ESA Clean Space Presentation

ESA Clean Space Team
UNOOSA Austria Symposium – Panel 1

14/09/2022

Objective of the Clean Space

Guaranteeing the future of space activities by protecting the environment

Clean Space

ecodesign

→ REDUCING IMPACTS

management of end of life

→ SPACE DEBRIS REDUCTION

Effect on the atmosphere

Environmental regulation

Life cycle assessment

Reentry

Capture

Discharge energy

Deorbit

Design for demise

Design for servicing

Rendezvous

in-orbit servicing

→ ACTIVE DEBRIS REMOVAL


EcoDesign

EcoDesign Scope

EcoDesign

Is necessary to understand how much space activities pollute on Earth and to identify alternatives to reduce the environmental impacts

LCA (Life Cycle Assessment)

Assessing the environmental impacts of the whole life cycle of the space missions

Eco-design

Identifying alternative processes or technologies that can be used to reduce these impacts

Enuironmental regulation

Finding alternatives to abide by legislations and avoid costly disruptions

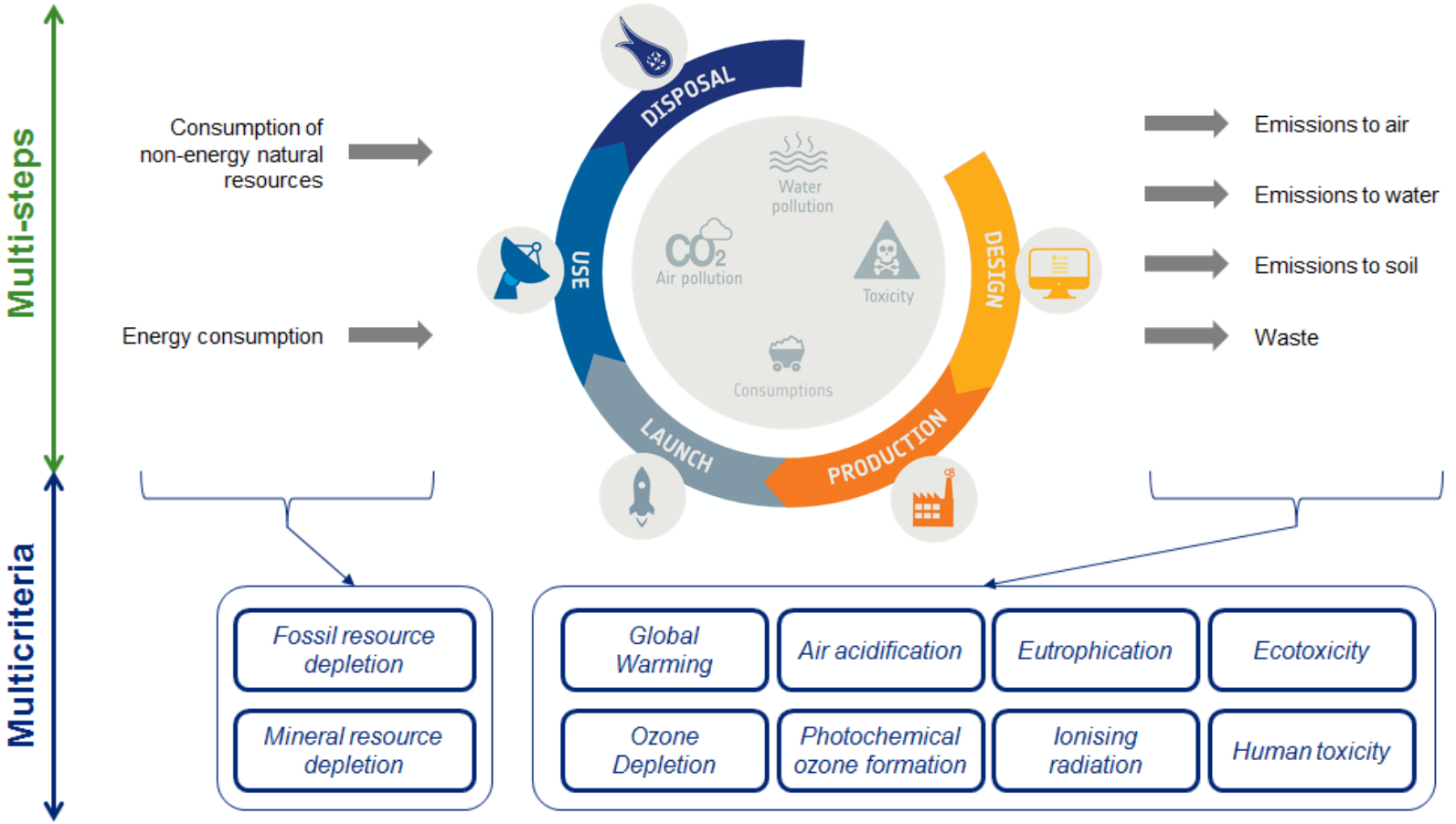
ecodesign

Life Cycle Assessment – Definition

