T20 Policy Brief

Task Force 6
Accelerating SDGs: Exploring New Pathways to the 2030 Agenda

SUSTAINING OUTER SPACE: AN SSA DATA-SHARING ARRANGEMENT FOR THE G20

June 2023

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Abstract

The Earth's orbits are an extension of the planet's environment. Orbital sustainability, therefore, must be an imperative consideration for the G20. The Guidelines on Long-Term Sustainability (LTS Guidelines), negotiated in 2018 under the UN COPUOS, calls on UN member states to promote the collection, sharing, and dissemination of space debris monitoring information. Over the coming years, the number of satellites in space is set to increase exponentially. With no mechanism in place to monitor space activities, ensuring the safety of operations in Earth's orbits becomes more difficult. This Policy Brief makes the case for the G20 to treat the Earth's orbits as an extension of the Earth's environment and thus, bring outer space into the fold of the Sustainable Development Goals (SDG) agenda. The Brief also posits that the G20 must pursue a Space Situational Awareness (SSA) data-sharing arrangement to be taken under the auspices of the United Nations Office for Outer Space Affairs (UNOOSA). The proposed arrangement will leverage the capabilities of the G20 member states to provide a near-complete picture of the activities in Earth's orbits. The collective SSA capabilities of the G20 members, along with commercially available technologies, gives rise to an opportunity to create a multilateral SSA network that makes operating in space safer for both orbiting spacecrafts as well as spacefaring humans.

The Challenge

1

The orbits around the Earth have become more congested and contested in recent years. Between 2018 and 2021, the number of satellites orbiting the planet increased two-fold.[1] If this trend continues, scientists expect the number of satellites to quadruple by the end of this decade.[2]

The exponential increase in satellites is also compounded by two interconnected problems that threaten to make outer space unsafe for future use. First, as space agencies and private companies undertake more launches to place satellites in orbit, they also leave behind used rocket components that cannot be de-orbited, thus creating space debris or space junk.[3] Second, since satellites utilise a limited number of orbits for operations,[4] the risk of collision between satellites and collisions between satellites and space debris also increases. This could lead to a condition known as the Kessler Syndrome, where the collision between objects in space could cascade out of control and pollute orbits with space debris, making the orbits nearly unusable.[5]

Such concerns are not just theoretical, as space operators already face the risk of accidents from space debris. For example, in November 2021, the International Space Station made several debris-avoidance manoeuvres to stay clear of space junk.[6] That same year, China's Tiangong space station made a series of manoeuvres to avoid collision with the Starlink satellite constellation.[7] Both incidents demonstrate that the international community must urgently address the issue of space debris and space traffic to use space in a safe and sustainable manner.

Space sustainability and the limits of current international space law

Outer space is governed by a series of treaties negotiated during the Cold War.[8] The Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, also known as the Outer Space Treaty (OST), of 1967 is the backbone of international space law.[9] It establishes the legal principles of exploration and use of outer space of member states. As a product of the Cold War, the treaty concerns itself with space security and the demarcation of peaceful and non-peaceful uses of outer space[10] but has little to say about space sustainability.

Nonetheless, the OST provides a basis for crafting new agreements for space sustainability and space traffic management. Article IX of the OST highlights the obligations of member states to act with due regard to the interests of all other member states. It also obliges member states to avoid harmful contamination of the space environment.[11] However, with no clear definition of 'harmful contamination', states are given a high degree of freedom to interpret their debris mitigation responsibilities under the OST.

