



Clean Space

Guaranteeing the future of space activities by protecting the environment

Environmental concerns:

- New legislations (REACH, RoHS, LOS)
- Competitive advantage due to green technologies
- Pressure on the space industry (risk of supply chain disruptions; requests from customers, employees)

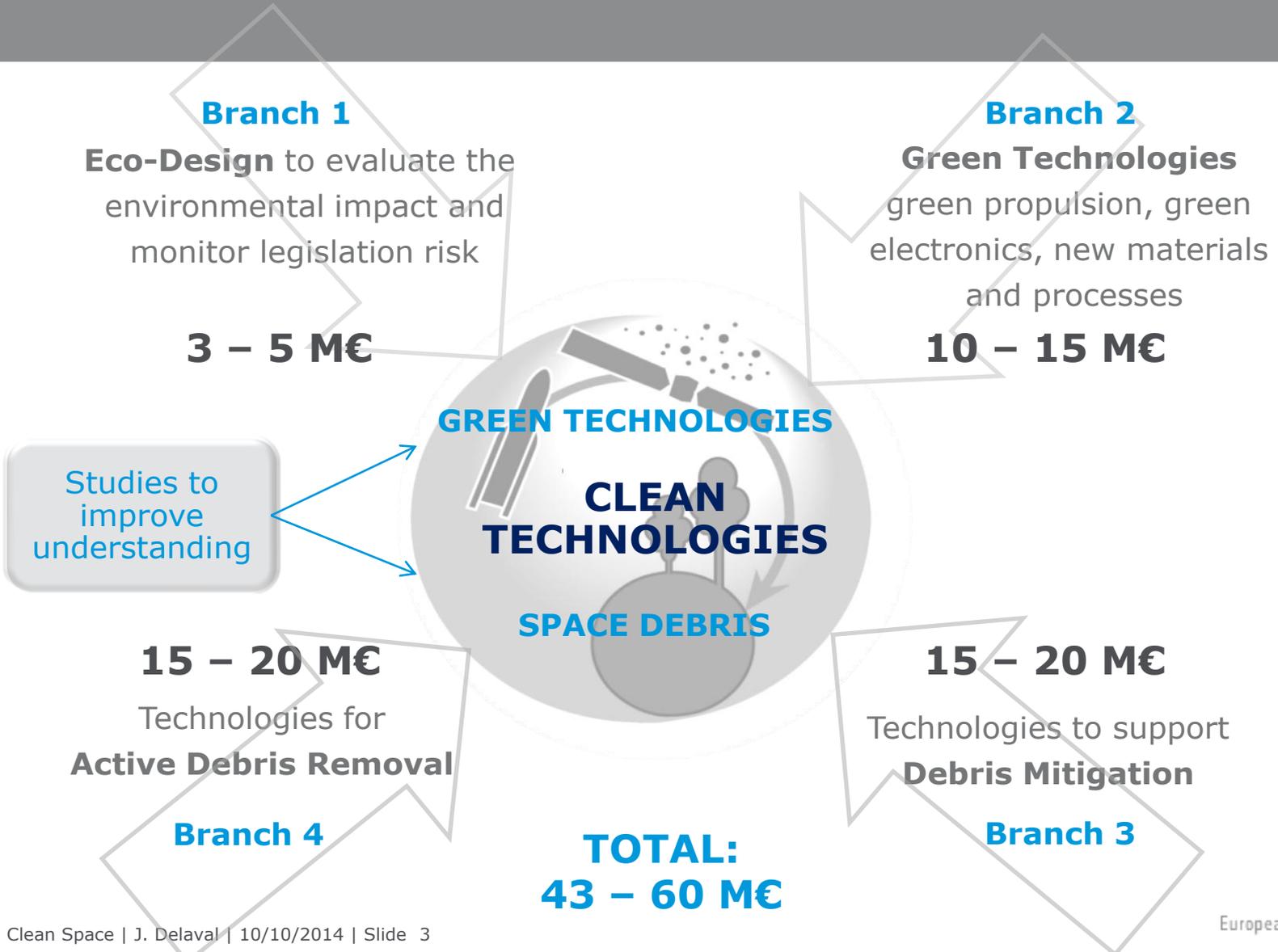
Concerns on the **sustainability** of the exploitation of space:

- Collision risks due to space debris
- News headlines due to space objects re-entering

ESA, with the Clean Space initiative, will **give a pro-active answer to the environmental challenges both on ground and in space**, including its own operations as well as operations performed by European space industry in the frame of ESA programmes

ACTION IS NECESSARY TO TRANSFORM THREATS INTO OPPORTUNITIES

Clean Space – An Overview



Objective of the Clean Space Initiative



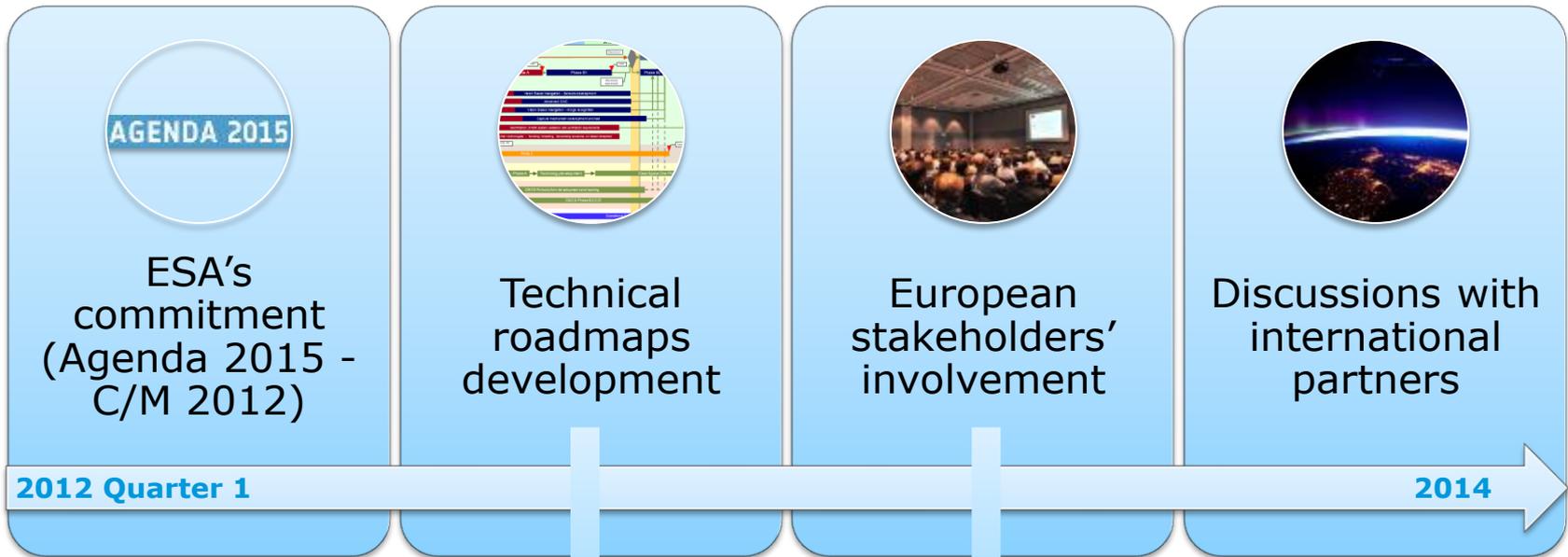
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*Guaranteeing the future of space activities
by protecting the environment*

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Clean Space technical content preparation



Implementation of roadmaps already started with **Over 40 finalised or on-going activities with industry.**

Branch 1 Eco-Design

Why?



