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Analyzing the Recent Multilateral Discussions on Outer Space Security

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1. Introduction

Outer space is now more dangerous than ever. The massive increase in the number of actors both governmental and private and the proliferation of space debris raises the possibility of catastrophic in-orbit collisions and of harmful electromagnetic interference. There are threats from natural hazards like dangerous solar activities or the fall of near-earth objects and also from intentional attack, for example demonstrated by the continuing direct-ascent anti-satellite (ASAT) missile tests. Security and safety, the military and the civil, the intentional and the accidental are intertwined under the name of outer space security. Space-faring nations recognize more and more the commercial and strategic interests in the use of outer space and have been trying to address the complicated problem of outer space security, but with different goals and in different places. The objective of this article is to analyze these recent multilateral discussions on outer space security to clarify their different natures, scopes, significances and prospects.

There are four major international forums where the discussions on outer space security have taken place recently: the Conference on Disarmament (CD), the Consultation Meeting of the International Code of Conduct (ICOC) initiated by the European Union (EU), the Group of Governmental Expert (GGE) on Transparency and Confidence Building Measures (TCBMs) in Outer Space, established under the UN Secretary-General by the UN General Assembly (UNGA) and the UN Committee on the Peaceful Uses of Outer Space (UN COPUOS). Each forum negotiates different measures, addresses different aspects of outer space security and has different results as of now. Before entering the discussions, the arms control provisions in the existing treaties are presented as background information.

2. Background: the Arms Control Provisions in the Existing Treaties

The arms control provisions of the Outer Space Treaty of 1967 are found in the article IV of the treaty. The first paragraph prohibits the states parties from placing “in orbit around the earth any objects carrying nuclear weapons or any other kinds of

weapons of mass destruction".[1] It is assumed that weapons in this category include all types of nuclear, biological and chemical weapons, irrespective of their size or destructive power, in accomplishing their intended destructive purpose. But conventional weapons do not belong in this category and therefore are not prohibited to be placed in orbit around the earth. It may also be presumed that an orbit around the earth implies a full orbit rather than a fractional orbit or a suborbital flight, making the use of ICBMS with nuclear warheads permissible. The states parties also undertake not to "install such weapons on celestial bodies", but reference to the moon is omitted here, though the phrase "moon and other celestial bodies" was frequently used in other parts of the treaty.

This omission has given rise to the negotiation of the Moon Agreement of 1979, which forbids the states parties not only from placing nuclear weapons or any other kinds of weapons of mass destruction on and around the moon, but also from engaging in "any threat or use of force or any other hostile act or threat of a hostile act on the moon", including threat "to the earth, the moon, spacecraft, the personnel of spacecraft or man-made space objects."[2] The Agreement calls for greater control of weapons and threat and use of force in outer space than the Outer Space Treaty. However, only seventeen states signed and ratified it, not including major space-faring states, which is a disappointing result in contrast to the Outer Space Treaty, that was signed and ratified by more than 106 states.

The Outer Space treaty includes also elements of transparency and confidence building measures. The article IX stipulates the consultations concerning national activities or experiments in outer space, the article X the opportunity to observe the flight of space objects of other states parties, the article XI the information sharing of the nature, conduct, localization and results of national space activities and the article XII the reciprocal access and visit to all stations, installations, equipment and space vehicles on the moon and other celestial bodies. The article VIII already refers to the concept of registration of space objects, but is elaborated by the Registration Convention, which established a mandatory registration system for objects launched into space.[3]

Article II of the Registration Convention requires the launching state to register the space object by means of an entry into an appropriate registry, and Article III the Secretary General to maintain a Register, which is in reality established at the UNOOSA on behalf of the Secretary General. [4] There should be full and open access to the information in that Register.[5] According to Article IV, the information to be furnished to the United Nations by the states parties are (a) name of launching state, (b) an appropriate designator of the space object or its registration number, (c) date and territory or location of launch, (d) basic orbital parameters including nodal period, inclination, apogee and perigee and

[1] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, Jan. 27, 1967 [hereinafter cited as Outer Space Treaty] at art. IV, para. 1.

