

# Introduction to the Zero Debris Removal services

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→ THE EUROPEAN SPACE AGENCY

## Several Debris Removal studies (and related) ongoing within ESA



ClearSpace-1 : removal of a European owned space debris (Space Safety)

e.Inspector: image a European owned space debris (GSTP Fly)

RACE: Rendezvous Autonomous CubeSats Experiment, automated docking (GSTP Fly)

Formulation and Assessment of Multi-Agent Active Debris Removal Application (PECS Plan for European Cooperating State)

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- $\rightarrow$  First major review ('KPG1') in 2022
- $\rightarrow$  ClearSpace is over 70 employees now

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<u>Objective</u>:

• To Image an European owned debris (target) in its current status

Baseline debris selection: VESPA (same as ClearSpace-1) M: 112 kg. h: 1.3m. D: 2.1m 664x801 km orbit

> Payload: visual + NIR camera Supplier: LEONARDO

12U cubesat. 11.5 kg. Prime: Polimi Deployable solar wings -> 144W Magnetic Enhanced Plasma (MET) thruster T4i REGULUS (ΔV : 500 m/s)

UHF + S-band TT&C Leaf Space Ground Stations Network

#### Drivers:

- To be completed before 2026
- Long transfer time: mission time up to 2 years
- High  $\Delta V$  transfer
- Close approach
- Large co

RDV approach:



### **Debris inspection: e.Inspector**



Started as a case study for the ESA Academy (2016) Phase 0 study done by ESA (2017) Phase A funded and performed by Polimi, Leonardo and Leaf Space (2020-2021) Phase B (B1 & B2) funded by Italy, kick-off this month (October 2022) SW/HW design refinement devoted to thermal and optical image processing Payload confirmation, performance and interface requirements Relative navigation confirmation (e.g. model matching versus feature based)

Raise custom OBC board TRL to >=6

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### Today's ADR session



- 1. Introduction by ESA (11:30 11:35)
- 2. ClearSpace and debris Removal (11:35 11:50)
- 3. Astroscale debris removal (11:50 12:05)
- 4. The Return Capsule Bay (CAT): designing and testing the ADR payload for the next future (12:05 12:20)
- 5. IOSHEX and Space Rider interaction as a new range of in-orbit complementary services in LEO (12:20 12:35)
- 6. The UK Space Agency's Active Debris Removal Mission (12:35 12:50)
- 13:00 end of session

