ADRIOS/ClearSpace-1: Overview and Status

ESA Clean Space Industrial Days - 21-Sep-2021

Muriel Richard-Noca

clearspace
today

Agenda

- Mission Objectives
- Team and Schedule
- Mission Reference
- Major Achievements
- Outlook

Mission Objectives

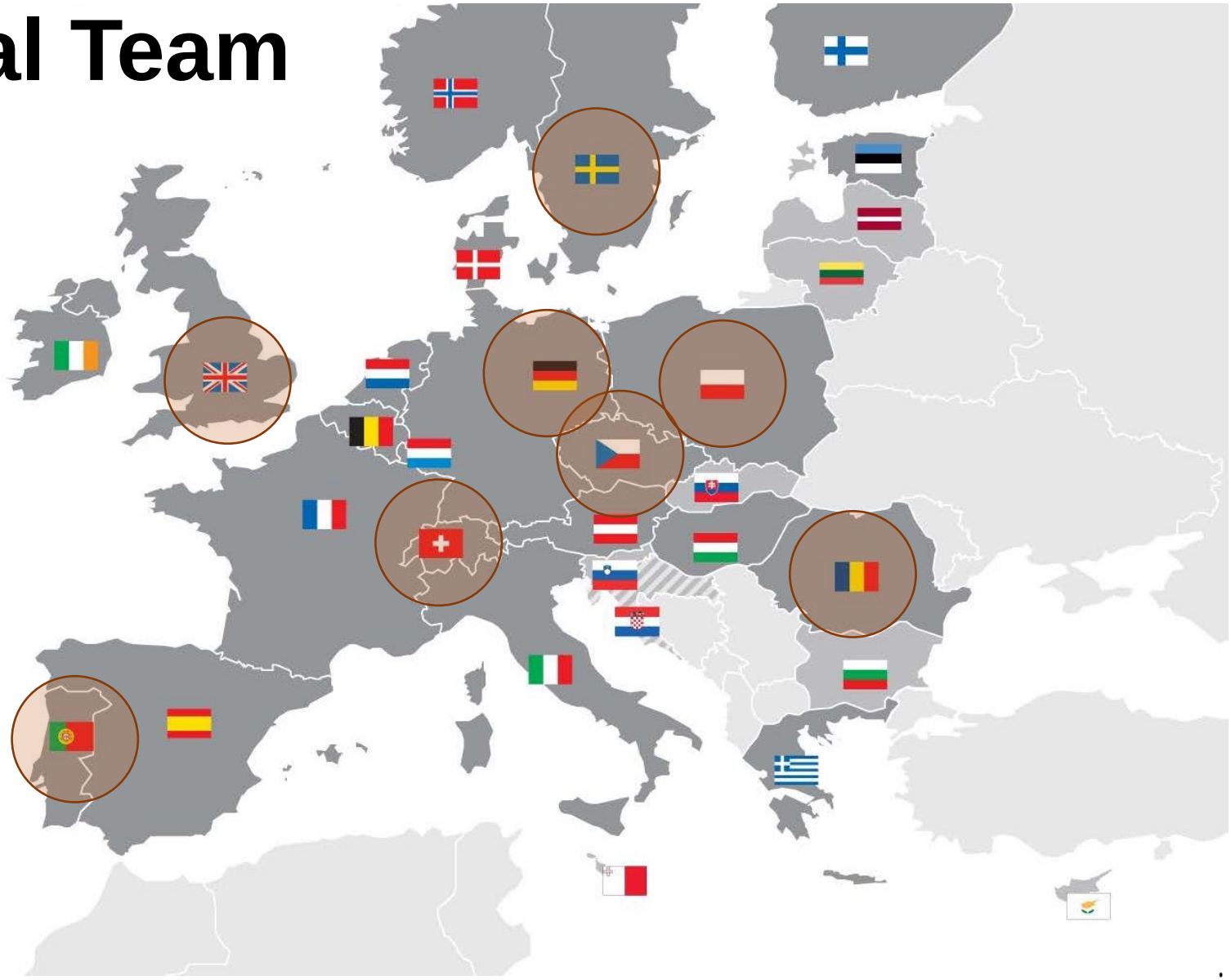
- SR.1 Remove from orbit ESA-owned object(s) with a total mass greater than 100 kg by no later than end 2025.
  - Success criteria: Confirmation by CSpOC of the target atmospheric entry (disappearance from ground radar track).

- SR.2 Demonstrate, in orbit, feasibility of critical technologies enabling other (commercial) in-orbit servicing opportunities.
  - Success criteria: Demonstration of the successful capture of VESPA and its associated GNC, and in-orbit or on-ground verification of at least [2] technologies necessary for future commercial applications.

- SR.3 Provide a robust business model for in-orbit servicing activities beyond the Service to be provided to ESA.
  - Success criteria: Demonstration of letter of interest or equivalent from future service customers is available KPG2/EoS.

- SR.4 Comply with space debris mitigation requirements.
  - Success criteria: ESA accepts verification of CS-1 compliance to ECSS-U-AS-10 Rev.1 (3rd of December 2019) Space sustainability. Adoption of Notice of ISO 24113: Space systems – Space debris mitigation requirements.

