Ensuring the National Security of Ukraine Through the Standardization of Space Activities

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Soroka, Larysa, and Oleksandr Ovcharenko (2022) Ensuring the National Security of Ukraine Through the Standardization of Space Activities. *Advanced Space Law*, Volume 9, 81-92. https://doi.org/10.29202/asl/9/8

The article analyzes international, including European, and national standards of the process of standardization of space activities. The author reveals the concept of "standard" as one of the main elements of the system of state guarantees of the safety of space activities. Using the method of empirical research, the current state of standardization of space activities in Ukraine was fully and objectively investigated. The comparativist method was used for a comparative analysis of the administrative and legal regulation of space activities in foreign countries and its compliance with international and European standards and principles, which allowed: first, to reveal the level of understanding by the international community of the importance of its processing and legal regulatory settlement; secondly, to form specific methods and initiatives to improve the administrative and legal provision of space activities and the development of the space industry in Ukraine. The article determines that the international aspect of standardization is quite relevant. The activity of standardization entities and the presence of a significant number of standards are proof of that. However, the main problem is their voluntariness. Obligation as a feature of these standards is present only in the case of their national settlement. This indicates the need to revise the paradigm of regulating international relations with the transition to the concept of global space management based on mandatory standards for all participants in space relations. The departure from the contractual paradigm with the further development of global space management will ensure the unity of the standard rules for the implementation of space activities, their obligatory status and the mechanisms of sanctioning influence for violations of the established modes of development and usage of outer space.

Keywords: standards, standardization, space activity, legal regulation, global administration, national security, state guarantees.

Received: 27 February 2022 / Accepted: 18 March 2022 / Published: 10 June 2022

Introduction

At the beginning of its existence, international space legal relations were built on the basis of publicity. At that time, this meant that only the state was responsible for carrying out space activities. However, the scientific development of the private sector far outpaced the space innovations of state institutions, so the change in the nature of space legal relations from state to mixed (public-private) was inevitable and depended only on time. A clear example of such cooperation is the program of NASA Centennial Challenges (NASA's, 2022), which provides $200 000 – $2 000 000 USD to support innovation in areas of interest for the agency, including the support of representatives of the private sector.

Ukraine has a difficult situation of ensuring the development of space activities and its compliance with international standards. Permanent underfunding of space programs (according to the report of the State Space Agency of Ukraine in 2020, UAH 95 000 thousand was planned, and in fact, 70% (Public, 2021) was financed, and in the structure of the market for the sale of products of the industry, the state direct order was 2.1%), providing permission to work in the space industry for private companies only from 2020 (On amendments, 2019) – restrained and restrains the development of space activities. Therefore, it is the state guarantees that should become a "stabilizer" and a guarantee for the development of the space industry on the national and international levels.

Today, space practice shows that effective market mechanisms and self-regulation tools in the implementation of national space activities (for example, certification, verification of compliance with operational suitability requirements, and technical regulations) ensure the safety of space products for an unlimited number of people (Shemshuchenko & Semeniaka, 2019). In this way, the state guarantees safety in processing of space activities.

At the legislative level in Ukraine, it is determined that the purpose of state support for space activities is: the preservation and further development of the scientific, technical, technological and productional potential of the space industry as one of the factors of national security; increasing the export potential of the space industry and the competitiveness of developments (products) of national subjects of space activity; creation of economic conditions and provision of guarantees for attracting investments (including foreign ones) in the development of the space industry (On state, 2000).

As a result, it is quite simple to determine the relevance of the consideration of the problem of the implementation of the standardization of space activities: unambiguity, uniformity and totality of the rules for the procession of space activities, which are practical for use by both private and public participants of space activities – one of the keys to ensuring the global security of mankind. Having revealed the concept of standards and standardization as one of the main elements of the system of state guarantees of the safety of space activities, having researched the current state of standardization of space activities in Ukraine and having analyzed its compliance with international and European standards and principles, we will be able to: first, reveal the level of understanding by the international community of the importance of

the process its implementation; secondly, to form specific methods and initiatives to improve the administrative and legal provision of space activities and the development of the space industry in Ukraine.

