

# Implementing the Long-Term Sustainability Guidelines: What's Next?

**Peter Martinez**

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The Secure World Foundation strives to be a trusted and objective source of leadership and information on space security, sustainability, and the use of space for the benefit of Earth. We use a global and pragmatic lens to study and evaluate proposed solutions to improve the governance of outer space. While recognizing the complexities of the international political environment, SWF works to encourage and build relationships with all willing stakeholders in space activities, including government, commercial, military, civil society, and academic actors. Central to this approach is increasing knowledge about the space environment and the need to maintain its stability, promoting international cooperation and dialogue, and helping all space actors realize the benefits that space technologies and capabilities can provide.

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# Implementing the Long-Term Sustainability Guidelines: What's Next?

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*In June 2019, following an eight-year process, the United Nations Committee on the Peaceful Uses of Outer Space (UN COPUOS) adopted twenty-one voluntary, non-binding consensus Guidelines for the Long-Term Sustainability of Outer Space Activities. These guidelines are intended to support states in developing their space capabilities in a manner that enhances the safety of space operations and avoids causing harm to the outer space environment. The guidelines are relevant to both governmental and non-governmental entities. They address all space activities, whether planned or ongoing, and apply to all phases of a space mission, from pre-launch mission design through to operation and end-of-life disposal. The guidelines will only achieve their intended purposes if they are implemented as widely as possible. Successful guideline implementation will both rely on and strengthen international cooperation in space activities. Implementation of the guidelines will also be facilitated by improved coordination and information exchange among space actors from government, the private sector and civil society. This article discusses the roles and recent contributions of each of these types of actors in promoting guideline implementation and the sustainability of space activities in general. The article concludes with some observations on the second phase of the LTS discussions in UN COPUOS and the connection between space sustainability and sustainable development on Earth.*

**Keywords:** LTS Guidelines, soft law, space sustainability, UN COPUOS

## 1 INTRODUCTION

Over the past decade, the number of active satellites has been increasing steadily year-on-year, and this trend has not been dampened even by the COVID-19 pandemic. Indeed, the number of active satellites launched during the past three years has continued to increase exponentially. Already in the early 2000s, there were concerns among a few states about the growing congestion in orbit and the proliferation of space debris, which led the United Nations Committee on the Peaceful Uses of Outer Space (UN COPUOS) to establish in 2010 a Working Group dedicated to addressing this topic in a holistic manner. The Working Group

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on the Long-Term Sustainability of Outer Space Activities was mandated to study this topic and to produce a set of voluntary, best-practice guidelines for the long-term sustainability of outer space activities. At the outset, this working group encountered resistance from some emerging space states who either saw this as an attempt by the leading space nations to raise barriers to entry to the ‘space club’ on the pretext of space environment concerns, or who saw space debris issue as an issue of concern only to the developed space nations and not something that they needed to worry about. Socializing the issue within COPUOS took several years, but after about 2013 the long-term sustainability of outer space activities (or ‘LTS’ as it came to be known) became the dominant issue on the agenda of COPUOS.<sup>1</sup>

In June 2019, following an eight-year process, COPUOS adopted, by absolute consensus of all of its then ninety-two member States, a set of twenty-one guidelines for the long-term sustainability of outer space activities, the so-called ‘LTS Guidelines’. The guidelines take the form of short action-oriented statements (guideline titles), which are then supplemented with more detailed guidance. Table 1 lists the titles of the LTS Guidelines. The full text of the guidelines is available in UN document A/74/20, Annex II.<sup>2</sup>

These guidelines comprise a collection of internationally recognized minimum measures for ensuring the long-term sustainability of outer space activities and for enhancing the safety of space operations. They address the policy, regulatory, operational, safety, scientific, technical, international cooperation, and capacity-building aspects of space activities. The LTS Guidelines are based on a substantial body of knowledge, as well as the experiences of states, international intergovernmental organizations, and relevant national and international non-governmental entities. Readers interested in a description of the process and challenges of negotiating these guidelines are referred to the article by Martinez.<sup>3</sup> Figure 1 shows the adoption copy of the Guidelines, signed by many of the COPUOS delegates following adoption of these guidelines on 20 June 2019.

The LTS Guidelines are intended to support the development of national and international practices and safety frameworks for conducting outer space activities

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<sup>1</sup> Readers interested in a detailed description of the emergence of this issue in COPUOS are referred to the article by Gérard Brachet, *The Origins of the Long-Term Sustainability of Outer Space Activities Initiative at UN COPUOS*, 28 *Space Pol’y* 161–165 (2012).