Industrial Team



deimos elecnor group

Critical software

AIRBUS

OHB SWEDEN

CBK PAN

CATAPULT Satellite Applications

ENEA

EPFL

AIUB

HEIG VD

APCO TECHNOLOGIES

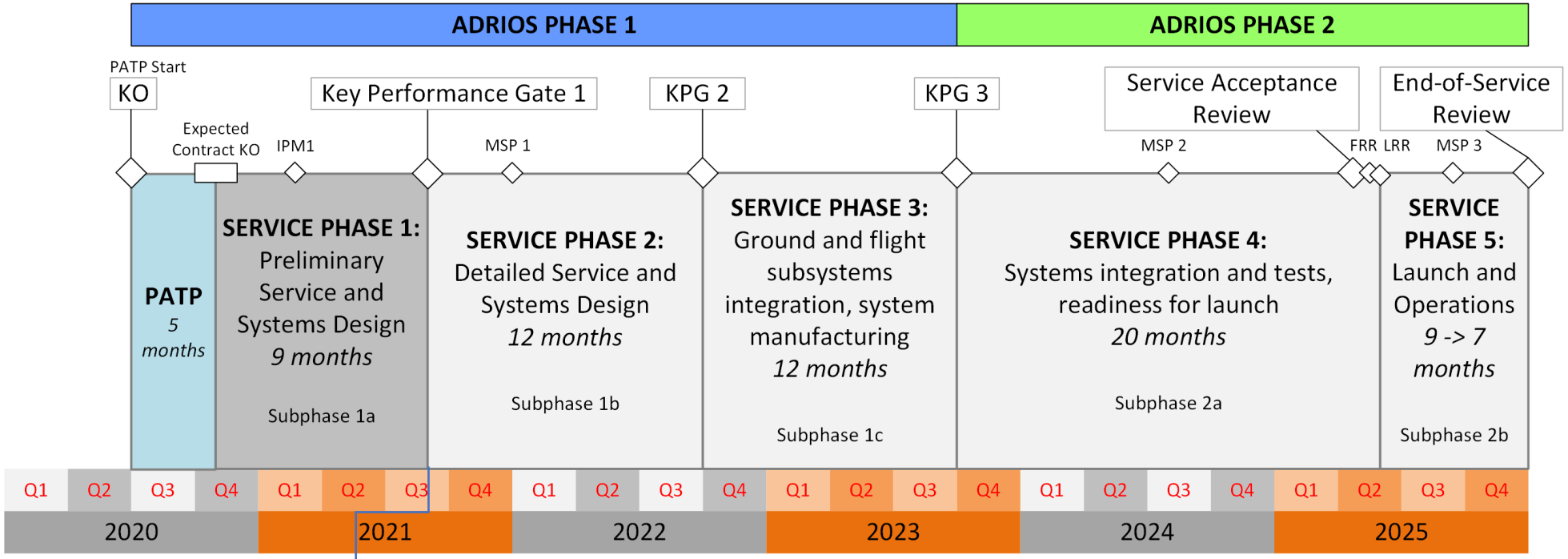
SYDERAL ELECTRONICS AND SOFTWARE

Together ahead. RUAG

nanospace

microcameras.space

Project Schedule



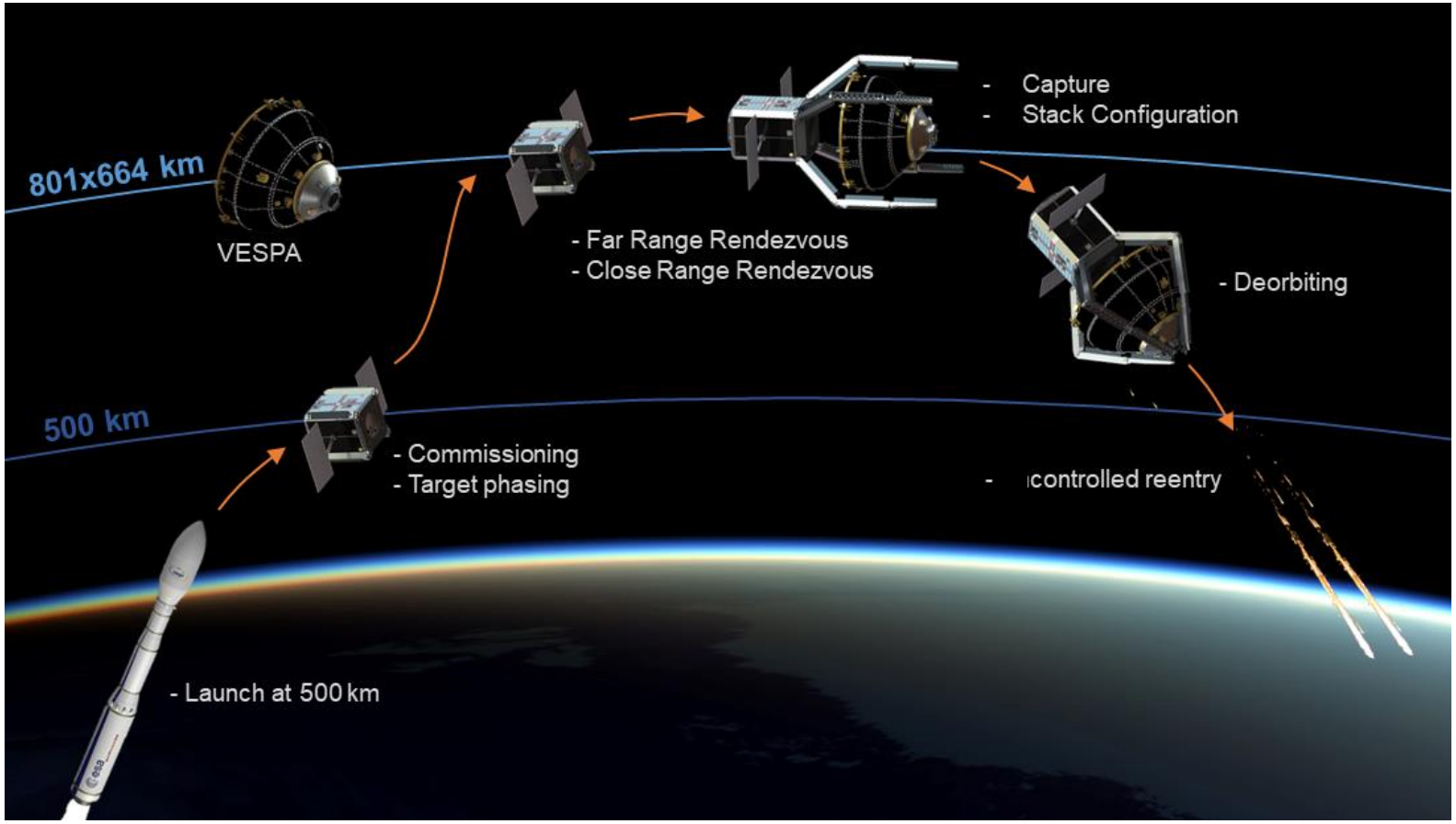
KPG1 Criteria

- Standards tailored
- Full Consortium
- Design & TRL
- Dev + Verif. Plans
- Cost & schedule

SP2: S/S + Equipmt Procure-ments

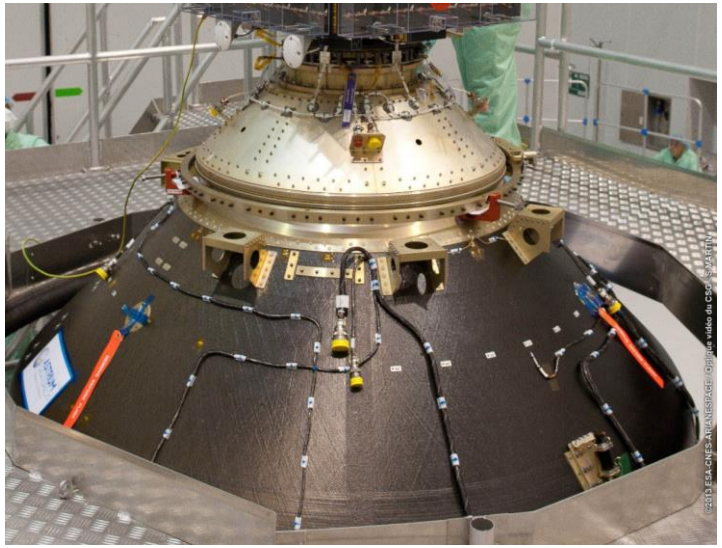
Mission Reference

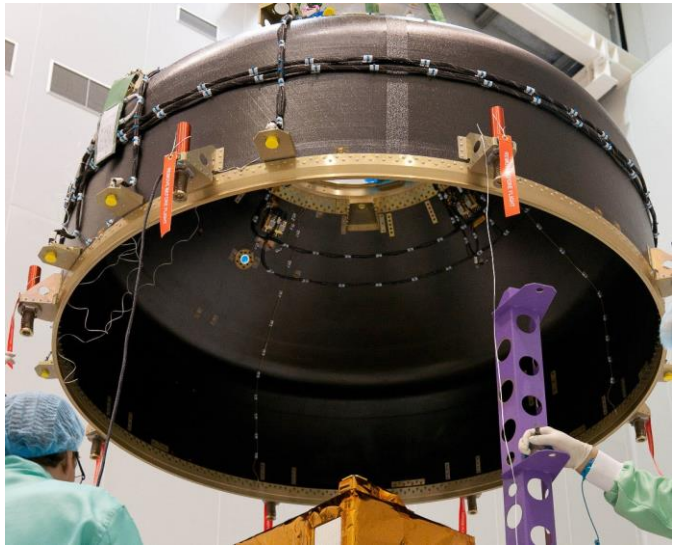
- Uncooperative tumbling target
- Rendezvous concept
  - Far range
    - NAC, AoN
  - Mid-range
    - NAC, Radar, Formation Flying