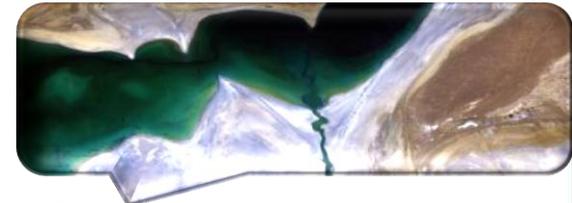
Environmental Legislation

- Considerable implications for European space activities, e.g. REACH
- Fast evolving regulation require pro-actively monitoring and finding alternatives to anticipate possible disruption in the supply chains



Environmental Impacts

- Understand and monitor the overall life cycle is essential to identify potential issues and to mitigate the risk of impacts that are as of now un-quantified



Communication

- Stakeholders pay increasing attention to the environmental impact
- Consistent communication and lobbying based on engineering tools is needed

Branch 1 Eco-Design Objective



Develop **framework and tools** to support future projects in monitoring their supply chain for **compliance** with environmental regulation and **evaluation** of environmental impact



Branch 2 Green Technologies

Why?



Supply Chain

- Mitigate the risk of supply chain disruption due to the non-compliance of certain products with regulations



New frontier to innovation

- Provide competitive advantages by
 - > cutting production steps
 - > decrease energy consumptions
 - > decrease waste

Branch 2 Green Technologies

Objective



Develop **Green Technologies** that shall allow ESA to:

- Reduce the energy consumption across the life-cycle of a space mission
- Use resources in a more sustainable way
- Minimise the use of harmful substances for human health and bio-diversity
- Have a pro-active engagement with environmental legislation
- Manage the residual waste and polluting substances resulting from space activities



Branch 3 Space debris mitigation

Why?



Compliance with mitigation requirements

- ESA "Requirements on Space Debris Mitigation" as of 2008 :
 - Remove from LEO within 25 years, un-controlled or controlled re-entry (10^{-4})
 - Remove from GEO to a graveyard orbit
 - Passivation



Strong impact on the system design

- High impact on missions design and raises feasibility issues
- Risk assessment in the preliminary design phase



Modelling and understanding

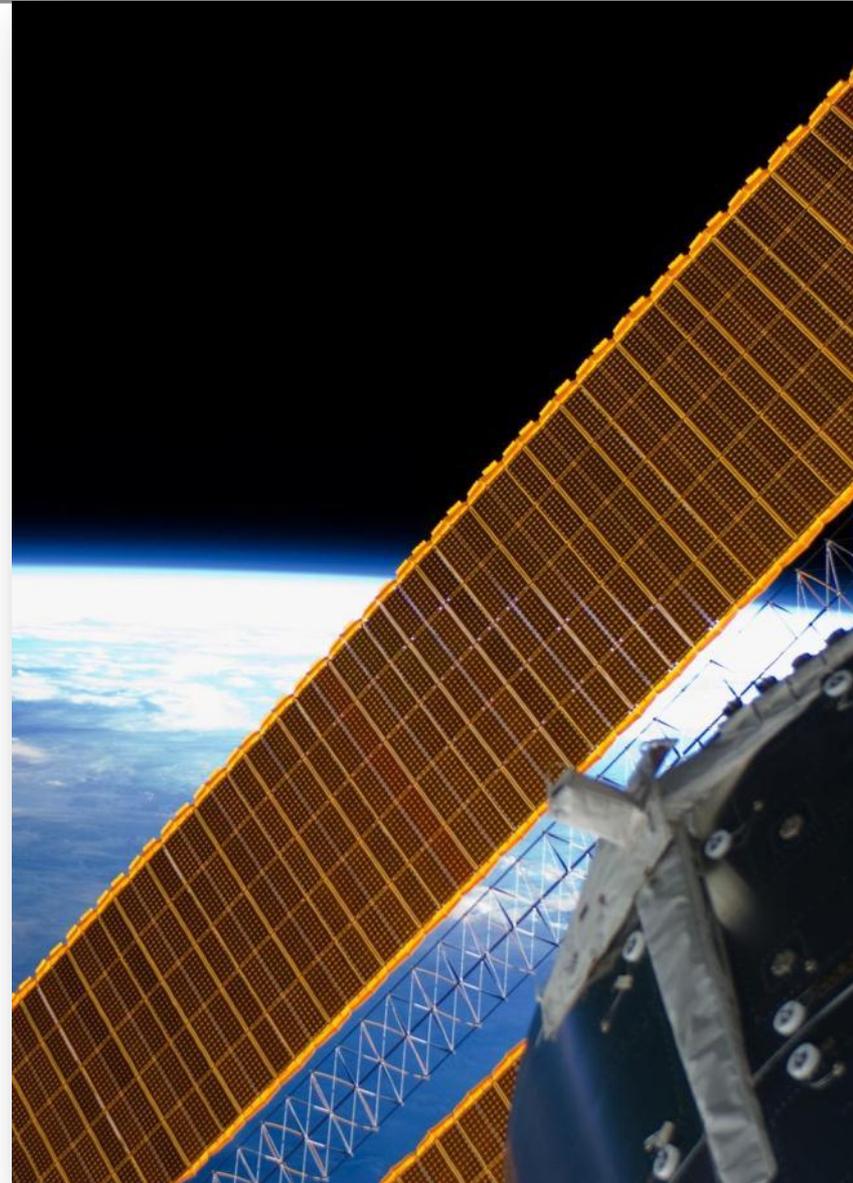
- Agreement on models to calculate impacts
- Space debris environment models require continuous improvements