<sup>2</sup> Report of the sixty-second session of the Committee on the Peaceful Uses of Outer Space (12–21 Jun. 2019), UN General Assembly document A/74/20, Annex II, [https://www.unoosa.org/oosa/en/oosadoc/data/documents/2019/a/a7420\\_0.html](https://www.unoosa.org/oosa/en/oosadoc/data/documents/2019/a/a7420_0.html) (all websites cited in this article were accessed and verified on 9 Jan. 2023).

<sup>3</sup> The process by which the LTS working group developed these guidelines and the content of the guidelines has been discussed by Martinez, *The UN COPUOS Guidelines for the Long-Term Sustainability of Outer Space Activities*, 8 *J. Space Safety Eng’g* 98–107 (2021).

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while allowing for flexibility in adapting such practices and frameworks to specific national circumstances. They are also intended to support states and international intergovernmental organizations in developing their space capabilities in a manner that enhances the safety of space operations and avoids causing harm to the outer space environment.

The guidelines are relevant to both governmental and non-governmental entities. They are also relevant to all space activities, whether planned or ongoing, and to all phases of a space mission, including mission design, launch, operation, and end-of-life disposal.

The LTS Guidelines will only achieve their intended effect if they are implemented by the widest possible number of actors. In this article, we will discuss some of the early implementation efforts and experiences of states as they begin to give effect to these LTS Guidelines at national level. We will also discuss the role of non-state actors from industry, academia, and civil society in socializing and implementing these guidelines.

*Table 1 UN COPUOS Guidelines for the long term sustainability of Outer Space Activities. The Full Text of the Guidelines Appears in Annex II of UN Document A/74/20. (United Nations, 2019)*

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A. Policy and Regulatory Framework for Space Activities

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Guideline A.1	Adopt, revise and amend, as necessary, national regulatory frameworks for outer space activities
Guideline A.2	Consider a number of elements when developing, revising or amending, as necessary, national regulatory frameworks for outer space activities
Guideline A.3	Supervise national space activities
Guideline A.4	Ensure the equitable, rational and efficient use of the radio frequency spectrum and the various orbital regions used by satellites
Guideline A.5	Enhance the practice of registering space objects

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B. Safety of space operations

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Guideline B.1	Provide updated contact information and share information on space objects and orbital events
Guideline B.2	Improve accuracy of orbital data on space objects and enhance the practice and utility of sharing orbital information on space objects

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Guideline B.3	Promote the collection, sharing and dissemination of space debris monitoring information
Guideline B.4	Perform conjunction assessment during all orbital phases of controlled flight
Guideline B.5	Develop practical approaches for pre-launch conjunction assessment
Guideline B.6	Share operational space weather data and forecasts
Guideline B.7	Develop space weather models and tools and collect established practices on the mitigation of space weather effects
Guideline B.8	Design and operation of space objects regardless of their physical and operational characteristics
Guideline B.9	Take measures to address risks associated with the uncontrolled re-entry of space objects
Guideline B.10	Observe measures of precaution when using sources of laser beams passing through outer space
<b>C. International cooperation, capacity-building and awareness</b>	
Guideline C.1	Promote and facilitate international cooperation in support of the long-term sustainability of outer space activities
Guideline C.2	Share experience related to the long-term sustainability of outer space activities and develop new procedures, as appropriate, for information exchange
Guideline C.3	Promote and support capacity-building
Guideline C.4	Raise awareness of space activities
<b>D. Scientific and technical research and development</b>	
Guideline D.1	Promote and support research into and the development of ways to support sustainable exploration and use of outer space
Guideline D.2	Investigate and consider new measures to manage the space debris population in the long term

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Figure 1 Adoption Copy of the LTS Guidelines, Signed by Many of the Negotiators of These Guidelines Following Their Adoption by UN COPUOS on 20 June 2019. (Photo: P. Martinez)



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## 2 IMPLEMENTATION OF THE LTS GUIDELINES

The first point to note about implementation of the LTS Guidelines is that they are voluntary and not legally binding under international law. The existing UN treaties and principles on outer space provide the fundamental legal framework for these guidelines. However, non-binding does not mean non-legal, in the sense that states may choose to incorporate elements of the guidelines in their national legislation, thus making them binding on their national actors, as has been the case with the UN COPUOS space debris mitigation guidelines.

