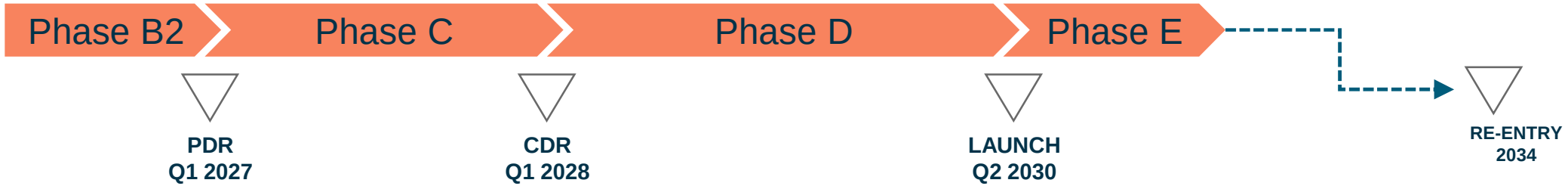
ADRIOS CLEARSPACE –1

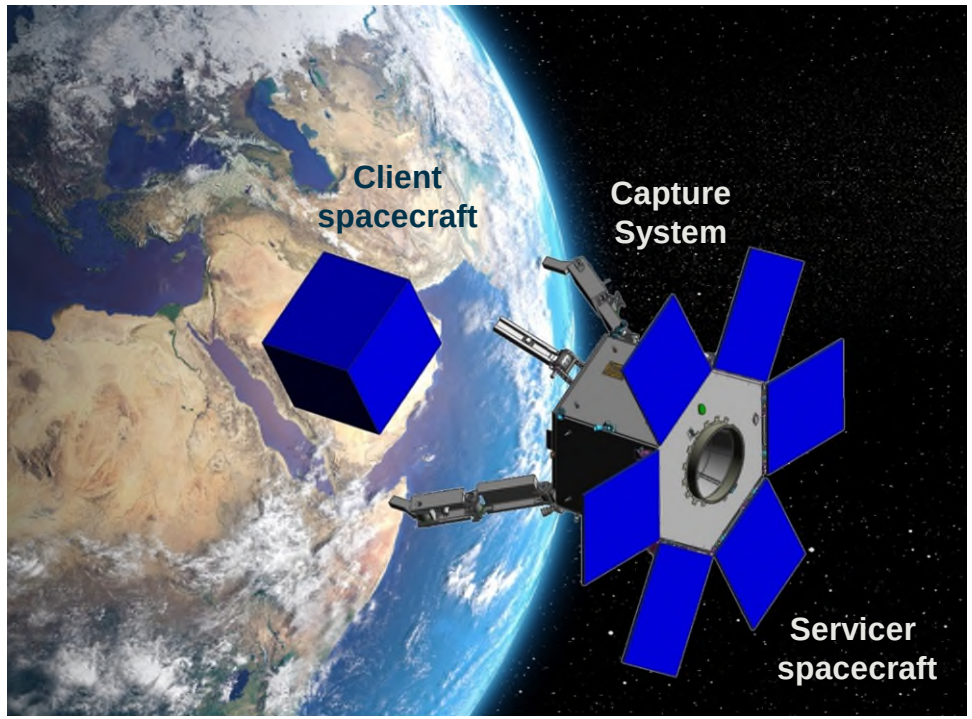
CLEANSPACE DAYS

CS-1 TEAM, 01.07.2026

CLEARSPACE-1 MISSION

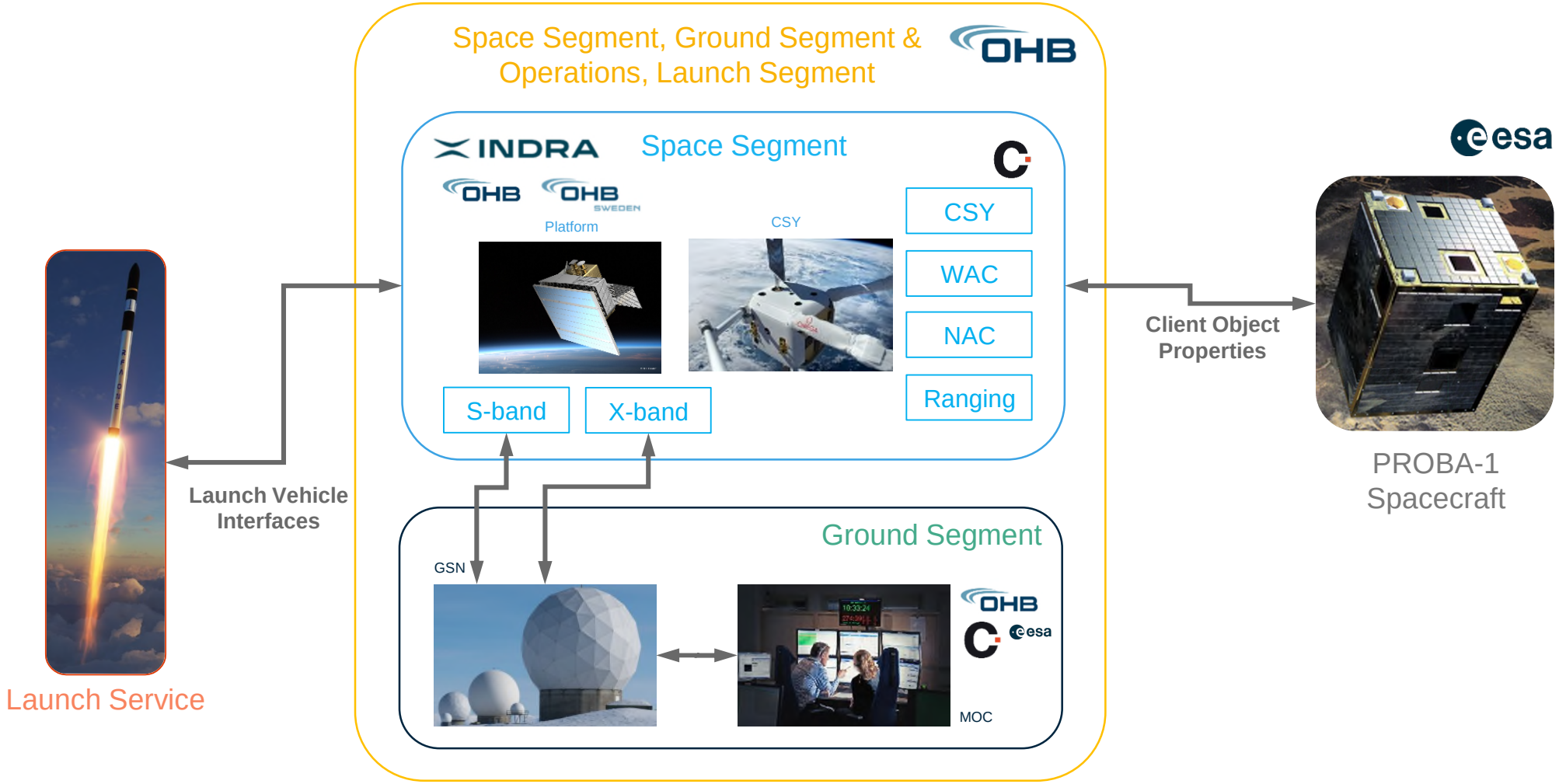


- First ever removal of a non-cooperative and unprepared client space object
- Visible and concrete implementation of ESA Zero Debris policy
- Validating key technologies and capabilities for agile operations in compliance with Space Debris Mitigation Requirements and Re-entry Safety Requirements
- Paving the way to more complex removal and other in-orbit services in the future
- Of high relevance for dual-use applications
- Promising domain of cooperation with the European Commission



