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Guidelines for the long-term sustainability of outer space activities

Note by the Secretariat

At its fifty-ninth session, in 2016, the Committee on the Peaceful Uses of Outer Space agreed that consensus had been reached on the text of twelve guidelines for the long-term sustainability of outer space activities (A/71/20, annex). At the fifty-fifth session of the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space, in 2018, the Working Group on the Long-term Sustainability of Outer Space Activities agreed that consensus had been reached on a preambular text and nine additional guidelines for the long-term sustainability of outer space activities (A/AC.105/1167, annex III). The present document contains in part A the agreed texts of the preamble and 21 guidelines and, in part B, the texts of seven guidelines still under discussion, as per the conclusion at the fifty-fifth session of the Scientific and Technical Subcommittee.

The numbering of the guidelines mirrors that used in the annex of document A/71/20 and in subsequent versions of the guidelines, as most recently reflected in A/AC.105/L.362/Rev.1. The ordering of the guidelines in part A is as follows: each section contains guidelines ordered as in the annex of document A/71/20, followed by the additional guidelines agreed on during the fifty-fifth session of the Scientific and Technical Subcommittee. Therefore, guideline numbers may be missing or appear out of numerical order.

Part A
Agreed texts

I. Context of the guidelines for the long-term sustainability of outer space activities

A. Background

1. 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 may affect the long-term sustainability of space activities. Addressing these developments and risks requires international cooperation by States and international intergovernmental organizations to avoid harm to the space environment and the safety of space operations.

2. Space activities are essential tools for realizing the achievement of the Sustainable Development Goals. Hence, the long-term sustainability of outer space activities is of interest and importance for current and emerging participants in space activities, in particular for developing countries.

3. Over the years, the Committee on the Peaceful Uses of Outer Space has considered different aspects of the long-term sustainability of outer space activities from various perspectives. Building on those previous efforts and other relevant related efforts, the Working Group on the Long-term Sustainability of Outer Space Activities of the Scientific and Technical Subcommittee has developed a set of voluntary guidelines with a view to setting out a holistic approach to promoting the long-term sustainability of outer space activities. The guidelines comprise 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.

4. The development of voluntary guidelines is premised on the understanding that outer space should remain an operationally stable and safe environment that is maintained for peaceful purposes and open for exploration, use and international cooperation by current and future generations, in the interest of all countries, irrespective of their degree of economic or scientific development, without discrimination of any kind and with due regard for the principle of equity. The purpose of the guidelines is to assist States and international intergovernmental organizations, both individually and collectively, to mitigate the risks associated with the conduct of outer space activities so that present benefits can be sustained and future opportunities realized. Consequently, the implementation of the guidelines for the long-term sustainability for outer space activities should promote international cooperation in the peaceful use and exploration of outer space.

B. Definition, objectives and scope of the guidelines

5. 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. This is consistent with, and supports, the objectives of the Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space and the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (Outer Space Treaty), as such objectives are integrally associated with a commitment to conducting space activities in a manner that addresses the basic need to ensure that the environment in outer space remains suitable for exploration and use by current and future generations. States understand that maintaining exploration and use of outer space for peaceful purposes is a goal to be pursued in the interest of all humankind.

6. The objective of ensuring and enhancing the long-term sustainability of outer space activities, as understood at the international level and as set out in the guidelines, entails the need to identify the general context of, and modalities for, continuous improvements in the way that States and international intergovernmental organizations, while developing, planning and executing their space activities, remain committed to the use of outer space for peaceful purposes, so as to ensure that the outer space environment is preserved for current and future generations.

7. These guidelines are grounded in the understanding that the exploration and use of outer space should be conducted in a way so as to ensure the long-term sustainability of outer space activities. Accordingly, they are intended to support States in engaging in activities aimed at preserving the space environment for the exploration and use of outer space for peaceful purposes by all States and international intergovernmental organizations. In this regard, the guidelines also reiterate the principles contained in article III of the Outer Space Treaty that the activities of States in the exploration and use of outer space shall be carried out in accordance with international law, including the Charter of the United Nations. Accordingly, States should build on these principles when developing and conducting their national activities in outer space.

8. The guidelines also promote international cooperation and understanding to address natural and man-made hazards that could compromise the operations of States and international intergovernmental organizations in outer space and the long-term sustainability of outer space activities. Preserving the use of outer space for current and future generations is consistent with upholding the long-standing principle contained in article I of the Outer Space Treaty that the exploration and use of outer space, including the Moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind.

9. The guidelines are intended to support the development of national and international practices and safety frameworks for conducting outer space activities while allowing for flexibility in adapting such practices and frameworks to specific national circumstances.

10. The guidelines are also intended to support States and international intergovernmental organizations in developing their space capabilities through cooperative endeavours, as appropriate, in a manner that reduces to a minimum or, as feasible, avoids causing harm to the outer space environment and the safety of space operations, for the benefit of current and future generations.

11. The guidelines address the policy, regulatory, operational, safety, scientific, technical, international cooperation and capacity-building aspects of space activities. They 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. Therefore, the guidelines are relevant to both governmental and non-governmental entities. They are also relevant to all space activities, whether planned or ongoing, as practicable, and to all phases of a space mission, including launch, operation and end-of-life disposal.

12. The guidelines are premised on the idea that the interests and activities of States and international intergovernmental organizations in outer space, as they have or may have defence or national security implications, should be compatible with preserving outer space for peaceful exploration and use, and safeguarding its status pursuant to the Outer Space Treaty and the relevant principles and norms of international law.

13. The guidelines duly take into account the relevant recommendations contained in the report of the Group of Governmental Experts on Transparency and Confidence-Building Measures in Outer Space Activities (A/68/189) and could be considered as potential transparency and confidence-building measures.

C. Status of the guidelines

14. The existing United Nations treaties and principles on outer space provide the fundamental legal framework for the guidelines.

15. The guidelines are voluntary and not legally binding under international law, but any action taken towards their implementation should be consistent with the applicable principles and norms of international law. The guidelines are formulated in the spirit of enhancing the practice of States and international organizations in

applying the relevant principles and norms of international law. Nothing in the guidelines should constitute a revision, qualification or reinterpretation of those principles and norms. Nothing in the guidelines should be interpreted as giving rise to any new legal obligation for States. Any international treaties referred to in the guidelines apply only to the States parties to those treaties.

D. Voluntary implementation of the guidelines

16. States and international intergovernmental organizations should voluntarily take measures, through their own national or other applicable mechanisms, to ensure that the guidelines are implemented to the greatest extent feasible and practicable, in accordance with their respective needs, conditions and capabilities, and with their existing obligations under applicable international law, including the provisions of applicable United Nations treaties and principles on outer space. States and international intergovernmental organizations are encouraged to administer existing and, if necessary, establish new procedures to meet requirements associated with the guidelines. In implementing these guidelines, States should be guided by the principle of cooperation and mutual assistance and should conduct all their activities in outer space with due regard for the corresponding interests of all other States.

17. The greater the technical and other relevant capabilities at the disposal of a particular State, the greater the emphasis that State should place on implementing the guidelines to the extent feasible and practicable. States without such capabilities are encouraged to take steps to develop their own capacity to implement the guidelines. In cases where the development and enactment of regulations, standards and procedures required for the implementation of the guidelines may prove to be a difficult task, the States concerned are encouraged to seek the support of other States or international intergovernmental organizations to develop their own capacity to implement the guidelines and to enhance, by appropriate means, their level of engagement in following space operations safety requirements and in monitoring safety trends.

18. States and relevant international intergovernmental organizations in a position to support developing countries in developing their national capacities for the implementation of these guidelines, through appropriate and mutually agreed capacity-building mechanisms, are encouraged to do so as one of the means of ensuring and enhancing the long-term sustainability of outer space activities.

19. The widest implementation of these guidelines by States (at the level of both governmental agencies and non-governmental entities) and international intergovernmental organizations requires certain capacities and capabilities, which could be built and enhanced, inter alia, through international cooperation. As reflected in the 1996 Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking into Particular Account the Needs of Developing Countries, States and international intergovernmental organizations are free to determine all aspects of their cooperation on an equitable and mutually acceptable basis, and those aspects should be in full compliance with the legitimate rights and interests of the parties concerned as, for example, with intellectual property rights. Other relevant aspects also include addressing the issues of technology safeguard arrangements, multilateral commitments and relevant standards and practices, as applicable.

20. International cooperation is required to implement the guidelines effectively, to monitor their impact and effectiveness and to ensure that, as space activities evolve, they continue to reflect the most current state of knowledge of pertinent factors influencing the long-term sustainability of outer space activities, particularly with regard to the identification of factors that influence the nature and magnitude of risks associated with various aspects of space activities or that may give rise to potentially hazardous situations and developments in the space environment.

E. Review of implementation and updating of the guidelines

21. The relevant United Nations body serving as the principal forum for continued institutionalized dialogue on issues related to the implementation and review of the guidelines is the Committee on the Peaceful Uses of Outer Space. States and international intergovernmental organizations are encouraged to share their practices and experiences in the Committee regarding the implementation of the present guidelines.

