sener

17/10/2023

SENER’s Perspective on ADR

Leading innovation through technological differentiation

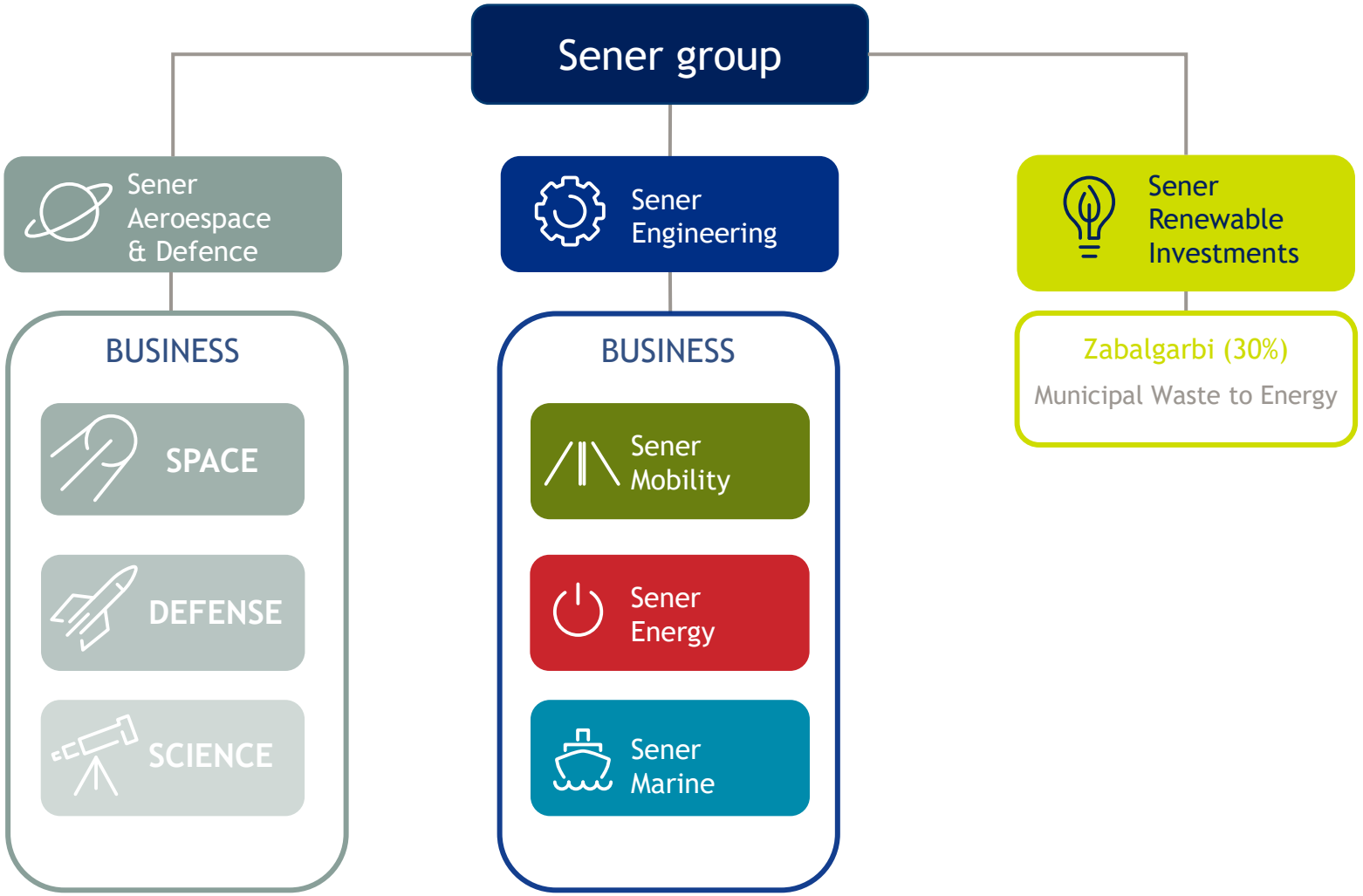
With the strength of a global leader, Sener Group looks to the future by leveraging innovation and reinventing excellence, adapting it to new demands.

Our passion for technological challenge drives us to systematically consider how to offer a differential value in the realization of projects through new and better technologies

Sener group

Organization chart

Sener is a privately owned engineering and technology group.



Global footprint

Group 2022

AMERICA

ARGENTINA
Buenos Aires

BRAZIL
São Paulo

CANADA
Toronto

CHILE
Santiago de Chile

COLOMBIA
Bogota

MEXICO
Mexico City

USA
Los Angeles

EUROPA / ÁFRICA

SPAIN
Barcelona
Bilbao
Madrid
Valencia

POLONIA
Warsaw

PORTUGAL
Lisbon

UK
London

BELGIUM
Brussels

EGYPT
Cairo

MOROCCO
Rabat

SOUTH AFRICA
Johannesburg

ASIA

SAUDI ARABIA
Riyadh

CATAR
Doha

UAE
Abu Dhabi

CHINA
Shanghai

SOUTH KOREA
Busan

Engineering & Aerospace
Renewable Investments

Sener

SENER AEROSPACE & DEFENSE

- Space
- Defense
- Science

SENER MOBILITY

- High speed railways
- Freight & mainline railways
- Metro systems
- LRT's & tramways
- Roads & highways
- Airports
- Ports
- Architecture
- Water & environment

SENER ENERGY

- Hydrogen & carriers
- Circular economy
- Gas
- Power
- Renewables and storage
- Wind and marine energies
- Sustainable industry

