Inter-Agency Space Debris Coordination Committee

Recent IADC work on MEO disposal

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Technical Presentation at ICG-15, 28 September 2021

www.iadc-home.org

IADC Overview

IADC is an international forum of national and international space agencies for the worldwide technical/scientific coordination of activities related to space debris in Earth orbit issues and provides technical recommendations.

The 13 IADC member agencies are:

ASI (Agenzia Spaziale Italiana)

CNES (Centre National d'Etudes Spatiales)

CNSA (China National Space Administration)

CSA (Canadian Space Agency)

DLR (German Aerospace Center)

ESA (European Space Agency)

ISRO (Indian Space Research Organisation)

JAXA (Japan Aerospace Exploration Agency)

KARI (Korea Aerospace Research Institute)

NASA (National Aeronautics and Space Administration)

ROSCOSMOS (State Space Corporation "ROSCOSMOS")

SSAU (State Space Agency of Ukraine)

UKSA (United Kingdom Space Agency)

Membership

IADC members are national or international space and state organizations that carry out space activities through planning, designing, launching, or operating space objects.

IADC members should **actively undertake space debris research activities** and **contribute to an increased understanding of space debris issues** for the preservation of the orbital environment.

IADC continues to receive expressions of interest from space agencies and governmental entities seeking to become members or observers.

Structure and Purposes

IADC consists of a Steering Group and four specified Working Groups (WGs) covering **Measurements** (WG1), **Environment and Database** (WG2), **Protection** (WG3), and **Mitigation** (WG4).

The primary purpose of the IADC is to

- exchange information on space debris research activities between member space agencies,
- facilitate opportunities for cooperation in space debris research,
- review the progress of ongoing cooperative activities,
- identify debris mitigation options.

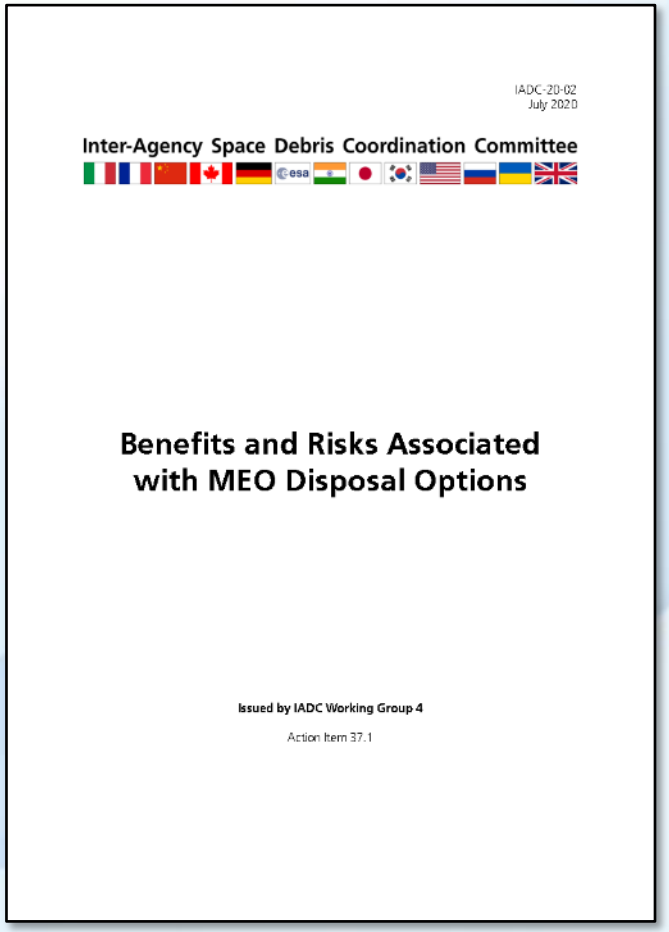
IADC provides technical recommendations to the world space communities. It is not a regulatory organization.

IADC Documents - excerpt

Inter-Agency Space Debris Coordination Committee

AI37.1 : Benefits and risks associated with different MEO Disposal Options

- In May 2019, a new *IADC Action Item* was assigned to WG4 after request from ICG to explore different MEO disposal options and the resulting benefits and risks in order to characterise these options and to provide a summary report.
- A first step to compare existing results of a number of related studies already completed by some IADC members and to identify the benefits and risks of different scenarios.
- The AI Report was prepared and approved in July 2020 and submitted for consideration to ICG.