The second point is that the guidelines are not prescriptive about the form of their implementation. This lack of specificity was a deliberate choice of the COPUOS member States to accommodate the wide spectrum of space capabilities among states and to allow for the many different ways in which space activities are conducted and governed in different states.

With these two points in mind, we now examine some of the preliminary steps towards implementation of the LTS Guidelines being taken by governments, the private sector, and civil society organizations.

## 2.1 GOVERNMENTS AND INTERGOVERNMENTAL SPACE ACTORS

The first step toward guideline implementation is raising awareness of space sustainability concerns and socializing the LTS Guidelines as a means to promote responsible behaviour among space actors. There are a number of pragmatic steps that governments are taking to socialize and implement these guidelines. At national level, states are promoting awareness of the guidelines to their domestic civil and private sector space actors. In their statements in COPUOS, several states have expressed their commitment to the implementation of the guidelines at national level and have started to review their existing regulatory systems with a view to adapting existing legislation or adopting new legislation to implement the guidelines. Regulators are starting to include guideline implementation in their considerations and processes concerned with the authorization and ongoing supervision of national space activities under their jurisdiction and/or control.

At the international level, states are starting to use guideline implementation and the sharing of their implementation experiences as tools to socialize the implementation of the guidelines in the international space community. Some delegations to COPUOS have started to report their implementation experiences during the sessions of the Committee.<sup>4</sup> These include revision of relevant domestic

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<sup>4</sup> Mostly, this reporting has been included in national statements delivered by national delegations under the agenda item on 'General exchange of views' or the agenda item on the 'Long-term sustainability of outer space activities'.



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legislation; improved and/or enhanced registration of space objects; implementation of national space policy directives; and enhancing national capabilities in space situational awareness and debris monitoring.

An example of this sort of voluntary reporting is the conference room paper presented by the delegation of the United Kingdom (UK) to the fifty-seventh session of the COPUOS Scientific and Technical Subcommittee in February 2020 and in updated form in February 2022.<sup>5</sup> The delegations of Belgium,<sup>6</sup> France,<sup>7</sup> the Russian Federation,<sup>8</sup> and the European Space Agency<sup>9</sup> have also submitted conference room papers on their implementation of the LTS Guidelines. In their conference room paper, the UK delegation outlined their national experiences with regard to implementing the LTS Guidelines. The UK paper presents a helpful template for reporting information on:

- a) The approach adopted by a member State on implementing individual LTS Guidelines;
- b) Progress made against the adopted implementation approach and future national activities envisaged;
- c) Lessons learnt and practices discovered during implementation, alongside any legal or technical support requirements identified; and
- d) Capacity-building needs to support implementation.

The elements identified in the UK conference room paper provide a helpful basis for compiling information on LTS Guideline implementation practices and experiences, and it will also serve as helpful guidance for states that are not quite sure

<sup>5</sup> Conference Room Papers by the UK delegation to COPUOS titled 'Voluntary Implementation of the Guidelines for the Long-term Sustainability of Outer Space Activities and Proposed Reporting Approach by the United Kingdom'. (UN COPUOS document A/AC.105/C.1/2020/CRP.15) and 'United Kingdom Update on its Reporting Approach for the Voluntary Implementation of the Guidelines for the Long-term Sustainability of Outer Space Activities' (document A/AC.105/C.1/2022/CRP.22).

<sup>6</sup> Conference Room Paper submitted by the delegation of Belgium to COPUOS in 2021 titled 'Implementation of the Guidelines for the Long-term Sustainability of Outer Space Activities of the Committee on the Peaceful Uses of Outer Space: Belgium', document number A/AC.105/C.1/2021/CRP.12.

<sup>7</sup> Conference Room Paper submitted by the delegation of France to COPUOS in 2022 titled 'General presentation of French activities and views concerning the long-term sustainability of outer space activities, in relation with the implementation of the 21 Guidelines (A/74/20, Annex II)', document number A/AC.105/C.1/2022/CRP.20.

<sup>8</sup> Conference Room Paper submitted by the delegation of the Russian Federation to COPUOS in 2022 titled 'Implementation of the LTSSA Guideline "A.1 Adopt, revise and amend, as necessary, national regulatory frameworks"', document number A/AC.105/2022/CRP.9 and a further document titled 'Considerations on key unresolved tasks of ensuring safety of space operations in the context of the long-term sustainability of outer space activities', document number A/AC.105/2022/CRP.11.

<sup>9</sup> Conference Room Paper presented by the delegation of the European Space Agency to COPUOS in 2022 titled 'Report on the implementation of the Guidelines for the Long-term Sustainability of Outer Space Activities in the European Space Agency', document number A/AC.105/C.1/2022/CRP.14/Rev.1.

