The Importance of the United Nations Guidelines for the Long-Term Sustainability of Space Activities and Other International Initiatives to Promote Space Sustainability*

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ABSTRACT

The long-term sustainability of space activities is an emerging issue to which actors in the global space community –including governments, agencies, and industry– are devoting increasing amounts of attention and resources. Considering the sustainability of space activities involves taking into account the present population of space debris, the size of the debris population in the most commonly-used Earth orbits in the future, and the possibility of collision events between objects in space. Addressing space debris and other threats to space sustainability involves both technological and political solutions. The United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) has led a major effort to define such solutions and has established a working group tasked with the development of non-binding long-term sustainability (LTS) guidelines.

This article includes an overview of the concept of space sustainability, a discussion of the need, development, and current status of the LTS guidelines, as well as an analysis of some of the guidelines themselves. It concludes with a broader discussion of space as an area without state sovereignty – one of the key aspects that have influenced the development of non-binding measures to address the space sustainability challenge. In this context, and given the governance questions that arise from the interaction between states and non-state actors in this domain, this discussion should be of interest to international relations scholars and practitioners.

Key words: Space sustainability, international cooperation, United Nations.

La importancia de las directrices de las Naciones Unidas para la sostenibilidad a largo plazo de actividades espaciales y otras iniciativas internacionales para promover la sostenibilidad en el espacio

RESUMEN

La sostenibilidad a largo plazo de las actividades espaciales es un problema emergente al cual la comunidad espacial global –incluyendo Gobiernos, agencias y el sector privado– está dedicando mayor atención y recursos. La sostenibilidad de las actividades espaciales implica tomar en cuenta la actual población de desechos espaciales, el tamaño futuro de la población de dichos desechos en las órbitas terrestres más comúnmente utilizadas, y la posibilidad de eventos de colisión entre objetos en las mismas. Abordar el problema de los desechos y otras amenazas a la sostenibilidad de las actividades espaciales requiere tanto de soluciones tecnológicas como políticas. El Comité para el Uso Pacífico del Espacio Exterior de la ONU (COPUOS, por sus siglas en inglés) ha liderado un esfuerzo para definir este tipo de soluciones y ha establecido un grupo de trabajo encargado de desarrollar directrices no vinculantes para asegurar la sostenibilidad espacial a largo plazo.

Este artículo incluye una descripción del concepto de sostenibilidad espacial, una

discusión de la necesidad, desenvolvimiento y estado actual de las directrices desarrolladas por COPUOS, así como un análisis de algunas de estas. Concluye con un debate más amplio sobre el espacio como una zona sin soberanía estatal, uno de los aspectos claves que ha influido en el desarrollo de medidas no vinculantes para afrontar el reto de la sostenibilidad espacial. En este contexto, y teniendo en cuenta las cuestiones de gobernabilidad que surgen de la interacción entre los Estados y actores no estatales en este dominio, esta discusión debe ser de interés para estudiantes y profesionales en el campo de las relaciones internacionales.

Palabras clave: sostenibilidad en el espacio, cooperación internacional, Naciones Unidas.

INTRODUCTION

The utilization of outer space is an increasingly important aspect of modern civilization. The more than 1,200 functional satellites currently in orbit around Earth provide a wide array a critical services and capabilities[1]. Earth observation satellites provide key information about Earth's environment and climate, contribute to the development of weather forecasts and warnings of potential natural disasters, and offer tools to manage Earth's natural resources more efficiently and responsibly. Communication satellites broadcast not only entertainment but also enable tele-medicine, tele-education, and emergency response. Global navigation satellite services give precise positioning and timing information that make air, ground, and maritime transportation safer and more efficient.

Humanity faces a number of challenges to our ability to continue to provide all of these space-based services and capabilities. The most well-known is the threat of space debris – non-functioning satellites, spent rocket stages, and other fragments associated with humanity's six decades of activity in space. There are currently more than 23,000 pieces of human-generated debris in Earth orbit larger than 10 centimeters in size, each of which could destroy an active satellite in a collision (National Aeronautics and Space Administration, n.d.). Research done by scientists from various space agencies indicates that there are an estimated 500,000 pieces of space debris between 1 and 10 centimeters in size that are largely untracked, which could cause severe damage to an active satellite in a collision (Union of Concerned Scientists, n.d.).

