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INTERNATIONAL SECURITY AND OUTER SPACE – TODAY'S LAW CHALLENGES

Abstract

Space security means safe and permanent access to space and limiting threats coming from there. This definition also includes the security aspects of man-made devices sent into space and of ground stations. Space infrastructure can be described as a network of space and ground systems connected by communication channels and allowing access to space. Today, the largest space powers have begun to consider space as an operational domain of warfare. Space more and more often appears to be a field for competition, which might become an arena of conflict.

The aim of this article is to present today's many law challenges to the security of space infrastructure, such as unintentional threats (space debris, geomagnetic and solar storms, and other random disturbances), intentional threats (ASAT anti-satellite weapons, malicious interference, and cyber-attacks), the growing problems of Earth orbit congestion, and the increasing amount of space debris from devices launched into space. The article also presents the role of international organizations (such as the UN Committee on the Peaceful Uses of Outer space) in making laws that are intended to observe and react to all changes necessary in the outer space environment and to be proactive to help outer space to be safe and secure for all mankind. The conclusion is, however, not optimistic. Space security is a sensitive issue, mainly during conflicts or wars. States are not inclined to bind themselves by international law in this matter. Thus, due to the absence of hard international law (treaties), bilateral and multilateral agreements as well as the best practices from countries that organize space flights must

apply. Space monitoring systems, such as the Situational Awareness System (SSA), the code of conduct in space, the UN Long Term Sustainability, or the space Traffic Management rules are legal tools to manage the above challenges in space today.

KEYWORDS

space security, Space Situational Awareness SSA, code of conduct in space, space traffic management, space debris

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bezpieczeństwo kosmiczne, świadomość sytuacyjna SSA, kodeks postępowania w kosmosie, zarządzanie ruchem kosmicznym, śmieci kosmiczne

1. INTRODUCTION

Space safety and security mean a secure, safe and sustainable access to space and mitigation of space hazards. This definition covers also aspects of safety and security of man-made equipment sent into space as well as ground stations. Space infrastructure can be described as a network of space and ground systems connected by means of communication channels and enabling access to space. Safety and security of space infrastructure involve numerous challenges, such as: unintended hazards (space debris, geomagnetic and solar storms and other accidental interferences), intended hazards (anti-satellite weapons – ASAT, malicious interferences and cyber-attacks) and increasing problems with Earth orbit congestion and growing quantities of space debris coming from equipment launched into space.

The aim of this article is to present the function of the Space Situational Awareness (SSA) programme as a tool that might play a significant role in space policies of countries. The creation of national or regional SSA systems should guarantee safety and security of people and infrastructure (in particular of satellites) from various threats both in space and on Earth. Therefore, establishment of permanent observation of space objects should be an essential component of a space policy (Space Surveillance and Tracking – SST). An SSA system should be, moreover, correctly implemented into the policy and law of individual countries.

Discussions about the term "Space Situational Awareness" were undertaken in the 1970s and it was defined as extensive knowledge about space objects and the ability to track, understand and predict their future location. The aim of this

programme is to protect space systems regarded as primary assets of a country's sustainable development. Destruction of even a part of space infrastructure might have serious consequences for the safety and security of citizens and the economic activity. The SSA system provides for combining all data acquired by various entities acting in space and on Earth for the purpose of creating a common database.

The creation of national or regional SSA systems should guarantee the safety of people and infrastructure (in particular satellites) in space and on Earth against various threats. Moreover, the SSA system should be properly implemented into the policies and laws of individual states. Increasingly, the SSA program is part of national space strategies, but so far there is no possibility of including it in international space law.[1] The only soft law regulations seem to be the LTS (Long Term Sustainability) and STM (space Traffic Management) rules discussed in international organizations and other international forums.

II. PROTECTION OF SPACE IN THE INTERNATIONAL ARENA

II.1. INITIATIVES ON THE UN FORUM CONCERNING SAFE AND SECURE ACTIVITY IN SPACE

The concept of space safety and security is an important matter of current discussions and debates on the forum of the UN and its specialised organisations. They concern both international security and disarmament and peaceful use of space; the latter has become a broadly employed notion, often without a uniform meaning. Indeed, no precise, generally accepted definition of space safety and security has been prepared to date.