22. States and international intergovernmental organizations should also work within the Committee and the Office for Outer Space Affairs of the United Nations Secretariat, as appropriate, to address concerns raised with respect to the implementation of the guidelines. When issues arise regarding the practical implementation of the guidelines, States and international intergovernmental organizations are encouraged to raise the issues with other directly involved States and international intergovernmental organizations through appropriate channels. Without prejudice to the mechanism foreseen in article IX of the Outer Space Treaty, these exchanges on practical implementation may seek to achieve a mutual understanding of the situation and options for mutual resolution. The outcome of those exchanges and resulting solutions could be presented to the Committee, on the basis of the consent of the States involved, with a view to sharing relevant knowledge and experience with other States and international intergovernmental organizations.

23. The guidelines reflect a common understanding on existing and possible challenges to the long-term sustainability of outer space activities, the nature of those challenges, and the measures that could prevent or reduce their harmful impact, based on current knowledge and established practices. States and international intergovernmental organizations are encouraged to promote and/or conduct research on topics relevant to these guidelines and their implementation.

24. The Committee may periodically review and revise these guidelines to ensure that they continue to provide effective guidance to promote the long-term sustainability of outer space activities. Proposals for revising this set of guidelines may be submitted by a member State of the Committee, for consideration by the Committee.

II. Guidelines for the long-term sustainability of outer space activities

A. Policy and regulatory framework for space activities

Guideline 1

Adopt, revise and amend, as necessary, national regulatory frameworks for outer space activities

1.1 States should adopt, revise and amend, as necessary, national regulatory frameworks for outer space activities, taking into account their obligations under the United Nations treaties on outer space as States responsible for national activities in outer space and as launching States. When adopting, revising, amending or implementing national regulatory frameworks, States should consider the need to ensure and enhance the long-term sustainability of outer space activities.

1.2 With the increase in outer space activities by governmental and non-governmental actors from around the world, and considering that States bear international responsibility for the space activities of non-governmental entities, States should adopt, revise or amend regulatory frameworks to ensure the effective application of relevant, generally accepted international norms, standards and practices for the safe conduct of outer space activities.

1.3 When developing, revising, amending or adopting national regulatory frameworks, States should consider the provisions of General Assembly resolution 68/74, on recommendations on national legislation relevant to the peaceful exploration and use of outer space. In particular, States should consider not only existing space projects and activities but also, to the extent practicable, the potential development of their national space sector, and envisage appropriate, timely regulation in order to avoid legal lacunae.

1.4 States, in enacting new regulations, or in revising or amending existing legislation, should bear in mind their obligations under article VI of the Outer Space Treaty. Traditionally, national regulations have been concerned with issues such as safety, liability, reliability and cost. As new regulations are developed, States should consider regulations that enhance the long-term sustainability of outer space activities. At the same time, regulations should not be so prescriptive as to prevent initiatives addressing the long-term sustainability of outer space activities.

Guideline 2

Consider a number of elements when developing, revising or amending, as necessary, national regulatory frameworks for outer space activities

2.1 When developing, revising or amending, as necessary, regulatory measures applicable to the long-term sustainability of outer space activities, States and international intergovernmental organizations should implement international obligations, including those arising under the United Nations space treaties to which they are party.

2.2 In developing, revising or amending, as necessary, national regulatory frameworks, States and international intergovernmental organizations should:

(a) Consider the provisions of General Assembly resolution 68/74, on recommendations on national legislation relevant to the peaceful exploration and use of outer space;

(b) Implement space debris mitigation measures, such as the Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space, through applicable mechanisms;

(c) Address, to the extent practicable, risks to people, property, public health and the environment associated with the launch, in-orbit operation and re-entry of space objects;

(d) Promote regulations and policies that support the idea of minimizing the impacts of human activities on Earth as well as on the outer space environment. They are encouraged to plan their activities based on the Sustainable Development Goals, their main national requirements and international considerations for the sustainability of space and the Earth;

(e) Implement the guidance contained in the Safety Framework for Nuclear Power Source Applications in Outer Space and satisfy the intent of the Principles Relevant to the Use of Nuclear Power Sources in Outer Space through applicable mechanisms that provide a regulatory, legal and technical framework that sets out responsibilities and assistance mechanisms, prior to using nuclear power sources in outer space;

(f) Consider the potential benefits of using existing international technical standards, including those published by the International Organization for Standardization (ISO), the Consultative Committee for Space Data Systems and national standardization bodies. In addition, States should consider the utilization of recommended practices and voluntary guidelines proposed by the Inter-Agency Space Debris Coordination Committee and the Committee on Space Research;

(g) Weigh the costs, benefits, disadvantages and risks of a range of alternatives and ensure that such measures have a clear purpose and are implementable and

practicable in terms of the technical, legal and management capacities of the State imposing the regulation. Regulations should also be efficient in terms of limiting the cost for compliance (e.g., in terms of money, time or risk) compared with feasible alternatives;

(h) Encourage advisory input from affected national entities during the process of developing regulatory frameworks governing space activities to avoid unintended consequences of regulation that might be more restrictive than necessary or that conflicts with other legal obligations;

(i) Examine and adapt existing relevant legislation to ensure its compliance with these guidelines, considering the need for transition periods appropriate to their level of technical development.

Guideline 3

Supervise national space activities

3.1 In supervising space activities of non-governmental entities, States should ensure that entities under their jurisdiction and/or control that conduct outer space activities have the appropriate structures and procedures for planning and conducting space activities in a manner that supports the objective of enhancing the long-term sustainability of outer space activities, and that they have the means to comply with relevant national and international regulatory frameworks, requirements, policies and processes in this regard.

3.2 States bear international responsibility for national activities in outer space and for the authorization and continuing supervision of such activities, which are to be carried out in conformity with applicable international law. In fulfilling this responsibility, States should encourage each entity conducting space activities to:

(a) Establish and maintain all the necessary technical competencies required to conduct the outer space activities in a safe and responsible manner and to enable the entity to comply with the relevant governmental and intergovernmental regulatory frameworks, requirements, policies and processes;

(b) Develop specific requirements and procedures to address the safety and reliability of outer space activities under the entity's control, during all phases of a mission life cycle;

(c) Assess all risks to the long-term sustainability of outer space activities associated with the space activities conducted by the entity, in all phases of the mission life cycle, and take steps to mitigate such risks to the extent feasible.

3.3 In addition, States are encouraged to designate a responsible entity or entities to plan, coordinate and assess space activities with the aim of promoting their effectiveness in supporting the Sustainable Development Goals and in supporting the objectives of the guidelines for the long-term sustainability of outer space activities in a broader perspective and vision.

3.4 States should ensure that the management of an entity that conducts outer space activities establishes structures and procedures for planning and conducting space activities in a manner that supports the objective of promoting the long-term sustainability of outer space activities. Appropriate measures to be taken by management in this regard should include:

(a) A commitment at the highest levels of the entity to promoting the long-term sustainability of outer space activities;

(b) Establishing and fostering an organizational commitment to promoting the long-term sustainability of outer space activities within the entity, as well as in relevant interactions with other entities;

(c) Urging, to the extent practicable, that the entity's commitment to the long-term sustainability of outer space activities is reflected in its management

structure and procedures for planning, developing and conducting outer space activities;

(d) Encouraging, as appropriate, the sharing of the experiences of the entity in the conduct of safe and sustainable outer space activities as a contribution by the entity to enhancing the long-term sustainability of outer space activities;

(e) Designating a contact point within the entity responsible for communication with relevant authorities to facilitate efficient and timely sharing of information and coordination of potentially urgent measures to promote the safety and sustainability of outer space activities.

3.5 States should ensure that appropriate communication and consultation mechanisms are in place within and among the competent bodies that oversee or conduct space activities. Communication within and among relevant regulatory bodies can promote regulations that are consistent, predictable and transparent so as to ensure that regulatory outcomes are as intended.

Guideline 4

Ensure the equitable, rational and efficient use of the radio frequency spectrum and the various orbital regions used by satellites

4.1 In fulfilling their obligations under the Constitution and the Radio Regulations of the International Telecommunication Union (ITU), States should pay particular attention to the long-term sustainability of space activities and sustainable development on Earth and to facilitating the prompt resolution of identified harmful radio frequency interference.

4.2 As provided for in article 44 of the ITU Constitution, radio frequencies and any associated orbits, including the geostationary-satellite orbit, are limited natural resources that must be used rationally, efficiently and economically, in conformity with the provisions of the Radio Regulations, so that countries or groups of countries may have equitable access to those orbits and frequencies, taking into account the special needs of developing countries and the geographical situation of particular countries.

4.3 Consistent with the purpose of article 45 of the ITU Constitution, States and international intergovernmental organizations should ensure that their space activities are conducted in such a manner as not to cause harmful interference with the reception and transmission of radio signals related to the space activities of other States and international intergovernmental organizations, as one of the means of promoting the long-term sustainability of outer space activities.

4.4 In their use of the electromagnetic spectrum, States and international intergovernmental organizations should consider the requirements for space-based Earth observation systems and other space-based systems and services in support of sustainable development on Earth, in accordance with the ITU Radio Regulations and the ITU Radiocommunication Sector (ITU-R) Recommendations.

