

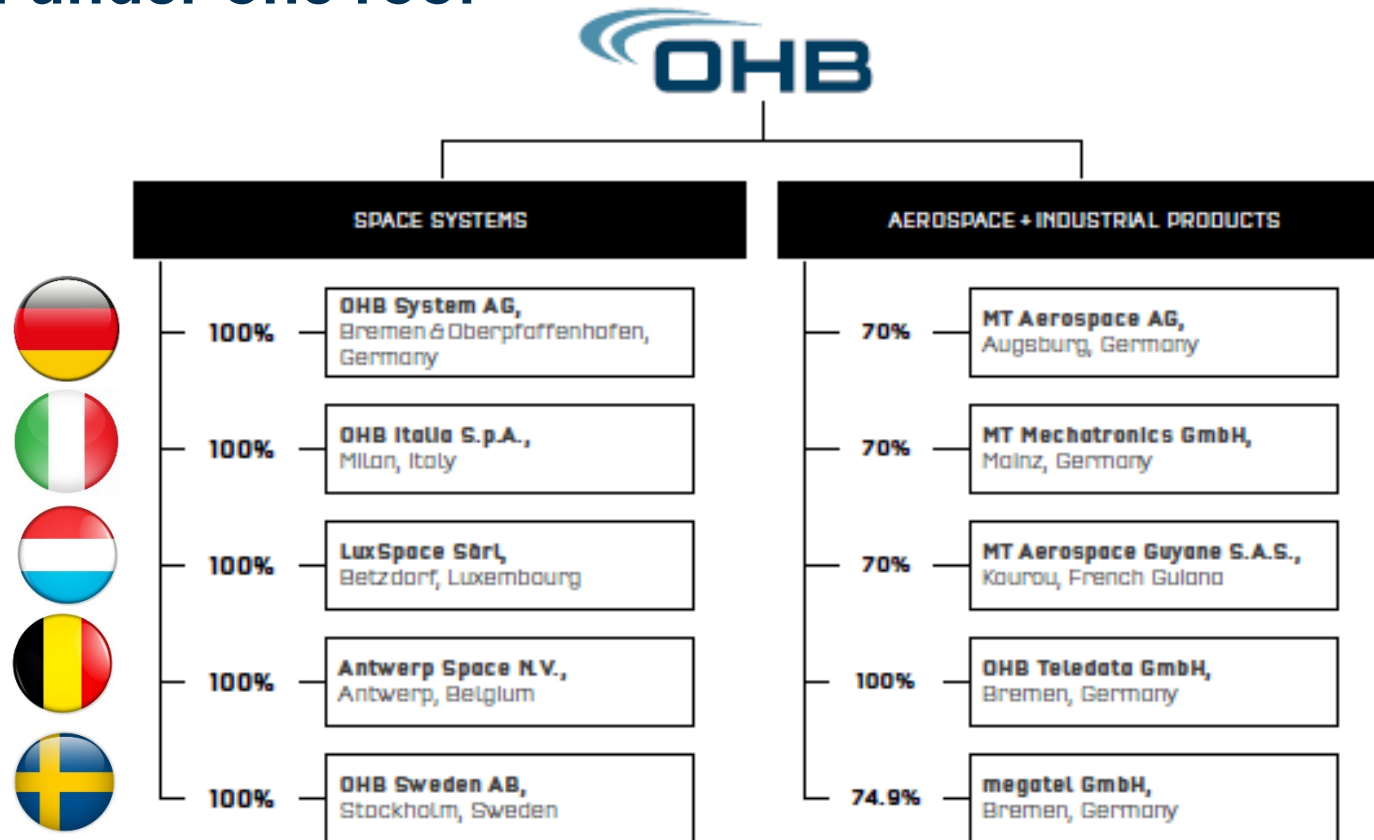


SPACE SYSTEMS

## OHB Italia capabilities for TOLIMAN mission

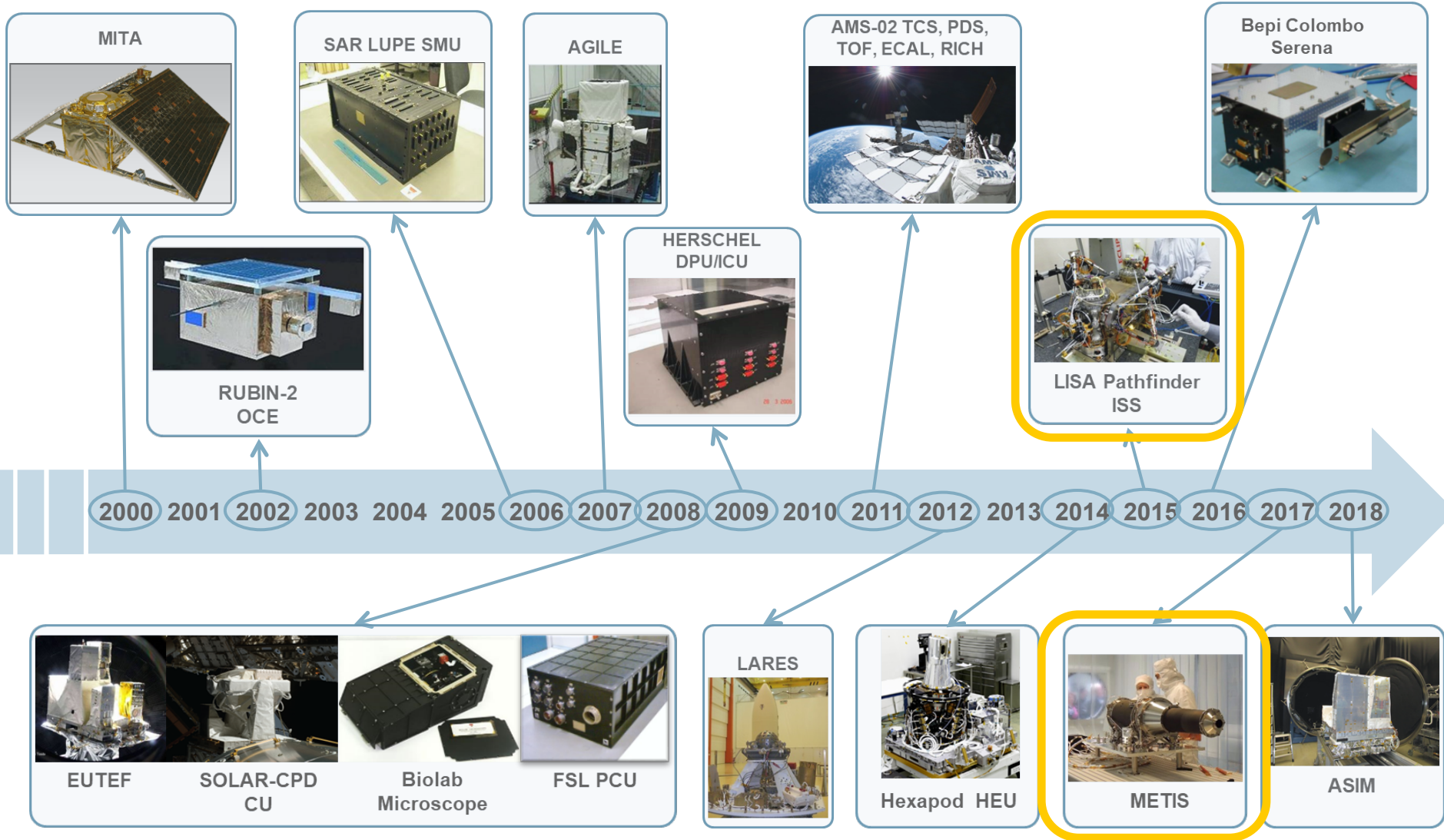
“Finding Earth twins within 10pc”, Nov. 20th 2018, ASI Rome

# United under one roof



- Satellite design, manufacturing and operation.