[2] Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, Nov. 29, 1971 [hereinafter cited as Moon Agreement] at art. III, para. 2 and 3.

[3] Outer Space Treaty at art. VIII, XI, X, XI and XII.

[4] Convention on Registration of Objects Launched into Outer Space, Dec. 18, 1973 [hereinafter cited as Registration Convention] at art. II, para. 1.

[5] Registration Convention at art. III. para. 2.

(e) general function of the space object.[6] The convention is legally binding for 63 ratified states parties including all major space-faring nations and makes no distinction between civil and military objects. But military satellites of major space-faring nations have often not been registered and this non-registration tendency is increasing with the increasing number of private and commercial space-faring actors. It should also be noted that the existing registered information is not harmonized and arbitrary. For example, some states describe the purpose of the object with one word, such as "communication", others give more detailed explanation on listing payload, radio frequencies etc.

In short, though the existing treaties were a significant landmark of arms control in outer space, they have been considered insufficient from the arms control perspective, because it prohibits weapons of mass destruction in orbit, but it allows for any other type of weapon anywhere except for the surface of planets, moons and asteroids. In order to address this, the CD adopted the agenda of Prevention of Arms Race in Outer Space (PAROS) in 1982 and mandated the arms control negotiations, held in accordance with the spirit of the Outer Space Treaty to prevent an arms race in outer space. Since then, the legal protection satellite, nuclear power systems in space, and various transparency and confidence building measures have been examined, but have not reached any conclusion in over 30 years.[7] This stalemate comes from the two conflicting views; the proposal of forbidden weaponization of outer space by legally binding measures has been opposed mainly by the United States' position that such multilateral measures are unnecessary because there is no current arms race in outer space and because they would not be effective anyhow. In spite of a continued deadlock in the CD, some states, particularly Russia and China, continued to push for negotiations regarding arms control in outer space. In 2008, those countries submitted the draft treaty called the Prevention of the Placement of Weapons in Outer Space and of the Threat of Use of Force against Outer Space Objects (PPWT) to the CD, which illustrates the impasse in it.

3. The Four Recent International Discussions on Outer Space Security

3.1 PPWT: a legally binding ban on placement of weapons in outer space

The main point of PPWT, according to its updated version of 2014, lies in Article II, which requires states parties "not to place any weapons in outer space", nor "to resort to the threat or use of force against outer space objects". The draft treaty gives definitions to "weapons in outer space", which means "any outer space object or component thereof which has been produced or converted to destroy, damage or disrupt the normal functioning of objects in outer space, on the Earth's surface or in its atmosphere, or to eliminate human beings or components of the biosphere".[8] This definition of a space weapon was faced by the criticism that it does not address the ground-based anti-satellite missile system, which is more likely an existing threat than weapons in orbit, as demonstrated by China in 2007 and in 2013 and by the United

[6] Registration Convention at art. IV. para. 1.

[7] Paul Meyer, "The Conference on Disarmament and the Prevention of an Arms Race in Outer Space," The CD Discussion Series, published by the UNIDIR on April 2011, p. 1-8.

[8] Draft treaty on prevention of the placement of weapons in outer space and of the threat or use of force against outer space objects, Jun. 12,

States in 2008. Another criticism is that the definition itself is ambiguous. Does it only refer to hit-to-kill weapons with kinetic energy in orbit or include soft-kill weapons such as a laser that could also disable a satellite?[9] In June 2016, China launched the Aolong-1 spacecraft on a Long March 7 rocket which is claimed to collect and remove man-made debris in outer space with its robotic arm.[10] Space systems like a robotic arm designed to mitigate space debris could also be used to interfere with and damage functioning satellites of another state. Then, could it be considered a space weapon? In other cases, even one satellite can be maneuvered to intentionally collide with another satellite. Does that mean that more than a thousand operational satellites currently in orbit would be possible weapons?