4.5 States and international intergovernmental organizations should ensure the implementation of the radio regulation procedures established by ITU for space radio links. Moreover, States and international intergovernmental organizations should encourage and support regional and international cooperation aimed at improving efficiency in decision-making and implementation of practical measures to eliminate identified harmful radio frequency interference in space radio links.

4.6 Spacecraft and launch vehicle orbital stages that have terminated their operational phases in orbits that pass through the low-Earth orbit (LEO) region should be removed from orbit in a controlled fashion. If this is not possible, they should be disposed of in orbits that avoid their long-term presence in the LEO region. Spacecraft and launch vehicle orbital stages that have terminated their operational phases in orbits that pass through the geosynchronous Earth orbit (GEO) region should be left in orbits that avoid their long-term interference with the GEO region. For space

objects in or near the GEO region, the potential for future collisions can be reduced by leaving objects at the end of their mission in an orbit above the GEO region such that they will not interfere with, or return to, the GEO region.

Guideline 6

Enhance the practice of registering space objects

6.1 States and international intergovernmental organizations, acting in accordance with their obligations under article VIII of the Outer Space Treaty and the Convention on Registration of Objects Launched into Outer Space and taking into consideration the recommendations contained in General Assembly resolutions 1721 B (XVI) and 62/101, should ensure the development and/or implementation of effective and comprehensive registration practices, as proper registration of space objects is a key factor in the safety and the long-term sustainability of space activities. Inadequate registration practices may have negative implications for ensuring the safety of space operations.

6.2 To that end, States and international intergovernmental organizations should adopt appropriate national or other relevant policies and regulations to harmonize and sustain over the long term such registration practices on the widest possible international basis. When registering space objects, States and international intergovernmental organizations should bear in mind the need to provide timely information that contributes to the long-term sustainability of outer space activities and should consider also providing information on space objects, their operation and their status, as set out in General Assembly resolution 62/101.

6.3 Prior to the launch of a space object, the State from whose territory or facility a space object will be launched should, in the absence of prior agreement, contact States or international intergovernmental organizations that could qualify as the launching States of that space object to jointly determine how to proceed with the registration of that particular space object. Following the launch of a space object, and considering relevant criteria in the Convention on Registration of Objects Launched into Outer Space (Registration Convention), States and/or international intergovernmental organizations that were involved in the launch should coordinate among themselves, to include those States and international intergovernmental organizations that may exercise jurisdiction and control over the non-registered space object, to register the space object.

6.4 In the event that a State or international intergovernmental organization receives, from another State or international intergovernmental organization, an enquiry seeking clarification about the registration/non-registration of a space object that could presumably be under its jurisdiction and/or control, that State or international intergovernmental organization should respond, as soon as practicable, in order to facilitate the clarification and/or resolution of a particular registration issue. In certain circumstances, a State may choose to communicate an enquiry through or copy an enquiry to the Office for Outer Space Affairs. In such cases, the requested State is encouraged to reply likewise.

6.5 The Office should be effectively engaged, within its standing responsibilities and existing resources, in executing integrated functions pertaining to: (a) the accumulation of information on orbital launches performed (i.e., completed launches resulting in the placement of objects into Earth orbit or beyond) and on orbital objects (i.e., space objects that have been launched into Earth orbit or beyond); and (b) the assignment of international designations to orbital launches and orbital objects in accordance with Committee on Space Research notation, as well as the provision of such designations to the States of registry. States and international intergovernmental organizations should support efforts by the Office to promote initiatives that would enable States to adhere to registration practices and consider implementing and sustaining the provision of registration information in furtherance of General Assembly resolution 62/101.

6.6 The launching States and, where appropriate, international intergovernmental organizations should request all necessary information from space launch service providers and users under their jurisdiction and/or control to meet all registration requirements under the Registration Convention and encourage their receptiveness to and consideration of the provision of expanded registration information. States and international intergovernmental organizations, having institutionalized the practice of providing expanded registration information, should strive to sustain such practice and identify circumstances complicating the achievement of that task.

6.7 States and international intergovernmental organizations should take into account General Assembly resolution 62/101 and consider providing information on any change of status in operations (inter alia, when a space object is no longer functional) and, following the change in supervision of a space object in orbit, information about changes in the orbital position. States and international intergovernmental organizations should be aware of the importance of achieving and sustaining a practicable degree of coherence and uniformity in applying the provisions of this paragraph. Varying implementation practices, inasmuch as such may relate to the contents and attributes of information furnished, may necessitate addressing appropriate interpretative aspects. In such cases, States and international intergovernmental organizations should, through dedicated consultative process within the Committee on the Peaceful Uses of Outer Space, consider, acquire and develop shared positions with respect to providing information on any changes in space objects' status of operations and in the orbital positions of space objects.

6.8 In cases where a launched space object contains other space objects planned for future separation and independent orbital flight, States and international intergovernmental organizations should, when entering these objects in their registry and when furnishing registration information to the Secretary-General of the United Nations, indicate (for example, in the form of side notes) the number and names of space objects that may, in the future, separate from the main space object, on the understanding that those space objects should not be given different or modified names when they are subsequently registered.

6.9 In accordance with article IV, paragraph 2, of the Registration Convention, and considering General Assembly resolution 62/101, on registration practices, as well as principle 4.3 of General Assembly resolution 47/68, States and international intergovernmental organizations should provide information to the Office through internationally accepted mechanisms on all space activities or objects that involve the use of nuclear power sources in outer space.

B. Safety of space operations

Guideline 12

Improve accuracy of orbital data on space objects and enhance the practice and utility of sharing orbital information on space objects

12.1 States and international intergovernmental organizations should promote the development and use of techniques and methods to improve the accuracy of orbital data for spaceflight safety and the use of common, internationally recognized standards when sharing orbital information on space objects.

12.2 Recognizing that spaceflight safety strongly depends upon the accuracy of orbital and other relevant data, States and international intergovernmental organizations should promote techniques and the investigation of new methods to improve such accuracy. Those methods could include national and international activities to improve the capabilities and geographical distribution of existing and new sensors, use of passive and active on-orbit tracking aids, and combining and validating data from different sources. Special attention should be paid to encouraging

the participation and capacity-building of developing countries with emerging space capabilities in this domain.

12.3 When sharing orbital information on space objects, operators and other appropriate entities should be encouraged to use common, internationally recognized standards to enable collaboration and information exchange. Facilitating greater shared awareness of the current and predicted location of space objects would enable timely prediction and prevention of potential collisions.

Guideline 13

Promote the collection, sharing and dissemination of space debris monitoring information

13.1 States and international intergovernmental organizations should encourage the development and use of relevant technologies for the measurement, monitoring and characterization of the orbital and physical properties of space debris. States and international intergovernmental organizations should also promote the sharing and dissemination of derived data products and methodologies in support of research and international scientific cooperation on the evolution of the orbital debris population.

Guideline 16

Share operational space weather data and forecasts

16.1 States and international intergovernmental organizations should support and promote the collection, archiving, sharing, intercalibration, long-term continuity and dissemination of critical space weather data and space weather model outputs and forecasts, where appropriate in real time, as a means of enhancing the long-term sustainability of outer space activities.

16.2 States should be encouraged to monitor, to the extent feasible, space weather continuously and to share data and information with the aim of establishing an international space weather database network.

16.3 States and international intergovernmental organizations should support the identification of data sets critical for space weather services and research and should consider adopting policies for the free and unrestricted sharing of critical space weather data from their space- and ground-based assets. All governmental, civilian and commercial space weather data owners are urged to allow free and unrestricted access to and archiving of such data for mutual benefit.

16.4 States and international intergovernmental organizations should also consider sharing real-time and near-real-time critical space weather data and data products in a common format, promote and adopt common access protocols for their critical space weather data and data products, and promote the interoperability of space weather data portals, thus promoting ease of data access for users and researchers. The real-time sharing of these data could provide a valuable experience for sharing in real time other kinds of data relevant to the long-term sustainability of outer space activities.

16.5 States and international intergovernmental organizations should further undertake a coordinated approach to maintaining the long-term continuity of space weather observations and identifying and filling key measurement gaps, so as to meet critical needs for space weather information and/or data.

16.6 States and international intergovernmental organizations should identify high-priority needs for space weather models, space weather model outputs and space weather forecasts and adopt policies for free and unrestricted sharing of space weather model outputs and forecasts. All governmental, civilian and commercial space weather model developers and forecast providers are urged to allow free and unrestricted access to and archival of space weather model outputs and forecasts for mutual benefit, which will promote research and development in this domain.

16.7 States and international intergovernmental organizations should also encourage their space weather service providers to:

(a) Undertake comparisons of space weather model and forecast outputs with the goal of improved model performance and forecast accuracy;

(b) Openly share and disseminate historical and future critical space weather model outputs and forecast products in a common format;

(c) Adopt common access protocols for their space weather model outputs and forecast products to the extent possible, to promote their ease of use by users and researchers, including through interoperability of space weather portals;

(d) Undertake coordinated dissemination of space weather forecasts among space weather service providers and to operational end users.

