut's participation in a medical experiment. It is also necessary to establish the grounds and conditions for amending and terminating the contract, liability, and dispute resolution.

The Model Contract for a space flight should include, as an integral part, a draft of procedure for calculating a one-time reward for a manned space flight and a flight program. The section

of the Model Contract dedicated to the rules of monetary compensation to the astronaut, and in case of his death to his spouse, children, and parents, upon receipt of disability or injury to him in connection with the execution of the contract, is particularly important.

The adoption of the Model Contract for a space flight would be an important step in ensuring the rights of astronauts as citizens of any launching state, whose professional activity is particularly important to protect the interests of both all mankind and the state — inside the country and abroad, to ensure the country's prestige.

In addition to the Model Contract for the implementation of manned space flight, a Model Contract for the preparation for space flight may be required. An indication that the procedure for training cosmonauts is determined by the contract in accordance with laws and other regulatory legal acts is contained in paragraph 2 of Art. 20 of the Law "On Space Activities." This Model Contract could provide guarantees to the astronaut from replacing him at any stage of preparation for reasons beyond his control (selling a crew seat to another space agency or to space tourist or unreasonably replacing him with another astronaut). The Model Contract for the preparation of a space flight could give the authorized organization for space activity certain guarantees that the astronaut will not refuse to prepare for the space light at the moment when it is no longer possible to replace him (the similar situations happened in the Russian Cosmonaut Team). In general, the Model Contract could regulate the behavior of the astronaut in preparation for the flight.

However, astronaut training practitioners have some noteworthy arguments against a Model Contract for flight preparation. Without going into discussion, we only note that this issue requires careful analysis.

The Model Contract for the implementation of a manned space flight and the Model Contract for flight preparation, along with the national legislation, will be additional grounds for the astronaut's legal status.

Insurance

A serious problem field is the life and health insurance of the astronaut from the day he was appointed to the full-time position of the astronaut until the end of his professional activity. The insurer of the astronaut will be the authorized body for space activities or an organization authorized by him. The policyholder is obliged to provide timely insurance for the astronaut. The insurer of the astronaut becomes the insurance organization selected by the authorized body for space activities on the basis of the competition, having an appropriate license, and concluding an insurance contract with the insured. Beneficiaries for cosmonaut insurance are persons defined by national law or an international legal agreement.

Insured events in the insurance of the astronaut, upon the occurrence of which the right arises to receive the amount (insurance amount) stipulated by the contract, are:

a) death of the insured person during the insurance period;
b) damage to the health of the insured person as a result of injury (shell shock) or illness received while he was in the full-time position of an astronaut.

The insurance contract should provide for the payment of the sum insured in the event that the insured person has a disability, is deemed unfit (temporarily unfit) for health reasons to perform professional activities, and is removed from the crew as a result of injury (contusion) or illness. It is necessary to establish the right to receive the insurance amount for a certain

period of time, for example, five years after the expiration of the term of filling the full-time position of an astronaut, if the death or illness was the result of professional activities during the period of being in the full-time position of an astronaut. It is advisable to determine the insurance amount based on the average monthly wage of the insured person for the entire period of professional activity, and to establish it in a significant, not less than 200-fold amount. The amount payable must be determined on the basis of the insurance amount, depending on the degree of damage to the health of the insured person and established in the insurance contract. The degree of damage to the health of the insured person as a result of injury (contusion) or disease should be determined by the results of examinations conducted by medical expert commissions and, if necessary, with the participation of representatives of medical and social examination institutions and other specialists.

Non-professional spaceflight participants

With the advent of commercial spaceflight opportunities, the question has arisen as to whether private or commercial spaceflight participants should also be considered "astronauts," thereby accruing the same rights and obligations as trained professional astronauts. Therefore, there is a clear inclination towards distinguishing between professional and private participants to spaceflight.

Fairly recently, a category of "spaceflight participant" was officially introduced in Russia firstly to define the so-called space tourists (Dennis Tito and others) and then to separate the more classical astronauts, trained for years to actually operate a manned spacecraft from the scientists who concentrated on the conduct of experiment and real tourists who were there basically for leisure. Scientists, who are usually employees of space agencies, may also be spaceflight participants. (An example is Anousheh Ansari, the Republic of Korea). There is a substantial difference and diverse contexts between spaceflight participants performing a public function, and tourist participants traveling to space for personal reasons and paying for this opportunity (for example, the case of Dennis Tito, the first space tourist who preferred to call himself a space, and the case Anousheh Ansari contain important semantic differences). The term "spaceflight participants" refers to people who have traveled aboard space missions but are not part of the crew (Hobe et al., 2017). Therefore, the notion of the "envoy of mankind" (see below) provided in Article V can hardly be applied to space tourists.

Astronaut's International Status

Until now, we have considered the legal status of an astronaut as labor and professional status. If an international agreement on the status of an astronaut will be adopted, then it will automatically become international legal status. Taking into account that today almost all space crews are international, it is advisable for each launching state to give its astronauts the status of the representative: "An astronaut of State *N*, who is outside his state in preparation for a manned space flight, when performing a manned space flight on a foreign manned spaceship, as well as in the implementation of other professional activities abroad, is a representative of its state, which delegated to astronaut the appropriate rights assigned to it responsibilities defined representational status astronaut abroad, and provides the necessary medical support, insurance, financing, and other elements of the status of representative of State *N*."

In the Outer Space Treaty of 1967, astronauts are regarded as the envoys of mankind. This formula appeared to ensure legal protection for the astronauts who, as a result of off-nominal

landing, found themselves in another state's territory. Precise formulas, however, always hide the new meanings too.

Envoy is one sent on a special mission

After the space mission is accomplished and the astronauts return to the Earth, their mission as envoys of mankind continues. What is this mission?

When an astronaut returns to Earth, he or she is different from what they were before the flight. Their experience makes them a better fit for living on Earth. This is what people sense (but do not realize) when communicating with those who worked in space. This is what makes the astronauts interesting to other people. They unconsciously sense in the astronauts something that they need here, on Earth. The astronauts are the people who have lived in a "simple" universe whose interrelationships and rules are fully cognizable, and therefore they know something about the basic rules of life that will make it safe and interesting. This is what the astronauts' mission on Earth is about.

Actually, what can astronauts flying into space teach humanity?

The world is holistic: man, environment, and machines created by man are all interrelated.

The value of life is unconditional.

In the holistic world, one should seek harmony.

Accept the world as it is — don't nurture illusions, and do not deceive yourself.

Work conscientiously on every task. If you do your work well, you will survive.

Do not be egocentric.

Respect your partner.

Restrain yourself.

Seek a compromise.

Look after yourself.

See the beauty of the world.

These are the simple truths. But only an astronaut who has traveled a very narrow path full of dangers begins to truly understand that everything in the world depends on everything, and treat the life of any living thing with respect. And then the envoy of mankind is ready to continue his or her earthly mission.

Conclusions

The first cosmonauts and astronauts felt their mission, have pursued, and still pursue it. Later on, the complexity of technical preparation for the spaceflights relegated the Mission to the background. In addition, not every astronaut ponders on it today. A good example was set by the astronauts from the European Space Agency who adopted a Charta in which they formulated their mission as follows: "We Share Space with the people of Europe by communicating our vision, goals, experiences, and the results of our missions" (European, 1998).

There are many situations, e.g., natural disasters involving mass casualties, when the UN sends the famous football players or actors to the affected countries as the UN goodwill envoys to attract attention to the victim's needs, collect funds, etc. It would also be quite helpful to enlist astronauts to perform such functions. The total number of the astronauts and cosmonauts who have flown to Space from the 12th of April 1961 to this day is a little over 500. Sadly, many of them are gone. Several hundred people in the entire mankind is too few. Not all of them are willing to perform particular international functions — but all of them saw our

Earth from outside and agree that Earth ought to be protected both from the wars and the environmental disasters. All of them, due to their unique experience, have planetary thinking and are respected worldwide.

Many international organizations use the services of various agents. The definition of such agent was first suggested by the International Court in its Advisory Opinion of 11 April 1949, titled "Reparation for injuries suffered in the service of the United Nations": "The Court understands the word "agent" in the most literal sense, that is to say, any person who, whether a paid officia1 ***or not*** [*emphasis added*], and whether permanently employed or not, has been charged by an organ of the Organization with carrying out, or helping to carry out, one of its functions — in short, any person through whom it acts" (Reparation, 1949). This wide definition includes not only the international functionaries, but also the diplomatic intermediaries, consultants, experts, including those involved in performing temporary tasks. The cosmonauts and astronauts from across the world can act as such consultants, experts, and intermediaries. It would be expedient to assign them the respective privileges and immunities and issue the respective UN documents enabling visa-free travel across borders. The astronauts have freely flown over the states' borders, and it would only be fair to grant them such rights in the interests of peace and humanity.

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Administrative and Legal Forms of Regulation of the Modern Market of Space Services and Technologies

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The relevance of the topic is primarily due to the fact that at the current stage of development of the world economy, a number of contradictions have arisen between the qualitatively new state of the world market and the inadequacy of existing mechanisms and methods of its legal regulation. Scientific development of modern problems of legal regulation of the world market of space services and technologies is extremely relevant today in connection with the significant diversification of applied areas of space activities, on the one hand, and with the increasing commercialization of these activities and the corresponding activation in relations in the world market of space services and technologies of the non — state sector, on the other.

Keywords: globalization, commercialization, space, technologies, market, services, International space station.

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Introduction

One of the main aspects of our time is the intensive processes of internationalization and globalization that take place in all spheres of human activity and have far-reaching consequences for the entire humanity. The immediate result of this comprehensive process is the formation of a global civil society whose material basis for existence is the world market and a unified international economic system. The world market of space services and technologies (hereinafter referred to as WMSST), which provides essential services and

technologies for modern society, is an integral component of the world economic system, a part of the importance of which increases with the adoption of the concept of sustainable development.

International cooperation in the sphere of space services and technologies provision is an objective necessity due to a number of reasons of an economic, political, social, scientific, technical, and legal nature. This cooperation is a natural result of the transformation of space activities, which during the cold war were mainly focused on military purposes, and which, with the development of "warming" processes, is increasingly becoming an essential and necessary factor in the development of space science and its further progress, especially in its applied areas. Cooperation in the global space market should be considered as a real way to solve many global problems of humanity: environmental; energy; raw materials; information and communication (formation of a global information space and improving communications); monitoring of disarmaments; forecasting, prevention and elimination of the consequences of natural disasters, man-made and space disasters, and so on.

International space law (ISL), which historically arose as a set of special rules and principles of General international law governing the relationship of entities involved in the exploration and use of outer space, is now increasingly unable to regulate the harmonious social relations. At the beginning of the space age, the only subjects of space activities were exclusively states, which were later joined by international (intergovernmental) organizations. Therefore, the relevant branch of law, space law, was started as a branch of public international law. Today it consists of five main international acts (treaties) on space activities. As many sets of principles of some regions of this activity developed and adopted under the auspices of the United Nations, multilateral international agreements related to space activities and, thus, affect the state of legal regulation of relations in the world market of space services and technologies, several agreements on the establishment of international space organizations, that play a crucial role in the development of institutional mechanisms for regulating these legal relations, numerous multilateral and bilateral agreements on cooperation between states in certain areas of practical space activities, including agreements on cooperation in the provision of space services and others. These international legal instruments and decisions of international organizations for space activities (and the problems related to this activity) have largely determined the mechanisms of legal regulation of space activities; based on this legal base internationalization of space science and technology was getting more and more widely spread, and the global space market was finally founded. They became the legal basis for the continued development of international space law, as well as for the emergence and improvement of national space legislation.

The processes of commercialization of space activities has resulted in the rapid development of WMSST involving the operation of enterprises and organizations of the private sector, which has led in turn to a growing weight of international economic law and the active intervention of private international law in resolving the expanded circle of subjects of this market. Further development of WMSST, tightly associated with the operation of advanced space vehicles and often have global consequences, and also the consolidation of transnational corporations (TNCs), banks and private enterprises and organizations as the most active participants of relations on the territory of SMSST require the development of radically new approaches to questions of control over the actions of these economic entities at the national and international level, their legal status, state responsibility for space activities of subordinate legal entities, preventing harm and compensating for it, and so on.

Considering the above and taking into account the exceptional role played by the ISL in settlement of relations between subjects of WMSST, on the one hand, and the improvement of national legislation, on the other, important is the fact that ISL as a relatively new branch of international law requires further development, especially given the processes of commercialization and diversification of relations in SMSST, with the appearance on the market of new subjects of space activities — international non-governmental organizations, private firms and transnational companies.

The place and role of international institutions in regulating the modern market for space services and technologies

The problems of adequacy of legal regulation of space activities have always been in the field of view of the world community. Therefore, it is quite natural that the United Nations and its specialized organizations have been dealing with the problems of legal regulation of relations between States in the field of space activities since the first steps of man into space. As a result, the United Nations Committee on the peaceful uses of outer space (CUOS), and first of all, its Legal Subcommittee, had accumulated the efforts of the world's leading lawyers in the first two decades of the space age, when the foundations of modern space law were laid – a branch of public international law that regulates "the relations of States among themselves, with international intergovernmental organizations in connection with the implementation of all their space activities" (including in the vast world space market).

Despite the fact that from the first steps of man outside earth's atmosphere, the UNGA by its resolution 1148 (XII) concerning disarmament called for the conclusion of the international Convention on disarmament and at the same time to create a system of international monitoring intended to ensure the launching of objects through outer space exclusively for peaceful purposes (Oprishko, 1995), only in 1959, the Special Committee for outer space was founded, and in 1961 CUOS began its work. At the same time, the UNGA stressed that the UN should become the center of international cooperation in the exploration and use of outer space for peaceful purposes. However, the contradictions in the positions of the USSR and the United States on problematic issues of legal support for space activities did not immediately allow equal cooperation between the countries of the West and the East, and, in particular, in the direction of formulating norms and principles of space activities as the basis for international legal regulation of relations between subjects of space activities. In March 1962, taking into account the provisions of the UNGA mandate on the main tasks of its activities (scientific-technical and legal problems of space activities), the UN Committee on outer space established its Scientific-technical and Legal subcommittees of the full membership. Since 1959, when the Committee had 24 member States, this UN body has grown significantly (to 61 members, Ukraine — since 1991), having received a fairly wide representation of intergovernmental and non-governmental organizations possessing the observer status in the Committee and its subcommittees.

The main issues that are constantly under the attention of the UN Committee on outer space and its subcommittees are: ensuring constant communication with governmental and non-governmental organizations engaged in the exploration and use of outer space for peaceful purposes; exchanging information on space activities that can be submitted by governments on a voluntary basis; studying, developing and implementing activities for international cooperation in the field of outer space, as well as addressing legal problems arising in the

course of space activities. The most significant achievements in the work of the Committee and the Legal Subcommittee are the theoretical research and development of the basic rules and principles of international space law, as well as international agreements in the field of space activities, in which these rules and principles are reflected.

The outer space Treaty remains the basis for legal regulation of relations between subjects of space activities. However, despite having a strong support in the world, the Treaty has not yet become truly universal, and the growth in the number of parties to it has slowed down in recent years, which is typical of the accession of States to the other four fundamental international legal instruments on space activities. This situation, as well as the interest of the world community in the further development of space science and technology, encouraged the Legal Subcommittee to come up with a proposal to assess the effectiveness of the five outer space treaties developed and adopted under the auspices of the United Nations.

In July 1997, the UN Secretary-General asked the member states of the world community to provide their conclusions on the factors that prevent States from joining the fundamental international legal acts on space activities. However, by this time, only 12 governments have sent the UN Secretariat (Osnovi, 1993) information on this issue, which objectively cannot give an adequate assessment of the community's attitude to the problem of the effectiveness of legal regulation of space activities, that is, to contribute to the synthesis and final determination of ways and means to solve the problem.

Some attempts to analyze the problems of legal regulation of space activities were made public at the world space forums of UN member States — UN Conferences on the peaceful uses of outer space. But neither the first (1968), nor the second (1982) conference focused primarily on the estimation of the level of development of space science and technology and the state of the practical use of space technologies, and also improvement of international cooperation level and the UN's role in the development of ISL, objectively could not see the prospects of commercial use of outer space and therefore did not highlight tendencies and issues of private sector participation in the provision of space services and technologies.

The third United Nations conference on the exploration and peaceful uses of outer space (UNISPACE III), which was held as well as the previous ones in the capital of Austria (19-30 July, 1999), for the first time addressed the challenges facing the world community in connection with the commercialization of space activities and the increasing involvement of the private sector and transnational corporations in these activities. In this aspect, it is significant that for the first time, a space forum of this level was attended (along with representatives of 98 official delegations of UN member States) by more than 100 delegations of internationally recognized national non-governmental enterprises and organizations for the development, production, and operation of space technology, which were invited by the organizing committee of the Conference to participate in the forum as guests. In addition to summarizing the development of space activities since UNISPACE 82 (1982), publishing of information on national programs for the development of space science and technology, as well as reviewing ways to improve international cooperation in the development of world space activities, much attention was paid at the Conference to issues directly or indirectly related to the problems of WMSST, recognizing a certain crisis of space law in connection with the new conditions of space activities, primarily related to their commercialization and privatization.

The world forum reviewed the current state of development of the ISL, including the unsolved issues: a review and possible revision of the Principles relating to nuclear power sources in outer space; the definition and delimitation of outer space, as well as the use of

the geostationary orbit (GSO), including consideration of ways and means for the rational and equitable distribution of GSO resources without harm to the role of the International telecommunication Union; and a review of the status of the five international legal documents on outer space.

At the same time, focusing on the importance of legal regulation of new areas of space activities, including those related to the increasing pragmatization of these activities and their accumulation within the framework of the WMSST, the Conference recommended that the UN Committee on outer space and its Legal Subcommittee analyze and submit proposals for new possible items on the agenda of the Legal Subcommittee through the Secretariat, namely: a comparative analysis of the principles of ISL and international environmental law; a review of existing international law that can be applied to space debris; legal aspects of space debris issue; an overview of the Principles of the use by States of artificial Earth satellites for international direct television broadcasting and the Principles relating to remote sensing of the Earth from space, for possible future conversion into contracts; improvement of the registration Convention; consideration of the Agreement on implementation of Part XI of the UN Convention on the sea law 10.12.1982 as a model to encourage wider accession to the Moon Agreement; commercial aspects of space activities (for example, issues of ownership, insurance and liability); revision of the concept of the "launching state".

Participants of the legal forum held within the framework of the Conference by the International Institute of space law stressed that UN member states need to consider possible frameworks for coordinating the rational use of global resources related to space activities. In this regard, States should focus particular attention on the diversity of needs, potential conflicts, the depletion of natural resources, value indicators of cost, and the activation of the privatization process in the field of space activities. According to many space industry experts who participated in the conference, the need to develop a Code of conduct related to space debris has already matured. For this purpose, the work already done in this area for the formation of possible models should be taken into account as much as possible.

With this in mind, the Legal Subcommittee, together with the Scientific -technical Subcommittee of the UN Committee on outer space, could consider this issue in the near future. To the vital issues of space activity regulation, it is also appropriate to add the problems of developing a legal regime for low earth orbits (LEO), taking into account recent changes in the Convention of the International telecommunication Union concerning the status of LEO as a limited natural resource and the protection of property in relation to space aircraft, for example, by developing an international list agreed with the UN Secretary-General's Register of space objects. UN member States should start discussing and finding solutions to the current legal problems as soon as possible and, in particular, recognize the need to take the most careful account of the fact that the role of private organizations and firms is expanding with the development of new legal norms.

Features of legal regulation of various segments of the market of space services and technologies

To understand the peculiarities of legal regulation of activity of subjects of WMSST, it must be remembered that the most developed segment of the market of space services and technologies is satellite communications (Merezhko, 1999a). At the same time, in our view, the central problems WMSST of modernity remain unsolved: the definition and delimitation

of outer space and usage of the geostationary orbit, including consideration of ways and means for the rational and equitable distribution of resources of GSO, to which we must add the problem of legal regulation of LEO.

Analyzing trends WMSST, it is difficult to overstate the exceptional value of GSO for creating modern telecommunication systems. The use of GSO is indivisible with the use of radio frequencies necessary to control the spacecraft (SC) during its launch, to ensure the functioning of SC in geostationary orbit, to transmit useful information to the Earth, and so on. In this aspect, it is also impossible to exaggerate the role of legal regulation of GSO, which is carried out by the International telecommunication union (ITU). I must say that ITU recognized its responsibility in relation to the establishment of a balanced organizational and legal framework for the implementation of activities in the field of space communications in the late 50s. The UNGA, for its part, in 1961, in the above-mentioned resolution 1721 (Goldman, 1980), called on ITU to consider the relevant aspects of international cooperation in the new field of communications.

In 1963, the ITU Emergency administrative conference on radio communications, reviewing the Radio regulations, supplemented the latter with a section that distributed frequencies necessary for use by space systems and communications services, including meteorological and navigation satellites, as well as communications satellites. In addition, perhaps for the first time, an article with definitions necessary for the operation of space systems, services and communication stations appeared in an official international document. At the same time, the Conference continued to base its decisions on the principle of "first come, first served." Therefore, during the application of the necessary frequencies for new communication systems in ITU working body, the International frequency registration Committee (IFRC) to those States and international organizations that first started working on these frequencies "... permanent privileges and protection were guaranteed, and those who joined later could only use the radio spectrum in such a way as not to interfere with frequencies already registered with the International registration Committee." (Koretskiy, 1989). It was only in 1971 at the ITU World administrative conference, when reviewing the Radio regulations in resolution Spa 2-1 that the provisions concerning guarantees of equal use of the frequency range by States for space communications services first appeared.

Taking into account that the radio frequency spectrum and the geostationary orbit are limited natural resources and should, therefore, be used most efficiently and economically, the 1971 ITU Conference rejected the "right of first" principle and established rules of conduct for space communications, according to which: registration in ITU of frequencies and their use are not a priority for any country or group of countries and do not constitute an obstacle to the creation of space systems by other countries; any country or group of countries that have registered frequencies for space communications services in ITU should implement all feasible measures to ensure that other countries or groups of countries use the new space systems.

In 1973, at the ITU Plenipotentiary Conference, the orbit of geostationary satellites and the frequencies that are provided for its use were declared a limited natural resource that should be used efficiently and economically in accordance with the needs and technical capabilities of States on the basis of the Radio Regulations (Mezhdunarodnoye, 1985). At the same time, ITU has started to apply virtually the same mechanisms to regulate the use of GSO that have developed in the sphere of monitoring the activities of states in the field of radio communications in general. Since 1973, the ITU has granted the International Radio Advisory Committee the right not only to advise on the rational use of the radio frequency spectrum, but

also to recommend the optimal placement of AES on the GSO, and the International frequency registration Committee, which previously only coordinated the use of radio frequencies, the right to register the orbital positions of these geostationary satellites.

According to article 11 of the Radio regulations (Boguslavskiy, 1998), the coordination procedure, which is used in relation to frequency assignments, and a number of other regulatory mechanisms were extended to the orbital positions of these AES. However, the "limitations" of the unique "natural resource" and the fears of a number of countries regarding the expansion in space by developed countries, including in the direction of using the GSO resource exclusively for their own interests, led to the holding of the conference of equatorial countries in Colombia and the adoption of the Bogotsk Declaration (1976). In this Declaration, Ecuador, Zaire, Indonesia, Colombia, Kenya, the Congo, and Uganda made public claims to "their" segments of the GSO corresponding to their territories along the equator.

However, these claims were rejected by the international community as contrary to the principle of not appropriating any part of outer space. The Declaration did not find the support of other states, and Ecuador, Kenya, Colombia, and Indonesia introduced working paper a and subsequently a draft resolution in the CUOS in 1984, which no longer referred to sovereignty over the relevant segments of GSO, but rather to the establishment of preferential rights that have analogs in the form of rights to exclusive economic zones in the law of the sea, that is, the establishment of a sui generis regime for this unique sector of outer space that would ensure its rational use for the benefit of all countries of the world. However, ITU in its Charter of 22.12.92 fixed this position: "when using a section of frequencies for radio communications, members of the Union should take into account that radio frequencies and the orbit of geostationary satellites are limited natural resources that should be used rationally, efficiently and economically, in accordance with the provisions of the Radio Regulations, in order to ensure equitable access to this orbit and the corresponding frequencies to different countries, taking into account the special needs of developing countries and the geographical location of some countries" (Merezhko, 1999b).

Despite the fact that the question of the legal regime of the GSO and the issue of delimitation of outer space are permanent issues on the agenda of the last 20 years of the UN Committee on outer space and its Legal Subcommittee, the problem of legal regulation of the geostationary orbit, including fair distribution of this "limited natural resource" of Earth is still not solved. ITU's regulation of GSO still has significant shortcomings, which, in particular, leads to the so-called "paper satellite problem." Since the mid-'80s, there has been an increasing trend for a number of ITU member states to declare orbital positions, not in order to create their satellite systems based on them, but to turn them into an object of sale (Lukashchuk, 2005). In connection with the creation of increasingly complex navigation systems, security systems in the air and at sea, the deployment of new mobile data transmission systems with extensive use of computers, as well as plans to deploy systems such as global mobile personal satellite communications, the issue of radio spectrum frequency distribution is becoming more acute. The problem of planning and coordinating ITU activities is still quite relevant (Shapira, 1993).

At the end of the 20th century, the share of commercial components in the activities of satellite communications operators increases sharply. Currently, a significant number of international joint ventures, private and public companies that offer a wide range of services in the field of satellite telecommunications on a commercial basis, have appeared and are successfully operating in the global telecommunications market. To obtain a license to create their own satellite systems, private corporations must complete a number of complex legal

procedures, which include submitting an application for the creation of such a system to the competent state authorities, obtaining permission, as well as coordinating actions with international organizations in order, first, to achieve technical standardization, and secondly, to avoid mutual economic damage. Since the coordination procedure is carried out by the state, private companies must be licensed by the government of a particular country or, at the very least, they must be given protection.

The current situation is unique in that the most international satellite organizations are subject to commercialization processes. Global and regional international satellite organizations (INTELSAT, INMARSAT, INTERSUPUTNIK, EVTELSAT, and others) carry out activities in the field of design, launch, and operation of satellites in geostationary orbit. While carrying out commercial activities, these organizations are engaged in international economic activities. This determines the specifics of the legal framework for the functioning of such organizations, which is based on two fundamental documents: an international convention signed by member states, and an operating agreement signed by national telecommunications organizations designated by the respective governments. However, as a rule, only one satellite operator from each state can be appointed by a country to sign an operating agreement. But the conditions of activity on the world market require improvement of the institutional forms themselves.

