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Report of the Scientific and Technical Subcommittee
on its fiftieth session

Compilation of proposed draft guidelines of expert groups A to D of the Working Group on the Long-term Sustainability of Outer Space Activities, as at the fiftieth session of the Scientific and Technical Subcommittee, held in February 2013

Note by the Secretariat

I. Introduction

1. At the joint meeting of expert groups A to D held on 15 February 2013 during the fiftieth session of the Scientific and Technical Subcommittee, the Chair of the Working Group on the Long-term Sustainability of Outer Space Activities was requested to compile, as soon as possible after the end of the fiftieth session of the Subcommittee, the set of draft guidelines proposed by the expert groups as at that date, for translation into all official languages of the United Nations.

2. The present document comprises a compilation of the proposed draft guidelines, as at the fiftieth session of the Scientific and Technical Subcommittee, held in February 2013. The draft guidelines of each expert group are still under development and the present document contains an account of the work done thus far. No attempt has been made by the Secretariat to harmonize these draft guidelines in substance, so there is a certain element of duplication and fragmentation that will be addressed as the work of the expert groups is aggregated to prepare the draft Working Group report. The present document is produced with a view to assisting member States of the Committee on the Peaceful Uses of Outer Space to give their considered views on the emerging guidelines and to guide the expert groups and the Working Group forward in their work.



II. Proposed draft guidelines

Expert group A

Sustainable space utilization supporting sustainable development on Earth

The following proposed guidelines are currently under discussion in expert group A.

Guideline A.1

Promote, in accordance with the Radio Regulations of the International Telecommunication Union (ITU), that Member States consider, in their use of the electromagnetic spectrum, the requirements of Earth observation systems and space-based services

In their use of the electromagnetic spectrum, States should consider the requirements for space-based Earth observation systems and of space-based services in support of sustainable development on Earth, in accordance with the ITU Radio Regulations.

Guideline A.2

Promote institutional and public awareness of space activities and applications for sustainable development on Earth, early warning of potential disasters and support for management of disaster-related activities

States and international organizations should initiate the voluntary collection of information on public awareness and education tools and programmes aimed at disseminating information on the benefits of space to sustainable development and request the assistance of communications experts from States and the Office for Outer Space Affairs of the United Nations Secretariat to help in the preparation of a living repository of such information, with a view to facilitating the development and implementation of similar initiatives with consistent messages.

Space actors, including States and international organizations, should promote public awareness of space applications for sustainable development through a joint effort by public institutions, private sector entities and civil society, in particular taking into account the needs of young people and future generations.

In designing space education programmes, States and international organizations should pay special attention to courses on enhancing knowledge and practice on utilizing space applications to achieve sustainable development.

In accordance with the Principles Relating to Remote Sensing of the Earth from Outer Space (General Assembly resolution 41/65, annex) and in response to emergency situations that may affect fundamental social well-being, such as natural disasters and other major harmful incidents and catastrophes, States and international organizations should undertake efforts to make relevant space-based information and data accessible to affected countries, applying the principles of neutrality, impartiality and non-discrimination.

Guideline A.3**Support and promote international cooperation for capacity-building and data accessibility and processing, taking into account the needs and interests of developing countries**

States and international organizations should coordinate international cooperation efforts in space-related capacity-building and data accessibility in order to avoid duplication, taking into account the needs and interests of developing countries.

States and international organizations should promote and support regional and international cooperation to assist countries in assembling human, technical and financial resources and to achieve efficient space-related capacities, enhancing the long-term sustainability of outer space activities and supporting sustainable development on Earth.

States and international organizations should explore new forms of regional and international collaboration, without prejudice to ongoing international collaboration initiatives, to assist countries to implement at the national level space practices, standards and governance approaches, taking into account the need for the long-term sustainability of space activities and the needs and interests of developing countries.