Guideline 17

Develop space weather models and tools and collect established practices on the mitigation of space weather effects

17.1 States and international intergovernmental organizations should undertake a coordinated approach to identifying and filling gaps in research and operational models and forecasting tools required to meet the needs of the scientific community and of the providers and users of space weather information services. Where possible, this should include coordinated efforts to support and promote research and development to further advance space weather models and forecasting tools, incorporating the effects of the changing solar environment and the evolving terrestrial magnetic field as appropriate, including within the context of the Committee on the Peaceful Uses of Outer Space and its Subcommittees, as well as in collaboration with other entities such as the World Meteorological Organization and the International Space Environment Service.

17.2 States and international intergovernmental organizations should support and promote cooperation and coordination on ground- and space-based space weather observations, forecast modelling, satellite anomalies and reporting of space weather effects in order to safeguard space activities. Practical measures in this regard could include:

(a) Incorporating current and forecast space weather thresholds into space launch criteria;

(b) Encouraging satellite operators to cooperate with space weather service providers to identify the information that would be most useful to mitigate anomalies and to derive recommended specific guidelines for on-orbit operations. For example, if the radiation environment is hazardous, this might include actions to delay the uploading of software, implementation of manoeuvres, etc.;

(c) Encouraging the collection, collation and sharing of information relating to ground- and space-based space weather-related impacts and system anomalies, including spacecraft anomalies;

(d) Encouraging the use of a common format for reporting space weather information. In relation to the reporting of spacecraft anomalies, satellite operators are encouraged to take note of the template proposed by the Coordination Group for Meteorological Satellites;

(e) Encouraging policies promoting the sharing of satellite anomaly data related to space weather-induced effects;

(f) Encouraging training on and knowledge transfer relating to the use of space weather data, taking into account the participation of countries with emerging space capabilities.

17.3 It is acknowledged that some data may be subject to legal restrictions and/or measures for the protection of proprietary or confidential information, in

accordance with national legislation, multilateral commitments, non-proliferation norms and international law.

17.4 States and international intergovernmental organizations should work towards the development of international standards and the collection of established practices applicable for the mitigation of space weather effects in satellite design. This could include the sharing of information on design practices, guidelines and lessons learned relating to mitigation of the effects of space weather on operational space systems, as well as documentation and reports relating to space weather user needs, measurement requirements, gap analyses, cost-benefit analyses and related space weather assessments.

17.5 States should encourage entities under their jurisdiction and/or control to:

(a) Incorporate in satellite designs the capability to recover from a debilitating space weather effect, such as by including a safe mode;

(b) Incorporate space weather effects into satellite designs and mission planning for end-of-life disposal in order to ensure that the spacecraft either reach their intended graveyard orbit or de-orbit appropriately, in accordance with the Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space. This should include appropriate margin analysis.

17.6 International intergovernmental organizations should also promote such measures among their member States.

17.7 States should undertake an assessment of the risk and socioeconomic impacts of adverse space weather effects on the technological systems in their respective countries. The results from such studies should be published and made available to all States and used to inform decision-making relating to the long-term sustainability of outer space activities, particularly with regard to mitigating the adverse impacts of space weather on operational space systems.

Guideline 11

Provide updated contact information and share information on space objects and orbital events

11.1 States and international intergovernmental organizations should exchange, on a voluntary basis, and/or make readily available regularly updated contact information on their designated entities authorized to engage in exchanges of appropriate information on on-orbit spacecraft operations, conjunction assessments and the monitoring of objects and events in outer space, in particular those entities that are responsible for processing incoming incident reports and forecasts and adopting precautionary and response measures. This may be achieved either by providing such information to the Office for Outer Space Affairs so that the Office can make it available, within its standing mandate and existing resources, to other States and international intergovernmental organizations and/or by providing it directly to other States and international intergovernmental organizations, with the understanding that contact information for national focal points, at a minimum, will likewise be communicated to the Office.

11.2 States and international intergovernmental organizations should establish appropriate means to enable timely coordination to reduce the probability of and/or to facilitate effective responses to orbital collisions, orbital break-ups and other events that might increase the probability of accidental collisions or may pose a risk to human lives, property and/or the environment, in the case of uncontrolled re-entries of space objects.

11.3 States and international intergovernmental organizations should exchange, on a voluntary basis and as mutually agreed, relevant information on space objects and information related to actual or potential situations in near-Earth space that may affect the safety of outer space operations. The information exchanged should, to the extent practicable, be reliable, accurate and complete, and be concluded to be so by

the providing entity. The information to be exchanged, including time reference and period of applicability and other relevant information, should be provided in a timely manner and on a mutually agreed basis.

11.4 States and international intergovernmental organizations should, through a dedicated consultative process, preferably under the auspices of the Committee on the Peaceful Uses of Outer Space, taking into account the work of relevant technical bodies, consider, acquire specific understanding of, and develop shared positions on the practical issues and modalities, as appropriate, relating to the exchange of relevant information on space objects and events in near-Earth space obtained from different authorized sources, in order to achieve harmonized and standardized record-keeping on space objects and events in outer space.

11.5 States and international intergovernmental organizations should consider the options for effectively accumulating and providing access to information on objects and events in outer space on a timely basis and for achieving consistency in the understanding and use of such information as one of the means to support their activities aimed at maintaining the safety of space operations. The options for consideration could include: standards and formats for representing information to enable the interoperability of information shared on a voluntary basis; bilateral, regional or multilateral arrangements to exchange information; bilateral, regional or multilateral coordination among providers of information to enable cooperation and interoperability; and the establishment of a United Nations information platform. Those options could serve as a basis for a distributed international information system for multilateral cooperation in sharing and disseminating multi-source information on objects and events in near-Earth space.

Guideline 14

Perform conjunction assessment during all orbital phases of controlled flight

14.1 Conjunction assessment should be performed for all spacecraft capable of adjusting trajectories during orbital phases of controlled flight for current and planned spacecraft trajectories. States and international intergovernmental organizations should, through national mechanisms and/or international cooperation, perform conjunction assessments during all orbital phases of controlled flight for their current and planned spacecraft trajectories. With due consideration to article VI of the 1967 Outer Space Treaty, States should encourage entities, including spacecraft operators and conjunction assessment service providers under their jurisdiction and/or control to perform conjunction assessments through national mechanisms, when applicable. International intergovernmental organizations should perform such assessments through their respective mechanisms.

14.2 States and international intergovernmental organizations should develop and implement in an appropriate manner approaches to and methods for conjunction assessment that may include: (a) improving the orbit determination of relevant space objects; (b) screening current and planned trajectories of relevant space objects for potential collisions; (c) determining the risk of collision and whether an adjustment of trajectory is required to reduce the risk of collision; and (d) sharing information on the proper interpretation and usage of the conjunction assessment results, as appropriate. States and international intergovernmental organizations should, where applicable, encourage entities under their respective jurisdiction and/or control, including spacecraft operators and conjunction assessment service providers, to develop or help develop such approaches and methods to conjunction assessment.

14.3 Spacecraft operators, including those of non-governmental entities, that are unable to perform conjunction assessments should seek support, via State authorities, as necessary and in accordance with relevant applicable regulations, from appropriate around-the-clock conjunction assessment entities. International intergovernmental organizations that are unable to perform conjunction assessments should seek support through their respective mechanisms.

14.4 States and international intergovernmental organizations should, in a dedicated international consultative process, acting through their designated entities, as appropriate, share knowledge and experience related to the interpretation of conjunction assessment information with the objective of developing methods and consistent criteria for assessing probability of collisions and making avoidance manoeuvre decisions and agreeing on classes of methods applicable to different types of conjunctions. States and international intergovernmental organizations that have developed practical methods and approaches for conjunction assessments and collision avoidance manoeuvre decision-making processes should also share their expertise by, inter alia, providing training opportunities for emerging spacecraft operators and disseminating best practices, knowledge and experience.

14.5 States and international intergovernmental organizations should encourage conjunction assessment service providers under their jurisdiction and control to consult on screening criteria and notification thresholds with spacecraft operators and pertinent parties before providing conjunction assessment services, as practicable.

Guideline 15

Develop practical approaches for pre-launch conjunction assessment

15.1 States and international intergovernmental organizations are encouraged to advise launch service providers under their jurisdiction and control to consider conducting pre-launch conjunction assessment for space objects to be launched. To facilitate and promote such pre-launch conjunction assessment practices, States and international intergovernmental organizations are encouraged, with the involvement of launch service providers and, as necessary, other relevant entities under their jurisdiction and control, to develop, implement and improve the corresponding methods and procedures.

15.2 States and international intergovernmental organizations are encouraged to advise launch service providers under their jurisdiction and control to seek support, as necessary, via designated entities authorized to engage in exchanges of information on pre-launch conjunction assessment, as appropriate and in accordance with relevant applicable regulations, for pre-launch conjunction assessment from appropriate conjunction assessment entities.

15.3 When performing a specific pre-launch conjunction assessment, launch service providers are encouraged to coordinate, via designated entities authorized to engage in exchanges of information on pre-launch conjunction assessment, with pertinent States and international intergovernmental organizations concerning the given assessment, if necessary.