As space debris is generated by human activities in space, it is concentrated in the most heavily used regions of Earth orbit where many active satellites also reside. These regions include the low Earth orbit (LEO) region below 2,000 kilometers in altitude, and the geostationary Earth orbit (GEO) region, approximately 36,000 kilometers above the equator. Of the two regions, satellites in LEO are currently at the highest risk of collisions with space debris. For example, NASA estimates a 1-in-42 chance

[1] The most accurate public estimate of the active satellites current in Earth orbit is a database maintained by the Union of Concerned Scientists (n.d.).

(in any given six-month period) that orbital debris will puncture the International Space Station (ISS), located in LEO, and cause a loss of pressurization. Over the projected ISS program timeframe, this becomes a startling 1-in-4 chance of such an incident. NASA also notes the degradation of ISS solar panels from space debris (nasa Office of the Inspector General, 2014, pp. 10,13). Because active satellites in the GEO region are often located in close proximity to other active satellites, the risk of collision between active satellites in GEO is also an important threat to consider.

A second challenge to our ability to utilize space is electromagnetic interference (EMI). All satellites currently use a portion of the electromagnetic spectrum to perform their missions. Nearly all satellites also use radio frequencies to communicate with the ground or other satellites. As the electromagnetic spectrum is a limited natural resource, the increase in the number of terrestrial and space users has led to concerns over interference. Terrestrial communication systems that utilize the same frequencies as satellite services can inhibit the ability of satellites to provide those services. Satellites utilizing the same radio frequencies and orbiting in close proximity to each other could end up creating unintentional radio frequency interference (RFI) for each other.

A third challenge to our long-term ability to utilize space is the risk of conflict, both in space and on Earth. A growing number of countries use space services and capabilities for terrestrial military and intelligence purposes. These technologies are generally agreed to have many peaceful applications and play an increasingly important role in both national and international security. However, as more countries integrate space into their national military capabilities and rely on space-based information for national security, there is an increased chance that any interference with satellites could spark or escalate tensions and conflict in space or on Earth. This is made all the more difficult by the challenge of determining the exact cause of a satellite malfunction and ascertaining whether it was due to a space weather event, space debris impact, unintentional interference or deliberate aggression. An important step forward in addressing these challenges is the development of norms of behavior that delineate responsible and irresponsible activities in space. Transparency and confidence-building measures (TCBMS) can also increase strategic stability and security.

Governance of Space Activities

Outer space is often referred to as being a "global commons" and closely linked to other perceived global commons, such as Earth's atmosphere and ocean, and the Internet. From an economic perspective, the global commons label stems from the traditional notion that space is non-excludable (all those who wish to utilize space for peaceful purposes are legally allowed to) and non-rivalrous (outer space is large enough that usage by one entity does not preclude usage by another). This view of outer space has led the historical economic policy discussions on space sustainability to focus on using environmental economics and threats such as space debris as negative externalities to be dealt with using microeconomic incentives. However, these efforts have largely

failed to achieve meaningful traction and are currently absent from the relevant national or international policy discussions[2].

At the core of this failure is the generalization of all of outer space as a global commons. While outer space as a whole is indeed non-rivalrous, the heavily used regions of LEO and GEO are rivalrous and also becoming congested. Thus, a more accurate economic label for these regions is as common-pool resources (CPRs) within the larger global commons of outer space, in the same way that fisheries and oil fields are CPRs within the global commons of the world's ocean. Viewed this way, the problem of space sustainability becomes a question about sustainable governance of one or more CPRs within the global commons of outer space.

Nobel Prize-winning economist Elinor Ostrom spent much of her life studying CPRs. She discovered that it was possible to avoid the famous "tragedy of the commons" and sustainably manage a CPR. Ostrom cited numerous cases where resource users effectively self-organized to sustainably manage a CPR without a centralized authority and without privatizing the common resource (Ostrom, 1998). Based on this research, Ostrom developed an eight-principle framework that outlines the conditions present in every successful case of a sustainably managed CPR. These principles are:

1. Clearly defined boundaries of the CPR (effective exclusion of external unentitled parties);
2. Congruence between governance structure or rules and the resource context;
3. Collective-choice arrangements that allow most resource appropriators to participate in the decision making process;
4. Effective monitoring by monitors who are part of or accountable to the appropriators;
5. Graduated sanctions for resource appropriators who violate community rules;
6. Low-cost and easy-to-access conflict resolution mechanisms;
7. Self-determination of the community, recognized by higher level authorities;
8. In the case of larger common-pool resources, organization in the form of multiple layers of nested enterprises.

