Space Policy xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

Space Policy

journal homepage: www.elsevier.com/locate/spacepol

Development of an international compendium of guidelines for the long-term sustainability of outer space activities

Peter Martinez

SpaceLab, University of Cape Town, Rondebosch, 7700, South Africa

ARTICLE INFO

Keywords:
Space sustainability
Space security
Space diplomacy

ABSTRACT

The Earth's orbital space environment constitutes a finite resource that is being used by an increasing number of States, international intergovernmental organizations and non-governmental entities. The proliferation of space debris, the increasing complexity of space operations, the emergence of large constellations and the increased risks of collision and interference with the operation of space objects are raising concerns about the long-term sustainability of outer space activities. Addressing these developments and risks requires international co-operation. In 2010, the United Nations Committee on the Peaceful Uses of Outer Space (UN COPUOS) established a working group to address these matters and to propose a set of voluntary, non-binding guidelines for States that represent a compendium of internationally recognized measures for, and commitments to, ensuring the long-term sustainability of outer space activities and, in particular, enhancing the safety of space operations. This paper describes the efforts of this Working Group in the context of other multilateral space security initiatives. The first twelve guidelines, which were agreed in 2016, are briefly discussed, as well as the linkages of this process with the recommendations contained in the report of the Group of Governmental Experts on Transparency and Confidence-Building Measures in Outer Space Activities. The paper ends with some reflections on factors shaping the negotiations of the remaining draft guidelines as the Working Group enters its final round of negotiations in 2018.

1. Introduction

The word *sustainability* is derived from the Latin verb *sustinere* and is usually used in the context of being able maintain an activity at a certain rate or level. Since the 1970s the concept of sustainability has been applied to human habitation and the equitable utilization of planet Earth and its resources. This has given rise to the widely-used term *sustainable development*, which was coined in the paper "Our Common Future", published by the Brundtlandt Commission in 1987 [1]. The association of the concept of *sustainability* with *outer space activities* is much more recent and arises from the realization that the Earth's orbital environment and the electromagnetic spectrum are limited natural resources that are under increasing pressure from the steady growth in the number and diversity of space actors.

It is estimated that there are currently about 1500 operational satellites in Earth orbit [2]. Of these, about 450 operate in the geostationary orbit, 120 in medium Earth orbit and the remaining 930 operate in low Earth orbit. These satellites are operating in an orbital environment that is becoming increasingly congested. As of the 1st of November 2017, the United States Space Surveillance Network tracked a total of 18,800 catalogued space objects larger than about 10 cm, of which only 8% are active satellites. Objects of size 1–10 cm cannot yet be reliably tracked and may number as many 500,000. Fragments smaller than 1 cm may number in the millions. All this debris creates significant challenges for the safety of space operations.

From the beginning of the Space Age in 1957 to the end of 2016, 5609 space launches occurred [3], with a yearly rate of around 80–90 launches per year in recent years. However, the number of space objects deployed *per launch* has shown a significant increase in recent years, with launches of one or two dozen objects at a time now fairly common; at the time of this writing the record is held by an Indian PSLV launch from Sriharikota that lofted the 714 kg Cartosat and 103 nanosatellites into orbit on February 15, 2017. Many of the satellites launched in these multiple launches are microsatellites or nanosatellites belonging to non-State entities. Advances in microelectronics and satellite miniaturization have lowered the barriers to entry for many aspiring space actors, thus accounting for the proliferation of small satellites in recent years. The situation regarding access to space has also changed dramatically in the past two decades. There are now ten nations with independent orbital launch capability, broadening the possibilities for access to space by emerging space actors. In addition to the State-controlled entities with launch capability, a growing number of private

E-mail address: peter.martinez@uct.ac.za.

https://doi.org/10.1016/j.spacepol.2018.01.002
Received 6 November 2017; Received in revised form 22 January 2018; Accepted 26 January 2018

sector entities are developing privately funded space launch systems. The private sector is also a dominant space actor and owns a large fraction of the operational satellites in orbit. Some private sector actors have plans to launch constellations of hundreds (and perhaps even thousands) of satellites into orbit. All these developments hold great promise for utilizing space for socioeconomic benefits on Earth, but at the same time they raise many concerns in terms of managing orbital congestion, the challenges of orbital debris and the management of radio frequency spectrum resources. Coupled to this are concerns about the potential for harmful interference and the possibility of deliberate aggression against space assets, which would present major risks to the safety of space operations. Thus, our ability to continue to use outer space in the long term is not guaranteed. Events such as the Cosmos 2251 – Iridium 33 collision in February 2009, and other less publicised but increasingly frequent orbital contingency situations have added a sense of urgency to this situation. The actions of a single actor in outer space could have serious consequences for many other space actors.

The international regulatory framework for outer space activities is predicated on the notion that States, as subjects of international law, bear international responsibility and liability for activities conducted in outer space by entities under their jurisdiction and/or control. However, no single State, or even a group of like-minded States, can adopt measures to mitigate entirely the risks posed by the congestion in the Earth's orbital environment. This is an intrinsically multilateral issue that requires a multilateral solution. The United Nations Committee on the Peaceful Uses of Outer Space is the appropriately mandated multilateral body to address such questions.