- Data transmission and processing.
- Design, development and manufacturing of scientific payloads.
- Structures for aerospace applications.

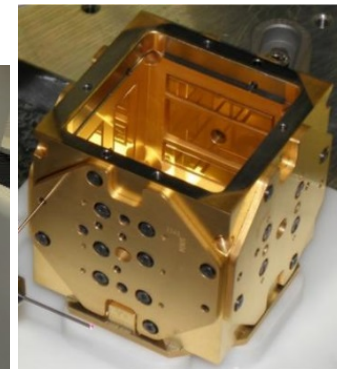
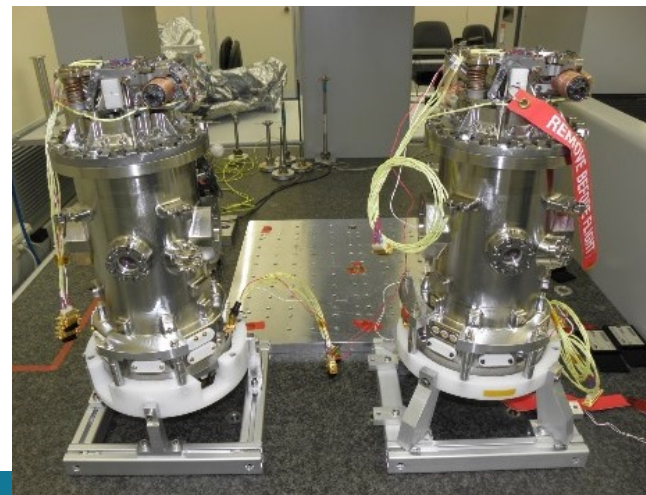
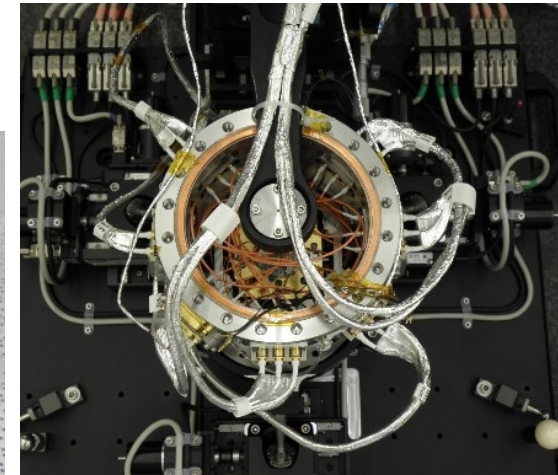
# MAIN PROJECTS AT OHB-I IN THE LAST YEARS