  - Fly-around
    - Additional sensors testing
  - Proximity operations
    - Test operations with Capture system open/closed
    - Test force motion
  - Close-range
    - Target pose estimation
    - Forced motion
    - Rate matching, 6DoF motion Synch
  - Capture
  - Detumbling & CoG alignment
- Stacked controlled re-entry



Target VESPA

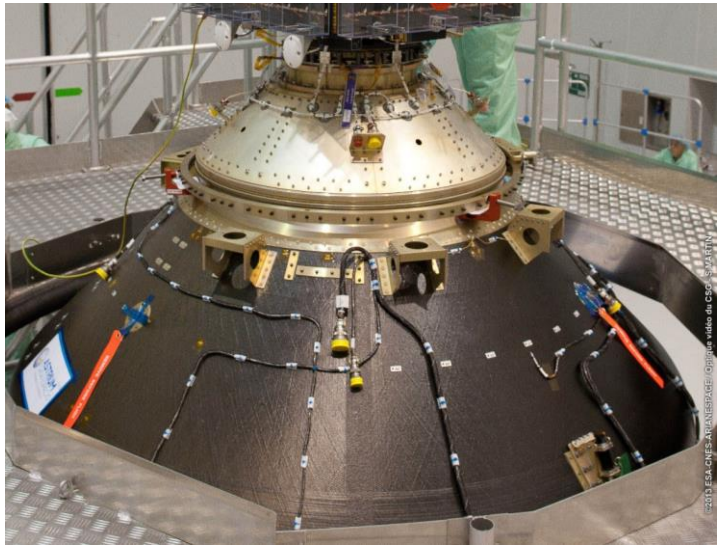
- Design
  - As-built configuration and documents not available to the project
  - Limited access to pictures and mass properties tables
  - ClearSpace reconstructed baseline structure based on pictures and material information
  - Mass ~ 110 kg
  - 1.8-m height, 2-m base diameter
- Properties
  - Expecting CFRP samples to consolidate assumptions