Today, the structure of the international satellite communications organization increasingly resembles that of a private company. This is eloquently evidenced by the following facts. Some time ago, the Assembly of INTELSAT parties decided to make several amendments to the Basic Agreement, which will allow each member state to designate several telecommunications organizations to sign the Operating Agreement. A similar decision was taken by the Assembly of EUTELSAT parties. In 1994, following English law, a subsidiary company INMARSAT was formed, which has the status of a private limited liability company. The governing body made such decisions of EUVTELSAT. By 2001, the space and ground segments of this organization must become the property of a newly created private company registered in France. These structural changes in international organizations of satellite communications are caused by increased competition in the international market of telecommunications services, increased technological requirements for satellite systems operated, and, consequently, the desire of these organizations to adequately meet the modern demands of the international telecommunications market (Osnovi, 1993).

However, such transformations do not always occur without complications. For example, the transition of the International space communications organization (ISCO) INTERSUPUTNIK to market principles of activity, which was far from cloudless. For states that, for various reasons, are not ready to accept changes in the organization's operating principles and grant the authority to national operators to sign a new version of the Operating Agreement, the decision of the Council gives the members of the ISCO time to determine before the Protocol is adopted. In our view, it is impossible not to see that there is a problem of the need to establish a conciliation procedure for a number of incongruities and inconsistencies arising from the operation of the two main ISCO agreements. At the same time, the increasing competition in the global space market, the spread of commercialization and privatization processes have put on the agenda the issue of expanding the capabilities of the ISCO System, the acquisition of Communications satellites organization that meet modern requirements for this technology, the invitation to implement joint projects of recognized suppliers of modern equipment and technologies, and the broad involvement of investors.

The international space station is an example of international cooperation

In our opinion, the current legal problems that await the participants of the WMSST in the coming years cannot be fully understood without understanding the intergovernmental agreement between the USA, ESA member countries, Canada and Japan on cooperation in the creation of the International space station (ISS), which was concluded on September 29, 1988. Then, in 1988, it was a question of building an American space station, to which the Europeans, Canada and Japan were attracted with their "important elements that together with the base American space station should make up an international space station complex with expanded capabilities" (Klimko et al., 1994). But the scale of this "project of the third Millennium" turned out to be such that even in the expanded structure of the project, participants could not ensure the implementation of the working plans for the construction of the ISS.

Since 1993-1994, Russia has been involved in the discussion of possible participation in the project as the legal successor of the USSR. It has accumulated a wealth of experience (as well as technical potential and trained personnel) in the field of creating and operating manned space stations and practical implementation of long-term missions in outer space. According to the intergovernmental agreement of 1988, although the project theoretically had the status of an international project, it was practically "written according to the American scenario": decisions on all issues were taken collectively, but if the US had its own "point of view", the latter had the upper hand. With the accession of Russia to the project on January 29, 1998, the situation changed: the project acquired a truly international status. This is especially noticeable if we take into account the final formula for making decisions by consensus. And only in cases of inconsistent situations, the final decision is made by the Chairman of the project management Board (representative of the United States), with the possibility of appealing this decision to the program coordination Committee. As a result of more than ten years of negotiations between the delegations of the partner States on the ISS, a system of mutual legal obligations of States and their Executive bodies that regulate the creation and operation of the ISS and its maintenance both in space and on Earth has emerged that is unprecedented in world legal practice.

Conventionally, this system can be imagined as a three-story structure, each of the floors of which regulates its own level of relationships: the highest level — an Agreement between the governments of the project member States, which has accumulated the basic principles of cooperation, as well as mutual obligations of partners in the ISS, which require consolidation by ratification (mutual waiver of liability claims, customs and immigration issues, exchange of data and goods, intellectual property protection, criminal jurisdiction at the station, etc.); the Agency level — several bilateral memoranda of understanding between the central Executive bodies of partner States, space agencies and the third level — the level of Individuals-cosmonauts, the leading operators of the ISS for the nearest period.

The code of conduct for cosmonauts is intended to regulate the rights and obligations of members of the international crew of the station has just appeared. Still, its appearance has caused a mixed reaction even among theorists who have a mediated relationship to human-crewed missions in space. This is not surprising. In contemporary international law regulating the rights and duties of members of the international crews is one of the most complex and contradictory: special conditions of space missions require, on the one hand, the implementation of the principle of unity of command (the unconditional implementation of

the orders of the commander of the crew, especially in extreme and emergency situations), on the other, the question of the limits of authority of the commander, the level of responsibility for their decisions and, even, possible measures of coercion, which the commander may apply to the members of this crew who refused to comply with its orders; to these problems, the problems of regulating the relationship between the state of registration of a manned space vehicle and a foreign or international element regarding the parties' definition of lex causae are added.

As already noted, the project provides for the design, production, and operation of the ISS for various needs in the field of basic scientific research, the development of new and practical use of space technologies; full (to a greater extent commercial) use of information from Earth's orbit for the needs of a number of sectors of the economy: nature management, ecology, resource support, disaster issues, and many others). And on the basis of the directions of use of the ISS, and considering the provisions of Section 101 "Commercialization of the space station," the last Act of the USA on the commercialization of outer space October 28, 1998 (An Act, 1998), we can talk about further spread of the commercialization of outer space, the inclusion of individual activities on Board manned space stations to areas WMSST. And, of course, about the need in the near future (2002-2005) to solve international legal and private law problems of regulating relations on this rather insignificant in volume, but very important in the weight of the results of activities (including for other areas) of the WMSST sector. Issues such as: "jurisdiction and control" over the national space segment and off-Earth crew members; "relations between the state of registration and a foreign or international element": what right to apply if the legal situation, regulated by private international law, whether on a manned object or outside of it in outer space?; "property right" (it refers to inventions and discoveries in the course of space activities outside the Earth), etc. In our opinion, the issues of preserving the right to intellectual and industrial property created on Board the ISS are particularly important, taking into account the problems of WMSST.

Conclusions

So, analyzing the law-making activities of international organizations in the light of the effectiveness of the mechanisms of legal regulation of WMSST and taking into account changes in the property market both through commercialization and privatization of space activities, the involvement of new stakeholders in these activities, and globalization of the market, it should be noted that the last 20-30 years, there has been some consistency problem (lack of coordination) of normative activities of international institutions at various levels. In addition to the UN Committee on outer space and its subcommittees, international specialized organizations of the UN system (ITU, UNESCO, WIPO), intergovernmental and special organizations (International Institute for the unification of private law, INTELSAT, INMARSAT), non-governmental organizations (International institute of space law, International law association, Committee on space research of the International Council of scientific unions) and regional organizations (European space agency, European satellite communications organization, the European organization for the exploitation of meteorological satellites) and the like today pay attention to the issue of improving legal regulation of relations in WMSST.

Thus, by expanding the horizons of international cooperation in the field of space activities and the use of space technology to meet the urgent needs of the world community, these organizations also add their significant contribution to the development of the ISL.

The problem of coordinating the law-making activities of these authoritative international organizations has been repeatedly highlighted in UNISPACE III documents. As a result of this lack of coordination, "international space law is becoming increasingly fragmented and, in some areas, inconsistent." In our view, significant efforts are required on the part of the international community to coordinate the efforts of all components of the global legal order in the space industry with a view to further progressive development of the ISL, as well as to bring normative work into line with a single process under the auspices of the UN.

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Cooperation between Ukraine and Kazakhstan in the Space Sector: Background, Regulatory Framework, and Further Development

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The article analyzes and studies theoretical and practical aspects of the relationship development of international scientific and technical cooperation between Ukraine and Kazakhstan, aimed at their improving, as a factor in expanding innovative, scientific, technical areas and increasing the competitiveness of economies in the context of globalization. The analysis of the current legal regulations of Ukraine and Kazakhstan on space activities enabled us to reveal the foundations of scientific and technological cooperation, as an essential component of international relations of our time. The theoretical and methodological approaches to the organization of scientific and technical collaboration are systematized. The modern specificities of bilateral cooperation are revealed, and the results and achievements of Kazakhstan and Ukraine in the space industry are presented.

Keywords: space, space activity, bilateral relations, scientific and technological cooperation, innovation, legal regulation, law.

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Introduction

Scientific and technological cooperation is an increasingly important and effective form of modern international relations. Considering the high rate of scientific and technological progress, no country, no matter how significant its potential in science and technology is, can fully satisfy its needs in advanced science and technology for the production of total

scientific products, which are constantly changing and improving. Cooperation in creating high-tech products is the most important part of modern international relations. According to Sergey Krichevsky and Sergey Udartsev, "…When analyzing the history of space activities, the current situation and forecasting the future of the space state, the world community and all our civilization on Earth and beyond, the prospects of space humanity, we deal with complex conceptual, legal, socioenvironmental, digital and other models of the past, present and future" (Krichevsky & Udartsev, 2019).

International scientific and technological cooperation is one of the forms of international economic cooperation, covering trade in licenses, performance of joint scientific developments, implementation of large technical projects, construction of enterprises and other objects, training of national personnel, exchange of general scientific and technological information, etc. (Dakhno, 2009: 201). This is a joint development of scientific and technological issues, mutual exchange of scientific achievements, experience, and training of highly qualified specialists.

Nowadays, all economies are assessed according to investments in education, science and technology, culture, and innovation. Knowledge, primarily scientifically based knowledge, is crucial to transforming the more and more complex challenges that society faces into opportunities for more sustainable development, achieving the Millennium Development Goals, and fulfilling other joint commitments.

Considering the relevance of this issue, the scientific community presents several concepts for the strategic development of scientific and technological cooperation: theories of economic growth (the relationship between science and industry, the impact of scientific and technological performance on economic development, innovation theories, the theory of stalemate in technology, exogenous and endogenous theories, new economic growth models) and the theory of increasing competitiveness through cooperation (functioning of commercial "ecosystems", "co-competition", the theory of intercompany cooperation, game theory) (Chernytska, 2009) and so on.

We suggest that the most progressive concept is the theory of "the knowledge triangle." This concept has gained popularity because it emphasizes an integrated (systemic) approach to the interlinkage between research, education, and innovation. In their work The Knowledge Triangle between Research, Education and Innovation (Unger & Polt, 2017), Maximilian Unger and Wolfgang Polt define this interaction as follows:

1. Research and Education: interactions are reflected, for example, in the geographical and sectoral mobility of graduates, postgraduate training programs, fundamental and applied research as the foundation for measures to improve skill-matching between companies and graduates.
2. Research and Innovation: here, knowledge comes into focus, for example via a) public-private partnership models (e.g., clusters, science parks), b) the commercialization of publicly funded research, c) contract research and development services from universities for the industrial sector, d) university spin-offs and academic start-ups, e) knowledge and technology transfer offices (TTO), f) incubators, g) open innovation platforms.
3. Education and Innovation: Collaboration between actors is evaluated by considering the support for the development of an entrepreneurial culture (entrepreneurial spirit) in the framework of (academic) training programs (e.g., industry-focused doctoral programs) and the formation of appropriate competencies (business plan development, management, etc.).

Therefore, the globalization of scientific and technological relations, the development of the "knowledge" market as the main factor of economic growth of the country, the formation of the world market of innovative technologies gives grounds to argue that a new form of international economic relations, that is, international scientific and technological cooperation has been formed.

International space law as the basis for the successful development of national space research projects

Traditionally, the launch of Sputnik-1 in 1957 is believed as the beginning of space law and space legislation. However, issues of legal regulation of space exploration appeared much earlier. As soon as a person had the opportunity "to fly," rules for the use of airspace were required. Airspace and outer space have been related to international law only since the beginning of the 20th century. Namely, in 1902, the Wright Brothers made more than seven hundred flights. These are two American pilots, engineers, inventors, and pioneers of aviation, who are usually credited with inventing, constructing and piloting the world,s first aircraft. They tested a plane Flyer in the dunes of Kitty Hawk on December 17, 1903 (de Gouyon, 2019).

Since then, the rules for the use of airspace should be established.

The first rules were approved by the Paris Convention on the Regulation of Aerial Navigation (1919) (Convention, 1919) and subsequently by various other multilateral treaties. On 11 July 1922, the Paris Convention entered into force after it had been ratified by 14 countries, including the British Empire (consisting of seven states: Great Britain, Australia, Canada, India, Ireland, New Zealand, and the Union of South Africa) and France.

The Paris Convention was the first multinational rule governing air navigation. Article 1 establishes the complete and exclusive sovereignty of each State over the atmospheric space over its territory, putting an end to many years of disputes.

In this article, the history of space law will not be analyzed, but it should be noted that both at the beginning of the 20th century and in the 21st century, the issues of the "right" to outer space and resources are discussed from two perspectives: first, outer space belongs to all states; second, outer space does not belong to anyone.

According to the practice, nowadays, space law cannot establish rules that will be valid for a long time. Technological progress is developing so fast that existing legal standards adopted to regulate space exploration are becoming obsolete. Therefore, Michel Bourbonniere (Bourbonniere, 2005) argues that today the question is the adoption of global rules of conduct not to regulate technological progress, but to restore order in the competing human interests that arise from this progress.

Consequently, at the sessions of the Committee on the Peaceful Uses of Outer Space, the proposal to adopt the Code of Conduct in Outer Space was repeatedly voiced. The draft Code of Conduct in Outer Space is based on three basic principles: freedom for all to use outer space for peaceful purposes, maintaining peace, preserving the integrity and inviolability of space objects, and preserving the interests of all participants in space activities (COPUOS, 2010). However, despite the progressiveness, the draft Code has one significant drawback. That is, it shall not be mandatory, and its signing shall entail neither responsibility nor sanctions for these countries.

The rapid development of space activities has revealed the shortage of a legal regime based on five existing treaties. It is required to fill in the gap to catch up decisively and urgently. The current legislation should be the basis for further movement gaining a foothold on new frontiers. The delegation welcomed everything done by the international community and supported the idea of creating favorable conditions for the formation of a single treaty on outer space (COPUOS, 2010).

Background for establishing Ukrainian-Kazakh bilateral relations

The Act of Independence of Ukraine of August 24, 1991, and the Appeal of the Verkhovna Rada of Ukraine "To Parliaments and Peoples of the World" (To the Parliaments, 1991) provide for the key objectives, areas, and priorities of the foreign policy of Ukraine, such as Ukraine is establishing a democratic, law-governed state; ensuring human rights and freedoms is a top priority. Ukraine will continue to abide by international law, guided by the Universal Declaration of Human Rights, the International Covenants on Human Rights ratified by Ukraine, and other relevant international instruments. Ukraine will strictly adhere to the norms of international law, guided by the Universal Declaration of Human Rights, the International Covenants on Human Rights, which Ukraine ratified, and other relevant international instruments. As one of the United Nations founding states, Ukraine, in full accordance with the purpose and principles of the UN Charter, will direct its foreign policy towards the consolidation of peace and security in the world, the intensification of international cooperation in solving environmental, energy, food and other global issues. Ukraine's foreign policy will be based on the international law principles (Pro proholoshennya, 1991).

Therefore, according to the legal regulations mentioned, Ukraine laid the foundation for productive cooperation with various states in strategically important sectors.

The past decade has shown that the principles of foreign policy, proclaimed at the beginning of the establishment of independence, have been consistently implemented in practice. As a result, Ukraine has become an important subject of world politics, which should be considered even by the great powers of today. Zbigniew Brzezinsk, a famous American political scientist, discussing geostrategic actors and geopolitical centres, estimates Ukraine as a new and important actor on the Eurasian chessboard, as a geopolitical pivot. He underlines that its very existence as an independent country helps to transform Russia. Without Ukraine, Russia can still strive for imperial status. Still, it would then become a predominantly Asian imperial state, more likely to be drawn into debilitating conflicts with aroused Central Asians (Brzezinski, 1997).

Therefore, the analysis of the formation of cooperation between the two countries, Ukraine and Kazakhstan, is of great importance. Considering that both countries have a favorable geopolitical position on the Eurasian continent, they do not want to be dependent on Russia and have the status of spacefaring nations.

The issues of development of the Ukrainian-Kazakhstan bilateral relations have not been studied enough yet by both Kazakh and Ukrainian scientists. The vast majority of publications are journalistic (separate articles in periodicals). Moreover, the bilateral relations between Ukraine and Kazakhstan in space are virtually non-existent.

The formation and development of bilateral Ukrainian-Kazakh relations took place under challenging conditions. Independent states were faced with a number of strategic missions that needed to be addressed as soon as possible. One of the most important tasks was to decide on

the concept of its foreign policy in order to become a full-fledged actor of international life as soon as possible.

The leadership of Ukraine has chosen a course for European and Euro-Atlantic integration, striving to maintain maximum contacts with a key partner in Central Asia, the Republic of Kazakhstan, which has chosen a multi-vector foreign policy, among which the main directions were the Russian Federation, China, the USA and the European Union. Both countries are located in the so-called buffer zones: Ukraine is between Russia and Europe integrated into the EU, the Republic of Kazakhstan is between Russia, China and the Islamic world (Tokar & Ruban, 2016).

Ukraine was one of the first states to recognize Kazakhstan as an independent state immediately after its independence proclamation (December 16, 1991). Kazakhstan recognized Ukraine on December 23, 1991, and on July 23, 1992, diplomatic relations were established between the two countries. Political contacts at the highest level evidenced the political will and joint readiness of the two states to develop mutually beneficial cooperation in various sectors, to deepen it in the light of current geopolitical and geoeconomic processes and national interests. Also, the proximity of historical destinies has long been connecting these nations. In the difficult times of the democratic state establishment, both Ukraine and Kazakhstan managed to make annual summits traditional, almost every year, to discuss a wide range of issues of international and bilateral relations. Over the entire period of cooperation, a number of important documents were signed that formed a solid regulatory framework.

In addition to the grounds for close bilateral cooperation mentioned above, it should be noted that the Ukrainian diaspora in Kazakhstan is one of the largest, the third among all Ukrainian communities in the world. Today, almost 450 thousand ethnic Ukrainians live in Kazakhstan. It is the second-largest diaspora in Kazakhstan, settled throughout its territory, but the largest number of Ukrainians live in Akmola, Pavlodar, Karaganda, Kustanai regions (Zhumambaev, 2008).

Due to the peculiarity of economic development in Soviet times, a certain shortage of specialists and technologies in metalworking, machine building, aviation and space industries arose in Kazakhstan. Meanwhile, Ukraine has a powerful scientific and industrial base, a sufficient number of specialists, and a high level of education. Nowadays, 124 joint Kazakh-Ukrainian enterprises operate in Kazakhstan.

Thus, the historical prerequisites for the establishment of Ukrainian-Kazakh bilateral relations include:

a) a common historical past, that is, both countries for a long time were the part of the Union of Soviet Socialist Republics and actually did not have state independence;
b) the geopolitical specificities of countries, that is, both countries are located in the so-called buffer zones: Ukraine is situated between Russia, and Europe integrated into the EU, the Republic of Kazakhstan is situated between Russia, China and the Islamic world;
c) the similar positions of the two countries on key issues of modern political development (to get rid of dependence on Russia, to be a full member of the Space Club, etc.), the absence of acute problems in bilateral relations;
d) the attempt to integrate into the global economic community through the development of an innovative economy, in particular, the space industry;
e) the possibility of sharing resources: while Ukraine is interested in the world's largest cosmodrome Baikonur, situated in Kazakhstan, Kazakhstan is interested in the scientific resources of Ukraine.

Each state sets a goal to improve life, to predetermine new social positive changes on the basis of economic, political, and social development. Therefore, it is imperative to understand the strategic plan for the future based on the globalization processes of our time. Consequently, it is relevant to consider ways of productive development of cooperation between these countries.

The Legal Framework for Bilateral Development between Ukraine and Kazakhstan in the Space Industry

The key documents of bilateral development between Ukraine and Kazakhstan are: "Treaty on friendship and cooperation between Ukraine and the Republic of Kazakhstan" (1994) and "Agreement on economic cooperation for 1999-2009" (1999). It should be noted that the years 1994-1997 became an important stage in the development of the legal framework, when more than 30 bilateral documents were signed during mutual visits of the presidents of the two states, that is, almost half of the ones in effect (The legal framework, 2019).

The key documents that have regulated bilateral cooperation between the two countries in the space sector are:

1. "Agreement on the principles of cooperation between the Government of Ukraine and the Government of the Republic of Kazakhstan in the implementation of space activities" (Uhoda, 1994) of January 20, 1994. Accordingly, both countries recognized the need to share their resources to achieve their goals, such as a useful exploration and use of outer space, the preservation and development of a unique space infrastructure in the interests of the national economy and science, the international cooperation, and security of both states. In addition to its historical significance, this Agreement marked the beginning of a long and productive cooperation in the space sector.
2. "Agreement between the Government of the Republic of Kazakhstan and the Government of Ukraine on cooperation in the research and use of outer space" (Uhoda, 1997) of October 14, 1997. Ukraine ratified the Agreement by Law no. 104-XIV (104-14) of September 11, 1998, Kazakhstan ratified it by Law no. 22 of December 30, 1999. This Agreement primarily determined the legal framework for bilateral cooperation in the exploration and use of outer space. In addition, this regulatory act expanded the principles of bilateral cooperation in comparison with the 1994 Agreement. The parties agreed on: ensuring the rights of the Parties in proportion to their investments in the share of industrial and intellectual property created in the course of projects (work); preservation of state secrets and compliance with well-agreed confidentiality in joint activities; compliance with environmental legislation with the predominant effect of the legal acts of the State where joint space activities are carried out.

After the aggravation of the political situation in Ukraine (the beginning of the Revolution of Dignity, caused by the refusal of the country's political leadership to take a legislative course on European integration, growing corruption and excessive concentration of power in the hands of V. Yanukovych), as well as the annexation of Crimea by Russia and the "referendum" in Crimea, Kazakhstan was not able to take an unequivocal position, but advocated the early restoration of order and stability (Tokar & Ruban, 2016). However, this did not affect bilateral relations between the countries.

The intensification of bilateral cooperation in the space sector occurred after a working visit of the President of Kazakhstan to Ukraine on December 22, 2014. Following negotiations, principal agreements on enhancing cooperation in the energy, engineering, aircraft manufacturing, space industries, and deepening cooperation in the military-technical sector were reached. They also discussed issues of cooperation in the space sector, in particular, the joinder of the Ukrainian Design Office Yuzhnoye, Yuzhmash and Khartron with the Kazakh capabilities, including the Baikonur Cosmodrome (Political, 2019).

In order to ensure the implementation of the high-level agreements and the implementation of various bilateral agreements, the Joint Interstate Ukrainian-Kazakh Commission for Economic Cooperation was created in 1996, following the meetings of which specific measures are planned to enhance mutually beneficial bilateral cooperation in various sectors. Moreover, the Minutes of the meeting provides for the priority areas for economic cooperation in the near future, such as the issues of studying and identifying new areas for cooperation in the space industry. The last meeting of this commission was held in 2018. After a telephone conversation between the President of Ukraine Petro Poroshenko and the head of Kazakhstan, Nursultan Nazarbayev, a meeting of the next interstate Ukrainian-Kazakh commission on economic cooperation was agreed to be held in 2019 (Ukraine, 2018), but to date it has not been held.

At the present stage, Ukrainian-Kazakh cooperation covers a large number of promising areas in strategic areas, such as space, military technology, aviation. Both countries have significant potentials in these areas, as well as in peaceful space exploration. The use of one of the best world cosmodromes Baikonur can successfully serve the purpose.

Besides, promising projects are the creation of ground infrastructure for a satellite navigation system, a scientific space system for studying the Earth's ionosphere, a space remote sensing system, participation in the creation of the World Space Observatory, cooperation in the training and advanced training of specialists for the Kazakhstan space industry in Ukraine.

Bilateral scientific and technical cooperation between Ukraine and Kazakhstan focuses on the introduction of advanced technologies in the industry. Moreover, Kazakhstan remains interested in using the capacities and deliveries of products of the military sector of Ukraine, including uncrewed aerial vehicles, aircraft training complexes, as well as carrying out modernization of the AN-2 and AN-2-100 aircraft.

Conclusion

Mandatory mechanisms for effective cooperation in the scientific and technological sector are a high level of costs for its development (at least 1% of GDP) with a constant upward trend of the private sector share in it; modernization of the innovation infrastructure; active cooperation at the regional level in the framework of innovation clusters, technology parks, business incubators; transnationalization of innovation through participation in international scientific and technical programs; enhancing of international technological strategic alliances; increasing the role of small and medium innovative entrepreneurship. In this entire process, the State takes a lead role, that is, it shall stimulate measures for the creation and sustainable development of innovative structures, as a guarantee of strengthening the country's competitiveness.

Bilateral relations between Ukraine and Kazakhstan demonstrates the development of positive cooperation dynamics in rocket and aircraft construction and identifies a number of new promising areas of cooperation: rocket and space technology, new materials and land remote

sensing, joint industrial ventures based on existing industries, etc. Considering that Ukraine has a significant number of advantages in rocket and aircraft manufacturing, for Kazakhstan, within the framework of cooperation, it is an opportunity to enter the world market in these industries due to the high potentials and the large number of available professional specialists of Ukraine. In contrast, Kazakhstan has a cosmodrome Baikonur for the development of space programs in our country.

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International Legal Regulation of the Missile Technology Control Regime in the Aspect of Private Space Company Activities

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In the article, the analysis of the provisions of the Missile Technology Control Regime enables to conclude that it requires to be amended, or, which is better, replaced by a new high-level international legal treaty. The authors reveal that classic civilian launch vehicles built by private space companies have a common good for humanity; in particular, they increase the chance of human survival as a result of global natural or human-made disasters. The authors conclude that a new paradigm should be implemented: from restraining the transfer of rocket technology to encouraging this process by space

companies under the banner of democracies governed by the rule of law. At the same time, the authors argue that more effective international legal sanctions and controls should be implemented by the international community to prevent ballistic missiles from getting to terrorists.