A range of initiatives on various UN forums point to the growing pressures exerted by the international community in relation to all aspects of space, including safety and security and the enhancement of the multi-lateral system that regu-

[1] P. Zimmer, M. Ackermann, J.T. McGraw, *Telescopes and Optics for Space Surveillance (SSA)*, AMOS (Advanced Maui Optical and Space Surveillance Technologies Conference), 15–18 September 2020; M. Polkowska, *Prawo bezpieczeństwa w Kosmosie*, Warsaw 2018; B. Chanock, *The Problems and Potential Solutions Related to the Emergence of Space Weapons in the 21st Century*, 'Journal of Air Law and Commerce' 2013, Vol. 78(4), p. 691 ff.; J. Su, *Use of Outer Space for Peaceful Purposes: Non-Militarization, Non-Aggression and Prevention of Weaponization*, 'Journal of Space Law' 2010, Vol. 36, p. 253; P.K. Gleeson, *Perspectives on Space Operations*, 'AIJSPP' 2007, Vol. 5, pp. 145–172. ESPI Report 66, Security in Outer space: Perspectives on Transatlantic Relations, October 2018, https://espi.or.at/news/espi-public-report-66-security-in-outer-space-transatlantic-relations (accessed 20.09.2020); S. Moranta, *Security in Outer space: Perspectives on Transatlantic Relations*, 12th ESPI Autumn Conference, Vienna, 27 September 2018.

lates the use of space. At the same time, significant differences between countries emerge as regards priorities, methodologies, mechanisms and settings that serve to solve problems related to space safety and security, and the majority of initiatives transform into unending discussions. However, another challenge might be more disturbing: deadlocks in the work of one authority can be transferred to other forums, thus limiting progress even in those aspects in which there has been a consensus traditionally. The existing frictions between various UN bodies are also a factor that limits any activities, similarly to the many years long split between the civil and the military use of space.

This situation has somewhat improved recently. Diplomacy regarding space safety and security looks relatively promising: at least it is more effective than in previous years. Discussions about short- and long-term solutions will probably be still conducted in parallel. While discrepant priorities and perceptions of space safety and security have still been (and will be) present among the leading "space" countries, the existence of a political will that takes into account rather than eliminates these differences might be key in finding a common ground for future actions, which will be acceptable to various parties. Due to the nature of the hazards to the space infrastructure and services, the general perception of the threats might be the reason for countries to decide to collaborate and find a future consensus.[2] Such a consensus would be also of great importance to SDA and SSA programmes; it might be possible to reduce their interest in military objectives and increase the emphasis on civil matters, among others, observation of events in space and on Earth as well as actions for defence against space debris, meteorites and cyber-attacks.[3]

Interest in space activity on the part of the private sector was already observed in the early 1980s in certain Western countries, mainly in the USA. The rapid development of commercial activity in space began basically upon the change in the international political situation in the early 1990s when the Soviet Union ceased to be one of the two biggest powers (the Russian Federation formed on the major part of its territory). As a consequence, democratic countries, chiefly the United States, decided to admit private entities to space activity to a greater degree, as they were more resourceful and efficient than state-owned entities.[4] Shortly thereafter another step of this process took place, where the government and private companies purchased services from the private sector. This is a new

[2] M. Pellegrino, *Views on Space Security in the United Nations*, (in:) K.-U. Schrogl (ed.), *Handbook of Space Security. Policies, Applications and Programs*, Vol. 2, New York/Heidelberg/Dordrecht/London 2015, pp. 1555–1558.

[3] ESPI Report 71, Towards a European Approach to space Traffic Management, January 2020, pp. 10–11, www.espi.or.at (accessed 28.04.2021).

[4] D. Sagar, *Privatization of the Intergovernmental Satellite Organizations*, (in:) A. Kerrest (ed.), *Le droit de l'espace et la privatisation des activites spatiales*, Paris 2003, pp. 43–61; B.E. Bowen, *War in Space. Strategy, Space Power, Geopolitics*, Edinburgh 2020, p. 9.

business model and a new type of partnership. It helped create numerous innovative technologies and projects and the space industry became a significant source of GDP growth in certain countries.