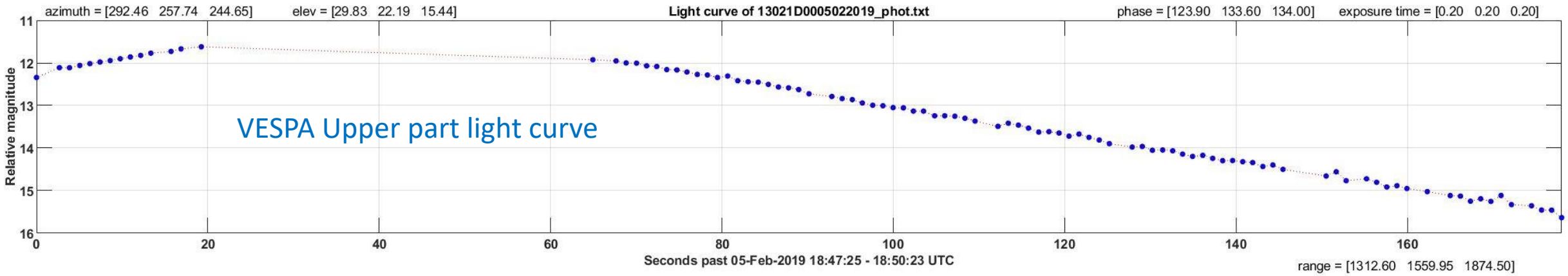




Target VESPA

- Attitude
  - Observations point to low tumbling rate with large uncertainty around axis of symmetry
  - Expect changes in optical properties and loose cables in flight

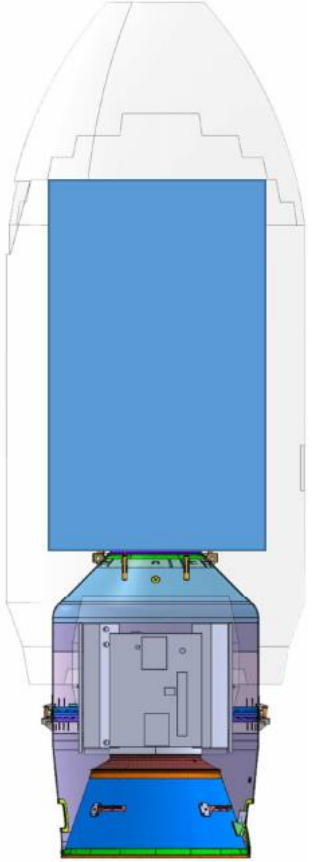


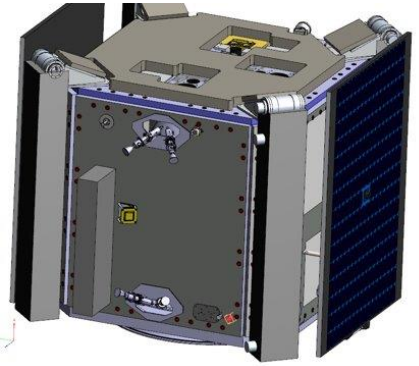


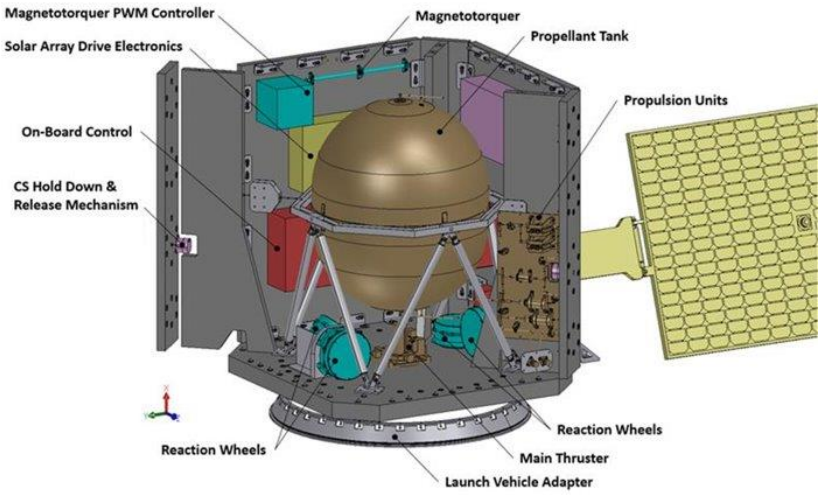
VESPA Upper part light curve

System reference definition

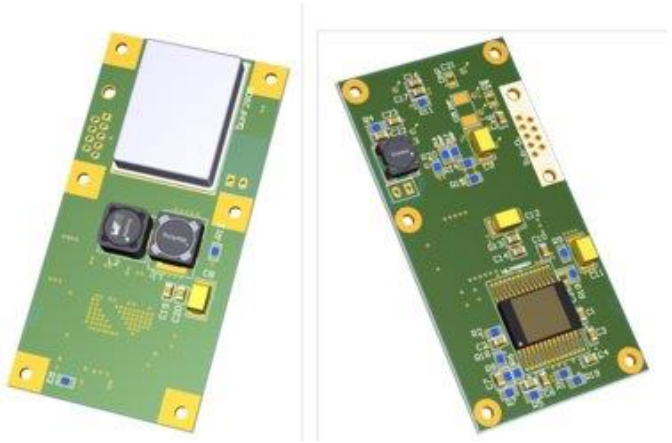
- Operation concept and timeline
- Launch opportunities
- Mission, System, Flight and Ground Segments requirements, Subsystems/equipment on-going
- Chaser design and capabilities
  - Mass ~ 370 kg dry, ~ 450 kg wet
  - Power ~ 600 W generated
  - S-band ~ 4 Mbps, X-band ~25 Mbps
- In-orbit safety and FDIR concepts
- System and control modes
- Ground functions, architecture and technologies
- Capture system, GNC, Software technologies on their way to TRL 4