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how to go about implementing the guidelines. In this regard, the third element, namely capacity building, is an important issue to be addressed.

The scope of the guidelines is very broad, as they address policy, regulatory, operational, scientific, and technical aspects of space activities. Implementation will be consistent with national needs, conditions and capabilities. Also, because the exact form of implementation is not prescribed, each country must determine its own modalities for implementation. This inherent flexibility to allow for implementation in different national contexts can also lead to uncertainty or inconsistency in implementation. For this reason, it is necessary to ‘unpack’ what guideline implementation means in different contexts. This is why the sharing of implementation experiences by states with different levels of space capabilities is so important.

With regard to enhancing or updating national regulatory frameworks to implement the Guidelines, established space nations have more experience and implementation capacity, but also more ‘legacy’ legal frameworks and institutional inertia. On the other hand, emerging space nations often lack space regulatory frameworks, regulatory experience and/or capacity, but at the same time, they can be more agile in adopting new space legislation that reflects current best practice in regulation. A common challenge facing all regulators is how to ‘future-proof’ legislation so that it will not get outpaced by technological or market developments.

Effective guideline implementation will also require greater cooperation among regulators of different states. This is to avoid regulatory lacunae across different jurisdictions that lead to ‘regulation shopping’ or chain-of-custody issues where space activities are conducted across multiple jurisdictions. Two examples of such chain-of-custody issues that raise concerns for space sustainability have already occurred. The first was the unauthorized launch of multiple unlicensed and untrackable small satellites by Swarm Technologies Inc. in January 2018 in defiance of a ruling by the Federal Communications Commission, for which the company was subsequently fined USD 900,000.<sup>10</sup> The second was the undocumented introduction of microscopic tardigrades onto the Israeli Beresheet lunar lander mission, which subsequently crashed on the lunar surface in April 2019.<sup>11</sup> These two cases point to the need for improved coordination among national regulatory authorities responsible for the authorization and ongoing supervision of space activities.

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<sup>10</sup> See the Reuters report David Shepardson, *FCC Fines Swarm \$900,000 for Unauthorized Satellite Launch*, <https://www.reuters.com/article/us-usa-satellite-fine/fcc-fines-swarm-900000-for-unauthorized-satellite-launch-idUSKCN1OJ2WT>.

<sup>11</sup> See Christopher D. Johnson, Daniel Porras, Christopher M. Hearsey & Sinead O’Sullivan, *The Curious Case of the Transgressing Tardigrades (Part 1)*, *The Space Review* (26 Aug. 2019) <https://www.thespacereview.com/article/3783/1>.

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There is also a need to improve coordination among the spectrum regulators and regulators of other aspects of space activities, such as launch and operations. Traditionally, these different regulators have operated independently, but with the advent of very large constellations of satellites, the decisions of spectrum regulators have implications for the non-spectrum aspects of space activities as well.

One common thread that emerges in statements by developing countries in COPUOS is the importance of capacity building for guideline implementation. Developing countries and emerging space nations face particular challenges when it comes to implementing the LTS Guidelines. These nations may not have sufficient regulatory capacity in government or sufficient experience in the regulation of space activities to support effective guideline implementation. There may also be a general lack of awareness among policy makers of space sustainability issues in general and the LTS Guidelines in particular. One cannot assume that, just because a given country participated in the LTS discussions in COPUOS, that the principles of space sustainability and the guidelines have been fully assimilated into that country's governance framework for space activities. This is especially the case in emerging space countries that may not have a well-developed space governance framework, and where there may be unclear or overlapping mandates in government entities responsible for authorizing or regulating different aspects of space activities.

For these reasons, capacity building has been identified as a priority area for successful implementation of the LTS Guidelines. Developing countries may need the support of more experienced actors to implement the guidelines. This is where voluntary reporting of guideline implementation experiences, such as the examples given above, is helpful. As more states, particularly those with well-established space sectors, report their implementation of the LTS Guidelines in COPUOS, this creates a kind of social pressure in the community of states for others to do likewise to demonstrate that they, too, are responsible space actors. This is how international norms become established, and prominent norms can become the established customary practice of states, which is one of the sources of international space law.