A key part of these principles is the existence of fora where all resource appropriators can participate in the decision-making process. In the context of outer space, governance agreements are mainly housed in the United Nations system, specifically the General Assembly (UNGA)[3]. Within the six permanent committees of the UNGA, space is considered in two: the First and Fourth Committees. The First Committee, generally dealing with disarmament and security, focuses on space within its Confe-

[2] *See also* Weeden (2012).

[3] A more detailed analysis of Ostrom's eight principles in the context of space can be found in Chow & Weeden (2012).

rence on Disarmament (CD), which examines military issues, such as weapons and an arms race in space. The Fourth Committee, which considers political issues, focuses on the civil and commercial uses of space through COPUOS. Many of the foundational legal principles for outer space stem from treaties produced by COPUOS since its formation in 1959.

BACKGROUND OF THE DRAFT GUIDELINES OF THE WORKING GROUP ON THE LONG-TERM SUSTAINABILITY OF SPACE ACTIVITIES

Space debris was the first threat to sustainable space activities to receive international attention and coordination. In response to the recognition that space debris poses a threat to space missions and activity reliant on space activities, several space agencies began working together in the mid-1990s to develop the Inter-Agency Space Debris Coordination Committee (IADC) Space Debris Mitigation Guidelines. These guidelines were adopted in 2002 and have since been observed and incorporated into national regulations pertaining to national space activities. In 2007, COPUOS supplemented the IADC guidelines (which are technical in nature) with the adoption of political guidelines. The COPUOS debris mitigation guidelines are a set of voluntary high-level guidelines for space debris mitigation (unoosa, 2007). The focus on space debris mitigation within COPUOS was mirrored by its ongoing attention to the more general issue of the sustainability of space activities, including the threats of EMI and the possibility of conflict, as discussed before.

In 2004, COPUOS Chair Karl Doetsch delivered a speech to the Committee addressing the long-term sustainability issue. In 2007, the then COPUOS Chair Gérard Brachet contributed a white paper on the topic to the Committee, and in 2008, the French delegation informed the COPUOS Scientific and Technical Subcommittee (STSC) of its intention to propose the long-term sustainability of space activities as a permanent agenda item of COPUOS. In accordance with UNGA Res. 64/86, the COPUOS STSC 2010 established a working group for the agenda item "Long-term sustainability of space activities". The Chair of the Working Group is Mr. Peter Martinez of South Africa. Four expert groups were established by the Working Group:

- Expert group A: Sustainable space utilization supporting sustainable development on Earth
- Expert group B: Space debris, space operations and tools to support collaborative space situational awareness
- Expert group C: Space weather
- Expert group D: Regulatory regimes and guidance for actors in the space arena

Each expert group was co-chaired by experts in their fields. Expert group A was co-chaired by Mr. Filipe Duarte Santos (Portugal) and Mr. Enrique Pacheco Cabrera (Mexico); expert group B was co-chaired by Mr. Richard Buenneke (United States) and Mr. Claudio Portelli (Italy); expert group C was co-chaired by Mr. Takahiro Obara (Japan) and Mr. Ian Mann (Canada); and expert group D was co-chaired by Mr. Sergio Marchisio

(Italy) and Mr. Anthony Wicht (Australia) (A/AC.105/C.1/2013/CRP.10, p. 2, para. 7).

THE DRAFT GUIDELINES OF THE WORKING GROUP ON THE LONG-TERM SUSTAINABILITY OF OUTER SPACE ACTIVITIES

The recommendations on the sustainability of space activities developed by the expert groups were compiled into a draft set of guidelines. Completed in November 2013, the compilation contained 33 draft guidelines, grouped into the following sections: 1) policy, 2) regulatory mechanisms, 3) international cooperation, and 4) management. The draft guidelines also have a "Purpose", "Rationale", and "Scope and Application" sections, which are similar to the preambular paragraphs of an international treaty (A/AC.105/C.1/L.339, 2013, pp. 3-4).

