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LONG TERM SUSTAINABILITY (LTS) OF OUTER SPACE ACTIVITIES *VIS A VIS* SPACE AWARENESS[1]

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Summary. Space Awareness is one of the priorities for all operations in outer space. Space is the place for commercial and military activities. This article is about awareness of space in civilian and military context. Awareness is the topic of one of the guidelines adopted by COPUOS in June this year. For NATO Space Awareness domain (and also SSA) has been always crucial (keeping in mind that NATO does not own any satellite and depend on member states in this area), that is the reason why NATO put so much attention to space in its activities. Policy on Space support in operations made integration of Space into NATO's core tasks as the priority. Civil and military cooperation seems to be unquestionable. Better leverage science and technology entities, foster communication with industry and relevant partners are the challenges for space awareness policy today. It must be agreed that States and international intergovernmental organizations (civil or military) as it was presented in the newly adopted by UN-LTS, should raise general public awareness of the important societal benefits of space activities and of the consequent importance of enhancing the long-term sustainability of outer space activities.

Key words: space awareness, United Nations, Long Term Sustainability, deterrence, defense, NATO

Civilian and military domain targets in New Space era are similar in the process of democratization of space (constellations/Mega Constellations, clusters, nanosatellites, fractionated spacecraft, hosted payloads, formation flying, additive manufacturing, and autonomous cooperative systems).

Space Awareness is one of the priorities for both domains. Space is the place for commercial and military activities. This article is about awareness of space in civilian and military context. Awareness is one of the guidelines adopted by COPUOS in June this year. It can be said that this is the latest great achievement of COPUOS after many years of preparation. For NATO Space Awareness domain has been always crucial, that is the reason why NATO put so much attention to space in its activities. Policy on Space support in

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operations approved in May 2018 and in June 2019 still under development made integration of Space into NATO's core tasks as the priority.

Civilian and military cooperation seems to be unquestionable. Better leverage science and technology entities, foster communication with industry and relevant partners are the challenges for space awareness policy today.

1. NEW SPACE ERA

The term New Space is commonly used within the industry, within the entities forming the law and policy and concerns new space activities. The concept this could mean a process of evolution since the era of commercialization and privatization, which was characterized by government contracts (where the government acted as the lessee and purchaser of the equipment) until the end of the period commercial, where government and private companies purchase services from the private sector. Niche areas of space activity are being developed. It is a new business model and a new type of partnership. It can be concluded that in today's world of all-encompassing cyberspace, man is less and less counting on and its future and knowledge is based on technology [Robinson 2014, 325]. You can also think about the following whether privatization and commercialization in space are legally possible – whether it is possible to privatize and commercialize in space whether this is contrary to the principle laid down in the 1967 Treaty on common interest of mankind? [Latipulhayat 2012, 253]. Prof. Jakhu claims that the term New Space is usually used in industry, regulation and policy and is adequate for new space activities. It is difficult to be precise define this term.

The term New Space is used in new technologies, entrepreneurship, individual human access to space (e.g. in a settlement space) or the exploitation of space resources. According to J. Pelton, New Space is something more than just new commercial space activities [Jakhu 2015]. New Space is home to brand new companies; new with older capital, older companies benefiting from new technologies, new with older capital, or older companies benefiting from new technologies. In addition, there are alliances between newer and older market players. Commercialization in New Space causes that space is less than in the past, a discipline dealing with rockets. New Space recognizes new legal problems and creates new solutions; hence legal certainty is a priority here. Although, pursuant to Article VI OST of 1967,[2] space activities carried out by non-governmental entities are legally possible (the responsibility is borne by the state), it is not every activity is regulated by national law [Polkowska 2016, 37]. The new era therefore still requires improvements in

[2] Outer Space Treaty 1967, http://www.unoosa.org/pdf/publications/STSPACE11E.pdf [accessed: 23.07.2019].

regulation, filling in the existing gaps. In this way, it makes it easier for entrepreneurs to operate within the New Space and to promote responsible use of space by all users. This happens in telecommunications, a dynamically developing discipline based on space.