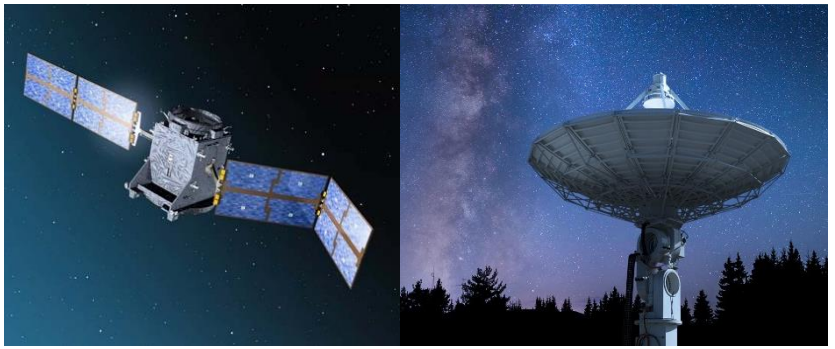
LCA is an ISO-standardised tool to quantitatively assess the potential environmental impacts of product, process or service

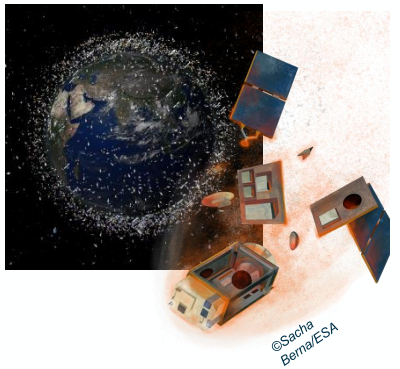
- ✓ **Multi-step analysis**
  The environmental impacts are assessed across all stages of existence.

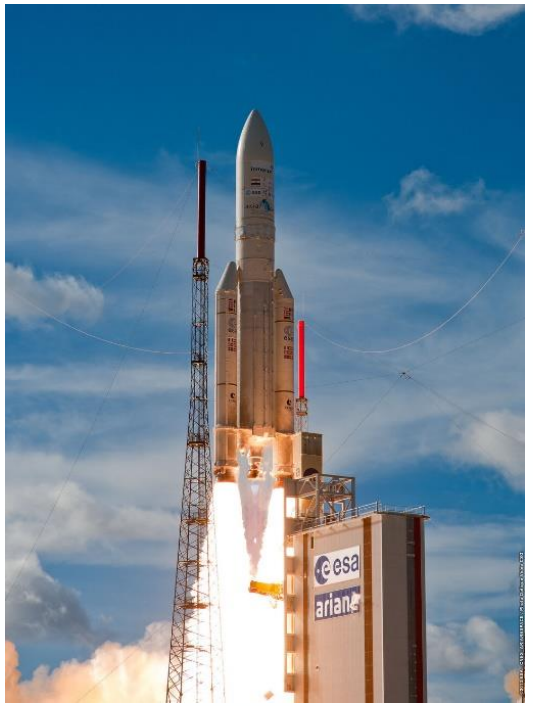
- ✓ **Multi-criteria analysis**
  The outcomes are expressed with several quantified environmental indicators (impact categories).

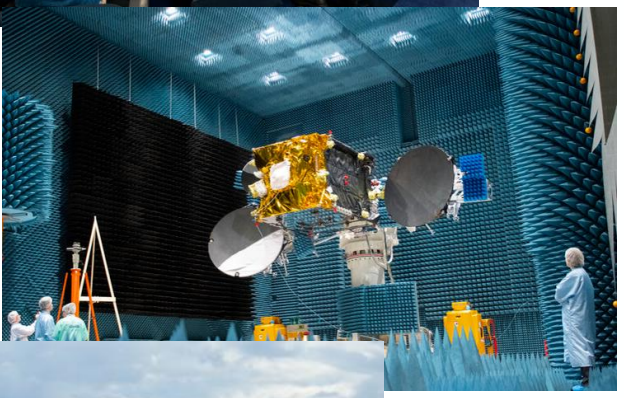


Space Mission Life Cycle









ESA’s eco-design vision

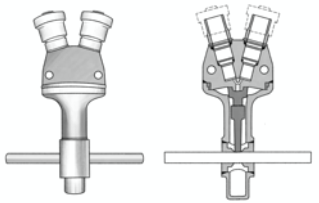
➔ GREEN TECHNOLOGIES ⟷ **➔ ESA PROJECTS**

Environmental Footprint

Ex: Efficient use of Ge

Environmental Regulation

Ex: Replacement of pyrotechnic powders



- **Ariane 6**
- **Earth Explorer 9**
- **Copernicus Missions**
- **Galileo 2nd generation**
- **…**

ROADMAP

LCA

LCA Launch segment

LCA Space segment

LCA Ground segment

LCA Launch segment - update

LCA implementation in ESA projects

Ariane 6
Earth Explorer 9 & 10
Copernicus Expansion Missions
Galileo 2nd generation
...