Guideline A.4**Promote international cooperation to support the growing interest of many countries to establish national capacities for outer space activities through capacity-building and transfer of technology, without affecting intellectual property rights, taking into account the requirement of long-term sustainability of those activities**

States and international organizations should promote international technical cooperation to enhance the long-term sustainability of outer space activities and support sustainable development on Earth.

States and international organizations should support current initiatives and new forms of regional and international collaboration to promote space capacity-building, taking into account the needs and interests of developing countries and in accordance with national legislation and international law.

States and international organizations should promote technology safeguard arrangements that may facilitate space capacity-building in support of long-term sustainability.

Guideline A.5**Promote international cooperation to assist countries to gather human resources and achieve technical and legal capabilities and standards compatible with the relevant regulatory frameworks, especially for countries that are beginning to develop their capacities in outer space applications and activities**

States and international organizations should support current initiatives and promote new forms of regional and international cooperation to assist countries to

gather human and financial resources, and achieve efficient technical capabilities and standards for outer space activities, compatible with long-term sustainability and relevant regulatory frameworks, and to assist emerging space countries to implement national space regulations, taking into account the need for the long-term sustainability of space activities.

Guideline A.6

Promote the development of studies and other initiatives on the regulatory regime for the sustainable use of outer space, including celestial bodies

In the peaceful use and exploration of outer space, including celestial bodies, States should take into account, with reference to the outcome document of the United Nations Conference on Sustainable Development, the three dimensions of sustainable development on Earth: social, economic and environmental.

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

Recommended topics for future consideration

1. The Committee on the Peaceful Uses of Outer Space should consider examining the issue of the exploitation of outer space in the context of sustainable development.
2. States and international organizations should compile a compendium of measures, practices, standards and others elements conducive to the safe conduct of space exploitation activities; the compendium should be made freely available and promoted by all space actors, including States and international organizations.
3. States are encouraged to develop new standards for the avoidance of harmful contamination of outer space to promote the long-term sustainability of outer space including celestial bodies.
4. The Committee on the Peaceful Uses of Outer Space should initiate work towards the development of a voluntary interaction model for equitable access to space to support sustainable development on Earth.

Proposal by the Russian Federation under guideline A.4

Subject to the provisions of articles I, III and VI of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, of 1967, States undertaking or authorizing or intending to undertake or authorize international space activities involving the use of goods (objects, materials, manufactured items, equipment and other products) that are based on technologies whose unauthorized disclosure and onward transfer are prohibited and thus warrant appropriate levels of protection, shall ensure that such activities are conducted in accordance with those Principles and the norms of international law, irrespective of whether such activities are carried out by governmental or non-governmental entities or through international organizations to which such States belong.

In order to further the growth, sustainability, efficacy, stability and security of international cooperation in the exploration and use of outer space and in the application of space technology, the States concerned shall provide opportunities to establish stronger legal and administrative regulation relating to such cooperation, in cases where it would be particularly appropriate or even essential in view of the nature of the controlled goods that are exported or imported. In such cases, States should seek to forge collaborative relationships based on mutual benefits and equal advantages with regard to the consideration and resolution of issues relating to the coordination of procedures for safeguarding controlled products. To maximize the potential benefits of this practice, States are also encouraged to provide, by means of agreements or other arrangements, for the implementation of measures, institutionalized appropriately under their national legislation, to ensure the safety and security of imported controlled goods while they are in the territory of the importing State.

In particular, States shall, acting in accordance with the relevant legislation, enter into consultations to reach agreement in relation to:

- Post-sale monitoring and verification to ascertain that controlled items are not at risk of unauthorized use or onward transfer.
- Strengthened end-use certification and authentication procedures at State (government) level.
- Legal supervision of contracts and contract-based activities in order to effectively facilitate the proper application of agreed measures on end use and to prevent any circumstances in which exported protected goods, when located in the territory of the importing State, could become the subject of disputed jurisdiction or used for illegal purposes.
- The granting to the relevant State bodies of the power to monitor the end use of controlled items and to take immediate measures (including the issuing of the relevant orders) where there is a presumption of non-compliance with the arrangements on end use.