MISSION OVERVIEW

SUBTITLE



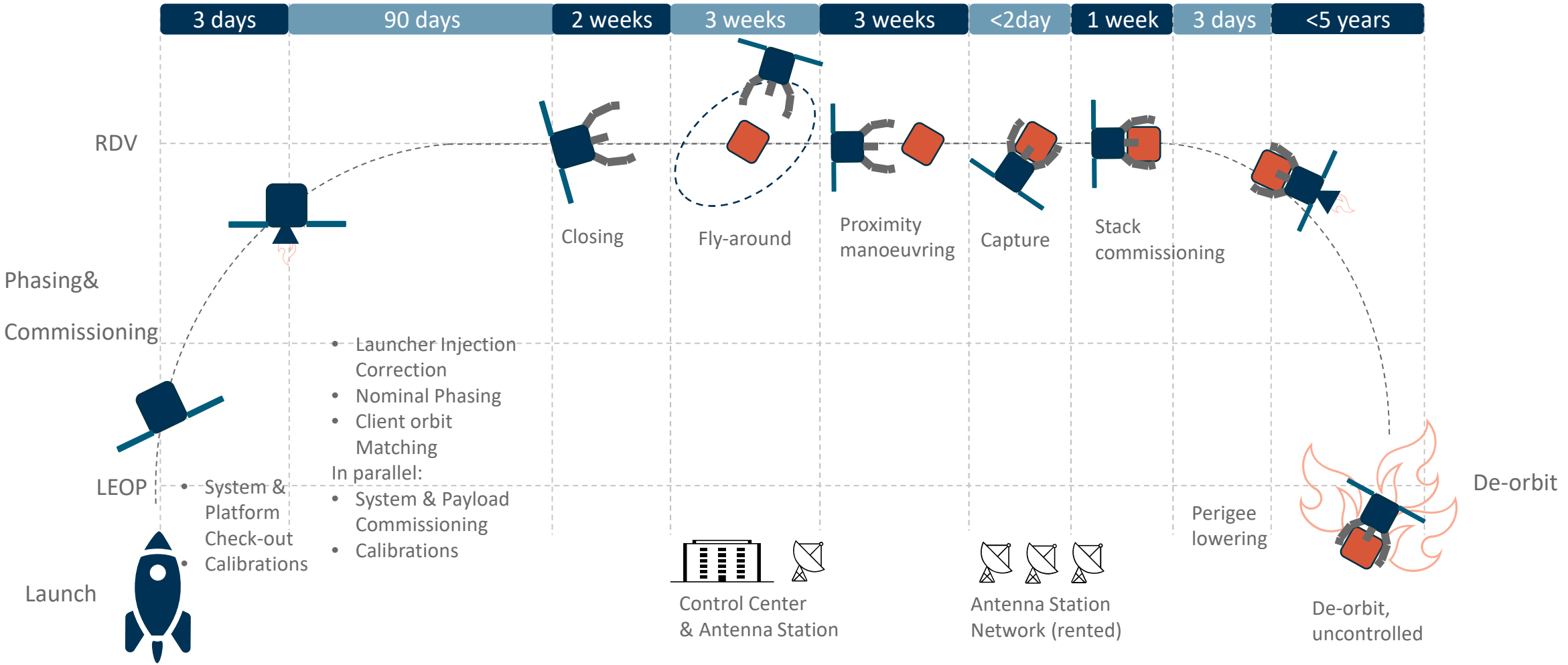
MISSION OBJECTIVES

SUBTITLE

- Demonstrate the functionalities required to safely approach a space object in low Earth orbit into close proximity
- Determine the Client object's relative position and attitude by visual means.
- Demonstrate far-range relative navigation, mid-range relative navigation, and close-range relative navigation, including pose estimation of the Client object.
- Demonstrate motion synchronisation with the Client object before a capture attempt.
- Demonstrate the capability of the Servicer spacecraft to avoid collision with the client by Collision Avoidance Manoeuvre.
- Demonstrate the safe capture of the tumbling non-cooperative, unprepared client
- Demonstrate the ability to relocate the stack in orbit
- Ensure the Servicer / Client stack being in an orbit with a natural orbital decay duration of up to 5 years at the end of the mission.