This paper describes the process by which the United Nations Committee on the Peaceful Uses of Outer Space (UN COPUOS) has been working towards the development of a compendium of voluntary, non-binding guidelines for the long-term sustainability of outer space activities. When referring to the long-term sustainability of outer space activities in the remainder of this paper, we shall use the acronym 'LTS', which has entered common use in COPUOS and is also beginning to be used outside of the UN system.

The remainder of this paper is structured as follows: In Section 2 we describe the establishment and progress of a Working Group in COPUOS tasked with developing a Compendium of UN COPUOS Guidelines for the Long-Term Sustainability of Outer Space Activities. In Section 3 we describe the first twelve guidelines agreed by COPUOS at its 59th session in June 2016 for inclusion in the Compendium. In Section 4 we consider the linkages between the LTS work in COPUOS and the report of the UN Group of Governmental Experts on Transparency and Confidence-Building Measures in Outer Space Activities. The paper concludes with some reflections on the way forward.

2. The establishment of the COPUOS LTS working group

The United Nations Committee on the Peaceful Uses of Outer Space (UN COPUOS) is the principal international forum for the development and codification of laws and principles governing the activities of States in outer space. It is a standing committee of the UN, established in 1959 by 24 Member States and given its mandate in UN General Assembly resolution 1472 (XIV). The Committee currently comprises 87 Member States and a large number of permanent observers that enrich its work. The technical work of COPUOS is carried out by two subcommittees, the Legal Subcommittee (LSC) and the Scientific and Technical Subcommittee (STSC). Decisions in COPUOS and its subcommittees are reached by consensus.

Although several aspects of the work of COPUOS are directly relevant to space sustainability (e.g. space debris, space weather, national space legislation), prior to 2010 these topics were being addressed in isolation as separate agenda items in COPUOS and its subcommittees. The initial impulse for a more integrated approach to these questions came from Mr Karl Doetsch (Canada), Chair of the Scientific and Technical Subcommittee for the period 2001–2003, in his reflections on the future directions of COPUOS as it approached its 50th anniversary in 2009. Mr Gérard Brachet (France), Chair of the Committee for the period 2006–2008, made great efforts to raise awareness of the urgency of addressing the LTS issue in the Committee. Brachet [4] has described the challenges encountered in the introduction of the concept of long-term sustainability of outer space activities in COPUOS and we will not repeat that discussion here, save to point out that much of the difficulty had to do with the fact that there was no common understanding, let alone a definition, of "space sustainability" [1,2] coupled to a degree of scepticism on the part of some delegations as to the real intent of the initiative. It also did not help that, in 2010, there were at least three initiatives related to space security within the UN system: the PPWT proposed by China and Russia at the CD, the Group of Governmental Experts on Transparency and Confidence-Building Measures in Outer Space Activities (the GGE), under the First Committee of the UN, and the LTS initiative in COPUOS, which falls under the Fourth Committee of the UN. In addition, there was the EU-led Code of Conduct initiative, which was outside the UN system, but which enjoyed the support of a number of COPUOS member States. Against this backdrop, many delegations were unsure how these various initiatives related to each other and whether one of them might "trump" the others. All these uncertainties contributed to some States not being sure where to focus their efforts in space diplomacy and consequently the consensus rule in COPUOS meant that a lot of outreach was required to build consensus on the importance of addressing LTS issues holistically in the Committee.

After much "socializing" of the LTS issue in COPUOS, particularly by the French delegation [4], at its forty-seventh session in 2010 the Scientific and Technical Subcommittee of COPUOS (STSC) established the Working Group on the Long-Term Sustainability of Outer Space Activities (WG on LTS) under the chairmanship of Peter Martinez (South Africa). The terms of reference of the new Working Group were agreed at the fifty-fourth session of COPUOS in 2011, with a four-year work plan for the period 2011–2014 [6].

The Working Group was tasked to consider current practices, operating procedures, technical standards and policies associated with the long-term sustainability of outer space activities throughout all the phases of a mission life cycle. The Working Group was to take as its legal framework the existing United Nations treaties and principles governing the activities of States in the exploration and use of outer space; in other words, the Working Group was not tasked to consider the development of new legal instruments, or the creation of new legally binding obligations.

The Working Group was further tasked to produce a report on the long-term sustainability of outer space activities and a consolidated set of voluntary, non-binding guidelines that could be applied by States, international intergovernmental organizations, national non-governmental organizations and private sector entities to enhance the long-term sustainability of outer space activities for all space actors and for all beneficiaries of space activities. To quote from the Terms of Reference [6]:

The guidelines should:

(a) Create a framework for possible development and enhancement of national and international practices pertaining to enhancing the long-term sustainability of outer space activities, including, inter

[1] The NGO sector played a very important role in building a common understanding of the issues encompassed by LTS, by bringing together various stakeholders to discuss the scientific, technical, policy and legal perspectives of the issue. The paper by Delgado López et al. [5] contains an interesting view of the key elements of space sustainability from the perspective of governance of common pool resources (e.g. spectrum, LEO orbits) within the larger global commons of outer space, much as fisheries are common pool resources within the global commons of the world's oceans.

[2] It is worth noting here that the definition of space sustainability remains a hotly debated issue in the preambular text of the guidelines (see Section 6).