The 21st century has brought plenty of remarkable achievements in the space management process. New technologies have been devised, the space industry has been commercialised, the number of countries pursuing an activity in space have increased, projects for utilisation of space resources have been launched, etc. The value of production and services generated by the global "space" economy in 2018 was estimated at approx. USD 360 billion.[5] However, the continual process of space commercialisation requires the existing legislation to be adapted to the current needs and challenges. Moreover, the political and economic competition exacerbated the conflicts between countries. In this situation, space safety and security covering two significant issues: secure, safe and sustainable access to space and mitigation of space hazards, have become more important.

Space applications, including remote sensing, signal intelligence, tele-communication and positioning/navigation, important for civil economies, have become key for military operations ever since the first Gulf War. The threats to space safety, security and infrastructure have multiplied, diversified and intensified over the past decade. Apart from safety and security issues related to the increasingly more congested space environment, space systems might also become targets of attacks aimed at physical damage to them, permanent destruction or temporary disruption of their capabilities or interception of confidential information. Not only military but also civil satellites are under this threat because boundaries between civil and military domains tend to blur: dual-use equipment has become widespread and military forces more and more often use commercial space services.

The threat of a space war is not realistic for the time being, but intensive armament processes in certain countries do not result in releasing the tensions in space and on Earth. It seems that the only solution here is patient diplomatic negotiations between the conflicted parties.

Given the absence of international laws, some countries regulate the issues related to the activity of private entities through internal legislation.[6] This gave rise to the idea of global cooperation between countries and private entities.[7]

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[5] G.S. Robinson, *Space Jurisdiction and the Need for a Transglobal Cybernation: the Underlying Biological Dictates of Humankind Dispersal, Migration and Settlement in Near and Seep Space*, 'Annals of Air Space Law' 2014, p. 325; R.S. Jakhu, *Introduction into the Conference*, 3rd Manfred Lachs International Conference on New Space Commercialization and the Law, 16–17 March 2015, Montreal, ICAO.

[6] R. Skaar, *Commercialization of Space and its Evolution, Will New Ways to Share Risks and Benefits Open Up a Much Larger Space Market?*, ESPI Report 4, May 2007, p. 5 ff.

[7] J. Monserrat Filho, *Why and How to Define "Global Public Interest"*, 'Proceedings of the Forty Third Colloquium on the Law of Outer Space', International Institute of Space Law of the International Astronautically Federation, 2–6 October 2000, Rio de Janeiro, Brazil, pp. 22–32.

A good example here is the regulations governing the activity of the International space Station (ISS).[8] Still, there are no sufficient legal solutions regulating, for example, operations of satellites. Means to facilitate satellite launches should be international standards independent of political circumstances and equal for all stakeholders, including private entities.[9]

Commercialisation of space activities is a natural result of the continuous development of space technology, but it leads to a range of legal issues which entail, among others, civil liability.[10] Some believe that this issue should be left to the market itself.[11] space transport services and telecommunication might require separate and specific international laws. Other authors argue that spaceflights may take advantage of the third and fourth freedoms of air (jointly), which were set already by the Chicago Convention[12] in 1944 and have applied to date in civil aviation. Transport of a satellite to Earth can be compared to cabotage (a satellite is deemed as a quasi-territory of a country).[13]

At present, private enterprises in certain countries are treated liberally: they only have to obtain a permit for pursuit of their activities in space from the country where they are registered. From the legal point of view, the technical and operational access to space is also free. Not all lawyers advocate excessive liberalisation of space activities, though; according to them an "international regulator" should take into account different opinions and requirements of countries, hence transport rights and an expansion of space activity cannot be identical for all countries.[14] Some authors point to the need to create a new branch of space law, i.e. law dealing with commercial activity in space.[15]

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[8] A. Farand, *Commercialization of International space Station Utilization: The European Partner's Viewpoint*, 'Air and Space Law' 2003, Vol. XXVIII(2), pp. 83–88.

[9] V. Leister, M.C. Frazier, *The Role of National and International Law in the Regulation of Space Activities*, 'Proceedings of the Forty Third Colloquium on the Law of Outer Space', International Institute of Space Law of the International Astronautically Federation, 2–6 October 2000, Rio de Janeiro, Brazil, pp. 164–167.

[10] H. Qizhi, *Certain Legal Aspects of Commercialization of Space Activities*, 'Annals of Air and Space Law' 1990, Vol. XV, pp. 333–342.