Recently there is a trend to use small satellites (for civil and military purposes). Small satellites play an important role for future generations, in particular for in terms of Earth observation or remote-sensing. Observation data used are both for security, humanitarian, agricultural and search purposes and rescue, as well as for communication systems. Due to the fact that small satellites are cheaper to produce and operate, a number of smaller satellites can be used in a more cost-effective way. Launches of such satellites are fast and frequent, but still there is a need for regulations in national law on small satellites, concerning, inter alia, their insurance, the principles of registration, or environmental protection (including the disposal of space debris) [Palkovitz 2013; Froehlich and Seffinga 2018, 15]. Mini-satellites have a weight of less than 1000 kg, micro – less than 100 kg, nano – 10 kg and pico – 1 kg. There are also satellites called CUBE SATS (in the shape of a cube and can have e.g. parameters of 10×10×10×10 cm). There is also a satellite weighing between 10 and 100 grams. These satellites are mainly located on the lower orbits; they don't usually have any fuel. However, they have different uses and structures, they are more or less complicated, and they have different radio frequencies and use different types of frequencies technology. They are used by a number of entities (private companies [Vernile 2018, 33–68], governments and their agencies), e.g. the armed forces, universities, research centers and even private individuals.

They have different dimensions and weight, are applied in rich and developing countries. They can be fired by large rockets or small devices from the surface of the earth, sea, air or air or space. The number of small satellites is growing and is expected to grow in the future. Small satellites offer many opportunities for scientific, strategic and revolutionary purposes. Small satellites are the main tool for the development of the commercialization of the new era. Thus, they are the following the challenge for existing treaties and regulations. This raises the question of the need for change of the existing international regulations (referring such issues as: Space Traffic Management principles [Schrögl 2010, 132–40]). At the same time, the most important thing is the cooperation of states in areas such as governance [Pelton and Jakhu 2014, 1].

The New Space era is connected to the commercialization of space as well. One of the examples is: suborbital operations or space exploration (mining) [Vernile 2018, 42; Pelton 2014, 77–100]. The era of commercialization also arose as a result of the policy pursued by the states, including a reduction in the government budget for research and science. It must be recognized that the role of private sector in space increased, when the government activity was

decreasing. The activity of private entrepreneurs is growing steadily, not only in terms of transport passengers, but also satellites. It's even said that there's a new concept of suborbital space tourism (suborbital space tourism) [Dirkx 2010, 55]. Already since 2005, the space transport system has experienced rapid technological and commercial development. It seems that this transport will also develop in the near future, in order to regularly carry passengers and goods from one point to another. The number of commercial companies ready to start operations is expected to increase in the next few years. Future operations in more than a dozen cases may be land-based; hence the need for integration between navigation systems and airports will be required. This will increase the importance of the safety of such operations, especially in view of existing air traffic. Legislation would be also necessary in such case [Polkowska 2018, 189–201].

2. UN COPUOS ACTIVITIES IN LTS

21 June 2019 during the 62nd session of Committee on Peaceful Uses of Outer Space (COPUOS) adopted a preamble and 21 guidelines for the long-term sustainability of outer space activities.[3] These provide guidance on policy and regulatory framework for space activities; safety of space operations; international cooperation, capacity-building and awareness; and scientific and technical research and development.[4]

This is the result of more than 8 years of work by a Working Group of the Committee and of efforts by experts from its 92 Member States, with support provided by the United Nations Office for Outer Space Affairs (UNOOSA). The Working Group and its expert groups addressed thematic areas including sustainable space utilization supporting sustainable development on Earth; space debris, space operations and tools to support collaborative space situational awareness; space weather; and regulatory regimes and guidance for actors in the space arena. In June 2016 the Committee agreed to a first set of guidelines for the long-term sustainability of outer space activities (A/71/20, Annex). In 2018, consensus was reached on a preamble and nine additional guidelines (A/AC.105/1167, Annex III and A/73/20),[5] although the Working Group could not agree on its final report.

The Committee encourages States and international intergovernmental organizations to voluntarily take measures to ensure that the guidelines are implemented to the greatest extent feasible and practicable. It also noted that the Committee should serve as the principal forum for continued dialogue on

[3] A/AC.105/C.1/L.366.

[4] See https://undocs.org/pdf?symbol+en/A/AC.105/C.1/L.366 [accessed: 23.07.2019].

[5] A/AC.105/C.1/L.367; 16 July 2018.

issues related to the implementation and review of the guidelines. Also at this session, the Committee decided to establish a new Working Group to continue work on the long-term sustainability of outer space activities. The Committee decided to establish, under a five-year workplan, a working group under the agenda item on the long-term sustainability of outer space activities of the Scientific and Technical Subcommittee.