SENER MARINE

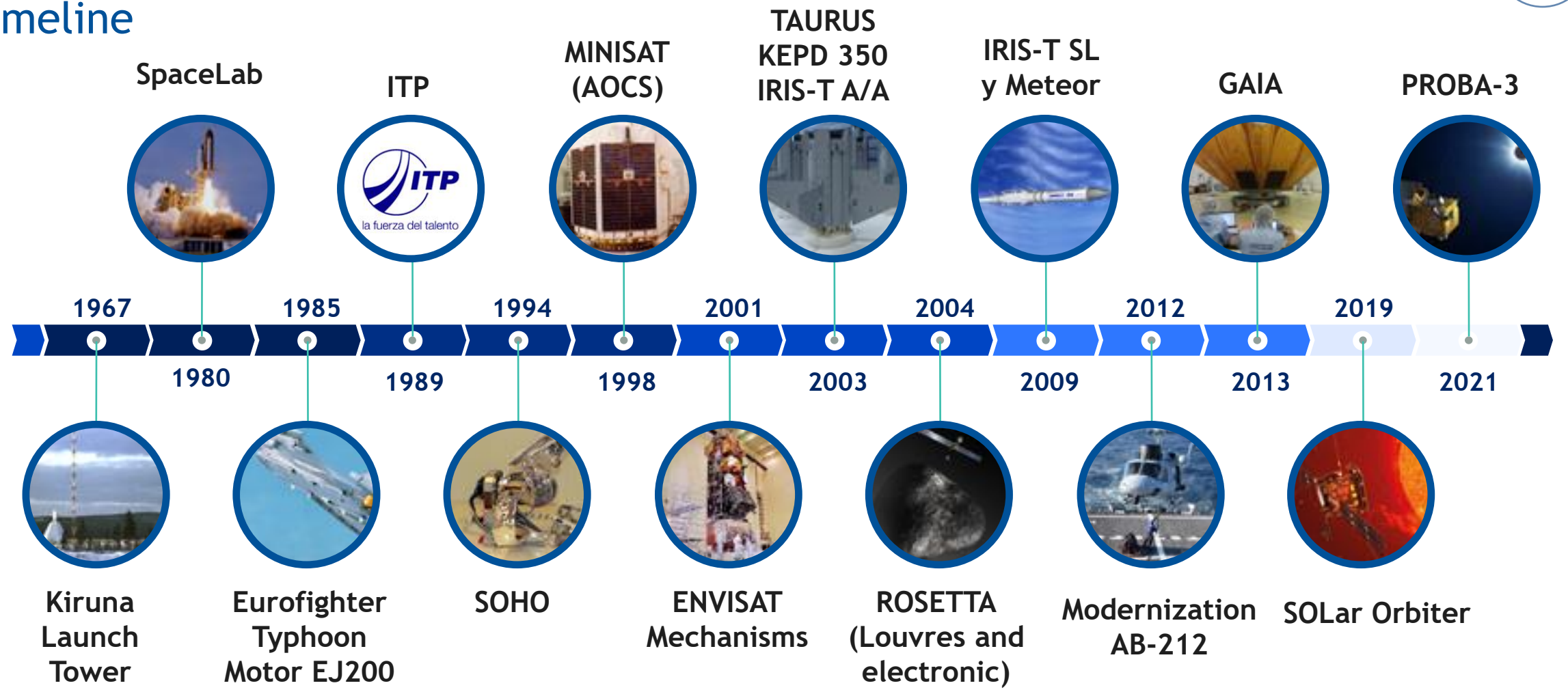
- Marine engineering

Sener Aerospace & Defense

Leading innovation.
In Sener we create innovative Aerospace solutions.

Sener Aerospace & Defense

Timeline



http://www.pioneeringspace.sener/50-year-in-space

Sener Aerospace & Defense

Activities per sector

SPACE

DEFENSE

SCIENCE

ELECTRO-MECHANICAL SYSTEMS

- Mechanical ground support equipment (MGSE)
- Rotary actuators
- Mechanisms for platforms & Payloads

- Fin control and actuation systems (CAS)
- Stabilization systems

- Ground telescopes mechanical systems
- Mechanisms for RIs

POSTION, NAVIGATION & TIME SYSTEMS (PNT)

- Attitude control
- Guidance, navigation and control
- Test equipments
- Hybrid navigation equipment