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 for flexibility in adapting such frameworks to specific national circumstances and organizational structures" (A/AC.105/C.1/L.339, p. 3, para. 8).

The guidelines were developed to fit within the existing international legal framework for space activities, including the various UN treaties and principles on outer space. Additionally, the practices of States (including their policies, operating procedures, technical standards, and the experience gained in space activities) were taken into account in the development of the guidelines (A/AC.105/C.1/L.339, p. 4). However, the guidelines are voluntary in nature and are not legally binding under international law. Rather, they are intended to "supplement guidance available in existing standards and regulatory requirements". (A/AC.105/C.1/L.339, p. 4, para. 17.)

In 2014, expert groups A, C, and D finished their work and submitted their draft guidelines to the Chair of the LTS Working Group[4]. These draft guidelines were discussed at both the COPUOS Scientific and Technical Subcommittee in February 2014 and at the COPUOS Legal Subcommittee in March 2014. They were again addressed at the COPUOS plenary in June 2014. In each session, the Chair of the Working Group, Peter Martinez of South Africa, made himself available to consultation by COPUOS Member States.

Guidelines 1 through 8 contain guidance on developing national policies and practices that aid the long-term sustainability of space activities, information and expertise sharing, and further research and development on sustainability. They include recommendations to share experience and expertise on the sustainability of space activities, promoting studies for such sustainable uses, and also providing

[4] While it did submit draft guidelines, expert group B had not submitted its final report by the time the preliminary set of guidelines were compiled. The group submitted its report on 16 June, 2014, with a slight wording change to guideline B.4, noted as "still under discussion" in the compilation. This guideline now reads "Promote techniques and investigation of new methods to improve the accuracy of orbital data for spaceflight activity". (A/AC.1-5/2014/CRP.14, 2014)

registration information to assist in identifying space objects. The international registration of space objects is also addressed by UNGA Resolution 1721 B (XVI) from 1961, and the 1975 Registration Convention.

Guidelines 9 through 15 concern the development of regulatory frameworks and practices supporting the long-term sustainability of space activities, both for national governments considering national regulation, and for international intergovernmental organizations (e.g., ESA) that authorize or otherwise conduct space activities.

Recognizing that space activities are inherently international in nature, and sustainability issues even more so, guidelines 16 through 20 address international cooperation. However, these guidelines are still under discussion. Guideline 17 encourages international cooperation for capacity-building and data accessibility, through data sharing, derived information sharing, and associated tools, and is meant to especially take into account the needs and interests of developing countries.

Guidelines 21 through 31 are focused on providing guidance of a scientific and technical nature, and were aimed at a wide audience: governments, international intergovernmental organizations, national and international non-governmental organizations, and private sector entities that engage in space activities. They largely address the collection, archiving, sharing, and dissemination of information on space objects and space weather, and on the use of international standards for information sharing.

The two concluding guidelines deal with the management of the entities conducting space activities, and were suggested by Martinez.

Consolidated Draft Guidelines

At the 2014 COPUOS, Martinez submitted a conference paper containing a proposal for the consolidation of the draft guidelines (A/AC.105/2014/CRP.5, 2014). The paper combines the substance of related draft guidelines into a smaller set of draft guidelines. The draft guidelines and their consolidation were discussed at COPUOS 2014, with a number of views expressed by the delegations, along with recommendations and suggestions for future work. The Committee received a number of more substantive suggestions, including a working paper from the Russian delegation for establishing a center for information on near-Earth space monitoring, under the auspices of the UN (A/AC.105/L.290). The Committee also heard views expressing the need to include guidance relevant to small satellites and small satellite operators, that nuclear power sources in space should be considered in light of their impact on space sustainability, and that while the guidelines are meant to be non-binding and voluntary in nature, States could ensure the compliance of non-governmental actors (i.e., corporations) through appropriate national legislation (United Nations, 2014, pp. 24-27).