Article V of PPWT "recognizes the need for measures to verify compliance with the Treaty, which may form the subject of an additional protocol," and the article VI stipulates that states parties "shall establish the executive organization of the Treaty" to promote the implementation of the treaty.[11] China and Russia could think about an organization, like IAEA in nuclear arms control or OPCW in chemical arms control, under the UNOOSA, but they did not specify the measures. This lack of an integral and international verification regime to monitor the ban on the placement of weapons in outer space with existing technologies and cooperative measures provoked doubt about its effectiveness. Another criticism, raised by the United States, is that the PPWT is not a comprehensive ban, because "typically, arms control treaties that prohibit the deployment of a class of weapon also prohibit the possession, testing, production, and stockpiling of such weapons to prevent a country from rapidly breaking out of such treaties."[12] The PPWT would have to be expanded to contain such prohibitions.

3.2 ICOC: the EU initiative for new rules of road on outer space activities

As the arms control discussions in the CD remained in stalemate, the European Union opened a new consultation process for the International Code of Conduct in 2008. A code of conduct is not arms control measures nor TCBM, but a set of rules outlining the appropriate norms, practices or behavior for an individual, party or an organization. The proposed code addresses the problems of space debris, in-orbit collisions between space objects, unpredicted reentry of space objects and natural hazards for example due to solar activities rather than the problem of space weapon. The former issues are not less urgent than the latter. Technological development lowered the cost of space exploration and increased the number of space-faring countries. The commercial activities in outer space, like satellite-based broadcasting, communication and observation have also boomed since the 1990s. Mini- (500kg), micro- (10-100kg), nano- (1-10kg), pico- (0.1-1kg), and even femto-satellites (10-100g) became popular for military, commercial and educational purposes, getting outer space more accessible. This trend of democratized space activities poses new questions on space security, especially the

2014, CD/1985 [hereinafter cited as PPWT] at art. II.

[9] Mike Gruss, "U.S. State Department: China Tested Anti-satellite Weapon", Space News, Jul. 28, 2014.

[10] Harsh Vasani, "How China Is Weaponizing Outer Space", The Diplomat, Jan. 19, 2017.

[11] PPWT at art. V.

[12] The statement of Ambassador Robert A. Wood Permanent Representative of the United States to the Conference on Disarmament (CD), Sep. 9, 2014.

diffusion of space debris and the increased possibilities of in-orbit collisions between space objects. These problems are not addressed by the existing international legal regime and so the European Union took the initiative for the new rules of road in outer space.

When the initiative was proposed in 2008, the United States opposed it because they were concerned that the code could constrain missile defenses or anti-satellite weapons. During the consultations, EU incorporated suggested U.S. language, such as the right to self-defense in space.[13] The United States afterwards recognized that it is of their interests to prevent or minimize the inherent risks of space activities and started to work with other space-faring nations to establish a non-legally binding international code of conduct for outer space activities. The code is a voluntary agreement among states with no formal enforcement mechanisms. The majority of space-faring countries, including Australia, Canada and Japan, have already endorsed the EU code, but not Russia nor China. Russia and China criticized the fact that the code was not legally binding and argued that the priority should remain in the efforts to draw a legally binding instrument on the prevention of an arms race in outer space.

