

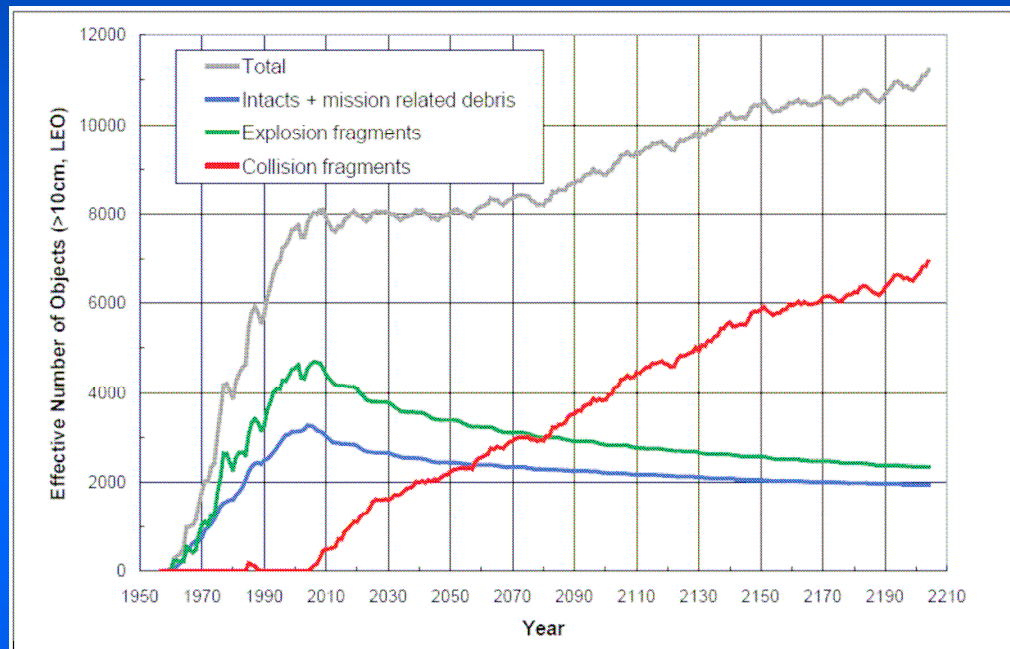
Inter-Agency Space Debris Coordination Committee (IADC)

Inter-Agency Space Debris Coordination Committee Space Debris Mitigation Guidelines Update

45th Session of the
Scientific and Technical Subcommittee
United Nations Committee on the Peaceful Uses of Outer Space

- **The Inter-Agency Space Debris Coordination Committee (IADC)** is the international forum for the coordination of activities related to the issues of man-made and natural debris in space (11 governmental space agencies - ASI, BNSC, CNES, CNSA, DLR, ESA, ISRO, JAXA, NASA, NSAU, ROSCOSMOS).
- The primary purpose of the IADC is to exchange information on space debris research activities between member space agencies, to facilitate opportunities for cooperation in space debris research and to identify debris mitigation options.
- The IADC Space Debris Mitigation Guidelines is the most prominent IADC document that includes proposals on debris mitigation and is based on consensus among the IADC members.
- The IADC Space Debris Mitigation Guidelines describe best existing practices that have been identified and evaluated for limiting the generation of space debris in the environment.