- Autonomous Navigation

RF & COMMUNICATION SYSTEMS

- Antennae pointing sub-systems
- RF active, passive and antenna products

- Communications intelligence (COMINT)
- Data Link Systems

- Waveguides and cavities for accelerators and other research institutes

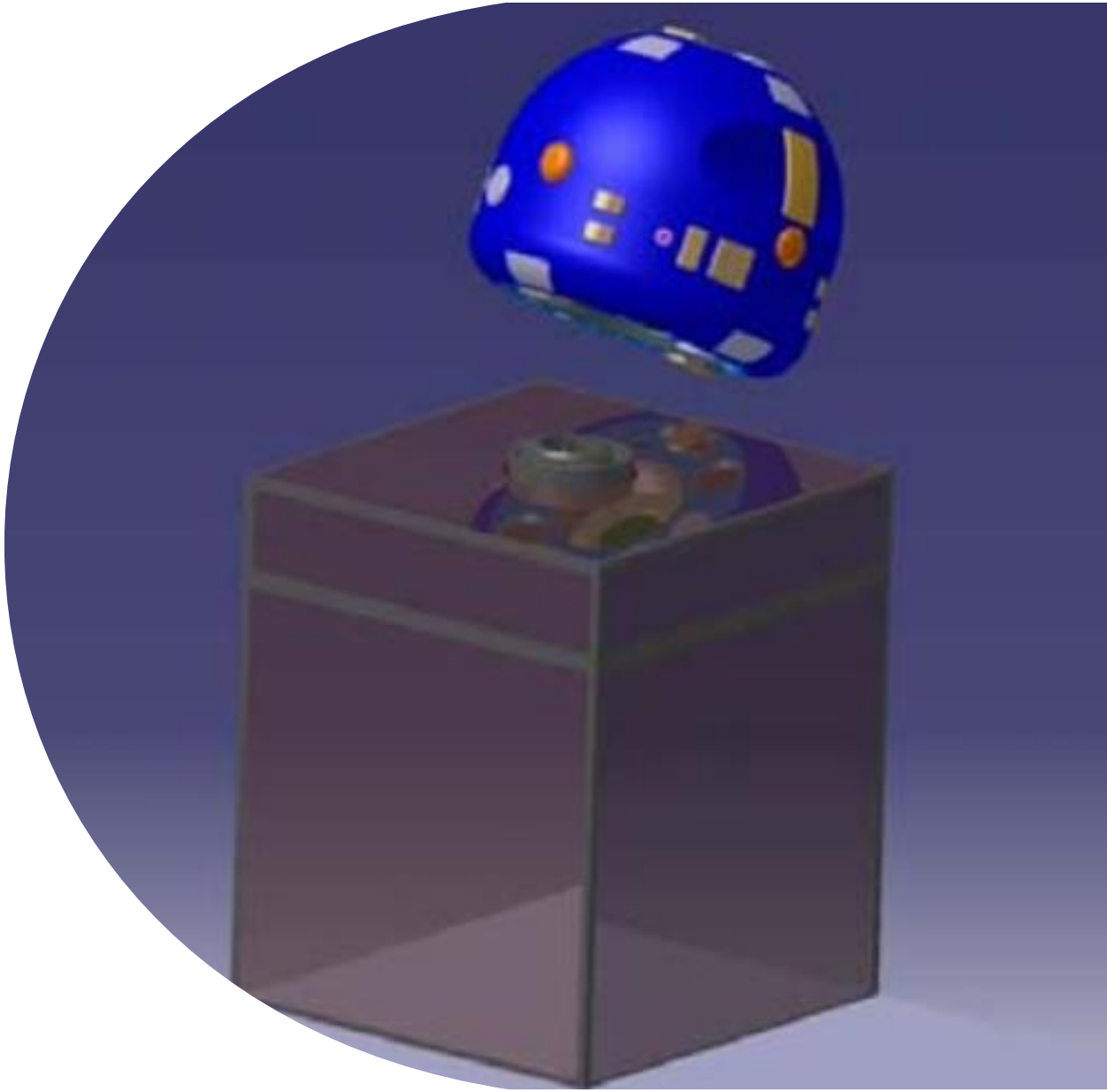
Technologies for ADR

Rendevous and Capture GNC
Grasping and Attachment
De-orbiting

Rendevous and Capture GNC

Autonomous rendevous with cooperative targets

- **ASVIS** - Automatic Servicing Vehicle for ISS Surveilling (2012)
  - Developed under program STEP for the ISS. SENER + GMV
  - TRL3
- SMART-OLEV
  - Developed (among others) under ARTES4.
  - Several phases and consortiums. ADSNL + OHB + DLR + SENER
  - Design of a spacecraft to mechanically dock to the client satellite using the liquid apogee engine nozzle and launch vehicle interface ring
  - SENER - GNC, RCS and camera image processing s/s



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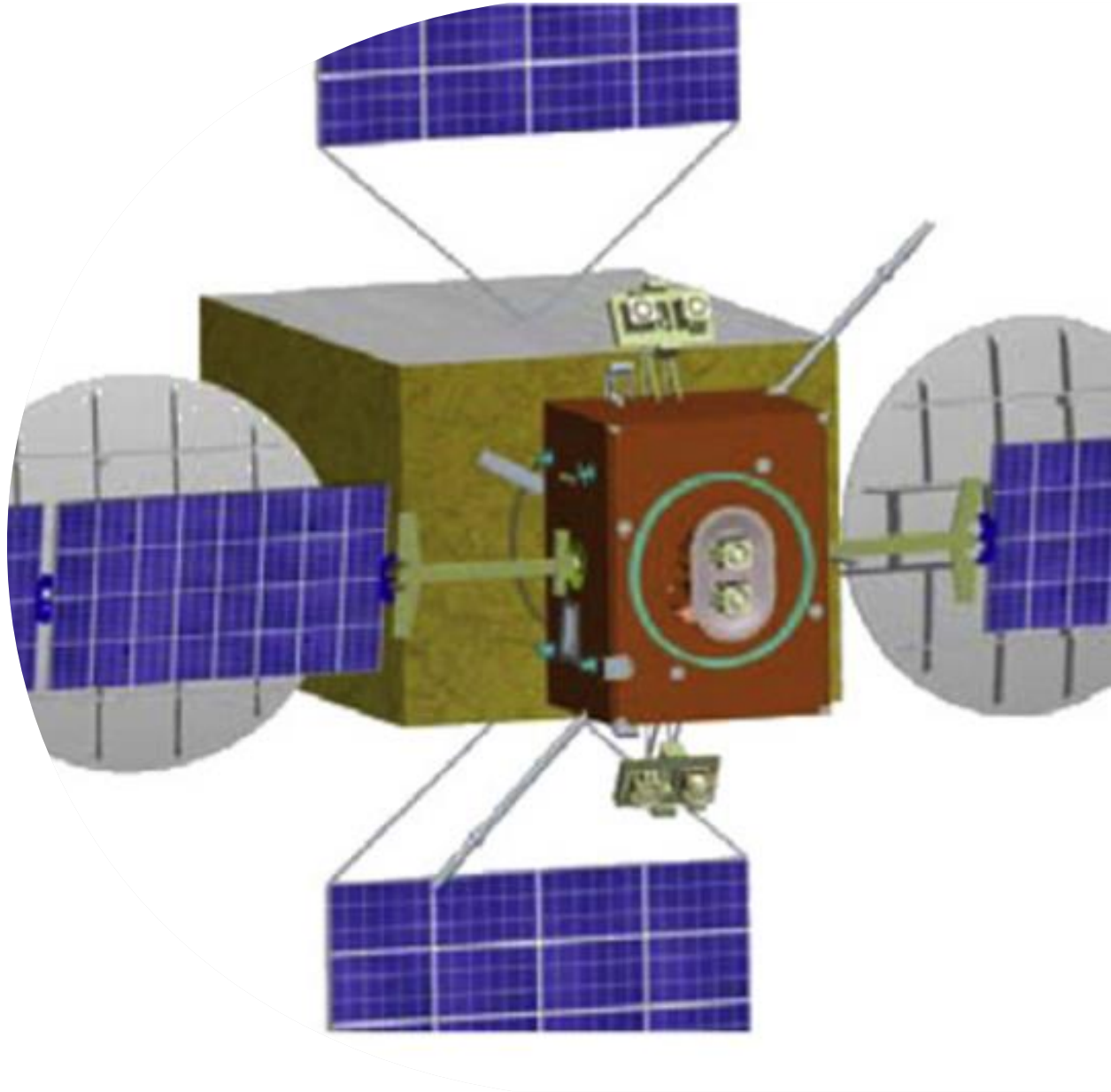