The code, lastly updated in 2013, is 13 pages long and its main points are analyzed here. The Preamble recognizes "the importance of preventing an arms race in outer space", and premises "without prejudice to ongoing and future work in other appropriate international forums relevant to the peaceful exploration and use of outer space such as the United Nations Committee on the Peaceful Uses of Outer Space and the Conference on Disarmament". These newly added statements in the updated draft, that the Code would not be used to interpret or otherwise affect the ongoing efforts in the Conference of Disarmament, which the PPWT implies, appear to appease China and Russia.[14]

In the first section, which is about Purpose, Scope and General Principles, the article 1.1 declares that the purpose "is to enhance the safety, security, and sustainability of all outer space activities pertaining to space objects, as well as the space environment". The article 1.4 stipulates the voluntary and non legally binding nature of the code and the article 2 shows the general principles that the subscribing states should abide by: in brief, (1) the freedom for all States to access, to explore, and to use outer space for peaceful purposes, (2) the responsibility of states to refrain from the threat or use of force against the territorial integrity or political independence of any state, but the recognition of the inherent right of states to individual or collective self-defense, as recognized in the Charter of the United Nations, (3) the responsibility of States to take all appropriate measures and cooperate in good faith to avoid harmful interference with outer space activities and (4) the responsibility of States to take all appropriate measures to prevent outer space from becoming an arena of conflict.[15] Here, the general principles were not that controversial, except the overt reference to the right to self-defense considered by countries in Latin America and Africa as a room for accelerating the trend toward space weaponization. Some of them stressed that they will not accept any alter-

[13] Micah Zenko, "A Code of Conduct for Outer Space", Council on Foreign Relations, Nov. 30, 2011.

[14] Draft International Code of Conduct for Outer Space Activities, version Mar. 31, 2014 [hereinafter cited as ICOC] at box 6 and 15.

[15] ICOC at box 19, 22 and 23.

native to the "without-exception" principle of keeping space a zone free of conflict.

The essences of the code lie in the fourth and fifth section. The fourth section of Measures on Outer Space Operations and Space Debris Mitigation requires the subscribing states to "refrain from any action which brings about, directly or indirectly, damage, or destruction, of space objects unless such action is justified: by imperative safety considerations, in particular if human life or health is at risk; or in order to reduce the creation of space debris; or by the Charter of the United Nations, including the inherent right of individual or collective self-defense".[16] This statement did not refer directly to space weapons or specific aggressive capabilities, but to operations in outer space. It also requires the subscribing states to take appropriate measures to minimize the risk of collision and to limit any activities in the conduct of routine space operations, including during the launch and the entire orbital lifetime of a space object, which may generate long-lived space debris.

The fifth section of Notification of Outer Space Activities stipulates that the subscribing states should notify scheduled maneuvers that could pose a risk to the safety of flight of space objects of other States; predicted conjunctions posing an apparent on-orbit collision risk, due to natural orbital motion, between space objects or between space objects and space debris; pre-notification of the launch of space objects; collisions, break-ups in orbit, and any other destruction of space objects which have taken place due to generating measurable orbital debris; predicted high-risk re-entry events in which the re-entering space object or residual material from the re-entering space object potentially could cause significant damage or radioactive contamination; malfunctioning of space objects or loss of control that could result in a significantly increased probability of a high risk re-entry event or a collision between space objects.[17] The code proposes the notification and information sharing process through the Central Point of Contact, according to the ninth section, or through other diplomatic channels. The sixth section stipulates the information sharing of national space strategies, policies and programs.

Lastly, the European Union opened a multilateral conference in New York from the 27th to the 31st of July 2015 and invited all countries to formally negotiate the Code. The EU hoped to end the negotiation and to open the code to subscriptions with the endorsement by the UN, but confirmed the remaining critiques and oppositions to the code. We have already observed the arguments that political commitment, rather than a legally binding instrument, is not sufficient and that the explicit reference to the right of self-defense could provoke arms race in outer space. Other than those, countries in Latin America and Africa which mostly do not yet have technological capabilities to perform space explorations, considered the measures in the code as a barrier, imposed by the developed countries, to efforts of developing countries to have such capabilities. Otherwise, they called for more technical cooperation from the advanced countries to implement the code. The other critique is that the code was conceived and elaborated outside the UN, and therefore cannot be regarded as the result of collective and inclusive work. The EU held open-ended consultation meetings with more than 90 countries but

[16] ICOC at box 51.