CONOPS

SUBTITLE



CLIENT OBJECT

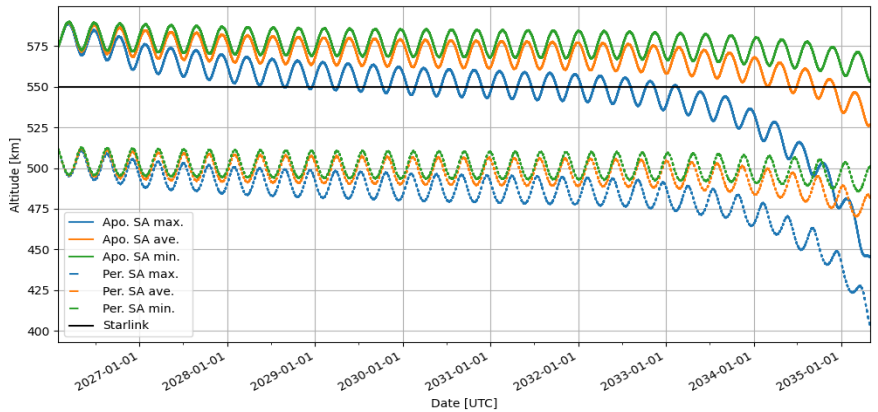
SUBTITLE

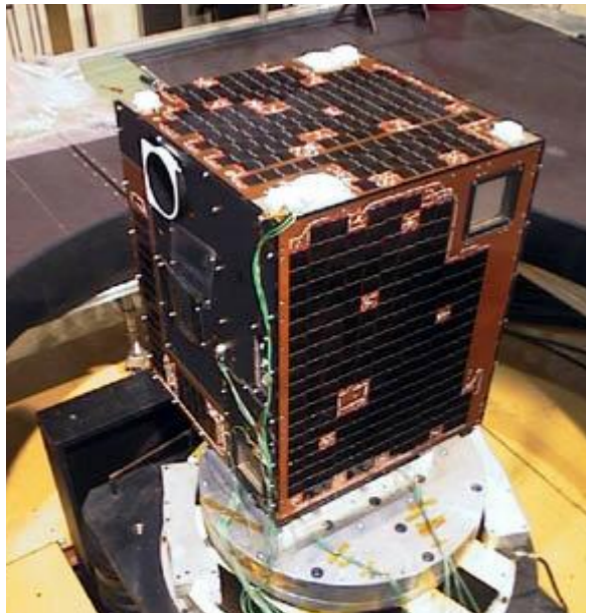
ESA owned satellite, currently still operational (ESA's longest operational mission in space, 20+ years)

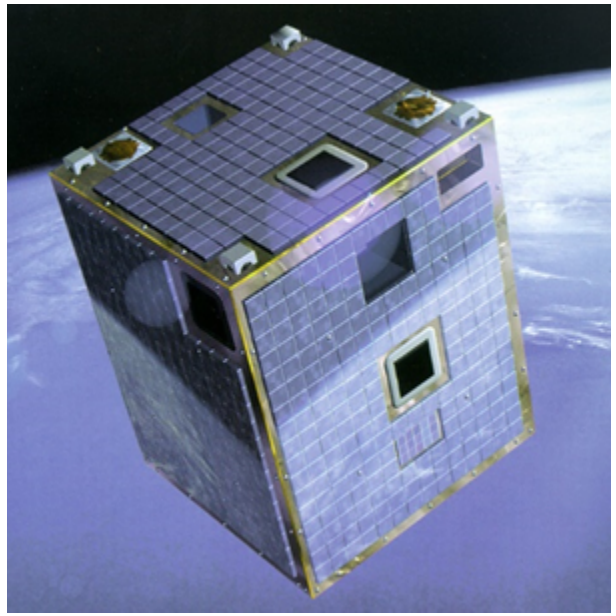
PROBA-I Fact Sheet:

- Mass: 95.18 kg (including launch interface ring)
- Dimensions: 60 cm x 60 cm x 80.5 cm
- Launched in October 2001
- Nominal operational orbit: 542 x 657 km LEO SSO, LTDN 10:30

Client mean apsis altitude (J2000)