Rendevous and Capture GNC

Autonomous rendevous with cooperative targets

- **Proof of Concept 1 (POC1): Phase 0/A1**
  - Kick-off: January 2023. 6 months duration
  - Three paralell Contracts. SENER present in the three consortiums

Rendevous and Capture GNC

Autonomous rendevous with cooperative targets

- **Proof of Concept 1 (POC1): TEC Consortium**

- Hard docking solution based on a SIROM D.
- High focus on the refuelling with AirLiquide defining the fluid circuit.
- Several capture simulations

Rendevous and Capture GNC

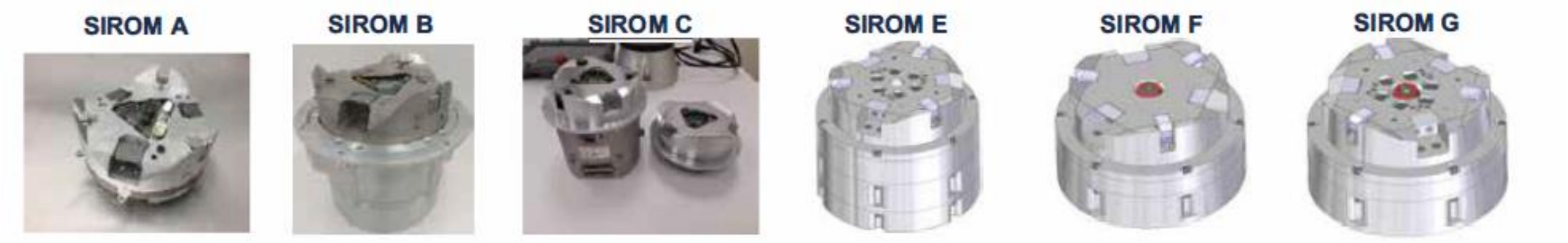
Autonomous rendevous with cooperative targets

- **Proof of Concept 1 (POC1): OHB Consortium**

- Hard docking solution based on SIROM E for data and power.
- Position Control based on de Cold Gas and Electric Propulsion thrusters.
- Attitude Control by means of Reaction Wheels.
- Simulation of captures.

Grasping and attachment

- SIROM – Robotic interface for in orbital and planetary applications – TRL 6



- PERASPERA
  - 1st Call (2016 – 2019): developed under a Consortium led by SENER. Tested in a final orbital scenario in AIRBUS DS (Bremen) and DLR
  - 2nd Call (2019 – 2021): EROSS (European Robotic Orbital Support Services). Led by TAS. Integrated SIROM product combining mechanics and flight compatible electronics.
  - 3rd Call: PERIOD – PERASPERA In-Orbit Demonstration
  - Curretnly: EROSS IOD, also led by TAS.

PERIOD
PERASPERA In-Orbit Demonstration

EROSS IOD
European Robotic Orbital Support Services | In-Orbit Demonstration

Grasping and attachment

SIROM applications:

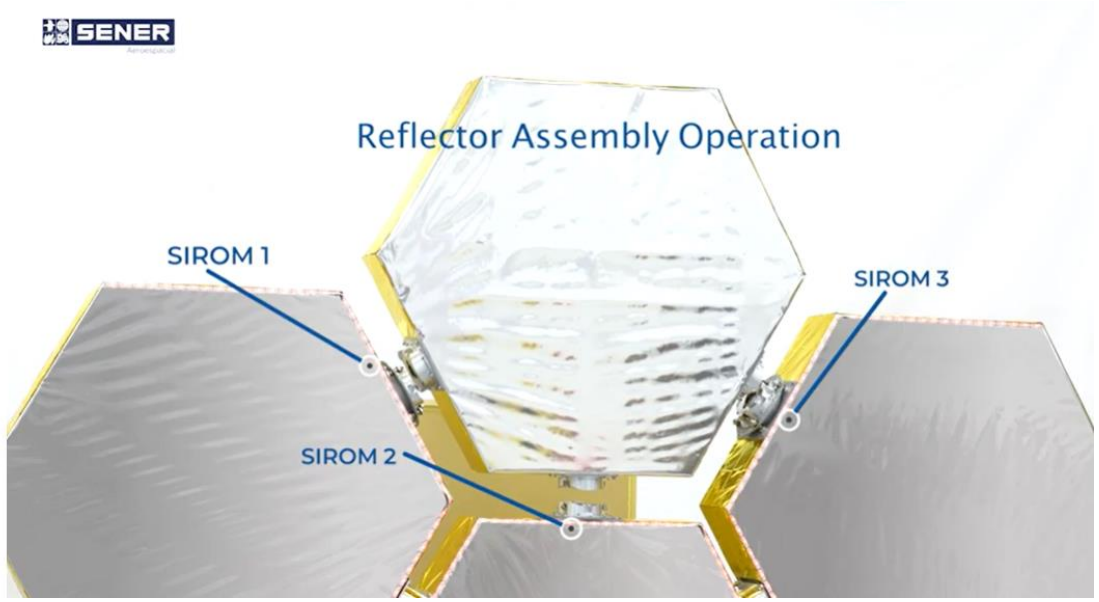
- Proof of Concept (POC1): TAS Consortium