15.4 States and international intergovernmental organizations should, with the involvement of launch service providers and other relevant entities under their jurisdiction and control as necessary, develop common international standards for describing relevant information required for pre-launch conjunction assessment in order to facilitate the provision, as mutually agreed, of pre-launch conjunction assessment support.

15.5 States and international intergovernmental organizations are encouraged to exchange their analytical assessment of the trends in the change of the risk of collision of space objects to be launched with other space objects operating near the planned insertion orbit.

15.6 States and international intergovernmental organizations are encouraged to consider providing, using, as appropriate, applicable existing and/or new dedicated mechanisms, information on launch schedules useful for assessing changes in the future population of space objects, pre-launch notifications containing information on the launch plan that would be useful for assisting in the identification of newly launched space objects, and notices for mariners and pilots on restricted zones at sea and in airspace. The contents and attributes of such information should be appropriate for its intended use.

15.7 States and international intergovernmental organizations should, through a dedicated consultative process within the Committee on the Peaceful Uses of Outer Space, consider, acquire and develop shared positions on information to be provided for pre-launch conjunction assessment.

Guideline 30

Design and operation of space objects regardless of their physical and operational characteristics

30.1 States and international intergovernmental organizations are encouraged to promote design approaches that increase the trackability of space objects, regardless of their physical and operational characteristics, including small-size space objects, and those that are difficult to track throughout their orbital lifetime, as well as facilitate the accurate and precise determination of their position in orbit. Such design solutions could include the use of appropriate on-board technology.

30.2 States and international intergovernmental organizations should encourage manufacturers and operators of space objects, regardless of their physical and operational characteristics, to design such objects to implement applicable international and national space debris mitigation standards and/or guidelines in order to limit the long-term presence of space objects in protected regions of outer space after the end of their mission. States and international intergovernmental organizations are encouraged to share their experiences and information on the operation and end-of-life disposal of space objects, in furtherance of the long-term sustainability of space activities.

30.3 Due to the importance of small-size space objects to all space programmes, in particular, for developing countries and emerging spacefaring countries, the implementation of the present guideline supports the development of space programmes, including the launching and operation of small-size space objects or any other space objects that are difficult to track, in a way that promotes the long-term sustainability of outer space activities.

Guideline 31

Take measures to address risks associated with the uncontrolled re-entry of space objects

31.1 States and international intergovernmental organizations should have in place procedures for furnishing to other States and/or the Secretary-General of the United Nations, via designated entities, as soon as practicable and with updates if necessary, information on the forecasted uncontrolled re-entry of potentially hazardous space objects that are under their jurisdiction and control, and communicating and coordinating the mitigation of risks associated with such events. States and international intergovernmental organizations without space object tracking capabilities should seek support from other States and international intergovernmental organizations with such capabilities. If a State or international intergovernmental organization has early information on forecasted uncontrolled re-entry of potentially hazardous space objects that are under the jurisdiction and control of another State or international intergovernmental organization, it should share such information with that State or international intergovernmental organization via their designated entities. If a State or international intergovernmental organization has early information on the forecasted uncontrolled re-entry of potentially hazardous space objects whose jurisdiction and control is not identified, it should share such information with other States and/or the United Nations via designated entities.

31.2 States and international intergovernmental organizations with relevant technical capabilities and resources and/or States and international intergovernmental organizations which exercise jurisdiction over the objects forecast to re-enter the atmosphere should assist each other (in a proactive manner and/or in responding to a request) to improve the reliability of results when predicting the uncontrolled re-entry

of potentially hazardous space objects, such as by tracking the objects and generating information on their trajectory. States and international intergovernmental organizations should cooperate to build capacity in the area of monitoring uncontrolled space object re-entries.

31.3 When feasible and without prejudice to furnishing preliminary information on possible hazardous events associated with the uncontrolled re-entry of space objects, the procedures referred to above should be employed during the final phase of the orbital flight of a space object. The procedures should be used until the termination of the ballistic flight of the space object has been confirmed, as well as in the event of the identification of the space object or its fragments that reach the surface of the Earth.

31.4 States and international intergovernmental organizations should furnish in a timely fashion relevant information they may have at their disposal, as practicable, to support addressing risks from uncontrolled re-entries. The contents and attributes of such information should, to the extent practicable, be relevant to raising awareness, where appropriate, of possible contingencies associated with high-risk uncontrolled re-entries. States and international intergovernmental organizations should designate appropriate entities that are authorized to provide, request and receive such information.

31.5 States and international intergovernmental organizations should consider applying design techniques to minimize the risk associated with fragments of space objects surviving uncontrolled re-entry.

31.6 Without prejudice to article 5 of the Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, the State(s) having jurisdiction over the territory on which a space object or its component parts have been discovered or are presumed to have reached the surface of the Earth, should respond to any request for timely consultations by the State or international intergovernmental organization with jurisdiction and control over the object. In such consultations, the State or international intergovernmental organization exercising jurisdiction and control over the object should advise and, if mutually agreed, assist the potentially affected State(s) in the search for and identification, assessment, analysis, evacuation and return of the object or its fragments. State(s) on whose territory a space object or its component parts have been discovered or are presumed to have reached the surface of the Earth should respond to requests from the State or international intergovernmental organization with jurisdiction and control over the object to follow appropriate procedures for, inter alia, identification, assessment, and analysis of the space object or its component parts, to avoid the harmful effects of any hazardous materials which could have survived the uncontrolled re-entry.

Guideline 32

Observe measures of precaution when using sources of laser beams passing through outer space

32.1 When governmental and/or non-governmental entities under the jurisdiction and control of States and international intergovernmental organizations use lasers that generate beams passing through near-Earth outer space, States and international intergovernmental organizations should analyse the probability of accidental illumination of passing space objects by laser beams; conduct a quantitative evaluation of the laser radiation power at the distance of crossing space objects; if possible, perform an assessment of the risk of malfunctioning of, damage to, and/or break-up of space objects due to such illumination; and, as necessary, observe appropriate measures of precaution.

C. International cooperation, capacity-building and awareness

Guideline 25

Promote and support capacity-building

25.1 States and international intergovernmental organizations with experience in space activities should encourage and support capacity-building in developing countries with emerging space programmes, on a mutually acceptable basis, through measures such as improving their expertise and knowledge on spacecraft design, flight dynamics and orbits, performing joint orbital calculations and conjunction assessments, and providing access to appropriate precise orbital data and appropriate tools for the monitoring of space objects through relevant arrangements as appropriate.

25.2 States and international intergovernmental organizations should support current capacity-building initiatives and promote new forms of regional and international cooperation and capacity-building that are in accordance with national and international law to assist countries in gathering human and financial resources and achieving efficient technical capabilities, standards, regulatory frameworks and governance methods that support the long-term sustainability of outer space activities and sustainable development on Earth.

25.3 States and international intergovernmental organizations should coordinate their efforts in space-related capacity-building and data accessibility in order to ensure efficiency in the use of available resources and, to the extent that it is reasonable and relevant, avoid unnecessary duplication of functions and efforts, taking into account the needs and interests of developing countries. Capacity-building activities include education, training and sharing of appropriate experience, information, data, tools and management methodologies and techniques, as well as the transfer of technology.

25.4 States and international intergovernmental organizations should also undertake efforts to make relevant space-based information and data accessible to countries affected by natural disasters or other catastrophes, guided by considerations of humanity, neutrality and impartiality, and to support capacity-building activities aimed at enabling the receiving countries to make optimal use of such data and information. These space-based data and information with appropriate spatial and temporal resolution should be freely, quickly and easily available for countries in crisis.

Guideline 26

Raise awareness of space activities

26.1 States and international intergovernmental organizations should raise general public awareness of the important societal benefits of space activities and of the consequent importance of enhancing the long-term sustainability of outer space activities. To this end, States and international intergovernmental organizations should:

(a) Promote institutional and public awareness of space activities and their applications for sustainable development, environmental monitoring and assessment, disaster management and emergency response;

(b) Conduct outreach, capacity-building and education on regulations and established practices relevant to the long-term sustainability of space activities;

(c) Promote activities of non-governmental entities that will enhance the long-term sustainability of outer space activities;

(d) Raise awareness among relevant public institutions and non-governmental entities about national and international policies, legislation, regulations and best practices that are applicable to space activities.

26.2 States and international intergovernmental organizations should promote public awareness of space applications for sustainable development, environmental monitoring and assessment, disaster management and emergency response through information-sharing and joint efforts with public institutions and non-governmental entities, taking into account the needs of current and future generations. In designing space education programmes, States, international intergovernmental organizations and non-governmental entities should pay special attention to courses on enhancing knowledge and practice of the utilization of space applications to support sustainable development. States and international intergovernmental organizations should initiate the voluntary collection of information on public awareness and education tools and programmes with a view to facilitating the development and implementation of other initiatives with similar objectives.

26.3 States and international intergovernmental organizations should foster outreach activities by or with industry, academia and other relevant non-governmental entities. Outreach, capacity-building and educational initiatives could take the form of seminars (in person or broadcast over the Internet), published guidelines to complement national and international regulations or a website with basic information on a regulatory framework and/or a contact point within the Government for regulatory information. Appropriately targeted outreach and education can assist all entities engaged in space activities in gaining a better appreciation and understanding of the nature of their obligations, in particular relating to implementation, which can lead to improved compliance with the existing regulatory framework and the practices currently being employed to enhance the long-term sustainability of outer space activities. This is particularly valuable where the regulatory framework has been changed or updated, resulting in new obligations for participants in space activities.