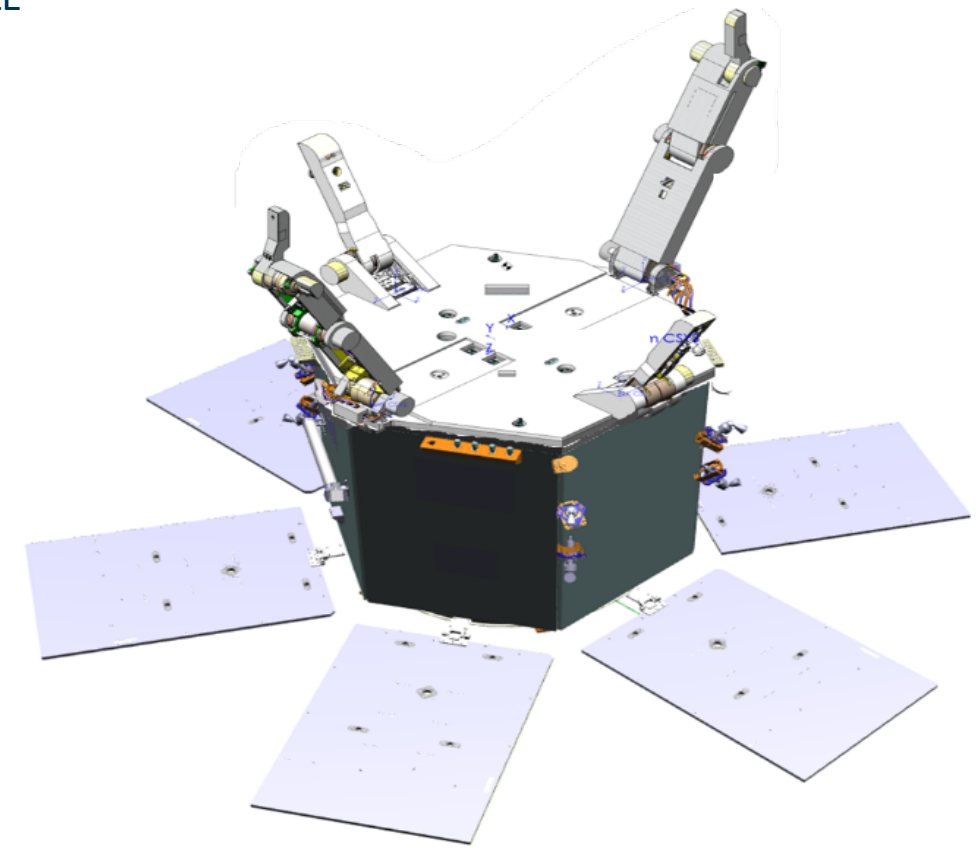




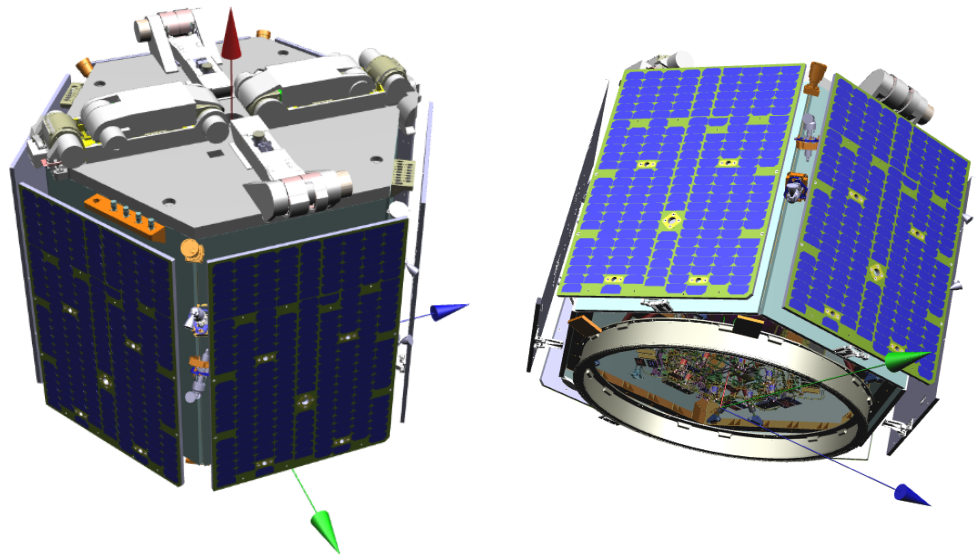


SERVICER OVERVIEW

SUBTITLE



Fully deployed configuration



Stowed/launch configuration

Dimension	Delta V	Mass
3.9 m × 3.9 m × 2.5 m	350 m/s	600 kg (wet)