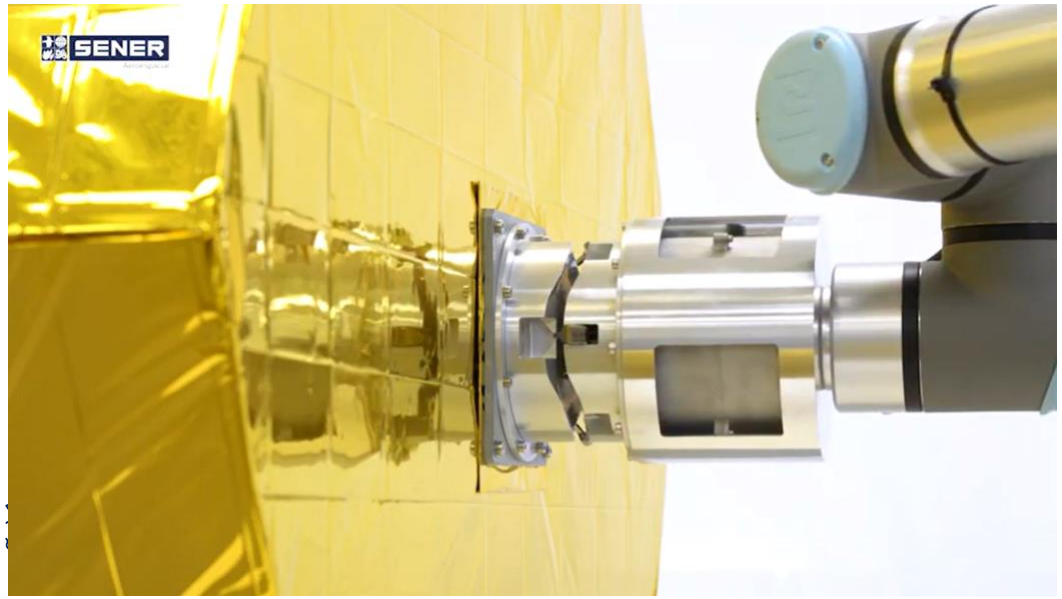
- Explores two solutions: berthing or hard docking.
- Hard docking based on SIROM.
- Vehicles from Thales (EROSS IOD) and Ariane Group (Astris Evo)

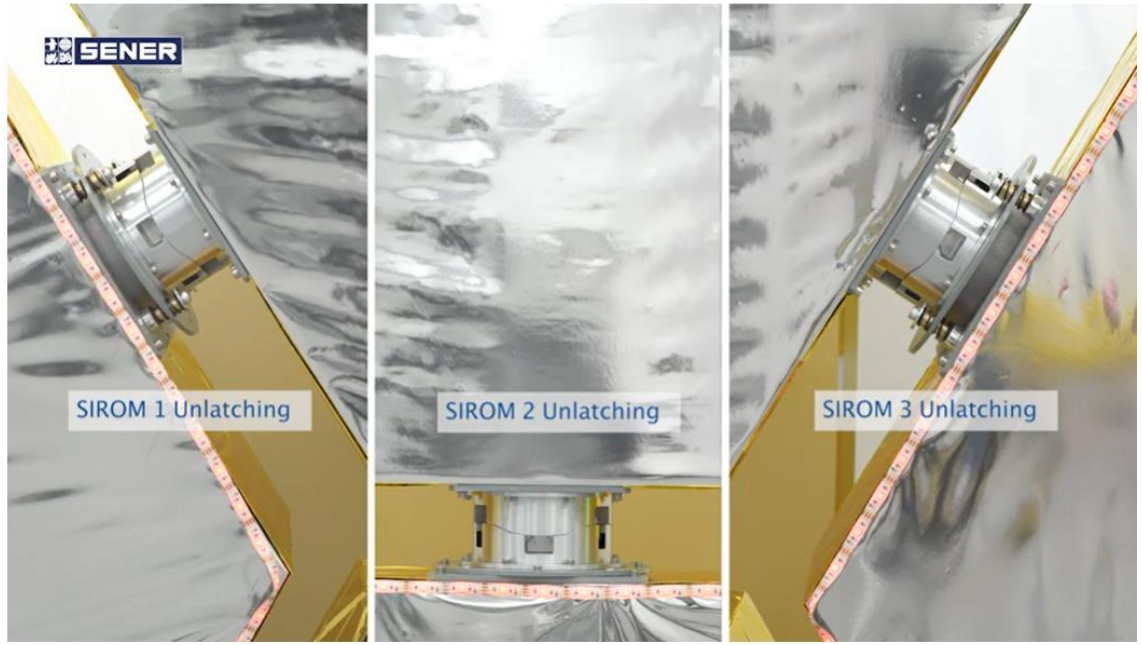
Grasping and attachment

SIROM applications:

- ESA: MIRROR (Multi-Arm Installation Robot for Readying ORUs and Reflectors).
- Lead by GMV.
- Integrates 11 SIROM units.