[11] P.D. Bostwick, *Liability of Aerospace Manufacturers: MacPherson v. Buick Sputters into the Space Age*, 'Journal of Space Law' 1994, Vol. 22(1-2), pp. 75–96. The author points to the growing number of court cases related to space equipment manufacturer's errors.

[12] Convention on International Civil Aviation, signed in Chicago on 7 December 1944, 15 UNTS 295.

[13] L. Ravillon, *Droits des contrasts spatiaux: quelques thèmes récurrents*, 'Revue Française de Droit Aérien' 1998, pp. 61–62. The author speaks of an evolution of the concluded space contracts due to the developing technology.

[14] H. Wassenbergh, *The Art of Regulating International Air and Space Transportation. An Exercise in Regulatory Approaches to Analyzing Air and Apace Transportation*, 'Annals of Air and Space Law' 1998, Vol. XXIII, pp. 201–229.

[15] P.A. Salin, *Orbites, fréquences et asteroïdes a l'heure de la commercialization des activités spatiales (vers une appropriation graduelle du patrimoine de l'espace?)*, 'Annals of Air and Space Law' 2001, Vol. XXVI, pp. 179–195.

As mentioned before, already in the 1980s the United States announced a space technology commercialisation programme, which included, among others, postulates for provision of convenient conditions for development of private enterprises and for support for their explorations and discoveries. Numerous US researchers are even convinced that private enterprises in the USA which pursue space activity should be permitted to circumvent certain legal regulations until they themselves create relevant laws concerning space operations.[16]

Nevertheless, jurisdiction issues remain a serious problem for private entities for the time being. The concept of responsibility for an activity that is in contravention to the rules of international law, including an activity of private entities, and responsibility of a country for damage inflicted by space objects, including by private operators, remains a fundamental problem of the international space law. Therefore, countries are forced to take internal measures to monitor and control the activity of private entrepreneurs.

Thus, controlling countries should have legislative mechanisms needed to determine the licensing and monitoring regime and a sanction system at their disposal. It seems that the international law should define the parameters and extent to which such control of private enterprises should be performed.[17]

As mentioned above, numerous countries have introduced their own regulations facilitating commercialisation, with the notable example of the United States (the first US law of 1984 was amended four years later).[18] Such kind of regulations should ensure safety and security, establish correct operational procedures, and facilitate acquiring outlet markets. It is important that relevant state authorities should be authorised for issuing commercial licences.

A rapid development of many private companies has been observable since the beginning of the 21st century thanks to the supportive attitude of certain countries (mainly the USA). New enterprises were founded (among others Nanoracks, Skybox and Made In space), while operations were commenced by new companies with older capital (Bigelow Aerospace, Blue Origin, spaceX or Virgin Galactic) and older companies making use of new technologies (Orbital Sciences, Boeing or Lockheed Martin). In addition, alliances were established between younger and older market players, such as Stratolaunch & Blue Origin and United

[16] A. Dula, *Authorization and Continuing Supervision of U.S. Commercial space Activities*, 'Air and Space Lawyer' 1984, Vol. 1(3), pp. 12–18; P.S. Dempsey, *The Evolution of U.S. Space Policy*, 'Annals of Air and Space Law' 2008, Vol. XXXIII, pp. 325–343; S. Trepczynski, *Benefits of Granting Immunity to Private Companies Involved in Commercial Space Ventures*, 'Annals of Air and Space Law' 2006, Vol. XXXI, p. 403.

[17] F.G. von der Dunk, *Public Space Law and Private Enterprise*, (in:) R.S. Jakhu (ed.), *Space Law – General Principles*, Montreal 2007, Vol. I, pp. 470–471.

[18] V.J. Vissepó, *Legal Aspects of Reusable Launch Vehicles*, 'Journal of Space Law' 2005, Vol. 31, pp. 165–217; Ch.W. Stotler, *International and U.S. National Laws Affecting Commercial Space Tourism: How ITAR Tips the Balance Struck Between International Law and the CSLAA (Commercial space Launch Amendment Act)*, 'Journal of Space Law' 2007, Vol. 33(1), p. 268.

Launch Alliance, or enterprises which do not deal with space equipment manufacturing on a daily basis.