Branch 3 Space debris mitigation

Objective



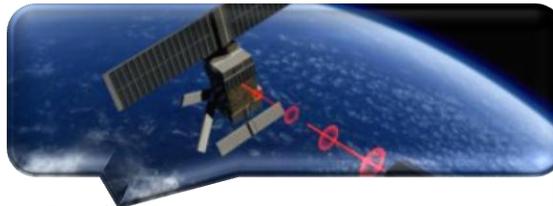
Develop **technologies** for the systematic compliance of ESA missions (S/C and launchers) with debris mitigation requirements, covering **re-entry** or parking in graveyard orbits, **passivation** and update debris models



Branch 4 Space Debris Remediation

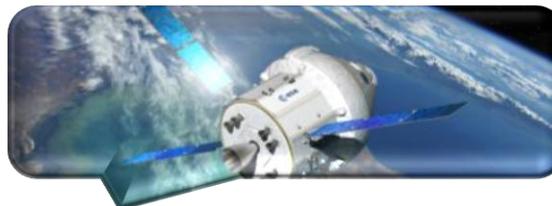


Why?



Compliance with mitigation requirements

- Raising number of debris
- World-wide actions by active debris removal (~5 objects per year)
- Increasing collision avoidance maneuvers



On ground safety

- Uncontrolled re-entry of debris causes a risk for on-ground safety



Innovation

- Innovative technologies (e.g. capture, sensors) are necessary
- Possibility of new market for ADR

Risk of an ESA satellite encountering a catastrophic collision in the next 50 years between ~7.5% and ~11%

Branch 4 Space Debris Remediation Objectives



- Develop **technologies** for space debris **rendezvous, capture and re-entry**
- Adopting a **system approach**, technology developments are planned to be focused on a mission for the controlled de-orbit of heavy objects
- Place European industry at a **forefront position** on anticipated future markets





- Main ESA body: Industrial Policy Committee
- Coordination with our stakeholders through dedicated workshops and presentations
 - ADR Workshop (2012) – The Netherlands
 - 6th European Conference on Space Debris (2013) - Germany
 - Clean Space workshop (2013) - UK
- Coordination with European Commission on relevant issues within FP7 and Horizon 2020
- ESA Clean Space website www.esa.int/cleanspace and twitter @ESAcleanspace