The Committee decided that the working group would agree on its own terms of reference, methods of work and dedicated workplan at the fifty-seventh session of the Subcommittee, in 2020, and that the working group would be guided by the following framework: a) identifying and studying challenges and considering possible new guidelines for the long-term sustainability of outer space activities. This could be done by taking into consideration existing documents including, *inter alia*, documents A/AC.105/C.1/L.367 and A/AC.105/2019/CRP.16; b) sharing experiences, practices and lessons learned from voluntary national implementation of the adopted guidelines; A/AC.105/L.318/Add.6, V.19-05000 3/3; c) raising awareness and building capacity, in particular among emerging space nations and developing countries.[6]

Peter Martinez, the Chair of the Working Group on the long-term sustainability of outer space activities that concluded its mandate last year, commented: "This is a historic moment for the Committee. It represents a significant step forward for ensuring the long-term sustainability of space activities, so that present and future generations from all countries can continue to enjoy the benefits of the peaceful exploration and use of outer space." The Chair of the 62nd session of the Committee, Andre Rypl, commented: "We started this session talking about how we at COPUOS make the impossible possible. We have done just that. The guidelines on the long-term sustainability of outer space activities and, more importantly, the decision to move forward and advance the concept of sustainability in space, are probably the most significant achievement of COPUOS in a decade." Simonetta Di Pippo, Director of UNOOSA, commented: "The Office looks forward to continuing its efforts to assist States in capacity-building in space science, technology, law and policy. Ensuring the long-term sustainability of outer space activities forms a key part of this work."[7]

The main purpose of the guidelines is to assist States and international intergovernmental organizations, both individually and collectively, to mitigate the risks associated with the conduct of outer space activities so that present benefits can be sustained and future opportunities realized. Consequently, the implementation of the guidelines for the long-term sustainability for outer

[6] A/AC.105/L.318/Add.6 June 2019.
[7] UNIS/OS/518; 22nd of June 2019.

space activities should promote international cooperation in the peaceful use and exploration of outer space.[8]

2.1. Definition, objectives and scope of the guidelines

The long-term sustainability of outer space activities is defined as the ability to maintain the conduct of space activities indefinitely into the future in a manner that realizes the objectives of equitable access to the benefits of the exploration and use of outer space for peaceful purposes, in order to meet the needs of the present generations while preserving the outer space environment for future generations. This is consistent with, and supports, the objectives of the Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space 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 (Outer Space Treaty), as such objectives are integrally associated with a commitment to conducting space activities in a manner that addresses the basic need to ensure that the environment in outer space remains suitable for exploration and use by current and future generations. States understand that maintaining exploration and use of outer space for peaceful purposes is a goal to be pursued in the interest of all humankind.

The objective of ensuring and enhancing the long-term sustainability of outer space activities, as understood at the international level and as set out in the guidelines, entails the need to identify the general context of, and modalities for, continuous improvements in the way that States and international intergovernmental organizations, while developing, planning and executing their space activities, remain committed to the use of outer space for peaceful purposes, so as to ensure that the outer space environment is preserved for current and future generations.

These guidelines are grounded in the understanding that the exploration and use of outer space should be conducted in a way so as to ensure the long-term sustainability of outer space activities. Accordingly, they are intended to support States in engaging in activities aimed at preserving the space environment for the exploration and use of outer space for peaceful purposes by all States and international intergovernmental organizations.

The guidelines also promote international cooperation and understanding to address natural and man-made hazards that could compromise the operations of States and international intergovernmental organizations in outer space and the long-term sustainability of outer space activities.

The guidelines support the development of national and international practices and safety frameworks for conducting outer space activities and States and international intergovernmental organizations in developing their space

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

capabilities through cooperative endeavors, as appropriate, in a manner that reduces to a minimum or, as feasible, avoids causing harm to the outer space environment and the safety of space operations, for the benefit of current and future generations.

The guidelines address the policy, regulatory, operational, safety, scientific, technical, international cooperation and capacity-building aspects of space activities. They are based on a substantial body of knowledge, as well as the experiences of States, international intergovernmental organizations and relevant national and international non-governmental entities. Therefore, the guidelines are relevant to both governmental and non-governmental entities. They are also relevant to all space activities, whether planned or ongoing, as practicable, and to all phases of a space mission, including launch, operation and end-of-life disposal.

The guidelines are premised on the idea that the interests and activities of States and international intergovernmental organizations in outer space, as they have or may have defense or national security implications, should be compatible with preserving outer space for peaceful exploration and use, and safeguarding its status pursuant to the Outer Space Treaty and the relevant principles and norms of international law. The guidelines duly take into account the relevant recommendations contained in the report of the Group of Governmental Experts on Transparency and Confidence-Building Measures in Outer Space Activities (A/68/189) and could be considered as potential transparency and confidence-building measures.