Expert group B

Space debris, space operations and tools to support collaborative space situational awareness

The following proposed guidelines are currently under discussion in expert group B.

Guideline B.1

Share space debris monitoring information

States and international 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. Space debris data from any source should be validated for its intended use.

Guideline B.2

Ensure space debris mitigation measures are implemented

In their national regulatory regimes, States should address space debris mitigation practices and procedures and implement the Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space through relevant national mechanisms.

Guideline B.3

Limit the risk to people and property from controlled spacecraft and launch vehicle orbital stage re-entries

States responsible for the operation of space objects under article VI of the Outer Space Treaty should consider furnishing additional appropriate information as recommended in paragraph 2 (b)(iii) of General Assembly resolution 62/101 on recommendations on enhancing the practice of States and international intergovernmental organizations in registering space objects. In cases of controlled re-entries, States also should consider furnishing notices to airmen and mariners using established procedures.

Guideline B.4

Investigate increasing the accuracy of orbit knowledge

Recognizing that the results of conjunction assessment depend strongly upon the accuracy of orbital and other relevant data, methods should be investigated for increasing the accuracy of orbit knowledge. These methods could include international cooperation and combining and validating data from different sources, including existing and new sensor capabilities and distribution.

Guideline B.5

Perform conjunction assessment during all phases of flight

Conjunction assessment with other space objects should be performed during all phases of flight. If the spacecraft operator is unable to perform conjunction assessments, the operator should provide relevant orbital information to an appropriate conjunction-assessment entity to perform the analysis necessary to verify that the planned trajectory does not indicate a potential collision.

Guideline B.6

Perform conjunction assessment prior to changes in trajectory

Conjunction assessment with other space objects should be performed in planning intentional changes of spacecraft trajectories during all phases of flight. If conjunction assessment indicates a potential collision, adjustment of the trajectory should be considered to minimize the collision risk and coordinated as appropriate. If the spacecraft operator is unable to perform conjunction assessments, the operator should provide relevant orbital information to an appropriate conjunction-assessment organization to perform the analysis necessary to verify that the planned trajectory does not indicate a potential collision.

Guideline B.7**Provide other States with contact information for spacecraft operations and conjunction-assessment entities**

States should exchange contact information about appropriate entities performing spacecraft operations and space situational awareness. Direct contact between spacecraft operations and conjunction-assessment entities can enable timely coordination to reduce the probability of, and facilitate effective responses to, orbital collisions, orbital break-ups and other events that might increase the probability of accidental collision.

Guideline B.8**Use standard formats when sharing orbital information on space objects**

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

Guideline B.9**Provide registration information to assist in the identification of space objects**

States and international intergovernmental organizations should provide registration information on space objects in accordance with the Convention on Registration of Objects Launched into Outer Space and consider furnishing enhanced registration information on any change of status in operations as recommended by the General Assembly in its resolution 62/101. States should provide this registration information to the Secretary-General of the United Nations as soon as practicable to assist in the identification of space objects and to contribute to the peaceful exploration and use of outer space.

Expert group C**Space weather**

The following proposed guidelines are currently under discussion in expert group C.

Guideline C.1**Support and promote the collection, sharing, intercalibration and dissemination of critical space weather data**

States and international organizations should engage experts in identifying critical data sets needed for space weather services and research and adopt policies for the free and unrestricted sharing of critical space weather data from their space- and ground-based assets. All space actors and governmental, civilian and commercial space weather data owners are urged to allow free and unrestricted access to and archival of such data for mutual benefit.

States and international organizations should also share real-time and near-real-time critical space weather data and products and should cross-calibrate and intercalibrate critical space weather data and data products; openly share critical space weather data and data products in a common format; adopt common access protocols for their critical space weather data and data products; and promote the interoperability of space weather data portals, promoting ease of data access by users and researchers.