Not every space activity is already regulated by national law. Even in the United States not all enterprises know which authority is responsible for issuing relevant permits for the operation of "space enterprises" and which one for the supervision over them.[19]

II.2 SPACE DEBRIS

Both SDA and SSA programmes have put an emphasis on solving the problem of space debris[20] created as a result of human activity in space. Several organisations, including OECD, and international committees, state administrations and space agencies have already conducted large-scale works related to the legal, technical and economic aspects of the problem of space debris and congestion in LEO. Insurance is also mentioned in this context.[21] Founded in 1993, the Inter-Agency space Debris Coordination Committee (IADC),[22] which affiliates many countries, including in particular China, is also heading in this direction. For the purpose of preventing and combating space debris, the IADC updates regulations in the form of recommendations for countries (IADC Space Debris Mitigation Guidelines) as soft law. The number of objects in space is still rising, thus this task seems impossible for the time being. The reason is people's carelessness; sometimes even carelessness of country leaders. The latest example here is the use of an ASAT by India in early 2019. Hopefully, the international community will not leave this act unpunished. National initiatives are one of the concepts of combat against space debris, apart from the activity of the IADC (guidelines). Space debris includes old, defunct satellites with various sizes and functions and parts thereof, which orbit and can re-enter Earth's atmosphere or pose a serious threat for operational satellites and other spaceships. Several failures of satellites have been caused by collisions with space debris. Commercial satellite operators and partners of the International Space Station had to repeatedly perform manoeuvres to avoid collisions with space debris over the past years.

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[19] M. Mineiro, *Regulatory Uncertainty for Non-Traditional Commercial Space Activities*, 3rd Manfred Lachs International Conference on New Space Commercialization and the Law, 16–17 March 2015, Montreal, ICAO.

[20] A. Koskina, *Artificial Intelligence and Space Situational Awareness: Data Processing and Sharing in Debris-Crowded Areas. ESA's Response*, 8th European Conference on Space Debris, 20 April 2021 (ESA/ESOC, 20-23 April 2021).

[21] M. Undseth, *The Economics of Space Debris in Perspective*, 8th European Conference on Space Debris, 23 April 2021 (ESA/ESOC, 20–23 April 2021).

[22] H. Krag, *The Space Debris Challenge, ESA's Response*, 8th European Conference on Space Debris, 20 April 2021 (ESA/ESOC, 20–23 April 2021).

When mentioning space pollution with space debris, problems related to its management and high costs are noticed. Therefore, it is proposed that low level forums and institutions be authorised to make decisions related to space debris elimination and to create a culture of cooperation based on trust and transparency. What is needed is inter-governmental discussions about global standards and amendments to treaties (e.g. as regards responsibility for debris left in space), public and private forums to facilitate the involvement of stakeholders (e.g. operators), preparation of standards on transparency and data exchange in SSA (e.g. with the use of artificial intelligence technologies) and enhancement of informal management tools, such as the establishment of ISO standards.[23]

II.3. PROPOSALS OF THE CODE OF CONDUCT IN SPACE

A code of conduct in space was initiated by the US Stimson Center. It was called "Rules of the Road" and concerned agreements on space operations on the international level. The key components of the code were: collision avoidance, prevention of creation of space debris, exchange of information and consultations concerning activities in space (for the purpose of reduction of amount of space debris) and allocation of space in orbits. The code was to be a voluntary, non-binding legal instrument. In addition, a code, as soft law, is easier to be agreed on, makes it possible to avoid lengthy discussions (e.g. about definitions) and constitutes an important signal for political processes, both home and abroad. There is risk, however, that such codes will be a distraction from efforts towards conclusion of international agreements.