2.2. Status of the guidelines

The existing United Nations treaties and principles on outer space provide the fundamental legal framework for the guidelines. They are voluntary and not legally binding under international law, but any action taken towards their implementation should be consistent with the applicable principles and norms of international law. The guidelines are formulated in the spirit of enhancing the practice of States and international organizations in applying the relevant principles and norms of international law. Nothing in the guidelines should constitute a revision, qualification or reinterpretation of those principles and norms. Nothing in the guidelines should be interpreted as giving rise to any new legal obligation for States. Any international treaties referred to in the guidelines apply only to the States parties to those treaties.

2.3. Voluntary implementation of the guidelines

States and international intergovernmental organizations should voluntarily take measures, through their own national or other applicable mechanisms, to ensure that the guidelines are implemented to the greatest extent feasible and practicable, in accordance with their respective needs, conditions and

capabilities, and with their existing obligations under applicable international law, including the provisions of applicable United Nations treaties and principles on outer space. States and international intergovernmental organizations are encouraged to administer existing and, if necessary, establish new procedures to meet requirements associated with the guidelines. In implementing these guidelines, States should be guided by the principle of cooperation and mutual assistance and should conduct all their activities in outer space with due regard for the corresponding interests of all other States. States and relevant international intergovernmental organizations in a position to support developing countries in developing their national capacities for the implementation of these guidelines, through appropriate and mutually agreed capacity-building mechanisms, are encouraged to do so as one of the means of ensuring and enhancing the long-term sustainability of outer space activities.

The widest implementation of these guidelines by States (at the level of both governmental agencies and non-governmental entities) and international intergovernmental organizations requires certain capacities and capabilities, which could be built and enhanced, inter alia, through international cooperation, which is required to implement the guidelines effectively, to monitor their impact and effectiveness and to ensure that, as space activities evolve, they continue to reflect the most current state of knowledge of pertinent factors influencing the long-term sustainability of outer space activities.[9]

2.4. Review of implementation and updating of the guidelines

The relevant United Nations body serves as the principal forum for continued institutionalized dialogue on issues related to the implementation and review of the guidelines is the Committee on the Peaceful Uses of Outer Space. States and international intergovernmental organizations are encouraged to share their practices and experiences in the Committee regarding the implementation of the present guidelines. States and international intergovernmental organizations should also work within the Committee and the Office for Outer Space Affairs of the United Nations Secretariat, as appropriate; to address concerns rose with respect to the implementation of the guidelines.

The guidelines reflect a common understanding on existing and possible challenges to the long-term sustainability of outer space activities, the nature of those challenges, and the measures that could prevent or reduce their harmful impact, based on current knowledge and established practices. States and international intergovernmental organizations are encouraged to promote and/or conduct research on topics relevant to these guidelines and their implementation.

[9] See https://undocs.org/pdf?symbol+en/A/AC.105/C.1/L.366 [accessed: 23.07.2019].

3. GUIDELINES FOR THE LONG-TERM SUSTAINABILITY OF OUTER SPACE ACTIVITIES[10]

3.1. Guidelines A (policy and regulatory framework for space activities)

There are few guidelines on that, such as: guideline A1 (adopt, revise and amend, as necessary, national regulatory frameworks for outer space activities), guideline A2 (consider a number of elements when developing, revising or amending, as necessary, national regulatory frameworks for outer space activities), guideline A3 (Supervise national space activities). Under guidelines A3 in supervising space activities of non-governmental entities, States should ensure that entities under their jurisdiction and/or control that conduct outer space activities have the appropriate structures and procedures for planning and conducting space activities in a manner that supports the objective of enhancing the long-term sustainability of outer space activities, and that they have the means to comply with relevant national and international regulatory frameworks, requirements, policies and processes in this regard. States bear international responsibility for national activities in outer space and for the authorization and continuing supervision of such activities, which are to be carried out in conformity with applicable international law.

In fulfilling this responsibility, States should encourage each entity conducting space activities to: establish and maintain all the necessary technical competencies required to conduct the outer space activities in a safe and responsible manner and to enable the entity to comply with the relevant governmental and intergovernmental regulatory frameworks, requirements, policies and processes. States should ensure that the management of an entity that conducts outer space activities establishes structures and procedures for planning and conducting space activities in a manner that supports the objective of promoting the long-term sustainability of outer space activities. States should ensure that appropriate communication and consultation mechanisms are in place within and among the competent bodies that oversee or conduct space activities. Under guideline A4 (ensure the equitable, rational and efficient use of the radio frequency spectrum and the various orbital regions used by satellites) States should pay particular attention to the long-term sustainability of space activities and sustainable development on Earth and to facilitating the prompt resolution of identified harmful radio frequency interference. Moreover, States and international intergovernmental organizations should encourage and support regional and international cooperation aimed at improving efficiency in decision-making and implementation of practical

[10] The text of the guidelines comes from the original language on the UNOOSA document: A/AC.105/C.1/L.366.

measures to eliminate identified harmful radio frequency interference in space radio links.