### 2.2 COMMERCIAL SPACE ACTORS

Through their Article VI obligations under the Outer Space Treaty, states bear international responsibility for the space activities of their commercial actors, and they are required to provide authorization and continuing supervision of such activities. In this regard, the LTS Guidelines are applicable to the space activities of commercial space actors to the extent that the applicable state chooses to

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implement these Guidelines. At the same time, private sector actors are rapidly accumulating a tremendous amount of operational experience in the safe conduct of space activities and in dealing with a range of contingency situations in orbit. However, given the increasing congestion in space with the advent of very large satellite constellations, it is becoming more important to ensure smooth operator-to-operator exchanges of information to deal with such contingency situations that may be impossible to forecast when thousands of satellites will be adjusting their orbits at any given time.

It is safe to say that the established major space actors are very well aware of the risks posed by debris and irresponsible behaviour in orbit and are motivated by their own commercial self-interest and also a sense of social responsibility to be good citizens in orbit. A number of private sector actors are taking the lead to demonstrate their commitment to responsible space operations. An example of this is the release of the ‘Satellite Orbital Safety Best Practices’ reference guide published by Iridium, One Web and Space X in partnership with the American Institute of Aeronautics and Astronautics (AIAA) in September 2022.<sup>12</sup>

While the advent of very large constellations has raised concerns about orbital congestion, it is also potentially creating the market opportunity to develop commercial capabilities to enhance space sustainability. The private sector is doing a lot of work to develop technologies to support various close-proximity operations in orbit, such as on-orbit servicing, refuelling and other life-extension interventions, and also for safe end-of-life disposal. These are all technologies that will underpin the future growth of the space economy.

However, the lack of clear, widely accepted technical and safety standards for the safe and responsible performance of such operations involving commercial satellites could lead to mishaps that would put the long-term sustainability of space activities at risk and this remains a major obstacle to the development of a satellite servicing industry. Hence, some private sector actors are already taking the lead in the development of such standards.

The Consortium for Execution of Rendezvous and Servicing Operations (CONFERS) is an industry-led initiative with initial seed funding provided by the Defense Advanced Research Projects Agency (DARPA) that aims to leverage best practices from government and industry to research, develop, and publish non-binding, consensus-derived technical and operations standards for on-orbit servicing and rendezvous and proximity operations. The consortium currently comprises fifty-two industry members and ten observers from different countries. In February 2019, the Consortium approved its first Design and Operational

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<sup>12</sup> The Satellite Orbital Safety Best Practices is available online at, <https://www.ascend.events/outcomes/satellite-orbital-safety-best-practices-by-iridium-oneweb-spacex-aiaa/>.

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Practices to enhance the operational safety and success of rendezvous and proximity operations and on-orbit satellite servicing.<sup>13</sup> The Consortium subsequently submitted its principles and practices to Subcommittee fourteen of the International Organization for Standardization (ISO) as the basis for a new international standard on this topic, ISO 24330.<sup>14</sup> The development and codification of standards for commercial rendezvous and close-proximity operations and on-orbit satellite servicing could pave the way for UN COPUOS to discuss and adopt best-practice international guidelines on these topics in the future.

Another example of the space community acting collectively to promote space safety and space sustainability is the Space Safety Coalition, an ad hoc coalition of sixty companies, organizations, and other government and industry stakeholders that actively promotes responsible space activities through the adoption of relevant international standards, guidelines and recommended practices. In particular, the members of the coalition commit themselves to implementing the guidance contained in the coalition's document *Best Practices for the Sustainability of Space Operations*.<sup>15</sup> These best practices are orbit-regime-agnostic and are generally applicable to all spacecraft, regardless of their physical size, orbital regime, or constellation size, and directly address many aspects of the long-term sustainability of space activities.

In October 2019, the Satellite Industry Association, a trade association based in the United States, adopted a set of Principles of Space Safety, drafted to help protect the freedom of use and long-term access to space by ensuring safe flight operations for satellites, human spacecraft and other space missions.<sup>16</sup>

Information exchange is a common thread running through the guidelines, whether it be exchange of operator contact information or the exchange of information on space object trajectories and manoeuvres. Industry bodies such as the Space Data Association are supporting the controlled, reliable, and efficient sharing of data critical to the safety and integrity of the space environment. These various industry initiatives will lead to best practices which could form the basis for future LTS Guidelines in COPUOS.

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<sup>13</sup> The CONFERS Guiding Principles for Commercial Rendezvous and Proximity Operations (RPO) and On-Orbit Servicing (OOS) and the CONFERS Recommended Design and Operational Practices, Nov. 2022, are both available on the CONFERS website at, <https://www.satelliteconfers.org/publications/>.