In 2016, the UN COPUOS began formal negotiations to adopt the Long-Term Sustainability (LTS) Guidelines.[12] The final document, titled "Guidelines for the Long-Term Sustainability of Outer Space Activities", set forth 21 guidelines which are non-binding in nature.[13] The LTS Guidelines set the minimum standards for states to adopt as they see fit.[14]

Despite the progress in making the Earth's orbits safe for operation, the key challenge is the implementation of the LTS Guidelines, which are worded in a manner that allows COPUOS member states a high degree of freedom to interpret debris mitigation and safety measures in outer space operations. The LTS Guidelines also hinge on national legislation for implementation[15] which, in some cases, may take several years to take shape, thus slowing the process of international cooperation.[16] Due to the sharp political divide among member states in the current geopolitical environment, reaching a consensus is unlikely in the near term.[17]

While legacy spacefaring nations could manage safe operations using their SSA capabilities, safe operations for new actors could prove more difficult due to the lack of advanced capabilities and the unavailability of cooperative data.[18] Even a small piece of debris 10-cm long travelling at a speed of 7.8 km per second could irreversibly damage a satellite. Further, constant debris-avoidance manoeuvres by satellites could reduce their lifespan, thus increasing the costs of space operations.[19]

On the other hand, open databases and commercial services could help new actors make better conjunction assessments.[20] However, they do not provide a complete picture of the number of objects in space. Cooperation in the area of space situational awareness is therefore key to ensure the long-term sustainability of outer space activities.

The G20's Role

2

Discussions regarding cooperation in outer space issues has remained at the periphery for much of the G20's history. The growing importance of the space economy led the G20 to form a new track to discuss space cooperation among the space agencies of member states.[21] The tradition of hosting the Space20 forum has continued under India's presidency, and discussions are taking place in two phases.[22]

In parallel, the G20 has embarked on implementing the UN's Agenda for 2030 Sustainable Development.[23] While members of the Space20 forum envision the use of space technologies to mitigate the risks posed by climate change,[24] the orbits around the Earth are not brought into the fold of the Earth's environment, either in the agenda of the UN or the G20. Bringing the space environment within the ambit of the G20's SDGs will be significant for two reasons.

First, all members of the G20 have a presence in space. While the group is host to countries that have been operating in the Earth's orbit since the 1960s, the G20 also includes new actors in space, such as Brazil, Indonesia, Saudi Arabia, South Africa, and Turkey, who wish to leverage the potential of the private sector in the New Space era to propel their countries to become space powers. Mitigating the risks posed by space debris and space traffic is therefore in the interest of the G20, as it equally impacts all operators.[25]

Second, some members of the G20, such as China, Russia, Germany, and the United States, have significant space debris monitoring and tracking capabilities. Pooling these capabilities to provide a more comprehensive picture of the Earth's orbits could help take the next steps towards space debris mitigation. Since the process of achieving consensus is likely to be more challenging within UN-led bodies, members of the G20 could take the initial steps to draw up areas of general agreement and set the goals of space sustainability before proceeding towards formal negotiations in relevant UN bodies such as COPUOS.

Assessing policy alternatives

The G20 must choose between three policy alternatives to achieve the goal of space sustainability.

- **Policy Option 1**

The G20 could pursue an SSA data-sharing arrangement to increase the safety of space operations for all actors involved. Knowledge of the position of satellites and other objects in orbit are derived from the SSA capabilities of a country.

SSA can be defined as "the comprehensive knowledge and understanding of the space and terrestrial environment, factors, and conditions, to include the status of other space objects, radio emissions from ground and/or space transmitters, and terrestrial and space weather, that enables timely, relevant, decision-quality, and accurate assessments, in order to successfully protect space assets and properly execute the function(s) for which a satellite is designed."[26] It involves the use of ground-based assets such as radars and electro-optical telescopes to detect objects traversing the orbit. SSA capabilities can also involve the use of space-based sensors to fill gaps in ground-based coverage. Currently, members of the G20 operate their own set of SSA networks. The United States, for example, has the largest set of SSA capabilities, which include both civilian and military systems.[27] Members of the European Union also operate a sizeable SSA network, which is itself an ecosystem of national sensors.[28] Russia and China operate their own set of SSA capabilities, distributed for both civilian and military operations.