Keywords: export control, weapons of mass destruction, space companies, international law, missile technology, launch vehicle, control regime, sanctions, terrorism

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Introduction

We, Homo sapiens, are a very young creature of nature (God) on planet Earth. Homo sapiens walk on the surface of his cradle, according to scientists, just under 200 thousand years, which is a tiny moment for the Cosmos. Obviously, the very first ones, watching the stars, already dreamed of achieving them. In the late nineteenth and early twentieth centuries, these fantasy dreams began to materialize into specific humanistic and technical knowledge. Konstantin Tsiolkovsky in his works sought to demonstrate the interdependence of a man and outer space, their continuity. He emphasized that a man as a being intelligent and creative, is a force in the universe enabled by mental and moral power to transform the nature on a growing scale and thereby actively influence the dynamics of cosmic evolution. He argued that man's fate depends upon the future of the Cosmos; the outcome of the universe depends on man's fate. Going into space for a scientist meant not only a purely practical exploration of outer space to gain power and wealth, but mostly to attain the immortality and eternity of human existence (Kasatkina, 2011).

After the start of the space epoch (October 4, 1957), humanity was given a chance to move beyond its cradle. To date, some positive results in space exploration and use have been achieved. For example, all information space is provided by telecommunications satellites in Earth's orbit.

It should be noted that from the launch of the first satellite into the Earth's orbit and to this day, all launches to outer space were made exclusively by ballistic missiles. The means of bringing cargoes and humans beyond the Earth's atmosphere with the help of a space elevator, an ion rocket engine, an antimatter engine, and a space sail remain at the level of fantasy or primary conceptual development. Today and in the nearest future, launch vehicles with liquid and robust propellant engines will remain the primary means of exploration and use of outer space.

In other words, launch vehicles and technologies for their development are a boon to humanity. They are the only way of bringing cargoes and people into the near and far space to date.

This is essential not only for providing humans and their communities on Earth with a variety of quality services and rare materials. Besides, this area affects the very fact of the survival of humanity, as the supreme matter of the Cosmos. After all, scientists warn that frequently on Earth species extinct totally. At least five examples of such extinction have been traced by biologists. Some of them argue that the sixth mass extinction of species has just begun (On Earth, 2012). At the same time, humanity as a species is also at risk of being destroyed by various natural or human-made disasters. For example, recently, we have all been concerned with the problem of the COVID-19, which is deadly, affecting less than one percent

of humanity. This is not a direct threat of human extinction. However, the evil fate of nature, or the actions of terrorists, or the fall of a large asteroid on Earth may cause irreparable results. To prevent this, sovereign states, alone or in cooperation, should create colonies of settlements on other planets, gigantic space stations, and artificial space islands beyond Earth. It is not possible to create anything like this without classic launch vehicles.

Therefore, the probability of increasing the chance of human survival in the face of natural, man-made disasters or terrorist acts depends on the development of rocket technology, the mass construction of new launch vehicles, the involvement of new states in this process, the private investments of individuals and legal entities of different countries.

Our conclusion is supported by statements on this issue by the great thinker, scientist theorist Stephen William Hawking. In his writings, he argues that it will be difficult enough to avoid catastrophes on planet Earth in the next hundred years, not to mention the next thousand or million if the human race resides on one planet. According to him, it is time to explore other solar systems. The spread of humanity beyond planet Earth may be the only thing that will save us (Wall, 2018).

At the same time, under current conditions, a significant factor in deterring the mass development and construction of civilian launch vehicles, which is now the only way for a person to enter outer space, is the Missile Technology Control Regime (MTCR). Historically, its occurrence was objective and positive in preventing ballistic missiles from falling into the hands of terrorist and unmatured State regimes. It should be considered that the first ballistic missiles were developed for military purposes, as a means of delivery of conventional bombs, first, and then, weapons of mass destruction. However, in a modern context, it no longer ensures the security of mankind from States that successfully develop their nuclear and missile programs and threatens them with democracies governed by the rule of law. An excellent example of this is North Korea's missile and nuclear program.

Therefore, the principles and other provisions of the MTCR require further development, at least, and it would be appropriate to launch a broad debate on the subject internationally and to adopt a new paradigm for non-proliferation of ballistic missiles at the U.N. level in the context of space commercialization.

In the article, the theoretical provisions and practical implementation of MTCR will be analyzed. This problem is central, since the survival of mankind in the face of natural disasters, the emergence of new dangerous viruses and man-made disasters depends directly on the quality and quantity of civilian launch vehicles available to mankind. There are some publications in law books and other literature. However, they transfer a crucial idea that the development and construction of new ballistic missiles and technologies should be deterred. In the current context, this is an ineffective means of achieving international public interest. Totalitarian States receive such technologies, while democracies governed by the rule of law, which strictly adhere to the guidelines of international law, cannot carry out exploration and use of outer space. Moreover, democracies governed by the rule of law that possess ballistic missile technology and means of ballistic missile production cannot engage foreign partners in mutually beneficial cooperation.

Therefore, the current MTCR should be relieved for the transfer of civilian ballistic missiles and their components to democracies governed by the rule of law and private business companies that are under the banner of such States. At the same time, sanctions should be not just increased, but strict collective sanctions should be applied to States that violate international law in general, and provisions of the MTCR, in particular (A/RES/68/262, 2014).

Moreover, the "informal" international agreement under the analysis should be replaced by an International Convention on Preventing the Transfer of Ballistic Missiles and Technology to Terrorist Subjects by the U.N. auspices. Therefore, further restraints on the proliferation of launch vehicles and their components and prevention of private space companies, entities to democracies governed by the rule of law, from producing them will cause overall damage to the international community, and we will prove it in the article.

The article is based on the following content. First, the State of affairs in the MTCR legal regulation is revealed as well as contradictions in this area is under focus, taking into account the activities of private space companies. Next, the specificities of MTCR compliance is analysed. The study proves that, although according to its principles, the MTCR does not intend to impede the peaceful use of advanced missile technology, in practice, due to the guidelines of this regime, democratic States that carefully follow export control guidelines are forced to hinder the development of their missile technologies and do not prevent totalitarian States from increasing their arsenal of ballistic missiles. In this respect, the level of international security against the spreading of ballistic missiles beyond the MTCR is under focus. The MTCR accession procedure for the new Member States is studied, and the significant bureaucratic nature of this procedure is concluded. The legal nature of sanctions for MTCR violations has been disclosed. The most substantial shortcomings and areas for improving the MTCR have been identified, given the need for active development of private space companies.

Current regulation status of the missile technology control regime

The Missile Technology Control Regime is an informal political multilateral agreement among 35 Member States in order to limit the proliferation of missiles and missile technology. Although such an agreement is not a treaty, since Member States do not have any legal obligations, but it is an essential document. MTCR's activities are consistent with U.N. efforts regarding non-proliferation and control of the export of missiles and missile technology (Frequently, 2020).

The principal objective of the MTCR, according to the statement following the results of the 32nd Plenary (October 7-11, 2019) of this general assembly, is to create mechanisms to prevent the proliferation of mass destruction delivery means [9 MTCR, 2019]. This emphasis is significant when considering the relationship between the MTCR and the real issues of exporting launch vehicles and individual items of missile technology.

The regime under analysis is based on the general export policy, which also applies to the list of items specified in the annex to the MTCR's hardware, software, and technologies. This list of questions, controlled by the international community, establishes a special regime for both military equipment and dual-use equipment. Practically all key hardware, materials, software, and technologies required for the development, production, and operation of systems capable of delivering nuclear weapons fall under this regime (WMD) (Nuclear, 2020).

The MTCR Appendix identifies two categories of equipment. The most significant concern of the world community is the restriction on the export of first category items, such as missile systems, primarily ballistic intercontinental missiles, space rockets, unmanned aerial vehicles, including cruise missiles and reconnaissance drones with a flight range of more than 300 km and payload of more than 500 kg. Furthermore, this category includes payloads that launch vehicles and other aforementioned vehicles, production facilities for their production, as well as integral delivery subsystems: rocket stages and rocket engines, guidance systems,

and warhead mechanisms into ballistic orbits. The second category includes the various and numerous missile systems according to the catalog, as well as specialized materials, fuels, technologies, and individual subsystems (Missile, 2017).

The Missile Technology Control Regime was established in 1987 by seven States (Canada, France, Germany, Italy, Japan, United Kingdom, and the United States) as an informal regime through bilateral exchange of diplomatic notes between partners. The purpose of this regime was to limit the proliferation of ballistic missiles capable of carrying nuclear warheads and unmanned weapons delivery systems of mass destruction. This regime was an additional measure to the mechanisms provided for in the Declaration on the Non-Proliferation of Nuclear Weapons. At a meeting in 1992, participants agreed to extend the scope of the MTCR to missiles and drones capable of carrying chemical and biological weapons. At present, 35 States are members of the regime. The MTCR uses a mutually agreed list of dual-use materials, equipment and technologies that can be used to construct missiles. With respect to complete rocket systems and production facilities (first category of the list), the principle of "failure as a rule" is established. Transfers of individual systems of such missiles and equipment for their production can be made only after appropriate consultations of partners. To ensure the regime's activities, its members hold regular discussions (Chechelyuk, 2013).

As of April 1 2020, 35 countries are participants in the International Missile Technology Control Regime, namely: Argentina, Australia, Austria, Belgium, Bulgaria, Brazil, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, India, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Poland, Portugal, Republic of Korea, Russian Federation, South Africa, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom, United States (MTCR, 2020).

The MTCR Guidelines provide for that exporting countries must be obliged to assess the risks for the transfer of missile technology, such as prevention of proliferation and delivery of weapons of mass destruction, as a result of the transfer; the mission (purpose) and objectives of the recipient's rocket and space programs; assessment of the probable use of the transferred items for the delivery of weapons of mass destruction and recipient States' representations of international legal refusal of such actions; application of corresponding multilateral agreements; consideration of the risk of controlled items falling into the hands of terrorist groups and individuals (Guidelines, 2002).

However, it should be considered that space exploration is now entering a new era of innovation and change. Nowadays, new technologies, new uses of space, and decreasing costs have made space flight much more accessible. Private space companies launch satellites, resupply the International Space Station, and even offer space flights to citizens. Currently, there are space agencies in 72 countries, including China, Japan, and India. The three largest space agencies are NASA in the US, Roscosmos in Russia, and the ESA in Europe (Hofford, 2019). In other words, States that aspire to explore and use outer space are twice as likely as MTCR participants.

At the same time, private space companies play an increasing role in the space agencies of nation States. Three American ones are the most powerful. SpaceX is the most famous private space company. It was founded in 2002 by Elon Musk, an entrepreneur, for the strategic purpose of colonizing Mars. It is the first commercial company to deliver cargo that has secured a contract with NASA for the transportation of astronauts to the ISS. Its Falcon 9 and Falcon Heavy rockets, for the first time, have launched reusable rockets. The founder of private space company Blue Origin (2000) is the legendary Amazon founder Jeff Bezos. This company aims

to provide access to space for private individuals. It has developed a reusable rocket New Shepard. This launch vehicle has undergone multiple successful flights. Blue Origin focuses on civilian space and the provision of 'low cost' space travel services. The company has also signed a number of contracts to use their rocket to launch civilian commercial satellites. In addition, Blue Origin has created the BE-4 rocket engine. They plan to sell it to other rocket companies that plan to construct launch vehicles. Richard Branson's Virgin Galactic was founded in 2004. It is an extension of the Virgin brand into the space tourism industry. In 2018, Virgin Galactic successfully launched a reusable space shuttle SpaceShipTwo that carried a passenger. This is great news for the 680 customers who have already paid the $200,000 deposit for the space travel. In general, Virgin Galactic aims to dominate the commercial space travel market by reusable space shuttles (Hofford, 2019).

From the perspective of law, all U.S. private space companies operate in the legal field of U.S. national law as well as international law ratified by Congress. Their activities are under the control of NASA, as a national body controlling the activities of private space companies on behalf of the U.S. government. This includes strict adherence to MTCR guidelines. In other MTCR space member States, private space companies comply with the same legal mechanism. However, it should be considered that not only the companies and their officials, but also the national space agency of the country and the government of the State as a whole are responsible for the violation of the MTCR by private space companies.

Specificities of compliance with the missile technology control regime by U.S. private space companies

As a general rule, the MTCR does not intend to interfere with the peaceful use of advanced missile technology, national space programs, or international space cooperation until such programs can potentially facilitate the delivery of nuclear or other weapons of mass destruction (Ozga, 1994). Modern ballistic missiles are a system of cargo delivery to Earth orbit or distant space, not weapons delivery (Novikov, 2012). Nowadays, most states that have entered into this regime as a result of bilateral agreements with the U.S. government have tighter restrictions than those set out in the MTCR since chemical and biological warheads can be deployed on small rocket systems with a flight range of less than 300 km and a payload of less than 500 kg (Ozga, 1994).

According to most experts, the MTCR crisis is largely caused by the initial following the principle of non-proliferation of missile technologies, which is similar to the non-proliferation regime of nuclear weapons. This meant its versatility and legally binding procedures. However, under the current conditions, the legal control mechanism is implemented within the framework of export control legal instruments regulated by national legislation. Accordingly, MTCR states impose legal restrictions, while other non-member States formally remain free to act (Novikov, 2012).

However, the commercialization of space activities and the active involvement of private space companies in the process has had positive results; for example, $5.8 billion was invested in 2019. Private funds make record-breaking investments in the space industry. Typically, private space companies are funded from three sources: corporate capital, venture capital, and individual or angel capital. Experts have proven that a $140 million investment is key taking a company from start-up to its first launch. Moreover, it should be noted that most of the space companies have a little more than a ten-year history. Nevertheless, they have received nearly

$26 billion in investments since 2009 (Sheetz, 2020).

Successful private American space companies are: Bigelow Aerospace, its objectives include providing a low-cost, low earth orbit (LEO) human-rated space station (founder: Robert Bigelow (1998); Copenhagen Suborbitals, its objective is to launch space tourists into suborbital space. Has performed 45 engine tests to date (founders: Kristian von Bengtson, Peter Madsen (2008)); Deep Space Industries, space company planning to mine asteroids for usable materials (founders: Rick Tumlinson, David Gump (2013)); Frontier Astronautics, it provides hard-to-get technology and services to the space industry, in particular, rocket engines and attitude control systems; Intelsat, leading provider of satellite services worldwide; Masten Space, a company that designs, builds, tests, and operates reusable launch vehicles (founder: David Masten (2004)); Moon Express (MoonEx), a company with the goal of mining the Moon for natural resources (founders: Robert D. Richards, Naveen Jain, Barney Pell (2010)); Planetary Resources, Asteroid mining company, with the goal to establish a new paradigm for solar system resource discovery and utilization (founders: Eric Anderson, Peter Diamandis); Rocketplane, a creator of a suborbital spacecraft for suborbital flights space tourists; Ventions, currently focused on development of small-scale propulsion systems (2004); XCOR Aerospace, focused on the design, development, and production of reusable launch vehicles (founders: Jeff Greason, Dan DeLong, Doug Jones, Aleta Jackson (1999)) [22 Space Settlement Institute, 2020]; Rocket Lab, American private space company that has its own rocket range in New Zealand. It has developed and successfully tested the ultra-light launch vehicle Electron (founders: Peter Beckd, location: Huntington Beach) (Incorporation, 2020).

In addition, fewer in number private space companies exist in other MTCR member States. For example, Russian space company Lin Industrial offers launches of medium orbit satellites up to 140 kg and up to 700 kg by their launch vehicles of small class [26 Lin Industrial, 2020]. In Japan, a private company Interstellar Technologies builds ultra-lightweight launch vehicles for launching nanosatellites into space. The founder of Taiki is Hokkaido, President of Akabira, Hokkaido, founded in 2005 (Mission, 2020). In Ukraine, a private space company Science and Space has declared itself (Founder: Valentyn Halunko (2020)), it is engaged in the development of light class launch vehicles for the launching of satellites with a total mass of up to 500 kg into a medium-orbit from sea launch (Science, 2020).

All of these companies have standard features: first, they are all overseen by national space agencies; second, they should comply with the MTCR guidelines; third, the export of manufactured products is carried out only after obtaining permission from the national export control services.

The legal system for ensuring the activity of private companies in non-MTCR States differs. For example, private Chinese space companies have made significant strides. Although, according to experts, they can be called private only provisionally. All of them, without exception, are supported by the State, and as the whole Chinese space is under the military umbrella. At the same time, there are nearly two dozen formally private rocket companies in China. The most successful of them is Expace, which is a subsidiary of the Chinese public company CASIC. It has successfully launched a four-stage solid rocket capable of delivering a payload of up to 700 kg into medium orbit (Overview, 2020).

The specificity of legal regulation of Chinese private companies is that the PRC does not have space laws, and national space provisions are established by two governmental resolutions, approved by numerous military orders. In addition, it should be emphasized that

the PRC has not yet been accepted into the MTCR. Moreover, since this State has submitted an application to this regime, it generally respects its guidelines and requires this from its private space companies.

Ballistic missiles proliferation beyond the MTCR is a critical threat to international security

The United States and other nations make significant efforts to prevent the proliferation of missile weapons and take measures to prevent the States from having ballistic missiles. This is a complex task that restrains the transfer of finished missiles, rocket technology, financial and human capital needed to successfully develop mid-range launch vehicles and intercontinental missiles. North Korea is of particular concern to the world community due to numerous ballistic missile tests, and U.S. intelligence officials believe that North Korea has successfully developed an intercontinental missile capable of striking the continental United States. Unfortunately, the Missile Technology Control Regime has often been disrupted. In fact, the only coercive means to enforce the MTCR guidelines are sanctions that may be imposed by the United States (Knox, 2017).

For example, the first space-faring nation, Russia, which joined the MTCR in 1995, but before this, between 1987 and 1995, Russia transferred a number of ballistic missiles to other states. In particular, from Russia, Slovakia achieved ballistic missiles SS23, according to western classification. Belarus achieved ballistic missiles SS-1 and SS25, Armenia and Greece achieved ballistic missiles SS21, R-17 Elbrus and FROG-7. However, after joining the treaty, Russia, against the MTCR, transferred a ballistic missile SS26 to Armenia in 2016 (Knox, 2017).

Non-traditional is the legal status of China, one of the most powerful space powers in the MTCR. This is due to the fact that China has applied for membership and promised to adhere to its key guidelines. China advances its capacity to exercise national control over the export of missile technology. According to international reports, China is taking steps to train its space firms and government authorities on the guidelines for an export-related to rocket technology and the improvement of export controls related to rockets. For example, in January 2004, Beijing released an export licensing directory for items and technology to help customs officials identify weapons proliferation issues, and the Chinese Ministry of Commerce announced that it had fined two of its companies for violating export controls of MTCR's items. However, according to the CIA report, in 2004, despite these efforts, Chinese organizations continued to work with Pakistan and Iran on ballistic missile projects, and firms in China provided raw materials or dual-use items to other countries (Rasmussen, 2007). In addition, there is information that China sold a DF-21 ballistic missile to Saudi Arabia in 2007 (Knox, 2017).

Therefore, it should be noted that the Chinese government faces some difficulties in restricting the unauthorized transfer of controlled items and missile technology. According to Niels Aadal Rasmussen, it is inappropriate to further deny China's accession to the MTCR. The ways to bring its missile technology export control policy and infrastructure to an acceptable level of the MTCR (Rasmussen, 2007).

However, the bigger problem is the existence of space-faring nations that do not seek to enter into the Missile Technology Control Regime and do not adhere to its guidelines. North Korea and Iran are among the most technologically successful and dangerous for the world community in terms of the use of weapons of mass destruction. This is of great concern to the

world community. In addition, almost all countries in the Middle East have ballistic missiles subject to the MTCR. These include Yemen, Saudi Arabia, Egypt, Israel, Iraq, Afghanistan, Turkey, Turkmenistan, Kazakhstan, the United Arab Emirates, Bahrain, and Pakistan. Among these States, only Turkey joined the MTCR (1997). Other countries in the Middle East, formally not part of the MTCR, can transfer ballistic missiles to each other. For example, in 2007, Iran transferred a ballistic missile to Syria (Knox, 2017).

Therefore, space powers outside the Missile Technology Control Regime undermine the effectiveness of missile proliferation and imposes unjust restrictions on Member States. After all, countries that do not seek to become MTCR partners can transmit missile technology to each other. Accordingly, first, intercontinental ballistic missiles are in state regimes (such as North Korea) where human life is of no value and the potential to blackmail democratic States exist; second, it discriminates the space industry in the MTCR Member States, which makes it difficult to attract investment in missile technology to non-members of the MTCR.

Why and how to become a member of the missile technology control regime?

The rationale for participation in the MTCR is: 1) the State either does not have at all or has not yet developed space industry, but wants to create one; 2) entrepreneurs of the State are eager to access dual-use high-tech; 3) the State wants to acquire a political image of space-faring nation; 4) in cases where States without accession to the MTCR are already engaged in space development then the reason for accession is the desire to avoid political pressure and corresponding international sanctions (Ozga,1994).

Usually, the decision to adopt a new MTCR partner is taken by consensus. When deciding on membership, Member States shall first consider whether the applicant country persistently strives for the non-proliferation of ballistic missiles to establish an effective export control system that implements the MTCR Guidelines and Procedures, to control and implement such controls effectively. Dialogue with potential partners is conducted through the MTCR chairman, a visit to the capital of the applicant country by a committee consisting of representatives of four MTCR partners and bilateral exchanges between delegations (MTCR. 2020).

However, Deborah A. Ozga, a scholar in this field, argues that the State should not only proclaim itself to be an adherent to the regime, but also strictly adhere to its guidelines. This does not necessarily imply that an adherent will be automatically recognized by civilized space nations. For this, recognition of adherent status by the U.S. government is particularly critical. What is usually legalized is a preliminary agreement between the U.S. government and the Candidate State (Ozga, 1994). For example, in 1994, a Memorandum of Understanding on the Transfer of Missile Equipment and Technology was signed between the Governments of Ukraine and the United States. In particular, the parties will not allow any transfer of missile equipment or technology, except for individually issued licenses or other written permission granted for transfer to the appropriate government agency. The Parties shall give the strict presumption of rejection of any application for the removal of any missile equipment or technology of Category I (Memorandum, 1994).

Exceptions to this may be only the rare cases that meet the following requirements. First, the transfer of such equipment is permitted by the Missile Technology Control Regime, that is, the missile system has the maximum potential capability to launch satellites up to 500 kg, with a range less than 300 km; second, governmental commitments will be confirmed that: 1) these

items will be used for peaceful and declared purposes; 2) such use will not be violated, and the items will not be modified or copied without the prior consent of the parties; 3) neither the items, nor their copies, or the related equipment will be re-exported without the permission of the supplier. In addition, the State of Ukraine assumes responsibility for all necessary steps, including on-site inspections in relevant cases, to ensure that the subject of the transfer is used for the stated purposes only (Memorandum, 1994). Subsequently, Ukraine implemented national export controls at the national level, provided for by the guidelines of the regime, as well as lists of corresponding goods, but actually acquired membership of the organization only in 1998.

However, according to Niels Aadal Rasmussen, MTCR membership may bring less advantage than expected. As the previous experience of other space powers such as Brazil and Ukraine illustrate, membership of the MTCR does not guarantee equal treatment by the U.S. and the E.U. in civilian space programs or technology sharing (Rasmussen, 2007).

Therefore, the Memorandum of the International Legal Control Regime for Missile Technology for Ukraine is more rigid than the very MTCR. After such strenuous commitments to the U.S. Government and in agreement with the other Member States, only four years later, Ukraine passed all the procedures foreseen and in 1998 became a full member of this esteemed society.

Sanctions for violating the missile technology control regime

No MTCR Member State can veto foreign exports of missile equipment and technology. However, U.S. law provides for the possibility of imposing national sanctions against violators (Stefanovich, 2020). Unfortunately, most other Member States do not impose sanctions for MTCR violations. They are usually limited to diplomatic actions.

According to U.S. national law, the President has the right to impose economic sanctions on national entities, and political and economic sanctions on foreign entities. For example, if they export or otherwise transfer MTCR equipment or technology, facilitate the acquisition, design, development or production of missiles in a non-MTCR country. If an entity is an intermediary, or tries to participate in such export, transfer or work, or promotes such export, transfer or trade by any other entity. However, the President of the United States may refuse to impose sanctions on such an entity if he believes that the export of a good or service is important to U.S. national security and proves it reasonably to Congress (Foreign, 1992).

According to recent provisions, U.S. space companies have been able to export ballistic missiles to Turkey (1988), Thailand (1993), the United Kingdom (1994), Greece (1996), South Korea (1999), Bahrain (2000) and the United Arab Emirates (2011). In five of the seven cases, the first category launch vehicles ready to use were transferred. Specifically, such ballistic missiles were sold to the United Kingdom, Greece, South Korea, Bahrain and the United Arab Emirates. Moreover, the United Kingdom has received a sophisticated ballistic missile from the United States with astronomically inertial warhead guidance and individual guidance to the target. But there are two cases of the transfer of individual components of the second category missile systems to Thailand and South Korea (Stefanovich, 2020). However, the U.S. government has repeatedly applied sanctions to foreigners. For example, in 2000 on subjects of Iran and North Korea engaged in activities to proliferate missile technology prohibited by MTCR (Missile, 2020).

Moreover, the United Kingdom has received the most advanced ballistic missile from the United States with astronomically inertial warhead guidance and individual guidance system.

But there are two cases of the transfer of individual components of the second category missile systems to Thailand and South Korea (Stefanovich, 2020). However, the U.S. government has repeatedly applied sanctions to foreign entities. For example, in 2000 on it was the case of entities of Iran and North Korea engaged in activities to a proliferation of missile technology prohibited by the MTCR (Missile, 2020).

Therefore, the international legal mechanism for imposing sanctions on MTCR violators is not appropriate. Nowadays, virtually only the U.S. government imposes economic and political sanctions on foreign entities that violate it. Other MTCR Member States are limited to diplomatic measures only.

Disadvantages of the missile technology control regime

It is an axiom in law that any provision of law should be protected by a sanction. International provisions are no exception to this rule. Otherwise, a provision of law that is not protected by legal coercion will almost never be enforced. This is relevant to the Missile Technology Control Regime. Its non-adherence should be ensured by international sanctions, not national sanctions of individual States.

