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Item 12 of the provisional agenda**
Long-term sustainability of outer space activities**

Information and views for consideration by the Working Group on the Long-term Sustainability of Outer Space Activities

Note by the Secretariat

Addendum

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* Reissued for technical reasons on 17 November 2022.

** [A/AC.105/C.1/L.405](#).



II. Replies received from States

India

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[28 September 2022]

Inputs to the Working Group on the Long-term Sustainability of Outer Space Activities of the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space: Summary

India places a high priority on the safety and sustainability of outer space activities in the rapidly changing space scenario and has welcomed the adoption of the 21 Guidelines for the Long-term Sustainability of Outer Space Activities. India is providing to the Working Group, via this submission, a summary of its inputs on the information and views on the topics listed below (see [A/AC.105/1258](#), annex II and appendix).

(a) Identifying and studying challenges and considering possible new guidelines for the long-term sustainability of outer space activities

In this submission, we focus our attention on challenges to the long-term sustainability of outer space activities that arise in the context of the safety of spaceflight, especially while operating in the presence of large constellations and small satellites.

Small satellites are often difficult to track as well as to be identified immediately after launch. Such satellites are usually non-maneuverable, the onus of collision avoidance falls single-handedly on the owner/operators of manoeuvrable satellites. In most cases of on-orbit conjunctions with small satellites, the lack of information to contact spacecraft operators proves to be a major challenge to initiate the requisite coordination and data exchange for collision risk mitigation.

Exchange of operational ephemeris of manoeuvrable satellites is essential for meaningful decision-making related to on-orbit collision avoidance. A common operational mechanism for inter-operator coordination, suitably supplemented with a standardized protocol for relevant information exchange needs to be evolved to cope with the future challenges of operating in increasingly congested orbital regimes.

The proliferation of very low Earth orbit constellations will restrict the availability of conjunction-free lift-off timings within a launch window and will pose a significant risk to the safety of human spaceflight missions. The anticipated rise in object density and the consequent increase in the frequency of collision avoidance manoeuvres will incur significant operational concerns and also necessitate intensive coordination to resolve conjunctions between operational assets.

Deployment of multiple large constellations could result in a non-trivial number of failed satellites adding to the already dense population of space debris. The long-term presence of these defunct objects significantly increases the chances of collisions in the crowded orbital regimes.

An unabated increase in the number of satellites would invariably affect accessibility to outer space and equitable utilization, as well as the ability to sustain safe space operations in future. This needs closer consideration during our work and deliberation.

The object detection capability of ground-based optical telescopes is significantly degraded due to the streaks caused by the satellites of large constellations.

(b) Sharing experiences, practices and lessons learned from voluntary national implementation of the adopted Guidelines*Section A: guidelines on policy and regulatory framework for space activities*

India has been taking all the possible efforts in implementing the adopted guidelines in its space activities to the maximum extent possible and practicable. In this section, we share some of our experiences while implementing the adopted guidelines and also the valuable lessons we learned in the course of their implementation.

India is a party to all major international treaties and regulations related to outer space, including the Outer Space Treaty, the Rescue Agreement, the Liability Convention and the Registration Convention. The Indian Space Research Organisation (ISRO) follows internationally accepted Space Debris Mitigation Guidelines and best practices while conducting space operations. The ISRO System for Safe and Sustainable Space Operations Management (IS⁴OM) has been established to ensure that ISRO outer space activities are conducted in a safe and sustainable manner.

India has in place a concrete system to monitor its space activities. While the Department of Space of the Government of India drafts policies for the space sector of the country, the Indian National Space Promotion and Authorisation Centre (IN-SPACe) under the Department of Space is the nodal agency mandated to authorize and supervise all space activities of non-governmental Indian entities.

As part of the efforts for efficient use of orbital regions, ISRO meticulously carries out post-mission disposal of geostationary Earth orbit satellites by manoeuvring them away from the geostationary Earth orbit protected region, followed by passivation to minimize post-mission break-up risk. Efforts have been initiated for post-mission disposal of low Earth orbit objects to limit their presence in the low Earth orbit region.

India maintains a national registry of all Indian space objects launched and regularly notifies the Secretary-General about the details of the launched objects. A mechanism has been established through IN-SPACe to obtain relevant information for the registration of space objects of non-governmental Indian entities as well.

Section B: guidelines on safety of space operations

India has been providing contact details of Indian space objects as part of the registration process. The contact information of operational satellites is made available on the Space-Track website. In our view, establishing points of contact a priori among agencies is found to be helpful to establish the authenticity of the communicator, which enables safe and expedited exchange of relevant information towards collision risk mitigation. The present mode of inter-operator coordination is primarily through email, which is likely to be highly inadequate in future as the number of conjunctions is expected to increase significantly.