Framework

Framework definition
- LCA Handbook
- LCA DataBase

Framework update
- LCA Handbook
- LCA DataBase

Framework consolidation

Eco-Design

GreenSat
First Eco-design implementation

Green technologies roadmap

First **Green Technologies** development

Eco-design implementation in ESA projects

2012 2015 2018 2021 2025 2030

Let's stay in touch!

Recordings of previous Clean Space webinars

https://blogs.esa.int/cleanspace/clean-space-webinars/

LCA and Ecodesign training for Space

16 September @ online

Follow us and contact us!

https://blogs.esa.int/cleanspace/

@ESAcleanspace

https://fr.linkedin.com/showcase/esa-clean-space

Zero Debris:
https://www.linkedin.com/groups/12670558/

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Back up slides

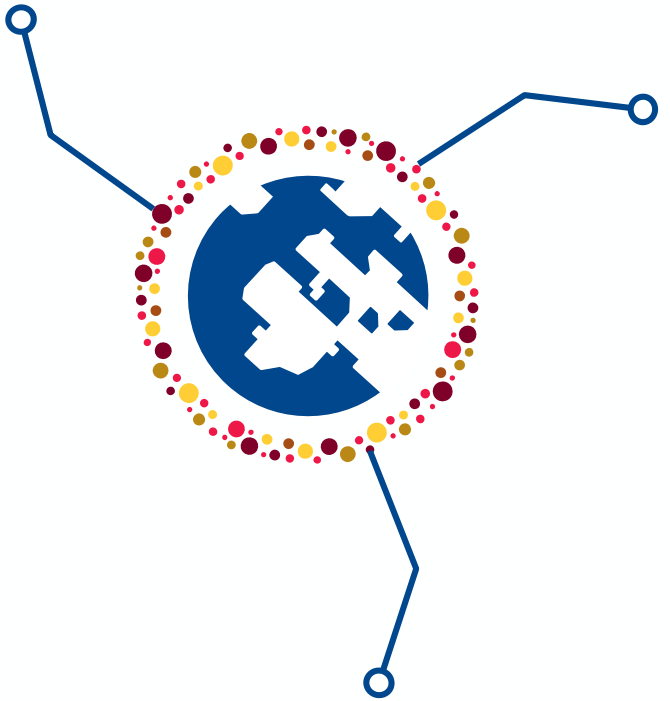
ESA Agenda 2025

ESA Director General's Agenda 2025 reiterated that **making ESA "a greener organisation"** is a **priority**, to support the implementation of the Paris Agreement and the European Green Deal to the fullest extent