<sup>14</sup> ISO 24330:2022 Space systems – 'Rendezvous and Proximity Operations (RPO) and On Orbit Servicing (OOS) – Programmatic principles and practices'. A description of this standard is, <https://www.iso.org/standard/78463.html>.

<sup>15</sup> More information about the Space Safety Coalition, as well as the text of the Coalition's Best Practices for the Sustainability of Space Operations, can be found on their website, <https://spacesafety.org>.

<sup>16</sup> Satellite Industry Association, *Principles of Space Safety for the Commercial Satellite Industry*, [https://sia.org/space\\_safety/](https://sia.org/space_safety/).

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## 2.3 THE SPACE INVESTMENT AND INSURANCE SECTORS

The investment and insurance sectors are two other key groups of actors in the space arena that have an important role to play in promoting space sustainability. The number of new space start-up companies has been increasing steadily over the past few years, and the investment in these companies is increasing as well. The COVID-19 pandemic seems not to have dampened the appetite for investment in the space sector. According to a 2022 study by Bryce Space and Technology, space industry start-ups attracted over USD 15 billion in total financing during 2021, almost doubling the previous record of USD 7.7 billion record set in 2020.<sup>17</sup> More than half of this investment, USD 9 billion, was made by venture capital firms. However, other actors in the world of finance are also becoming more engaged in space financing. Investment banks and the institutional investment sector are also becoming interested in space investments. In 2021, there were a record of twelve start-up space initial public offerings (IPOs), of which special purpose acquisition companies (SPACs) represented ten of the twelve deals. This rapid growth in investment in space start-up companies means that there is a lot of money being invested in space ventures by fund managers who may not understand that space is a fragile and strategic domain, and a lot of people entering the space sector in start-ups who may not be thinking about space sustainability issues as they strive to raise funding and get their systems to the market as quickly as possible.

This situation gives rise to two concerns; the first has to do with the rate of growth itself and the second has to do with the venture capital mindset that accompanies such growth. Turning to the first concern, there is a real danger that we are seeing a space investment bubble that is growing at an unsustainable rate and that it will burst at some point. This could result in the failure of ambitious space projects, leaving large numbers of satellites essentially abandoned in orbit. Alternatively, one or two spectacular mishaps in space could result in investors withdrawing from the space sector, leaving a vast number of small companies with assets in space floundering. The second concern is related to the venture capital mindset of failing quickly, testing prototypes in the market and generating sales as soon as possible. These may be good approaches to high-tech start-ups on the ground, but they could be potentially disastrous for space sustainability.

One often hears of how disruptive technologies are changing the paradigm of commercial space activities, but space sustainability is much more susceptible to disruptive investment models than their underlying technologies per se. This is why it is so important to raise the awareness of aspiring space actors (and this includes people who invest in space activities) that they are entering a fragile domain where an

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<sup>17</sup> BryceTech report, *Start-Up Space: Update on Investment in Commercial Space Ventures 2021*, <https://brycetech.com/reports>.

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irresponsible action by even one small actor could have terrible, irreversible and long-lasting consequences for all other users of a given orbital regime. This inevitably means that adopting measures to support space sustainability will impact a company's financial bottom line and could mean the difference between profitability and loss for a lean start-up company. This is why it is so important to have regulations that level the playing fields for all commercial space actors and hence why improving regulator-to-regulator dialogues should be one of the priorities of states. Moreover, by leveraging their regulatory powers, not only with the space industry, but also with the investment sector and the insurance sector, states can provide incentives for the development of technical solutions to the challenges of space sustainability. The advent of commercial capabilities for close-proximity operations that allow for activities such as on-orbit servicing, refuelling and active debris removal, could also provide the basis for imposing regulatory requirements for end-of-life disposal. For example, a regulator might require a licensee to either: (1) equip its spacecraft with the technical means to move to a disposal orbit at end of life; or (2) procure such a service commercially from another operator. Verification of compliance with the end-of-life disposal requirement would form part of the 'continuing supervision' obligation under Article VI of the Outer Space Treaty.

