FOR PARTICIPANTS ONLY

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COMMITTEE ON THE PEACEFUL USES OF
OUTER SPACE
Scientific and Technical Subcommittee
Forty-first session
Vienna, 16-27 February 2004
Agenda item 8
Space Debris

COMPILATION OF COMMENTS SUBMITTED BY THE MEMBER STATES TO THE IADC SPACE DEBRIS MITIGATION GUIDELINES CONTAINED IN THE DOCUMENT A/AC.105/C.1/L.260

A. Comments to the Specific Sections of the Guidelines.

2. Application

Russian Federation

In *section 2, first indentation*, the wording should be written as follows:
"The IADC space debris mitigation guidelines are applicable to mission planning and the design and operation of *newly designed* spacecraft and orbital stages (defined here as space *vehicles*) that will be injected into Earth orbit".

In *section 2, third indentation*, the words "…to the greatest extend possible…" should be excluded because they are in contradiction with the recommendatory character of the document as a whole.

3. Terms and definitions
3.2 Space systems

Czech Republic

The term "Space Systems" is different to the definition provided in the Recommendation ITU-R S.1003 of the International Telecommunication Union entitled "Environmental Protection of the Geostationary-Satellite Orbit".

Russian Federation

The term “space systems” determines only spacecraft and orbital stages. Contradiction takes place when considering item 3.2.2 and 3.2.3: the “space systems” term does not spread to the launch vehicles but they include orbital stage as a component.

Recommendation: the term “space systems” should be changed to the term “space vehicles” throughout all the text.

3.2.1 Spacecraft

Czech Republic

The term “Spacecraft” is different to the definition provided in the Recommendation ITU-R S.1003 of the International Telecommunication Union entitled “Environmental Protection of the Geostationary-Satellite Orbit”.

3.3.2 Protected regions

Russian Federation

Taking into account increased requirements to assure safety at the orbits of manned flights and safety of people and property at re-entry, *section 3.3.2* should be written as follows:

“3.3.2 Protected regions

“Any activity that takes place in outer space should be performed while recognizing the unique nature of the following regions (A_0, A and B), of outer space, to ensure their future safe and sustainable use. These regions should be protected regions with regard to the generation of space debris:

(1) Region A_0, the region of re-entry trajectories and of orbits of manned flights - the spherical region that extends from the Earth's surface up to an altitude (Z) of 500 km;

(3) Region A, Low Earth Orbit (LEO) Region—the spherical region that extends from the ~~Earth's surface~~ *altitude of 500 km* up to an altitude of 2,000 km;

(2) Region B, the Geosynchronous Region—a segment of the spherical shell defined by the following:

lower altitude = geostationary altitude minus 200 km upper altitude =

geostationary altitude plus 200 km -15 degrees ≤ latitude ≤ +15

degrees

geostationary altitude (Z_{GEO}) ° 35,786 km (the altitude of the geostationary Earth orbit)”.

3.3.3 Geostationary Earth orbit

Czech Republic

The term "Geostationary Earth Orbit (GEO)" should be replaced with "Geostationary Satellite Orbit (GSO)", as used by the International Telecommunication Union.

3.5.1 Launch phase

Czech Republic

It is noted that an additional phase, called Space Debris Phase, should be introduced. The space systems without capability to perform actions for reducing the hazards posed to other space systems will enter into the Space Debris Phase directly from the Mission Phase. Other space systems enter into this phase at the end of their Disposal Phase. The Space Debris Phase ends with the decay of the object either by heating and evaporation in the atmosphere, or with the fall of the remaining parts to the ground.

4. General guidance

Russian Federation

Section 4 item (5) should be deleted because any mitigation measure demands justifications of choice and selection.

5. Mitigation measures

5.1 Limit debris released during normal operations

Russian Federation

In s*ection 5.1, first indentation,* the words "normal operations" should be amended to the words "regular operations".