States and international organizations should further undertake a coordinated approach to identifying and filling key measurement gaps so as to meet critical space weather needs. Space actors, including States and international organizations, are urged to fly small and low-power integrated payloads for space weather science and monitoring whenever and wherever possible (e.g. radiation monitors on Earth-orbiting satellite missions).

Guideline C.2

Support and promote further coordinated development of advanced space weather models and forecasting tools in support of identified user needs

States and international organizations should engage experts in developing a coordinated approach to documenting space weather research and operational models, as well as forecasting tools currently in use, and assess them in relation to space weather science and service and user needs.

States and international organizations should undertake a coordinated approach to identifying and filling gaps in models and forecasting tools needed to meet space weather needs. Where necessary this should include coordinated efforts to support and promote research and development to further advance space weather models and forecasting tools.

Guideline C.3

Support and promote the sharing and dissemination of space weather model outputs and forecasts

States and international 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 high priority space weather model outputs and forecasts. All space actors and governmental, civilian and commercial space weather model and forecast providers are urged to allow free and unrestricted access to and archival of space weather model outputs and forecasts for mutual benefit.

States and international organizations should also undertake to make available and share real-time and near-real-time space weather model outputs and forecasts to the extent possible, and as soon as is practical. States and international organizations should undertake comparisons of space weather model and forecast outputs with the goal of assessing their metrics and comparative performance with the goal of improved model and forecast accuracy; openly share and disseminate historical and future critical space weather model outputs and forecast products in a common format; and 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.

Guideline C.4 [still under development]

Support and promote the collection, sharing and dissemination of and access to information relating to best practices for mitigating the effects of space weather on ground- and space-based systems and related risk assessments

States and international organizations are urged to submit, to a common archive, documentation outlining best design practices, guidelines and lessons learned relating to mitigation of the effects of space weather on operational 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.

States and international organizations should provide support to enable national agencies, satellite operators and space weather service providers to work towards the development of international standards and best practices applicable for the mitigation of space weather effects in satellite design.

States and international organizations should support and promote cooperation and coordination on ground- and space-based space weather observations, forecast modelling, satellite anomaly and reporting of space weather effects in order to safeguard space activities. This could be done in collaboration with the International Space Environment Service and the World Meteorological Organization (WMO).

States and international organizations should incorporate current, “nowcast” and forecast space weather thresholds into space launch commit criteria, and

(a) Provide support to enable their satellite operators to work together with space weather service providers to identify the information that would be most useful to mitigate anomalies and to derive recommended specific guidelines for best practices for on-orbit operation. For example, if the radiation environment is hazardous, this might include actions to delay the uploading of software, action manoeuvres, etc.;

(b) Ensure that satellite designs include the capability to recover from a debilitating space weather effect, such as including a safe mode;

(c) Ensure that satellite designs for end-of-life disposal include due regard for space weather effects in order to ensure that the spacecraft either reach their intended graveyard orbit or de-orbit appropriately, in accordance with Inter-Agency Space Debris Coordination Committee guidelines. This should include appropriate margin analysis.

States and international organizations should also:

(a) Encourage collection, collation and sharing of information relating to ground- and space-based space weather related system anomalies, including spacecraft anomalies;

(b) Use a common format for reporting the information. In relation to the reporting of spacecraft anomalies, the template of the Coordination Group for Meteorological Satellites provides an excellent proposed approach;

(c) Encourage policies promoting the sharing of satellite anomaly data such that the satellite anomaly archive is available to all States.

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.

Guideline C.5

Promote the education, training and capacity-building required for a sustainable global space weather capability

Given that WMO already has extensive training programmes on terrestrial weather, expanding this to also include space weather training would be valuable since it would leverage the existing infrastructure and capabilities.