India has undertaken projects like the Network for Space Object Tracking and Analysis (NETRA) to set up observational facilities (radar and optical telescopes) for dedicated tracking and monitoring of space objects. Capabilities are also being established to process the observational data and carry out object identification and cataloguing.

ISRO regularly conducts conjunction assessment and performs collision avoidance manoeuvres for its operational satellites as and when needed. Space Object Proximity Analysis is carried out to identify potential collision threats to operational satellites. Any manoeuvre plan for maintenance of mission orbit is subjected to conjunction assessment to ensure that the post-manoeuve orbit of the satellite is clear from collision threat. Conjunction assessments are carried out to similarly screen all manoeuvre plans for post-mission disposal of low Earth orbit and geostationary Earth orbit satellites. ISRO carries out pre-launch conjunction assessment for all of its launches. Launch Collision Avoidance (LCOLA) analysis is carried out for different lift-off timings within the entire launch window to detect any close approach of space objects during the ascent (and descent) phase of the launch vehicle and the initial

orbital phase of the payload (or payloads) after the injection. The time of performing collision avoidance manoeuvre is a trade-off between operational feasibility and accuracy of risk estimation, which in turn depends on the availability of more updated and accurate orbital data of the objects under conjunction.

Over the years, a number of methodologies have been developed in-house by ISRO to predict the re-entry timing and impact location for a space object undergoing uncontrolled re-entry into the Earth's atmosphere.

Section C: guidelines on international cooperation, capacity-building and awareness

India cooperates with various countries and intergovernmental entities for sharing data related to the long-term sustainability of outer space activities through appropriate mechanisms. India has been promoting and supporting space capacity-building for the developing nations in the Asia-Pacific region through specific programmes and courses conducted by the Centre for Space Science and Technology Education in Asia and the Pacific, affiliated to the United Nations, and by various Indian institutes. As a member of the Charter on Cooperation to Achieve the Coordinated Use of Space Facilities in the Event of Natural or Technological Disasters (also called the International Charter on Space and Major Disasters), India regularly shares satellite data for disaster monitoring, impact assessment and relief operations with other countries. ISRO is actively involved in the activities of the Inter-Agency Space Debris Coordination Committee, the Space Debris Committee of the International Academy of Astronautics, the Space Traffic Management Technical Committee of the International Astronautical Federation and Working Group 7 of the International Organization for Standardization, related to the long-term sustainability of outer space activities.

Section D: guidelines on scientific and technical research and development

ISRO has initiated the development of environment-friendlier technologies for space, such as the usage of green propellants for its launch vehicle and satellite propulsion.

ISRO has been implementing all applicable measures on space debris mitigation, such as passivation of launch vehicle upper stages at end-of-mission, monitoring atmospheric re-entry of upper stages, operational collision avoidance and post-mission disposal of geostationary Earth orbit satellites followed by passivation. Specific initiatives have been undertaken to improve compliance with the guideline of the Committee on the Peaceful Uses of Outer Space on post-mission disposal for low Earth orbit satellites.

(c) Raising awareness and building capacity

India is keen to participate in capacity-building initiatives on long-term sustainability organized by other space-faring nations and will also explore the opportunity of sharing its expertise with other nations aspiring to embark into space ventures through bilateral or multilateral mechanisms.

Russian Federation

[Original: English and Russian]
[1 June 2022]

Considerations on key unresolved tasks of ensuring safety of space operations in the context of the long-term sustainability of outer space activities*

The Committee on the Peaceful Uses of Outer Space, at its sixty-second session, in 2019, adopted a preamble and 21 Guidelines for the Long-term Sustainability of Outer Space Activities. In addition, under the agenda item of the Scientific and Technical Subcommittee concerning the long-term sustainability of outer space activities, it established a working group tasked with, among other things, identifying and exploring challenges and considering possible new guidelines for the long-term sustainability of outer space activities.

The Committee also recommended that the Working Group, while addressing this issue, take into consideration the existing documents and conference room papers (in particular, [A/AC.105/C.1/L.367](#) and A/AC.105/2019/CRP.16), which reflect the progress and interim results of the discussions held previously by the Working Group on the Long-term Sustainability of Outer Space Activities (2010–2018).