### 2.4 ACADEMIC COMMUNITY AND PROFESSIONAL ORGANIZATIONS

There are a number of aspects of the LTS Guidelines that require research and scholarship. Indeed, two of the twenty-one LTS Guidelines call for the promotion of research on ways to manage the debris population and on ways to support the sustainable exploration and use of outer space. This includes not only the scientific and technical aspects of the problem, but also the policy and regulatory aspects. Such work can be carried out by the academic community and professional organizations such as the International Academy of Astronautics (IAA), International Institute of Space Law (IISL), Committee on Space Research (COSPAR), etc. Examples of such work include efforts by a number of academic institutions and the IAA to define the concept of orbital carrying capacity and the contributions of several academic institutions to the development of a Space Sustainability Rating.<sup>18</sup> Legal questions that could benefit from scholarship include

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<sup>18</sup> The Space Sustainability Rating is a score representing a mission's sustainability as it relates to debris mitigation and alignment with international guidelines. The scoring system was developed by a consortium comprising the European Space Agency (ESA), the Massachusetts Institute of Technology Media Lab, the University of Texas at Austin, BryceTech and the World Economic Forum's Global Future Council on Space Technologies. The Space Center (eSpace) at the Swiss Federal Institute of Technology Lausanne (EPFL), Switzerland operates the Rating, which went 'live' in Jun. 2022.

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concepts such as what constitutes ‘due regard’. Many academic institutions are carrying out cutting-edge research on ways and means to improve our knowledge of the debris environment and the general awareness of objects and events in outer space. In addition to carrying out research on debris mitigation, on-orbit servicing and active debris removal concepts, the detection and tracking of space objects, and the evolution of the space object population, this community can also conduct simulations that investigate the effects of different policy and regulatory measures on the space environment.

## 2.5 THINK TANKS

Think tanks bridge the space between government, industry and academia to support evidence-based policy formulation. In this regard, think-tanks can support governments to ‘unpack’ the LTS Guidelines from an implementation perspective. For example, on the face of it, LTS Guideline A.5 on enhancing registration practice, seems straightforward, but it is actually quite complex to implement from a regulatory perspective. Think tanks could assist governments to work through various possible scenarios for implementing this guideline. Another guideline that seems straightforward to implement is Guideline B.1 on the provision of updated contact information and sharing of information on orbital events, which is meant to support improved coordination among operators, especially in contingency situations. The need for more robust methods of communications and alert handling, especially in contingency situations, was highlighted with an incident that occurred in early April 2021, and which received considerable media coverage. This occurred several days after the launch of a batch of thirty-six OneWeb satellites. Because OneWeb’s constellation operates in higher orbits (1200 km) compared to the 550 km orbit of the Starlink satellites, OneWeb’s satellites must pass through SpaceX’s grid of Starlink satellites to get to their operational orbits. It was during this part of the deployment that the conjunction occurred. A conjunction warning was issued to both operators by the US Space Force’s eighteenth Space Control Squadron, which provides conjunction warnings to all contactable satellite operators. The way that these two operators responded to this conjunction warning is both an encouraging example of inter-operator cooperation and a cautionary tale about the importance of coordination and the need for clear rules for space traffic, such as ‘right-of-way’.<sup>19</sup>

This is an area where think tanks can help to support governments and the private sector to develop efficient means of rapid information exchange to address

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<sup>19</sup> Jeff Foust, *SpaceX and OneWeb Spar Over Satellite Close Approach*, Space News (22 Apr. 2021), <https://spacenews.com/spacex-and-oneweb-spar-over-satellite-close-approach/>.



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contingency situations in space, develop some clear rules for deciding which space object manoeuvres in the event of a close conjunction, etc. Think tanks, like the European Space Policy Institute and the Secure World Foundation, carry out research and provide unbiased advice and ideas on cooperative solutions to promote space sustainability through publishing studies, and facilitating multi-stakeholder dialogues among senior leaders from a wide range of sectors to discuss concrete collective actions needed to support space sustainability.

### 3 LTS 2.0: NEXT STEPS IN COPUOS

While the twenty-one consensus LTS Guidelines represent a significant step forward to promote space sustainability, COPUOS member States agree that the work of COPUOS on this issue is far from over. Building on the lessons learnt from the LTS discussions, the Committee has initiated a new phase of the LTS discussions in COPUOS – LTS 2.0.

At its sixty-second session in June 2019, the Committee noted that it should continue to serve as the principal forum for continued institutionalized dialogue on issues related to the implementation and review of the guidelines. The Committee also decided to establish, under a five-year workplan, a working group under the Scientific and Technical Subcommittee to continue the LTS discussions in COPUOS. The Committee decided that this new working group would be guided by the following framework:

- (1) Identifying and studying challenges and considering possible new guidelines for the long-term sustainability of outer space activities. This work could also take into consideration draft guidelines that were discussed, but for which consensus could not be reached during the term of the first LTS Working Group.
- (2) Sharing experiences, practices and lessons learned from voluntary national implementation of the twenty-one already adopted guidelines.
- (3) Raising awareness and building capacity, in particular among emerging space nations and developing countries, to implement the guidelines.