[17] ICOC at box 58-64.

only after the essential part of the code had already been drafted. The support of the UN Institute of Disarmament Research to the code and the EU's choice of the UN Headquarters as a location of conference did not convince many states, especially not those of the Non-Aligned Movement and BRICS which demanded the negotiation to be held under the formal UN framework.[18]

The most serious debate was about the nature and the scope of the code. Should it be a civil security measure to curb the diffusion of debris, or to avoid unintentional collisions? Or should it be an arms control tool, or an anti-weaponization-of-space tool? The code does not explicitly address any space weapon or ASAT weapon, but that does not mean that the code only covers civil space activities. The preamble refers to PAROS and the fourth section to space operations which can damage or destruct other space objects. There is an irreconcilable difference of opinions between some states which want to exclude military space related issues and others which want to develop the code into a stronger arms control measure through negotiation in the CD. The EU might intend to develop the code into the transparency and confidence building measures with emphasis on information sharing to avoid misunderstandings and unintentional escalation and conflicts. However, this option became redundant, because in 2013 the UNGA has already adopted the TCBMs in outer space, agreed to by the Group of Governmental Experts (GGE).

3.3 UN GGE Report: an agreed TCBMs on outer space activities

In 2011, the UN General Assembly took another initiative and approved a resolution to establish a GGE under the UN Secretary General to study transparency and confidence-building measures (TCBMs) for outer space activities. The United States abstained in this vote with the concerns that Russia and China could bypass the CD and achieve their goals directly through the UNGA. The fifteen members of the GGE were elected on the basis of equitable geographical representation and included the permanent five members of the UN Security Council. After two years of work of the GGE, the UNGA received and endorsed the final report at its 68th session on 8 December 2013. Since then, the result has received widespread support from the international community and been considered a significant progress in the field of space security.

The first chapter is the Introduction which states that pursuant to the General Assembly resolution 65/68, the Secretary-General established the GGE on TCBMs in outer space activities to conduct the study on outer space transparency and confidence building measures, without prejudice to the substantive discussions on the prevention of arms race in outer space within the framework of the Conference on Disarmament. The second chapter is about the Background Overview where the GGE recognized the existing international treaties, legal framework and proposals on the table, and the roles of other relevant international organizations such as UN COPUOS, the CD, the International Telecommunication Union (ITU) and the World Meteorological Organization

[18] Lucia Marta, "Code of conduct on space activities: unsolved critiques and the question of its identity", FRS note n. 26/2015, p. 2-3.

(WMO).[19] The third chapter defines the Characteristics and Principles of TCBMs in outer space. The nature and purpose of TCBMs are means by which governments can share information with an aim of creating mutual understanding and trust, reducing misperceptions and miscalculations and thereby helping both to prevent military confrontation and to foster regional and global stability. TCBMs are voluntary and not legally binding and complement, not undermine, the existing international legal framework pertaining to outer space activities. TCBMs could contribute to the consideration of concepts and proposals for legally binding arms control measures as well as verification protocols included in legally binding international instruments.[20]

Chapter four, the most important part, specifies the measures of enhancing the transparency of outer space activities as follows.

Main Elements of UN TCBM[21]
• Information exchange on national space policy and goals, and exchange of information on military space expenditures
• Information exchange on activities in outer space including orbital parameters, possible conjunctions, natural space hazards and planned launches
• Notifications on risk reductions such as scheduled maneuvers, uncontrolled high-risk re-entries, emergency situations and intentional orbital breakups
• Voluntary visits to launch sites and command and control centers, and demonstration of space and rocket technologies

The remaining chapters introduce international cooperation, consultative mechanisms, outreach and coordination. The agreed UN TCBMs refer to military space activities, the second time on information exchange, on "military outer space expenditure and other national security space activities" and in voluntary familiarization visits for an understanding of national "space activities, including dual-use and military activities." However, they elaborate more in detail the information sharing of orbital parameters and conjunctions, forecast natural hazards, planned launches and re-entry events. They rule out the issue of weaponization in outer space from softer, but not less urgent, security threats, while remaining open to the consideration of legally binding arms control measures. A tug of war will continue. Russia and China argue that TCBMs are not enough and should be strengthened by a legally-binding arms control negotiation, for example on the PPWT verification protocol, but the United States want to stick to the agreed voluntary recommendations of the UN TCBMs.