Analysis of the above-mentioned documents shows that some basic problems related to the safety of space operations are not included in the adopted Guidelines. The following tasks remain unresolved:

- Implementation of self-restraint measures: implementation of operational and technological measures of self-restraint to States' space activities in order to prevent adverse developments in outer space
- Preclusion of interference with the operation of foreign space objects: implementation of policy aimed at precluding interference with the operation of foreign space objects through unauthorized access to their on-board hardware and software
- Refrain from modifications of the environment: prevention of dangerous alterations of space environment parameters resulting from intentional modifications
- Respect for the safety and security of foreign space-related ground and information infrastructures: preclusion of activities that could damage foreign ground and information infrastructures related to space activities
- Active removal: development and implementation of criteria and procedures for the preparation and conduct of space activities aimed at the active removal of space objects from orbit
- Safe conduct of operations for destruction of space objects: establishment of procedures and requirements for the safe conduct of operations resulting in the destruction of in-orbit space objects
- Appropriate solutions for active removal and destruction of non-registered space objects: development of criteria and procedures for the active removal and, in exceptional circumstances, for the intentional destruction of non-registered space objects

To complete these tasks, the Working Group, as directly implied by its mandate, would consider it advisable to focus on the elaboration and adoption of a set of additional guidelines for the long-term sustainability of outer space activities. In

* This text was first made available at the sixty-fifth session of the Committee on the Peaceful Uses of Outer Space (see [A/AC.105/2022/CRP.11](#)).

deliberations on the texts of these guidelines, it is important to consider the following points.

The safe conduct of space operations is understood as a certain procedure for carrying out outer space activities whereby States and international intergovernmental organizations undertake a range of efficient (sufficient) and timely measures at the political, regulatory, technical and organizational levels that would quite confidently and reliably allow parties, firstly, to protect their own space objects and related ground infrastructure from risks, hazards, threats and encroachments and, secondly, not to create (through intentional actions or inaction) and to prevent such risks, hazards and threats and encroachments upon foreign space objects and related ground infrastructure that could result from, and/or be induced by, their own space objects and related ground infrastructure. These measures should include:

- Ensuring safety of parties' own space objects and related ground infrastructure
- Renouncing intentional actions and preventing inaction that may cause vulnerability and/or pose danger to parties' own and foreign space objects and related ground infrastructure
- Setting tasks, developing security system parameters and capabilities of parties' own space objects and related ground infrastructure, as well as ensuring protection of parties' own space objects and related ground infrastructure from unauthorized outside interference and countering negative impacts thereto that may be caused by contingencies, in a safe manner considering internationally recognized principles, norms and procedures, including the holding of consultations

The regulatory functions to be implemented as part of the emerging holistic framework for ensuring the safety of space operations are:

- Enhancing the practice of registering space objects
- Implementation of self-restraint measures in outer space
- Preclusion of interference with the operation of foreign space objects through unauthorized access to their on-board hardware and software
- Prevention of modifications of the environment
- Various aspects of raising awareness of scheduled space launches
- Preclusion of activities that could impair foreign ground and information infrastructures related to space activities
- Active removal
- Safe conduct of operations for destruction of space objects
- Appropriate solutions for active removal and destruction of unregistered space objects
- Implementation
- Addressing approaches to the design and operation of small-size space objects
- Compliance with procedures for mitigating risks associated with uncontrolled re-entry of space objects
- Observing safety precautions when using sources of laser beams passing through outer space

It can be unequivocally concluded that without the elaboration of a set of additional guidelines aimed at solving the tasks outlined above, it does not seem possible to ensure the long-term sustainability of outer space activities. The Russian Federation is open to the discussion of those guidelines and calls on the delegations of all interested countries to join the dialogue within the Working Group.

Additional information and views

The submissions by the Russian Federation on implementation of the Guideline for the Long-term Sustainability of Outer Space Activities entitled “A.1 Adopt, revise and amend, as necessary, national regulatory frameworks” (A/AC.105/2022/CRP.9) and on the contribution of the Centre for Space Science and Technology Education in the Eurasian Region to strengthening the capacity of member States of the Committee on the Peaceful Uses of Outer Space to implement the Guidelines for the Long-term Sustainability of Outer Space Activities (A/AC.105/2022/CRP.10) are also before the Working Group for its consideration.**

United States of America

[Original: English]
[16 September 2022]

United States of America’s approach to the voluntary implementation of the Guidelines for the Long-term Sustainability of Outer Space Activities

The United States of America welcomes the adoption of the terms of reference, methods of work and workplan for the Working Group on the Long-term Sustainability of Outer Space Activities of the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space. The United States also notes its appreciation for the skilled leadership provided by Umamaheswaran R. of India as the Working Group’s Chair.

Pursuant to the adopted workplan, the United States has compiled information on its domestic efforts to implement the Guidelines for the Long-term Sustainability of Outer Space Activities and expects to submit this information ahead of the Working Group’s informal consultations, planned for 15–17 November 2022.