The problem of non-proliferation of missile technology is a very complex set of political, economic, legal, and technological issues that are unlikely to be resolved quickly and relatively painlessly (Novikov, 2012). Accordingly, the scientific literature highlights MTCR shortcomings such as: 1) a limited number of members; 2) by its legal nature, the MTCR does not have the legal status of an international treaty; it is not formally binding; 3) some of its guidelines are imperfect, not specific and interpreted differently by different States; 4) frequently MTCR membership provides the Member State not with a positive incentive to develop, but refusal to develop missile programs; 5) the regime does not offer the majority of Member States any advantages; 6) there are no international sanctions for their violation; 7) MTCR does not address all aspects of ballistic missile proliferation by totalitarian regimes that ignore international rules (Ozga,1994).

Therefore, countries that carefully adhere to the MTCR lose their space technology, for example, Ukraine. On the contrary, rogue States that violate international law make significant progress in launching ballistic missiles, for example, North Korea. Moreover, U.S. sanctions cannot stop further enhancement of North Korea's space and nuclear program.

Improvement areas of the missile technology control regime, considering private space companies development

The above study enables one to argue that classical international legislation on the peaceful proliferation of ballistic missiles is virtually absent. Therefore, States adhering to it are in worse condition than those that do not recognize or (and) violate it. Under the U.N., it must be built, approved, and, most importantly, set effective sanctions for violations. That is a very difficult task. The common security system in the form of the U.N. Security Council is not perfect or effective. However, further establishment of international legislation on the peaceful use of launch vehicles is required. Evidently, modern humanity increasingly become not Earth but cosmic one. It is impossible to stop this process.

It is important to emphasize that, prior to the adoption of high-level international legislation on the peaceful design, development, production, operation, export and launch of launch vehicles with civilian satellites and stations, all States, whether or not they are MTCR

members, must strictly adhere to their guidelines. In relation to States that violate this regime, all Member States should be consolidated to impose strict political and economic sanctions. There is no other way.

In addition, we argue that, first, the procedure for joining MTCR by democracies governed by the rule of law should be simplified. Because the more civilized space powers are in society, the higher the development of overall social progress of the world economy through the use of space resources. Second, the procedure for democracies governed by the rule of law, applicants to the MTCR to use ready-made launch vehicles to launch their civilian satellites, should be simplified. Export should be with the exclusive right of use, without the right of ownership and regulations. It should be without the transfer of technical documentation and technology. Moreover, MTCR manufacturers' staff should provide maintenance of such missile systems. This will enable us to engage both public and private investments by individuals and legal entities of States currently uninvolved in the exploration and use of outer space. This will increase the MTCR status as an international institution. Furthermore, it will be a factor in counteracting the proliferation of ballistic launch vehicles in the uncontrolled civilized world community.

Conclusion

Therefore, the MTCR has long played a positive role in preventing the transfer of ballistic missiles and related technologies to terrorist organizations and totalitarian State regimes. However, it is not effective under the current MTCR. On the one hand, it does not deter States from successfully developing ballistic missiles and weapons of mass destruction. On the other hand, it hinders the development of space technologies by non-space club States. This is despite the fact that, under the present conditions, liquid and solid civilian engines are the only vehicles that provide access to Earth orbit and the long space of cargo and humans.

It is proved that humanity is in such a state that only civilian ballistic missiles make the Earth Man into the Cosmic Man. In other words, the proliferation of rocket technology among private companies of democracies governed by the rule of law not only increases the quality of life and work of people on Earth, but also increases the probability of human survival in the face of global natural and man-made disasters. Our further research will focus on the development of the theory and practical recommendations on a high-level international legal mechanism (at the U.N. level) to prevent ballistic missiles from entering terrorists. Nevertheless, simultaneously private companies, residents in democracies governed by the rule of law, should be provided with the conditions to build many new launch vehicles.

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Current Problems and Challenges in International Space Law: Legal Aspects

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The article is devoted to the study and research of contemporary legal issues in the field of international space law. Today we are witnessing the rapid and unstoppable development of the space industry. Such cooperation requires an appropriate legal framework. In this article, we will review the leading normative legal acts regulating relations in outer space today and analyze current development trends and problems.

Space law is a relatively new branch of international public law, involving a combination of customs and treaties. The legislative framework of the space industry is expanding accordingly to the subject that is regulated. One of the main issues that are investigated in this article is the search for a balance between free access of humanity to the space and the opportunity to establish ownership of certain study objects in outer space. The ability to develop the right of ownership of private enterprises, companies, research centers is extremely important for the economic development of the space industry.

This article aims to provide a holistic understanding of current trends and challenges in space law with particular emphasis on such issues as space tourism, the "new space" and climate change. The article will examine the founding treaties of space law, the legal framework, and scientific literature concerning space law. The leading goal of this article is to highlight new trends and prospects of space research, the exploration of new perspectives, which are distributed today in the field of outer space, and search of ways of its solution within the framework of legislative regulation.

Keywords: United Nations Office for Outer Space Affairs, European Space Agency, European Space Research Organization, space treaties, space, tourism, privatization, commercialization, new space, climate change, debris.

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Introduction

The development of human civilization is a leading factor in expanding the boundaries of such science as international law. The law of the sea emerged because of the conquest of the ocean by humans. The law for the regulation of airspace relations resulted from the use of aircraft and the conquest of the sky. In such a way, next branch of international law — the law of airspace — was created. Outer space becomes the next, precisely as a result of the subjugation of space by humans. So, the issue of regulating relationships in this branch and setting legal rules becomes acute.

Currently, controversial questions concerning the legal status of airspace continue to compete with each other. The peak of this problem we can observe at the beginning of the 20th century when people finally conquered the air with the help of new technology — aircraft. However, humanity does not stand still, and the next step was the conquest of outer space. At present, there are certain kinds of territories recognized in international law as falling outside the construct of state sovereignty. The following territories include high seas, international seabed its soil and subsoil under the high seas, Antarctica and outer space. To use the designated areas for peaceful purposes and the benefit of humanity as a whole, the international community of sovereign states has created the standard of a "common heritage of mankind."

The concept of "common heritage of mankind" consists of five main elements: the absence of a right of appropriation; the duty to exploit the resources in the interest of mankind in such a way as to benefit all, including developing countries; the obligation to explore and exploit for peaceful purposes only; the duty to pay due regard to scientific research; the duty duly to protect the environment. Such a concept of the "common heritage of mankind" was extended to the new frontier human managed to reach — the cosmos (Richards, 2013).

Most of the leading scientists consider the date of the beginning of legal relations concerning space exploration as 1957, which was well-known as the year when the first artificial satellite had been launched into Earth. At that time, there were no comments or objections from other states concerning this event. There was no state which asked the question of sovereignty. The lack of protest from the members of the international community led to the freedom of scientific exploration in space. This rule helps to expand the area of space research (Tronchetti, 2013).

To sum up, all the above-mentioned events have led to the formation of international rules and principles in the field of outer space, which now makes up the system of legal acts. Current space law extends to the issues such as satellite telecommunications networks, the geostationary orbit, satellite distribution, remote sensing, the operation of the civilian international space station and space debris guidance.

Overview of the five U.N. space treaties

Concerning international law treaties, we should mention that the United Nations General Assembly has adopted several resolutions regarding the matter. It is advisable to outline the most important of them.

The Resolution 1472 (XIV) of 1959 establishes the Committee on the Peaceful Uses of Outer Space (COPUOS). Considering that the overriding goal of space exploration and exploitation should be only for the betterment of mankind and to the benefit of States regardless of their stage of economic or scientific development, the Resolution commends to States for their guidance in the exploration and use of outer space the following principles: (a) International law, including the Chapter of the United Nations, applies to outer space and celestial bodies;

(b) Outer space and celestial bodies are free for exploration, and use by all States in conformity with international law and are not subject to national appropriation; c) Invites the Committee on the Peaceful Uses of Outer Space to study and report on the legal problems which may arise from the exploration and use of outer space (RES 1472 (XIV), 1959).

The Resolution 1721 (XVI) of 1961 International cooperation in the peaceful uses of outer space. The main task of the Resolution was to strengthen the idea of peaceful use of outer space, as well as to introduce a voluntary system for the registration of space objects in the international registry. It also represented the effort of UNCOPUOS to set aside any statements that outer space could eventually constitute a form of res nullius, therefore subjected to sovereignty claims. Also, it should be noted that the provisions outlined in the Resolution form the leading opinion on the principle non-appropriation of outer space was already effectively consolidated in International Law by that time (Resolution 1721 (XVI), 1961).

The Declaration of Legal Principles Governing the Activities of States in the Exploration and Uses of Outer Space (General Assembly resolution 1962 (XVIII) of 13 December 1963). Following the provisions of the statutory instrument, States shall be guided by relevant principles during the exploring and using outer space. It is advisable to mention the most important of them:

a) the research and use of outer space shall be for the benefit of all mankind;
b) outer space and celestial bodies are free for study and use by all states based on equality;
c) outer space and celestial luminaries are not subject to sovereignty by appropriation;
d) the activities of States in the exploration and use of outer space shall be carried out under international law, including the Charter of the United Nations, in the interest of maintaining international peace;
e) States should bear responsibility for national space activities carried out by government agencies or non-governmental organizations. The activities of non-governmental organizations in space require an appropriate authorization, supervision, and control;
f) an important principle in the exploration and use of outer space is also mutual assistance and cooperation;
g) the object launched into space must be subordinate to the country to which it belongs. It should be noted that the state should be responsible for the objects and property of objects placed in space, and their parts are not affected by their passage through space or return them to the Earth (Declaration, 1962).

The Principles Governing the Use by States of Artificial Earth Satellites for International Direct Television Broadcasting (Resolution 37/92, 1983). According to the provisions of this regulation, each state has an equal right to carry out activities in the field of international direct television broadcasting by satellite and to allow such activities to persons and institutions under its jurisdiction. Also, access to technology in this field should be accessible to all states without discrimination. It should be noted that the Charter of the United Nations, the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies are the leading normative legal acts, their provisions are at the core of activities in the field of international direct television broadcasting by satellite. Concerning the state responsibility, it is reasonable to highlight that in the case where international direct television broadcasting by satellite is provided by an international

intergovernmental organization, the responsibility should rest with both that organization and the States participating in it (Resolution 37/92, 1983).

The Principles Relating to Remote Sensing of the Earth from Outer Space. Following these provisions, fifteen principles should be realized. It is advisable to mention the most important of them. Remote sensing activities can only be done for the benefit or in the interests of all countries, and it is not dependent on the economic or social development of the countries. The regulatory legal act in this activity is the Treaty on Principles governing the activities of States in the Exploration and Use of Outer Space, including the Moon and other Celestial Bodies, according to which exploration and use of outer space establish the principle of freedom of exploration and use of outer space based on equality. To maximize the impact of remote sensing activities, States are encouraged to implement through the agreements the operation of data collection and storage stations, processing, and interpretation facilities. As a result of the creation of primary and processed data relating to the territory under its jurisdiction, the State concerned will have access to it on a non-discriminatory basis and at a reasonable cost. The Earth remote sensing State shall, upon request, consult with the state whose territory is being sensed to provide opportunities for participation and enhance the mutual benefits arising from there. This is to facilitate and enhance international cooperation. In compliance with Article VI of the Treaty on Principles, States that operate remote sensing satellites should bear global responsibility for their activities, including the Moon and Other Celestial Bodies. Such actions shall be conducted following these principles and rules of international law, whether undertaken by governmental or non-governmental organizations or through international organizations to which such States are parties. In the event of a dispute arising out of the application of these principles, such dispute shall be settled amicably (Resolution 41/65, 1986).

By The Principles Relevant to the Use of Nuclear Power Sources in Outer Space (RES 47/68, 1992) states launching space facilities with nuclear energy sources should protect people, the general public, and the biosphere from radiological hazards. The use of space objects with nuclear energy sources should provide a high degree of security. International Commission on Radiological Protection notes that during regular operation of space facilities with nuclear energy sources on board, should be investigated and controlled, including re-entry from high enough orbits. The purpose of this is to protect the public. Besides, it should be noted that the design and construction of a nuclear energy source system must take into account relevant international radiological protection rules. Following Principle 5 Notification of re-entry, any state launching a space object with nuclear power sources on board shall in a timely fashion inform States concerned in the event this space object is malfunctioning with a risk of re-entry of radioactive materials to the Earth. The information shall be per the following format: (a) System parameters: (i) Name of launching State or States, including the address of the authority which may be contacted for additional information or assistance in case of an accident; (ii) International designation; (iii) Date and territory or location of launch; (iv) Information required for best prediction of orbit lifetime, trajectory and impact region; (v) General function of spacecraft; (b) Information on the radiological risk of nuclear power source(s): (i) Type of nuclear power source: radioisotopic/ reactor; (ii) The probable physical form, amount and general radiological characteristics of the fuel and contaminated or activated components likely to reach the ground. The term "fuel" refers to the nuclear material used as the source of heat or power (RES 47/68, 1992).

And the last declaration of the peculiarities of which is expedient to outline is the Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and the Interest of All States, Taking into Particular Account the Needs of Developing

Countries (resolution 51/122 of 13 December 1996). By the provisions specified in this legal action and considering the need of States for technical assistance and the rational and efficient allocation of financial and technical resources, international cooperation should focus on the following objectives: (a) Promoting the development of space science and technology and its applications; (b) Fostering the development of relevant and appropriate space capabilities in interesting States; (c) Facilitating the exchange of expertise and technology among States on a mutually acceptable basis. It is also important that national and international agencies, research institutions, development assistance organizations have a scientific obligation to carry out research, study, and use of space programs and the potential of international cooperation to achieve good development. For this purpose, the Committee on the Peaceful Uses of Outer Space should strengthen its role in the area of international cooperation in the field of Outer Space Use international cooperation following their outer space capabilities and their involvement in space exploration and utilization (Resolution 51/122, 1996).

Subsequently, as a result of the U.N.'s endless efforts at regulating the conduct of space exploration nations, new international treaties in the field of space were introduced and drafted. It should also be noted that the Committee on the Peaceful Uses of Outer Space is a forum for the development of international space law. An essential result of the Committee's work is the conclusion of five international treaties and sets of space activity principles. Such treaties were implemented under the auspices of UNCOPOOS. It is advisable to outline the most important of them: The 1967 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (known as "Outer Space Treaty"); The 1968 Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space (the "Rescue Agreement"); The 1972 Convention on International Liability for Damage Caused by Space Objects (the "Liability Convention"); The 1975 Convention on Registration of Objects Launched into Outer Space (the "Registration Convention"); The 1979 Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (the "Moon Treaty"). What are the main goals of these treaties? First of all, these treaties regulate the issue of the prohibition of space allocation by any country, control the issue of arms, establish rules on freedom of exploration, specify the legal framework of liability for damage caused by space objects, prescribe rules for the salvation of spacecraft and astronauts in case of danger, as well as the use of natural resources. Analyzing these treaties, we can observe that outer space, space-based activities, and any benefits that can be gained from space must be dedicated to enhancing the well-being of all countries and humanity.

Overview of the United Nations Office for Outer Space Affairs (UNOOSA)

UNOOSA is the United Nations office responsible for promoting international cooperation in the peaceful uses of outer space. UNOOSA located at the United Nations Office at Vienna, Austria. Nowadays, UNOOSA represents the main organization for space affairs within the U.N., which implements the decisions of the G.A. and the UN COPUOS[1], and is the primary

[1] The Committee on the Peaceful Uses of Outer Space (COPUOS) was set up by the General Assembly in 1959 to govern the exploration and use of space for the benefit of all humanity: for peace, security and development. The Committee was tasked with reviewing international cooperation in peaceful uses of outer space, studying space-related activities that could be undertaken by the United Nations, encouraging space research programmes, and studying legal problems arising from the exploration of outer space.

international forum for the development of laws and principles governing outer space. Its field of activity is to support intergovernmental discussions and the Committee and its Scientific and Technical Subcommittee and Legal Subcommittee. Moreover, it assists developing countries in using space technology for development and also follows all scientific and technical developments relating to outer space affairs. It maintains the Register of Space Objects on behalf of the Secretary-General and also collects other relevant data and documentation (Resolution 47/68, 1992). UNOOSA's main objectives are to promote international cooperation in peaceful uses and space exploration. It is also important to highlight that the use of space science and technology contributes to economic and social development, the establishment and implementation of a legal framework in the field of space relations regulation, and the implementation of programs aimed at the development and integration of space capabilities in international development programs.

It is interesting to note that the U.N. Office for Outer Space was created only as a small expert unit within the United Nations Secretariat to serve the Special Committee on Peaceful Uses of Outer Space, set up by the General Assembly in its resolution 1348 (XIII) of 13 December 1958. However, the further history of U.N. development is that this department was reassigned to the Department of Political and Security Services in 1962. Later, in 1968, the department was transformed into the space unit of the Department of Political Affairs. In 1993 the Office was transferred to the U.N. Office in Vienna and set itself new responsibilities, such as responsibility for essential secretariat services to the Legal Subcommittee, which had previously been provided by the Office of Legal Affairs in New York.

The leading functions of UNOOSA include the implementation of the tasks of a single General Assembly Committee that deals exclusively with international cooperation for peaceful uses of outer space: the U.N. Committee on Peaceful Uses of Outer Space (COPUOS). Also, UNOOSA conducts international seminars, training courses, and pilot projects on topics including remote sensing, satellite navigation, and satellite meteorology and prepares and disseminates reports, research, and publications in various fields of space science and technology and international law. Such activities are usually supported by the United Nations Space Program.

It should be noted that such UNOOSA's activity as promoting international cooperation in peaceful uses and space exploration is a leading factor in the sustainable economic development of countries. UNOOSA helps United Nations Member States to create the legal and regulatory framework for space management so that countries with low economic development are now able to develop through collaboration and use of space scientific technologies (Bohinc, 2013).

Current problems in international space law

In practice, today, we can observe that some new businesses break the rules, ignore and contradict existing international space agreements. Today, the Space Law is a combination of rules and customs aimed at ensuring the free, unhindered, and non-discriminatory access of mankind to space. As already mentioned, the leading treaties in the field of the application of space law today are the "Treaty on the Principles Governing the Activities of States in the Exploration and Use of Outer Space (OST), Including the Moon and Other Celestial Bodies" of 1967; the 1968 "Rescue Agreement," the 1972 "Liability Convention," the 1975 "Registration Convention" and the 1979 "Moon Agreement." Today those founding treaties of Space Law find many issues unaddressed. It should also be noted that today most of the leading scientists believe

that much attention is needed to the development of space tourism, "New Space," space debris, and climate change. Therefore, given the fact that the space environment is changing today and quite actively, there is an increase in the number of private companies whose activities are related to space — there is a need to improve legislation, international treaties on space and land-based activities. It should be understood that the old rules and customs need their renewal today.

For example, asteroids are known to be rich in valuable resources like iridium, platinum, and palladium, which are rare on Earth. Because of the high value of these materials, mining expeditions are expected to be a frequent phenomenon. The critical question then is, "Who will own those mined resources?" When national councils and private operators are predicated on an ownership basis, this causes concern. Accordingly, countries should look at detailed national legislation for outer space activities (Roles, 2020).

Regarding the leading and defining legislative acts in the field of space relations regulation, the Law on Space Regulation should be mentioned. For example, the Space Settlement Institute based in New York has put forward a proposal to introduce a legislative act which is possible to regulate property rights relations. This law provides legal support for land ownership "for any individual who has established a settlement on the Moon, Mars, or a permanent asteroid, with regular traffic between the settlement and the Earth open to any paying passenger." Therefore, according to the provisions of this law, any private company can create and settle settlements on Mars without the government of its state. As a result, private space settlements should not be subject to the sovereign jurisdiction of any terrestrial nation. This will help to remedy the situation in such a way that private property rights will be secured and the issue of national allocations resolved.

Nowadays, not only organizations whose main preoccupation is outer space discuss the possibilities which might arise within this field in the future, e.g., the Competitive Enterprise Institute (hereafter CEI), an NGO organization the main aim of which is entrepreneurship and free-market initiatives. CEI in April 2012 published a paper "Homesteading the Final Frontier — A Practical Proposal for Securing Property Rights in Space" (Simberg, 2012). This paper presented a practical proposal to introduce a new regime. The author argues that space ownership is not just a need for space and development. Recognition by governments and property of space would create a powerful financial incentive to open the space border. According to this understanding, competition in the free market can help reduce the high costs of space-related space activities.

Besides, the proposal elaborates that the 1967 Outer Space Treaty implicitly prohibits private property in outer space, but on the other hand, there are different conceivable interpretations. For example, one of them only forbids declarations of national sovereignty, not only from individuals. In this sense, importance is the ability to maintain freedom, openness, and developing the economy through competition and by reducing political interest in space issues (Gorove, 1969). According to article 2 of the OST, ownership of celestial bodies cannot be invoked. However, this position limits researchers to any type of ownership of their subject matter. Article 2 of the OST creates some contradictions in the contract for the prohibition of property rights for individuals and businesses. Many private companies and individuals, whose home countries are not signatories of the Moon Treaty, use this deficiency to assert their belief that the concept of res nullius remains valid for private individuals and business entities. However, even if one country would decide to use this interpretation, another problem would arise, and that is protecting the claim from others, which could lead to major political repercussions (Brittingham, 2010).

Therefore, the first changes in the current legislation will become inevitable when the first settlements on the Moon appear and the missions of which will be exploring the Moon for the benefit and in the interest of all countries (i.e., according to the OST stipulation).

The law which we should also mention is the Space and Settlement Development Act of 2019. This law is a refinement and is based on Congressman George Brown's original Space Law. The work on revising the law in the current version was done by Dana Rohrabacher. The principal purpose of the law to outline is to add enabling space development and settlement to NASA's charter, to the Office of Commercial Space Transportation's charter, and the Office of Space Commerce charter. The act is included in the Alliance for Space Development's[2] MarchStorm event, and its passage is the cornerstone of the Space Settlement Campaign, a joint project between the National Space Society and the Waypaver Foundation (Dunstan, 2012).

Following this law, the development of space will create new jobs, catalyze new industries, accelerate innovation and new technologies, and enable the United States to tap vast new resources that will generate new wealth, enhance national security (The Space, 2019). Consistent with the national security interests of the United States, the Office of Science, Technology, and Policy shall, in close cooperation with the National Aeronautics and Space Administration, the Department of Transportation, the Office of Space Commerce, other appropriate agencies, the private sector, academia, and the international community, obtain, produce, and provide information relating to all issues important for the development of a thriving space economy and the development and establishment of human space settlements (The Space, 2019).

Commercial space tourism

Today, as we examine this issue, we realize that many risks are hidden. These include technological risks, liability, and security issues. At present, the topic of rescue and security is not new, because there are treaties and agreements concerning it. For example, Article V of the 1967 Rescue (RES 2345 (XXII), 1967) addresses near exclusively "the return of astronauts and space objects," the "assistance to astronauts" and the "obligation to inform other states and the U.N. Secretary-General of any phenomena liable to constitute a danger to the life or health of astronauts" (H.R.4752, 2016). Interestingly, the cosmonauts should assist other astronauts, but there is no such obligation on the partner countries. At present, the law on the rescue of space flight participants is insufficient, since in recent years the rules have been prescribed only for astronauts. Existing general humanitarian obligations to assist people in distress would prevail. Regardless, it would be beneficial for the international community to clarify the status of "space-flight participants" and the applicability of the Rescue Agreement, which would then lead to the clarification of provisions and the subsequent elimination of conflicting laws and practices (Forganni, 2017). Among the most significant challenges facing the international community in the coming years are the commercialization of space and the ever-increasing amount of space debris. Other issues, such as ownership of space objects,

[2] The Alliance for Space Development (ASD) is a group of 15 non-profit member organizations working together toward the goals of space development and settlement. Its members include The National Space Society, The Space Frontier Foundation, The Lifeboat Foundation, The Mars Foundation, The Mars Society, The Moon Society, The Space Development Foundation, The Space Development Steering Committee, Space for Humanity, Space Renaissance USA, the Space Tourism Society, Students for the Exploration and Development of Space (SEDS), Tea Party in Space, and the Waypaver Foundation

space resources, will become more important with the development of space technology and their various uses.

Conclusion

Today's space law is a young branch of international law, a new and dynamic sphere of application of international legal norms. This branch needs further development, given the rapid and unrestrained dynamics of space science, the latest space technologies, satellites, the widespread use of mobile communications and the Internet. As a result of careful scientific analysis of trends and problems in outer space, we can predict that the commercialization of the economy will inevitably become imminent shortly. Concerning new activity, it should be noted that the area of asteroid production is quite enjoyable now.

Therefore, the emergence of complex legal issues for international communities, space companies, and legislatures is inevitable. Expected events are that private entrepreneurs and businesses will be active actors and will increase their stake in space operations in collaboration with government agencies. Therefore, the future of space business and international space law must find a balance between adhering to the basic principles of space law and supporting the private economic sector.

It is entirely foreseeable that as the number of people in outer space increases as a result of the expansion of outer space activities, the law governing human activity in this environment becomes more and more relevant. We should also note that it becomes necessary today to harmonize legislation governing legal relationships in outer space because every day, more and more questions appear that require proper and adequate regulation.

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The Cooperation between China and Ukraine in Space Exploration: Genesis and Development[1]

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Mainly, the studies of China-Ukraine relations have focused on topics such as trade agreements, commodity exports, investment, migration, and geopolitical implications for the post-Cold War world order. The issue of space cooperation has been almost completely absent in the studies of China-Ukraine cooperation, despite the central importance of space technology for many spheres of life, which have stimulated research and political participation since the beginning of the millennium. Bilateral cooperation on space exploration between China and Ukraine began in 1992 and has already celebrated its twentieth anniversary. This cooperation is an important determinant of what is considered "new" or "modern" geography of China-Ukraine cooperation. In this article, the study of collections, legal documents, and interviews enables to analyze the strategies of cooperation between China and Ukraine in space briefly.

Keywords: bilateral relations, space programs, White Paper, space exploration, cooperation, law.

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Introduction

Outer space is a common property of all mankind, and all countries of the world have an equal right to freely explore, develop and use outer space and its celestial bodies, moreover, in all countries of the world the outer space activity should promote economic development and society of all countries. Progress should promote the security, survival, and development of humanity and promote the friendly cooperation of the peoples of all countries.

Primarily, the history of space exploration is associated with the history of the "space race" of the 50s of the last century and its two main leaders — the United States and the USSR. The technologies invented in these countries have been further developed in other countries. They were the first and active participants in the exploration of outer space, as well as countries successful in their missions.