In *section 5.1, following the second indentation,* an additional separate sentence should be added:
"Any program, project or experiment that will release objects in orbit should not be planned unless an adequate assessment can verify the possibility to determine the trajectories of these objects by using of available observational means".

5.2 Minimize the potential for on-orbit break-ups

Russian Federation

Section 5.2, item (2) should be written as follows:

"… (2) All space vehicles should be designed and operated so as to prevent accidental explosions and ruptures ~~at~~ *till* the end of mission".

Section 5.2, an additional item (4) should be added as follows:

"… (4) in case of space vehicles carrying nuclear power units the regular fragmentation procedures are acceptable not to cause radioactive unacceptable contamination of the atmosphere and the surface of the Earth".

5.3 Post mission disposal

5.3.1 Geosynchronous region`

India

1. The IADC proposals indicate the minimum increase in perigee altitude at the end of the re-orbiting as:
235 km + (1,000.C_R.A/m)

This recommendation did not specify the limits of eccentricity of the orbit, after re-orbiting. A high eccentricity may have effects on the orbit to lower the perigee. The limits of eccentricity from this angle may have to be discussed and determined.

2. Para 5.3.1 of the IADC proposals states that "Operators should avoid the long-term presence of launch vehicle orbital stages in the geosynchronous region". Presently, there are only one or two launch vehicles in the world which can take the satellites to the Geostationary Earth Orbit (GEO) directly by using the final propulsion stage of the launch vehicle. Once the injection velocity and flight path angle are achieved for the last stage of the launch vehicle and the satellite, it may not be possible to alter the orbit of the spent stage of the launch vehicle to meet the above guidelines. In addition, a large number of in-orbit breakups were due to such launch vehicle stages. The phrase "long-term presence" is not precisely defined in terms of number of years.

The feasibility of implementation of such a recommendation may have to be studied.

3. The International Telecommunication Union (ITU) guidelines for the disposal of spacecraft from GEO[i] recommend that the satellite orbit should be raised to no less than 300 km fixed altitude above GEO. This recommendation is simple. The minimum perigee altitude as per IADC guidelines[ii] also indicate less than the minimum altitude per ITU guidelines for the present and foreseeable size of a satellite to be orbited into GEO.

Hence, it is suggested that the IADC recommendations be harmonized in line with the ITU recommendations and set a single number of disposal orbit as 300 km above GEO altitude.

5.3.2 Objects passing through the LEO region

India

The IADC guidelines[iii] indicate that a space system should be left in LEO orbit, at the end of its mission, so that the atmospheric drag will limit the orbital lifetime to a limited number of years. 25 years are recommended to be a reasonable and appropriate lifetime limit for such disposal.

Considering a number of nuclear-powered satellites are in the LEO region as space debris after completing their missions, it should be made clear whether the above recommendation applies to such Nuclear-Powered space debris. If the recommendation is applicable to such satellites, it is also not clear whether it is safe in future for a nuclear-powered satellite to re-enter the orbit when its mode of disintegration may not be clear.

These issues may have to be considered and appropriate recommendation to be evolved.

Russian Federation

Section 5.3.2. should be written as follows:

"5.3.2 Objects passing through the LEO region

Whenever possible, space systems that are terminating their operational phases in orbits that pass through the LEO region, or have the potential to interfere with the LEO region, should be de-orbited (direct re-entry is preferred) or where appropriate maneuvered into an orbit with a reduced lifetime. Retrieval is also a disposal option.

"A space system should be left in an orbit in which, using an accepted nominal projection for solar activity, atmospheric drag will limit the orbital lifetime after completion of operations. A study on the effect of post-mission orbital lifetime limitation on collision rate and debris population growth has been performed by IADC. This IADC and some other studies and a number of existing national guidelines have found 25-*50 years to be a reasonable and appropriate lifetime limit. In case of circular orbits with the altitude more than 1000 - 1300 km the disposal maneuver requires too much fuel resources thus reducing appeal of these projects from the point of view of "efficiency - cost" criterion. If the realization of such projects on other orbits is impossible, the additional basis of mitigation measures should be made.*

Space vehicles designs that do not include the capability to be de-orbited or maneuvered should be planned to be launched into orbits with lifetime consistent with the stated disposal guidelines.