The essence of state guarantees of space activity

In legal literature, there is no single approach to understanding the term "guarantee." Hence, due to the ambiguity of the interpretation of the mentioned term, there are disagreements in its understanding at the scientific and doctrinal levels. Thus, in the legal literature, there are various signs that form the basis of the concept of guarantees. Scientists define the guarantee as "conditions," "means," "factors," "measures," "state obligations," "mechanism," etc. Guarantee is a very extensive socio-political and legal phenomenon, which is used in many fields of legal, sociological, philosophical, political science, economics, and other sciences (Kulinich, 2014: 79-80). The explanatory dictionary of the Ukrainian language defines the concept of "guarantee" as a surety in something, provision of something; conditions that ensure the success of something (Bilodid, 1971: 29). The basis of the most common definitions of the general concept of guarantees is the methodological understanding that guarantees are certain means of ensuring the actual possibility to enjoy rights and freedoms. So, with the help of guarantees, the state creates all the conditions for a person to enjoy his rights and freedoms (Soroka, 2020).

Therefore, guarantees are the proper conditions supported by legal norms to ensure certain social relations.

The current legislation of Ukraine actively uses the term "guarantee." In general, its interpretation is reduced to the provisioning process of something, which contains two integral components: implementation and protection. Therefore, today it is urgent to develop such theoretical legal means and conditions, which in practice would be maximally implemented and protected (Kulinich, 2014: 79-80).

Despite the different approaches to the understanding of the term "guarantee," it should be noted that they all have certain similar features, including 1) methods and means considered as a whole; 2) their legislative implementation; 3) they are aimed at achieving one or another goal. To guarantee means to take responsibility for something; to give a promise, a surety in the performance of something (Terekhin, 2001: 43). Each of these conditions and means is directly defined in the Constitution when it comes to guarantees. They are traditionally enshrined in the Basic Law in the form of generalized principles, such as: humanism, justice, legality, expediency, equality, etc. (Constitution, 1996; Yehorova, 2012).

Accordingly, we can determine that the most common definition of the term "guarantees" is the understanding of it as specific means that provides an opportunity to implement a certain action. At the same time, it is more about the fact that the state guarantees that all conditions are created so that people can enjoy their rights and freedoms and authorities can exercise their powers.

Here it is necessary to clarify that, according to our vision, in the space industry, the category of "guarantees" has a slightly different meaning, different from legal guarantees, since by their nature guarantees in the researched field are actually standard rules for the implementation of space activities.

Taking into account the peculiarities of standard legal guarantees and the norms of the current legislation in the space industry, it can be determined that the state guarantees of space

activity should be understood as the rules for the implementation of space activities, which are formed by regulatory and legal acts into a coherent, interdependent system that establishes the procedure for determining the object's compliance of space activity to operational criteria (certification, registration, standardization), features of legalization of subjects of space activity and requirements for such economic activity (licensing, permit system), provision of safety measures (environmental protection in the process of space activity; conducting search, emergency and rescue works in the space industry; official investigation of incidents and extraordinary events, etc.) and other rules for ensuring effective and progressive space activities (control and supervision activities, insurance, etc.).

As a result of the reform of the space industry of Ukraine, the system of state guarantees for the provision of space activities has changed somewhat. The modern principles of space activity, determined by the legislation of Ukraine, seem to be an interconnected area with a system of state guarantees for space activity, which are comprehensively created for the development of the space industry. But the compliance of space activities in Ukraine with international standards is still imperfect. As an example, the standardization of private space activities is currently poorly regulated.

In general, all processes of the development and functioning of space activities in Ukraine (commercialization, investment, reform, scientific and technical development, international cooperation) can be effectively implemented only through state guarantees for the provision of space activities, which must comply with international standards and principles. With the understanding that there have been radical changes in the procedure for carrying out space activities in Ukraine as a result of the adoption of the Law of Ukraine "On Amendments to Certain Laws of Ukraine Regarding State Regulation of Space Activities" dated October 2, 2019 № 143-IX (On amendments, 2019), state guarantees for the development of space activities require a comprehensive study, including the standardization of space activities as a leading condition for the state's guarantee of proper security of such activities.