SERVICER OVERVIEW

SUBTITLE

OHB

INDRA OHB SWEDEN

clearspace today

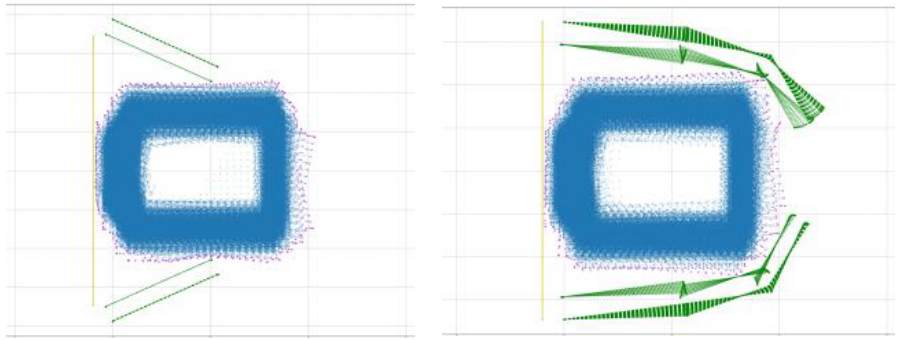
- Spacecraft key functions
    - Visual-based relative navigation with Narrow Angle Camera (NAC) and Wide Angle Camera (WAC) and pose estimation algorithm
    - Range measurement to client spacecraft
    - On-board observation of capture operation with Media Camera
    - Capture System compatible with the client spacecraft geometry and characteristics
    - Data downlink through X-band
    - Power generation with 6 solar arrays, power distribution, storage
    - TMTC through S-band link
    - Attitude and orbital control with GNSS, sun sensor, gyro, star trackers, magnetometers, reaction wheels, magneto torquers
    - 6 DOF chemical propulsion system

CAPTURE SYSTEM

SUBTITLE

Capture System features

- Autonomous client detection within the capture envelope
- Motion of arms to enclose, grasp and securely capture the client
- Absorption of the contact loads and avoidance of damage to the client or the servicer by force limitation
- Securing of the client for stack formation