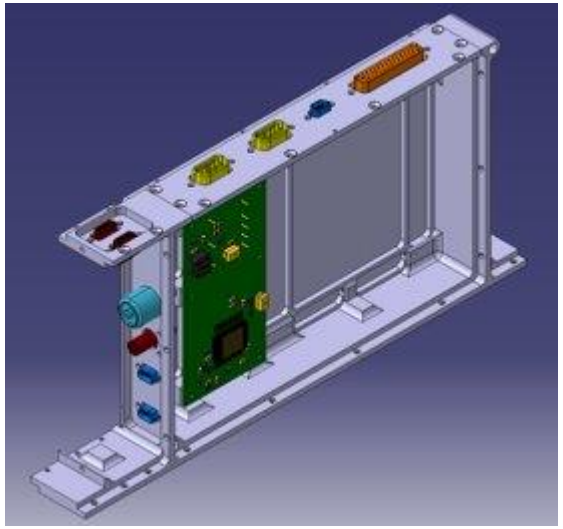




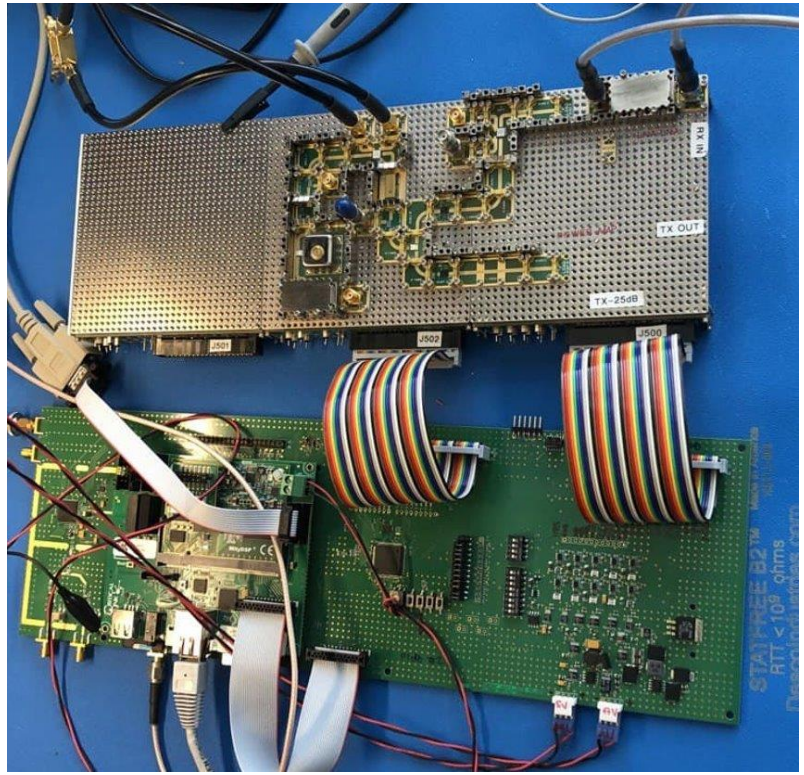


On-board Computer Housing Prototype





Rel. Nav. RADAR EBB field test