3.4 UN COPUOS LTS Guidelines: the most recent negotiations

In 2010, the Scientific and Technical Subcommittee (STSC) of UN COPUOS established the Working Group on the Long-Term Sustainability of Outer Space Activities. Its objectives are to identify the areas of concern for the long-term sustainability of outer space activities and to propose the guidelines that could enhance sustainability, as well as producing voluntary guidelines to reduce risks to long-term sustainability. The initiative may come from the success of STSC in concluding the Space Debris Mitigation Guidelines in 2007.[22] Setting aside the sensitive political considerations, but based more on the scientific

[19] Group of Governmental Experts on Transparency and Confidence-Building Measures in Outer Space Activities, A/68/189* [hereinafter cited as UN TCBMs] p. 9.
[20] UN TCBMs, p. 12-15.
[21] UN TCBMs, p. 15-18.
[22] Report of the Committee on the Peaceful Uses of Outer Space, General Assembly Official Records Sixty-Second Session Supplement No. 20 (A/62/20), 2007, p. 47-50.

and technical background, STSC might expect to ambitiously achieve another progress in the hot issue of new rules of road for outer space. Four expert groups were created to discuss specific topics and develop draft guidelines; the expert group A titled "Sustainable space utilization supporting sustainable development on Earth"; the expert group B titled "Space debris, space operations and tools to support space situational awareness sharing"; the expert group C titled "Space weather"; and the expert group D titled "Regulatory regimes and guidance for new actors in the space arena".

Experts finalized their reports for STSC 2013 which contained 33 draft guidelines, voluntary in nature and not legally binding under international law. From there on, the member states have been reviewing, adding, modifying and consolidating the guidelines, intending to submit the final report to the UN General Assembly in 2016. However, the schedule is delayed to 2018 because the agreement has not been reached.

First, the purpose and general structure of guidelines are introduced here, based on the original draft of 2013. The stated purpose of the guidelines is to "provide a foundation for the development of national and international practices and safety frameworks for conducting outer space activities, while allowing flexibility in adapting such frameworks to specific national circumstances and organizational structures".[23] The guidelines are voluntary, not legally binding and intended to "supplement guidance available in existing standards and regulatory requirements".[24]

The guidelines 1 to 8 address the development of national policies and practices, including the recommendations of sharing experience and expertise on the sustainability of space activities, promoting studies for such sustainable uses, and providing registration information to assist in identifying space objects. The guidelines 9 to 15 refer to the development of regulatory frameworks for national and international organizations[25] that authorize or conduct space activities. The guidelines 16 to 20 suggest international cooperation measures, considering the needs and interests of developing countries. The guidelines 21 to 31 provide scientific and technical guidance to collect, archive, share and disseminate information on space objects and space weather. International standards for information sharing are also recommended. This technical guidance of information sharing, proposed by the expert group B, could be the most important part of the draft guidelines.

Afterwards, the member states have consolidated the guidelines, crossing the guidelines proposed by different expert group, and so the above sequentially ordered structure has changed. When the member states modify the guidelines, or add new guidelines to them, however, the emphasis and controversy have remained in the part of the technical guidance to information sharing, drafted by the expert group B. Based on the result of negotiations until the end of 2016, the agreed and disagreed guidelines are contrasted here.[26]

[23] Proposal for a draft report and a preliminary set of draft guidelines of the Working Group on the Long-term Sustainability of Outer Space Activities, Nov. 1, 2013, A/AC.105/C.1/L.339 [hereinafter cited as LTS 2013] p.3.