Man-made orbital debris poses an increasing risk to space vehicles

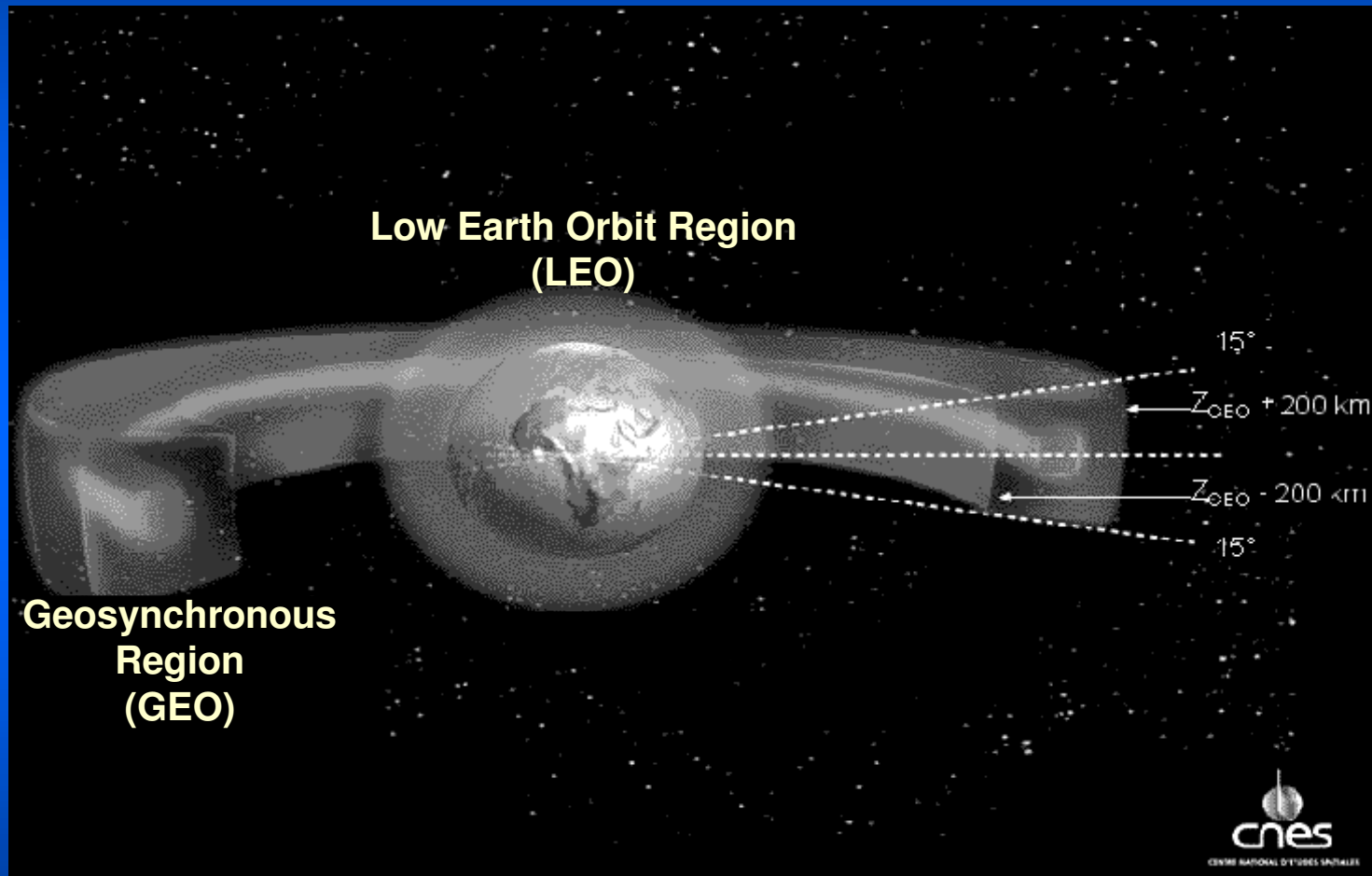


- NASA studied future evolution of debris population with key assumption that no launches were conducted after January 2005 (Orbital Debris Quarterly News, vol. 10, issue 2, April 2006).
- “No future launches” is unrealistic scenario, but it does provide a baseline assessment of the current debris environment: i.e. the best-case scenario.

- The simulated LEO population indicates that until 2055, collision fragments replace other debris (decaying due to atmospheric drag), keeping the total LEO population approximately constant.
- **Beyond 2055 new collision fragments outnumber decaying debris, and force the total population to increase.**

- **Mitigation measures are needed now to preserve the near-Earth space environment for future generations.**
- Fundamental principles followed by many space-faring organisations for debris mitigation are essentially the same:
 - Limitation of debris released during normal operations.
 - Minimisation of the potential for on-orbit break-ups & collisions.
 - Removal of non-operational objects from populated regions.
- **The IADC Space Debris Mitigation Guidelines** is a document of a technical nature that covers the principles of space debris mitigation and is applicable to Earth orbiting vehicles addressing:
 - Mission Planning.
 - Design.
 - Operation (launch, mission, disposal).