December 2008, the Council of the EU officially presented a draft of its space code. As an international instrument, the code was intended to be binding on the countries which would become its members on a voluntary basis (except for norms that are uniform and customary – they are applied even by countries that are not signatories of the code). That act was to supposed to apply both to the military and the civil aspects of space operations; it was decided that it could bring practical benefits for safety and security in space and affect the operations performed there. The regulatory issues placed in the code, including defence issues, were an integral part of the European space policy, although the code did not grant the EU any particular role or responsibility. The code's objective was twofold. On the one hand, it helped reinforce the existing treaties, rules and other arrangements and it encouraged countries to join these initiatives and to implement their provisions into their legal order. On the other hand, the code supplemented UN treaties by

[23] D. Lambach, *Tackling the Space Debris Problem: A Global Commons Perspective* and N. Isnard, *Active Debris Removal: Mitigating Legal Barriers for Promising Technologies, Comparisons and Proposals* – presentations at the 8th European Conference on space Debris, 23 April 2021 (ESA/ESOC, 20–23 April 2021).

codifying good practices in the field of space operations, including notification and consultation. Despite these advantages, ultimately the idea of a code was not adopted by most countries.[24]

II.4. NEW GUIDELINES FOR CONDUCT IN SPACE (LTS)

Given the failure of the codes proposed by the Stimson Center and the EU, a similar initiative proposing the establishment of soft law was taken by the UN Committee on the Peaceful Uses of Outer space – UNCOPUOS. In June 2016, the Committee agreed on the first set of guidelines concerning long-term sustainability of outer space activities (A/71/20, Annex). In 2018, an agreement was reached regarding the preamble and nine additional guidelines (A/AC.105/1167, Annex III and A/73/20). However, the working group could not reach an agreement regarding its final report for a long time. On 21 June 2019, the preamble and 21 guidelines concerning "long-term sustainability of outer space activities" (LTS) were adopted during the 62nd UNCOPUOS[25] session. These documents contain programmes concerning the policy and regulatory framework for space activities. This is the outcome of over 8 years of work performed by the working group appointed by UNCOPUOS and supported by the United Nations Office for Outer Space Affairs (UNOOSA). The subject matter of their work concerned sustainable use of space. The Committee addressed countries and international organisations with an appeal to take relevant measures to implement the enacted guidelines.[26]

During said session, UNCOPUOS decided to establish, for the subsequent five years, a new working group to continue the work on the "long-term sustainability of outer space activities". The Committee decided that during the 57th session of the Scientific and Technical Subcommittee in 2020 the working group would agree on its own scope of authorisations, work methods and a special work plan towards:

a) specifying and analysing new challenges and considering possible new recommendations concerning "long-term sustainability of outer space activities";

b) exchanging the experiences, practices and conclusions drawn from the voluntary implementation of the adopted guidelines on the national level;

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[24] D. Oltrogge, *The Contributions of Commercial Best Practices to the Global Space Governance Continuum*, AMOS (Advanced Maui Optical and Space Surveillance Technologies Conference), 15–18 September 2020.

[25] The Committee on the Peaceful Uses of Outer space, http://www.unoosa.org/oosa/en/ourwork/copuos/index.html (accessed 28.04.2021).

[26] M. Polkowska, *Uchwalenie nowego kodeksu postępowania w Kosmosie; czy bliżej do opracowania projektu zarządzania ruchem kosmicznym?*, (in:) M. Polkowska (ed.), *Współczesne trendy w polityce bezpieczeństwa kosmicznego*, Warsaw 2020, pp. 49–66.

c) raising awareness and building potential, in particular among developing countries and those intending to commence activity in space.

Their 21 guidelines constitute the first tangible achievement of the Committee on the Peaceful Uses of Outer Space after 2007. Over the past 10 years, it has been possible to induce the majority of the member states not only to reach an agreement but also to continue further discussion on the implementation of the guidelines into the national legal systems of the member states.

Adoption of the guidelines, i.e. soft law, marks a huge success of the international community. The primary goal of the guidelines is to help countries and international organisations in their efforts towards mitigating the risk related to performance of space activities so that it is possible to maintain the present benefits and to tap future ones. The guidelines promote international cooperation in the area of peaceful use of and research on space.[27]

The long-term sustainability of outer space activities is defined as the ability to maintain the performance of activities there indefinitely in the future in a manner that accomplishes the objectives of fair access to the benefits of the exploration and use of space for peaceful purposes, for the purpose of meeting the needs of the present generations, at the same time preserving the space environment for future generations. This definition is consistent with the objectives of the Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space of 13 December 1963 and the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies.[28]

Countries understand that the maintenance of exploration and use of outer space for peaceful purposes is a goal which must be pursued in the interest of all humankind.[29] Adoption of the guidelines, i.e. soft law, marks a huge success of the international community.[30] LTS is included in Appendix 1 to this publication.