26.4 Cooperation between Governments and non-governmental entities should be encouraged and fostered. Non-governmental entities, including professional and industry associations and academic institutions, can play important roles in increasing international awareness of issues associated with space sustainability, as well as promoting practical measures to enhance space sustainability. Such measures could include adoption of the Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space; compliance with the ITU Radio Regulations related to space services; and the development of open, transparent standards for the exchange of data necessary to avoid collisions, harmful radio frequency interference or other harmful events in outer space. Non-governmental entities can also play important roles in bringing stakeholders together to develop common approaches to certain aspects of space activities that can collectively enhance the long-term sustainability of space activities.

Guideline 23

Promote and facilitate international cooperation in support of the long-term sustainability of outer space activities

23.1 States and international intergovernmental organizations should promote and facilitate international cooperation to enable all countries, in particular developing and emerging spacefaring countries, to implement these guidelines. International cooperation should, where appropriate, involve the public, private and academic sectors, and may include, inter alia, the exchange of experience, scientific knowledge, technology and equipment for space activities on an equitable and mutually acceptable basis.

Guideline 24

Share experience related to the long-term sustainability of outer space activities and develop new procedures, as appropriate, for information exchange

24.1 States and international intergovernmental organizations should share, as mutually agreed, experiences, expertise and information relating to the long-term sustainability of outer space activities, including with non-governmental entities, and

develop and adopt procedures to facilitate the compilation and effective dissemination of information on the ways and means of enhancing the long-term sustainability of space activities. When further developing their information-sharing procedures, States and international intergovernmental organizations could take note of existing data-sharing practices used by non-governmental entities.

24.2 The experiences and expertise acquired by those engaged in space activities should be regarded as instrumental in the development of effective measures to enhance the long-term sustainability of outer space activities. States and international intergovernmental organizations should therefore share relevant experiences and expertise to enhance the long-term sustainability of space activities.

D. Scientific and technical research and development

Guideline 27

Promote and support research into and the development of ways to support sustainable exploration and use of outer space

27.1 States and international intergovernmental organizations should promote and support research into and the development of sustainable space technologies, processes and services and other initiatives for the sustainable exploration and use of outer space, including celestial bodies.

27.2 In their conduct of space activities for the peaceful exploration and use of outer space, including celestial bodies, States and international intergovernmental organizations should take into account, with reference to the outcome document of the United Nations Conference on Sustainable Development (General Assembly resolution 66/288, annex), the social, economic and environmental dimensions of sustainable development on Earth.

27.3 States and international intergovernmental organizations should promote the development of technologies that minimize the environmental impact of manufacturing and launching space assets and that maximize the use of renewable resources and the reusability or repurposing of space assets to enhance the long-term sustainability of those activities.

27.4 States and international intergovernmental organizations should consider appropriate safety measures to protect the Earth and the space environment from harmful contamination, taking advantage of existing measures, practices and guidelines that may apply to those activities, and developing new measures as appropriate.

27.5 States and international intergovernmental organizations conducting research and development activities to support the sustainable exploration and use of outer space should also encourage the participation of developing countries in such activities.

Guideline 28

Investigate and consider new measures to manage the space debris population in the long term

28.1 States and international intergovernmental organizations should investigate the necessity and feasibility of possible new measures, including technological solutions, and consider implementation thereof, in order to address the evolution of and manage the space debris population in the long term. These new measures, together with existing ones, should be envisaged so as not to impose undue costs on the space programmes of emerging spacefaring nations.

28.2 States and international intergovernmental organizations should take measures at the national and international levels, including international cooperation

and capacity-building, to increase compliance with the Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space.

28.3 Investigation of new measures could include, inter alia, methods for the extension of operational lifetime, novel techniques to prevent collision with and among debris and objects with no means of changing their trajectory, advanced measures for spacecraft passivation and post-mission disposal and designs to enhance the disintegration of space systems during uncontrolled atmospheric re-entry.

28.4 Such new measures aimed at ensuring the sustainability of space activities and involving either controlled or uncontrolled re-entries should not pose an undue risk to people or property, including through environmental pollution caused by hazardous substances.

28.5 Policy and legal issues, such as ensuring that these new measures are compliant with the provisions of the Charter of the United Nations and applicable international law, may also need to be addressed.

Part B
Texts of guidelines for the long-term sustainability of outer space activities still under discussion

A. Policy and regulatory framework for space activities

Guideline 7

Provide, in national legal and/or policy frameworks, for a commitment to conducting space activities solely for peaceful purposes

[*Three alternative formulations of guideline 7 are given below for consideration by delegations.*]

[*Alternative 1 for guideline 7*]

[7.1 States and international intergovernmental organizations conducting activities in outer space should provide for the observance of the principle that exploration and use of outer space should be carried out for the benefit and in the interests of all States. To that end, States and international intergovernmental organizations should commit in their legal systems and/or policy frameworks to conducting activities in the exploration and use of outer space, including the Moon and other celestial bodies, solely for peaceful purposes.

7.2 Without prejudice to a possible broader conceptual meaning that may, within the United Nations system and/or international treaties, be attributed to the activities in the exploration and use of outer space solely for peaceful purposes [and satisfy additional criteria], the conduct of activities in the exploration and use of outer space solely for peaceful purposes would not prevent the use of space technologies in the interests of activities and space applications such as monitoring, navigation, communication, data relay, geodesy and mapping [, which support national and international security]. Such [commitment to] [legal and policy frameworks for] upholding the conduct of activities in the exploration and use of outer space solely for peaceful purposes should be considered as commensurate with the need to contribute to [a regime of] transparency and confidence-building measures in outer space activities and to engage constructively in international dialogues, including discussion within the General Assembly, on possible challenges to space [security] [safety] and the sustainability of outer space activities. Insofar as States may have legitimate [security] interests in outer space, those interests should comply with applicable international law and should take into account the common interests of all humankind.

7.3 States, in particular those with major space capabilities, should contribute actively to the goal of [preventing an arms race] in outer space as an essential condition for the promotion of international cooperation in the exploration and use of outer space for peaceful purposes. Accordingly, States are encouraged to work collectively to prevent threats to the [peace], safety and [security] [sustainability] that can compromise the long-term sustainability of outer space activities.]

[*Alternative 2 for guideline 7*]

[7.1 Failing to preserve outer space for peaceful purposes would be detrimental to the long-term sustainability of outer space activities. Therefore, States and international intergovernmental organizations conducting, authorizing or supervising outer space activities should firmly uphold the long-standing principle that the exploration and use of outer space is to be carried out in peace and for the benefit and in the interests of all countries for current and future generations. States and international intergovernmental organizations should commit in their national legal and/or policy frameworks to conducting activities of a peaceful nature in outer space.

7.2 States are encouraged to work collectively to [prevent threats] [avoid risks] that can compromise the long-term sustainability of outer space activities. When doing so, States should [implement] [consider] the recommendations of the report of the Group of Governmental Experts on Transparency and Confidence-Building Measures in Outer Space Activities.

7.3 States should refrain from conducting activities that may give rise to concerns by other States in relation to the shared aim of preserving the long-term sustainability of outer space activities.]

[*Alternative 3 for guideline 7*]

[7.1 States and international intergovernmental organizations should continuously address the issue of maintaining exclusively peaceful conditions in outer space and are encouraged to duly reflect allegiance to furthering this objective in policy statements. States and international intergovernmental organizations are also encouraged to foster and develop dialogues congenial to harmonizing perceptions [understanding] of the ways and means of maintaining outer space for peaceful purposes, considering appropriate facets of this task.]

B. Safety of space operations

Guideline 18+19

Ensure the [safety and security] [protection] of terrestrial infrastructure that supports the operation of orbital systems

[*Two alternative formulations of guideline 18+19 are given below for consideration by delegations.*]

[*Alternative 1 for guideline 18+19*]

[18.1 States and international intergovernmental organizations should [recognize that the [safety and security] [protection] of] [protect] terrestrial infrastructure that supports orbital systems is integral to ensuring the long-term sustainability of outer space activities. [[Taking into account applicable international law, including the Outer Space Treaty and the ITU Constitution, Convention and Radio Regulations,] States and international intergovernmental organizations should [provide for][take] measures [at the policy and regulatory levels] aimed at [avoiding the use of radio frequencies and/or the conduct of activities that they have reason to believe may cause][reducing the risk of] potentially harmful interference with the terrestrial infrastructure supporting the [peaceful exploration and use of outer space] [operation of the orbital systems of other][by other] States and international

intergovernmental organizations[, including infrastructure under the jurisdiction and/or control of another State or international intergovernmental organization].]