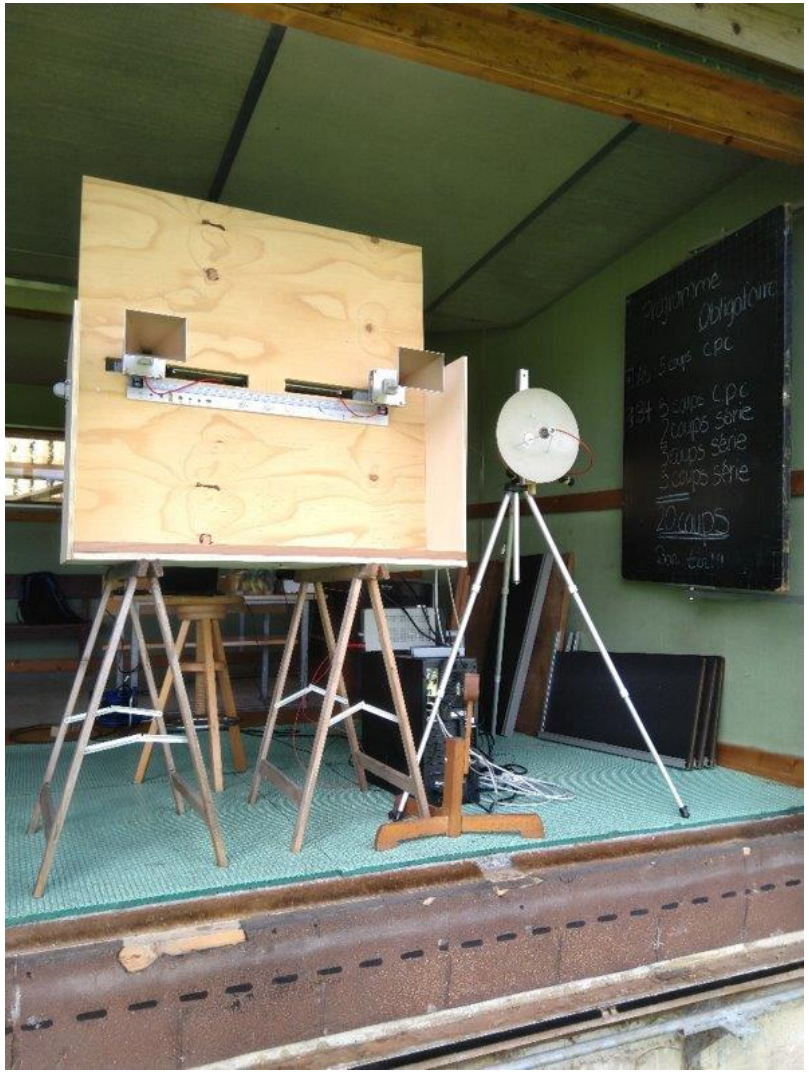
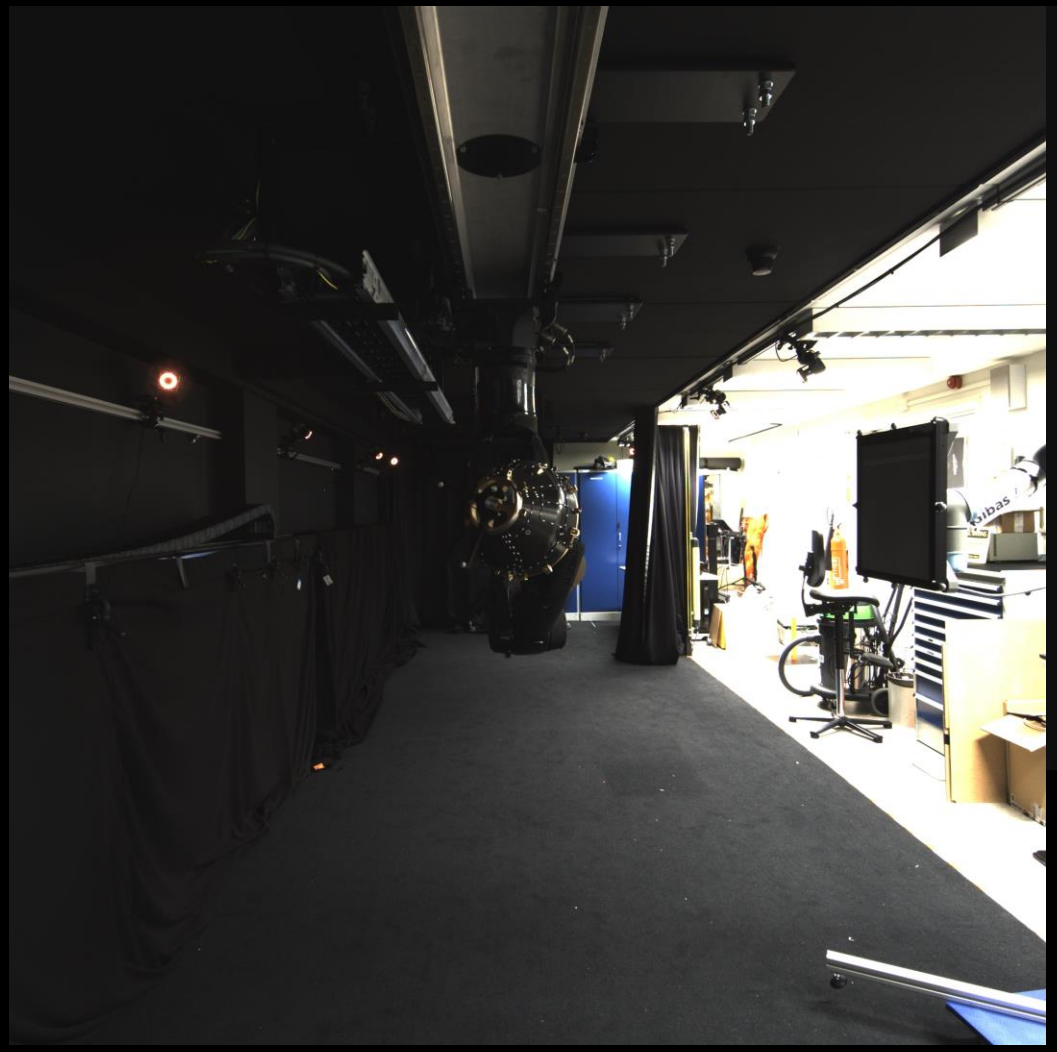
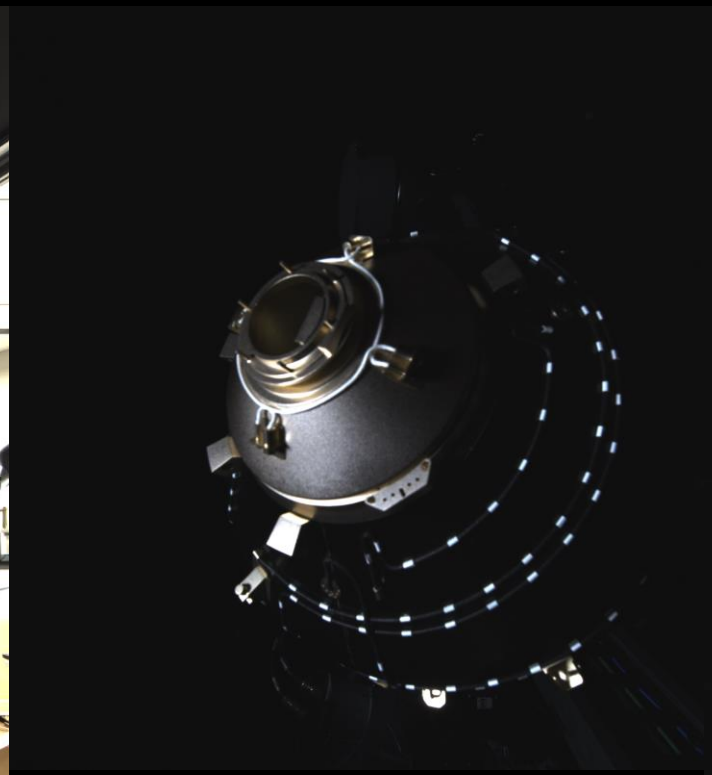
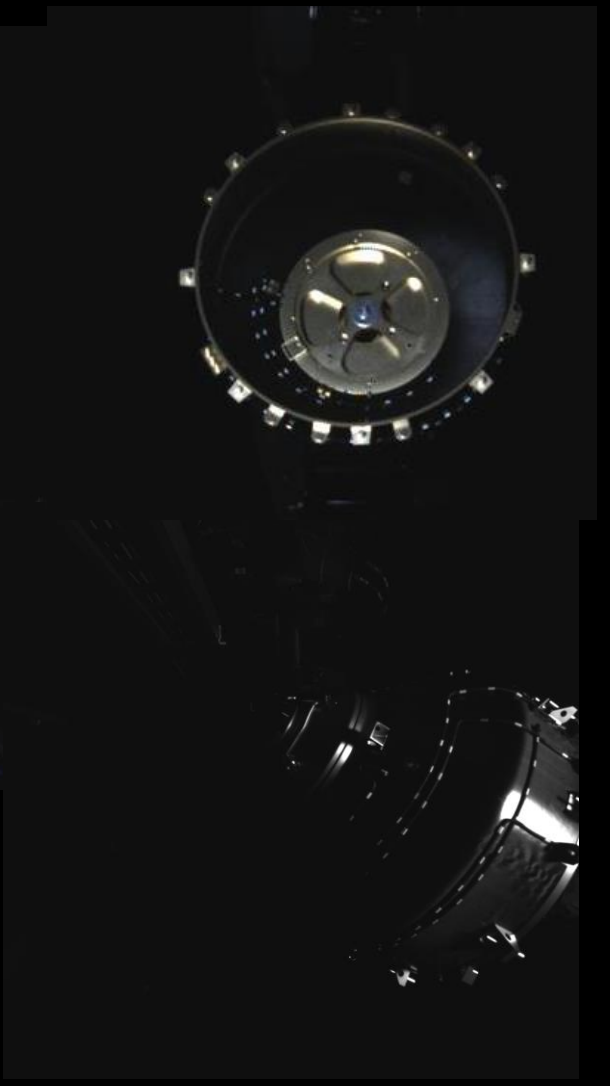