[27] A/AC.105/L.318/Add.4, 19 June 2019; V.19-04973.

[28] Res. 2222 (XXI).

[29] During the AMOS (Advanced Maui Optical and Space Surveillance Technologies Conference), 15–18 September 2020, the participants of the panel discussion titled: SSA Policy Forum/ Evolution of Industry Best Practices for Space Sustainability, facilitated by I. Christensen from the Security World Foundation, were asked about the notion of sustainability. It was stated that there was still no single definition. As underlined by one of the participants, it is important to preserve the space for the future generations and remember about a balance between those who are using space now and those who will use space in near or distant future. It is difficult to measure the notion of sustainability, so behaviors of countries and their compliance with the requirements, e.g. for dealing with the issue of space debris, are analyzed. For this purpose, a space sustainability rating is created and behaviors of countries and their operators are examined. For more see D. Woods, *Leave no Traces, ESA's Response*, 8th European Conference on space Debris, 20 April 2021 (ESA/ ESOC, 20–23 April 2021).

[30] UNIS/OS/518, 22 June 2019.

II.5. ADOPTION OF UN RESOLUTIONS CONCERNING PREVENTION OF MILITARISATION OF SPACE

Another success was the adoption of three resolutions regarding militarisation of space during the session of the First Committee (Disarmament and International Security) of the UN General Assembly in November 2019. The first resolution titled: "No first placement of weapons in outer space" was adopted by a vote of 123 in favour to 14 against, with 40 abstentions. This resolution was prepared based on an amended draft, proposed in 2008 by Russia, China, Cuba, North Korea and Syria, regarding the "possibility of undertaking political commitments not to be the first to place weapons in outer space". At that time it was alleged that the resolution contained numerous gaps, including the lack of a clear definition of a space weapon; as a result this draft was rejected.

The second resolution, concerning the preparation of "Further practical measures for the prevention of an arms race in outer space", was adopted by a vote of 124 in favour to 41 against, with 10 abstentions. Essentially, this meant an approval for the works of the Group of Governmental Experts, in operation since 2018, tasked with preparing "elements of an international legally binding instrument preventing an arms race in outer space".

The third resolution titled "Transparency and confidence building measures in outer space activities" was adopted almost unanimously (166 votes in favour to 2 against, with 5 abstentions). This resolution was proposed by the Group of Governmental Experts already in 2013.[31]

III. SPACE TRAFFIC MANAGEMENT PROJECTS

Space Traffic Management (STM) is one of recurring concepts referring to actions in space. The highest priorities are the security and protection of space and of all operations performed there. It seems that due to the growing congestion of space there is an urgent need to regulate the rules of space navigation on the international, regional and national levels. No generally accepted definition of STM and no comprehensive and unified collection of Space Traffic Management regulations have been created so far. It is unclear how or based on what authorisations an entity (organisation) could manage traffic in space. Nevertheless, the STM concept has caught wide attention, above all due to the growing number of entities (both state and private) operating in space. Both LEO and GEO orbital systems involve a continuous collision risk. In order to mitigate this risk, satellite

[31] ESPI Yearbook 2019 – Space, Policies, Issues and Trends, May 2020, https://espi.or.at/?view=article&id=468:espi-yearbook-2019&catid=29 (accessed 23.04.2021).

operators that track space objects and their dynamics are required to stay alert at all times for the purpose of ensuring safe and effective use of space.[32]

Indeed, the STM concept is not new; the first mention about such a project regarding military aviation dates back to 1932. Later, this idea was revived in France, when its satellite was damaged by space debris. The tasks of STM include in particular orbit management and collision avoidance but solid studies are required in this regard because there are few publications concerning the civil application of STM. The military is the party that is most interested in this system now. For the time being, there are still more questions than answers regarding STM.[33]

Space flights include various stages (e.g. launch, orbiting and return). An STM system would cover them all. Such traffic should be organised and transparent for each operator. It must be remembered that spaceships cannot reach space and return to Earth without crossing the airspace, which is used by aircraft. Therefore, the Space Traffic Management system must not pose a threat to the safety and security of both aircraft and space objects. Moreover, there is a high risk of collision of active and defunct objects in Earth orbit.