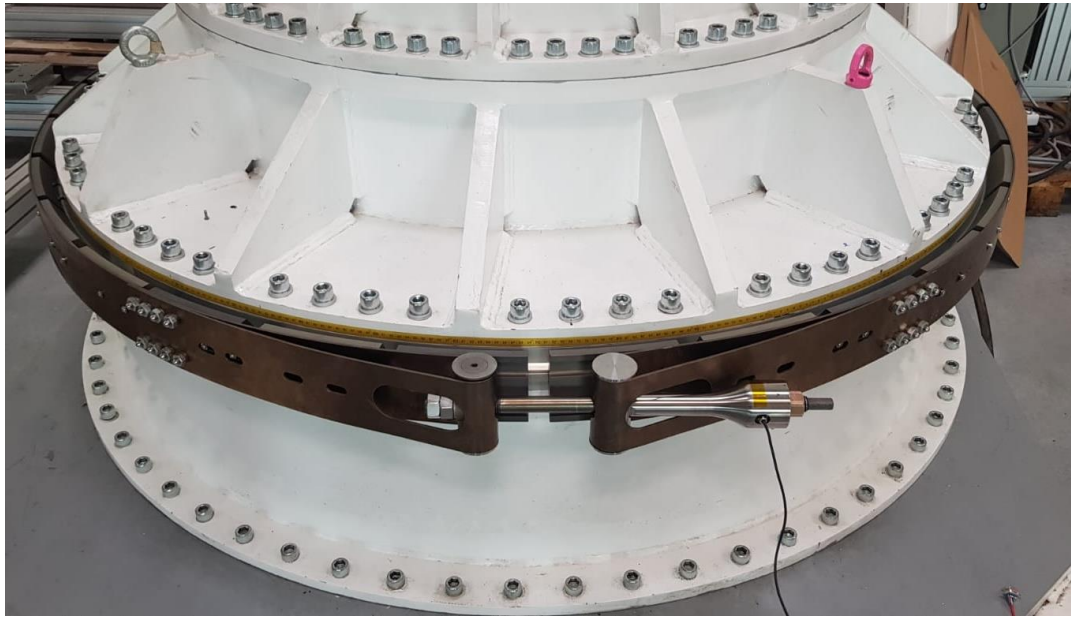
Grasping and attachment

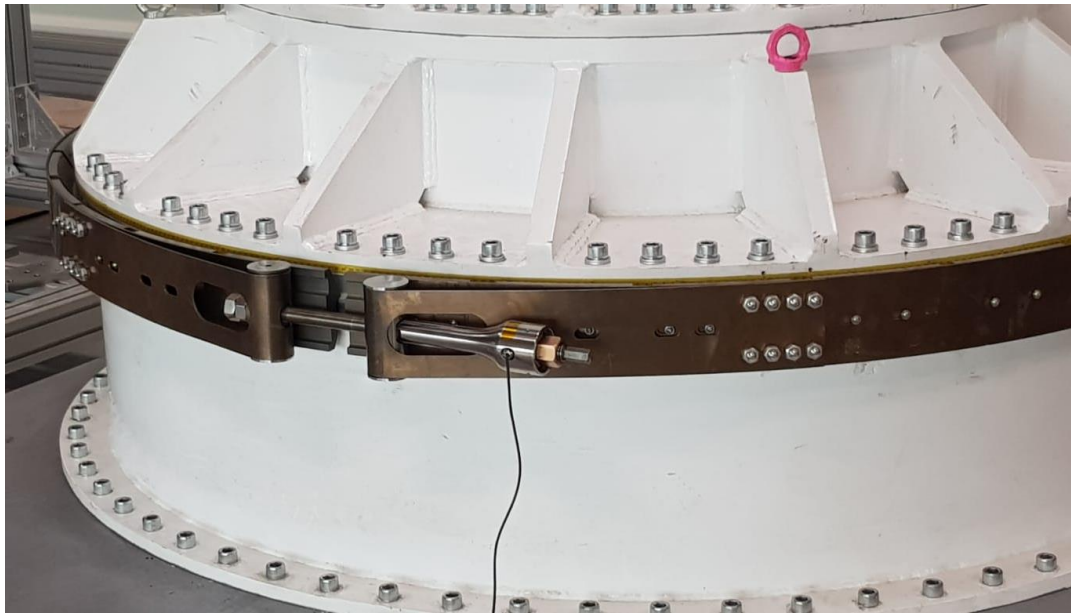
- SIROM – applocation
  - Horizon Europe: ORU-BOAS
  - Orbital Replacement Unit – Based on Building Blocks for Advance Assembly of Space Systems
  - Led by SENER

Funded by Grant Agreement 101082078

Grasping and attachment

- **LAR (Launcher Adapter Ring)**
  - Selected in the frame of e.Deorbit led by Airbus
  - Further developed with ESA funds under OSIP by SENER Poland
  - Clamp driven by a motor with a gear
  - Current TRL4





De-orbiting

E.T.PACK / E.T.PACK-F

- **A deorbit kit** based on an **electrodynamic tether**
- **FET-open** project (3M€) + **EIC** innovation project (2,5 M€).
- **International** consortium lead by Universidad Carlos III de Madrid.
- **In-Orbit demonstration mission confirmed** (2025).

Technology

Tether related projects (>6M€)

E.T.PACK (3M€ EC PATHFINDER) UC3M - SEN - TUD - UniPD - IKTS - ATD

- **Goal**: design, develop & manufacture a Deorbit Kit (DK) **System** up to TRL4.
- **Duration**: 45 months (1/3/2019 – 31/11/2022).

E.T.PACK PHD (135k€ CAM) SEN - UC3M

- **Goal**: design, develop, assembly and test **Avionics & Software** for DK.
- **Duration**: 36 months (3/2/2020 – 2/02/2023).

BMOM (100k€ EC LAUNCHPAD) SEN - UC3M - EUROCONSULT

- **Goal**: develop a **Business Model** for orbital maneuvering systems.
- **Duration**: 12 months (5/5/2021 – 4/5/2022).