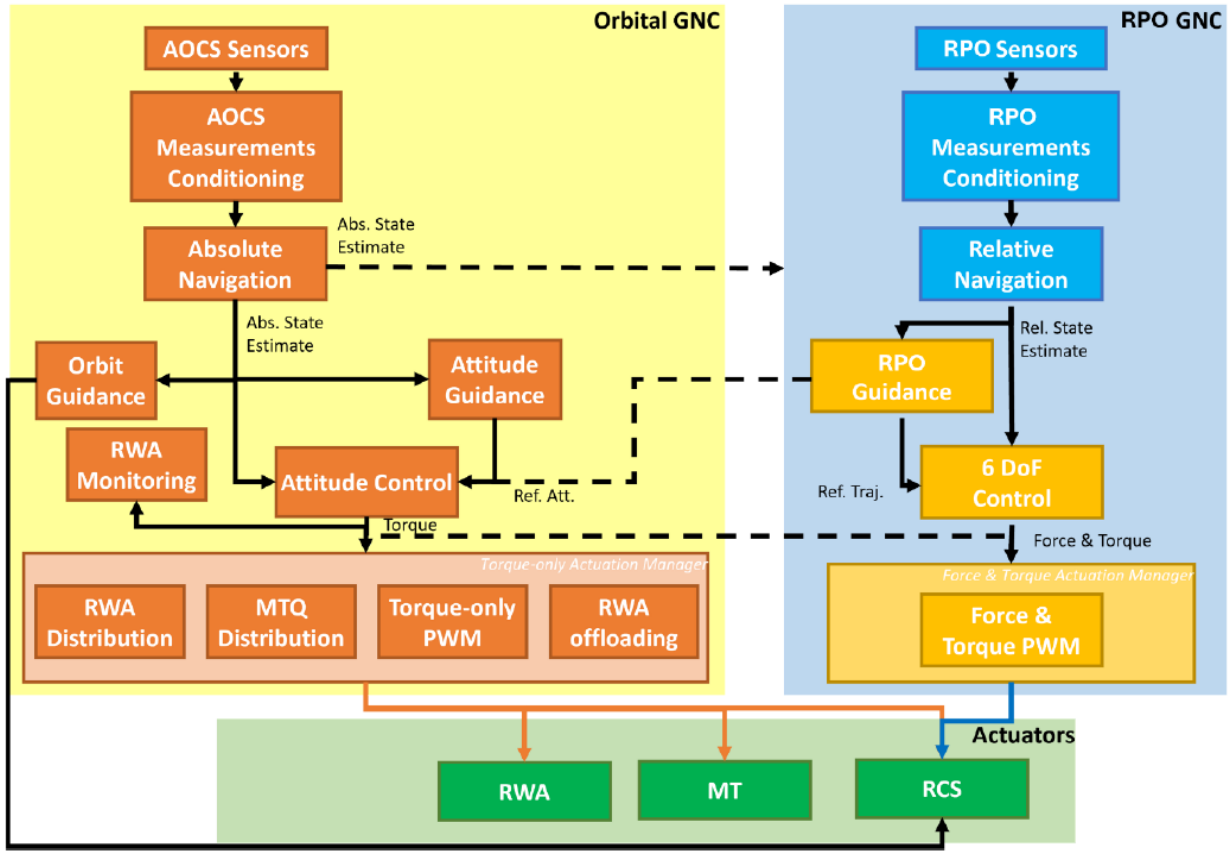
Encompassment of client spacecraft
[image courtesy: ClearSpace]

Assembly of an Arm EM meant for extensive testing
[image courtesy: ClearSpace]

GNC

GNC ARCHITECTURE

- GNC supports the fulfillment of the different mission phases.
- Although designed as an integrated unit, it covers two major sets of functional needs:
  - **Attitude and Orbit Control System**
    - Dedicated to the absolute 6D motion.
    - Needed for all mission phases, but acting stand alone before rendezvous and after capture.
  - **Rendezvous GNC**
    - Dedicated to the 6D motion relative to the target.
    - Complemented by AOCS functions.
    - Dedicated sensors & solutions for capture: NAC/WAC and associated Image Processing algorithms, ranging device.



GNC

GNC FUNCTIONALITIES TO SUPPORT THE RENDEZVOUS AND CAPTURE

- **Control**
  - **Target pointing** to orient the relative sensors towards the target,
  - **Stack detumbling and deorbiting** to control the stack,
  - **Relative Control**, for regulating and tracking the S/C translational and rotational states relative to the target.
- **Relative Navigation**
  - **Angles-Only Navigation**, detecting the target using centroids of the images taken with the Narrow-Angle Camera,
  - **3D Navigation** combining direction to the target and a range measurement from the ranging device,
  - **Pose Estimation**, estimating pose when the image of the target is large enough,
- **Guidance**
  - **Impulsive delta-V** with passively safe trajectories based on natural dynamics for closing and fly-around,
  - **Forced motion** to approach the target along its dynamic, tumbling motion.