Recommended topics for future consideration

1. States members of the Committee on the Peaceful Uses of Outer Space should work through the Committee and related international organizations to develop a basis for the coordination of ground- and space-based research and operational infrastructure to ensure the long-term continuity of critical space weather observations. States members of the Committee should work under the space weather agenda item of the Scientific and Technical Subcommittee in order to provide a mechanism for the coordination of ground- and space-based infrastructure to ensure the long-term continuity of critical space weather observations. The Subcommittee should instigate a process to evaluate the impact and review the progress of the coordination of ground- and space-based infrastructure to ensure the long-term continuity of critical space weather observations. Reviews should be completed at least every five years.
2. States and international organizations should investigate the coordination of space weather information, including observations, analyses and forecasts, to support decision-making and risk mitigation relating to the operation of satellites, spacecraft and suborbital vehicles, including rockets and vehicles serving manned spaceflight including for space tourism.

Expert group D

Regulatory regimes and guidance for actors in the space arena

The following proposed guidelines are currently under discussion in expert group D.

Guideline D.1

Promote and facilitate international cooperation in the peaceful uses of outer space as a means of enhancing the long-term sustainability of outer space activities

Guideline D.1 applies to all modes of cooperation, including governmental and non-governmental; commercial and scientific; global, multilateral, regional or bilateral;

and among countries at all levels of development. This principle is particularly important since, for many States, international cooperation facilitates their participation in space exploration. Article IX of the Outer Space Treaty, when interpreted in the light of the 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, of 1996, bases international cooperation on the free determination of fair, equitable and mutually acceptable contractual terms.

Guideline D.2

Share experience and expertise relating to the long-term sustainability of outer space activities

The experience and expertise acquired by those engaged in space activities are instrumental to the development of effective measures to enhance the long-term sustainability of outer space. Sharing such experience and expertise with others will facilitate and enhance the development of guidelines, rules, regulations and best practices in this area. The exchange need not be limited to a State to State level, but can occur between national regulatory authorities, government agencies, intergovernmental organizations and non-governmental entities. New participants or those with very little experience in space exploration will benefit from the experience and expertise of other space actors, and established actors will also find value in developing new partnerships and sharing experiences more widely.

Guideline D.3

Develop and adopt procedures to facilitate the compilation and effective dissemination of information that will enhance the long-term sustainability of space activities, among the relevant national and international space actors

In many cases where States and international organizations are willing to share information, the procedures to enable information to be shared are non-existent, slow or lead to incompatible data. The information should be shared as widely as necessary to enhance the long-term sustainability of outer space activities, which means adopting procedures that permit sharing with private sector entities and national non-governmental organizations in addition to sharing between States and international organizations. In some cases, private sector entities already have effective mechanisms for sharing data which States and other organizations might adopt. Ratification of, and compliance with, the Registration Convention should be encouraged as a starting point in the compilation and exchange of information.

Guideline D.4

Conduct appropriately targeted outreach and education on regulations and technical best practices relevant to long-term sustainability in view of the increasing number and diversity of potential space actors

Appropriately targeted outreach and education can assist all space actors to gain a better appreciation and understanding of the nature of their obligations, which can lead to improved compliance with the existing regulatory framework and the best practices currently being employed to enhance the long-term sustainability of outer space activities. While regulators should always strive for clarity when designing measures to enhance long-term sustainability, outreach and education can

assist with any implementation issues that arise out of national regulatory frameworks. This is particularly valuable where the regulatory framework has been changed or updated resulting in new obligations. States are encouraged to foster outreach activities by or with industry, academia, regulators and other relevant organizations.

States, including their regulators and agencies, can also benefit from the input of space actors when designing regulations and issuing guidelines to the space industry. Outreach programmes may provide a valuable, iterative feedback mechanism for regulators.