The research on STM was reflected in, among others, the 2006 report titled "Cosmic Study on Space Traffic Management", which was prepared by the research group of the International Academy of Astronautics (IAA). Said report defines STM as: "the set of technical and regulatory provisions for promoting safe access into outer space, operations in outer space and return from outer space to Earth free from physical or radio-frequency interference". Another proposed definition of STM reads as follows: Space Traffic Management covers activities related to surveillance, coordination, regulation and promotion of activities (including space environment protection) during several separate mission stages, such as launch, space operations and return from space.[34]

As pointed by experts, data for STM must be appropriately gathered, processed, stored, managed, adjusted, used and disseminated. Particular caution must be exercised when issuing final messages and presumptions which are not confirmed by the gathered information must be avoided. Many observers are able to reconstruct events and trajectories but few can predict them because prediction requires knowledge and understanding of many variable data.[35]

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[32] D.L. Oltrogge, *The "We" Approach to Space Traffic Management*, Space Ops Conference 2018, https://arc.aiaa.org/doi/10.2514/6.2018-2668 (accessed 12.04.2021).

[33] AMOS (Advanced Maui Optical and Space Surveillance Technologies Conference), 15–18 September 2020, technical panel. Opening speech: Q. Verspieren, *Challenges and Opportunities in Developing Norms of Behavior.*

[34] M. Dickinson, *Future STM Capabilities*, ESPI Autumn Conference, 27–28 September 2018, www.espi.or.at (accessed 12.04.2021).

[35] M. Jah, *Space Object Behavior Quantification and Assessment for Space Security*, (in:) K.-U. Schrogl (ed.), *Handbook of Space Security. Policies, Applications and Programs*, Vol. 2, New York/Heidelberg/Dordrecht/London 2015, pp. 969–970.

Discussions on this topic mention three possible management regimes: high, medium and low. In the case of the high regime, a superior authority with a range of operational and penal authorisations (among others, prohibition to act in orbit and levying fines) must be established. The medium regime takes into account the national laws and standards, focuses on consensus and soft law. The low regime is based on the national law and its institutions. STM is supposed to be exclusively civil while SDA and, to a smaller extent, SSA – military in nature. A question arises whether operators will understand the requirements of both these domains and be able to act for the benefit of them both.[36]

IV. CONCLUDING REMARKS

The 21st century has been marked a tremendous acceleration of space activity performed by individual countries. In this situation, a potential sensitivity of space systems has become the primary problem and made governments reconsider their doctrines and adopt a more assertive attitude in this area. The largest space powers have begun to consider space as an operational domain of warfare, alongside land, air, and sea. Therefore, space more and more often appears to be a field for competition, which might become an arena of conflict. Many countries develop also their offensive and defensive capabilities as part of the space security and deterrence strategy.

Space-related capabilities and services have been of primary significance for supporting the armed forces as well as public utility enterprises and the industry, which underlie a major part of the global economy and technology. However, threats to these capabilities and services are disturbing. Protection of space systems (satellites and ground infrastructure), which provide users with capabilities and services, is a special sovereign obligation of individual countries. In fact, not only the operation of these systems but also the gathering/acquisition and dissemination of information about activities undertaken in space are sovereign in nature. As space has gained importance as a contentious field expanding the human activity, it is becoming an increasingly bigger problem regarding global security, safety, protection, and sustainable management. Bearing that in mind, a concept providing for the establishment of an SDA/SSA programme and common database emerged.

Due to the absence of hard international law, bilateral and multilateral agreements as well as the best practices from countries organising space flights must

[36] C. Newman, *Space Law and the Space Law Games: Legal Liability and Mapping the Future in Orbit*, workshop at the AMOS (Advanced Maui Optical and Space Surveillance Technologies Conference), 15–18 September 2020.

apply. The development of SSA systems across the world and the exchange of (mainly non-confidential) data do not encounter any political obstacles; however, not all countries support the principle of secure operation of enemy satellites. Hence the intensification of cyber-attacks, which cannot be fully prevented yet. The SDA/SSA systems are acceptable to all countries engaged in space activity and they could contribute to reducing tensions between countries. The preparation of an international space object catalogue will be an important element of actions for the peaceful use of space. Soft regulations such as: STM, IADC or LTS might create "traffic rules" for all space users. They may help states in providing safety and security of outer space.

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