18.2 States and international intergovernmental organizations should [, as appropriate,] strengthen the security and resilience of their terrestrial infrastructure that supports the operation of orbital systems. States and international intergovernmental organizations involved in the establishment and/or operation of a particular terrestrial infrastructure that supports the operation of orbital systems are encouraged to cooperate to strengthen the security and resilience of that infrastructure. Such efforts could include information exchanges between and among governmental and non-governmental entities responsible for terrestrial infrastructure — via State authorities as necessary and in accordance with relevant applicable regulations — regarding effective practices for withstanding and recovering from accidents and incidents.

18.3 [[When considering appropriate measures for the protection [and improvement] of [and] [improving] the resilience of terrestrial infrastructure that supports the operation of space systems,] States and international intergovernmental organizations should [provide for regulation that] ensure[s] that the methods and procedures used to support the resilience of terrestrial infrastructure preclude any action that could impair or adversely affect the operation of terrestrial and information infrastructures [under the jurisdiction and/or control of] [supporting the peaceful exploration and use of outer space by] other States or international intergovernmental organizations.]

18.4 [States and international intergovernmental organizations should establish [and pursue, both internally and through active efforts at the international level, an] [national] information security [policy that would appropriately address] [policies to promote] effective [domestic and international] cooperation in preventing, identifying, investigating and deterring malicious usage of information and communications technology and/or any other activities that may endanger or disrupt critical national, foreign and international information infrastructure [that may be] directly involved in ensuring the safe and secure operation of orbital systems [under national or foreign jurisdiction].]

18.5 States and international intergovernmental organizations should, [whenever needed and/or as requested] [as needed], [liaise and engage in practical interaction with each other in response to relevant real-time, emerging and] [cooperate to prevent and respond to] potential [threats] [risks] and incidents that may affect the terrestrial infrastructure that supports the operation of orbital systems. To facilitate communication regarding such [threats] [risks], States and international intergovernmental organizations should designate points of contact [and determine policies and procedures] [for information exchanges].]

[*Alternative 2 for guideline 18+19*]

[18.1 States and international intergovernmental organizations should recognize that the safety and security of terrestrial infrastructure, including related information infrastructure, that supports the operation of, and data transmission to and from, orbital systems is integral to ensuring the long-term sustainability of outer space activities and the safety of space operations in both the domestic and international contexts. Considering this, and having due regard for the principles and norms of international law, including the Outer Space Treaty, in particular its articles VI and IX, and the ITU Constitution, Convention and Radio Regulations, States and international intergovernmental organizations should provide for measures at the policy and regulatory levels aimed at avoiding the use of radio frequencies and/or the conduct of any other activities, specifically with regard to the use of information and communications technologies, that they have reason to believe may cause potentially harmful interference to such terrestrial infrastructure.

18.2 States and international intergovernmental organizations should strengthen, and should advise non-governmental entities under their jurisdiction and

control to strengthen, the security and resilience of their respective and/or joint (shared) terrestrial infrastructure that supports the operation of, and data transmission to and from, orbital systems. States and international intergovernmental organizations involved in the establishment and/or operation of a particular terrestrial infrastructure are encouraged to cooperate, as feasible and agreed, to strengthen the security and resilience of that infrastructure. Such efforts may include information exchanges among the designated entities of the States and international intergovernmental organizations and non-governmental entities responsible for specific terrestrial infrastructure, in accordance with relevant applicable regulations and/or arrangements, regarding effective practices for withstanding and recovering from accidents and incidents. In a more general context, States and international intergovernmental organizations are encouraged to be receptive to requests, communicated through designated entities, to liaise and engage in practical interaction with each other in response to accidents, incidents and/or real-time, emerging and potential threats affecting the terrestrial infrastructure, in particular, when a relation to malicious usage of information and communications technologies is found or reasonably assumed. To facilitate communication regarding such accidents, incidents and/or threats, States and international intergovernmental organizations should, acting through designated entities, provide for an agreed formal process and setting for information exchanges, subject to the observance of statutory requirements.

18.3 Given the general goals and the substantial interests to which the regulation of the safety and security of terrestrial infrastructure that supports the operation of, and data transmission to and from, orbital systems is committed, States and international intergovernmental organizations are encouraged to embrace both commitment to avoiding harmful interference to the operation of terrestrial infrastructure outside their jurisdiction and/or control, and contingency responses, as those are based on reliable, accurate and complete information about the source and nature of the harmful interference, are in line with international law, and may, as relevant to a given situation, include consultations and coordination procedures.

18.4 Should States and international intergovernmental organizations developing information security policies and guidance identify reciprocity of interests in, and opportunities for, assisting each other, through timely provision of information and/or otherwise, in preventing, identifying and investigating cases of malicious usage of information and communications technologies, as such interaction could be coherent and synergistic with the tasks of ensuring the safety and security of terrestrial infrastructure that supports the operation of and data transmission to and from orbital systems, those States and international intergovernmental organizations are encouraged to keep the channels of communication open and, if necessary, engage in appropriate consultations to discuss and develop policy principles to guide potential cooperation.]

Guideline 20+21+part of 22

Observe procedures for preparing and conducting operations on active removal [and intentional destruction] of space objects

20.1 States and international intergovernmental organizations considering or initiating, either individually or collectively, the execution of, or involvement in, operations aimed at active removal or intentional destruction of space objects, [controlled, owned, and/or operated under their jurisdiction] either functioning or non-functioning, should review and implement requirements and measures aimed at identifying space objects planned for removal or destruction, and identifying, analysing, evaluating and preventing risks, as well as employing means and methods that would [make such operations safe] [ensure, to the greatest extent practicable, that removal or destruction of such objects is carried out in a manner that contributes to the long-term sustainability of outer space activities].

20.2 When deciding on risk mitigation methods and choosing tools and techniques to implement [such] active removal or intentional destruction operations,

States and international intergovernmental organizations should align their actions with the task of preventing any actions or omissions that could make vulnerable or threaten space objects controlled, owned and/or operated outside their jurisdiction, and/or result in the loss, operational malfunction, degradation or loss of integrity of such objects and thus impair or circumscribe the rights and interests associated with such space objects. Active removal and intentional destruction operations should be contemplated, [designed] [planned] and implemented so as to avoid negative effects on the above-mentioned space objects, unless agreed to in advance of such operations by the authorities exercising jurisdiction and control over the said space objects and the holders of proprietary or other vested rights with respect to them, or any irregularities in the exercise of the said functions and rights.

20.3 States and international intergovernmental organizations contemplating [such] operations on active removal or intentional destruction should be encouraged to provide information on such operations at the international level in advance, through the Office for Outer Space Affairs and/or other appropriate channels[, if safety considerations warrant such information provision]. The degree to which the international community is to be informed about the technical aspects of the method chosen for implementing the operation is to be determined at the discretion of the States and/or international intergovernmental organizations that [jointly] plan and conduct such operations. It should be a general principle that the greater the probability of side effects from such an operation, the more detailed should be the information made available at different stages of the operation's preparation and implementation. Where practicable, organizing the provision of information in an expeditious reactive mode or in a near-real-time mode should be considered.

20.4 States and international intergovernmental organizations should avoid any intentional destruction operations that could generate [long-lived] [long-term] debris, with the understanding that, under certain exceptional circumstances, such operations may need to be considered because the alternatives would have far more negative consequences. The need to proceed with such operations may, for instance, be correlated with the need to avert an immediate or potential serious [threat] [risks] to human life, the environment or property in outer space or on the ground, in the air or at sea in the case of re-entry of the space object.

20.5 States and international intergovernmental organizations should proceed on the understanding that securing legitimate grounds for operations for active removal or intentional destruction depends on whether the specific space object (whether or not it is registered in compliance with the Registration Convention or General Assembly resolution 1721 B (XVI) of 1961) planned for active removal or intentional destruction, and a specific physical object in orbit that is presumed to be or is associated with that space object, are in fact one and the same physical body. In this regard, positive identification of the object should be considered as the determining factor when deciding whether to proceed with the operation. Accordingly, until the origin and the status of a specific physical object are determined in a sufficiently precise way, the object should not be regarded as an immediate target for active removal or an intentional destruction operation. States and international intergovernmental organizations should consistently seek to establish and maintain procedures and mechanisms that would make it possible to effectively address and satisfy individual and common needs in the identification of objects in orbit. Other States and international intergovernmental organizations, if requested, should, as feasible, provide information and analytical support for such operations. In addition to the provision of valid near-Earth space monitoring information and the results of space situational analysis (if such results are available), such support may include assistance in identifying relevant space objects through analysis of the relevant monitoring or information archives and making the results of such analysis available for general access and use.

