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COMMITTEE ON THE PEACEFUL USES OF
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Item 7
Report of the Scientific and Technical Subcommittee
on its forty-second session

INTERSESSIONAL MEETING OF THE WORKING GROUP ON SPACE DEBRIS OF THE SCIENTIFIC AND TECHNICAL SUBCOMMITTEE (13-16 JUNE, CONFERENCE ROOM VII)

PROGRESS REPORT OF THE CHAIRMAN OF THE WORKING GROUP ON THE RESULTS OF THE INTERSESSIONAL MEETING

1. The Working Group held its intersessional meeting in accordance with the new multi-year work plan endorsed by the Scientific and Technical Subcommittee at its forty-second session, held in Vienna from 21 February to 4 March 2005.

2. At its intersessional meeting the Working Group considered proposals from the member States of the Committee on the Peaceful Uses of Outer Space for the document to be developed covering space debris mitigation contained in the document A/AC.105/2005/CRP.8, Corr. 1 and Add.1.

3. During the course of its discussions, the Working Group began the drafting of a document on space debris mitigation, based on the above-mentioned proposals.

4. The present document contains the text of the preliminary draft of a document on space debris mitigation, as elaborated by the Working Group during its intersessional meeting and will be reviewed by the Working Group at the forty-third session of the Scientific and Technical Subcommittee, to be held in Vienna from 20 February to 3 March 2006.

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PRELIMINARY DRAFT OF A DOCUMENT ON SPACE DEBRIS MITIGAION TO BE FURTHER REVIEWED BY THE WORKING GROUP

PROVISIONAL TITLE:
«UN COPUOS STSC SPACE DEBRIS MITIGATION GUIDELINES»

1. BACKGROUND

Since the United Nations Committee on the Peaceful Uses of Outer Space (UN COPUOS) published its Technical Report on Space Debris in 1999, it has been a common understanding that the current space debris environment poses a risk to spacecraft in Earth orbit. For the purpose of this document, space debris is defined as all man-made objects including fragments and elements thereof, in Earth orbit or re-entering the atmosphere, that are non-functional. As the population of debris continues to grow, the probability of collisions that could lead to potential damage will consequently increase. The prompt implementation of appropriate debris mitigation measures is therefore considered a prudent and necessary step towards preserving the outer space environment for future generations.

Historically, the primary sources of space debris in Earth orbits have been (1) accidental and intentional break-ups which produce long-lived debris and (2) debris released intentionally during the operation of launch vehicle orbital stages and spacecraft.

Space debris mitigation measures can be divided into two broad categories: those that curtail the generation of potentially harmful space debris in the near-term, and those that limit their generation over the longer term. The former involves the curtailment of the production of mission-related space debris and the avoidance of break-ups. The latter concerns end-of-life procedures that remove decommissioned spacecraft and launch vehicle orbital stages from regions populated by operational spacecraft.

2. RATIONALE

Some space debris has the potential to damage spacecraft leading to loss of mission, or loss of life in the case of manned spacecraft. Hence, space debris mitigation measures are **[needed/recommended. In addition, there is also the risk of damages on the ground, if debris survives Earth's atmosphere re-entry.]** [1]

A set of Mitigation Guidelines has been developed by the Inter-Agency Space Debris Coordination Committee (IADC) which reflects the fundamental mitigation elements of a series of existing Practices, Standards, Codes and Handbooks developed by a number of national and international organizations. UN COPUOS acknowledges the benefit of a set of high-level qualitative guidelines, having wider acceptance amongst the global space community. A Working Group on Space Debris was therefore established (at the Scientific and Technical Subcommittee of COPUOS) to develop a set of recommended guidelines, based on the technical content and the basic definitions of the **[annexed]** [2] IADC Space Debris Mitigation Guidelines.

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[1] Point for further consideration by the Working Group.
[2] Point for further consideration by the delegation of the Russian Federation.

[This present document on space debris mitigation has been developed on the following set of axioms:

- **The implementation of space debris mitigation remains voluntary and should be carried out through national mechanisms;**
- **It would not be legally binding under international law and it would recognize that exceptions may be justified;**
- **The Document could be updated on a regular basis in accordance with evolving national and international practices on space debris mitigation and related research and technology developments;**
- **It would be applicable for mission planning and operation of newly designed spacecraft and orbital stages and, if possible, for existing ones;**
- **It would take into consideration the United Nations Treaties and Principles on Outer Space.]** [3]

3. APPLICATION

Member States and international organizations should voluntarily take measures, through national mechanisms or through their own applicable mechanisms, to ensure that these guidelines are implemented, to the greatest extent feasible, through space debris mitigation practices and procedures.

These guidelines are applicable for mission planning and operation of newly designed spacecraft and orbital stages and, if possible, for existing ones. They are not legally binding under international law. It is also recognized that exceptions may be justified.

