Research ethics for space research

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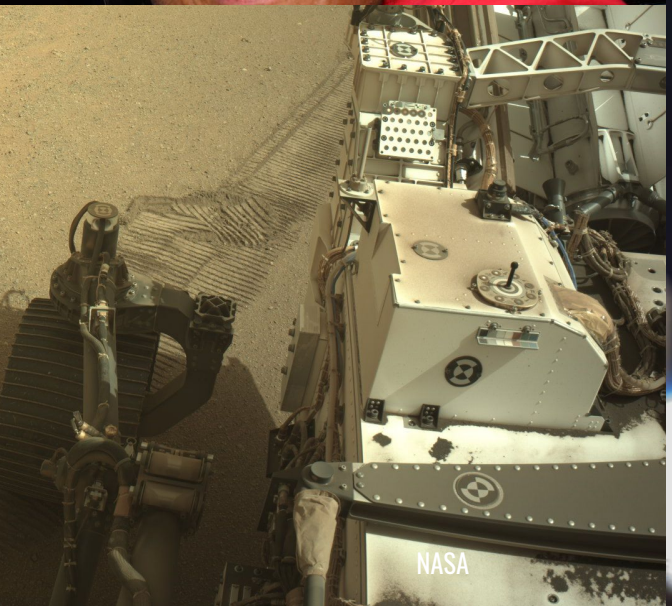
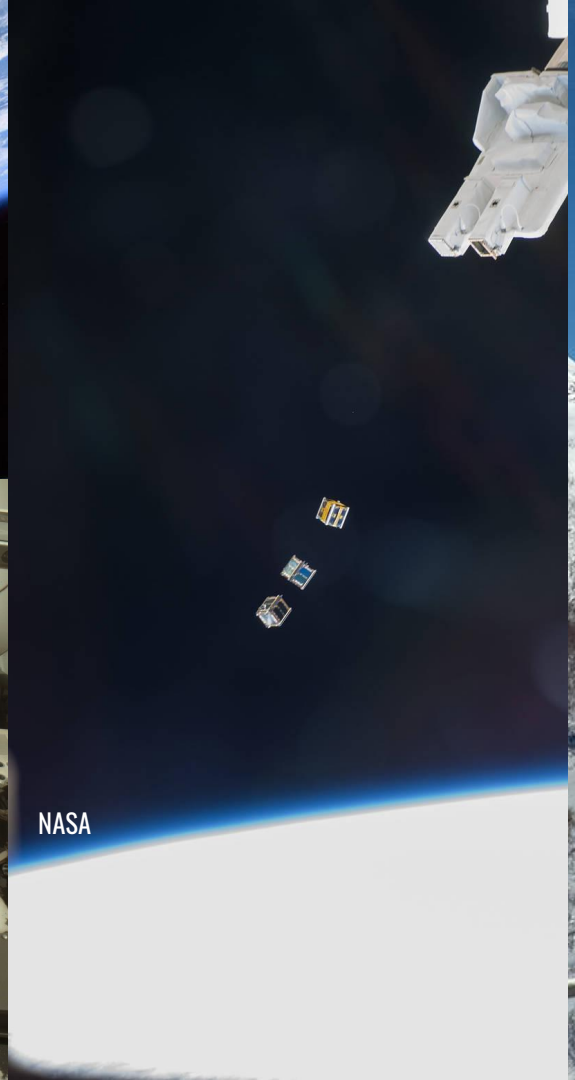
What is research ethics in the context of space?

- How do space research activities link to other research ethical guidelines and the body of research ethical literature? What can we learn from that?
- What is unique in the context of space that merits separate guidelines?
- Understanding the context of 'space research ethics':
  - Complexity
  - Does not operate in a vacuum!
  - Deleterious effects of space activities
- Balancing the need for specificity and high complexity
  - Specific guidelines for specific fields, specific space environments, and specific research goals?





EISCAT Tromsø site. Photo: Craig Heinselman

Biological impact

- In space research, we sometimes send living subjects into space.
- A suggested research ethical principle: (P1) *Ethical review is needed when the research involves sending living organisms intentionally to space.*
- Microorganisms can stow away on spacecrafts. → The risk of harmful forward contamination is important!
- COSPAR
  - Space research should comply with planetary protection protocols but that is only the **minimum** . In some cases, planetary protection considerations should be accompanied by a wider ethical evaluation.
- Revised principle (P1*): *Ethical review is needed when the research involves sending living organisms intentionally to space or when the research creates a non-negligible risk of harmful forward contamination.*

Physical impact

- We can leave marks on space environments.
  - For example, increasing orbital debris.
- A second suggested principle could be: (P2) *Ethical evaluation is needed when space research has a significant physical impact on a space environment.*
- Two interesting observations about space environments:
  - In space we have truly natural and pristine environments.
  - Some space environments are less dynamic than Earth, meaning that any mark we live on them lasts for a much longer time than it would on Earth.

Information-related impact

- We can send information, that is, signals to space during our research or with our scientific instruments.
- Case EISCAT
  - Illustrates how ground-based space science facilities and instruments are often based in remote and rural areas that may be important areas for Indigenous people.
  - Dual use (Doritos commercial and Sónar Calling GJ273b)
- (P3) *Ethical evaluation is needed when space research entails transmitting detectable signals to possibly habitable areas in outer space.*
- (P4) *Ethical evaluation is needed when space research entails a significant risk of dual use.*

Space as ‘commons’

- Science is not the only space activity, space is shared with other actors
- Understanding the setting:
  - Space environments like orbits are a resources that are
    - 1) Scarce
    - 2) Best approached as a ’commons’, common-pool resource

→ Tragedy of the commons

- The need for cooperation and coordinated action

Space and research ethics in a global context

- The importance of the international context
- The risk of ethics dumping
- Environmental justice
- What role should Finnish space research take in this global and international context?

Concluding remarks

- We suggested a handful of potential principles for space research ethics.
- Such principles are very important and valuable but as noted space research happens in a global and complex setting where various and multifaceted ethical questions emerge.
- → In addition to some set of principles, science community needs to foster a spirit of responsible research ethics, holistically understood. For example:
  - use our voices as scientists in matters of great importance
  - maintain an international dialogue on research ethical issues specific to our fields
  - educate ourselves and consult experts about the ethical conundrums related to our research activities.
- By doing so we can better maintain public trust in space and climate science.


Kiitos!
Thank you!
NASA, ESA, CSA, STScI