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Space debris: Regulatory and technical tools at ESA

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Space debris: una sfida tecnica e legale

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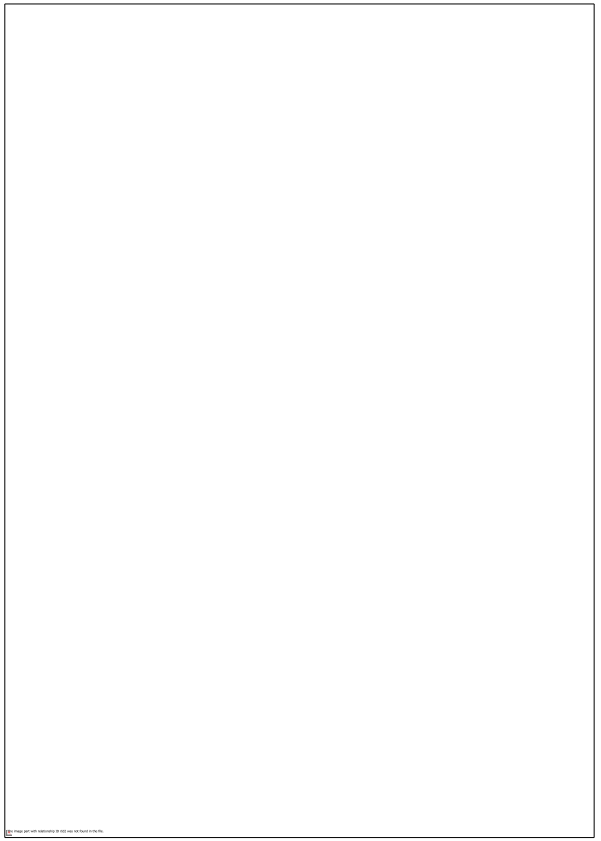
Six decades of spaceflight …

- … left in orbit:
  - 750.000 objects of > 1cm
  - +100 million objects of < 1cm
- Operational, de-commissioned, non-functional **spacecraft**
- **Rocket upper stages**, **fragments**

Sources of space debris

- De-commissioning at “end of life”
- Failure including in-orbit explosions
- Collisions and intentional destruction
- Solid rocket motor firing
- Intentional object release
- Spacecraft surface erosion



More and more debris in space

Space debris: risk, consequence, action

- Space debris poses a significant threat to spaceflight and the safe conduct of space operations
- Hyper velocity impacts (HVI) in case of collision => possible destruction of a satellite => economic loss => new debris
- Need to do:
    - Space debris **mitigation** (avoidance)
    - Space debris **remediation** (removal)

Space debris in international law

- *“Corpus iuris spatialis”:* **UN Space Treaties and national space law**
- Space treaties do not provide for the mitigation of space debris.
- Debris was no practical or regulatory concern in the 1950s / 1960s.

The origins of space debris (self-)regulation

"Good things often arise from unfortunate events, and the IADC is a case in point."

- 1986: spontaneous explosion of a rocket upper stage in LEO
- Space agencies' experts started to take coordinated action at technical level -> establishment of the **Inter-Agency Space Debris Coordination Committee (IADC)** in 1993

The IADC

- **a “forum for the worldwide coordination of activities related to the issues of man-made and natural debris in space.”**
- The IADC has no legal personality: it is an “ad hoc” cooperation mechanism.
- Members: 13 national space agencies + ESA as an intergovernmental organisation

IADC Space Debris Mitigation Guidelines 2002

- The SDMG identify standards for mission requirements to:
  - prevent on-orbit break-ups;
  - remove non-functional spacecraft and orbital stages from “densely populated” orbital regions;
  - limit objects released during nominal spacecraft operations.
- **Non-legally binding** -> technical character!