Spacecraft and launch vehicle orbital stages that have terminated their operational phases in orbits that pass through the low-Earth orbit (LEO) region should be removed from orbit in a controlled fashion. If this is not possible, they should be disposed of in orbits that avoid their long-term presence in the LEO region. Spacecraft and launch vehicle orbital stages that have terminated their operational phases in orbits that pass through the geosynchronous Earth orbit (GEO) region should be left in orbits that avoid their long-term interference with the GEO region. For space objects in or near the GEO region, the potential for future collisions can be reduced by leaving objects at the end of their mission in an orbit above the GEO region such that they will not interfere with, or return to, the GEO region.

Guideline A5 is about enhancing the practice of registering space objects. States and international intergovernmental organizations should adopt appropriate national or other relevant policies and regulations to harmonize and sustain over the long term such registration practices on the widest possible international basis.

3.2. Guidelines B (safety of space operations)

There are few guidelines on that, such as: guideline B1 (provide updated contact information and share information on space objects and orbital events). According to this guideline States and international intergovernmental organizations should exchange, on a voluntary basis, and/or make readily available regularly updated contact information on their designated entities authorized to engage in exchanges of appropriate information on on-orbit spacecraft operations, conjunction assessments and the monitoring of objects and events in outer space. This may be achieved either by providing such information to the Office for Outer Space Affairs so that the Office can make it available, within its standing mandate and existing resources, to other States and international intergovernmental organizations and/or by providing it directly to other States and international intergovernmental organizations, with the understanding that contact information for national focal points, at a minimum, will likewise be communicated to the Office.

States and international intergovernmental organizations should establish appropriate means to enable timely coordination to reduce the probability of and/or to facilitate effective responses to orbital collisions, orbital break-ups and other events that might increase the probability of accidental collisions or may pose a risk to human lives, property and/or the environment, in the case of uncontrolled re-entries of space objects.

States and international intergovernmental organizations should exchange, on a voluntary basis and as mutually agreed relevant information on space

objects and information related to actual or potential situations in near-Earth space that may affect the safety of outer space operations. Guideline B2 is about improving accuracy of orbital data on space objects and enhancing the practice and utility of sharing orbital information on space objects, guidelines B3 promotes the collection, sharing and dissemination of space debris monitoring information. Guideline B4 is about performing conjunction assessment during all orbital phases of controlled flight and guidelines B5 is about developing practical approaches for pre-launch conjunction assessment.

Guideline B6 refers to the sharing operational space weather data and forecasts; guideline B to the developing space weather models and tools and collect established practices on the mitigation of space weather effects. Guideline B8 is about the operation of space objects regardless of their physical and operational characteristics. Under these provisions, inter alia, States and international intergovernmental organizations are encouraged to promote design approaches that increase the trackability of space objects, regardless of their physical and operational characteristics, including small-size space objects, and those that are difficult to track throughout their orbital lifetime. Guideline B9 refers to risks associated with the uncontrolled re-entry of space objects, guideline B10 is about observing measures of precaution when using sources of laser beams passing through outer space.

3.3. Guidelines C (international cooperation, capacity-building and awareness)

There are few guidelines on that; guideline C1 refers to the promotion and facilitation of the international cooperation in support of the long-term sustainability of outer space activities. International cooperation should, where appropriate, involve the public, private and academic sectors, and may include, *inter alia*, the exchange of experience, scientific knowledge, technology and equipment for space activities on an equitable and mutually acceptable basis. Guideline C2 is about sharing experiences related to the long-term sustainability of outer space activities and developing new procedures, as appropriate, for information exchange.

The experiences and expertise acquired by those engaged in space activities should be regarded as instrumental in the development of effective measures to enhance the long-term sustainability of outer space activities. States and international intergovernmental organizations should therefore share relevant experiences and expertise to enhance the long-term sustainability of space activities. Guideline C3 enhances to promote and support capacity-building in developing countries with emerging space programmes, on a mutually acceptable basis, through measures such as improving their expertise and knowledge on spacecraft design, flight dynamics and orbits, performing joint orbital calculations and conjunction assessments, and providing access to appropriate

precise orbital data and appropriate tools for the monitoring of space objects through relevant arrangements as appropriate.