The “IADC Space Debris Mitigation Guidelines”

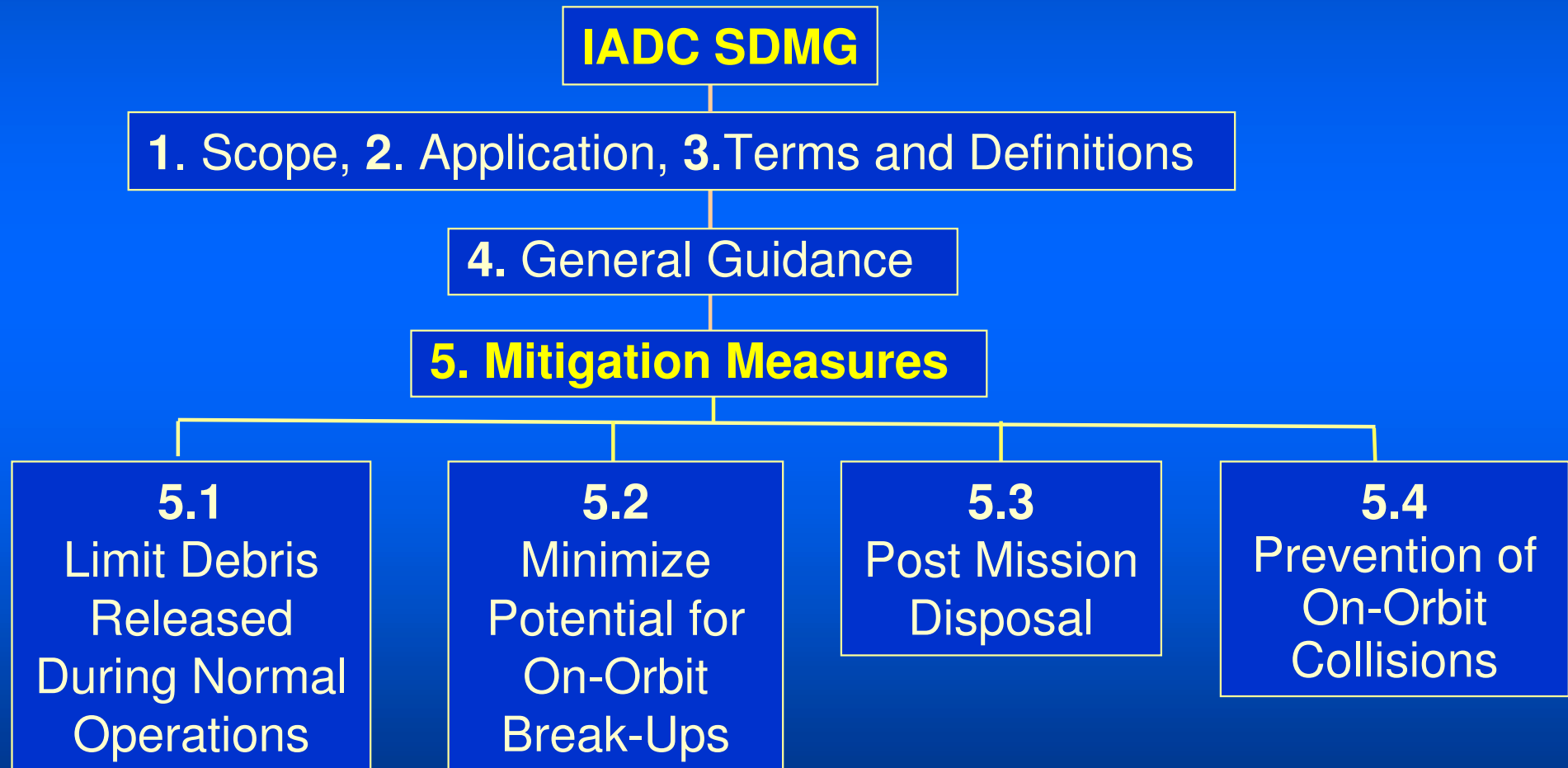


LEO and GEO Protected Regions were identified



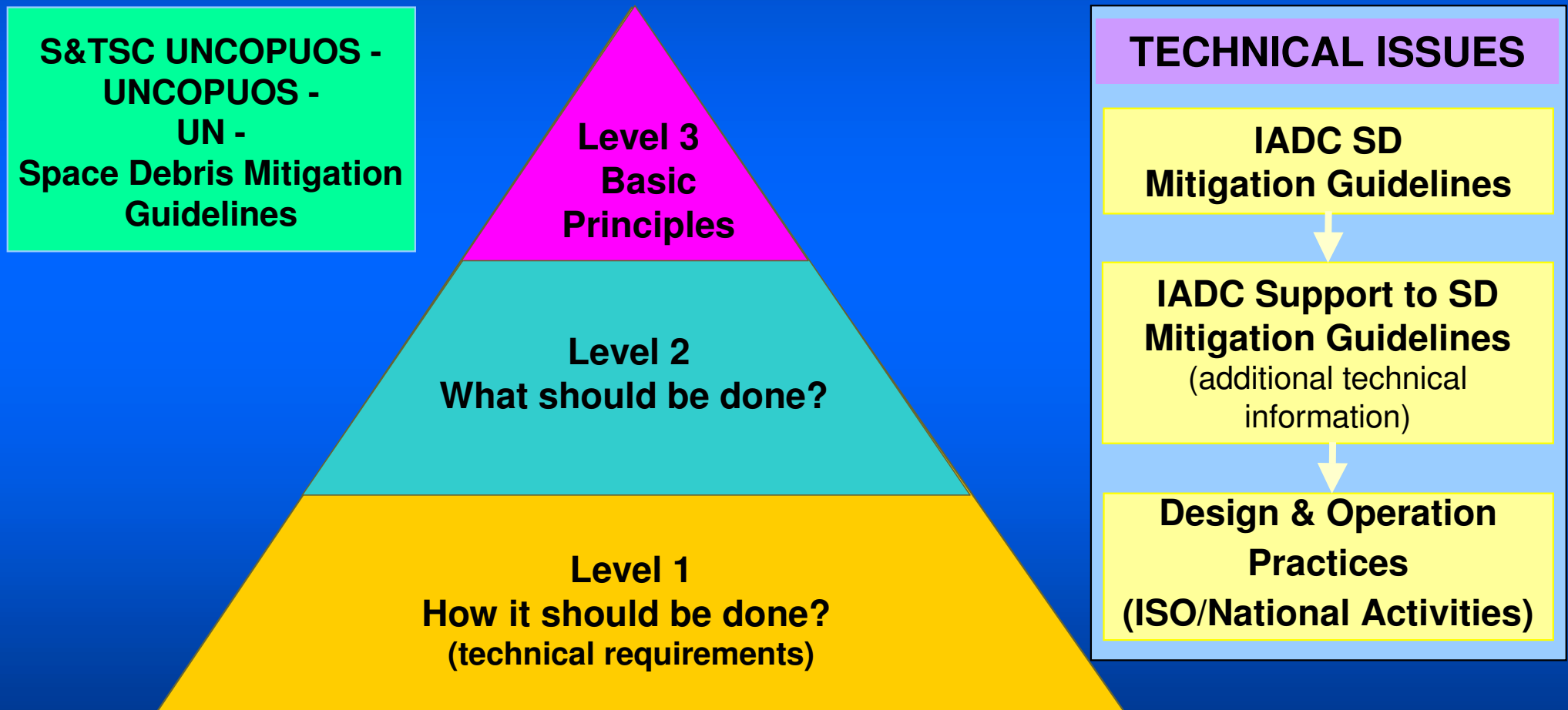
The IADC Space Debris Mitigation Guidelines were presented at 40th session of the UNCOPUOS STSC

(Ref. Doc. # is A/AC.105/c.1/L.260)





SYSTEM OF DEBRIS MITIGATION DOCUMENTS



UNITED NATIONS DOCUMENTS ON SPACE DEBRIS MITIGATION

- In June, 2007 at its 62nd session, the UN Committee on the Peaceful Uses of Outer Space (hereafter – the Committee) endorsed the Space Debris Mitigation Guidelines (Ref. Doc. is A/62/20).
- The Committee Mitigation Guidelines are 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.
- The Committee agreed that its approval of the voluntary guidelines for the mitigation of space debris would increase mutual understanding on acceptable activities in space and thus enhance stability in space-related matters and decrease the likelihood of friction and conflict.
- The UN General Assembly endorsed the UN Space Debris Mitigation Guidelines (Ref. Doc. is A/RES/62/217 issued 10 January, 2008).