The consolidated draft guidelines combine analogous guidelines, in an aim to make them simpler and more streamlined. The existing 33 draft guidelines were consolidated into 16 draft guidelines (A/AC/.105/2014/CRP.5). A survey of the consolidated guidelines shows that

many individual guidelines were already well suited for consolidation. Guidelines 1 and 2, for example, originally read "[s]hare experience and expertise relating to the long-term sustainability of outer space activities" and "[d]evelop and adopt procedures to facilitate the compilation and effective dissemination of information that will enhance the long-term sustainability of space activities, among the relevant space actors". Developed by expert group D, and focused on regulatory regimes and guidance for actors in the space arena, these draft guidelines easily lend themselves to a consolidation. Accordingly, consolidated draft guideline 1 now reads: "States and intergovernmental organizations are encouraged to share experience and expertise relating to the long-term sustainability of outer space activities and to develop and adopt procedures to facilitate the compilation and effective dissemination of information that will enhance the long-term sustainability of space activities". (A/AC.105/2014/CRP.5, 2014). Draft guideline 20, concerning contact information for operators, easily dovetails with draft guideline 6 which addressed providing registration information to assist in the identification of space objects.

Other consolidations take multiple guidelines developed by the different expert groups and combine them. When combined, the related guidelines may reduce duplication and overlap. At the same time, the view was expressed at COPUOS 2014 that the consolidation of the guidelines should not result in them being so consolidated and streamlined so as to no longer offer practical solutions to real problems relating to the long-term sustainability of outer space activities (United Nations, 2014, p. 26, para. 194). For example, draft guideline 17, 19, and 31 are now combined to read "States and international intergovernmental organizations are encouraged to support and promote capacity-building in scientific, technical and legal capabilities and improved data accessibility as a means to promote the long-term sustainability of outer space activities". The original draft guidelines that this consolidated guideline comes from, however, may be more explicit. They read:

> Support and promote international cooperation for capacity-building and data accessibility, on a mutually acceptable basis, through the sharing of data, derived information and associated tools taking into account the needs and interests of developing countries (Draft Guideline 17).
>
> Promote international cooperation to assist countries in gathering human resources and achieving technical and legal capabilities and standards compatible with the relevant regulatory frameworks, especially countries that are beginning to develop their capacities in outer space applications and activities (Draft Guideline 19).
>
> Promote the education, training and capacity-building required for a sustainable global space weather capability (Draft Guideline 31).

This example shows that in the work of consolidation there is the danger of losing content. The consolidated draft guideline above does not explicitly mention space weather capability, for example.

During and subsequent to COPUOS 2014, the Working Group continued to receive comments and additional draft guidelines. Two additional draft guidelines were submitted

by the Russian Federation; Switzerland also submitted a proposal (A/AC.105/C.1/L.340, 2014). The Russian-proposed guidelines, below, address active debris removal, and ground and information infrastructures: "States and international intergovernmental organizations should develop and implement criteria and procedures for the preparation and conduct of space activities aimed at the active removal of debris from space. Respect the security of foreign space-related ground and information infrastructures".

Additionally, the new Swiss proposal addresses new measures for space sustainability: "States and international organizations are encouraged to investigate and consider new measures, including technical solutions, with a long-term effect on sustainability of outer space activities".

With these additional proposals, the Chair of the Working Group circulated an updated set of draft guidelines in October 2014 for the intersessional consideration of Member States before the February 2015 meeting of COPUOS STSC (A/AC.105/C.1/L.340, 2014). The current draft guidelines retain their thematic grouping, into 1) policy, regulatory and organizational; 2) scientific and technical; and 3) international cooperation and capacity-building sections. Subsequent new proposals for guidelines are expected by other Member States leading into 2015.

FUTURE DEVELOPMENTS AND WORK PLAN

In 2015, COPUOS will again consider the LTS guidelines at STSC 2015 and the COPUOS plenary in June, both held at the United Nations in Vienna, Austria. STSC will meet in February 2015, and the COPUOS plenary will meet in June 2015. At COPUOS 2014, the Committee agreed that Member States should work to finalize the draft guidelines for their approval at COPUOS 2016, and for their subsequent referral to the UNGA, also in 2016 (United Nations, 2014, p. 27).