PV-TETHER (175k€ ESA OSIP) SEN - UC3M - TUD - UniPD

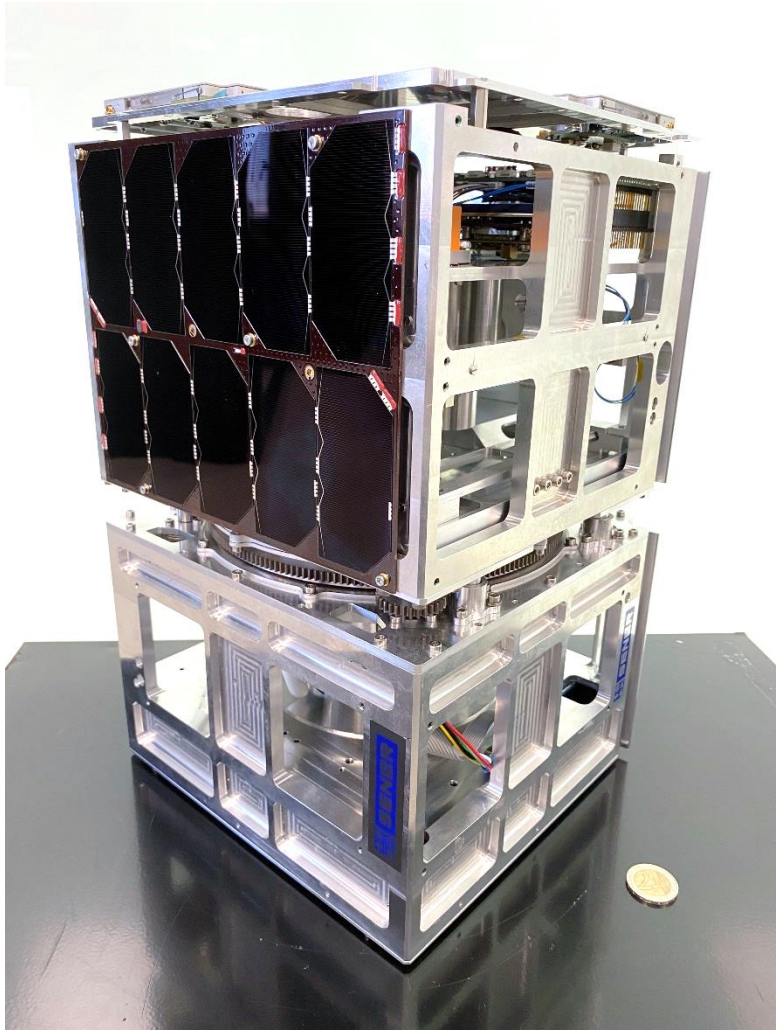
- **Goal**: develop a **Photovoltaic Tether** segment up to TRL4.
- **Duration**: 12 months (15/01/2022 – 15/01/2023).

REE (125k€ ESA OSIP) TUD - SEN

- **Goal:** develop a **Radial Electron Emitter** up to TRL4.
- **Duration**: 18 months (01/03/2023 – 30/09/2024).

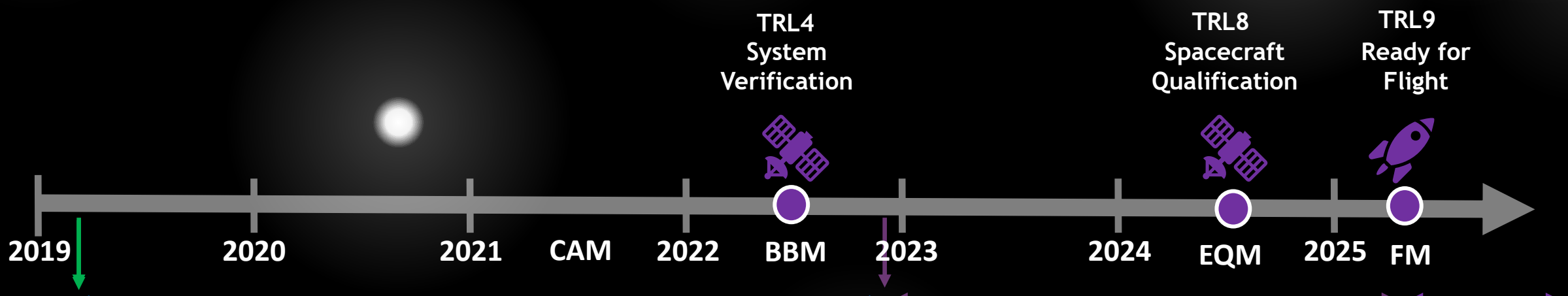
E.T.PACK-F (2.5M€ EC TRANSITION) UC3M - SEN - TUD - UniPD - RFA

- **Goal**: manufacture a **Deorbit Device EQM and FM**.
- **Duration**: 30 months (01/09/2022 – 28/02/2025).