IADC Mitigation Guidelines Update

- The IADC Mitigation Guidelines is itself a living document. These guidelines may be updated as new information becomes available regarding space activities and their influence on the space environment.
- The first update to the IADC Mitigation Guidelines was officially adopted by the IADC Steering Group on 25 September, 2007 while Hyderabad meeting.
- Guidelines update concerns two points:
 - para 3. Terms and Definitions
 - para 5.3. Post Mission Disposal

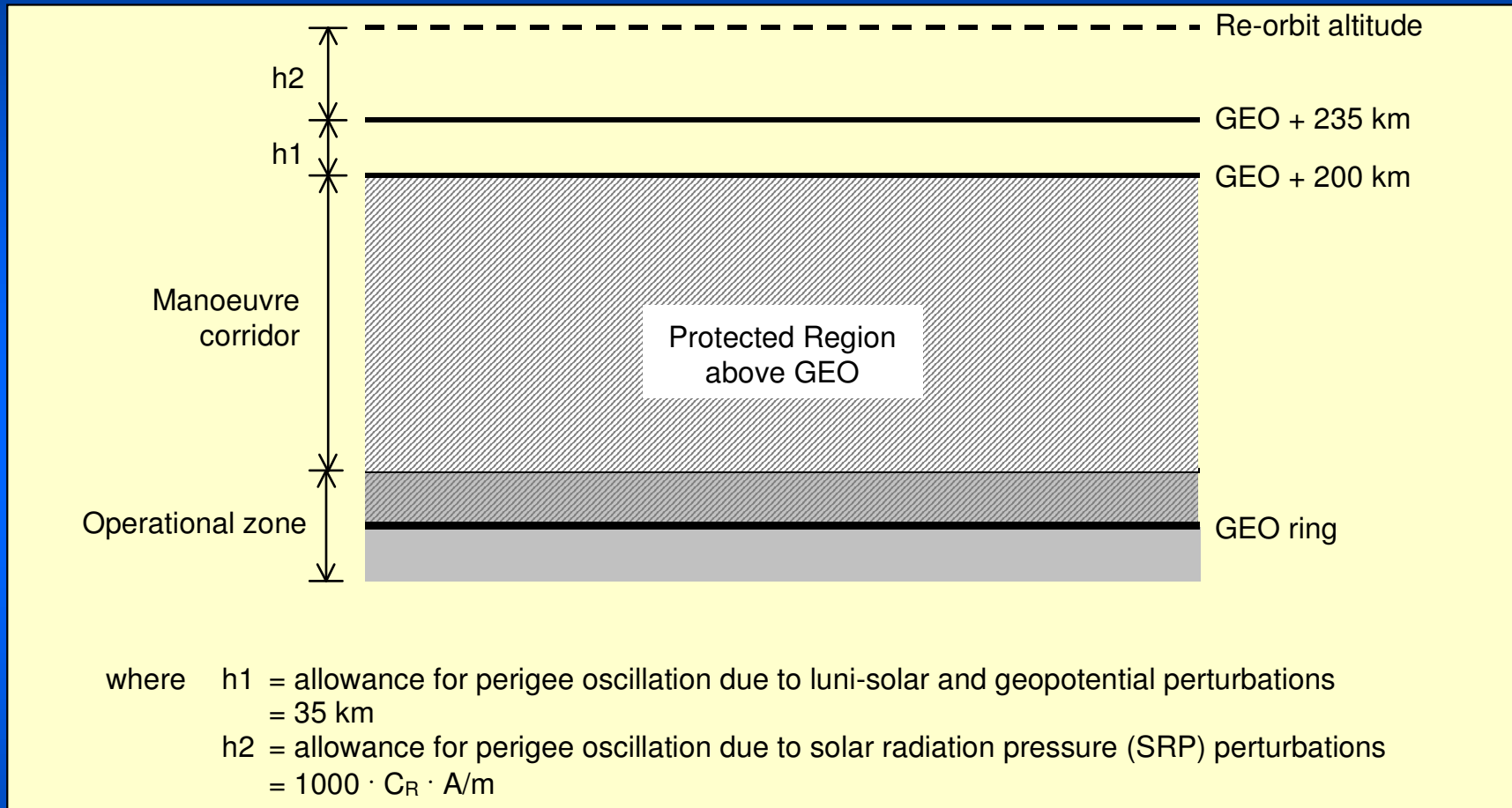


IADC Mitigation Guidelines Update

para 3. Terms and Definitions

Wording of November, 2002	Updating of July, 2007
<p>3.2 Space systems Spacecraft and orbital stages are defined as space systems within this document.</p> <p>3.2.1 Spacecraft A spacecraft is an orbiting object designed to perform a specific function or mission (e.g. communications, navigation or Earth observation). A spacecraft that can no longer fulfil its intended mission is considered non-functional. (Spacecraft in reserve or standby modes awaiting possible reactivation are considered functional.)</p> <p>3.2.2 Launch vehicle A launch vehicle is any vehicle constructed for ascent to outer space and for placing one or more objects in outer space, and any sub-orbital rocket.</p> <p>3.2.3 Launch vehicle orbital stages A launch vehicle orbital stage is any stage of a launch vehicle left in Earth orbit.</p>	<p>3.2 Spacecraft, Launch Vehicles, and Orbital Stages</p> <p>3.2.1 Spacecraft — an orbiting object designed to perform a specific function or mission (e.g. communications, navigation or Earth observation). A spacecraft that can no longer fulfil its intended mission is considered non-functional. (Spacecraft in reserve or standby modes awaiting possible reactivation are considered functional.)</p> <p>3.2.2 Launch vehicle – any vehicle constructed for ascent to outer space, and for placing one or more objects in outer space, and any sub-orbital rocket.</p> <p>3.2.3 Launch vehicle orbital stages — any stage of a launch vehicle left in Earth orbit.</p>
<p>The reason of changes: In the practice of some space agencies the term Space systems includes on-ground systems.</p>	<p>The term Space systems was changed to Spacecraft and Orbital Stages throughout all the text of the IADC Mitigation Guidelines</p>

IADC Mitigation Guidelines Update (para 5.3. Post Mission Disposal)



The IADC and other studies have found that fulfilling the additional condition at the end of the disposal phase would give an orbit that remains above the GEO protected region: the eccentricity should be less than or equal to 0.003.

IADC Mitigation Guidelines updating (para 5.3. Post Mission Disposal)