## LISA Pathfinder: Inertial Sensor Subsystem

LISA Pathfinder: technology verifications of LISA mission, a gravitational waves space observatory

- OHB-I in charge of:
  - Inertial Sensor Head design, manufacturing and verification
  - Capacitive Sensor design, manufacturing and verification
  - LTP Core Assembly thermal stability analysis
  - Self-gravity compensation system development
- Launched in Dec. 2015
- Mission successfully completed after additional 6 months operation in June 2017

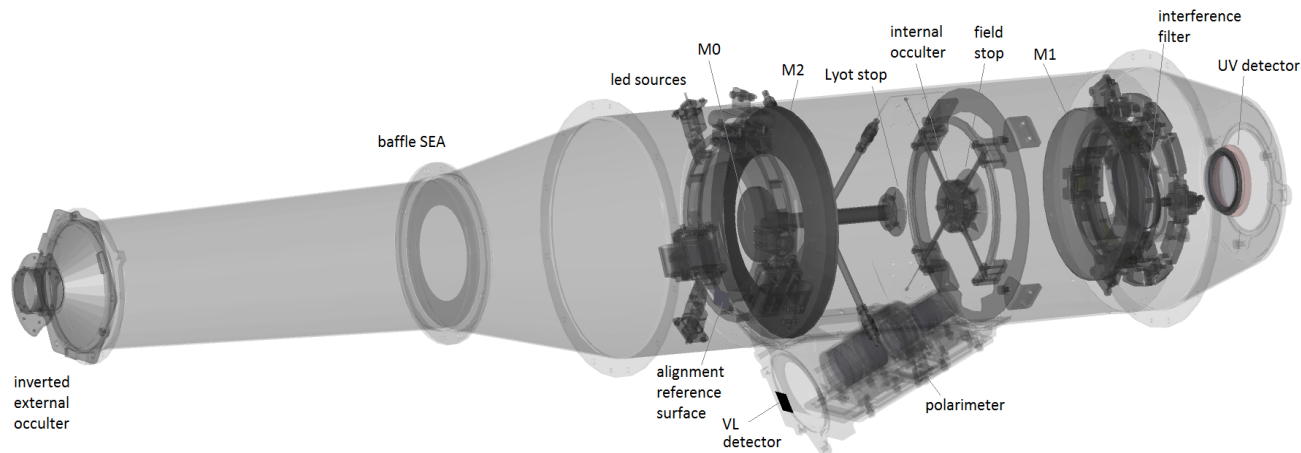
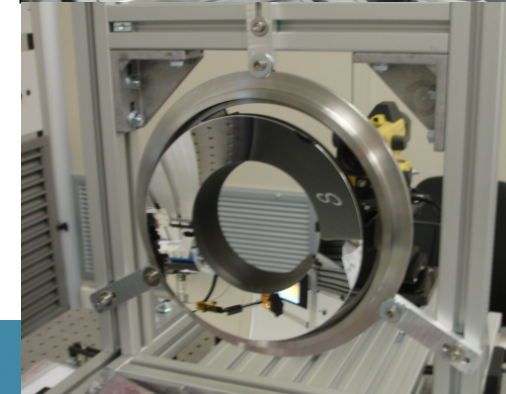
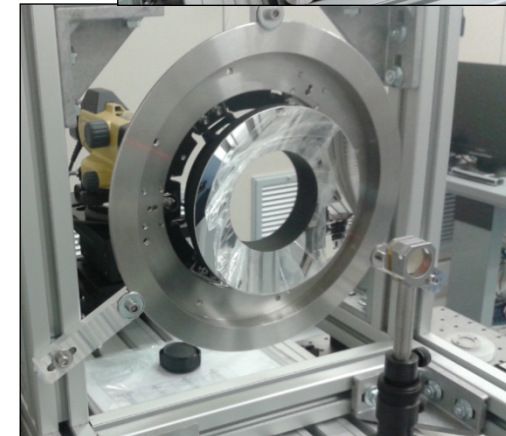
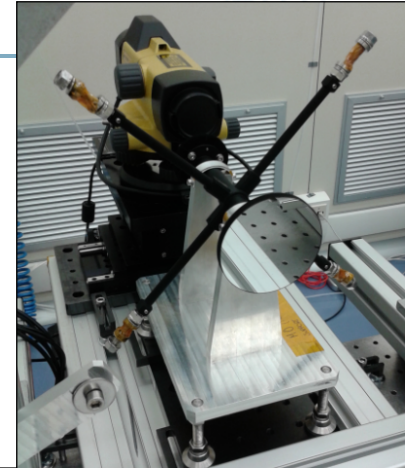




