

Navigating the Stars Responsibly

Ethics in Mission Implementation for Active Debris
Removal and In-Orbit Servicing

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Tragedy of the global commons

Earth's Orbit as a Global commons

Space as a global commons

- *The Tragedy of the Commons* - Garrett Hardin (1968)
 - Communal property system leading to exploitation
- *The Tragedy of the Global Commons* - Erin A. Clancy (1998)
 - “promotes **maximum exploitation**” and that “the incentive for **overuse** is further increased.” (603)
 - little interest in preserving environments, and instead continuing to exploit
 - “**res communes**: the idea that these areas are for the benefit of all nations and, as such, every nation shares a common interest in them.” (1998: 603)

Common Heritage of Mankind

- Paradigm shift from international scientific investigations in 1957-1958
- 5 key principles
 - 1. **not owned** by anyone
 - 2. management **controlled by everyone**
 - 3. **benefits** derived are **shared** among all parties
 - 4. use limited to **peaceful activity**
 - 5. **scientific research is readily available** to interested parties
- Used in:
 - Declaration of Governing the Seabed and Ocean Floor (1970)
 - Treaty Governing the Activities of States on the Moon and Other Celestial Bodies (Moon Treaty) (1979)

Existing legal frameworks and guidelines

UNOOSA, COPUOS, IADC

United Nations: Office for Outer Space Affairs (UNOOSA)

- *Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space* - UNOOSA (1962)
 - “the benefit and in the **interests of all mankind.**” (Principle 1)
 - “in accordance with **international law**” (Principle 4)
 - Origin of a **launched object retains jurisdiction** and control over it (including personnel) (Principle 7)
 - “**internationally liable for damage** to a foreign State” (Principle 8)

United Nations: Office for Outer Space Affairs (UNOOSA)

- *Treaty on Principles Governing the Activities of States in the Exploration and use of Outer Space, Including the Moon and Other Celestial Bodies* - UNOOSA (1966)
 - "Recognizing the **common interest of all mankind**"
 - **not place** nuclear **weapons in orbit** (or any 'weapons of mass destruction') (Article IV)
 - **avoid** the **harmful contamination** of celestial bodies and "adverse changes in the environment of the Earth" (Article IX)
 - states to **consult internationally** before carrying out activities that could interfere with other space activities (Article XI)

Other treaties, and regulations

- Convention on International Liability for Damage Caused by Space Objects (UNOOSA 1972)
- Convention on Registration of Objects Launched into Outer Space (UNOOSA 1976)
- Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (UNOOSA 1984)
- Principles Governing the Use by States of Artificial Earth Satellites for International Direct Television Broadcasting
- Principles Relating to Remote Sensing of the Earth from Outer Space
- International Telecommunication Union (ITU) Regulations

IADC: Space Debris Mitigation Guidelines

- **Inter-Agency Space Debris Coordination Committee (IADC)**
- *Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space – COPUOS (2010):*
 - understanding research related to space debris, including:
 - debris measurement techniques
 - mathematical modelling of the debris environment
 - characterising of the space debris environment
 - measures to mitigate the risks of space debris, including spacecraft design measures to protect against space debris

IADC: Space Debris Mitigation Guidelines continued

- Applicable guidelines for mission planning, for new spacecraft, orbital stages, and existing spacecraft. (2010)
 - Guideline 1: **Limit debris** released during normal operations
 - Guideline 2: **Minimize** the potential for **break-ups** during operational phases
 - Guideline 3: **Limit** the probability of accidental **collision** in orbit
 - Guideline 4: **Avoid** intentional **destruction** and other **harmful activities**
 - Guideline 5: **Minimise** potential for **post-mission break-ups** resulting from **stored energy**
 - 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
 - Guideline 7: **Limit the long-term interference** of spacecraft and launch vehicle orbital stages with the geosynchronous Earth orbit (**GEO**) region after the end of their mission

IADC: Active Debris Removal

- IADC Statement on Active Debris Removal (2022)
 - IADC Guidelines, COPUOS, and other organisations, “**are meant only curtail the growth of the space debris population in Earth orbit, not to reverse it**” (1)
 - space debris mitigation remains necessary and need additional measures to limit debris multiplication
 - Debris removal must be conducted in accordance with, national and international law, and that not impose hazards to space systems in orbit or to people/property on Earth

IADC: Active Debris Removal continued

- IADC encourages:
 - Operators follow existing orbital debris mitigation guidelines and have post mission disposal (PMD) reliability no less than 90%,
 - Further research and cost-risk-benefit analysis on active debris removal
 - “to identify and demonstrate concepts and enabling technologies which can satisfy technical, economic and safety considerations with the goal of stabilizing the debris population” (1)
 - Newly launched spacecraft/upper stages be ADR ready in case of PMD failure.

Ethical considerations for orbital debris

Ethics of planetary protection

- *Final Frontier: Space* - Alice Gorman (2013)
- Space as the last frontier, “ripe for colonial conquest”.
- Draws on Western **anthropocentric assumption** that the non-human world is for our use.
- Val Plumwood (2007): we pay attention environmental resources and their limits, “only after disaster has occurred” and then only to “fix things up”.
- Human use of Earth orbit for satellites which we depend on “**has created a seemingly irreversible environmental crisis**”
 - It is still framed from an anthropocentric/geocentric perspective

Can we separate economic and anthropocentric ideals?

- *Valuing humans and valuing places: “Integrity” and the preferred terminology for Geoethics* - Tony Milligan (2018)
 - Value in ‘places’ that is not only instrumental
 - “life carrying capacity” (Milligan 2018: 4).
 - “Whatever the reason, part of what it is to value places in the relevant sense is to be prepared to **forego various practical advantages in order to protect them from certain kinds of alteration and damage**, even if we ourselves have no prospect of ever directly experiencing the places in question” (Milligan 2018:4)

Can we separate economic and anthropocentric ideas?

- *Basic Methodology for Space Ethics* - Tony Milligan (2018)
 - “Ethics can be difficult to place, and particularly so at present, given the emergence of private sector space activity in combination with state-funded programs. It is an important and [...] reasonable concern that **ethical considerations should not *unduly* constrain either scientific exploration or the development of commerce.**”
 - Planetary protection : enabling science
 - James Schwartz, draws upon the value of science as the primary and most effective justification for human activities in space (2011, 2014)
 - Outer Space Treaty
 - Ethical framework for Search for extraterrestrial life (SETI)

Ethics and Rights for Orbit

- **Land Ethic** - Aldo Leopold (1949)
 - Relationship between land and people are intertwined
 - James Lovelock's **Gaia Hypothesis** (1972)
- **Rights of Nature**
 - Natural elements/environments have rights comparable to Human Right Theory
- **Precautionary Principle**
 - Careful consideration on the potential for cause harm

What's next?

How do we ethically approach debris mitigation and in-orbit servicing

How do we ethically approach active debris removal and in-orbit servicing?

- Returning to the tragedy of the global commons
 - Common Heritage of Mankind
- Beyond the Common Interest Mankind
 - Non-anthropocentric?
 - outside of human exploitative benefits?
- Apply planetary protection to Earth's orbit and ADR and IOS missions
 - A Geoethical framework?
 - Precautionary Principles for mission design?

How do we ethically approach active debris removal and in-orbit servicing within existing frameworks

- Soft law approach?
 - “Soft law is typically characterized as a set of nonbinding legal principles that aim to establish standards and best practices for a particular activity” (Byrd 2022:831, see also Urban 2016)
 - International coordination and agreement to mitigate risks
- UNCOOPUS, COPUOS, IADC

**Can we think differently about
regulating/cleaning up our
orbits?**

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