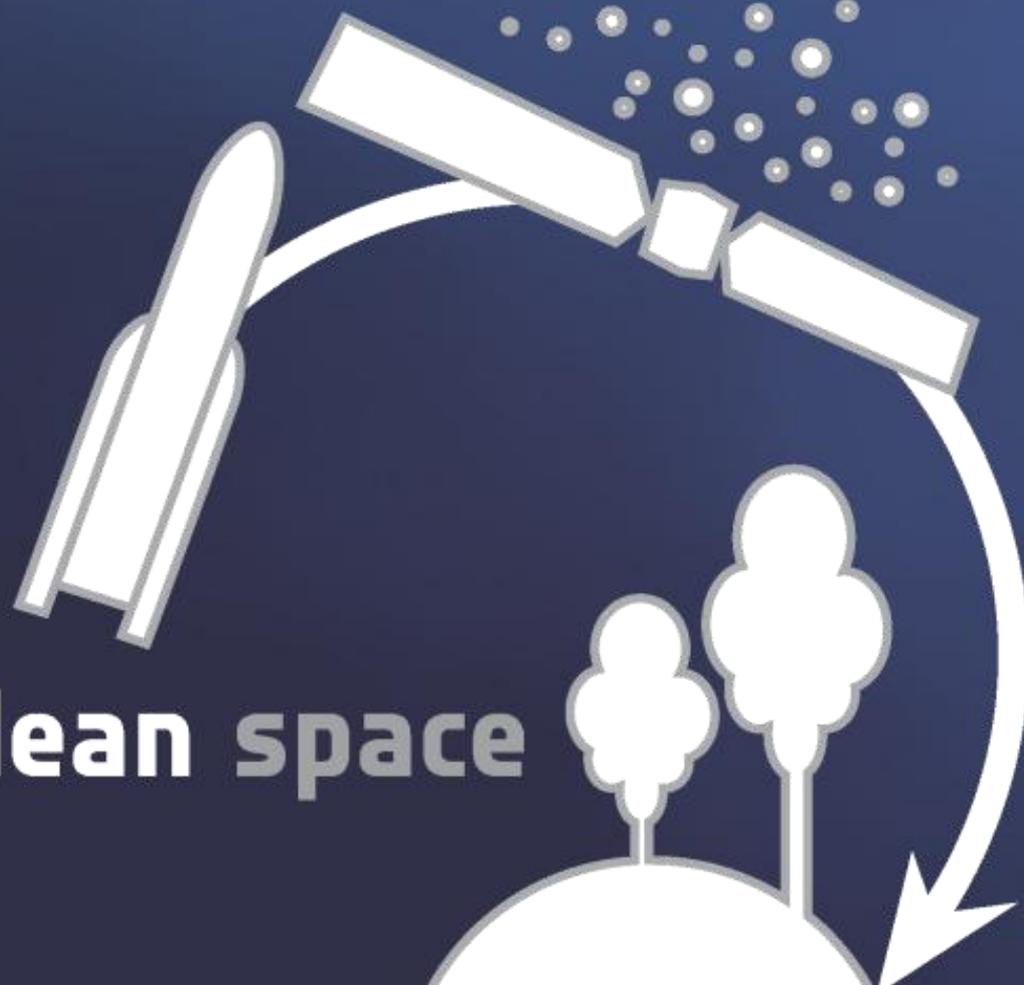
The Clean Space initiative is:

- 🌍 a **cross-cutting theme** within ESA's Technology programmes

- 🌍 aiming at **making ESA an exemplary agency** in terms of terrestrial and space environmental protection

- 🌍 containing **technology activities** grouped in roadmaps which will allow European space industry to:
 - > effectively use resources
 - > implement regulations
 - > mitigate risks

- 🌍 turning an apparent threat into **an opportunity for the entire space sector**

The logo features a stylized white rocket on the left, a satellite in the upper right, and a circular Earth at the bottom. A white arrow curves from the satellite down to the Earth. The text 'clean space' is written in white lowercase letters, with 'clean' in a bold font and 'space' in a regular font. The Earth is depicted with two stylized trees on its surface. The background is a dark blue gradient with a cluster of white dots representing stars in the upper right.

clean space

**Thank
you**

For further information

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Follow us on Twitter [@ESAcleanspace](https://twitter.com/ESAcleanspace)