States and international intergovernmental organizations should support current capacity-building initiatives and promote new forms of regional and international cooperation and capacity-building that are in accordance with national and international law to assist countries in gathering human and financial resources and achieving efficient technical capabilities, standards, regulatory frameworks and governance methods that support the long-term sustainability of outer space activities and sustainable development on Earth.
Guideline

C4 is about raising awareness of space activities. States and international intergovernmental organizations should raise general public awareness of the important societal benefits of space activities and of the consequent importance of enhancing the long-term sustainability of outer space activities. To this end, States and international intergovernmental organizations should: (a) Promote institutional and public awareness of space activities and their applications for sustainable development, environmental monitoring and assessment, disaster management and emergency response; (b) Conduct outreach, capacity-building and education on regulations and established practices relevant to the long-term sustainability of space activities; (c) Promote activities of non-governmental entities that will enhance the long-term sustainability of outer space activities; (d) Raise awareness among relevant public institutions and non-governmental entities about national and international policies, legislation, regulations and best practices that are applicable to space activities.

States and international intergovernmental organizations should promote public awareness of space applications for sustainable development, environmental monitoring and assessment, disaster management and emergency response through information-sharing and joint efforts with public institutions and non-governmental entities, taking into account the needs of current and future generations. In designing space education programmes, States, international intergovernmental organizations and non-governmental entities should pay special attention to courses on enhancing knowledge and practice of the utilization of space applications to support sustainable development. States and international intergovernmental organizations should initiate the voluntary collection of information on public awareness and education tools and programmes with a view to facilitating the development and implementation of other initiatives with similar objectives.

States and international intergovernmental organizations should foster outreach activities by or with industry, academia and other relevant non-governmental entities. Outreach, capacity-building and educational initiatives could take the form of seminars (in person or broadcast over the Internet), published guidelines to complement national and international regulations or a website

with basic information on a regulatory framework and/or a contact point within the Government for regulatory information.

Cooperation between Governments and non-governmental entities should be encouraged and fostered. Non-governmental entities, including professional and industry associations and academic institutions, can play important roles in increasing international awareness of issues associated with space sustainability, as well as promoting practical measures to enhance space sustainability. Such measures could include adoption of the Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space; compliance with the ITU Radio Regulations related to space services; and the development of open, transparent standards for the exchange of data necessary to avoid collisions, harmful radio frequency interference or other harmful events in outer space. Non-governmental entities can also play important roles in bringing stakeholders together to develop common approaches to certain aspects of space activities that can collectively enhance the long-term sustainability of space activities.

3.4. Guidelines D (scientific and technical research and development)

Among these guidelines there are some (D1) referring to the promotion and support research into and the development of ways to support sustainable exploration and use of outer space. States and international intergovernmental organizations should consider appropriate safety measures to protect the Earth and the space environment from harmful contamination, taking advantage of existing measures, practices and guidelines that may apply to those activities, and developing new measures as appropriate. Guideline D2 is about investigation and consideration new measures to manage the space debris population in the long term. States and international intergovernmental organizations should take measures at the national and international levels, including international cooperation and capacity-building, to increase compliance with the Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space. Investigation of new measures could include, *inter alia*, methods for the extension of operational lifetime, novel techniques to prevent collision with and among debris and objects with no means of changing their trajectory, advanced measures for spacecraft passivation and post-mission disposal and designs to enhance the disintegration of space systems during uncontrolled atmospheric re-entry. Such new measures aimed at ensuring the sustainability of space activities and involving either controlled or uncontrolled re-entries should not pose an undue risk to people or property, including through environmental pollution caused by hazardous substances. Policy and legal issues, such as ensuring that these new measures are compliant with the provisions of

the Charter of the United Nations[11] and applicable international law, also need to be addressed.[12]

4. SPACE AWARENESS

Awareness issue is recently more and more discussed worldwide. Awareness in general as it was said in the COPUOS guidelines (C4) is connected to the space use as such; on the other side it's close to the security and defense (Space Situational Awareness [Gasparini and Miranda 2010, 73–84]). That is the reason why international fora (civilian and military) are very interested in the area of space awareness. For example, NATO has become critically dependent upon space capabilities and services[13] to conduct the Alliance's missions and related responsibilities in a responsive and efficient manner. There is no NATO operation without Space support (threats to Space services are always present), so NATO must keep its role in space. Its policy on Space is under development, among the provisions there is NATO's role as integrator of Space into its tasks (collective defense, crisis management, cooperative security), forum for political military considerations (deterrence, defense), provision of Space support and effects to the Alliance's operations, missions and other activities) or facilitating development of compatibility and interoperability between Allies. Responsibility for Space is still in the hands of the operating nations. NATO's role is currently 'just' coordinating the service(s) [Vasen 2019]. One of the lines of efforts is development of Space Domain Awareness at all levels, mainly in the democratization of Space today and near future [Comparini and Bussolletti 2019].