Most people will not directly associate China and Ukraine with the start of the aerospace industry, although some parallels exist. For example, discoveries made by the Chinese during the Song Dynasty in the 1200s, that is, the invention of an early form of a rocket using gunpowder,[2] can be directly associated with the history of space exploration.

With regard to Ukraine, scientists have always been and are its main asset. The vast majority of leading rocket engineers of the Soviet era either came from Ukraine or worked in Ukraine. It was thanks to them: Sergei Korolev, Valentin Glushko, Mikhail Yangel, Vladimir Chelomey, that the majority of launch vehicles were created, both for the military and peaceful space. The first satellite and the first man were launched into outer space, and the orbital stations reached Moon, Venus, Mars, etc. (Zhuravlov & Halunko, 2019). In Ukraine, about 30% of the industrial, scientific, and human resources of the former Union are located, as well as world-known PA Yuzhmash, Yuzhnoye State Design Office, PJSC HARTRON, SE IA Kievpribor and other collectives. Ukraine possesses the whole process of space technology construction, from design to production and operation in space. Over 25 years of independence, more than 140 launches of domestic missiles have been carried out, 375 spacecraft, made to order from 25 countries, have been launched into orbit (Kuznetsov, 2018).

The current economic situation of Ukraine is characterized as deeply critical. But this is not a reason to forget about the space industry, which will enable us to bring the country out of crisis. After all, the industry is connected with nearly every human activity on Earth: agriculture, medicine, communication, television, remote sensing of the earth, weather forecasting, magnetic disturbances (space weather), and more.

Many countries recognize modern China as an economic superpower, with the largest economy in the world. Moreover, China's space technology comes first. Thus, cooperation with China in the aerospace industry becomes very attractive.

China is also interested in cooperation with other countries in the field of aerospace industry to achieve its own national goals. For example, to access the resources and technologies of other countries.

[2] The word "rocket" first appeared in "Wei Lue", quoted by Pei Songzhi in The Three Kingdoms and the Period of Emperor Wei Ming. In the second year Wei Taihe (228 years), Zhuge Liang from the Kingdom of Shu, sent troops to attack Chen Tsang. Wei Shaw made Hao Zhao "shoot down a ladder from a rocket". According to the "Song Story". three years after Kaibao (970), Feng Jisheng introduced how to make rockets before the government of the Song Dynasty. "Wu Jing Sui Yao" formally listed the shape of the rocket, with drawings, this is the first rocket drawing in the world. https://zh.wikipedia.org/zh-hant/火箭

In 2007, Li Xueong, vice-minister of science and technology, said that China hopes to become the 17th country to join the International Space Station (ISS) (Xiaofang, 2011). In 2012, during a meeting of agency leaders in Quebec, Vladimir Popovkin, the head of the Russian Space Agency Roscosmos, and Jean-Jacques Dordain, the head of the ESA, announced that they were open for cooperation with China in the framework of the ISS (Ebeling, 2016: 9). However, the US did not give its consent to China's participation in the ISS (An Act, 2011).

Since Russia is skeptical about providing China with military technology because of the high probability of copying, to receive them from Ukraine gives the PRC two advantages: first, China will receive technology, and second, it will strengthen its position in a country that Russia considers its sphere of influence. In addition, China plans to implement its global strategy to increase exports and investment in potential markets located between Russia and the EU (Goncharuk et al., 2016).

While the United States is very reluctant to cooperate with China in the field of aerospace technology, the EU and Ukraine become increasingly attractive and sustainable partners for China. Since China seeks to strengthen its position in Europe and Ukraine seeks to expand its presence in Central Asia, both countries are among the States with space status, both countries are of interest to each other in the field of building bilateral relations in the space sector.

Similar to China, Ukraine is considered an agricultural country. However, the American physicist, Dr. Michio Kaku, argues that nations that believe only in agriculture are doomed to poverty (Kaku, 2019)**.** Therefore, both countries actively develop science and innovative technologies in all sectors of the economy.

In China, a specific shortage of specialists and technologies in the field of metalworking, mechanical engineering, as well as in aviation and space industries exist. Ukraine has a powerful scientific and industrial base, a sufficient number of specialists, and a high level of education.

Regarding the policies of both countries towards each other, China supported Ukraine not only in territorial integrity but was one of the countries that provided nuclear security guarantees to Ukraine in 1994. The Joint Declaration, signed by the two presidents, clearly stated that China recognizes consistently Ukraine's sovereignty and territorial integrity, as well as it is committed to ensuring its earlier security guarantees. For its part, Ukraine supports the "One-China" concept, that is, opposes Taiwan's independence by pledging not to have any official contacts with this Chinese province, as stipulated in the Joint Statement between the People's Republic of China and Ukraine signed on September 2, 2010 (China, 2010). This position on the part of the Ukrainian government will further support Ukraine's international arena and bring the two countries closer in geopolitical terms.

With the beginning of the Revolution of Dignity, these relations were put on hold. China's leadership did not support Yanukovych's approach to the resolution of the political crisis. When the State Duma of the Russian Federation issued permission on 1 March 2014 to use its own troops against Ukraine, China took a clear position as soon as on 2 March in support of Ukraine's independence, sovereignty and territorial integrity, and urged the sides to use dialogue and negotiations based on international law and international relations for peace and stability in the region. However, the Chinese representative expressed the opinion that there were certain causes of events in Ukraine. This approach enabled to interpret China's official position very widely and differently (Goncharuk et al., 2016: 37). Somewhat later, Qin Gang, a spokesman of China's Ministry of Foreign Affairs, clarified his country's position: "China always advocates respect for the sovereignty and territorial integrity of any country.

China always sticks to this main course of foreign policy. The Chinese side believes that the Ukrainian crisis has complicated historical background and is caused by modern realities. All this must be analyzed and taken into account when resolving the crisis"(China, 2014).

As the revolution events unfolded, China urged the parties in Kyiv to resolve conflicts based on the law and legitimate interests of the Ukrainian people. Unlike Moscow, which forced Yanukovych to take more active and tough actions to curb the protests, China strongly condemned acts of violence (Foreign, 2014).

Thus, the historical prerequisites for the establishment of China-Ukraine bilateral relations are:

a) the similarity of both countries' positions on the key problems of contemporary political development (to reduce the influence of Russia and the US, to be full members of the Space Club and to participate in joint international projects, etc.);
b) the absence of acute problems in bilateral relations;
c) the desire to integrate into the world economic community through the development of an innovative economy, in particular, space industry;
d) the possibility of sharing resources, while for Ukraine, China's investment resources are of interest. For China, the scientific resources of Ukraine are relevant.

Each state aims to improve life, create new conditions for the society that would be positive changes on the basis of economic, political, and social principles of development. Therefore, the strategic plan of the future is extremely important, taking into account the globalization processes of today. Consequently, it is essential to consider ways of productive development of cooperation between these countries.

Therefore, the study aims to analyze the legal framework for cooperation between China and Ukraine in the space sector by comparing space programs and State policies to find motives or possible obstacles to China-Ukraine participation.

Space programs of China and Ukraine

International and national politics play an important role in the space sector. Developed on the basis of international principles, national space programs will not only determine the policies of each State in space exploration, but also determine the rules of the game for partnerships.

China

China's rapid economic development has been mostly driven by cheap labor and resources. After entering the next stage, China has developed a new development strategy based on innovation. Today, China is pursuing an innovative development strategy aimed at deepening the reform of the scientific and technological system, stimulating technological and economic integration, building a technological innovation system combining production, science, and research, and based on market-oriented entrepreneurship. China strives to improve knowledge of the innovation system and increase the research level.

At the opening ceremony of China's First International Import Expo, President of the People's Republic of China Xi Jinping stated that economic globalization was an irreversible historical trend that had given a strong impetus to the development of the world economy

(Speech, 2019). Considering that the topic of the event was "New Epoch, Joint Future," it is not surprising that the key points of the speech of the Chinese helmsman were as follows:

a) open cooperation is an important driving force in strengthening the international economy and trade;
b) innovations, in other words, only those who are brave enough to implement changes and transformations will be able to make a breakthrough in the development of the global economy;
c) inclusivity and universal preferences, promotion of joint development of all countries in the world.

Therefore, the Chinese leadership has defined the socio-economic policies of the country for many years, putting at its core a triad: openness-innovation-inclusivity.

The history of China's space programs can be viewed in the context of four significant periods: 1) 1956-66; 2) 1966-76; 3) 1977-86; 4) 1986 - present time (Chen, 2016).

In turn, the fourth period may be divided into subperiods: a) 1986-2000; b) 2000-2011; c) 2011-2016; d) 2016-2021.

Not all the periods of development of China's space programs will be analyzed in detail. Still, the period from 2016 to the present will be under focus, i.e., since the adoption of China's last policy document White Paper (White Paper, 2016), published on December 27, 2016, which determined the country's policy for the next five years in the field of space activities[3].

It should be noted that the White Papers on China's Space Activities are not just a set of texts with generalizations and planning measures for space activities. This is the scientific and practical matter of building a new China, as a leading spacefaring nation, which considers space as an essential tool for realizing the dream of the Chinese society, as an independent world leader in science and technology (Yeshchuk & Vasina, 2019: 141).

In the socio-economic development of the country, Chinese leadership focuses on science. Science and innovation should be a driving force for China's development. In this regard, the Government of the country provides comprehensive support for science and innovation development. In February 2006, the State Council of the PRC published An Outline of the National Medium- and Long-Term Program for the Development of Science and Technology (2006-2020). The Program includes 15 important objectives that are scheduled to be completed over 15 years. They concern some strategically important and relevant fields, such as informatics, bionics, energy, ecology, healthcare, etc.

Moreover, plans involve building large-scale aircraft for civilian aviation, launching human-crewed space shuttles, and exploring the moon. According to this program, by 2020, funding of research and development will increase from 1.33% of GDP up to 2.5%. The share of GDP created by scientific and technological progress will exceed 60% of the country's GDP (Ukraine — China, 2018).

China develops legal regulations in the field of international cooperation in space, first and foremost, according to the provisions and principles approved by the United Nations (International Declaration on Space Cooperation) (A/RES/51/122, 1997). China advocates strengthening international exchanges and cooperation in the space sector according to the principles of equality, mutual benefit, peaceful use, and joint development.

[3] In China, the exploration and use of outer space is carried out in accordance with the so-called White Papers on Space Activities, which are regularly (every five years) adopted by the State Council of China in 2000, 2006, 2011 and 2016

To implement plans adopted, since 2018 the Chinese government took a number of important measures, including reducing the burden on enterprises, reducing tax benefits, reducing budget expenses, reducing administrative permits and providing enterprises with a "single service" to help reduce the costs of the corporate system to make administration as desirable as possible for business and minimize corruption mechanisms.

The space sector is no exception; that is, China continues to increase its investment and encourage the creation of a diversified and multi-channel system to maintain sustainable development of the space industry. With China's 2011 Space White Paper, the Chinese government has started active commercialization of space activities (White Paper, 2011).

With the initial creation and continuous improvement of the socialist system and market economy, with the development of space activities in China, the role of the State was fundamental. According to the first White Paper (2000), the State-controlled space activities through macro control (White Paper, 2000), through coordinated development of space technologies, space science, and promoted research, as well as the development of basic technologies, in the space industry.

Moreover, the State assumed the responsibility for the legal support of space activities: to strengthen the legal system; to construct and manage policies; to create the order of aerospace law; to regulate, to formulate technological policy in the aerospace industry; to guarantee an orderly and standardized development of aerospace activities.

However, in contrast to Ukraine, where space activities are regulated by the Basic Law of Ukraine "On Space Activities" (On space, 1995), in China, by-laws carry out such regulation. The necessity of adopting the law was discussed at the National Meetings of China and in the scientific community (Xiaodan, 2018; Zhenjun, 2014), but it was not adopted. In this regard, Prof. Zhang Zhenjun argues that "…the current regulation on space activities falls short of the rule of law, as showcased by an insufficient supply of legal institutions, inadequate awareness of the rule of law, and space regulatory frameworks that require further reform. Top-level planning, enhanced space legislation, and a combination of promoting the rule of law in China's space industry and deepening reform on space regulatory frameworks are needed to start a new age of China's space industry under the rule of law" (Zhenjun, 2014).

China should be pragmatic regarding space legislation in terms of commercialization of space, and the most important legal issues should be regulated in law, that is, establish a mechanism for protecting intellectual property, mechanisms for export control, and dispute resolution (Long, 2016).

Moreover, in 2020, a Chinese private company is about to launch a reusable spacecraft for the first flight. Its most giant version will be able to lift 20 people to a height of 130 km and provide them with four minutes of weightlessness. Logically, it is precisely in this field of space services; legal challenges occur more frequently than financial ones. For example, the legal status of space tourists and members of space taxi crew requires regulation. Their subjective rights and legal obligations should be clearly stated. The legal responsibility of each member of the space mission should be determined (Yeshchuk & Vasina, 2019: 142).

Although Chinese and Ukrainian space programs are structured differently, they have much in common.

Ukraine

Space activities in Ukraine are governed by the National Space Program of Ukraine, developed for five years, and approved by the Verkhovna Rada of Ukraine upon submission by the Cabinet of Ministers of Ukraine. The State Space Agency of Ukraine, together with the central executive bodies and the National Academy of Sciences of Ukraine, is responsible for the development of the National Space Program of Ukraine, based on the purpose and basic principles of space activity of Ukraine (Soroka, 2019). Since 1992, five Space Programs have been adopted and implemented in Ukraine.

The sixth one has never been adopted. To date, only the Concept of National Targeted Scientific and Technical Space Programme 2018-2022 has been approved by the Resolution of the Cabinet of Ministers no. 629-r of September 5, 2018. It aims to "... increase the efficiency of the use of space potential for solving urgent tasks of socio-economic, environmental, cultural, information, scientific and educational development of society, to ensure the realization of the State's interests in the field of defense and national security" (On approval, 2018). According to the Government of Ukraine, this mission should be implemented by expanding cooperation, first of all with the EU, by increasing the number of new specialists in educational institutions and retaining old staff (by raising salaries), by allowing the private sector to participate in space activities.

Moreover, to increase the efficiency of space activities, to solve urgent problems of national security and defense, and to realize the geopolitical interests of the State, to promote the socio-economic, scientific, educational and ecological-cultural development of society, to increase the prestige of Ukraine as a space State on the world stage, to turn the space industry of Ukraine into a multiplier of high-tech development of the domestic economy, the Conception of implementation of the state policy in the field of space activities for the period up to 2032 was approved by order of the Cabinet of Ministers of Ukraine of March 30, № 238-R (Conception, 2011) (hereinafter the Conception).

The result of its implementation, that is, the quantitative measurement of its goals, is decisive for public policy. According to this Conception, the state has declared its results, methods, and ways of achieving these results. The primary way to solve the existing problems of the space industry of Ukraine is seen through the improvement of the mechanism of providing state support and ensuring the investment attractiveness of space activities. Analyzing the components of the organization of space activities in Ukraine, it can be noted that the state has taken the lion's share in ensuring the development of the industry through two interrelated processes — state support and investment attractiveness of space activities, which are noted in the regulatory acts (Soroka, 2019).

Therefore, the rules and principles of "classical" International Space Law have been implemented sufficiently enough in the national law of Ukraine to be content with international obligations. Nevertheless, as we have repeatedly stated in our publications (Soroka, 2019), current studies and practice indicate that the main tasks facing Ukraine's space law are:

a) strengthening the legal protection of investors in Ukraine;
b) initiation of tax and other incentives for forming long-term investment resource proposals;
c) demonopolization of the state for space activities;
d) reducing the involvement of regulatory authorities in economic activity; substantial simplification of procedures for issuing permits;

e) return of State controlling functions over the space activities of all entities through a mechanism for licensing such activities;
f) proper regulation of ownership of investment assets and transparent integration of such assets.

Joint projects implemented by Ukrainian and Chinese specialists are in the fields of high technology, new materials, environmental protection, and drug production. Cooperation with the PRC in the space industry is particularly beneficial for Ukraine as it enables the conscious realization of the Ukrainian space potential. In Ukraine, funds are limited in this area. Instead, China is one of the leading investors in space exploration. Nowadays, Ukraine executes 21 contracts with China totaling more than USD 67 million, implements its 5-year space industry development programs, and has the concept of space activities by 2032. For its part, China has a space program very ambitious and sufficiently funded. China is interested in importing high-tech finished goods, and Ukraine should take this into account and use it in the interests of national production (Goncharuk et al., 2016).

Therefore, the policies of both countries in space have both commonalities and differences. The common features are:

a) Outer space is a common property of all mankind, all countries of the world have an equal right to freely explore, develop, use outer space and its celestial bodies;
b) Outer space activities in all countries of the world should promote their economic development;
c) The key role of the State is in the organization, regulation, control and legal support of space activities;
d) Commercial private enterprises have equal access to space activities along with state-owned ones, subject to compliance with requirements for such activities;
e) Progress in space shall ensure security, sustainability, and cooperation.

The differences are:

a) While in Ukraine, laws and by-laws regulate space activities, in China, only regulations govern them;
b) While China's space programs are funded in full, in Ukraine, they are financed with a constant deficit;
c) While in China, the government of the country considers the development of space as one of the priority areas both de jure and de facto, in Ukraine, de jure — yes, de facto — no.

Legal framework for China-Ukraine bilateral cooperation in space

Cooperation in science and technology is one of the main areas of bilateral relations between China and Ukraine. The priority areas of participation in the field of scientific and technical cooperation are energy efficiency, aviation, shipbuilding, environmental management, development of aerospace, information and communication technologies, training, and internship of graduate students and young scientists.

The legal framework for cooperation in space are legal regulations, such as the Agreement between the Government of Ukraine and the PRC Government on cooperation in the field of exploration and use of outer space for peaceful purposes (20 may 1996), the Memorandum

of Understanding between the State Aviation Administration of Ukraine and the Directorate General of Civil Aviation of the PRC (25.06.1999), the Protocol between the Ministry of Industrial Policy of Ukraine and Chinese Commission for Defence Science, Engineering and Defence Industry on cooperation in the aeronautical engineering (18 November 2002), the Program of Ukrainian-Chinese Cooperation on exploration and use of outer space for peaceful purposes for 2011-2015 (02 September 2010), the Agreement on strategic cooperation between the Joint-Stock Company "Motor Sich", State Enterprise "Ivchenko-Progress" and the Chinese Aviation Corporation "AVIC International Holding Corporation" (04 December 2013 p.), the Protocol of the Third meeting of the Subcommission in the field of exploration and use of outer space for peaceful purposes of the Commission for cooperation between the Government of Ukraine and the Government of the PRC (07 April 2016 p.), the Protocol of the Fourth meeting of the Subcommission in the field of outer space of the Commission for cooperation (for 2016-2020) between the Government of Ukraine and the Government of the PRC (21 November 2017 p.).

Mainly, the Subcommission on Space Cooperation, created to replace the Ukrainian-Chinese Subcommission in the field of exploration and use of outer space for peaceful purposes, which existed from 1997 to 2010, is in charge of bilateral space relations. During this period, two joint five-year cooperation plans (for 2001-2005 and 2006-2010) were implemented, as well as the Space Cooperation Plan for 2011-2015 was adopted.

At the beginning of November 2018, the Fifth Meeting of the Subcommission on Space Cooperation took place in Beijing. The parties reviewed the status of implementation of the Program of Ukrainian-Chinese Cooperation and approved its new version. The updated version of the Program contains more than 80 active points and a list of long-term perspectives for cooperation: joint activities to prevent natural disasters, plans against space debris, and space exploration.

Critical outcomes of bilateral China-Ukraine relations in space

China and Ukraine do not provide complete open official information on aircraft and missile science, which complicates the analysis, including the analysis of trends and opportunities for further cooperation between China and Ukraine. However, available open sources enable to summarize some of the outcomes.

In the space segment of bilateral cooperation, the developments should be highlighted as follows (Badrak, et al., 2009: 63):

a) the exchange of information on the technical parameters of the Chinese Environment-1B project and the Ukrainian Sich-2 project to establish mutually beneficial cooperation in the field of space data exchange;
b) delivery to China of a laboratory facility (including the transfer of production technology) for manufacturing non-plasma engines for spacecraft;
c) closeness and interchangeability of the Ukrainian UNOSAT project and the Chinese seismic electromagnetic satellite project give the possibility of establishing mutually beneficial cooperation on these projects.

According to the Agreement between Ukraine and China, Kharkiv Military University has started training Chinese air defense specialists (Training Aviation Command began operating in the military town "Rogan-1" near Kharkiv). It is possible that in the future Ukraine will

begin to train cadets-pilots from the PRC, as well as provide medical support for the training of astronauts, which is especially important for the implementation of the Chinese Space Program "Project 921" (Joint Project, 2018).

To date, Ukraine's position in the space sector is the strongest in the launch services market. While China is interested in developing its satellite navigation system, Ukraine is interested in acquiring microelectronics technology and investing. Therefore, constant and promising cooperation between the PRC and Ukraine can be established and stabilized in these sectors. However, nowadays, Ukraine should be more actively involved in projects within the framework of cooperation with China on legal, clearly stipulated contractual bases with the maximum contract validity to enhance its capabilities in this sector and gain competitive advantages in international markets.

Promising forms of scientific and technical cooperation, such as the creation of technoparks, incubators, engineering and technology transfer, etc., are being implemented between China and Ukraine.

Moreover, in the People's Republic of China, the first industrial zones were established back in 1980. Currently, there are 54 technoparks in the country that provide about 10% of GDP and accumulate 30% of FDI. In Ukraine, 12 industrial parks are registered, and only a few of them are under construction. The rest is not functioning (Natalushka, 2017).

The creation of technoparks will provide potential foreign investors with new opportunities for preferential taxation, as it has been done in Singapore. With such technoparks, the owner will be able to draw up all the necessary permits for Chinese investor companies, eliminating the need to run around the offices of officials.

Along with the positive points in bilateral relations between China and Ukraine, factors that hinder the development of interstate partnerships remain and need to be addressed. First, these are a narrow foreign policy orientation of the Government of Ukraine to the countries of Europe and the USA, the inaction of the Ukrainian side in holding official meetings, visits to China with the participation of the first persons of the State, the absence of political continuity (every time after a change of power, a new plan, a new strategy of development occur) and the presence of corrupt schemes in legal regulation (Natalushka, 2017). Second, insufficient explanatory work on the meaning and ultimate purpose of socio-political transformation in Ukraine (for example, the Chinese will understand de-sovietization as a rejection of the negative heritage of the USSR and will not understand decommunization, because communism remains the official ideology of the PRC) (Goncharuk et al., 2016: 38). Third, the difficulty of a Ukrainian visa for the PRC citizens remains a huge obstacle to establishing effective relations with China, and there are problems with guaranteeing the safety of Chinese living in Ukraine, their businesses, and property.

At the present stage, China and Ukraine have every opportunity to realize a considerable potential of bilateral cooperation in science, technology, and education, to be in close relation with the international scientific and technological community, and to participate in creating an innovative global society (Joint, 2018).

Conclusions

China's role in the world becomes more significant. Expanding political, economic, cultural, and other relations with this country is one of the critical areas of Ukraine's foreign policy. Before the declaration of independence in 1991, Ukraine, as part of the USSR, had

been building its relations with the People's Republic of China within the framework of the all-Union foreign policy doctrine. Only after the collapse of the USSR and the proclamation of its independence an independent policy became possible.

Ukraine and the PRC are known to have much in common. This concerns geopolitics, which broadly defines the role and place of Ukraine and the PRC not only in the Eurasian region but also in the broader, global geopolitical context. The countries have mutual economic interests and close positions on the key problems of contemporary world political development. Both states face similar internal socio-economic issues. In both countries, a transition to a market economy occurs, a desire for a policy of openness exists. Both countries are in the Eurasian region, are neighbors of Russia, and are in the interests of the United States of America.

The foreign policy of both countries is based on a realistic consideration of their national interests. Ukraine is an essential factor in European and world politics. It is respectful of the PRC's growing role in contemporary international relations. Ukraine and the PRC have been productively and consistently working and coordinating their policies at the UN and other international organizations.

According to Meng Hin, despite a great interest of politicians and the public regarding the issue of China-Ukraine cooperation in the 1990s of the twentieth century, it remains studied incompetently. However, for the first time in the history of the two countries, their relations have begun to develop on a broad legal basis (Meng, 2005). This requires an in-depth study of the various strands of relations between Ukraine and the PRC. The study of this issue will enable us to understand the main trends in the development of relations between the States and to offer recommendations on the implementation of comprehensive cooperation.

Therefore, considering the benefits of scientific and technical cooperation, and existing areas of cooperation, the authors propose the following strategic approaches to expanding science and technology-based relationships, which form an overall strategy for long-term cooperation in space that could, in the long run, bring China and Ukraine to a new level of development, increase their competitiveness in the world markets: joint research and development; exchange of scientific and technical information and documentation, samples of products and materials, as well as the exchange of know-how and licenses on a compensatory basis; organization of scientific-technical seminars, symposia and scientific conferences, etc. Besides, the successful commercialization of space exploration products requires to develop and adopt regulatory acts promptly to create the necessary legal platform to realize the prospects for both China and Ukraine.

In conclusion, some truths are eternal. Ancient Chinese philosopher Confucius said: "Those who do not care about their future will be in trouble soon." If Ukraine had perceived the recommendation of its first president, "science can wait" as a ridiculous joke. Our current "famine of science" might not have occurred, or, as our Western colleagues say, "innocide" instead of innovation (Driga, 2017: 61).

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Corruption Factor as a Destabilizing Element of Development of the Space Industry

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This work is devoted to the analysis of the phenomenon of corruption, its impact on the development of the space industry, because under the condition of the rapid development of new space technologies, building a new model of the space economy and generally rethinking the prospects of the space industry by the world, the exploration of its unknown spaces — this question is extremely relevant. In a global sense, corruption as a transnational socio-legal phenomenon is, firstly, a type of behavior of persons with a special status (particularly in the sphere of making individual decisions that have legal consequences), in which the interests of such a person occupy a privileged position over public or state ones; secondly, it is a reviled ideology of society that allows, contrary to the law, to commit, allow or encourage unethical and illegal behavior of authorized persons. In a general sense, it is a comprehensive phenomenon that includes manifestations of any abuse of a special status on the one hand, and on the other — inducement and active actions before their implementation by other interested persons. In other words, it is a two-way relationship, a symbiosis of needs and benefits. It is proved that corruption in the space industry is manifested by the aggregate indicator of its existence in the state, in its main sectors. The space industry is hindered in its development precisely because funds that should potentially be used for research and development of outer space are not being used for their intended purpose. Accordingly, there is no innovation activity, and technological progress is minimal. Therefore, the priority is to eliminate corruption both in the world and in individual countries, because it, like a viral infection, tends to migrate, threatening the entire humanity.