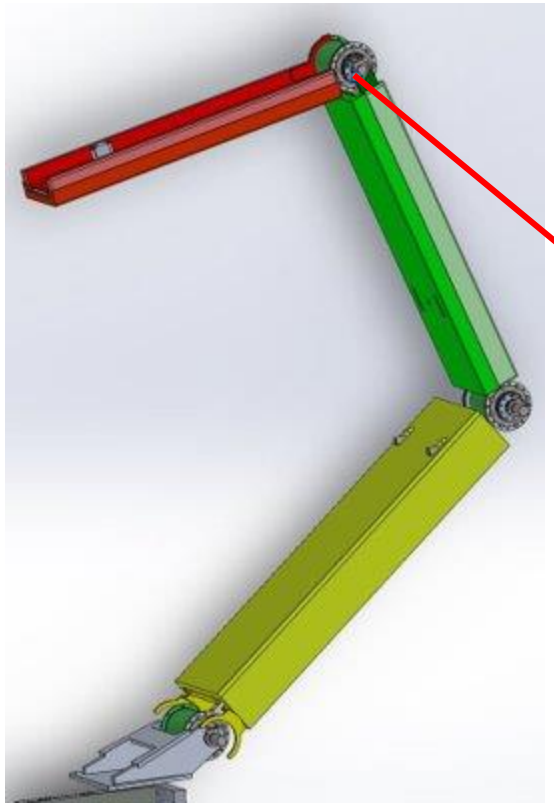
Image acquisition campaign in ESA GRALS

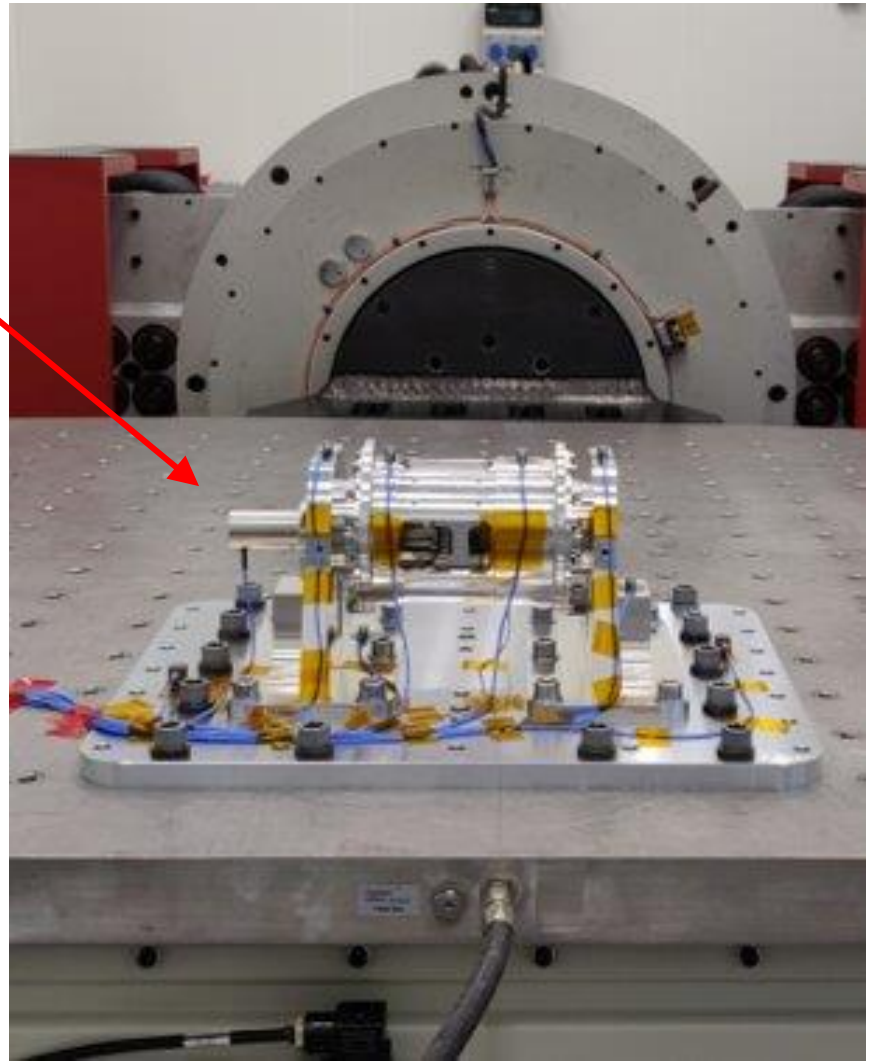


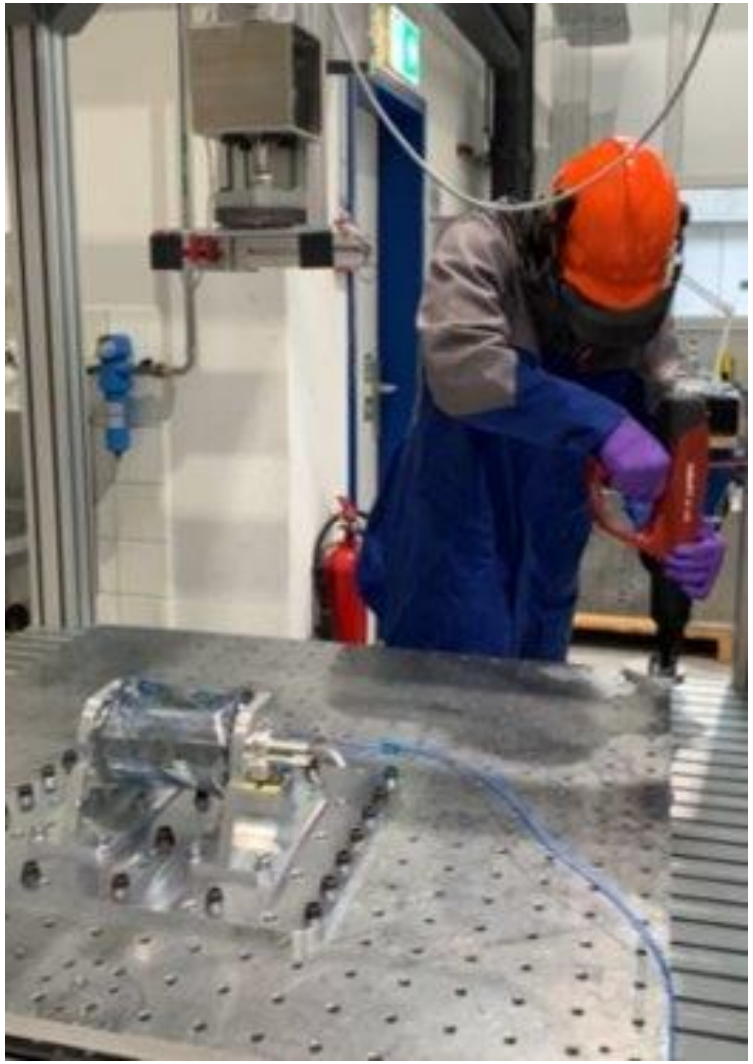




Capture System EM tests

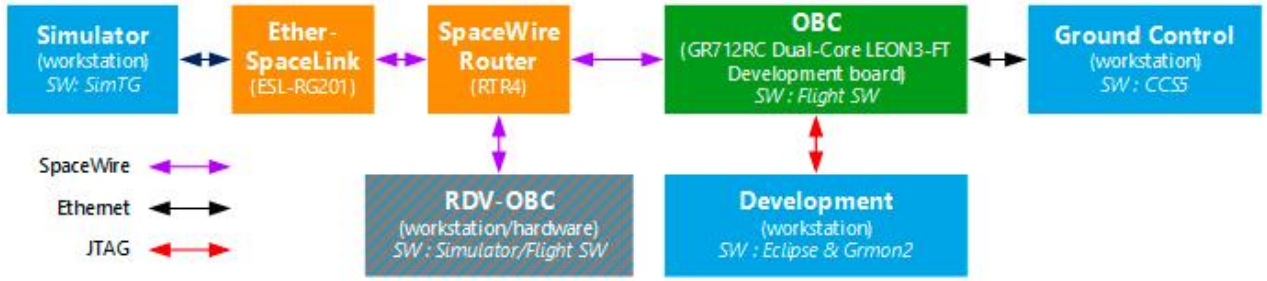






FlatSat MCS/Database <-> FSW remote tests

Database



FSW v1.0 TC Acknowledgement

Dashboard

Conclusion and Outlook

- In this first year of mission definition:
  - ClearSpace established a competent team from 7 FTEs to 35 FTEs
  - 15+ industrial partners were subcontrated
  - The mission, system, segments and subsystems architectures, performance and requirements were established
  - Key technology tests were performed

- The project is now focused on the confirmation of the baseline design, the readiness of the technologies, and confirmation of the industrial team for KPG1

- As a company, ClearSpace has opened offices and is hiring in CH and UK

Thank you!

muriel@clearspace.today