[24] LTS 2013, p. 4.

[25] ESA and WMO are the examples.

[26] Please note that the guidelines are shortened and summarized from the original ones.

Contrast 1: Guidelines on Electromagnetic Interference
• [Agreed] Ensure the equitable, rational and efficient use of the radio frequency spectrum and the various orbital regions used by satellites
• [Under discussion] Implement policy aimed at precluding interference with the operation of foreign space objects through unauthorized access to their on-board hardware and software

First, the above table shows the contrast between agreed and disagreed guidelines on electromagnetic interference. The agreed guideline reaffirmed the obligations under the Constitution and the Radio Regulations of the International Telecommunication Union (ITU) and emphasized the prompt resolution of identified harmful radio frequency interference.[27] However, the guideline still under discussion specifically prohibits "unauthorized access to their on-board hardware and software" of foreign space objects, which address the issue of cyber-attacks on space objects.[28]

Contrast 2: Guidelines on Registration of Space Objects
• [Agreed] Improve accuracy of orbital data on space objects and enhance the practice and utility of sharing orbital information on space objects, placement of a space object into a graveyard orbit
• [Under discussion] Enhance the practice of registering space objects (in accordance with the following indicative list)
- Purposeful change of orbital parameters of a space object as a result of which the said space object moves to a different region of near-Earth space;
- Placement of a space object into a graveyard orbit or an orbit with reduced ballistic lifetime;
- (c) Change in location in geostationary orbit;
- (d) Repositioning (not entailing significant changes in basic orbital parameters) of a spacecraft operating as part of a satellite constellation among nominal slots within the orbital structure of this constellation.

The expert group B proposed also the measure to improve the current practice of registration of space objects, considering that the existing registered information is not harmonized and arbitrary. In the explanation of the agreed guideline, emphasis was put on technical means to "improve the capabilities and geographical distribution of existing and new sensors, use of passive and active on-orbit tracking aids, and combining and validating data from different sources", [29] and in exchange of such obtained information. However, the guideline under discussion specifies which information should be given and to whom. The information includes the purposeful change of orbital parameters, the change of location in geostationary orbit and the repositioning of spacecrafts, which would be considered as an offensive maneuver. For the destination of such information, the UNOOSA is mentioned.[30]

Contrast 3: Guidelines on Conjunction Assessment
• [Under discussion] Perform conjunction assessment during all orbital phases of controlled flight
• [Under discussion] Develop practical approaches for pre-launch assessment of possible conjunctions of newly launched space objects with space objects already present in near-Earth space

The above table shows that the member states have not agreed on whether they should perform the conjunction assessment in the pre-launch phase or in all orbital phases. [31]

When it comes to monitoring of space debris and other orbital objects or to sharing of space weather data and forecasts, the

[27] Guidelines for the long-term sustainability of outer space activities, Jun. 16, 2016, A/AC.105/2016/CRP.17 [hereinafter cited as LTS 2016] p. 5-6.
[28] LTS 2016, p. 23-24.
[29] LTS 2016, p. 6.
[30] LTS 2016, p. 18-21.
[31] LTS 2016, p. 28-30.

guidelines are all agreed. The guideline 13 promotes "the collection, sharing and dissemination of space debris monitoring information";[32] the guidelines 16 and 17 recommend to "share operational space weather data and forecasts" and to "develop space weather models and tools and collect established practices on the mitigation of space weather effects".[33]