Keywords: eradication of corruption, destabilization, corruption, space sphere, outer space, world cooperation.

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Introduction

There is no need to prove the thesis that corruption is a negative phenomenon that massively permeates all spheres of both public and state sectors, not just in two, but in a significant number of states around the world.

The modern existence of the analyzed phenomenon is historically conditioned and quite natural. For millennia, corrupt practices have been either encouraged or prohibited. It is clear that this was done in various ways, by various authorized entities and using the tools that met the needs of the time. However, it should be understood that corruption is, first of all, a conscious choice of everyone, regardless of the active or passive nature.

The international community has long defined corruption as a mass phenomenon, a global disease that gradually poisons key areas of national and global economic development. The space industry is no exception, because space has always been a source of inspiration for researchers and scientists, who, by the way, have significantly expanded the scientific knowledge of mankind about it, which in the future has greatly improved our daily lives (The future, 2019).

Commercial interest in space technologies of private business entities encourages them to search for forms of cooperation with state institutions that have a powerful administrative resource and technological heritage of the era of "military space races." At the same time, the state is also interested in attracting material, financial, intellectual, and other types of private investment for the quality upgrade of its production and service capacities (Malysheva & Hurova, 2019: 73). This situation is now the starting point for the exploration and use of outer space within the framework of a public-private partnership, the ways of deployment of which significantly depend on national policies, legal regulators, and the economic background created by the state. But public-private collaboration in the field of space activities has positive aspects as well as negative ones. In this case, we are talking about the existence of manifestations of corruption in the state sector in general, and in the space industry in particular.

So, in the conditions of the rapid development of new space technologies, building a new model of the space economy and generally rethinking by the world the prospects for the space industry, the development of its unknown spaces, it is extremely important to investigate whether corruption affects the development of the space industry.

Definition of the term "corruption" in international legal acts

For a careful consideration of the issue raised, we consider it necessary to investigate how the term "corruption" is defined in international legal acts, since knowledge of the essential characteristics of the subject gives an almost exhaustive idea of its essence. The technical perfection of the adopted actions depends on how well the rule-makers apply the means of legislative technique and especially definitions in their activities (Tkalya & Pravova, 2011: 65), and, as a result, how the visible phenomenon realizes itself in reality, its essence is demonstrated. There is a separation from other objects (Khvorostyankina, 2020).

In the Model Law "On the basis of legislation on anti-corruption policy" of 15.11.2003, corruption is bribery (receiving or giving a bribe), any illegal use by a person of their public status, involving the receipt of benefits (property, services or benefits and/or advantages, including non-property) for themselves and their relatives contrary to the legitimate interests of society and the state, or illegal provision of such benefits to a specified person (Model law, 2003).

It should be clarified that persons with public status are persons who permanently, temporarily or by exclusive authority perform staff or official duties in state and local government bodies, state and municipal institutions, as well as persons who perform managerial functions in state and municipal enterprises or in non-profit (including foreign and international) organizations that are not state bodies, local government bodies or their institutions (Model law, 2003).

In "Practical measures to combat corruption," this phenomenon is defined as "violation of ethical (moral), disciplinary, administrative, criminal nature, manifested in the illegal use of their official position by the subject of corruption" (Practical, 1991). We should add that the Reference document on the international fight against corruption interprets the concept of corruption as "abuse of state power for personal gain" (Zadorozhniy, 2016: 50).

In turn, the Civil Convention against corruption contains a specific purpose definition of this term, which means direct or indirect extortion, offering, giving or receiving a bribe or any other improper benefit or opportunity to obtain it, which violate the proper performance of any obligation by the person who receives the bribe, improper benefit or opportunity to have such a benefit, or the conduct of such person (Civil Convention, 2003).

So, in a global sense, corruption as a transnational socio-legal phenomenon is, firstly, a type of behavior of persons with a special status (in particular, in the sphere of making certain decisions that have legal consequences), in which the interests of such a person occupy a privileged position over public or state ones; secondly, it is a reviled ideology of society that allows, contrary to the norms of the law, to commit, allow or encourage unethical and illegal behavior of authorized persons.

In a general sense, it is a widespread phenomenon that includes manifestations of any abuse of special status on the one hand, and on the other — inducement and active actions before their implementation by other interested persons. In other words, it is a two-way relationship, a symbiosis of needs and benefits. The highest corruption manifestation is bribery, which in any case, should be criminally punishable with abuse of influence, laundering of proceeds from crimes related to corruption and financial fraud.

It is worth noting that the variety of definitions of corruption indicates the complexity and versatility of this phenomenon, so the descriptions of this concept, are in constant development (Trepak, 2015: 196).

International retrospective of the development of standards to combat corruption

As it has already become clear from the previous provisions, there are now a number of fundamental international acts — specialized and side ones — related to certain aspects of international legal regulation of the fight against corruption in the world. The initiators of their adoption (union recognition of the problem and the same, cooperative opposition to it by a group of states of the world) are the UN bodies, the EU, the CIS — that is, global and regional international organizations, as well as international organizations created under their auspices.

We will try to analyze the international anti-corruption standards in a retrospective aspect.

Let's start with the fact that in the international arena, active disapproval of all kinds of corruption, including bribery, began in the second half of the twentieth century. One of the first documents in this area is UN General Assembly Resolution 3514 (XXX), adopted on December 15, 1975, "Measures against corruption practiced by transnational and other corporations, their intermediaries and other parties involved" (Measures, 1975). This document calls on all governments to take all necessary measures at the national level to prevent and combat corruption, as they deem appropriate, including legislation (Klimova & Kovalova, 2015: 20-21). This need was due to the transition to a new international economic order, where the activities of transnational corporations were closely monitored (Measures, 1975).

This document proposed the introduction of a national system for monitoring the activities of corporations, as well as the collection, processing, and interstate exchange of information on the state of corruption in countries. The UN Center for transnational corporations was defined as the analytical center for such information (Measures, 1975).

On 24 May 1989, the United Nations Economic and Social Council proposed the eighth United Nations Congress on the prevention of crime and the treatment of offenders and its preparatory meetings to explore ways and means to promote compliance with the Guidelines for the effective implementation of the Code of conduct for law enforcement officials. It was proposed to apply the provisions of this act to all law enforcement officials, regardless of their departmental affiliation, with the mandatory development of specialized national codes (A/CONF.144/28/Rev.1, 1990), which initiated norms of required behavior of such persons.

Moreover, the international code of conduct for public officials as an international UN document was adopted on July 23, 1996, and declared a fundamental rule — a public position is a position of trust, which provides for the obligation to act in the interests of the state. Such persons must be attentive, fair, and impartial in the performance of their functions and, in particular, in their relations with the public. They will never give any undue preference to any group of persons or individuals, discriminate against any group of persons or individuals, or otherwise abuse the powers and authority granted to them (International Code, 1996).

In 1990, the Eighth UN Congress in the resolution "Corruption in public administration" (Resolution A/CONF. 144/28/Rev.1, 1990) noted that the problems of corruption in public administration are universal and their harmful impact is felt throughout the world. The international community is agitated by transnational corruption and proposes to add criminal liability for bribery abroad to national legislation (Vanovskaya, 2018: 9).

At the same time, "Practical measures to combat corruption" have been adopted. The document identified the most important tasks for overcoming corruption. Accordingly, governments should: review the adequacy of their criminal legislation, including procedural rules, in order to respond to all types of corruption; develop administrative and regulatory mechanisms to prevent corruption; establish procedures for identifying, investigating and convicting corrupt officials; and develop legal provisions for the confiscation of funds and property acquired as a result of corruption; take appropriate measures against enterprises involved in corruption (A/CONF.144/28/Rev.1, 1990). Separately, the Committee of Ministers of the Council of Europe adopted the Programme of action against corruption in November 1996, and the United Nations Declaration on combating corruption and bribery in international commercial transactions was solemnly proclaimed by the General Assembly on 16 December of the same year.

This international document, in order to promote economic and social development, protect the environment, promote social responsibility of private and public corporations, and combat and prevent corruption and bribery in all countries (A/RES/51/191, 1997), contains the necessary conditions for achieving them. There are 12 such conditions, in particular, for example, the necessary ones are considered:

1) ensure the effective application of existing laws and promote the adoption of laws for this purpose where they do not exist;

2) recognize the giving of bribes to foreign public officials as a criminal offense, the objective side of which is such actions as:

a) the offer, promise or transfer of any payment, gift or another benefit, directly or indirectly, by any private or public corporation, including a transnational corporation, by an individual of a state, to any public official or elected representative of another country, as improper remuneration for the performance or refraining from performing the duties of that official or representative in connection with an international commercial transaction;

b) requiring, accepting or receiving, directly or indirectly, by any official or elected representative of a state, payments, gifts or other benefits in any private or public corporation, including a transnational corporation, or an individual from another country, as improper remuneration for the performance or refraining from performing the duties of that official or representative in connection with an international commercial transaction;

3) develop or apply standards and accounting methods to prevent and combat corruption, bribery and related illegal activities (A/RES/51/191, 1997), and others.

Within the framework of this act, an attempt was made to distinguish such terms as "corruption," "bribery," "unlawful gain," "illegal enrichment." However, the American Convention against corruption, adopted at the third plenary session on March 29, 1996, differs as a more precise one from the previous document (B-58, 1996). A United Nations framework Convention against organized crime of 21.07.1997 actually indicates that corruption is one of the three main means (the other two are violence and intimidation) that enable the leaders of organized crime to profit, control territories, foreign and domestic markets, continue their criminal activities and penetrate the legal economy (Zadorozhniy, 2016: 50).

Later, in November 1997 and May 1998, resolutions were adopted that led to the conclusion of a partial and expanded agreement on the establishment of the "Group of States against Corruption (GRECO)," which aims to expand the capabilities of its members in the fight against corruption by monitoring their compliance with their obligations in this area (Resolution (98) 7, 1998).

On May 5, 1998, the Charter of the group of states against corruption (GRECO) was adopted, the purpose of its activities is to improve the competence of its members in the fight against corruption in order to take action through a dynamic process of joint assessment of methods of conduct and equal influence in accordance with their obligations in this field. To achieve this, the Group monitors compliance with the anti-corruption Guidelines adopted by the Committee of Ministers of the Council of Europe on 6 November 1997 and the implementation of international legal instruments adopted in accordance with the Anti-corruption action program (Resolution (98) 7, 1998).

Noting the twenty principles of the fight against corruption, it should be clarified that the Committee of Ministers of the Council of Europe at its 101st session noted that the fight against corruption should be multidisciplinary and cooperative.

The relevant Resolution No. R (97) 24 defines 20 basic principles on how such activities should be implemented at the national level, in particular:

a) take effective measures to prevent corruption and, in this regard, raise public awareness and promote ethical behavior;
b) ensure that national and international corruption is criminally punishable act;
c) ensure that those responsible for preventing, investigating, prosecuting and adjudicating corruption cases are independent and autonomous;
d) provide appropriate measures for the confiscation and deprivation of income as a result of cases of corruption;
e) provide appropriate measures to prevent pressure on lawyers who are engaged in exposing corruption (Resolution (97) 24, 1997), and others.

GRECO monitors all its member states on an equal basis through mutual assessment processes and pressure from other member states. All states, without exception, participate in the evaluation and enforcement procedure. The monitoring process of the Group consists of: 1) a horizontal assessment (all states are evaluated during assessment rounds), which ends with recommendations on necessary legislative, institutional and practical reforms; 2) an implementation procedure, the purpose of which is to provide an assessment of the measures that states are taking to implement the recommendations (Zadorozhniy, 2016: 53).

Let us also consider the Criminal Convention against corruption (Criminal Convention, 1999) and the Civil Convention against corruption (Civil Convention, 2003), which were adopted by the Council of Europe in 1999.

Since the Programme of action against corruption encourages the coordinated recognition of corruption-related crimes as criminal, the strengthening of cooperation in the prosecution of persons suspected of committing such crimes, as well as the creation of an effective mechanism for further action on an equal basis, it has become necessary to conclude a criminal Convention as soon as possible (Criminal Convention, 1999).

Chapter II provides for measures to be taken at the national level, in particular, the establishment of criminal liability for: 1) the giving of bribes to national public officials or their receiving by individuals or by a member of a national representative body exercising legislative or executive powers; 2) bribery by an official of any other state or by a member of an elected body that performs legislative or executive functions in any other state; 3) giving a bribe in the private sector, that is, to a person who holds senior positions in private enterprises or works for them in any capacity, and vice versa — responsibility for its receipt by these persons; 4) abuse of influence, laundering of proceeds derived from crimes related to corruption, issuing an invoice or use of an account or any other accounting document or record containing false or incomplete information, illegal failure to make a payment record (Criminal Convention, 1999), and the like.

At the same time, cooperation, immunity, jurisdiction, and the need to impose liability of legal entities for these crimes are separately determined. The Group of States against corruption monitors the implementation of this Convention by the Parties (Criminal Convention, 1999).

Noting the Civil Convention on combating corruption, it should be clarified that the need for its adoption was due to the fact that civil legal means of obtaining compensation for damage caused as a result of corrupt actions were not directly enshrined in international documents.

The document contains several recommendations that are necessary for national adoption in order to protect individuals who are harmed as a result of corrupt practices. As in the previous document, the implementation of this Convention by the Parties is monitored by the Group of States against corruption (Civil Convention, 2003).

In view of all the above, many scientists consider the United Nations Convention against corruption of October 31, 2003, to be the first global document in the field under study, which is aimed at promoting and strengthening measures to prevent and combat corruption more effectively and efficiently (United Nations, 2003), since it laid the foundations of a universal system for fighting corruption. This Convention is considered to have a significant international impact, as it is supported by both international organizations and specialized agencies of the UN system, such as the World Bank, the International Monetary Fund, and the governments of most countries of the world (UNODC).

The Convention is based on two key principles: measures to prevent and combat corruption (Zinchuk, 2018). The Convention under review establishes obligations to criminalize certain acts, take preventive measures in the public and private sectors, establish international cooperation in investigation and law enforcement, take technical support measures, and also contains a provision on asset recovery (Petrashko, 2011: 90-91). Today, this document is a so-called basis for bringing the national legislation of each state party in line with generally recognized methods and measures to prevent and combat corruption (Zinchuk, 2018).

At the same time, in the EU, an important step in the fight against corruption was the publication by the European Commission of the Communique of 28.05.2003 on the comprehensive anti-corruption policy of the European Union. It defined the main principles of the fight against corruption in the EU, described the principles for improving anti-corruption in new member countries, candidate countries and third countries. In addition, the Council of the European Union issued a Framework decision "On combating corruption in the private sector" No. 568 of 22.07.2003, which defined the concept of "active" and "passive" corruption, and established sanctions for such crimes (Zinchuk, 2018).

Another platform for cooperation in preventing and combating corruption is the Organization for economic and social development (OECD) and, in particular, its Anti-corruption Network for Eastern Europe and Central Asia. As part of the work of the OECD in 2003, representatives of the governmental delegations of Armenia, Azerbaijan, Georgia, the Russian Federation, Tajikistan, and Ukraine approved the Istanbul action plan for fighting corruption of the OECD Anti-corruption Network for Eastern Europe and Central Asia. The main principles of the Istanbul action plan are the development of an effective and transparent public service system, strengthening the fight against bribery and ensuring integrity in business, and supporting active public participation in reforms (Klimova & Kovalova, 2015: 23).

These acts are only part of the overall array of international legal framework in the field of combating and preventing corruption. In addition to these, the Council of Europe Convention on laundering, search, seizure, and confiscation of the proceeds from crime and on the financing of terrorism of 16.05.2005 and the UN Economic and Social Council Resolution entitled the Bangalore principles of judicial conduct of 27 July 2006 No. 2006/23, Recommendation CM/Rec (2010) 12 of the Committee of Ministers of the Council of Europe to Member States on judges: independence, effectiveness, and responsibilities, adopted by the Committee of Ministers of the Council of Europe on 17 November 2010, Resolution No. 1943 (2013) of Parliamentary Assembly of the Council of Europe "Corruption as a threat to the rule of law," and many others are also of significant importance.

So, in the international arena, active condemnation of all types of corruption, including bribery, began in the second half of the twentieth century. At the beginning of the emergence of international legal mechanisms to combat corruption, its existence was recognized exclusively in the field of transnational business. Over time, the world begins to discuss corruption in public administration.

Influence of corruption on the development of the space industry in Ukraine

As soon as people moved from abstract thinking to the practical use of outer space for peaceful purposes, space law was born. This happened on October 4, 1957, when the first satellite flew around the planet Earth at an altitude of more than 200 kilometers above the state borders of sovereign States. None of them protested to the state that owned the first satellite, which led to the emergence of the first rule of space law "instant principle" — that any country has the right to launch artificial civil satellites into earth orbit without asking permission from other states (Kobzar & Danylenko, 2019). Since then, a rapid development of the space industry began, which was initially under the monopoly of governments — the only entities that could afford complex and risky projects (Christensen & Magnus, 2019) that were associated with the exploration and development of outer space. Today's review of the space ecosystem shows the dynamics of changes — space activities are no longer the exclusive prerogative of state institutions. More and more new companies, from small businesses with two people to large corporations, are creating a variety of different business concepts in the field of space activities. Besides, companies that have been engaged in space activities for decades are rethinking and adjusting their approaches in the context of ongoing changes (Christensen & Magnus, 2019).

Today the rocket and space industry of Ukraine has two priority state tasks: create and implement space and space-rocket projects by the National target scientific and technical space program of Ukraine, focused on solving national economic tasks and getting greater economic returns from the use of space products (satellite information from national satellites for Earth observation, satellite communications, telecommunications, broadcasting, navigation services, research, and experiments); creation of modern missile weapons for the needs of the Armed Forces of Ukraine with a focus on ensuring the return on public investment due to possible subsequent exports.

Taking into account the chronic shortage of budget funds and the forecast data on the state's economic development for the near and far future, it is quite problematic to solve these problems using the traditional approach. Taking into account that the country now owns the majority of enterprises in the space industry, and private companies have just begun to participate in commercial space activities, a possible way out of this situation is to expand public-private partnerships.

According to article 1 of the Law of Ukraine "On the public-private partnership," state partners can be the state of Ukraine, the Autonomous Republic of Crimea, territorial communities represented by the relevant state and local government bodies (Pro derzhavno-pryvatne partnerstvo, 2010). In the field of space activities, the state acts as a partner in the state space Agency of Ukraine.

That is why, in our opinion, corruption in the space industry should be considered in a broad sense. Corruption of officials who are public persons directly related to the development

of the space industry is only one side of the phenomenon under study. Also, the issues of combating corruption in the sphere of forming budget funds, providing administrative services, education, aerospace and defense industries, the interaction between the state and business, and so on are of great importance. Accordingly, corruption in the space industry is manifested by the aggregate indicator of its existence in the state, in its main sectors.

Taking into account the urgent need to adapt the space industry to the market economy as soon as possible, taking into account all the above, it is necessary to amend the Law of Ukraine "On public-private partnership" and provide the following:

a) give the state policy status to relations between the state and its private partners in the space industry;
b) formulate a clear transparent mechanism for interaction of organizations and enterprises in the industry with private partners (to minimize corruption risks), providing maximum motivation for their involvement in practical activities (public-private partnership in the space sector should become attractive for business);
c) provide for the right to create legal structures in the space industry of Ukraine with the participation of public and private partners, the share of state ownership of which can be used for the implementation of business ideas that will contribute to the expansion of international activities of Ukraine in this field;
d) when creating public-private partnership structures, provide safeguards for private partners for their mandatory preservation in the staff of space technology production facilities and their support, despite changes in management, the need to consolidate assets and then divide them into segments based on new business strategies with a shift in emphasis towards creating more profitable products, and so on.

According to Bank of America Merrill Lynch, the main driving force of the new space race will remain the interests of the defense sector. Still, the Space age 2.0 will also be characterized by other factors: innovations of private companies, commercial activities, attracting new countries, reducing the cost of space launches (2017). This, in turn, will encourage all subjects of space activities to search for optimal forms of cooperation (public-private cooperation, international cooperation, etc.). Therefore, minimizing corruption factors is a priority for the Ukrainian political elite. Although Ukraine is not among the ten least corrupt countries for the results of the Corruption Perceptions Index (Corruption Perceptions Index, CPI)[1], it is hoped that the space industry will become an example for other spheres in preventing corruption and will lead the state to the highest level of this rating. After all, in countries where the society is free from corruption, there is a transparent, responsible and conscious decision-making on the formation of anti-corruption policy and, accordingly, its virtuous implementation. Citizens, first of all, respect themselves and others — a violation of their rights is considered unacceptable. Any discriminatory manifestations are mostly absent, since it is not appropriate to speak about the absolute in this case, but it is quite possible to assert about the ideal. Society really can influence the government by exercising its constitutional right to participate in making various

[1] For example, Denmark is considered one of the least corrupt countries in the world. This is confirmed by the annual analytical results Of the corruption Perceptions Index (CPI), an indicator that has been calculated by Transparency International since 1995 (the organization itself does not conduct its own surveys, but calculates the Index based on 13 studies by reputable international organizations and research centers) (Corruption Perceptions, 2019). So, in recent years, Denmark is the undisputed leader in the world, which with slight fluctuations, but retains its position in the top ranking of the least corrupt States.

political and economic decisions. Citizens and authorities are subject to the rule of law. Still, they have the right to free expression of their opinions, honest and open media, and they are own moral and ethical right to resist corrupt officials and business people.

Conclusions

All countries are different in all aspects. There are no identical ones. In some countries, the rule of law prevails, the state apparatus functions smoothly, the economy develops steadily, citizens are protected socially, and young people develop their talents and skills. And in others, chaos reigns — citizens complain about the state power, pensioners and young people are vulnerable almost unprotected layer of the population, and the ruling elite has all the possibilities beyond understanding — unprecedented income: offshore accounts, their air and sea vessels, foreign villas or even castles.

It is clear that in such conditions, the space industry of a particular country is somewhere better but somewhere less developed. However, to sum up, we should answer the main question raised in this study: does corruption affect the development of the space industry? So, of course, it changes. If this phenomenon were harmless and did not cause global consequences, would the international community take the issue of its eradication so seriously? The answer is obvious.

Global cooperation in the fight against corruption is the primary mechanism for reducing its manifestations. Sharing experience, conducting joint discussions, including seminars and symposiums, as well as providing material, information, or other resources to countries that are "outsiders" in the process of eliminating corruption on their territory — this is the key to the world's security from its mass spread. These are instruments of its containment, which in modern conditions, are supplemented by a variety of innovative ones, which, by the way, confirm their effectiveness.

The space industry is hindered in its development precisely because funds that should potentially be used for research and development of outer space are not being used for their intended purpose. Accordingly, there is no innovation activity, and technological progress is minimal.

Therefore, the priority is to eliminate corruption both in the world and in individual countries, because it, like a viral infection, tends to migrate, threatening all of humanity.

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International Legal Regulation of Space Tourism

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The article analyzes the state of legal regulation of the process of organization and implementation of space tourism, defines the features of its application and its place in modern international space law. The legal norms in the field of space travel and the legal bases of their organization were analyzed.

An attempt to analyze the legal status of persons taking part in space missions was made. The issue of the international legal personality of the participants of the space tourist service contract was investigated. Particular attention was paid to the legal status of space tourists. The content of the definition of "cosmonauts as messengers of humanity into space" was analyzed. The issues of the risks inherent in space tourism activities and the international legal liability of the parties to the space tourist services contract were considered. It has been stated that a space traveler has a certain amount of rights and obligations throughout the period, from the beginning of preparation to the journey and ending with the period after returning to Earth. An indicative list of space tourists' rights has been restated, and examples of their obligations and limitations in time and space have been provided. It was noted that the legal status of persons who have the status of space tourists, does not coincide with the status of professional astronauts, despite the fact that the first and second performing space travel. It is proved that the concept of "space tourist" is an integral part of the concept of "participant of space flight". The study found that space tourists have the opportunity to undertake space travel on the basis of a contract for space tourist services and solely on a commercial basis. It was stated that the activities to be conducted while the tourist is in space should be well planned and approved by a particular state body — the national space agency of the launching country. A specific condition for the participation of a space tourist in space flight is the process of its preparation and the passage of special selection, which includes checking personal, biographical, medical information about the person, physical and mental health status, command of the language of communication and so on.

The study develops the idea that to determine the concept of space tourist does not matter the period during which the specified person has already made or is just planning his space trip. The study concluded about the need for further improvement and development of the theory of space law, while taking into account modern space practices and results and experience, obtained during the implementation of contemporary space programs.

Keywords: space tourism, international space law, space flight participant, liability, space travel service contract, professional astronaut, International Space Station.

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Introduction

The tourism sector is an area of foreign economic activity that is quite actively developing. Issues of international legal regulation of tourism occupy a special place in their study.

The Law of Ukraine "On Tourism" of September 15, 1995, No. 324/95-VR defines the general legal, organizational, and socio-economic principles of the implementation of the state policy of Ukraine in the field of tourism. It aims at securing the rights of citizens to rest, enshrined in the Constitution of Ukraine, freedom of movement, health care, a safe and environmentally friendly environment, the satisfaction of spiritual needs, and other rights when traveling. It establishes the principles of rational use of tourism resources and regulates relations related to the organization and implementation of tourism in Ukraine. Article 1 of the Law states that tourism is the temporary departure of a person from a place of residence for wellness, cognitive, professional, business, or other purposes without carrying out paid activity in the place where the person goes.

Depending on the purpose of the tourism industry, different types of tourism are distinguished, including those for acquaintance, recreation, for business purposes, for participation in sporting events, as well as educational, scientific, pilgrimage and space.

Today, in the world of modern tourist services, there is a new, but quite promising direction called space tourism, which is considered to be the most expensive, but most exciting for tourists. Any valid international legal act does not prohibit space tourism. Space tourism is a type of commercial space activity.

Space tourism has already become a reality. The number of modern companies intending to provide space tourism services is steadily growing. The same can be said about their representatives. At the same time, with the increase of space tourism companies, it is possible to predict in the near future a decrease in the cost of these services, which in turn may lead to a wider involvement of the inhabitants of our planet in tourist journeys to space.