For many years the Science and Technology Organization's (STO) Systems Concepts and Integration (SCI) Panel has fostered activities that enhance Science & Technology (S&T) knowledge in NATO in support of resilient space operations. Nonetheless, it has been nearly five years since space experts from across the Alliance congregated for SCI-268 to develop a comprehensive shared awareness of NATO's future needs for space capabilities [Snider 2019]. Not only did SCI-268 provide a basis for promoting a shared awareness, it also identified important and appropriate technical investments for NATO to consider initiating in its collaborative program of work (CPoW) under the stewardship of the STO.[14]

[11] Charter of UN, https://treaties.un.org/doc/publication/ctc/uncharter.pdf [accessed: 24.07.2019].

[12] See https://undocs.org/pdf?symbol+en/A/AC.105/C.1/L.366 [accessed: 24.07.2019].

[13] Even though NATO does not own any SATCOM satellites, but NATO owns fixed and deployable ground terminals [Fungo 2019].

[14] Other panels focused on Space in STO are: AVT (Applied Vehicle Technologies, IST – Information Systems Technologies, SAS – System Analysis and Studies, SET – Sensors and Electronic Technologies.

From 25 to 27 June 2019 the SCI Panel conducted a Research Specialists' Meeting (RSM) entitled (SCI-318). SCI – 318 objectives are: promote shared awareness throughout the NATO space community of NATO's current and future space needs, identify key scientific and technical as well as operational challenges that NATO STO should address, recommend collaborative activities within the NATO STO and partner space community, promote and expand the NATO community-of-interest focused on NATO's space needs, current and future. The Space Domain and NATO Operations; a Critical S&T Review, to once again re-establish a shared awareness amongst space experts from across the Alliance and to assure that work done by the Alliance's space professionals is coherent with NATO needs and requirements, even if not explicitly stated through official documents. The participant of this STO meeting developed a comprehensive shared awareness of NATO's future needs for space capabilities and identified important and appropriate technical investments for NATO to consider undertaking in its CPoW. The output of this specialists meeting will serve, in part, as a roadmap for future NATO STO space-related activities, demonstrations, field trials and experiments. The technical content of this activity can support training and education on the space domain as well as provide a contributing basis to future NATO space support requirements that can guide its member nations in their planning, acquisition and implementation of space solutions and capabilities to be shared throughout the Alliance. The ultimate exploitation goal is the achievement of resilient, effective, efficient and affordable capabilities as well as the effective operational application of those capabilities throughout the Alliance. Among some potential future SCI Panel Space Activity Topics are: operational requirements for space capabilities in the Arctic, operational requirements or space capabilities in urban operations, space support to autonomous systems in maritime, land and air operations, modeling and simulation of space operations in NATO planning scenarios, opportunities (risks from commercial space products and services to NATO operations, space domain awareness issues with new proliferated commercial constellations, role of space in NATO deterrence strategies and practice, role of space in NATO influence operations; opportunities and risks.

The Space Security Awareness (SSA) concept is not new. The widest known and the original definition (coming from the beginning of the Space activities – Sputnik Era 1957) [Żylicz 1960, 184–87] was originated in the Military area as the Space Situational Awareness as defined by the US Armed Forces, USSTRATCOM and executed by the Joint Space Operation Centre (JSOpC). Also other nation around the Globe and some European nations have been developing the National Military contribution to SSA network (e.g. Russia, France, Japan, Korea, and Australia). On the other hand, in Europe, ESA in 2009 has initiated the SSA optional research and development program concentrated only on civilian aspects and divided into three segments:

the Space Surveillance and Tracking (SST), the Space Weather (SWE) and the Near Earth Objects (NEO). Additionally, to complement listed above definition there are plenty of other international activities. As conceived today, a space SSA consists of three principal elements and activities: the collection of data and information, the arrangements of the collected information in a systematic manner and computer processing capacity to predict the status, events and threats in the future, to issue reliable conjunction information [Kaiser 2015, 5–12].