Outreach and educational initiatives could take the form of seminars (in person or broadcast over the Internet), published guidelines to complement national or regional laws and regulations, an Internet site with basic information on a regulatory framework, or the availability of a contact person within the Government who can assist participants in finding crucial information.

The availability of resources to support such initiatives varies greatly among States; thus fostering similar initiatives by industry, academia and international organizations is strongly encouraged. These entities can contribute valuable input on regulatory matters and technical best practices.

Guideline D.5

Encourage and promote the activities of non-governmental entities that will enhance the long-term sustainability of outer space activities, such as engaging stakeholders, developing consensus standards and common practices and increasing international cooperation

Non-governmental organizations and private sector entities conduct activities that have significant impacts, both directly and indirectly, on the long-term sustainability of space activities. Private commercial activities in space are a growing part of the global economy and many entities have taken steps to implement technical measures in conformity with the Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space. Universities and other educational institutions have shown increasing interest in using small satellites for scientific and teaching purposes. Given the technical and cost constraints often found in small satellite missions, particular attention being paid to the activities of non-governmental and private sector entities may be warranted to ensure that their activities do not become a significant source of long-lived orbital debris in the future.

Non-governmental organizations play important roles in bringing potential stakeholders together to develop consensus approaches in relation to the conduct of space activities. For example, the International Organization for Standardization has adopted several standards on best practices and data exchange formats for collision avoidance. States are encouraged to evaluate these standards and seek to use common standards where practicable for debris mitigation, orbit lifetime estimates, safe disposal of hardware, re-entry management and satellite characteristics and trajectories. This will, in turn, promote valuable contributions by non-governmental organizations in this field.

Non-governmental organizations, such as industry associations, academic institutions and educational public interest entities can play important roles in increasing international awareness of issues associated with space sustainability, as well as practical measures to enhance sustainability. Such measures could include adoption of the Space Debris Mitigation Guidelines of the Committee, compliance with ITU Radio Regulations related to space services, and the development of open, transparent standards for the exchange of data necessary to avoid collisions, radio frequency interference or other harmful events. To these ends, international cooperation between Governments and non-governmental organizations and private sector entities should be encouraged and fostered.

Guideline D.6

Consider the long-term sustainability of outer space activities when adopting or implementing national regulatory frameworks

Traditionally, national regulation has 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. There are two major aspects to such regulation. The first is ensuring that space actors under the jurisdiction of the regulator have incentives to conduct their activities in a manner that preserves the long-term sustainability of space activities. For example, regulators could require space actors to comply with the Space Debris Mitigation Guidelines of the Committee. The second aspect is to allow and encourage appropriate new methods for ensuring the long-term sustainability of space activities. Regulation should not be so prescriptive as to prevent sensible innovation aimed at improving the long-term sustainability of space activities.

Guideline D.7

Take measures to address space debris mitigation practices and procedures and implement the Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space in the regulation of space activities [to be discussed with expert group B on issues of overlap with proposed guideline B.2]

States and international organizations should voluntarily take measures, through national mechanisms or through their own applicable mechanisms, as appropriate, to ensure that the Space Debris Mitigation Guidelines of the Committee are implemented, to the greatest extent feasible, through space debris mitigation practices and procedures. National mechanisms can include national regulatory regimes. In their national regulatory regimes for space activities, States should include space debris mitigation practices and procedures and consider the Space Debris Mitigation Guidelines in their regulation of space activities.

Guideline D.8

Communicate within and among their competent authorities to facilitate efficient and effective measures for the long-term sustainability of space activities

States are encouraged to ensure that appropriate communication and consultation mechanisms are in place within and among the competent bodies that oversee or conduct space activities. This is because the regulation of space activities draws on many disciplines such as economics, law, public policy and the social

sciences, in addition to scientific and engineering concerns, and no single entity can be expected to cover all disciplines. For example, licences imposing conditions on space operations may involve many distinct activities such as launches, on-orbit operations, radio frequency usage, remote sensing activities and end of life disposal of space objects in orbit. Communication within and among relevant regulatory bodies can promote regulations that are consistent, predictable and transparent so as to ensure regulatory outcomes are as intended by States.