In all circumstances, such space law as space tourism will be further developed. Therefore, for their harmonious development, all their stakeholders and member states should develop unified rules of the game. In all circumstances, such space law as space tourism will be further developed. Therefore, for their harmonious development, all their stakeholders and member states should develop unified rules of the game. The study of space tourism issues and the prospects of their international legal regulation will remain a topical and vital problem for a long time.

The primary purpose of this study is to consider the concept of space tourism, to study in the international legal sphere the problems of improving its international legal regulation.

The research should identify the main issues that exist in the context of international and national law and the prospects for their legal fixing.

Therefore, the legal regulation of space tourism is not well understood in the legal literature. Also, these issues are studied at the boundaries of international space and international tourism law, and therefore, when considering these issues should consider both the sources and existing principles and norms that determine the international legal regime for the organization of space tourism.

Presentation of the main material

In December 2004, a law was approved in the United States to legalize the use of private property for the purpose of space flight organizing.

In 2002 States Parties of the International Space Station program agreed on a document entitled "Principles Regarding Processes and Criteria for Selection, Assignment, Training and Certification of ISS," which set the general criteria for the selection of astronauts and visitors to the International Space Station (Gerold et al., 2013).

Roscosmos and Space Adventures have been cooperating in the area of organizing tourists' flights since 2001.

In connection with the implementation of space tourist flights, there was a need for legal support for this activity. To create a regulatory framework, it is necessary to prepare a basic concepts and terminology. First of all, the meaning of the concept of space tourism should be defined.

From national laws governing the activities in the field of tourism, they regulate exclusively relations that arise within the framework of their national laws.

And space tourism is a type of tourism that is implemented in outer space, which studies the participation of the citizen in outer space. Therefore, space tourism cannot be governed by national laws on tourism.

Richard Crowther, in his work "The regulatory challenges of ensuring commercial human spaceflight safety," has defined the term "space tourism" as "the term commonly used to refer to ordinary members of the public buying tickets to travel to space and back" (Crowther, 2011).

Steven Freeland in his work "Up, Up and … Back: The Emergence of Space Tourism and Its Impact on the International Law of Outer Space" defined the term "space tourism" as "any commercial activity offering customers direct or indirect experience with space travel" (Freeland, 2005).

The concept of space tourism can be combined with the observation of objects and phenomena in outer space during space flight with the help of both space and terrestrial infrastructure. The primary purpose of space tourism is the use of outer space.

Thus, it can be summarized that space tourism can be called paid for private account flight management services for one person or a group of people in space or in Earth orbit for the fulfillment of their scientific, research needs, or entertainment and cultural purposes.

Reflecting on activities in the field of space tourism, it will be interesting to characterize the range of services that can be provided to users. In this connection, we can find interesting the opinion of researcher Marina Krytkina, who suggests that space tourism may include "participation of citizens in a manned space flight as a passenger (crew member), observation of objects and phenomena in outer space, as from specially equipped places on Earth for this, and in the process of participating in a manned space flight; use of space infrastructure, as well

as the monitoring of its functioning; use of decommissioned space technology, as well as the results of space activities for tourism" (Krytkina, 2015).

She was speaking about the commercial human spaceflight market Professor Crowther names such persons as "the operator, the flight participants, and third parties" who may be considered as the parties of the agreement of space tourism (Crowther, 2011).

Following the theory of international space law, space tourism can be understood to mean the following activities, such as the participation of citizens as space flight passengers, observing phenomena and objects in space when traveling through space or being in specially equipped places on Earth, application space infrastructure and observation of its activities, the use of special space technology. The concept of space tourism can also include activities such as visiting an observatory, observing the launching of space objects at a spaceport, using a special center and equipment to train astronauts, staying at a flight control center, and more.

Determination of legal personality of the space tourist

The Agreement on the rescue of astronauts, the return of astronauts, and the return of objects launched into outer space was considered and negotiated by the Legal Subcommittee from 1962 to 1967. Consensus agreement was reached in the General Assembly in 1967 (resolution 2345 (XXII)), and the Agreement entered into force in December 1968. The Agreement, elaborating on elements of articles 5 and 8 of the Outer Space Treaty, provides that States shall take all possible steps to rescue and assist astronauts in distress and promptly return them to the launching State, and that States shall, upon request, provide assistance to launching States in recovering space objects that return to Earth outside the territory of the Launching State (The Rescue Agreement, 1967).

The concept of "space tourist" is an integral part of the concept of "participant of space flight." It should be noted that the legal status of persons with the status of space tourists does not coincide with the status of professional astronauts, even though both the first and the second make space travel. Also, for the definition of the space tourist, the period during which these individuals have made their commercial space travel, or just going to implement it is not essential.

An individual — space tourism throughout the period, from the beginning of the preparation to the journey and ending with the return after returning to Earth, must have a certain amount of rights that it can exercise. In particular, a space tourist has the right to receive complete and reliable information about the rules of entry into and stay in space, to free access to tourist resources, to ensure personal security and preservation of his property, to receive medical aid, to compensation for losses and compensation for non-pecuniary damage in case of failure to fulfill the terms of the contract for space tourist services, etc. A space traveler must fulfill his obligations under the terms of the space travel agreement.

During space travel, preparation for transit, and transit, the space tourist must fulfill a number of obligations. In particular, he must adhere to international space laws and space rules, preserve the environment of outer space, and observe personal safety rules throughout the journey.

A special condition for the participation of a space tourist in space flight is the process of his preparation. In particular, the space tourist must pay the full cost of the flight. In case the specified person does not take part in the flight, not due to the fault of the organizing flight, then the expenses for space travel will not be refunded to the tourist. Due to the high cost of space travel services, the risks in this area should be insured from the outset.

In order for an individual to be able to fly into space, he must undergo a very thorough selection, which includes the verification of personal, biographical, medical information about the person, the state of his physical and mental health, the level of command of the language of international communication, the absence of diseases that would endanger the life and health of the potential space tourist.

Particularly, the International Space Station medical community has adopted a document entitled "International Space Station Medical Standards and Certification for Space Flight Participants." It is emphasized that the criteria applied to the ISS spaceflight participant candidates are substantially less stringent than those for professional astronauts and/or crewmembers of visiting and long-duration missions to the ISS

Legal grounds for space tourism

One of the essential attributes that define space tourism activities is the conclusion of an agreement. The subjects of this contract are: a natural person — a space tourist and a representative of a company providing services in the field of space travel.

Activities that will be undertaken, while a tourist is in space, should be well planned and approved by a particular state body — the national space agency of the launching country.

Upon arrival of the space tourist back to Earth, his obligations to fulfill the terms of the contract are not terminated. Considering, that this person was with professional astronauts, who together with the tasks, provided by the terms of the space service agreement, at the same time fulfilling their functional responsibilities, and this person could be present during a series of experiments, accordingly, a space tourist may be subject to a number of restrictions on exporting information. Also, the space traveler must return the equipment used during the space trip.

The provisions of the first part of Article V of the Outer Space Treaty about the fact that all States Parties "regard astronauts as envoys of humanity to space." This phrase implies a legally complex content that would provide an opportunity to protect people involved in space exploration for the benefit of all mankind, because of fears of the United States of America and the former USSR that they are dealing with space travelers may not proceed correctly in the event of an unforeseen emergency landing within the jurisdiction of another country.

The same right of defense is provided for the category of persons designated as "envoys of mankind to space" in situations where they will also be in space that does not fall under the jurisdiction of any state but will need assistance. Article V of the Outer Space Treaty can be interpreted as imposing an obligation on those who may be concerned to provide information on space travelers (Cheng, 1997).

Space excursions safety issues

When we talk about the safety of space travel, the matter referred to the protection of falling just two categories, first spaceship crew and second space tourists. Throughout the space spacecraft, they will take part in a space trip, together with crew members they are considered space travelers who may be in trouble.

The desire to secure the possibility of protection for "space travelers in need" has always been a subject of study of international space law. The United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) has been working on this issue. The idea of protecting space travelers has been reflected in several provisions of the UN General Assembly resolution

1962 of 13 December 1963 entitled "Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space."

So in principle nine, it was stated that "States shall regard astronauts as envoys of mankind in outer space, and shall render to them all possible assistance in the event of accident, distress, or emergency landing on the territory of a foreign State or on the high seas. Astronauts who make such a landing shall be safely and promptly returned to the State of registry of their space vehicle".

As we can see, the 1962 resolution is quite rightly regarded as the starting point for the beginning of the drafting of the Space Treaty in the context of Article V.

The next important document — the 1967 Space Treaty uses the terms "astronauts," which sometimes creates some confusion due to the peculiarities of translating this document and the Russian side's desire to use the term "cosmonaut." Nevertheless, the Treaty's multilingual texts have the same legal force. Similar is the situation with the use of the term "taikonaut," which was used to name astronauts in Chinese.

At the time of preparing the provisions of the Space Treaty, the question of the possibility of participation in space travel by individuals was not considered, so there was no need for a precise definition of the term "astronaut." Therefore, it is believed that this term is more descriptive than technical, and may refer to any person traveling to space or traveling aboard a spacecraft.

However, in connection with the aboard of persons who are considered space tourists and who make their space travel on a commercial basis, it is advisable to ask how to call such space passengers, since the use of the term "cosmonaut" about them will give them the opportunity to acquire the rights and responsibilities of astronauts (Hobe et al., 2017) professionally.

In the following document — "Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space," the term "Spacecraft" is used instead of the term "astronaut."

In contrast to professional astronauts who, for professional reasons, take part in space missions, have many years of practice, and actually ensure the operation of spacecraft, "space flight participants" are tourists who have a commercial and private nature of travel and recreation. The term "space flight participant" was proposed by the participants of the International Space Station program in order to separate from each other the categories of persons flying into outer space. The separate category includes the scientists who conduct various experiments, and the main purpose of which stays aboard the space shuttle is the implementation of research activities.

The presence of a tourist component during a space flight hinders the activity of crew members, as space tourists distract crew members — professional astronauts who perform their functional duties.

Staying of the participants of a spaceflight on the spacecraft should be appropriately regulated. Thus, the amendments to the US Commercial Space Launch Act 2004 provided a detailed legal regime for commercial space flights and set licensing requirements for commercial space-operated space suites. In any case, a space flight participant will have only those powers that are characteristic of the space tourist. Still, they must in no way duplicate the rights and responsibilities of professionally trained astronaut personnel. The conditions in which space tourists will stay will be different from the usual requirements for ordinary tourism. They will remain in a closed environment for a long time, in the face of large temperature fluctuations and radiation levels.

It should be noted that a member of the NASA program "Teacher in Space," an American teacher and astronaut from Concord, New Hampshire Sharon Christa McAuliffe, died in the wake of the Challenger spacecraft after its launch, belongs to the category "Space flight participant." Considering that the US National Aeronautics and Space Administration (NASA) applies the term "astronaut" to persons, who are the members of space crews, perform the functional duties of commander, pilot, flight specialist, flight engineer and were selected to serve NASA in order to be directed into the Earth's orbit and beyond, the Russian crew members perform the functional duties of the ship's commander and flight engineer, as well as being able to qualify as a test astronaut and a space astronaut. None of the categories of positions mentioned above may be replaced by the term "commercial flight attendant" because of the number of competencies that underlie them. There are also concepts such as "persons engaged in extra-ship activities under the program" and "other persons involved in any phase of the flight."

Conclusions

Despite the fact that very few people can afford space travel for themselves space tourism can be considered as a promising source for the future development of astronautics, its legal regulation will require a thorough study, that in the near future will become a subject of attention for scholars in the field of international law.

Although space flight makes a significant contribution to the development of science, they have a negative impact on the ozone layer, which can further lead to an environmental catastrophe on Earth. However, taking into account the desire of humans to fly into space and the ability of only a few of them to realize this idea into practice, we can talk about certain capabilities of organization of short, relatively cheap, but not tested suborbital flights. However, these activities should be regulated and solely supported by the state.

Today, there is no specific law on space tourism, but in the case of the spread of the phenomenon and the need to ensure its legal regulation, a relevant legislative act can be developed in the countries concerned with the introduction of information on the rights and responsibilities of tourism operators, similar to the sections of laws on tourism basics of tourism activities of these countries.

It should be noted that in order to develop and improve the legal regulation of the activities related to space tourism, it is necessary to continue research related to the study of systematization of the legal framework in the field of space tourism, the mode of stay of tourists, their rights and responsibilities, rights and responsibilities of the organization, which provides space flight services, flight conditions, safety issues and the quality of services received. Separate sections on the use of outer space for tourism purposes should be included in the state's new space laws. It is advisable to consider the issue of legal regulation of space tourism not from the position of the Law on Tourism, but the location of the Law on Space Activity.

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National Space Activities: Modern Realities and Legal Challenges

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The article studies the current state of affairs in national space activities. The legal problems facing the space industry at the present stage, the mechanism of their solution are analyzed. The author highlights the crucial issue, which requires an immediate solution regarding the location of the launch site for domestic space objects. The special role of the State in ensuring the legal conditions for the development of national space activities, which should be carried out using good in law modern methods and means of public regulation, is determined. Nowadays, the legislation of Ukraine on space activities requires significant changes and additions, taking into account the new space realities and instruments for the development of public relations in the field of space exploration and use. The author argues that a strategy for the development of space activities in Ukraine, public administration of the space industry, as well as ensuring its restructuring require a substantial rethinking and improvement. The relevance of the legal framework for the creation and use of space defense and dual-use space technology in the interests of the national security and defense sector is underlined. The author argues that the Concept of Ukrainian law reform on space activities, including the legal rationale for choosing the optimal behavior model regarding the solution of complex legal problems based on modern space-legal doctrine and practice of space relations, should be developed.

Keywords: space law, space relations, space activity, launch site, launch vehicle, spacecraft.

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Introduction

Ukraine occupies a worthy place in the global market for commercial space services and technologies. The leading areas of national space activities include the production and launch of launch vehicles for the delivery of payloads, such as spacecraft to the Earth's space orbit, the manufacture of systems and instruments for the control of launch vehicles and spacecraft. Domestic production infrastructure enables us to carry out the design, manufacture, and operation of world-class competitive launch vehicle products.

Since 1991, 165 space launches have been made with the use of Ukrainian-made launch vehicles (Zenit-3SLB, Zenit-3SL, Zenit-2, Cyclone-2, Cyclone-3, Dnipro) and foreign launch vehicles: American Antares and the European Vega, which are completed with domestic components (respectively, the basic design of the first stage and the upper stage marching engine) (Statistics, 2020). It was found that the record year for Ukraine was 2004, when the share of Ukrainian launches of space objects accounted for 13% of world space launches. Without exaggeration, the Ukrainian space program has something to be proud of.

However, since 2014, the situation in the space services market has changed dramatically for Ukraine. According to information and statistics, launches of Ukrainian launch vehicles have actually stopped. Only two launches were made using Zenit-3SLB launch vehicle (2015, 2017) from the Baikonur site within the Ground Launch project, three launch vehicles using the Dnipro (2014, 2015) from the launch site Yashyi and launch vehicle Zenit-3SL (2014) within the Sea Start project (Statistics, 2020). Only the international space projects Antares and Vega are fully implemented.

The current external and internal changes that have taken place in the country require to update systematically and structurally national space legislation and to bring it into line with new economic and legal realities. In order not to lose its place in the global space services market, the State should more actively apply the existing public legal instruments to create conditions for the development of space activities in the interests of the national economy, science, defense, and security.

In light of the challenges and threats to Ukraine's space industry, the legal issues of organizing and ensuring the further effective use of national space-rocket capabilities are relevant.

Main material

Space activities for launching a space launch system are carried out by Ukrainian entities operating in the space sector of the economy on the basis of external economic relations with foreign objects.

Predominantly, launches of Ukrainian launch vehicles were carried out in close cooperation with the Russian Federation using its Yasnyi launch base, launch sites of Plesetsk and Baikonur (Kazakhstan transferred Baikonur into the possession and use of the Russian Federation by 2050) (Treaty, 2004). It was a mutually beneficial Ukrainian-Russian space collaboration. However, as a result of Russia's occupation of the Autonomous Republic of Crimea (ARC), the seizure of the National Centre for Space Control and Testing in Yevpatoria, as well as military aggression in the territory of Donbas, cooperation between the States in the field of the creation and operation of rocket and space technology is de facto curtailed.

Therefore, one of the key problems of modern space industry development is that our State does not have its own launch site for launching a domestic launch vehicle. According to the global space market's data, Ukraine slows down its space launch operations. In 2019, 102 launch

vehicles were launched from 16 launch sites of the world, and 433 spacecraft were launched into space (Zheleznyakov, 2019). However, Ukraine has not launched any Ukrainian launch vehicle, which causes the loss of competitive positions in this segment of the commercial space launch services market. Meanwhile, the number of countries that search for quality, reliable and cost-effective space launch services, especially in low Earth orbit, increases every year.

Our state had ambitious space plans to use the Ukrainian-Brazilian launch site, which had been constructed in the territory of Brazil within the framework of the joint space project of Ukraine and the Federal Republic of Brazil Alcantara Cyclone Space since 2006 (Treaty, 2003). It was planned to create a Cyclone-4 launch pad at Alcantara Launch Centre and provide services for national space programs as well as commercial launch service customers. Moreover, Ukraine provided funding for the development of the launch vehicle Cyclone-4, its components and assemblies, a comprehensive test, and preparation of the production base.

The first launches from this pre-equatorial launch site were due in late 2014. However, work on the launch site was suspended by the Brazilian side in 2013, and in 2015 the Brazilian Government unilaterally terminated an international agreement on the implementation of this project, and Brazil withdrew from the project (Order, 2017). Therefore, the implementation of this project has been terminated.

Since then, Ukraine has been searching for partners and a new launch site for Ukrainian launch vehicles on a rush basis. An alternative launch site to Russian one should be found as soon as possible, as the space launch system must work for the benefit of the State, its citizens.

However, the Space Strategy of Ukraine up to 2022 (Strategy, 2015) and the Government's Concept of public policy in the field of space activities for the period up to 2032 (Order, 2011) do not provide for the use of launch site to launch Ukrainian launch vehicles, despite unfulfilled plans to use the Ukrainian-Brazilian launch site. Unfortunately, the issue of the location to launch space objects is still not in any of the strategic documents of the space industry. However, it is very relevant for the development of the space industry and needs to be addressed.

It should be noted that the project of the National Target Scientific and Technical Space Program of Ukraine for 2019-2023 provides for the creation of spacecraft for national needs (Project, 2018). However, a logical question arises, "How should Ukraine ensure their launch into outer space?" Despite having our launch vehicle, we will actually be forced to become consumers of foreign space launch services.

Meanwhile, space activities require an immediate solution to this problem. For example, the options for the location of the space launch system in Australia (Kimberley), the USA (Cape Canaveral), Mexico, and Canada have been considered. As practice shows, launch sites are usually built on sparsely populated areas of the earth, where the likelihood of harm, especially to the population and environment, is minimal.

As a result of the investigations, the most effective and rational location was determined in the Canadian province of Nova Scotia (Analytical).

In 2017, a Memorandum of Understanding in the field of peaceful exploration and use of outer space was signed between the State Space Agency of Ukraine (SSA) and the Canadian Space Agency (Memorandum, 2018). The target of mutually beneficial Ukrainian-Canadian cooperation was the creation of a common space launch system. Moreover, such arrangements have specific forms. In 2018, contractual documents were signed on the construction of a private Ukrainian-Canadian space launch system to launch Ukrainian Cyclone-4M medium-lift class launch vehicles from the Canadian province of Nova Scotia. It uses the developments from the design of the Cyclone-4 space launch system.

By now, permits and procedural approvals have been completed to construct the launch site. The direct conduct of construction works began at the end of 2019 without the involvement of the State budget. The main participants of the project were Ukrainian Yuzhnoye State Design Office, SE PA Yuzhmash, PJSC Hartron, and Canadian Maritime Launch Services Ltd. (Analytical).

At the same time, to ensure real freedom of national space activities, to empower Ukraine in the global space services market, domestic space groups discuss the possibility of building their Ukrainian launch site for launching space objects. Furthermore, the leading space enterprises in the space industry of Ukraine are simultaneously developing two projects for their location in the Kherson region. For example, Yuzhnoye SDO proposes to create a space launch system based on a lightweight launch vehicle Cyclone-1M for launching space objects into low Earth orbit (Treaty between, 2003). Also, SE PA Yuzhmash proposes the construction of a floating platform for space launches (The first, 2019). Therefore, the consolidation and coordination of their efforts to address the sustainable development of national space activities become essential. In this context, an important mission is given to the Ministry of Development of Economy, Trade, and Agriculture of Ukraine (Ministry of Economy) and the SSA to formulate and ensure the implementation of national space policy in this area.

An individual launch site is independent in access to outer space, including the moon and other celestial bodies. Ukrainian comprehensive space cooperation with Russia and Brazil have exposed extremely high political and economic risks, the probability of which is unpredictable.

However, it should be noted that the launch system is of high risk by its nature. Legal relations associated with possible launching of space objects from Ukraine shall be subject to the rule of international space law regarding the specificities of foreign legal liability for damage caused by space objects, since the State will have the legal status of the launching State.

According to Article VII of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (Treaty, 1966), the launching State shall be liable for damage to another State Party to this Treaty, to its natural or juridical persons by space objects or their component parts on the Earth or in outer space, including the moon and other celestial bodies. That is, the subject of international legal relations, ultimately liable for damage to a third party by a space object on the Earth's surface or an aircraft in flight, is the launching State of the relevant space object. Therefore, the risk of international legal liability for the damage caused lies unconditionally on the launching State and not on the launch service operator as the launching entity.

However, the provisions of the Convention on International Liability for Damage Caused by Space Objects (hereinafter referred to as the Liability Convention) (Convention, 1971) do not provide for an upper limit for compensation for damage caused by space objects on the Earth's surface or aircraft in flight. Therefore, the corresponding damage is subject to full compensation by the State.

During the pre-launch and launch of space technology into orbit, business entities must take the necessary precautions to prevent technogenic incidents and disasters that may cause damage to the lives and health of individuals and damage to property of individuals and legal entities (victims). However, space liability risk insurance is an active civil law way of protecting the property interests of the State and of space entities (in particular, the launch service operator) due to the need to provide compensation for damage to life, health and property of victims in the process of space activity.

The provisions of international space law do not specify the specific legal mechanism of space liability insurance. The insurance protection is addressed at the level of national legislation.

Paragraph 1 of part 1of Article 7 of the Law of Ukraine on Insurance (Law, 1996) provides for compulsory liability insurance for risks associated with the preparation for launching space technology at the launch site and its launching.

The Resolution of the Cabinet of Ministers of Ukraine "On approval of the procedures and rules of compulsory insurance in the field of space activity" (hereinafter — Procedure and Rules) (Resolution, 2010) provides for the procedure and rules for carrying out this type of compulsory liability insurance, the risk of policyholder's obligation to compensate losses caused by the object of space activity. According to the Procedure and Rules, compulsory liability insurance is carried out in Ukraine if a launch vehicle, spacecraft, boosters, and other space objects owned by Ukraine are used. That is, liability for damage caused only by objects of space activity, which are the property of Ukraine, is subject to compulsory insurance.

By this type of insurance, the insured is the SSA. In this case, victims are foreign States, third parties (legal and natural), whose life, health and/or property are damaged due to pre-launch, launch, and operations in orbit.

Insured risks are risks arising from the obligation of the policyholder to compensate for the damage caused by the space activity: 1) to an aircraft on the ground or in-flight; 2) to any other space object or persons or property on board such a space object in any place elsewhere than the Earth's surface. An insured event is, by the Liability Convention and/or in accordance with the law, the occurrence of an insured person' obligation to compensate the victim for the damage caused by the object of space activity as a source of increased danger.

The subject of the liability insurance contract is the property interests of the insured, which are not in contradiction of the law and related to the compensation of the insured for the damage caused to the life, health and/or property of the victim. Consequently, liability insurance is aimed at protecting the property interests of the insured against the losses that he may suffer as a result of third-party claims for compensation.

The sum insured shall be established in a compulsory insurance contract equivalent to 500 USD at the official exchange rate of the National Bank of Ukraine, established at the date of the insurance contract, per kilogram of the starting mass of the space object. And the amount of the insurance tariff is determined depending on the state of the object of space activity, the significant circumstances of the insurance risk, the term of the insurance treaty, the situation of the international insurance market, etc. Mandatory insurance has a maximum insurance rate of 2 percent of the sum insured (Regulation, 2010).

Therefore, the State ensures the protection of its property interests in the event of a binding relationship in relation to its absolute liability for damage caused to third parties. However, compulsory civil liability insurance of space entities other than the State is carried out on a voluntary basis by concluding a relevant insurance contract, since the Cabinet of Ministers of Ukraine has not defined the procedure and rules for its conduct, form of a standard contract, special licensing conditions of compulsory insurance, sums insured and maximum insurance rates or actual calculations.

Therefore, the implementation of potential launches of Ukrainian launch vehicles involves a set of political, technical, environmental and legal risks that require systematic analysis and expert assessment. However, the issue of own launch site faces the need to solve the problem of providing investment component of space activities, government and financing of space industry. Space activity is an extremely capital-intensive type of business that requires the accumulation of significant financial resources. Therefore, the analysis of the economic profitability of construction and use of the national launch site is also of importance.

In the Ukrainian context, national space activities are financed from the budget within the framework of the National Target Scientific and Technical Space Programs, developed and approved by the Verkhovna Rada of Ukraine every five years (Law, 1996). However, what is planned for the program contradicts to what is actually coming into the space industry. Nowadays, its development is under-financed. This is probably one of the reasons why Ukraine does not operate any spacecraft. However, it has the necessary technological potential to create and use the space launch system that many countries dream of. It should be noted that our State does not use it properly to ensure the innovative development of the State. For example, Ukraine still purchases space services for Earth remote sensing, television broadcasting, mobile communications from foreign space partners.

In the current context, the consideration of global trends in space activities, based on the use of public-private partnership instruments in the field of space, is of particular importance. The legal space relationship between the National Aeronautics and Space Administration (NASA) and the US private enterprise SpaceX illustrates such a partnership. Unfortunately, this instrument has no practical application in the domestic space industry, since the legal framework for its formation and development are almost absent. Activities related to the development, testing, production, and operation of launch vehicles and their space launches were the sole responsibility of State-owned enterprises and organizations (Law, 1991). That is, the State monopolized these types of national space activities.