For STSC 2015, Member States "intending to submit proposals on significant new elements, proposals on structural changes to existing guidelines and/or additional draft guidelines are strongly encouraged to do so by, and preferably prior to, the start of [STSC 2015]". At STSC 2015, the LTS Working Group will again consider the latest draft version of the guidelines, and additional proposals for guidelines, and aim to consolidate them by the end of the STSC (United Nations, 2014, p. 27, para. 199 (a) and (b)).

The deadline for proposing significant new elements to existing guidelines or additional draft guidelines is COPUOS 2015 in June 2015. The Working Group will also consider a revised draft report and set of guidelines, along with any additional proposals for guidelines (United Nations, 2014, p. 27, para. 199 (c)).

The following year, at STSC 2016, the Working Group will again consider its draft report and updated guidelines "with an aim of decisively moving forward with the finalization process (United Nations, 2014, p. 27, para. 199 (d)).

Subsequently, at COPUOS 2016, the Committee will address any outstanding issues with the Working Group's report and the set of guidelines, consider and agree on the form

in which the guidelines will be presented to the UNGA, and also consider topics for future discussion on the long-term sustainability of space activities (United Nations, 2014, pp. 27-28, para. 199 (e)).

In light of the work still yet to be done in COPUOS (its Subcommittee, Working Group, and expert groups), Martinez has encouraged Member States to include experts able to support and advise their delegations in the development of the guidelines. In the meantime, the draft report and draft guidelines will be translated into the six official languages of the United Nations (Arabic, Chinese, English, French, Russian, and Spanish) before the start of STSC 2015 (United Nations, 2014, p. 28, para. 200, 201.)

CONCURRENT ACTIVITIES AT THE INTERNATIONAL LEVEL

It should be noted that other relevant activities have been developed to address the long-term sustainability challenge. The two initiatives discussed below have also focused on non-binding measures and on the behavior of actors in space. They do not compete against each other and are, in fact, a type of concurrent effort to ensure the long-term sustainable use of space.

The UN Group of Governmental Experts Report on Transparency and Confidence-Building Measures in Outer Space

The LTS guidelines effort discussed above is being implemented under the auspice of the Fourth Committee to the United Nations General Assembly. Meanwhile, the UNGA First Committee, whose work is concerned with matters of peace and security, has also demonstrated interest in space sustainability. In 2010, the Committee established a Group of Governmental Experts (GGE) on Transparency and Confidence-Building Mechanisms (TCBMS) for outer space activities. This GGE included experts from across the UN system and with a wide geographic diversity. The experts did not represent the views of their countries.

The GGE on Space TCBMS was set up by the Secretary General of the United Nations in 2011 and early 2012, following the adoption of UNGA Res. 65/68 adopted in 2010. It was mandated to conduct a study on voluntary TCBMS in outer space activities that could be presented and endorsed by the UNGA, without prejudice to the discussions on the Prevention of an Arms Race in Outer Space (PAROS) at the Conference on Disarmament.

The parties to the GGE were Brazil, Chile, China, France, Italy, Kazakhstan, Korea, Nigeria, Romania, Russia, South Africa, Sri Lanka, Ukraine, the United States, and the United Kingdom. The expert from Russia, Victor Vasiliev, was elected Chair of the GGE. Some of the experts were familiar with COPUOS, others were not. The permanent members of the Security Council are automatically members of UN-convened GGEs.

The GGE met in three full weeklong sessions: in New York City in 2012, in Geneva in April 2013, and in New York City in July 2013. Written contributions were also received from States not represented in the GGE, along with the International Telecommunication Union and the Secure World Foundation,

among other organizations. The final version of the report was published by the UN Secretariat in September 2013 and translated into the six official languages. The GGE report considered the general characteristics and basic principles of outer space TCBMs.

From the beginning, GGE members determined that a consensus report would have more weight. Even though there was disagreement on some substantive issues, the group's achievement of this objective demonstrated an excellent spirit of cooperation. Issues of disagreement included the voluntary and non-legally binding character of TCBMs, references to the Russia-China draft Treaty on the Prevention of Placement of Weapons in Outer Space, the Threat or Use of Force Against Outer Space Objects (PPWT), references to the draft International Code of Conduct for Outer Space Activities, references to the Hague Code of Conduct against missile proliferation, and references to the Missile Technology Control Regime. However, compromises were eventually found to resolve these issues.