Standardization and standards of space activity in Ukraine

The process of standardization of space activity as a form of state guarantee of its safety must necessarily meet both established national and international standards.

Back in 1975, David Hemenway, in his work *Industry Wide Voluntary Product Standards*, pointed out that "ironically, standards have not been completely standardized" (Hemenway, 1975). Therefore, the legal definition of any terms and processes is of great importance for jurisprudence and application practice.

The Law of Ukraine dated June 5, 2014 No. 1315-VII "On Standardization" gives the following definition of standardization – it is an activity that consists of establishing provisions for general and repeated use in relation to existing or potential tasks and is aimed at achieving the optimal degree of order in a certain area. Accordingly, a standard is a normative document based on consensus, adopted by a recognized body, establishing for general and repeated use rules, guidelines, or characteristics of activities or their results, and aimed at achieving an optimal degree of order in a certain area (On standardization, 2014).

A similar definition of the term "standardization" is also used in the national legislation of individual countries. For example, in the US Law "National Technology Transfer and Advancement Act of 1995" (National, 1996) determined that this is: "Common and repeated use of rules, conditions, guidelines or characteristics for products or related processes and production methods, and related management systems practices" (Circular, 1998).

Therefore, standardization is necessary and mandatory, although in most cases voluntary, activity in the space sphere, and the standard is a legal basis for such activity.

National standards, codes of established practice and amendments thereto, in accordance with the "Agreement on Technical Barriers to Trade" dated 15.04.1994 (Agreement, 1994), are developed in a manner that does not create technical barriers for trading and allows them to occur and appear.

Depending on the level of the subject of standardization, standards are divided into national standards and codes of established practice adopted by the national standardization body; standards, codes of established practice and technical conditions adopted by enterprises, institutions and organizations carrying out standardization. They are developed on the basis of: 1) international standards, codes of established practice and amendments thereto, if they have already been adopted or are at the final stage of development or their corresponding parts, except in cases where such standards, codes and amendments are ineffective or inappropriate, in particular with due to insufficient level of protection, significant climatic or geographical factors or technological problems; 2) regional standards, codes of established practice and amendments to them or their corresponding parts in the event that international standards, codes of established practice and amendments to them cannot be used for the reasons specified in paragraph one of this part; 3) standards, codes of established practice and amendments to them or their corresponding parts of states that are members of relevant international or regional standardization organizations and with which relevant international agreements of Ukraine on cooperation and carrying out work in the field of standardization have been concluded; 4) scientific achievements, knowledge and practice (On standardization, 2014).

The bodies of the public administration of Ukraine that adopt normative legal acts in the field of standardization are 1) the central body of executive power, which ensures the formation of state policy in the field of standardization; 2) the central body of the executive power, which implements the state policy in the field of standardization; 3) national standardization body; 4) technical standardization committees; 5) enterprises, institutions, and organizations carrying out standardization (On standardization, 2014).

So, depending on the level of the public administration body that adopts regulatory documents in the field of standardization, they are divided into 1) national standards and codes of established practice; 2) local standards, codes of established practice and technical conditions.

It should be noted that in accordance with the Order of the Cabinet of Ukraine "On the definition of a state enterprise that performs the functions of a national standardization body" dated November 26, 2014, No. 1163 (On the definition, 2014), the state enterprise "Ukrainian Research and Training Center for Standardization, Certification and Quality" performs the functions of the national standardization body. On its official website, free of charge (http://uas.gov.ua/), it posts the texts of national standards and codes of established practice no later than 30 calendar days after the official publication of such acts.

National standards and codes of established practice are applied: 1) directly or by reference to them in other documents; 2) on a voluntary basis, except in cases where their application is mandatory established by regulatory and legal acts.

Therefore, the standardization of space activity is the process of formation and establishment by authorized subjects of the rules for the processing of space activities and the operation of space objects in the form of requirements and criteria for multiple uses (of standards) with the aim of streamlining legal relations in this area (in particular, demonopolization of the space

industry and observance of equal trade rules), as well as guaranteeing high-quality and safe space activities.