Technology II

Roadmap

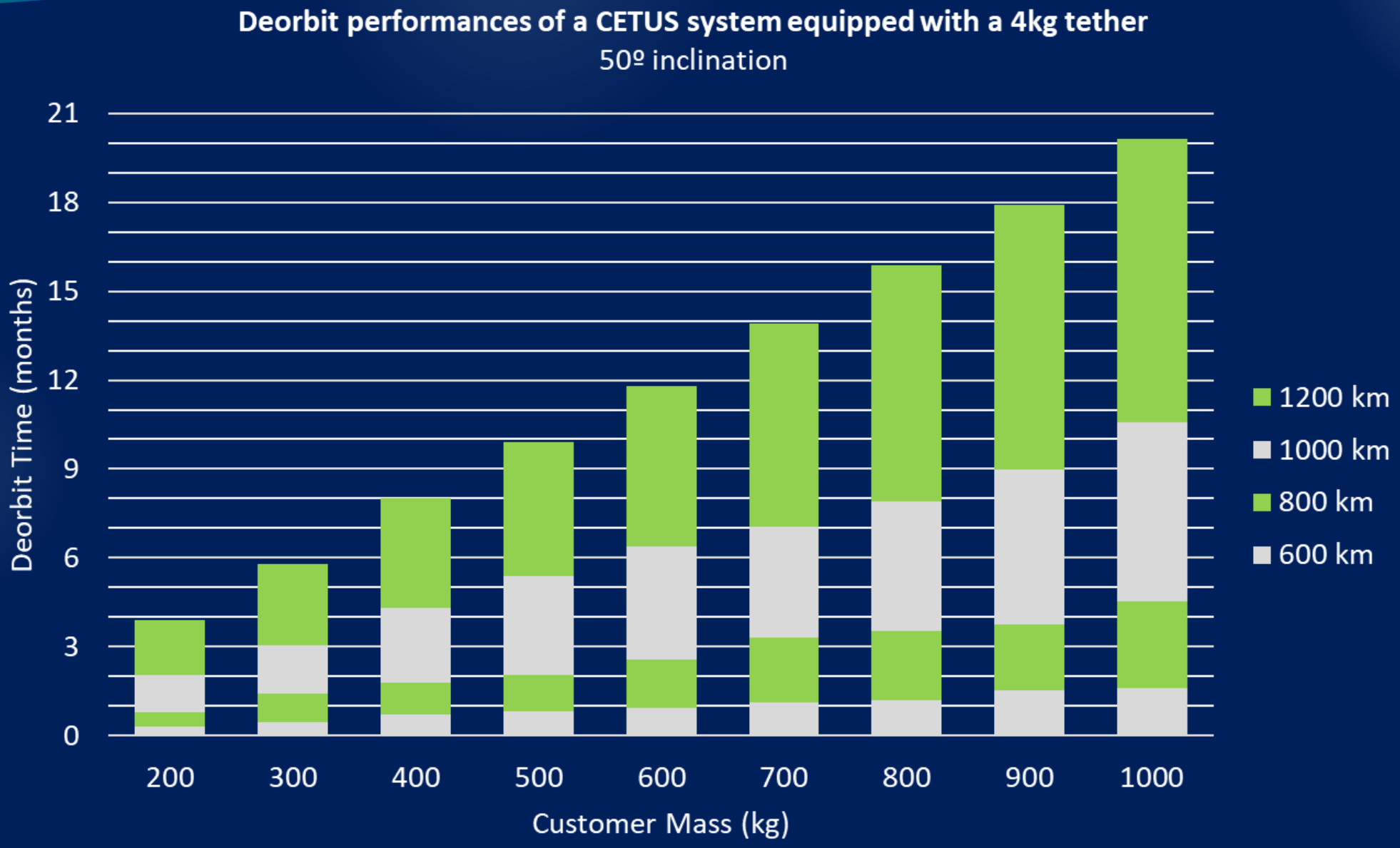


EC: E.T.PACK
Granted 3M€

EC: E.T.PACK-F
Budget: 2.5 M€

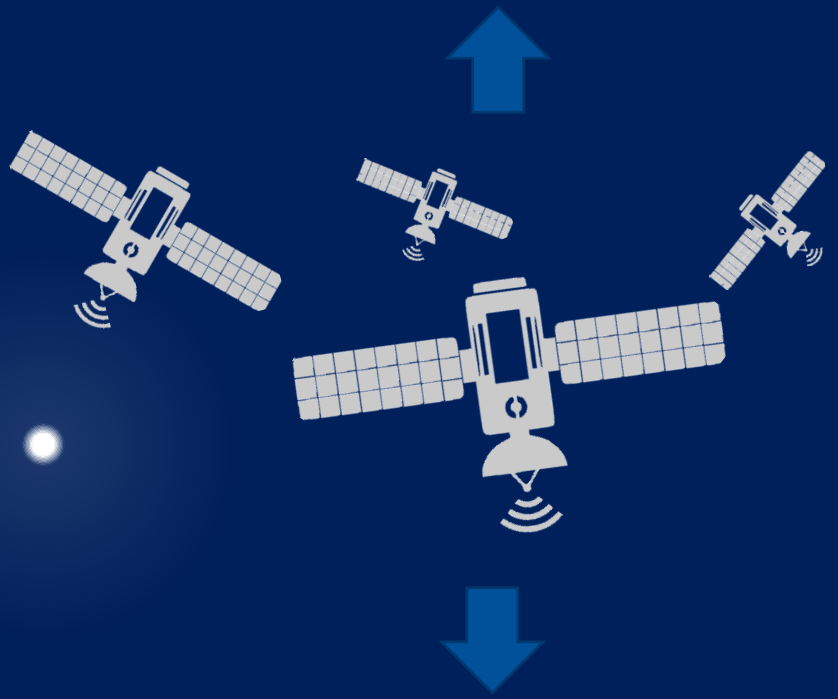
Pre-commercial
Phase

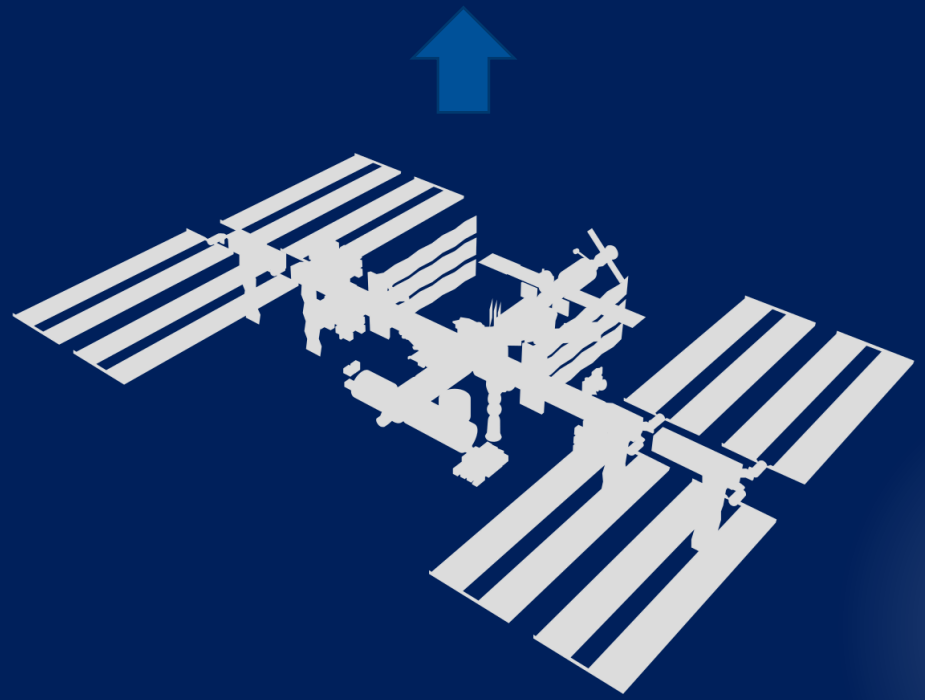
Performances



Orbital Mobility

Dedicated CETUS (Compact Electrodynamic Tether for Upper Stage and Satellite) units deployed by a servicer vehicle would allow “multiple” spacecraft deorbiting or reorbiting. Station Keeping via CETUS can enable constellations in Very low LEO (below 400 km altitude). ISS CETUS could save up to 7000 kg of propellant per year.





A Tether in drag and thrust modes was demonstrated by the PMG mission (NASA) in 1993.

SENER's vision

Towards Space Sustainability through Space Logistic System

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www.youtube.com/@SenerGroup