The GGE report was presented to the First Committee of the UNGA in October 2013 and adopted without dissent. The draft UNGA resolution welcoming the GGE report and endorsing its consensus was submitted by China, Russia, and the United States. It was adopted as Res. 68/50 by a unanimous vote.

The GGE report is linked to the LTS guidelines discussed above. As was discussed at COPUOS 2014, both indicate the value of information exchanges, notifications on outer space activities, registration of space objects, information exchanges relating to forecasting natural hazards in outer space, and for international cooperation for capacity building (United Nations, 2014, p. 25, para. 180). By reducing the risks of misunderstanding, mistrust, and miscalculations, TCBMs help promote long-term space sustainability.

The Draft International Code of Conduct for Space Activities

There is a parallel effort to develop an International Code of Conduct for Space Activities (ICoC). Initially led by the European Union, which released the first draft in 2008, the ICoC is a non-binding, voluntary instrument that seeks to build norms of responsible behavior in space.

The first draft formed the basis for global consultations and led to a series of meetings in which interested countries were asked to provide feedback in order to develop language that would be acceptable to as many nations as possible. Meetings were held in Vienna, Austria, in June 2012; in Kiev, Ukraine, in May 2013; and in Bangkok, Thailand, in November 2013.

The consultation process allowed for non-European countries to express their views on the content and process of the effort[5]. Many countries applauded the effort and have been actively engaged in the drafting process. Some countries, including Mexico and Brazil, while supportive of international discussions to ad-

[5] For a detailed account of some of the views expressed about this effort, see Rajagopalan and Porras (2014)

dress common concerns, criticized the initial drafting process because it did not engage the wider international community, and have called for the development of legally binding measures. The ICoC effort is ongoing; the latest draft was released in March 2014.

Space Sustainability within a Broader Context

The concurrent efforts to promote space sustainability discussed above indicate an awareness of the need for creative, non-binding, intergovernmental coordination mechanisms. To understand this phenomenon, it is useful to consider space sustainability within a broader context.

The regime for outer space is different from many familiar domains as space is a domain of activity that lacks the territorial sovereignty that is an integral part of the modern international system of States. *Ad personam* sovereignty, namely state jurisdiction over objects and persons, certainly exists, but outer space is unlike many areas familiar to legislating bodies and a novel approach is therefore necessary.

One example of the importance of this distinction is the status of real property in space. On Earth, title to real property is either held by the sovereign state or is conveyed between individuals or institutions under the real estate law appropriate to the territory where the transaction occurs. In space, there is no authority empowered to declare or sanction the establishment or transfer of title.

States can legislate on matters impacting the behavior of their citizens, and they could order that such citizens not interfere with a property claim of someone else. Because of the Outer Space Treaty's ban in Article II on territorial claims or national appropriation, however, such claim would not have the status of title and such order could only apply to persons over whom the state had personal jurisdiction (United Nations, 1967).

In this legal environment, close coordination among sovereign States is critical to ensure peaceful and cooperative use of space, safeguard resources present in space, and continue access to space-based applications of great importance to Earth.

In addition to the lack of traditional forms of sovereignty, the approach taken by space actors to both debate and resolve important issues is also changing. The state-centric international system has long been geared toward nation-state representatives, and, since the end of World War II, has largely gone through the United Nations as the forum where issues that affect overall stability have been discussed. In the past, this approach would culminate in some sort of treaty that would ban a certain type of technology or weapon that was considered unduly threatening to the overall stability of the international regime.

Space is different, however. First, many space technologies are inherently dual-use, meaning they can be used for military purposes as well as non-military purposes. Simply limiting space technology would do nothing to reduce the risk posed by threatening applications of that technology, while unduly limiting beneficial non-military applications. Second, the physical conditions of the space environment –specifically Earth orbit– make it a truly international domain: actions by one

actor can have consequences for all. Thus, if one wanted to ensure that space could continue to be used over the long term, all major stakeholders should be involved in the discussion and have a shared understanding of what sorts of behavior would be considered responsible. This highlights the importance of having representatives from all over the world participate in discussions like those that have produced the draft LTS guidelines.