The other disagreed guidelines, meaning still under discussion, usually have strong implications on arms control. For example, guideline 10 requires states to "refrain from intentional modifications of the natural space environment" with reference to the Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques of 1977;[34] guideline 20 suggest to "develop and implement criteria and procedures for the preparation and conduct of space activities aimed at the active removal of space objects from orbit", which could be used to damage other satellites intentionally or unintentionally;[35] guideline 21 addresses the intentional destruction of in-orbit space objects, possibly by the ASAT missile system by proposing to "establish procedures and requirements for the safe conduct, in extreme cases, of operations resulting in the destruction of in-orbit space objects." The last guideline limits such destruction operations to the cases in which there is "an unavoidable measure to avert immediate or potential serious threat to human life, the environment or property in outer space or, in case of the predicted entry of a space object into the Earth's atmosphere, on the ground, in the air or at sea."[36] Considering national infrastructures in foreign territories tend to increase for space situational awareness, the guideline 18 requires states to "Ensure the safety and security of terrestrial infrastructure that supports the operation of orbital systems and respect the security of foreign space-related terrestrial and information infrastructures", but are not agreed on yet.[37]

The negotiation among member states within the framework of STSC of UN COPUOS will continue this year, aiming to submit the final report to the UN General Assembly in 2018, but at this stage it appears difficult to reach an agreement among member states.

Conclusion

In this article, by analyzing the four different negotiations in the diplomatic field of outer space security, it is observed that the focus has shifted from the Conference of Disarmament, the more traditional forum for arms control negotiations to the UN Committee of Peaceful Uses of Outer Space, originally considered as the forum for civil cooperation. The character of norms has changed from legally binding arms control treaty to voluntary-basis TCBMs. The subjects of debate on outer space security have also been diversified from the issue of weaponization to the one of space debris, in-orbit collision, re-entry, electromagnetic interference, active removal of space debris and any other abnormal operations of space objects. The four different measures are summarized in the following table.

It is noticeable that the United States, who had formerly opposed to join the discussions of ICOC or other TCBMs, started to participate actively in the negotiations of new rules of road for outer space activities.

[32] LTS 2016, p. 6.
[33] LTS 2016, p. 7-9.
[34] LTS 2016, p. 25-26.
[35] LTS 2016, p. 32-33.
[36] LTS 2016, p. 33-34.
[37] LTS 2016, p. 30-31.

The United States now consider the voluntary and pragmatic norms, like TCBMs as one of measures to enhance the resilience of their commercial and strategic space assets.

Russia and China are clearly trying to implement their goals, the settlement of a legally-binding arms control treaty, within the discussion of TCBMs and its implementation measures. This attempt is often interpreted as an effort to prevent the United States from expanding its superior conventional military technologies, especially the missile defense system, into outer space.

However, strengthening of arms control in outer space is at the same time considered to be the only way to prevent outer space from being an arena of armed conflict, which can produce intolerable space debris and eventually spoil the humanity's outer space exploration. The UN COPUOS now became the most important forum to resolve the conflicting opinions and the relevant discussion on the LTS Guidelines should therefore be carefully monitored.

	PPWT	**ICOC**	**UN TCBMs**	**LTS Guidelines**
Discussion Period	since 2008	since 2009	2011-2013	since 2010
Discussion Forum	CD	no UN activity (Invitation Basis)	UN GGE	UN COPUOS STSC
Initiated by	Russia and China	EU	Russia and UNGA	UN COPUOS STSC
Status	Draft Treaty	Draft Code	Endorsed by UNGA	Draft Guidelines
Legal Basis	Legally binding	Voluntary	Voluntary	Voluntary
Type	Arms control	Code of Conduct	TCBMs	Technical Implementation
Supporters	China and Russia (Europe absent)	Major space-faring nations but China and Russia	All	*Still under discussions but*
Opponents	United States	China and Russia NAM, Latin and African Countries	-	*similar pattern as in ICOC*

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Die Interdisziplinäre Forschungsgruppe Abrüstung, Rüstungskontrolle und Risikotechnologien (IFAR²) beschäftigt sich mit dem komplexen Zusammenspiel von rüstungsdynamischen Faktoren, dem potenziellen Waffeneinsatz, der Strategiedebatte sowie den Möglichkeiten von Rüstungskontrolle, Non-Proliferation und Abrüstung als sicherheitspolitische Instrumente. Weitere Informationen unter http://www.ifsh.de/IFAR.

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