## METIS

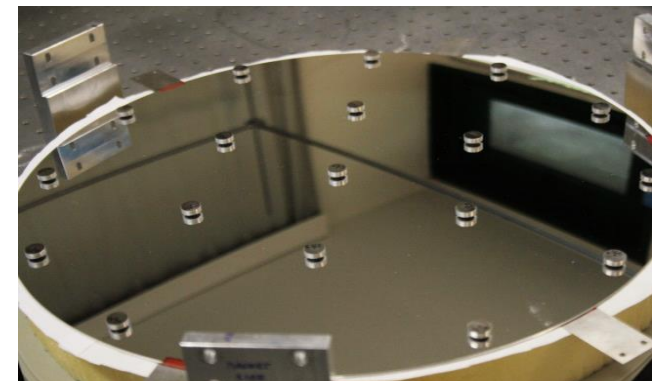
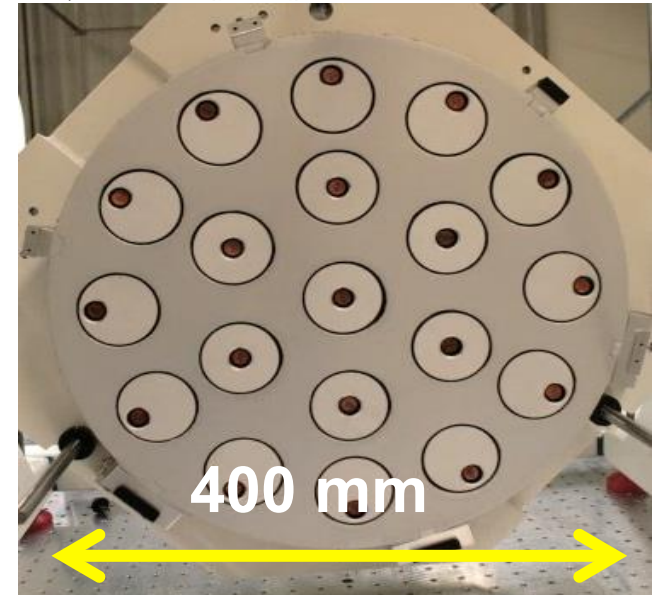
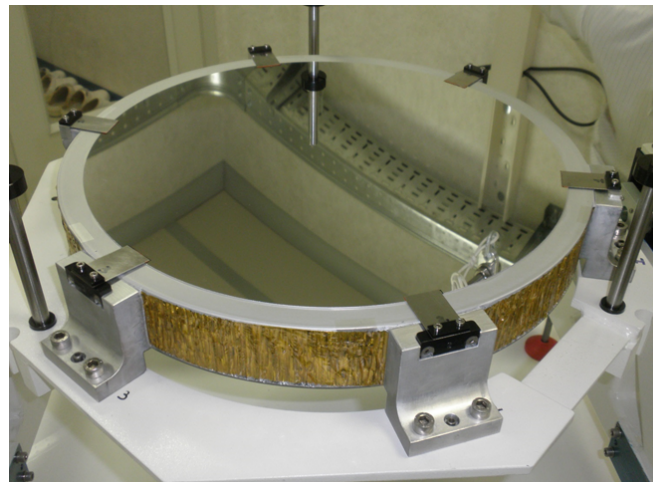
### (Multi Element Telescope for Imaging and Spectroscopy)

- Italian contribution to ESA Solar Orbiter (ESA M1) mission, aimed to the exploration of the Sun and the inner heliosphere.
- Inverted-occultation coronagraph with two separate channels:
  - VL broad-band imaging of the Sun corona 580 to 640 nm
  - UV narrow-band imaging of the Sun corona (121.6 nm)
- OHb-I in charge of design, manufacturing and verification of M0, M1 and M2 Zerodur mirrors glued to Invar mechanics
- Launch planned Feb. 2020