Nowadays, the State has decided to engage private entities in this type of space business, eliminating a discriminatory approach to economic entities. In turn, the removal of restrictions on the right to conduct space activities by its standards and organizational and legal forms of management should encourage the development of national space activities.

However, the rules of the current space legislation of Ukraine do not contain a stimulating legal effect. The provision of Article 10 of the Law of Ukraine "On Space Activity" requires obtaining the permits by economic entities for carrying out space activities, such as:

a) testing (other than computer-based) launch vehicles, including their units and components and spacecraft;
b) launches of the launch vehicle and/or spacecraft;
c) control of spacecraft in Earth orbit or outer space;
d) the return of spacecraft and/or their rotating components from Earth's orbit or outer space to Earth.

Therefore, the motivation of entities to engage in space activities requires liberalizing the legal regulation of space activities by abolishing the licensing mechanism for its implementation, since this instrument of public legal regulation is unjustified. It lacks the necessary balance of space operators' interests and the State.

Excessive direct influence of the State on space activities does not contribute to the sustainable development of scientific space research, creation and application of space technology, use of outer space. In this area, it is advisable to use alternative legal means to ensure compliance of national space activities with the standards and principles of international space law, for example, to increase the requirements for the quality of space works (services, goods), the introduction of certification of certain space activities.

The formation and development of modern entrepreneurship in the field of space exploration and use should be based on the free choice of economic entities to conduct national space activities. The limits of freedom of enterprise should be determined by the specific conditions

of space activities. The most optimal combination of market self-regulation of space relations of economic entities and public regulation, their interaction and coexistence are of particular significance. Definitely, public regulation of space activity is effective when its permissible limits are determined by the specific conditions of the space market. Usually, public regulation is determined necessary if the market mechanism of self-regulation cannot meet the challenges of sustainable development of space activities. Due to these objective reasons, it is supplemented by effective administrative and legal means of public regulatory influence on the activities of economic entities (licensing, patenting, technical regulation, etc.) (Semenyaka, 2019).

However, the State has a unique role and place in providing legal conditions for the development of national space activities. Commercialization of the results of space activities requires the legal framework first and foremost.

Meanwhile, the strategy of space activity development in Ukraine, public administration of the space industry, and its restructuring should be considerably rethought and improved.

In 2018, the entire property complex of the State enterprise Scientific Production Association Pavlograd Chemical Plant, involved, in particular, in the development, testing and production of components of the launch vehicle, was transferred from the SSA management to the management of the Ministry of Economy (Resolution, 2017). The leading enterprise for space launch system products, SE PA Yuzhmash, made some steps to get out of the re-subordination of the SSA to the Ministry of Economy. Earlier, proposals were made for the merger of Yuzhnnoe SDO and SE PA Yuzhmash by subordination of Yuzhnnoe SDO to SE PA Yuzhmash (Space, 2017), including them in the holding company and others.

Nowadays, the organizational structures and forms of space enterprise management do not comply with the requirements of conditions functioning in the market. Restructuring and corporatization of State-owned space enterprises in order to ensure their productive commercial functioning should be one of the key areas of space industry reform.

The decision to improve and optimize the management of space enterprises should be preceded by the determination of the effectiveness of modern management of State-owned objects in the field of space activity and the mandatory consideration of system-forming sectoral specifics of production and economic activity of space enterprises. In this regard, the analysis and evaluation of the legal effects of relevant legal actions should be under focus to ensure the conservation, development, and efficient use of the existing scientific, technical, industrial and export potential of the space industry.

The mission of the State, which needs an adequate solution, is to provide the legal framework for the most favorable conditions for the implementation of national space activities by entities using legally sound modern methods and means of public regulation.

In the current context, the legislation of Ukraine on space activities requires amendments and additions, considering new space realities and instruments for the development of public relations in the field of space exploration and use (Shemshuchenko & Semenyaka, 2019), in particular under external aggression of Russian Federation and violation of the territorial integrity of Ukraine (temporary occupation of the Autonomous Republic of Crimea, the city of Sevastopol and military aggression in certain areas of Donetsk and Lugansk regions).

At the present stage, first and foremost improved defense capabilities of the space industry enable to solve the current problems of the national security sector. In other words, the legal prerequisite for ensuring national security and enhancing the State's defense capability is the effective use of the Earth's outer space and the capabilities afforded by modern space activities. In particular, the creation and operation of defense and dual-use space technology (for example,

spacecraft intelligence) will solve the complex of military-defense missions in the Donbas, will increase the effectiveness of the Armed Forces of Ukraine, will provide effective control over the implementation of the Minsk agreements by the parties, the situation in the ARC. According to the former SSA chairman Pavlo Dehtiarenko, Ukraine should have "its own ears and eyes" in these Ukrainian territories. Therefore, the issues of legal support for the creation and use of appropriate space technology in the interests of the national security and defense sectors also await immediate resolution.

The creation of effective legal conditions for the development of national space activities requires a comprehensive approach to the modernization of Ukrainian space legislation. The use of the "patching of holes" format, as practice illustrates, does not allow to achieve the desired economic and legal result in the field of space activities. It is important to summarize the research outcomes and development of the theory and practice of space law, systematization, and codification of space legislation of Ukraine.

Conclusions

The successful functioning of an effective mechanism for the legal regulation of modern space relations requires the development of the Concept of Ukrainian law reform on space activities. This document should contain the legal rationale for choosing the optimal behavior model regarding the solution of complex legal problems on the basis of modern space-legal doctrine and practice of space relations. Determination of options for the legal regulation of public relations in the field of national space activity enables to provision new organizational, legal and economic preconditions and mechanisms for ensuring innovative development of space activity in Ukraine will be laid.

However, conceptual foundations for space law should be determined using scientific methods, developments, and achievements of the space law study. Therefore, the development of the Concept should involve highly qualified representatives of academic science, such as legal scholars who are specialists in the field of international and national space law.

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Space Critical Infrastructures as Part of Critical Infrastructures: Threats and Methods of Protection

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This article is devoted to the problem of protecting critical space infrastructure as one of the main elements ensuring national security in general, as well as the safety of the population. This article will discuss such concepts as critical infrastructure and critical space infrastructure as one of its parts, the threats faced by states, and ways of protection. It will also consider several national strategies for protecting such infrastructures, the need for cooperation at various levels, which will ensure security in this area, and a quick response to threats. The author offers the following definition of critical infrastructure. The critical infrastructure of Ukraine is systems and resources, physical and virtual, that ensure the normal functioning of the state, ensure an adequate standard of living for the population, extraneous interference in the work of which will lead to negative and unforeseen consequences in the life of the society and may constitute threats to national security.

Keywords: critical infrastructure, space critical infrastructure, space, cyberspace, cyberthreats

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Introduction

The rapid development of the modern world carries many advantages on the one hand, but also hides many threats. Today it is difficult to imagine a typical day, without the use of modern technology. We perform many daily operations using cyberspace: work processes, payment for services, information transfer, and many other things. Advanced technology is penetrating deeper into our lives. In confirmation of this, we can cite the example of the Internet of things, which is gradually being increasingly introduced into our homes. Ordinary everyday things of life are able to collect and send information.

But are we adequately prepared for the threats that such integration of cyberspace into the physical world carries? Experts predict that IoT devices run the risk of becoming the primary targets for hackers, since all these gadgets were created without taking into account the need for protection against cyber threats.

If the most ordinary things can become tools of cybercriminals, then what can we say about equipment that is of strategic value to states and is part of a critical infrastructure. Unfortunately, world experience is such that it is almost impossible to predict the nature of the attack and where it will come from. What remains for states is to repel attacks and adapt defense systems after the fact, enhancing protection based on previous threats and their analysis.

One way to respond quickly is to enact appropriate legislation, a protocol and response instructions, staff training, and so on. One of the most important aspects is cooperation between states, between states and the private sector.

Concepts and features of critical information infrastructure

To date, there is no single unified international concept of critical infrastructure. Different states give their definitions of what critical infrastructure is. It should be noted that in spite of the proximity of definitions of the term in the legislation of various countries and international organizations, there are some differences that obviously reflect national or organizational specifics of the application of the term (Biryukov, 2012).

Below we will consider some definitions of what critical infrastructure is.

According to Art. 2 Council Directive 2008/114/EC of 8 December 2008 on the identification and designation of critical European infrastructures and the assessment of the need to improve their protection "critical infrastructure" means an asset, system or part thereof located in Member States which is essential for the maintenance of vital societal functions, health, safety, security, economic or social well-being of people, and the disruption or destruction of which would have a significant impact in a Member State as a result of the failure to maintain those functions (Council, 2008). Also, this Directive contains four-step instructions for determining what constitutes critical infrastructure, which Member States should be guided by.

A slightly different definition contains American legislation. The American Heritage Dictionary defines the term "infrastructure" as "The basic facilities, services, and installations needed for the functioning of a community or society, such as transportation and communications systems, water and power lines, and public institutions including schools, post offices, and prisons" (The American, 2000).

The Council established by P.L. 98-501, provided yet another definition of "infrastructure." The Council's report characterized "infrastructure" as facilities with high fixed costs, long economic lives, strong links to economic development, and a tradition of public-sector involvement. Taken as a whole, according to the Council, the services that they provide "form the underpinnings of the nation's defense, a strong economy, and our health and safety." Under this definition of "infrastructure," the Council included highways, streets, roads, and bridges; airports and airways; public transit; intermodal transportation (the interface between modes); water supply; wastewater treatment; water resources; solid waste; and hazardous waste services (Fragile, 1988).

In Germany, critical infrastructure includes "the organizational and physical structures and objects so vital to the society and economy of the country that their failure or deterioration will result in persistent supply disruptions, significant disruption of national security or other dramatic consequences" (National, 2009).

As previously stated, we can see that the definition of critical infrastructure is different in different countries.

In 2015, Ukraine also prepared and published Green Paper on the protection of Ukraine's critical infrastructure. The Green Paper is designed by the objectives of the Annual National Program of cooperation between Ukraine and NATO in 2015. The Green Paper raised the issue of establishing in Ukraine system of critical infrastructure protection. The formulated strategic goals of public policy in the protection of critical infrastructure in Ukraine, the principles of protection of critical infrastructure and objectives of such protection.

In Ukraine, the term "critical infrastructure" is often used in legal documents. For the first time in official documents term "critical infrastructure" appeared in 2006 in the text "Recommendations of parliamentary hearings on the development of the information society" but without further development. In the National Security Strategy "Ukraine in a Changing World" (2012), the term mentioned in determining ways to strengthen energy security and the directions information security. In the new National Security Strategy of Ukraine (2015), the term "critical infrastructure" used in more detail. First, among "actual threats to national security" threats to critical infrastructure distinguishes also a separate section "Cybersecurite threats and security of information resources" (Biryukov, 2012). In July 2019, the Cabinet of Ministers of Ukraine approved the general requirements for cyber defense of critical infrastructure. The decision was made in the framework of the implementation of the Law of Ukraine "On the basic principles of ensuring cybersecurity of Ukraine".

The Green Paper on Critical Infrastructure Protection in Ukraine offers the following definition: "Critical Infrastructure of Ukraine is systems and resources, physical or virtual, that provide functions and services that will lead to the most serious negative consequences for society, socio-economic development countries and national security" (Biryukov, 2012).

According to the author, the emphasis on the fact that these are physical and virtual systems and resources is significant. Such a description corresponds to the real situation of the modern world, namely the transition to cyberspace.

In turn, the author offers the following definition of critical infrastructure. The critical infrastructure of Ukraine is systems and resources, physical and virtual, that ensure the normal functioning of the state, ensure an adequate standard of living for the population, extraneous interference in the work of which will lead to negative and unforeseen consequences in the life of the society and may constitute threats to national security.

Existing threats to critical infrastructure and how to protect it

Critical infrastructure failures can occur for various reasons and can be caused by many factors. In most cases, they are the result of intentional (vandals, criminals, terrorists, hacker attacks, and others), accidental (natural disasters, human factors, force majeure circumstances), or due to incorrect decisions (whether in the field of design, management or regulation). It is also important to note that critical infrastructure failures can occur regardless of whether the equipment is connected to the global network or is operating in closed mode. The functioning

of critical processes in most critical infrastructure increasingly depends on information and communication technologies. Therefore, the undisturbed functioning of critical infrastructure depends on the security of information assets, hardware, software, information-based processes, and internal an external communication networks and links. These assets include process control systems and networks that monitor and control the physical processes of critical infrastructure (Luiijf, 2012).

The tasks of protecting critical infrastructure are many and complex problems because they can consist not only of system systems, but also of interconnected and international software management systems, where individual violations can be associated with unexpected consequences and entail a domino effect. In this case, it is necessary to have a reliable and reliable infrastructure, which can be crucial from the point of view of economic, economic or social points of view and will help to accelerate the elimination of the consequences of interference with critical infrastructure (Roman et al., 2007).

Today, there are two main areas of threat to critical infrastructure. It is technical and human.

Technical level. Since, as previously mentioned, critical infrastructure facilities are directly related to the life of the state and citizens. Earlier, the author described how deeply integrated technology into our lives. With addiction comes vulnerability. At the first level, this vulnerability is associated with the danger of system failures, which can have cascading effects that affect not only an individual, but also disrupt the regular operation of entire sectors of social activity and security (Glorioso & Servida, 2012).

Various technical malfunctions, malfunctions in the software, hardware, foreign interventions, attacks, failures due to the human factor are one part of a possible source of disturbances in the operation of critical infrastructures. The second is the various catalysis, natural interventions, and natural wear of equipment. All these factors must be considered when developing instructions and programs for protecting critical infrastructures.

Actor level. Triggered by the pervasive societal dependence upon information and communication technology, the second area of vulnerability is the one linked to the potential malevolent agency. The panoply of malevolent agents deploying their activities in and/or through cyberspace is vast, but can be generally categorized into four elements. These include — in decreasing order of gravity — state-sponsored actors, ideological and politically extremist actors, frustrated insiders, organized criminal agents, and individual criminal agents (Glorioso & Servida, 2012).

The Green Paper identifies the following categories of threats which should be set to the protection of critical infrastructure:

a) accidents and technical failures, including aviation disasters, nuclear accidents, fires, accidents in the power system, the emissions of dangerous substances, the rejection of accidents and emergencies caused by negligence, institutional mistakes etc.;
b) natural hazards, including extreme weather conditions, forest, steppe and peat fires, seismic phenomena, epidemics and pandemics, cosmic phenomena, hurricanes, tornadoes, earthquakes, tsunamis, floods, etc.;
c) malicious acts, including malicious actions of individuals or groups such as terrorists, criminals and saboteurs, and military operations in war (Biryukov, 2012).

Protecting critical infrastructure is strategically important. At the same time, it is decentralized, interconnected, interdependent, and controlled by many actors (includes partial

ones) and includes various types of technologies. The consequences can be serious, even if interruptions do not last long (Cukier, 2005).

The standards governing the protection of critical infrastructures are placed in various regulatory documents at various levels. They can be divided into national defense strategies, documents governing the protection of specifically critical infrastructures, and documents governing a particular area taken.

Slightly more specific protection goals are found on the second level of critical infrastructure protection strategies. They are more precise and specific than the protection principles, but still follow a systemic-abstract logic, as they refer to the totality of all critical infrastructures rather than to one sector or one infrastructure. Examples for "protection goals" on this aggregated level are the goals of "identifying critical infrastructures and key resources," "enhancing resiliency," or "analyzing interdependencies and vulnerabilities." These goals, formulated for all critical infrastructures, can be described as "protection policies," as they define in a general way what must be protected from which threats in what way. The third level is the sector-specific dimension. On this level, the "protection goals" are more concrete. Examples are the goals to ensure "the availability, integrity and confidentiality of information and information technology" or "sustain protection of public health and the environment." They may be referred to as (sector-specific) "protection goals" (Cavelty & Suter, 2012).

It is essential to understand that protecting critical infrastructures is not a one-off event. This is an area that must constantly be dynamic, develop, use new technical solutions, improve and update equipment, and at the same time, remain flexible and quickly respond to any changes and quickly cope with any external factors that threaten any element of the infrastructure.

Space infrastructure

One of the most vulnerable sectors of critical infrastructures, on which the stability of other components can also depend, is space infrastructure. Orbital stations, space satellites, other space equipment, perform an incredibly important function in the modern world. In addition to scientific research, space equipment performs many tasks that directly affect our lives. For example, it is meteorological satellites, communication satellites that provide signal relay between points on the surface of the earth, satellite navigation systems. To date, satellites are actively used in rescue operations. They allow the researcher to take pictures, for example, from territories that are under the influence of any natural disasters, without endangering people and continue to carry out rescue operations. Outer space is also actively used for military purposes. There is a separate category of satellites, such as military, the placement of weapons in space, which is controlled from the ground. On the one hand, for a simple layman, space may seem so far away, and on the other hand, the threats, with unauthorized access to space infrastructure, are more than real and carry great danger.

As we can see, space equipment is actively used in various fields, including ensuring the normal functioning of the state and individuals. Today, there are a number of regulatory acts, national and international, that regulate outer space, allow it to be used in a civilized manner by various states, provide for registration and accounting of space equipment, and regulate the safety of space operations.

Another aspect that complicates the development of defensive strategies is the confidentiality and secrecy of data related to attacks on space infrastructures, if any. Unlike most other critical

infrastructures, where the private sector is widely present, space infrastructures are under state jurisdiction.

In the course of studying this topic, the author found a study that simulates an attack on space infrastructure and shows its vulnerability. This study is described in the article "Cyber Defense of Space-Based Assets: Verifying and Validating Defensive Designs and Implementations" (Byrnea et al., 2014). In this paper, the researchers modeled a reconnaissance attack on space mission systems that were considered safe. Safety was ensured by following standard punctures and a safety plan.

The knowledge that was obtained as a result of this experiment made it possible to find and identify vulnerable areas that should be strengthened in the future in order to build more reliable systems to counter cyber threats. The study demonstrates how individual machines, which themselves are protected, when assembled into one single system, become unsafe. Having obtained a result in which the system is not secure, the researchers planned work to create rigorous methodologies and tools for repeated cyber defense testing. Along with this, a specialized stand for cyber defense is being developed, which in the future will help simulate attacks and improve defense systems.

The author shares the point of view of the research that threats develop and improve much faster than tools to protect against them. Therefore, it is essential, through various experiments, to identify weaknesses in the protection of space infrastructures, since the consequences of interventions in their work can become fatal.

In the field of space infrastructure, cooperation with the private sector is also important, as in any other area where critical infrastructures are present. This cooperation should be based on the principles of trust, confidentiality, and security of information and mutual partnership.

Conclusions

Today, mankind has already entered the era of technology, and the changes that this era has brought into the usual life order are already irreversible. What awaits us in the future is a deeper integration of cyberspace into the physical world. It is foolish to deny all the privileges that it gives, how it simplifies life. And do not underestimate the threats that these changes entail. Data insecurity and the crimes associated with this, cyberattacks, hacking, and more, are no longer surprising.

In this new picture of the world, critical infrastructures seem to be unprotected, and especially space critical infrastructure. The inability to predict the source and nature of attacks reduces the effectiveness of their defense. Today, threats are adapting to protection systems in order to circumvent them, much faster than the system is able to improve to protect itself. Preventive measures are ineffective. Separate elements, which themselves are protected, gathering in a single system, can not resist threats and can cause a domino effect.

The solution to the problem lies in several planes. In addition to improving the technical base, it is necessary to adopt a series of ordinary acts at different levels that would regulate the space sphere and identify it as a critical space infrastructure, along with other critical infrastructures.

Cooperation with the private sector based on the principles of transparency, security, confidentiality, and mutual exchange of information is also essential. That would make it possible to use the principle of synergy in work between the parties and, as a result, to get a system more resistant to threats.

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Comment Section

China Airlines "Escort" to Fight Outbreak Prevention and Control

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The Gengzi Spring Festival, the epidemic spread, the whole country made the same effort, united in their efforts, and Miaoli moved forward. In the novel coronavirus epidemic prevention and control issues at the beginning of 2020, the aviation people took up the great trust of the Motherland and the people without hesitation, transported medical personnel, and important materials from all over the country and even from all over the world for Wuhan. They opened up the way for the stranded homeless overseas compatriots to go home, provided hard nuclear protection to prevent citizens from going out at will and strengthen the epidemic propaganda, gave full play to the efficiency, convenience and safety of China Airlines in the major emergency prevention and control of the country, demonstrated aviation wisdom as well as the aviation responsibility.

Military aviation did not disgrace its mission and took the lead in becoming the first "aviation retrograde" to fight against the epidemic. On January 24, the night of the New Year's Eve, when thousands of lights were on, the joint logistics support forces completed the emergency delivery of 450 military medical personnel and accompanying materials into Hubei in three directions of Xi'an, Shanghai, and Chongqing in only eight hours, placing a strong "reassurance" for Wuhan in the first time. On February 2, eight air force transport planes carried 795 medical personnel from Nanjing, Guangzhou, Lanzhou, and Shenyang to Wuhan, setting a record for the PLA's air-jet transport force to use the most transport capacity since its establishment. In peacetime, military transport planes have changed their usual "combat image" and become one of the most flexible and critical means of transportation in emergency rescue and disaster relief, playing an irreplaceable role in fighting the epidemic.

Public aviation was racing against time and doing its best to deliver professional medical care, prevention, and control personnel and various materials to the frontline with the fastest speed and the highest efficiency. On January 24, after receiving an order from the Civil Aviation Administration, China Eastern Airlines urgently coordinated a Boeing 737-800 plane and its crew to execute flight MU500, carrying 136 medical personnel and 4,690 kilograms of medical equipment and medicines to rescue Wuhan. At the same time, China Southern CZ5241 charter flight took 128 Guangdong medical personnel, 3415 kilograms of luggage, and medical items to the forefront of the fight against the "virus war." On February 2, the Civil Aviation Administration organized China Eastern Airlines, China Southern Airlines, Sichuan Airlines, Mountain Airlines, and Huaxia Airlines to arrange charter flights to ensure that medical teams from Shenyang, Xi 'an and Chongqing arrived in Wuhan as soon as possible. In addition to transporting medical teams and emergency supplies for Wuhan and other disaster-stricken areas, public aviation has also taken the initiative to bring home citizens from Hubei, especially Wuhan, who are stranded overseas. On January 31, two Boeing 737-800 charter flights of Xiamen Airlines took off from Xiamen Gaoqi International Airport to Bangkok, Thailand, and Bavaria, Malaysia, to take Hubei passengers back to their hometowns. At 2: 15 a.m. on February 1, Chunqiu Airlines flight 9C6152 took off from Tokyo's Haneda Airport, carrying 111 Hubei nationals who voluntarily returned home and landed at Wuhan Tianhe International Airport at 6 a.m.; As of February 12, 1,185 stranded overseas passengers had been picked up by public airlines, effectively easing the current situation of Wuhan compatriots who are adrift and have no place to rely on. In addition, the Civil Aviation Administration, considering that travelers may be infected with the epidemic on the way, requires airlines to implement a free refund and re-sign system for passengers who have purchased tickets on Wuhan flights. Air China, China Eastern Airlines, China Southern Airlines, Hainan Airlines, Sichuan Airlines, Xiamen Airlines and other public airlines have responded to the national call, allowing citizens who originally had travel plans to re-plan their travel time according to the actual situation, effectively ensuring their personal safety and reducing the spread risk of the epidemic.

In short, from the first moment of the outbreak to the present, public aviation has never stopped its flight pace. While carrying out emergency medical personnel and supplies at an altitude of 10,000 meters, it coordinates several charter flights to carry out the mission of relief for overseas citizens, and attaches great importance to the improvement of passenger service quality. Thus General aviation is flexible, fast, and efficient and actively opens up a "green channel" to fight the epidemic. On February 5, four helicopters flown by Hubei Tongcheng General Aviation Co., ltd. carried the great hope of Thai Chinese to win the anti-epidemic war in China and safely transported 120,000 medical surgical masks, N95 masks, 15,000 pairs of medical gloves, and 16 boxes of medicines purchased overseas to Xiangyang, Hubei province. On the same day, Wuhan Cultural Innovation Industry Promotion Association raised a batch of necessary materials such as protective clothing, surgical clothing, goggles, and disinfectant, which were eventually transported to Jingzhou by Shanghai Jinhuitong Airlines Co., Ltd. helicopter. There are far more general aviation companies providing first-line assistance. Chutian Airlines, Desheng Airlines, Happy Airlines and other airlines are also continuously delivering supplies to Hubei. According to incomplete statistics, as of February 12, a total of 105 general aviation companies nationwide have used 558 aircraft to deliver about 48 tons of epidemic prevention items to disaster areas, carried out 2,416 aerial spraying operations, and disinfected and killed 161,100 square kilometers, greatly enhancing the courage and determination of Hubei and even the whole country to defeat the epidemic.

Uncrewed Aerial Vehicles (UAVs) bravely appeared, took the lead, loaded and unloaded medical supplies at any time, and stood by to support Wuhan. On February 12, a Shunfeng UAV took only 7 minutes to deliver 3.3 kilograms of medical materials to Wuhan Jinyintan Hospital, effectively solving the problem of shortage of medical personnel and medical materials in Wuhan. Also, the whole country uses the shooting function of unmanned aerial vehicles (UAVs) to monitor citizens who go out at will during the epidemic period in real-time, to conduct all-round investigation in key areas, to carry out propaganda from a distance for personnel who do not meet the regulations on going out, and to vigorously publicize the knowledge of epidemic prevention and control, so that UAVs become "patrol members" in fighting the epidemic, forming an "air+ground" three-dimensional full coverage epidemic prevention network, providing an indestructible scientific and technological guarantee for the national fight against the epidemic. In addition to its function of delivering materials and mastering the movement of personnel, unmanned aerial vehicles also performed a wonderful and inspiring public welfare performance on February 9. On that day, a fleet of 500 unmanned aerial vehicles over Guangzhou's Pearl River formed patterns such as "Wuhan Refueling," "Fighting Epidemic," "Wearing masks and Defending Viruses," inspiring Wuhan people's courage to overcome the disease in a special way, sending warmth from all parts of the country to Wuhan through a different voice, and enhancing the confidence of the whole nation in the war of resistance through a brand-new expression contributing high airpower to the country's fight against epidemic prevention.

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