

ESA approach to best practices and standards for satellite servicing

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Towards a Zero Debris approach by 2030

1. ESA Standards Evolution



Step-by-step approach towards the implementation of the Zero Debris approach

2. Upgrade platforms



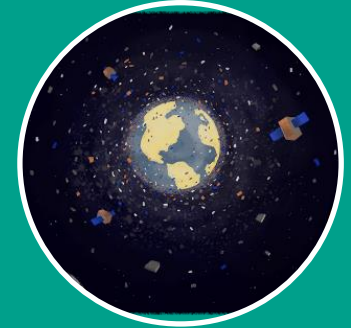
System level development and integration of innovative technology

3. Removal services



Demonstrate reliable services, establish standard interfaces

4. Improving operations

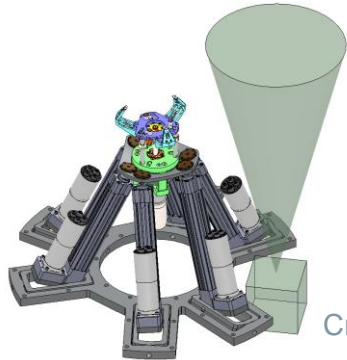


Expand the current processes, coordination and operational capabilities

Engage with partners to promote collaboration and capacity building through partnership

Technology development

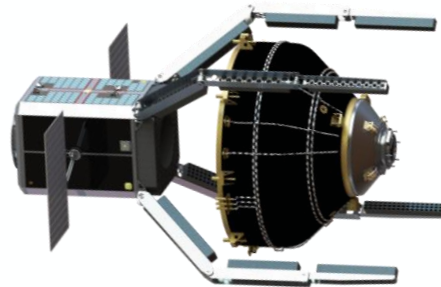
- Working on **removal technologies**,
e.g., Ground demonstration and testing, Capture Bay system and Design for Removal interfaces (CAT),



Credits: GMV/AVS

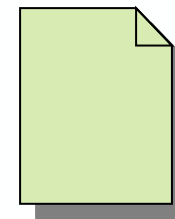
Missions

Working on the implementation of various **ADR and IOS missions**,
e.g. ClearSpace-1, SUNRISE, IOS, CAT IOD, etc.



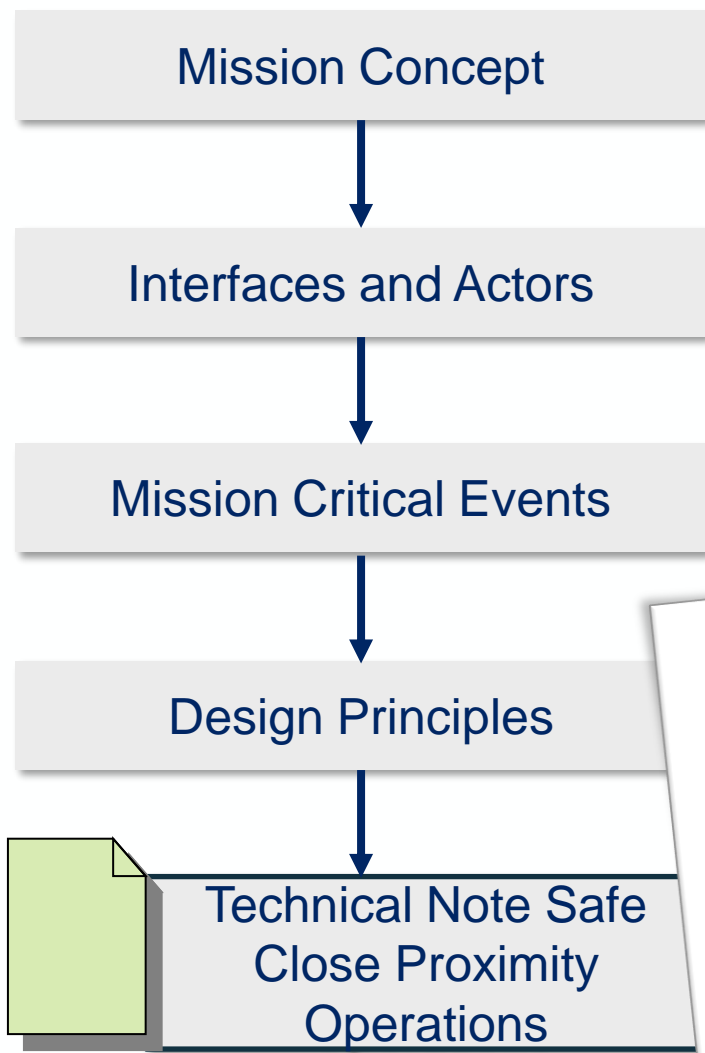
Standards

Lessons learnt compiled in **standards and guidelines**
e.g. Guidelines on Safe Close Proximity Operations, Interface Requirements Document for D4R, etc.