IADC-20-02
July 2020

Inter-Agency Space Debris Coordination Committee

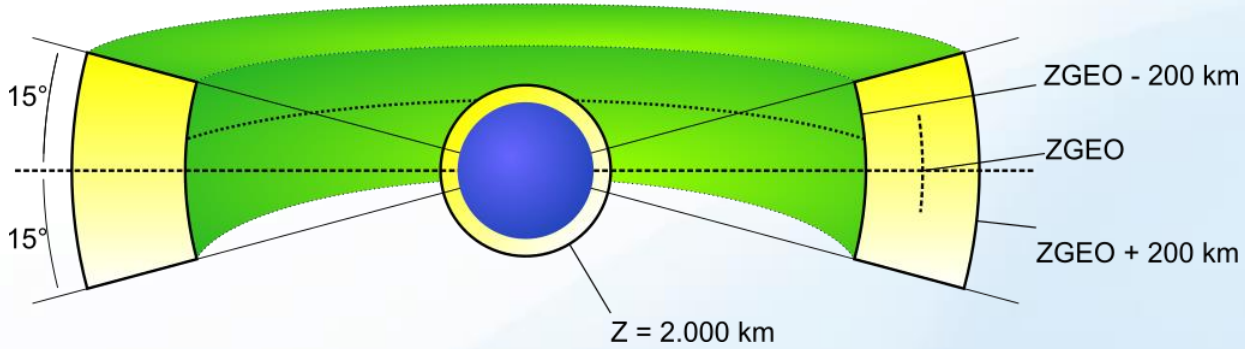
Benefits and Risks Associated with MEO Disposal Options

Issued by IADC Working Group 4

Action Item 37.1

Inter-Agency Space Debris Coordination Committee

Benefits and risks associated with different MEO Disposal Options



The IADC Space Debris Mitigation Guidelines identify two protected regions, Low Earth Orbit (LEO) and the Geosynchronous Region,
but also clearly indicate the need for sustainable behaviour in other orbital regions:

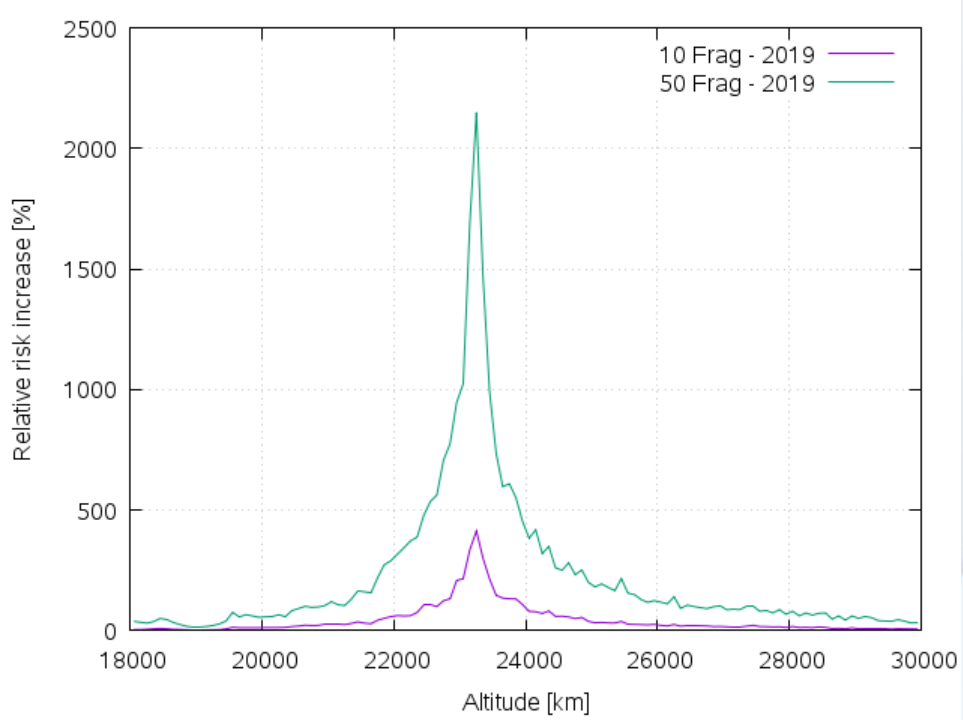
Spacecraft or orbital stages that are terminating their operational phases in other orbital regions should be manoeuvred to reduce their orbital lifetime, commensurate with LEO lifetime limitations, or relocated if they cause interference with highly utilised orbit regions.

Benefits and risks associated with different MEO Disposal Options

With the absence of a natural sink mechanism for space debris objects, MEO objects experience a situation similar to those in the Geosynchronous Region.