Guideline D.9

Allow and encourage advisory input from affected national stakeholders in the development of the national regulatory frameworks governing space activities

States may find it beneficial and efficient to receive advisory input by affected national stakeholders during the process of developing regulatory frameworks governing space activities. These stakeholders may include private sector entities, universities or research organizations, non-governmental organizations operating under the jurisdiction of the State, agencies of the State, or other bodies that play a role in space activities and that will be affected by the proposed regulatory initiative.

States with developing space capabilities should identify the essential components of a national regulatory framework after advisory input from, or consultation with, relevant stakeholders. Without such input, the State might regulate its stakeholders too heavily by writing a regulatory framework that is more restrictive than is needed at such a stage of capability development. Over-regulation can have the unintended consequence of stifling the development of space capabilities. In instances in which the State has not previously attempted to legally control or regulate space activities, the State might wish to consider other States' space legislation or, by analogy, other national laws, as a guide to drafting. Without experience, however, the State might inadvertently write laws that are not applicable or not technically accurate for the particular space activities or space actors under its control. Allowing advisory input from the affected stakeholders can help States with developing space capabilities from making these mistakes.

For a State with advanced space capabilities, stakeholders are likely to have a practical understanding of how a regulatory framework will affect operations or administration of the space activities. By allowing early advisory input, the State can avoid unintended consequences of regulation that have an adverse impact on key stakeholders. These stakeholders might also be aware of conflicting obligations by law or agreement. Identifying such conflicts early can avoid jurisdictional disputes after the regulatory framework is adopted.

Guideline D.10

Weigh the costs, benefits, disadvantages and risks of a range of alternatives in developing regulatory measures applicable to the long-term sustainability of outer space activities and consider the potential benefits of using existing international technical standards

States should create and implement their own regulations, applicable to those persons subject to their jurisdiction or control as appropriate, and share such regulations and resulting experience with other States as models for consideration.

Regulations should be practicable in that they should be capable of actually being implemented in terms of the technical, legal and management capacities of the State imposing the regulation. A closely related concept is that of technical feasibility in that a regulation should not require a technical innovation or exceed the current state of practice for the space activity.

The effect of regulations should be predictable. The groups to which the regulation applies should know the effects of the regulation on their activities in advance of conducting those activities, as far as possible. A reporting regime to gather information on how the regulations are being applied in practice should be considered.

Regulations should be both efficient and effective. Effective regulations are those which accomplish their intended purpose. An important component of effective regulation is to ensure that the regulation has a clear intended purpose. At the same time, regulations need to be efficient in terms of imposing the least cost for compliance (e.g., in terms of money, time or risk) compared with feasible alternatives. Compliance costs fall upon the regulator and the entity being regulated in both immediate and long-term effects. A best practice for controlling compliance costs is to ensure that regulations are performance-based and responsive to technical innovation. They should avoid requiring a particular technical approach or proprietary solution that constrains future innovation.

States are encouraged to solicit input from affected stakeholders prior to developing new regulations. Similarly, regulated entities should be afforded opportunities to provide feedback on regulations related to the long-term sustainability of space activities. A continuing dialogue between States and all affected parties, whether governmental or non-governmental, on the regulation of space activities can provide useful information to enhance the prospects for the long-term sustainability of space activities.

International cooperation is an important part of the long-term sustainability of outer space activities. Development of regulations should take into account any impacts of the regulation on international cooperation. For example, regulations that have the effect of impeding sharing information or limiting multinational cooperative projects should be avoided where appropriate.

Regulations should also take into account the effects on the aspirational goals for outer space activities. For example, the effect of regulations on the peaceful, free, equitable and safe use and exploration of outer space should be carefully considered.