The United States has focused its submission on providing a comprehensive set of inputs to reflect the full range of government and non-government space activities, including inputs from academia, non-governmental organizations and the commercial sector. Nations must work with all aspects of their space sectors to help ensure the responsible and safe use of outer space.

The United States gathered information on national implementation of the 21 Guidelines for the Long-term Sustainability of Outer Space Activities in two parts:

1. United States government departments and agencies involved in the launch, licensing, procurement, regulation or operation of space objects were asked to provide input on practices and procedures relevant to the Guidelines for the Long-term Sustainability of Outer Space Activities;
2. The United States Department of State released a public solicitation requesting information from the United States private sector on how they are voluntarily implementing the Guidelines for the Long-term Sustainability of Outer Space Activities. A diverse group of space actors submitted inputs, including legacy space companies, smaller start-ups, academic institutions and non-governmental organizations.

Inputs were compiled, condensed and formatted to create a streamlined submission that reflects the actions specific United States departments and agencies and private

** The full texts are available in English and Russian on the web page of the sixty-fifth session of the Committee on the Peaceful Uses of Outer Space (see www.unoosa.org/oosa/en/ourwork/copuos/2022/index.html) and are also available to members of the Working Group on the Long-term Sustainability Outer Space Activities on the dedicated web page of the Working Group.

sector entities have taken to implement the Guidelines for the Long-term Sustainability of Outer Space Activities.

Submissions provided by United States stakeholders highlight government and private sector initiatives to promote the safe and responsible use of outer space through the voluntary implementation of the 21 Guidelines for the Long-term Sustainability of Outer Space Activities. Due to the size and diversity of the United States space sector, the United States plans to submit a supplement to its initial submission in advance of the sixtieth session of the Scientific and Technical Subcommittee, to be held in February 2023, with further detail on steps the United States has taken to advance the long-term sustainability of outer space.

Based on the inputs received from government and private sector entities, several challenges and opportunities to improve our practices were identified and are described below:

- The dynamic and rapidly advancing nature of the United States space enterprise and the ongoing exploration and use of space presents a number of challenges to the current United States domestic regulatory framework. As the United States continues to meet its international obligations and authorize and continually supervise its space activities, the United States must also advance efforts to ensure continued leadership in promoting the safe, responsible and sustainable use of outer space, including through implementation of the Guidelines for the Long-term Sustainability of Outer Space Activities. To better address this concern, the United States is reviewing its existing regulatory framework and engaging the private sector to ensure that it is able to respond to the rapid pace of commercial innovation while ensuring spaceflight safety and the utilization of space applications to support sustainable development.
- The private sector has generated some of the most innovative and ambitious developments in the space sector. Commercial space entities and their investors also have an interest in ensuring that the outer space environment is safe and sustainable for current and future space operations. The United States continues to value the unique insights private sector actors can provide and welcomed the substantive inputs received in response to our solicitation on Guideline implementation. In particular, private sector submissions identified a number of challenges and opportunities in relation to the Guidelines for the Long-term Sustainability of Outer Space Activities that the United States Government had not previously identified. This highlights the value of bringing diverse perspectives to the conversation, which can offer novel insights that may have otherwise been missed.
- Capacity-building is a foundational component of the Guidelines for the Long-term Sustainability of Outer Space Activities and of the Committee on the Peaceful Uses of Outer Space itself. During bilateral exchanges with a wide range of nations on space cooperation, the United States has found the Guidelines for the Long-term Sustainability of Outer Space Activities to be a useful point of reference to facilitate better understanding and increased cooperation on a number of issues. The ability to reference a thoughtfully developed, consensus-based international guideline when discussing space cooperation has allowed for more efficient conversations that start with a shared understanding. This underscores the utility of the Guidelines for the Long-term Sustainability of Outer Space Activities and the unique and indispensable work of the Committee on the Peaceful Uses of Outer Space to advance international cooperation in outer space and associated capacity-building.

The United States appreciates the opportunity to discuss both its submission and the submissions of other member States during the informal consultations, to be held from 15 to 17 November 2022, and during subsequent meetings of the Working Group. These exchanges can serve as substantive opportunities for Committee members to learn from one another on how best to implement the Guidelines for the Long-term Sustainability of Outer Space Activities and promote a sustainable outer space

environment. It is important to note that this submission is not the final report on the United States' Guideline implementation efforts. Rather, this is the first of many inventories of the United States' own sustainability efforts and reaffirms our commitment to work domestically, and with the international community, to promote the long-term sustainability of the outer space environment while maintaining and expanding the benefits of space to all people.