The two main potential sources of space debris due to break-ups are

- non-passivated objects at risk of explosion or rupture, or
- abandoned objects that pose a collision risk.



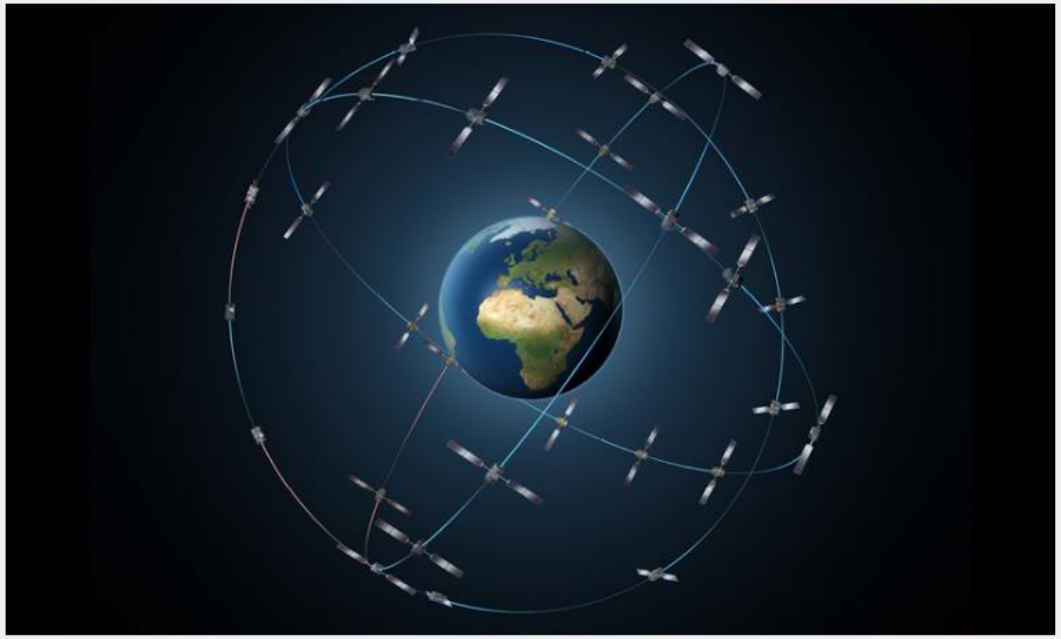
Benefits and risks associated with different MEO Disposal Options

The current collision risk level at the operational Galileo orbit is very low, at ~ 5 / 10 000 000 (5e-7) per year at 2019 conditions when considering objects 1 cm and above,

however: risk is not zero (!)

Galileo satellite performs collision avoidance manoeuvre

Published: *10 March 2021*



The manoeuvre was conducted following receipt of a collision risk alert from EUSST. Image ©ESA-P. Carril

Under the management of the European GNSS Agency (GSA), a collision avoidance manoeuvre for satellite GSAT0219 was performed over the past weekend. This manoeuvre was conducted following a collision risk alert received from EU Space Surveillance and Tracking (EUSST).

https://www.euspa.europa.eu/newsroom/news/galileo-satellite-performs-collision-avoidance-manoeuvre

Benefits and risks associated with different MEO Disposal Options

To avoid space debris issues in the short-term (i.e. order of a few decades) or long-term (i.e. order of one or two centuries) three disposal scenarios can be considered:

- passivation in the operational orbit,
- manoeuvre to a minimum eccentricity growth (stable) orbit, or
- manoeuvre to a maximum eccentricity growth (unstable) orbit

+

- directed de-orbit as variant of the third option

New AI38.3: Quantifying benefits and risks associated with different MEO Disposal Options

Second step in the overall study, with an objective to

- Quantify the risks and benefits of each of the four main disposal strategies for satellites in MEO orbits as outlined in AI37.1 report.
- Use identified tools and methods to characterise as related to MEO disposal:
  - The overall collision risk related to the disposed objects over their orbital lifetime, up to 200 years
  - The relative risks associated with incomplete passivation or accidental explosion of some disposed objects
  - Re-entry human casualty risk

Conclusion

- **IADC concluded a first part of its study on MEO disposal option** (AI37.1), identifying four main disposal options
  i. Passivation in the operational orbit;
  ii. Manoeuvre to stable / minimum eccentricity growth disposal orbit;
  iii. Manoeuvre to unstable / maximum eccentricity growth for long-term re-entry;
  iv. Directed de-orbit.
- **Second step is initiated and expected to conclude in 2023** (AI38.3) to characterize/quantify risks as related to MEO disposal

- **The IADC would appreciate receiving feedback and suggestions for further consideration from ICG**