Guideline D.11

Adopt regulatory frameworks suitable for national space activities that provide clear guidance to actors under the jurisdiction and control of each State

With the globalization and generalization of space activities, in particular the emergence of new actors in non-governmental services and operations, States should ensure the effective application of international norms and standards considering the specificities of enterprises and projects undertaken under their jurisdiction. States are notably encouraged to consider not only existing space projects and activities, but also potential development of their national space sector

and to envisage appropriate timely regulation in due time in order to avoid legal lacunae. It is important that national regulation address the specific nature and characteristics of the State's space sector, as well as its general economic framework to the extent that it provides the context in which the space sector may further expand.

Guideline D.12

Address risks for people, property, public health and the environment associated with the launch, in orbit operation and Earth entry of space objects

The main purpose of national regulation is to ensure concrete application and implementation of national legislation. To the extent that space legislation of States transposes at the national level their commitments and undertakings under international law, national regulation must ensure full consistency with international law. But regulation of space activities also originates from other legal areas, such as general administrative law, economic law or environmental law. To such extent, it is important that the subjection of space activities to general national law be provided for in consistency with applicable international law, in particular with the principles of the United Nations outer space treaties and General Assembly resolutions.

Recommended topics for future consideration

There is a range of areas in which future regulatory developments could potentially improve the long-term sustainability of outer space activities. These issues are not addressed in the guidelines contained in the present document for various reasons. In some cases, the issue is intrinsically legal and best addressed by the Legal Subcommittee of the Committee on the Peaceful Uses of Outer Space. In other cases, international practice is not sufficiently established for expert group D to reach consensus on the best way to regulate the issue.

The first area identified for future regulatory development is the development of definitions. Regulation is generally most effective when there is a clear understanding of the scope of the regulation. In managing the key issues affecting the sustainability of outer space activities, a consistently applied definition of "space debris" would be valuable. In addition, the increasing connection between ground infrastructure and space infrastructure indicates that definitions of "space activities" will become important in the future. The conduct of Earth-based activities, such as radio frequency interference, has significant potential to affect the sustainability of space-based activities. Therefore regulation of "space activities" will need to encompass both Earth-based and outer-space-based activities if it is to be effective in ensuring the sustainability of outer space activities.

The second area identified for future regulatory development is the development of regulations relating to the ownership of space objects. The issue of ownership is not straightforward for two reasons. First, under existing international law, all objects in space are under the jurisdiction of a State, regardless of their funding source, functionality or integrity. Secondly, space objects increasingly have multiple owners. Hosted payloads are increasingly common, increasing the number of ownership interests in a single satellite. A single launch can now transfer the payloads of many different space actors into orbit (for example, launching a number of CubeSats), which could potentially blur the lines of responsibility and ownership.

The third area identified for future regulatory development is to improve the practice of States in registering space objects. A variety of practices exist with regard to the quality and timeliness of information provided under the Registration Convention. This undermines the utility of the Registration Convention as a global information-sharing mechanism.

The fourth area identified for future regulatory development is to improve the consistency of national regulation globally in order to avoid a disproportionate number of space objects being registered in countries with the least demanding regulations on long-term sustainability of space activities. Inconsistencies in the current practice of States concerning licensing, registration fees and insurance requirements may encourage “forum shopping”, which may not encourage efficient practices and procedures in relation to the long-term sustainability of outer space activities.

The fifth area identified for future regulatory development is the legal framework for active removal of space debris. In this context, a number of issues have to be addressed, such as the identification of the launching State and the responsible State in relation to the space object, the question of whether it is necessary to get consensus from the respective State or States, as well as the question of who bears the costs and risks of such an activity. It should be discussed whether active space debris removal could be undertaken or authorized by a single State, or if an international framework for active space debris removal under international consensus would be more suitable. With regard to the latter alternative, existing international organizations or forums could be involved for the development and implementation of appropriate and practicable procedures.