CONSORTIUM SET-UP

SUBTITLE

OHB

INDRA

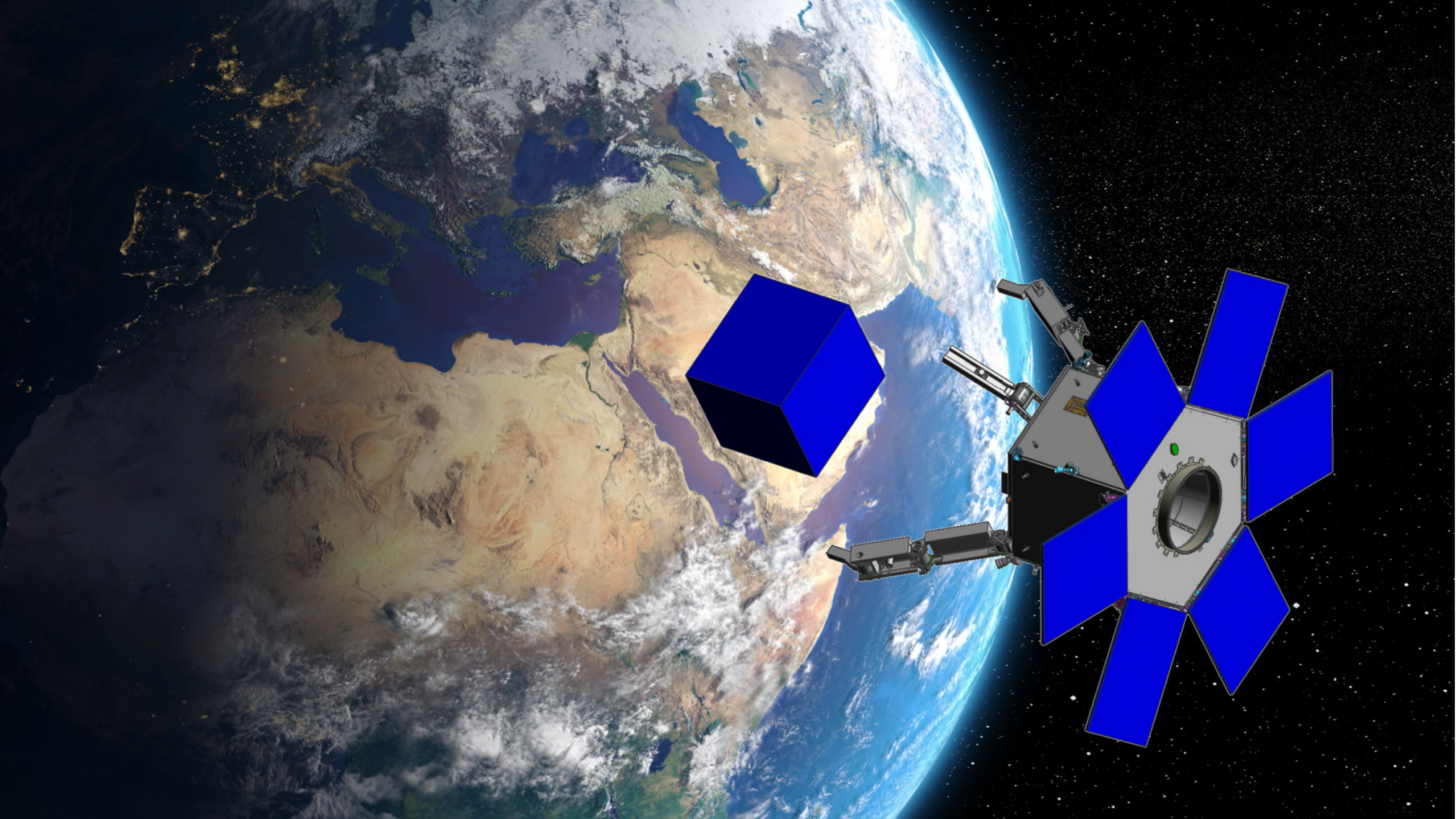
OHB SWEDEN

clearspace today

- **OHB System**: Prime and System Lead, in charge of different platform functionalities
- **ClearSpace**: Payload prime and core team member in charge of RPO GNC and other platform functionalities closely linked to proximity operations
- **OHB Sweden**: core team member in charge of different platform functionalities for example propulsion
- **INDRA Deimos**: core team member in charge of GNC

The END

THANK YOU FOR YOUR ATTENTION



THANK YOU!

OHB SE
Manfred-Fuchs-Platz 2-4
28359 Bremen
Germany

Phone: +49 421 2020 8
Fax: +49 421 2020 700
Email: info@ohb.de
Web: www.ohb.de