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COMMITTEE ON THE PEACEFUL USES OF
OUTER SPACE
Scientific and Technical Subcommittee
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Agenda Item 8
Space Debris

PROGRESS REPORT OF THE CHAIRMAN OF THE WORKING GROUP OF THE SCIENTIFIC AND TECHNICAL SUBCOMMITTEE ON SPACE DEBRIS

1. The Working Group on Space Debris held informal meetings from 23-27 February 2006, during the forty-third session of the Scientific and Technical Subcommittee, in accordance with multi-year work plan endorsed by the Subcommittee at its forty-second session.

2. The Working Group had before it document A/AC.105/2005/CRP.18, which contained the text of the preliminary draft document on space debris mitigation which had been developed by the Working Group during its intersessional meeting in June 2005.

3. During the course of discussions in the informal meetings, the Working Group reviewed the text of the preliminary draft document on space debris mitigation contained in CRP.18.

4. The present document contains the revised text of the preliminary draft document on space debris mitigation, as reviewed by the Working Group during its informal meeting at the forty-third session of the Scientific and Technical Subcommittee.

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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. In addition, there is also the risk of damage on the ground, if debris survives Earth's atmospheric re-entry. 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. In the future, fragments generated by collisions are expected to be a significant source of space debris.

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

The implementation of space debris mitigation measures is recommended since some space debris has the potential to damage spacecraft leading to loss of mission, or loss of life in the case of manned spacecraft. For manned flight orbits, space debris mitigation measures are highly relevant due to crew safety implications.

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 organisations. 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 IADC Space Debris Mitigation Guidelines, taking into consideration the United Nations Treaties and Principles on Outer Space.

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 minimised.

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 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: Minimise 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, the probability of these catastrophic events can be reduced.

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 manoeuvre 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: Minimise 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 removed from orbit in a controlled fashion. If this is not possible, they should be disposed of in orbits which avoid their long-term presence in the LEO region.

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. REFERENCE

The reference version of the IADC guidelines at the time of the publication of this document is included in A/AC.105.C.1/L.260.

For more in-depth descriptions and recommendations pertaining to space debris mitigation measures, Member States and international organizations may refer to the latest version of the IADC Space Debris Mitigation Guidelines and other supporting documents, which can be found at the following world-wide web address: www.iadc-online.org.