Guideline 22

Develop procedures for outer space activities involving non-registered objects

22.1 [As part of responding to challenges associated with developing practical approaches and measures aimed at facilitating and promoting space environment remediation activities or any other outer space activities involving or affecting space objects, their component parts as well as their launch vehicles and parts thereof, which have not been subjected to registration under the Registration Convention or General Assembly resolution 1721 B (XVI) of 1961, due to varying established practices of applying the said Convention and resolution,] States and international intergovernmental organizations are encouraged to consider using the following guidance [with respect to non-registered objects]:

(a) Non-registration of space objects, their component parts as well as their launch vehicles and parts thereof, including those that have not been capable ab initio of performing their assigned functions or have lost the capability to do so, should not in itself be construed as grounds for considering such objects to be devoid of title, taking into account, inter alia, the requirements of the Convention on International Liability for Damage Caused by Space Objects. The absence of specific information on those objects, either in a particular registration entry or as a reference in registration entries for other objects, should not be considered as a reason for divesting jurisdiction and control over such objects and/or terminating interests in, or vested rights to, them;

(b) Due consideration for the practical observations contained in subparagraph (a) above should not decrease the motivation of States and international intergovernmental organizations with regard to developing, as appropriate, policies that would be instrumental for the ascertainment by the launching State, and/or the international intergovernmental organization that has accepted the relevant rights and obligations, of the status of non-registered objects. Such policies should provide for the possibility of States and/or international intergovernmental organizations waiving, in whole or in part, the authority they exercise with respect to such objects so as to make it possible to develop a framework for taking decisions on space environment remediation activities;

(c) The approach outlined in subparagraph (b) above should assist States and international intergovernmental organizations in entering into joint decisions and arrangements that could fully accommodate requests for well-defined and validated obligations and technical procedures for the implementation of space environment remediation activities where such activities have been determined by the parties to such joint decisions and arrangements to be a prioritized requirement or a prioritized task.

22.2 In defining the particular status of fragments resulting from break-ups of space objects or other events, consideration should be given to the fact that, for objective reasons irrespective of their linear dimensions, those fragments may not be easily susceptible to registration owing to the very nature of their origin, their physical condition and the complexity of determining and regularly updating the parameters of their orbital motion. The degree of reliability with which each particular fragment can be correlated with another identified space object that may be the object of its origin and/or with an event that led to its appearance in orbit, should be evaluated with all due diligence in order to assess the feasibility of registration of such fragments. States and international intergovernmental organizations wishing to register fragments that they regard as having relevance to space objects previously registered by them should direct to the Office for Outer Space Affairs confirmation of their intention to register such fragments, accompanied by information on planned applications and requests to have such information included in a relevant information resource of the Office. A reasonably limited period of time should be allotted for the receipt from other States and/or international intergovernmental organizations of objections to such registration, given that the relevance of the orbital information decreases steadily unless it is updated.

22.3 The shared vision of the practical aspects of addressing and resolving the interrelated issues of the safety of space operations and space debris mitigation should include allowing States and international intergovernmental organizations to provide, consistent with their authority and responsibilities in accordance with, and by implication of, the relevant principles and norms of the Outer Space Treaty, for options that would envisage adjustments to the status of space objects under their jurisdiction and control (including objects originally part of such space objects) that have ceased to function or to be functional, so as to provide definitive eligibility with regard to potential international efforts to clear outer space of space debris. Such practice may, in particular, be validated as an operational necessity with regard to space debris fragments if it is convincingly established that such fragments have irretrievably lost the ability to function or sustain functionality and that lifting constraints on their removal could be the best solution. The entire set of relevant activities should be motivated by a strict procedure whereby States and international intergovernmental organizations make official announcements that they anticipate the need for such an adjustment of status while fulfilling, when technically feasible, their responsibilities under international law. The decisions planned for adoption and actually adopted should be explicit as to the specific rights to exercise functions involved in determining the treatment of such objects that would either be conferred or waived. The feasibility and expediency of authorizing such practices and rendering them valid should be determined on a case-by-case basis. Acting in implementation of article IX of the Outer Space Treaty, States and international intergovernmental organizations should consider engaging in cooperative activities on the basis of relevant agreements to provide for specific solutions in this area. Within such agreements, responsibilities should be defined and duties should be allocated among all participants in the activities planned. Such agreements should prescribe applicable procedures for regulating access to a space object and/or its component parts as well as measures to protect technology, where such procedures and measures are necessary and feasible in practical terms.

Guideline 8

Implement operational and technological measures for the safe conduct of close proximity space operations

8.1 States and international intergovernmental organizations should ensure, and advise entities under their jurisdiction and/or control to ensure, that close-proximity space operations that involve space objects with respect to which they exercise jurisdiction and control or proprietary or other vested rights are carried out in conformity with international law and appropriately meet risk-tolerance and safety criteria. States and international intergovernmental organizations or entities undertaking close-proximity space operations that involve or may involve space objects other than those with respect to which they exercise jurisdiction and control or proprietary or other vested rights should provide for, and advise their related entities to provide for, precautionary measures aimed at precluding events that may compromise safety and security of such space objects. Operations which may entail technical or operational impacts on such space objects may be undertaken only with the express agreement of the authorities that exercise jurisdiction and control over the said space objects and the holders of proprietary or other vested rights with respect to them.

8.2 States and international intergovernmental organizations are encouraged to share, from time to time, with the Committee on the Peaceful Uses of Outer Space their assessment of the situation in outer space from the perspective of safety of space operations. They are also encouraged to share analyses of events which might affect the safety of space operations.

8.3 To further enhance the safety of space operations and enhance confidence-building in outer space activities, States and international intergovernmental organizations should be open to discussing and identifying possible approaches that could lead to the development of viable internationally

approved safety criteria for close-proximity operations as a prerequisite for addressing further standard-setting practices in this area.

Guideline 10

[*Two alternative formulations of guideline 10 are given below for consideration by delegations.*]

[*Alternative 1 for guideline 10*]

Implement measures for the safe conduct of activities involving intentional modification of the natural space environment

[10.1 When planning and conducting, consistently with the international law, experiments and/or activities involving technologies or techniques that could potentially result in intentional modification of the natural space environment, States and international intergovernmental organizations should be aware of the need to preclude uses of such technologies (techniques) that may jeopardize or harm space objects and affect radio wave propagation through the ionosphere, as well as compromise space systems' mission benefits.

10.2 Space environmental modification technologies and techniques are to be associated with the intentional alteration of characteristics of the space environment (such as electron concentration and temperature of the ionosphere, density and chemical composition of the upper atmosphere, intensity of electromagnetic emissions and characteristics of radiation belts). The use of space environment modification technologies (techniques) for peaceful purposes should be supported by relevant safety criteria and procedures so as to forestall actions that may harm operational space objects and/or produce far more hazardous effects resulting in the fragmentation of space objects. The selection of safety-critical parameters characterizing the state of the natural space environment and the setting of acceptable thresholds for their values in case of the use of space environment modification technologies (techniques) should be based on the appropriate assessment of possible effects on the space environment due to the use of such technologies (techniques), inter alia, in comparison with variations of the selected parameters due to natural processes.

10.3 The understanding should be that the use of modification technologies (techniques) should not result in effects on the space objects that would be more severe than those due to natural phenomena. In deciding on the use of space environment modification technologies (techniques) States and international intergovernmental organizations are encouraged to consider, inter alia, the attitudes characteristic of the Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques of 5 October 1978.]

[*Alternative 2 for guideline 10*]

Avoid negative side effects in connection with the use of natural space environment modification techniques for peaceful purposes

[10.1 [[Notwithstanding] [Considering] the concept of, and the principles and norms derived from the Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques of 5 October 1978,] States and international intergovernmental organizations, when planning and conducting, consistently with the international law, activities involving the use of space environment modification techniques for peaceful purposes (such as local gas and plasma outbursts for purposes of deorbiting space debris, or the injection of charged particle beams with the purpose of conducting scientific experiments in the ionosphere), should keep themselves fully aware of the need to avoid known, presumed or accidental risks to space objects which may affect radio wave propagation through the ionosphere as well as compromise space systems mission benefits.

10.2 The use of space environment modification techniques for peaceful purposes should be supported by relevant precautionary safety [criteria and safety control applications] [measures]. The selection of safety-critical parameters characterizing the state of the natural space environment and the setting of acceptable thresholds for their values in case of the use of space environment modification techniques for peaceful purposes should be based on the appropriate assessment of the possible effects on the space environment of using such techniques, inter alia, in comparison with variations in the selected parameters due to natural processes. The understanding should be that the use of modification techniques should not result in effects on the space objects that would be more severe than those due to natural phenomena.]

Guideline 9

[*Alternative 1 for the title of guideline 9*]

Raise awareness of the need to exclude the use of information and communications technology products compromising the safety and security of space objects and related equipment

[*Alternative 2 for the title of guideline 9*]

Consider measures to address the issue of precluding malicious use of information and communications technology to compromise the safety and security of space objects and related equipment

9.1 States and international intergovernmental organizations should seek to prevent the proliferation of malicious information and communications tools and techniques and harmful hidden functions in software, as such techniques and functions may, if embedded in space objects and/or related equipment, compromise the operational status and mission performance of space objects and the ability to operate these space objects with assurance.

9.2 States and international intergovernmental organizations should take steps to ensure the integrity of the supply chain so that end users can have confidence in the security of information and communications technology products to be used aboard space objects and/or as part of related equipment. Regardless of the regulatory oversight that States and international intergovernmental organizations may appropriately choose to provide, the general understanding should be that manufacturers and suppliers of space objects and/or related equipment should see to it that good-faith practices and commercial integrity are honoured and the established safety and security assurance processes are followed. Manufacturers and suppliers should be open to giving recipients and/or end-user assurances of the absence of harmful hidden functions on space objects and/or related equipment they provide.