# LATT (Large Aperture Telescope Technology)

- Follow-up of ALC (Advanced LIDAR Concept)
- Apply and extend the well-established ground experience acquired on the adaptive optics thin mirrors to active optics primary mirrors
- Become the main components of space (LIDAR/EO/astronomical) telescopes for future space missions
- OHB-I in charge of design, manufacturing and verification of Demonstrator Model (TRL 4 / 5)
- Program completed Nov. 2015



## ThermoMechanical design and verification tools

### Mechanical

- Siemens Nx (up to 11)
- Catia 5
- Autocad/Mechanical Desktop

### Structural and Analysis

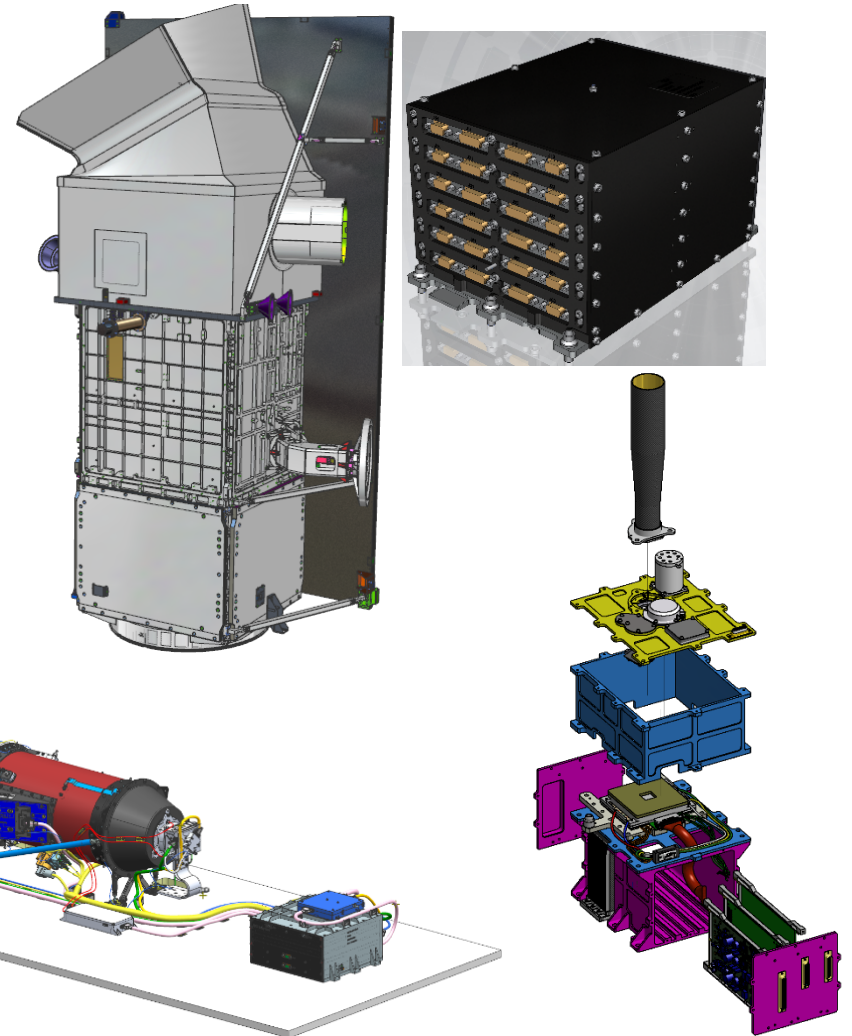
- MSC Nastran/Patran
- Esacrack/Nasgro
- Hyperworks
- Adams
- VAOne
- Matlab/Mathcad