It should be noted that as of January 1, 2022, the base of national state standards of Ukraine of the State Enterprise "UkrNDNC" included more than 36,000 DSTU (state standards of Ukraine). The search process in the DSTU database (National, 2022) allows obtaining the following results regarding state standards in the field of space activities: DSTU 2795-94 "Spacecraft control systems. On-board cable network. General technical requirements"; DSTU 4415:2006 "Aerospace industry. Non-metallic materials. Textile materials – narrow woven fabrics. Specifications"; DSTU ISO 14620-1:2002 "Space systems. Security requirements. Part 1. System security"; DSTU 4179:2017 "Aerospace series. Qualification and certification of personnel for non-destructive testing"; DSTU 9100:2018 "Quality management systems. Requirements for organizations of the aviation, space and defense industries"; DSTU "1540:2006 Aerospace systems. Characteristics of airborne electrical systems"; DSTU 9300-004:2018 "Aerospace industry. LOTAR. Long-term archiving and retrieval of digital technical documents"; DSTU 10168:2018 "Steel products. Acceptance documents. List of information and description"; DSTU ISO 14222: 2019 "Space environment (natural and artificial). The upper layers of the Earth's atmosphere"; DSTU 4220-2003 "Remote sensing of the Earth from space. Terms and definitions of concepts"; DSTU 4758:2007 "Remote sensing of the Earth from space. Data processing. Terms and definitions of concepts"; DSTU 7307:2013 "Remote sensing of the Earth from space. Terrestrial data on the control of the state of crops and the productivity of agricultural crops. General requirements"; DSTU 7894:2015 "Remote sensing of the Earth from space. Methodology of data processing. The order of development."

Searching the DSTU database for the word "satellite" allows you to get the best result – 36 DSTU. Regarding satellite radio navigation systems, for example, DSTU 2599-94 "Satellite radio navigation network systems. Terms and definitions"; regarding satellite telecommunication systems, for example, DSTU 3560:2007 (IEC 60050-725:1988) "Satellite telecommunication systems. Terms and definitions of concepts"; regarding satellite communication system stations, for example: DSTU 4162:2003 (ETSI EN 301 443 V1.2.1:2001) "Terrestrial satellite communication system stations. Classification. Basic parameters and methods of measurement"; regarding digital television broadcasting, for example, DSTU ETSI EN 302 583:2010 "Digital television broadcasting. Frame structure, channel coding and modulation techniques for satellite broadcasting services to portable receivers in frequency bands below 3 GHz."

The given examples show that one of the actual tasks of the national space industry is the development of technical legal regulation of space activities, in particular, through the implementation of European and international standards. This applies both to space activity in general and to specific types of it.

Therefore, the standardization of space activity is a process that comprehensively establishes the legal relationship of the state between the subjects of space activity in order to exercise legal control over space activity and implement high-quality, safe and progressive space activity in Ukraine that meets international and national standards. And since space activity is mostly regulated by administrative and legal mechanisms modernized under the conditions of European integration and globalization, a wide system of standards is used in the process of standardization in Ukraine, the basis of which is international and European standards, the analysis of which is presented below.

International standards of space activity

In the space sphere, international standards play an almost decisive role in the standardization process. The unifying institutional subject of standardization is the International Organization for Standardization (ISO) (International, 2022). It is an independent non-governmental international organization, which includes 164 national standardization bodies. Through its members, ISO brings together experts to share knowledge and develop voluntary, consensus-based, international standards that support innovation and offer solutions to global challenges. ISO has published more than 20,000 international standards and related documents covering almost every industry, from technology to food safety, agriculture and healthcare.

As for the international standardization of space activities, today ISO has developed over 24338 International Standards, and all are included in the ISO Standards catalog. In chapter 49, "Aircraft and space vehicle engineering" which has subsection 49.140 entitled "Space systems and operations including space data and information transfer systems, and ground support equipment for launch site operations" (Space, 2022) it's placed more than 300 standards which consider the space activities.