In this context, treaties delimiting certain types of technology have limited usefulness in ensuring that the space domain is stable and sustainable. First, a treaty would either be so inclusive that everything could be considered a threat or so exclusive that nothing would appear to be one. The dual-use nature of space technologies makes this distinction a difficult one. Second, a treaty is only as effective as those who have signed it and does not put legal obligations on non-signatory countries[6]. If there was a treaty on space technologies that was not ratified by all space actors, they would not be held responsible by the requirements and the limitations of the treaty. Third, treaties usually require a verification process to ensure their enforcement (or to determine that they are not being complied with), which is difficult to do with space technologies, given that situational awareness is limited in space. In fact, if a space asset stops working, it is often unclear whether it was due to intentional interference, a solar flare, engineering breakdown, mechanical malfunction, or something else entirely.

With the three major international initiatives undertaken to ensure that space is a stable, reliable domain whose resources should be managed in order to allow for the long-term use of it, it is clear that the global community recognizes the importance of space sustainability and how it affects international security, stability, and development.

It should also be noted that the international initiatives discussed above are efforts that focus on shaping the behavior of space actors. In space, it is not the capabilities but the intent that can threaten other actors; the best way to signal good intent is to demonstrate that one recognizes there is an on-orbit responsibility to not interfere with others' use of space. Through establishing norms of behavior, the international community can clarify what its expectations are of responsible space actors and, perhaps more importantly, allow for the quick identification and response when one actor is acting irresponsibly.

There has been one major effort to establish a treaty on space security issues. In February 2008, Russia and China submitted the draft Treaty on the Prevention of Placement of Weapons in Outer Space, the Threat or Use of Force Against Outer Space Objects (PPWT) to the United Nations' Conference on Disarmament. It was updated in the summer of 2014 but still languishes on the sidelines of international discussions on space security and sustainability issues. This treaty is written so that it bans space-based missile defense

[6] Until they are considered to reflect customary international law, and thereafter binding even upon non-signatory States.

but allows for ground-based anti-satellite weapons. Because of this, countries like the United States argue that it is not equitable and, perhaps more importantly, is unverifiable and thus unenforceable. Russia and China have also been pushing for unilateral declarations of no-first-placement of weapons in space. Both of these initiatives have the underlying base assumption that the biggest threat to the stability of the space environment is a hostile nation using specific weapons technologies to actively target others, whether it be their national territories or their space assets. This contradicts the underlying purpose of non-legally binding efforts, which look at the behavior, not the technical capabilities, to determine the intent of the user.

CONCLUSION

This paper examined the importance and timeliness of international intergovernmental coordination on the issue of sustainable space activities. Three kinds of threats to space sustainability were outlined: space debris, EMI, and conflict in space. Space debris was the first threat addressed through the IADC and subsequently by COPOUS. The STSC at COPUOS has since focused on the broader issue of the long-term sustainability of space activities by establishing a Working Group and including it as an agenda item under its regular work plan. The Working Group has developed an initial set of 33 draft guidelines, which the Chair consolidated into 16 draft consolidated guidelines. These and other draft guidelines submitted for consideration will be open for discussion in the upcoming meetings of COPUOS and its STSC with an aim for their adoption at COPUOS 2016 and subsequent referral to the UNGA later in 2016.

In explaining the rationale behind the LTS guidelines effort, two other efforts –the draft ICoC and the GGE on TCBMS– have been described. Also seeking non-binding, voluntary measures to impact the behavior of space actors, taken together these initiatives reflect a shift towards creative international mechanisms to address space sustainability, given the various aspects that limit the effectiveness of treaties. As discussed before, these limitations include the difficulties of distinguishing between civilian and military applications from a purely technological basis, as well as the challenge of securing enforcement by non-signatories.

In an area without state sovereignty but which is seen as a common-pool resource that actors must share, cooperative mechanisms that strengthen information-sharing and that demonstrate an awareness of the interdependence of actors operating in space form the basis of the most effective solutions. These findings may yield important considerations as to how to define responsible behavior in other areas. Not just an issue for professionals involved in space activities, the issue of space sustainability illustrates the need to develop technological and political solutions in a growing and diversifying global community, and one that touches on humanity's ability to use an ever more critical resource for societal benefit and development, now and in the future.

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