Wording of November, 2002	Update of July, 2007
<p>5.3.1 Geosynchronous region</p> <p>Spacecraft that have terminated their mission should be manoeuvred far enough away from GEO so as not to cause interference with space systems still in geostationary orbit. The recommended minimum increase in perigee altitude at the end of re-orbiting, which takes into account all orbital perturbations, is:</p> $235\text{km}+(1,000\times C_R\times A/m)$ <p>where C_R: Solar radiation pressure coefficient (typical values are between 1 and 2), A/m: Aspect area to dry mass ratio [m^2/kg] 235 km: Sum of the upper altitude of the GEO protected region (200 km) and the maximum descent of a re-orbited space system owing to luni-solar and geopotential perturbations (35 km).</p>	<p>5.3.1 Geosynchronous Region</p> <p>Spacecraft that have terminated their mission should be manoeuvred far enough away from GEO so as not to cause interference with spacecraft or orbital stage still in geostationary orbit. The manoeuvre should place the spacecraft in an orbit that remains above the GEO protected region.</p> <p>The IADC and other studies have found that fulfilling the two following conditions at the end of the disposal phase would give an orbit that remains above the GEO protected region:</p> <ul style="list-style-type: none"> ➤ A minimum increase in perigee altitude of: $235\text{km}+(1,000\times C_R\times A/m)$ where C_R is the solar radiation pressure coefficient A/m is the aspect area to dry mass ratio (m^2kg^{-1}) 235 km is the sum of the upper altitude of the GEO protected region (200 km) and the maximum descent of a re-orbited spacecraft due to luni-solar & geopotential perturbations (35 km). ➤ an eccentricity less than or equal to 0.003. <p>Other options enabling spacecraft to fulfil this guideline to remain above the GEO protected region are described in the “Support to the IADC Space Debris Mitigation Guidelines” document.</p>

Summary

- Man-made space debris poses an increasing risk to space vehicles. Mitigation measures are needed now to preserve the near-Earth space environment for future generations.
- IADC Mitigation Guidelines is the most meaningful document that describes best existing practices for limiting of space debris and includes the proposals on debris mitigation.
- IADC Mitigation Guidelines is a living document. The first Guidelines update was made on 25 September , 2007 while Hyderabad meeting.
- All participants of space activity are encouraged to use the technical information, provided by the IADC Mitigation Guidelines (including its future updates) and IADC Support Documentation to help establish mission requirements for planned and existing space systems.