During 2022, the LTS 2.0 Working Group agreed on its terms of reference, methods of work and work plan for the period 2022–2026. In taking these discussions forward, COPUOS will have to deal with the challenge of preserving the consensus decision-making rule in a committee that at the time of this writing (Dec. 2022) has 102 member States and is steadily increasing in size. As the Committee membership increases, so too does the diversity of space capabilities, views and priorities represented by the member States. Moreover, given the growing role of the commercial space sector, COPUOS will have to explore

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methods of work that allow it to incorporate inputs from non-governmental organizations and the private sector in its discussions. These trends will make it ever more challenging to reach consensus in the Committee.

Lastly, COPUOS will also need to discuss the ways by which the already agreed guidelines may be revised and updated in future, and also a process by which new topics for guidelines could be proposed for consideration by states. This is in keeping with the view of a number of member States that these guidelines should become a 'living document' that is updated from time to time. Indeed, one may identify topics not included among the already agreed guidelines or the remaining unagreed draft guidelines<sup>20</sup> which could be addressed by COPUOS under the general context of the long-term sustainability of outer space activities in future. Perhaps issues arising from on-orbit servicing or the placement and operation of very large constellations in Earth orbit could be the subjects of such future discussions and one or more possible draft guidelines. In this regard, industry initiatives such as CONFERS and the Space Safety Coalition discussed earlier may help to identify elements of future international standards and guidelines.

#### 4 CONCLUSION

The adoption of the LTS Guidelines by COPUOS in 2019 was an important step forward for the international community in that it extended the well-established notion of sustainable development on Earth to our activities in outer space as well. This paradigm shift is perhaps best illustrated by the wording of the definition of space sustainability contained in the preamble of the guidelines, which though not an operative part of the document, was nevertheless the subject of very spirited negotiations:

“The long-term sustainability of outer space activities is defined as the ability to maintain the conduct of space activities indefinitely into the future in a manner that realizes the objectives of equitable access to the benefits of the exploration and use of outer space for peaceful purposes, in order to meet the needs of the present generations while preserving the outer space environment for future generations.”

Readers familiar with the 'Brundtland report' *Our Common Future* by the World Commission on Environment and Development (1987) will notice a parallel between the definition of sustainable development on Earth given in that report as 'development that meets the needs of the present without compromising the

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<sup>20</sup> In addition to the twenty-one agreed LTS Guidelines, there were an additional seven draft guidelines discussed for which the LTS Working Group did not reach consensus. Those draft guidelines are contained in a document titled 'Draft guidelines for the long-term sustainability of outer space activities' UN document number A/AC.105/C.1/L.367, [https://www.unoosa.org/res/oosadoc/data/documents/2019/aac\\_105c\\_1/aac\\_105c\\_1\\_367\\_0\\_html/V1804974.pdf](https://www.unoosa.org/res/oosadoc/data/documents/2019/aac_105c_1/aac_105c_1_367_0_html/V1804974.pdf).

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ability of future generations to meet their own needs’ and the UN COPUOS definition of space sustainability quoted above.

This definition, with its emphasis on meeting the needs of present and future generations, allows one to highlight the critical role that space systems are playing in areas such as climate action and meeting the Sustainable Development Goals and it therefore allows the topic of space sustainability to resonate with a much wider cross-section of the multilateral community that has been working on sustainability issues for decades and does not consider itself part of the space community. Indeed, further evidence of the mainstreaming of space sustainability as a topic for multilateral diplomacy is provided on the report of the UN Secretary-General titled *Our Common Agenda*,<sup>21</sup> which addresses some of the key governance challenges facing humanity. In this document, space governance is listed among the topics proposed for discussion at a Summit for the Future, to be held in 2024. This is significant because space sustainability is really a global challenge that can only be addressed successfully if all countries act collectively. No single actor, or group of like-minded actors can ensure the safety, security and sustainability of their space activities through their actions alone. The challenges of space sustainability are inherently multilateral challenges that are most effectively addressed through multilateral space diplomacy, where the international community works together to find ways to expand access to the benefits of space activities to more nations, but also to ensure that the space environment is preserved and protected for use by future generations.

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<sup>21</sup> United Nations, *Our Common Agenda*, <https://www.un.org/en/common-agenda>.