Progressive regulation

- The SDMG “transcended” into soft / hard law:
  - **Resolution** of the UN General Assembly 62/217 of 22 December 2007 … “UNCOPUOS Space Debris Mitigation Guidelines”
  - ISO Standard on space debris mitigation (similar content)
  - **National space legislation** -> make SDMG applicable as part of a governmental authorisation / supervision process
  - Legal frameworks such as ESA’s “SDM Policy for Agency Projects”
  - **State practice!**

ESA and space debris mitigation

- **ESA is very active in trying to mitigate negative consequences of space debris. Its engagement includes:**
  - **ESA Space Debris Office – one of the world leaders in debris research**
  - **Cleanspace initiative – “green” satellite technologies**
  - **Deorbit studies – preparing for future debris removal**
  - **ESA SSA Programme, future Space Safety Programme**
  - **Strong international cooperation (e.g. with USSTRATCOM)**

ESA Space Situational Awareness Programme

Why it matters:

Sentinel-1A Impact 2016/08/23 – onboard camera

Detriti spaziali: direttive non vincolanti

United Nations Space Debris Mitigation Guidelines

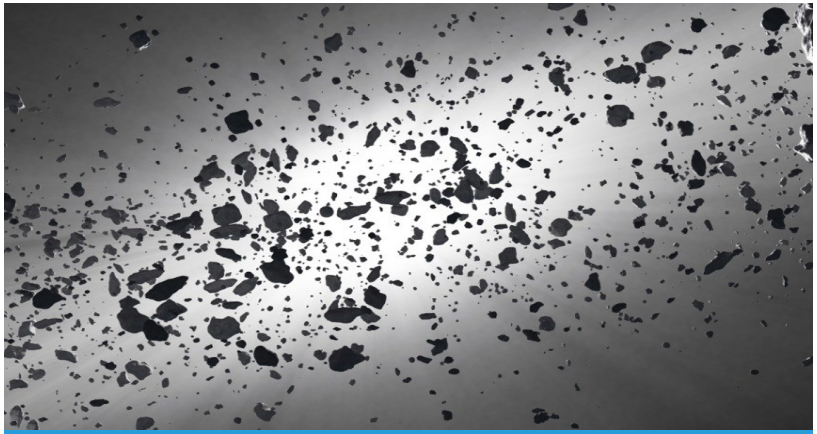
IADC Space Debris Mitigation Guidelines

European Code of Conduct for Space Debris Mitigation

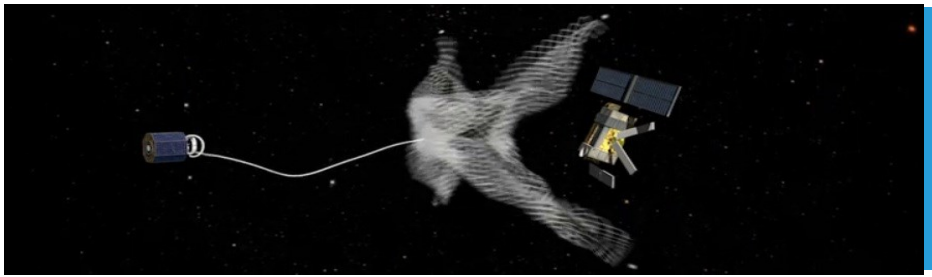
ISO Standard 24113

Azioni dell’ESA

un ufficio per detriti spaziali, che segue 40.000 oggetti nello spazio



uno dei più grandi cataloghi dei oggetti spaziali nel mondo



il programma **Cleanspace** su metodi di rimozione dei vecchi satelliti da orbita *(«Active Debris Removal»)*

Summary

- Space debris is one of the **most urgent problems** to be tackled by the space community.
- Space debris mitigation is **not (yet) legally binding** but important ‘soft law’ instruments exist.
- The most important of these instruments is the **“IADC Space Debris Mitigation Guidelines”**.
- **ESA is at the forefront** of space debris mitigation with a multitude of activities and facilitating international cooperation.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