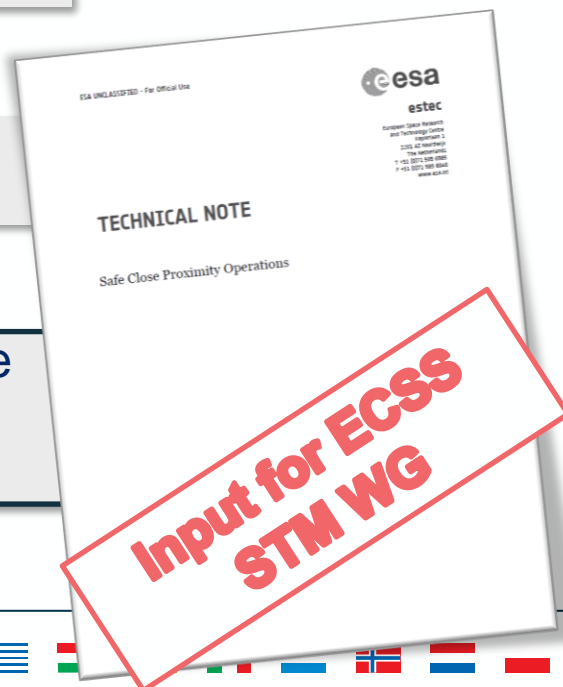


Close Proximity Operations - 2019-2021

European Close Proximity Operations Working Group



- I. Technical guidance and identification of potential licensing methods
- II. Capture of knowledge
- III. Protect the orbital environment and other assets
- IV. Enable international engagement



| European Stakeholder | |
|--|-----------------|
| Space System Integrators/ Suppliers/ Manufacturers | ADS |
| | TAS |
| | OHB |
| | Astroscale |
| | ClearSpace |
| | Deimos |
| | MDA |
| | D-Orbit |
| | Effective Space |
| | GMV |
| | SENER |
| | Ariane Group |
| | SSTL |
| | Avio |
| Agencies | UKSA |
| | CNES |
| | DLR |
| Operators | Eumetsat |
| | Eutelsat |
| | Avanti |
| Insurers | Hiscox |
| | AXA |
| Legal Partners | Eurospace |



Towards a Handbook on Close Proximity Operations

2018



2019

2021

2023

ESA Working Group

September 2018:

Technical Document on Guidelines for Safe Rendezvous and Capture for Commercial Missions

European WG

Service Providers

Operators

Agencies

Insurers

Manufacturers

Coordination

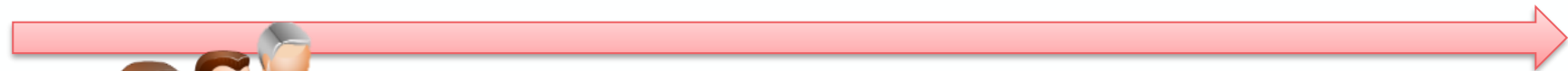
ECSS, ISO, European Operation Framework (EOF), CONFERS, UN

Oct 2021:

ESA Technical Note "Guidelines on Safe Close Proximity Operations" publicly released

Jun 2023:

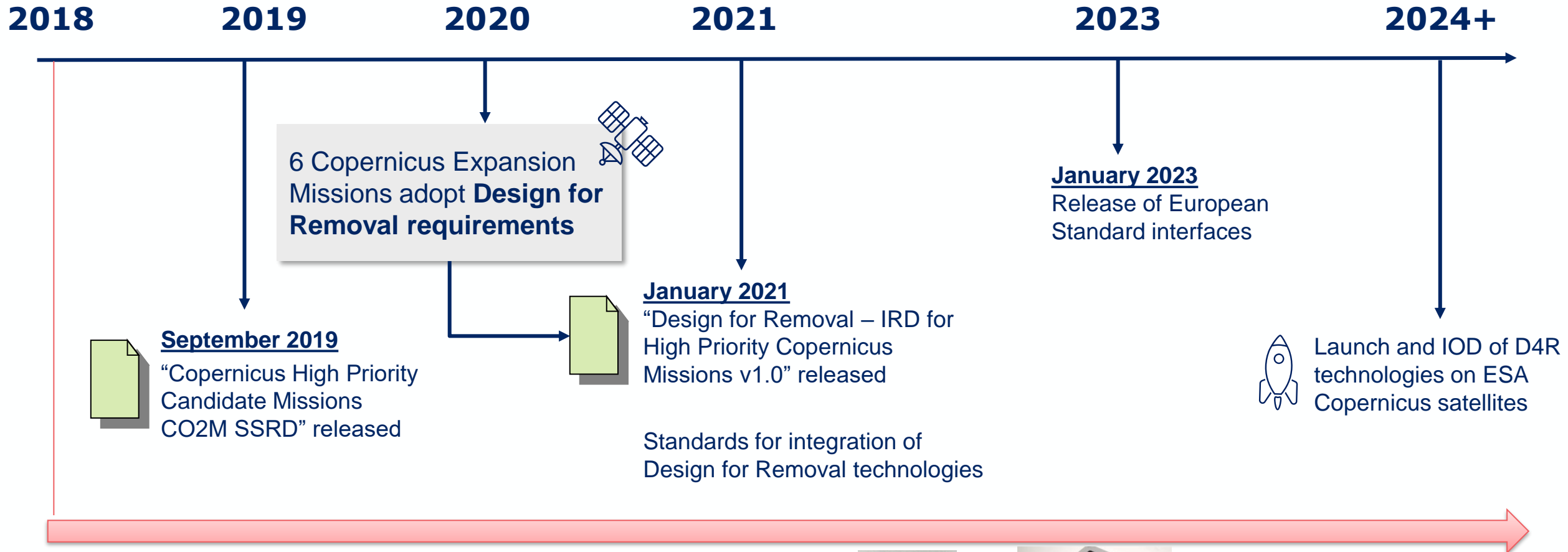
Draft ESA Handbook "ESA Close Proximity Operations Compliance Verification Guidelines"



Implementation of Industrial activities to support guideline specification / analysis of verification processes

Capturing other relevant best practices for servicing

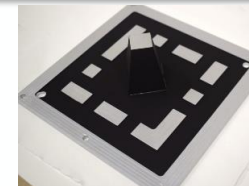
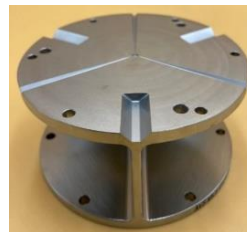
Design for Removal



Development of D4R technologies

→ TRL 8 by Q3 2023

e.g. mechanical capture interface, detumbling, 2D and 3D markers for RDV and ground tracking



Credits: GMV/AVS and Admatis

... 2019

2022

2026

2030+

R&D and Operations of collision avoidance system since 2002

Space Situational Awareness programme since 2009



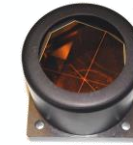
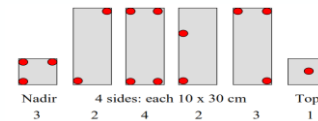
Expert Centers for tracking sensor calibration, qualification, and processing.

Laser technology push for improved tracking accuracy

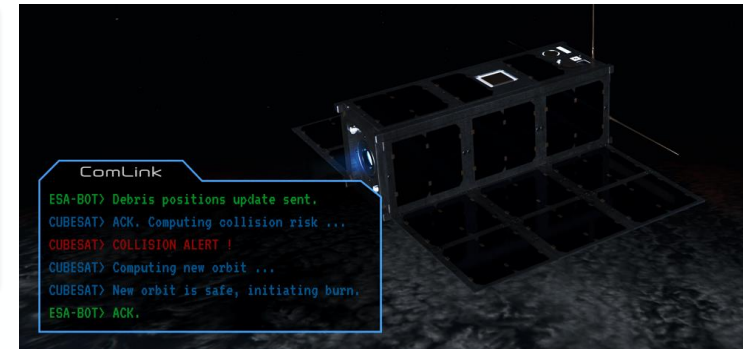
Collision Risk Estimation and Automated Mitigation

Software targeting secure operator to operator exchange and automate collision risk assessment

"Design to be seen" while Limiting impact on observers



On-orbit Demonstration of Automated Collision Avoidance (selected technologies)



Consolidation of efforts on international standardization of Space Traffic Coordination

Thank you for listening



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



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



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