4. SPACE DEBRIS MITIGATION GUIDELINES

The following guidelines should be considered for the mission planning, design, manufacture and operational (launch, mission and disposal) phases of spacecraft and launch vehicle orbital stages:

Guideline 1: Limit debris released during normal operations

Space systems should be designed not to release debris during normal operations. If this is not feasible, the effect of any release of debris on the outer space environment should be minimized.

During the early decades of the space age, launch vehicle and spacecraft designers permitted the intentional release of numerous mission-related objects into Earth orbit, including, among other things, sensor covers, separation mechanisms, and deployment articles. Dedicated

[3] Point for further consideration by the delegation of India.

design efforts, prompted by the recognition of the threat posed by such objects, have proven effective in reducing this source of space debris.

Guideline 2: Minimize the potential for break-ups during operational phases

Spacecraft and launch vehicle orbital stages should be designed to avoid failure modes which may lead to accidental break-ups. In the case that a condition leading to such a failure is detected, disposal and passivation measures should be planned and executed to avoid break-ups.

Historically, some break-ups have been caused by space system malfunctions, such as catastrophic failures of propulsion and power systems. By incorporating potential break-up scenarios in failure modes analysis, these catastrophic events can be avoided.

Guideline 3: Limit the probability of accidental collision in orbit

In developing the design and mission profile of spacecraft and launch vehicle stages, the probability of accidental collision with known objects during the system's launch phase and orbital lifetime should be estimated and limited. If available orbital data indicate a potential collision, adjustment of the launch time or an on-orbit avoidance maneuver should be considered.

Some accidental collisions have already been identified. Numerous studies indicate that as the number and mass of space debris increase, the primary source of new space debris is likely to be from collisions. Collision avoidance procedures have already been adopted by some member States and international organizations.

Guideline 4: Avoid intentional destruction and other harmful activities

Recognizing that an increased risk of collision could pose a threat to space operations, the intentional destruction of any on-orbit spacecraft and launch vehicle orbital stages or other harmful activities that generate long-lived debris should be avoided.

When intentional break-ups are necessary, they should be conducted at sufficiently low altitudes to limit the orbital lifetime of resulting fragments.

Guideline 5: Minimize potential for post-mission break-ups resulting from stored energy

In order to limit the risk to other spacecraft and launch vehicle orbital stages from accidental break-ups, all on-board sources of stored energy should be depleted or made safe when they are no longer required for mission operations or post-mission disposal.

By far the largest percentage of the catalogued space debris population has originated from the fragmentation of spacecraft and launch vehicle orbital stages. The majority of these breakups were unintentional, many arising from the abandonment of spacecraft and launch vehicle orbital stages with significant amounts of stored energy. The most effective mitigation measures have been the passivation of spacecraft and launch vehicle orbital stages at the end of their mission. Passivation requires the removal of all forms of stored energy, including residual propellants and compressed fluids and the discharge of electrical storage devices.

Guideline 6: Limit the long-term presence of spacecraft and launch vehicle orbital stages in the low Earth orbit (LEO) region after the end of their mission

Spacecraft and launch vehicle orbital stages that have terminated their operational phases in orbits that pass through the LEO region, should be de-orbited **[directly]**. If this is not possible, they should be left in orbits which avoid their long-term presence in the LEO region.

[For space objects in the widely used LEO region, i.e., in the region below 2000 km altitude above the surface of the Earth, the most practical means of removing space objects after the completion of their missions normally is to transfer the objects to lower altitudes, thereby accelerating their natural fall back into the atmosphere. For space objects in the region between 1500 km and 2000 km, the most practical solution might be to manoeuvre the object into an orbit above 2000 km.] [4]

When making determinations regarding potential solutions for removing objects from LEO, due consideration should be given to ensure that debris which survives to reach the surface of the Earth does not pose an undue risk to people or property, including through environmental pollution caused by hazardous substances.

Guideline 7: Limit the long-term interference of spacecraft and launch vehicle orbital stages with the geosynchronous (GEO) region after the end of their mission

Spacecraft and launch vehicle orbital stages that have terminated their operational phases in orbits that pass through the GEO region, should be left in orbits which 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.

5. UPDATES

Research by Member States and international organizations in the area of space debris should continue in a spirit of international cooperation to maximize the benefits of space debris mitigation initiatives. This document will be reviewed and may be revised, as warranted, in light of new findings.

6. [ANNEX] / [REFERENCE]

For more in-depth descriptions and recommendations pertaining to space debris mitigation measures, Member States and international organizations may refer to the current version of the IADC *Space Debris Mitigation Guidelines*, which can be found at the following world-wide web address: www.iadc-online.org. **[The current version of the IADC guidelines at the time of the publication of this document is annexed.]** [5]

[4] Point for further consideration by the delegation of the Russian Federation.
[5] Point for further consideration by the Working Group.