Bringing large pools of data from a variety of sources helps fill the gaps in national SSA coverage and builds trust among various actors.[29] Countries already share SSA data among each other on a limited scale. The United States has signed several bilateral agreements to share SSA data with both spacefaring and non-spacefaring countries. Russia's International Scientific Optical Network, on the other hand, is a specialised SSA network designed for objects in geostationary orbits.[30]

An SSA data-sharing agreement at a larger scale comes with pressing challenges. First, a state's SSA

infrastructure has both civilian and military components. Sharing data obtained from these sensors could prove difficult, as states might fear that sharing sensitive information could give a rival state the ability to avoid detection.[31]

Simply having the data, however, is of little use, as different states and actors use differing methods of data analysis and processing. Often, this could cause greater confusion than clarity for satellite operators.[32] Since these challenges are largely political rather than technical, members of the G20 could take steps to resolve the matter through high-level discussions.

- **Policy Option 2**

The G20 could undertake extensive development and promotion of the Space Sustainability Rating (SSR) system, which was first proposed in the World Economic Forum (WEF) in 2021.[33] The SSR aims to create a representative score of a mission's sustainability, which is used to assess the mission's alignments with the international guidelines on sustainability. The data gathered to provide the sustainability score is set as follows: "Organizations will provide mission data through a questionnaire, which will be evaluated in combination with other external data through a mathematical model that establishes a rating for the mission."[34]

The SSR also complements a best-practices guide published by several groups of private entities to enhance the safety of space operations.[35] Together, the SSR and best practices are designed to incentivise actors in space to adhere to the LTS Guidelines and cooperatively enforce responsible behaviours.[36]

While the SSR system is designed to be a bottom-up approach that is founded upon inputs from actors, it also has several shortcomings. First, the SSR score requires actors to be fully transparent about the design and function of their spacecraft. In practice, however, it is impractical to expect such a high degree of transparency. As witnessed in the past, space operators often take several years to register their satellites as prescribed by the Registry Convention.[37] Therefore, from prior experience, it is likely that the SSR does not provide a representative score of the actual activities in space.

The second issue relates to the potential for the politicisation of the SSR score.

Since state actors often place a premium on national security secrets in space, they are likely to remain non-transparent about the orbital parameters and characteristics of their spacecraft. Therefore, state entities may contest the estimates provided by the SSR score or refuse to participate in the process entirely.

- **Policy Option 3**

The G20 could agree upon a safety zone for satellites, wherein spacecrafts are required to maintain a minimum distance between each other to avoid the possibility of collisions. The concept of safety zones takes inspiration from similar rules found in terrestrial treaties such as the UN Convention on the Law of the Seas.[38]

The concept of safety zones has two significant limitations. First, proposals such as keep-out zones or safety zones invoke measures taken at wartime and therefore, may not be suitable for space sustainability.[39] Second, safety zones may not be technically feasible. Since satellites in the Low-Earth Orbit (LEO) often maintain extremely close distances on different orbital planes, prescribing a safety zone might decrease the overall efficiency of satellite operations.[40]

Recommendations to the G20

3

To take forward space sustainability goals, this Policy Brief makes the following recommendations to the G20.

i. Declare the Earth's orbits as a key part of the environment, and therefore, extend SDGs to near-Earth orbits.

ii. Begin discussions on SSA data-sharing at the Environment and Climate Sustainability Sherpa Track to resolve the following issues:

   a. Demarcation of civilian and military systems for data-sharing;

   b. Standards for processing data and interpreting conjunction assessments;

   c. Best practices for space traffic management.

iii. Share and promote knowledge of space sustainability at the Research and Innovation Initiative Gathering (RIIG) and initiate new research in SSA technologies.

Undertaking the above-mentioned steps could strengthen the implementation of the LTS Guidelines and smoothen the process of negotiating new measures elsewhere. While the G20 might not resolve all issues, declaring space as an extension of the Earth's environment increases attention to the growing problem of space debris.

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