Management of end of life

Current orbital environment

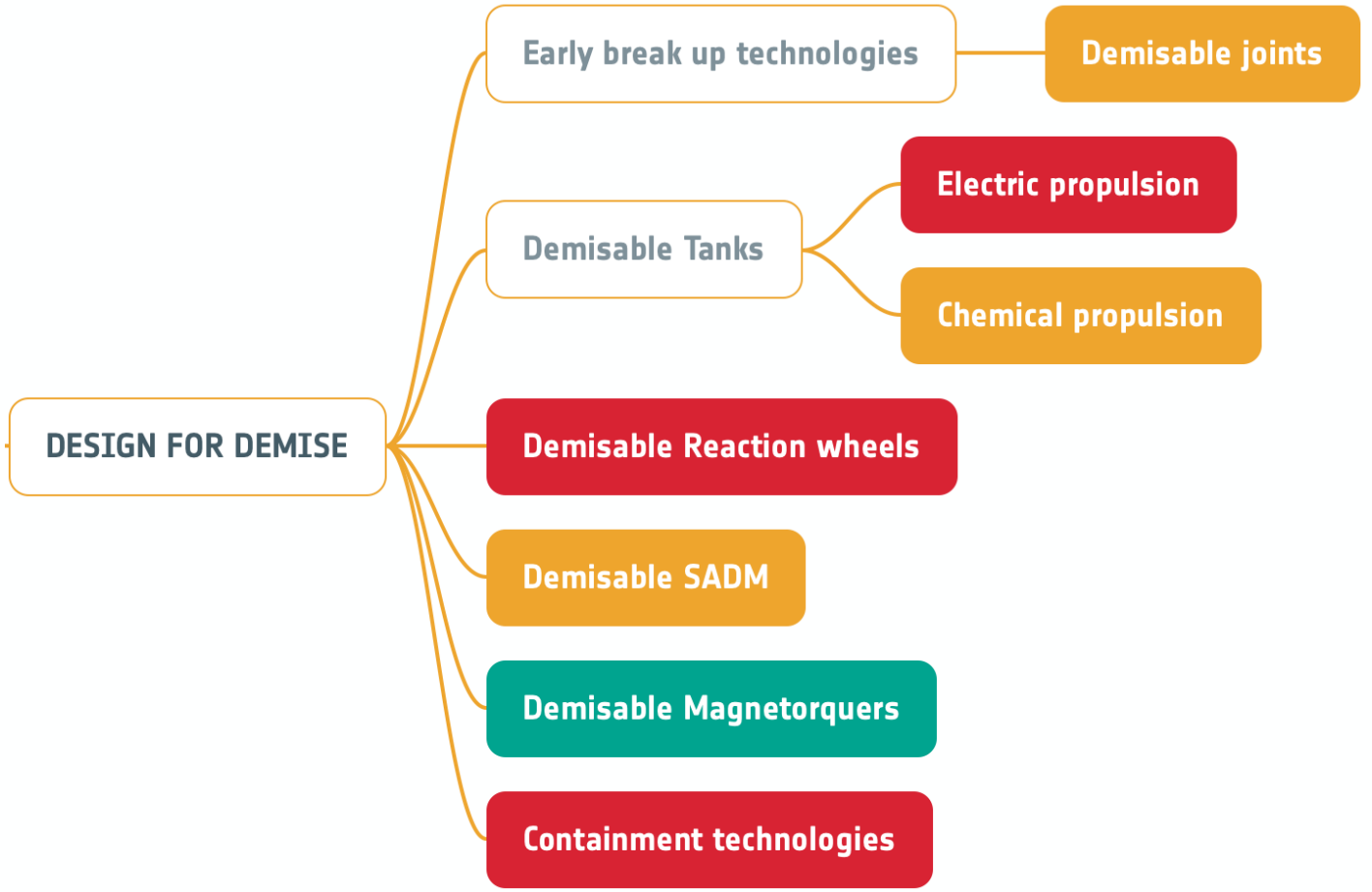
36 500 objects
greater than 10 cm

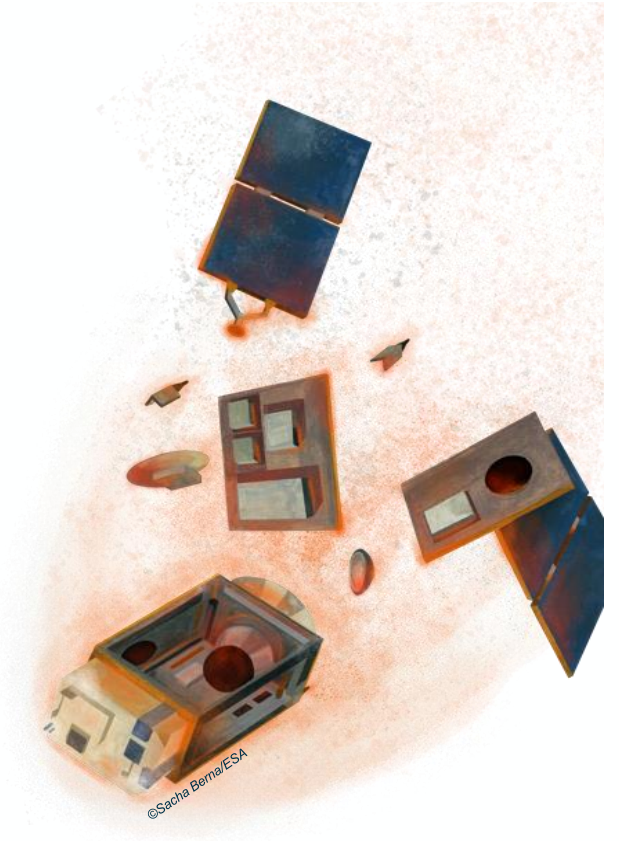


130 million objects
from 1 mm to 1 cm

1 million objects from
1 cm to 10 cm

Design for Demise





Legend

- > TRL 6
- > TRL 4
- TRL 3/4

Zero Debris Approach

Zero Debris Approach requires **transversal action -** the 4 pillars:

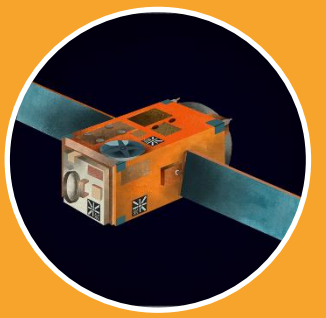
1. Evolution of ESA Policy

Introduce a requirement for removal in case a spacecraft fails

2. Upgrade platforms

System level development and integration of innovative technology

3. Removal services



Demonstrate reliable services, establish standard interfaces

4. Improving operations

Expanding monitoring and operational capabilities