In case of spacecraft with on-board nuclear power units or radioactive substances the re-entry procedures should be performed so, not to cause unacceptable contamination of the atmosphere or the Earth surface.

If a space vehicle is to be disposed of by re-entry into the atmosphere, debris that survives to reach the surface of the Earth should not pose an undue risk to people or property. This may be accomplished by limiting the amount of surviving debris or confining the debris to uninhabited regions, such as broad ocean areas.

Also, ground environmental pollution, caused by ~~radioactive substances~~ toxic substances or any Other environmental pollutants resulting from on-board articles, should be prevented or minimized in order to be accepted as permissible.

In the case of a controlled re-entry of a space system, the operator of the system should inform the relevant air traffic and maritime traffic authorities of the re-entry time and trajectory and the associated ground area."

B. Comments Made to the Whole Document.

Czech Republic

An owner of an object should provide notification when its object becomes debris (i.e. changes its operational/functional status). The notification should be considered by the Legal Subcommittee in the framework of its new agenda item "Practice of States and international organizations in registering space objects".

India

India highly appreciated contributions by the IADC, which is an international forum of governmental bodies on the subject of space debris, to the consideration of the subject of space debris by preparing the document on the guidelines for debris reduction, developed via consensus within IADC. The efforts made by the experts in preparing the document are commendable, and India will provide further clarifications on its comments, if required, and also will participate in the discussions to resolve the issues raised.

Russian Federation

The Russian Federation supports the Committee's activity which is directed at decrease of space contamination, and in accordance with the work plan adopted by the Subcommittee at its thirty-eighth session (A/AC.105/761, para. 130) continues consideration of IADC proposals on space debris mitigation. The Guidelines were analyzed by design and production enterprises of Russian space-rocket industry and by organizations of other Russian ministries and departments.
The Russian Federation expresses firm reliance that rational decisions will be found on all the questions concerning the "IADC Space Debris Mitigation Guidelines" as a result of consensus between the member States of the Committee on the Peaceful Uses of Outer Space and further steps will be planned to solve space debris problem.

Turkey

The proposals of the IADC on debris mitigation have been carefully studied by the research institute of the Scientific and Technical Research Council of Turkey (BILTEN). Given the fact that the highest risk in outer space is being posed by nuclear reactors, Turkey was of the opinion that the control and limitation on the usage of nuclear systems in outer space should be enhanced as much as possible.

United States of America

1. The representative on the Inter-Agency Space Debris Coordination Committee (IADC) of the National Aeronautics and Space Administration (NASA) of the United States of America was a key proponent of the space debris mitigation guidelines that IADC developed and subsequently presented to the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space at its fortieth session, in 2003.

2. The United States Government endorses the IADC space debris mitigation guidelines and itself adopted similar guidelines in December 2000. Those guidelines have been implemented by each United States government agency according to its own set of policies and procedures. The United States Department of Defence and NASA, which are responsible for the majority of United States government satellites, have long adhered to the United States policy of minimizing the creation of orbital debris.

3. The United States Government invites other space-faring nations to join it by implementing the IADC space debris mitigation guidelines in their space operations, consistent with mission objectives and cost-effectiveness. The United States will encourage the Scientific and Technical Subcommittee to endorse formally the IADC space debris mitigation guidelines and to continue its interaction with IADC to ensure that the Subcommittee is apprised of future developments in that area. The United States Government believes that widespread implementation of the space debris mitigation guidelines by Member States as expeditiously as possible will effectively reduce the risks created by orbital debris.

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[i] Recommendation ITU-R S.1003 "Environmental Protection of the Geostationary - Satellite Orbit".
[ii] A/AC.105/C.1/L.260, annex.
[iii] A/AC.105/C.1/L.260, annex.