In the space industry, Ukraine is also guided by a number of ISO standards, for example, ISO 24113:2011 "Space systems – Space debris mitigation requirements" (this standard has been revised by ISO 24113:2019) (ISO, 20110; ISO/TR 16158:2013 "Space systems – Avoiding collisions with orbiting objects" (ISO / TR, 2013), ISO 20892:2018 "Space systems – Launch complexes modernization process – General requirements" (ISO, 2018), ISO 16126:2014 "Space systems – Assessment of survivability of unmanned spacecraft against space debris and meteoroid impacts to ensure successful post-mission disposal" (ISO, 2014).

As can be seen from the quantitative ratio of existing international standards and standards used in Ukraine, it can be stated that the process of bringing the domestic space industry closer to the level of the leading space states is still ongoing.

The next body that develops and implements international standards in the space sphere is the International Telecommunication Union (ITU). ITU is a specialized agency of the United Nations in the field of information and communication technologies (ICT). Founded in 1865 to facilitate international connectivity in communications networks, the ITU allocates global radio spectrum and satellite orbits, develops technical standards that ensure seamless interoperability of networks and technologies, and directs efforts to expand access to ICTs in the world's underserved (About, 2022).

The main instrument used by the ITU in creating a regulatory and legal environment, policy formation, and dissemination of best practices in the specified sphere is the public-private partnership of its members. Because now, as never before, all ITU participants realize that the path to sustainable development can be found in close cooperation with state bodies, academic organizations and other interested parties. And such cooperation should be within the framework of joint efforts to implement appropriate norms and standards that would promote investment, innovation, and wide opportunities for joint use (About, 2022) of both ICT in general and space technologies in particular.

Thus, the ITU structure includes The Space Services Department (SSD), which is responsible for coordination and recording procedures for space systems and earth stations (Space Services, 2022). It consists of Space Publication and Registration Division (SPR), Space Systems Coordination Division (SSC), and Space Notification and Plans Division (SNP).

Specialists of the said Department are engaged in the collection, processing and publication of data, as well as verifying frequency assignment notifications submitted by administrations for inclusion in official coordination procedures or recording in the Main International Frequency Register (MIFR). The Department is also responsible for managing the procedures for ISS space assignment or allocation plans and assisting administrations in all of the above matters (Space Services, 2022). ITU also regularly publishes Weekly Information Circulars and International Frequency Information Circulars for Space Services containing Parts and Special Sections publications with information on the frequency assignments for space stations, Earth stations or radioastronomy stations submitted to the Radiocommunication Bureau by ITU Member State administrations (BR, 2021).

It should be noted that the current problem of international standardization of space activities is in the fact that the adoption of standards is voluntary because they do not have the weight of international treaties. So, for example, at the legislative level of the USA in NIST Circular A-119 in the market, the use of international standards is a voluntary consensus (Circular, 1998). And such wording is also placed in the legal acts of other countries. And as some authors rightly determine (Spencer, 2010), due to the inability of states to reach any agreement on the binding nature of international norms in space activities, the development of space law has slowed down. Its existence in the form of "soft law" in which principles, guidelines and codes of conduct are represented, has resulted that its non-compliance has no legal consequences because it is not binding. All of the above also applies to international standards used in the space sphere. Even though each state regulates space activities taking into account national interests, the most important reason and one common basis for state regulation, and therefore compliance with international standards, is the international responsibility of the state for national activities in outer space, as stated in several international space treaties and other documents.

EU standards

It should be noted that in accordance with Chapter 8 of Section V of the Association Agreement between Ukraine and the EU, the parties agreed to promote the development of mutually beneficial cooperation in the field of civil space research and use of outer space, in particular, in the following areas: 1) global navigation satellite systems; 2) Earth observation and global monitoring; 3) space science and research; 3) applied space technologies, in particular launch technologies and rocket engine technologies (Association, 2014). Such cooperation may include the exchange of experience in the field of management of space research and scientific institutions, as well as the creation of favorable conditions for conducting research and the introduction of new technologies and the proper protection of relevant intellectual, industrial and commercial property rights.