### Thermal and Analysis

- ESATAN-TMS
- THERMICA SYSTEMA
- SINDA/FLUINT
- Thermal Desktop/  
RadCad

## Mechanical Design Capabilities

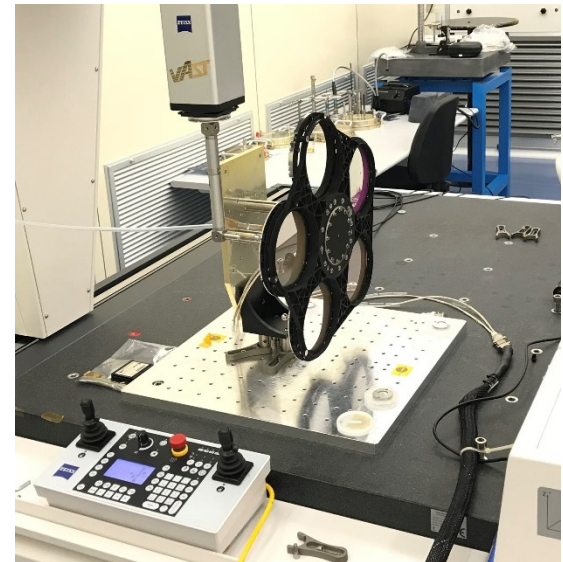
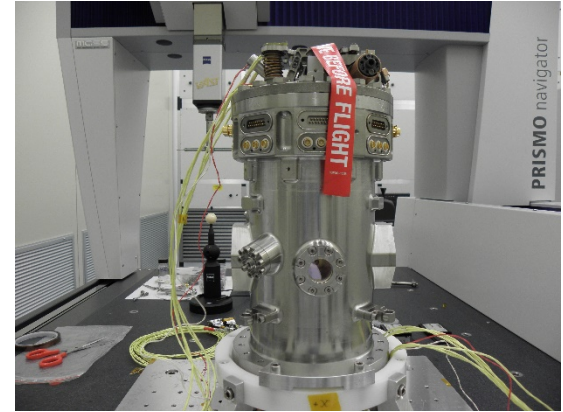
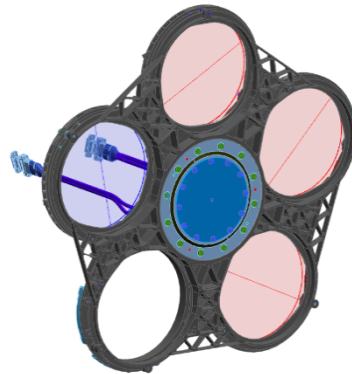
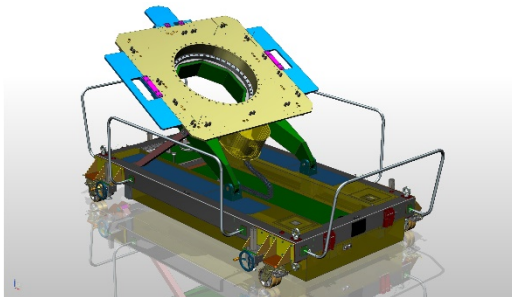
- Mechanical design at equipment, subsystem and system/satellite level of structure, accommodation, harness etc
- Separation device system (pyrotechnics and non pyrotechnics)
- Mechanism devices systems
- Metallic and composite materials
- Good knowledge of standard (welding/gluing) and non standard (Rapid prototyping / Soldering / Brazing / casting / micro casting) manufacturing processes
- Opto-mechanical design: primary and secondary mirrors accommodation





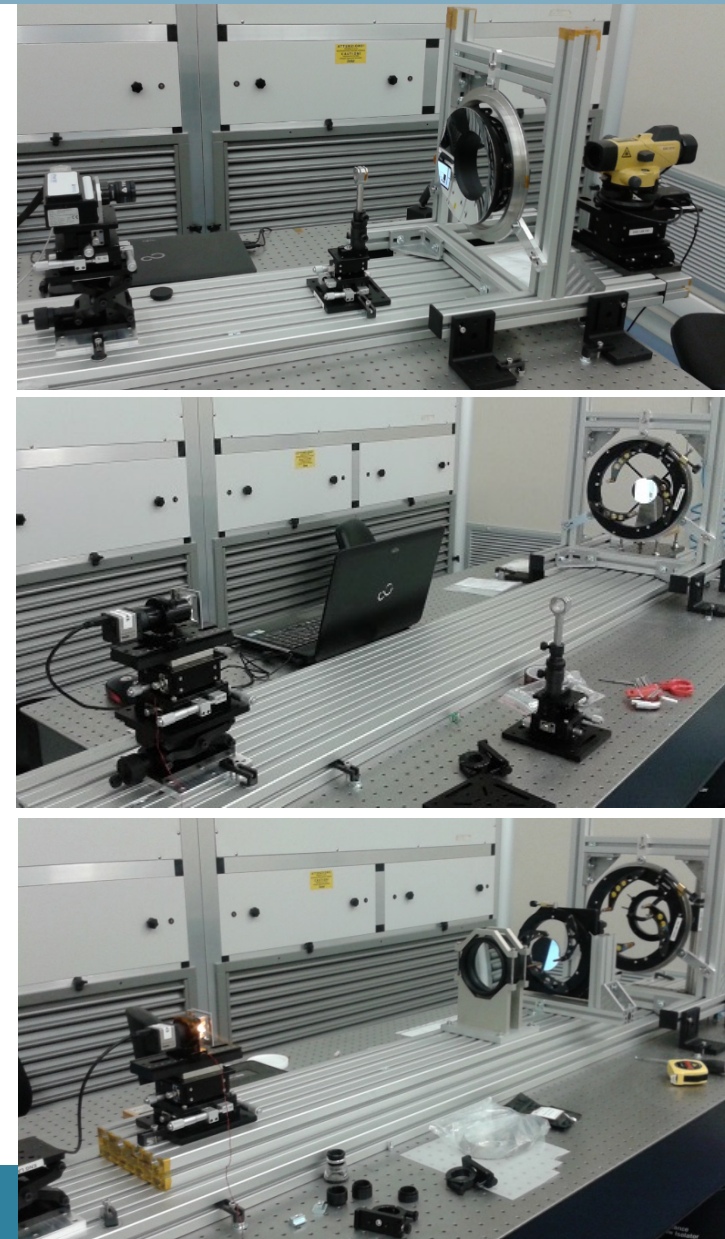
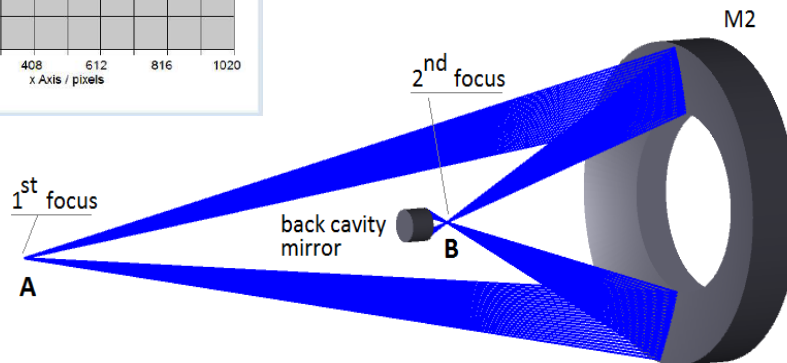
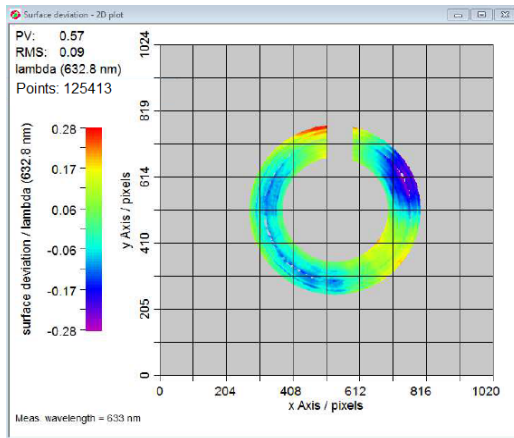
# Mechanical Parts Integration and Verification