There are several formal meanings of SSA, which can be understood as current and predictive knowledge and understanding of the outer space environment including space weather and location of natural and manmade objects in orbit around the Earth. SSA is to support safe, stable, and sustainable space activities [Oltrogge 2018]. There are some goals of SSA referring to the security. One of them is that societies are heavily dependent on critical space and ground assets. Critical assets need to be protected against adverse effects from space [Bobrinsky 2018]. The sensitive issue connected to SSA is space debris. The problem is growing due to the increasing number of space operations (civil and military) [Pavesi 2018, 27]. This is one of the reason of congestion in space [Alvez 2019].[15]

Under STO a SCI-311 a Research Task Group (RTG) Collaborative Space Domain Awareness (SDA) Data Collection and Fusion Experiment was created. The objective of this group is experimental demonstration effort to collect, share, and fuse SDA information among member nations. There are several topics which are discussed at the meetings of the group, such as: Satellite Radio Frequency Interference (RFI), Space environment (weather) conditions affecting spacecraft, data fusion algorithms, decision support communication concepts, tools and methods for communicating changes in the space domain. NATO and military operations are becoming increasingly dependent on space-based capabilities, that is why NATO has established a Long Term Aspect (LTA) requirement for NATO Space Capability Preservation; SSA is a key component of Space Domain Awareness (SDA) relevant to conducting effective space operations.[16]

[15] The Commission proposes to allocate the €16 billion budget for the 2021–2027 Space Programme, including Galileo/EGNOS, Copernicus, and the development of to develop new security components i.e. SSA, GOVSATCOM.

[16] C. Sheaff, SCI-311 Research Task Group (RTG) Collaborative Space Domain Awareness (SDA) Data Collection and Fusion Experiment, presentation at the STO meeting in Turin 2019, June.

CONCLUSION

As it was presented in the article above, the space awareness is necessary today and in the near future. It must be agreed that States and international intergovernmental organizations (civilian or military) as it was presented in the newly adopted by UN-LTS, should raise general public awareness of the important societal benefits of space activities and of the consequent importance of enhancing the long-term sustainability of outer space activities. States and international intergovernmental organizations should promote institutional and public awareness of space activities and their applications for sustainable development, environmental monitoring and assessment, crisis management and emergency response, conduct capacity-building and education on regulations and established practices relevant to the long-term sustainability of space activities. They are responsible also for promoting activities of non-governmental entities that will enhance the long-term sustainability of outer space activities and raising awareness (as well in security context) among relevant public institutions and non-governmental entities about national and international policies, legislation, regulations and best practices that are applicable to space activities.

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TRWAŁY ZRÓWNOWAŻONY ROZWÓJ DZIAŁAŃ W PRZESTRZENI KOSMICZNEJ A ŚWIADOMOŚĆ W DZIEDZINIE KOSMICZNEJ

Streszczenie. Świadomość dotycząca przestrzeni kosmicznej jest jednym z priorytetów wszystkich operacji w przestrzeni kosmicznej. Przestrzeń kosmiczna jest miejscem dla działalności handlowej i wojskowej. Niniejszy artykuł dotyczy świadomości na temat przestrzeni kosmicznej w kontekście cywilnym i wojskowym. Świadomość jest tematem jednej z wytycznych przyjętych przez COPUOS w czerwcu tego roku. Dla NATO domena świadomości kosmicznej (SSA) zawsze miała kluczowe znaczenie (pamiętając, że NATO nie jest właścicielem żadnego satelity i zależy od państw członkowskich w tym obszarze), dlatego też w swoich działaniach NATO poświęciło tak wiele uwagi działalności kosmicznej i spowodowała włączenie przestrzeni kosmicznej do podstawowych zadań NATO (traktując je, jako priorytet). Współpraca cywilno-wojskowa wydaje się niekwestionowana. Lepsze wykorzystanie jednostek naukowych i technologicznych, wspieranie komunikacji z przemysłem i odpowiednimi partnerami – to dzisiejsze wyzwania dla polityki świadomości kosmicznej. Należy uznać, że państwa

i międzynarodowe organizacje międzyrządowe (cywilne lub wojskowe), przedstawione w nowo przyjętej przez ONZ LTS, powinny zwiększyć świadomość społeczną w zakresie ważnych korzyści społecznych wynikających z działań w przestrzeni kosmicznej i konieczności wzmocnienia długoterminowego zrównoważenia działań w przestrzeni kosmicznej.

Słowa kluczowe: świadomość kosmiczna, ONZ, długoterminowa trwałość LTS, odstraszanie, obrona, NATO

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