The main goal of the modern space policy of Ukraine in the European direction is active cooperation with the European Commission (EC), the European Space Agency (ESA), EU member states and their space agencies, as well as participation in the AURORA program (Interplanetary Missions Program), GALILEO projects (European Global Navigation Satellite System), GMES (Global Monitoring for Security and Environment) and FLPP (Future Spacecraft Training Program) and gradual acquisition of membership in the European Space Agency (ESA). In order to promote cooperation with the European Commission, ESA created a mechanism for such cooperation – the Joint Working Group on Cooperation of Ukraine with

the EU in the field of Space Research and the Use of Space for Peaceful Purposes within the framework of the Ukraine-EU Committee on Cooperation (Brussels, March 2003) (Report, 2022; International, 2021).

Since the process of European integration is underway in Ukraine, particularly in the space industry, the ESA of Ukraine tries to cooperate with the ESA closely; therefore, in the field of improving the space industry, European standards must also be taken into account. Thus, The European Space Agency created the European Cooperation for Space Standardization (ECSS) (Latest, 2022), which is a platform for the development of a coherent, single set of user-friendly standards used by all European space activities.

Examples of European space standards are ECSS-E-AS-50-26C-DIR1 "Space engineering – Adoption Notice of CCSDS 232.1-B-2, Communications Operation Procedure-1, Issue 2, September 2010," ECSS-E-AS- 50-25C-DIR1 "Space engineering – Adoption Notice of CCSDS 232.0-B-3, TC Space Data Link Protocol, Issue 3, September 2015," ECSS-E-ST-50C-Rev.1-DIR1 "Space engineering – Communications," ECSS-E-ST-32-01C Rev.2 DIR1 "Fracture control": Public Review (9 December 2019 – 14 February 2020), ECSS-Q-ST-70-16C-DIR2 "Space product assurance – Adhesive bonding for spacecraft and launcher applications," etc.

Therefore, the goal of the national space policy of Ukraine is the activation of scientific research and technological innovations, as well as raising the scientific and technical levels to EU standards. Cooperation with the EU in the field of science and technology (especially in the space field) is considered in Ukraine as a decisive factor for achieving economic development based on innovation.

Conclusions

Security guarantees are a complex and multifaceted phenomenon. Their specificity is due to the multi-disciplinary direction. The development of space technologies and products cannot be considered separately from the processes of innovative development, scientific and technological progress, or ensuring the ecological, national, and information security of mankind. However, space safety guarantees themselves are a specific type of legal guarantee, as they are standard rules for the implementation of space activities.

The presence of a permit procedure, standards and a standardization process is a guarantee that binds states to implement their obligations under the 1975 Liability Convention. The provisions of which indicate that the state that launched the space object bears absolute responsibility for the damage caused by such activity. At the same time, mixed space relations in this aspect do not have a sufficient normative basis for development. The standardization system in the field of private sector activity is insufficient.

Within the framework of this study, we needed to provide an answer to two main questions: the attitude of the international community to the importance of the process of standardization of space activities and what necessary actions should be taken by the public administration to improve the implementation of administrative and legal support for space activities and the development of the space industry in Ukraine.

Thus, we discovered that the international aspect of standardization is quite relevant. The activity of standardization subjects and the presence of a significant number of standards are proof of that. However, the main problem is their voluntariness. Obligation as a feature of these standards is present only in the case of their national consolidation. This indicates the

need to revise the paradigm of regulating international relations with the transition to the concept of global space management based on mandatory standards for all participants in space relations. The departure from the contractual paradigm with the further development of global space management will ensure the unity of the standard rules for the implementation of space activities, their obligation and the mechanisms of sanctioning influence for violations of the established modes of development and use of outer space.

We also discovered that Ukraine has a rather difficult situation regarding compliance with international standards of space activity. One of the urgent tasks of the domestic space industry is the development of technical regulatory regulation of space activities, in particular, through the implementation of European and international standards. This applies both to space activity in general and to specific types of it. The specified activity is cumbersome, but necessary in the conditions of the declared development vectors of Ukraine.

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