- Tools/jigs for high-precision mechanics subsystem integration
- Good heritage in high precision Metrology Inspections (Theodolite alignment of satellite subsystems / CMM for high precision mechanics assemblies)
- Extensive knowledge in Mechanical properties characterization and material control
  - Destructive test (Tension/Lap shear/Drum peel/Flat wise)
  - Non destructive test (Ultrasonic scan/X-rays/Dye penetrant)



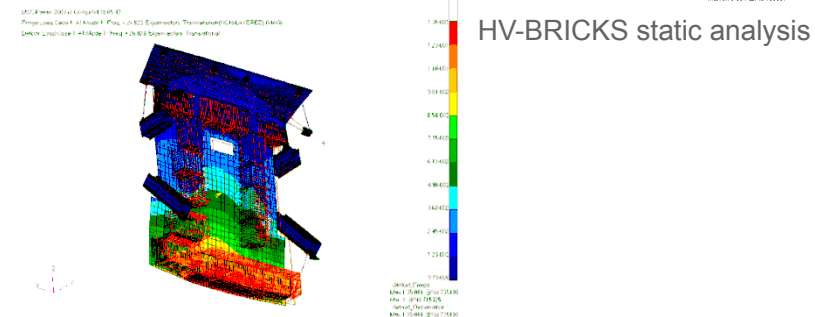
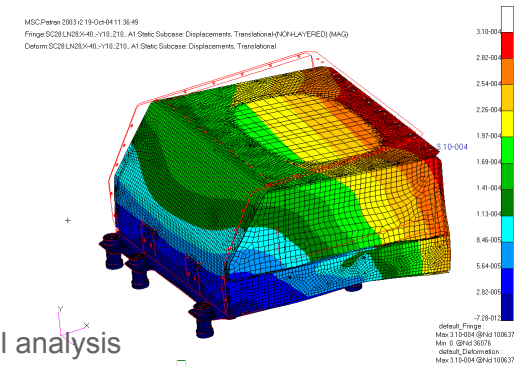
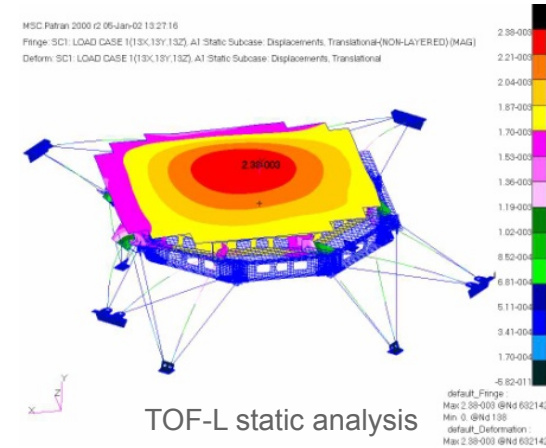
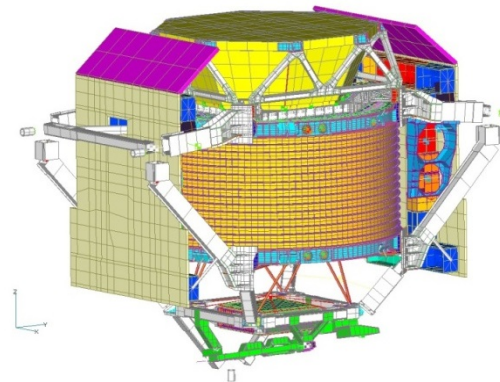
# Optical Parts Integration and Verification

- Trioptics digital interferometer
- Shack Hartmann wavefront sensor
- WFE measurements (heritage of METIS mirrors and interferential filter)



# Structural Design and Analysis

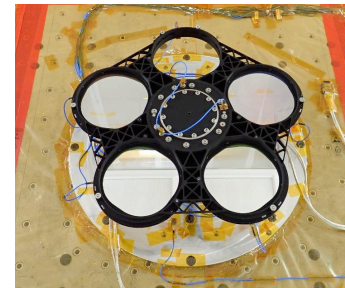
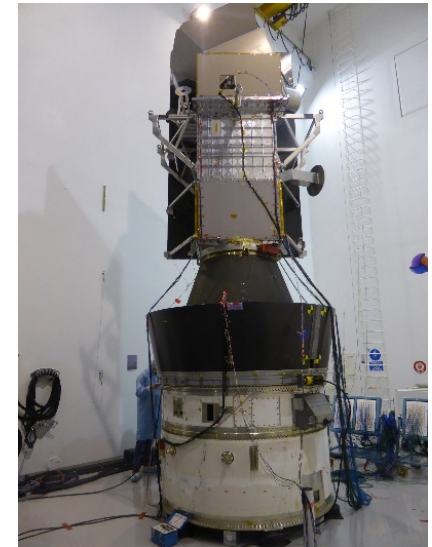
- Static Analysis
  - Linear
  - Non Linear
  - Thermo-elastic
- Dynamic Analysis
  - Modal Analysis
  - Frequency Response Analysis
  - Random Vibration Analysis
  - Transient Response Analysis
  - Acoustic Analysis
  - Shock Damage Risk Assessment
- Buckling Analysis
  - General Buckling
  - Angle Crippling
  - Inter Rivet Buckling
  - Buckling Analysis in Sandwich Panel





## Structural Design Verification

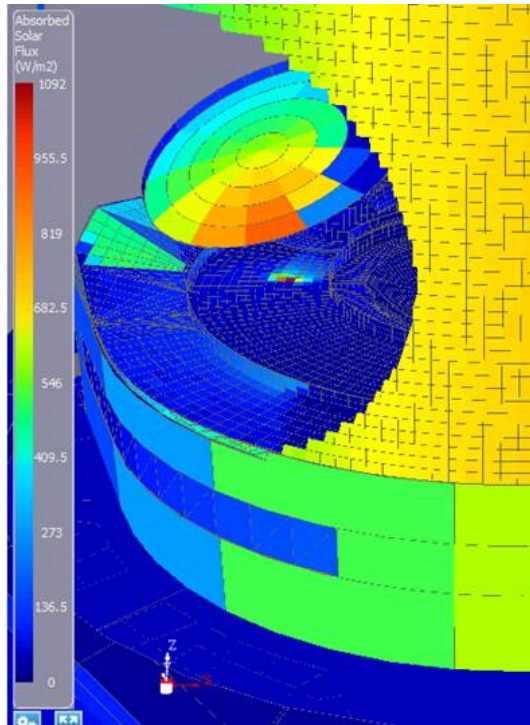
- Complete coverage of the whole structural verification: test specification, planning, prediction, setup and instrumentation, execution and reporting
  - Unit/sub-unit level
  - Subsystem level
  - System Level (e.g. Satellites)
- Static Testing
  - Metallic and Non metallic Material Characterization
  - Component and S/S level testing (i.e. Strength, Stiffness, ...)
  - Satellite level testing
- Dynamic Testing (according to ECSS-E-10-03A, RTCA/DO-160E, MIL-STD-810F)
  - Modal Survey
  - Sinusoidal Vibration
  - Random Vibration
  - Shock
  - Acoustic



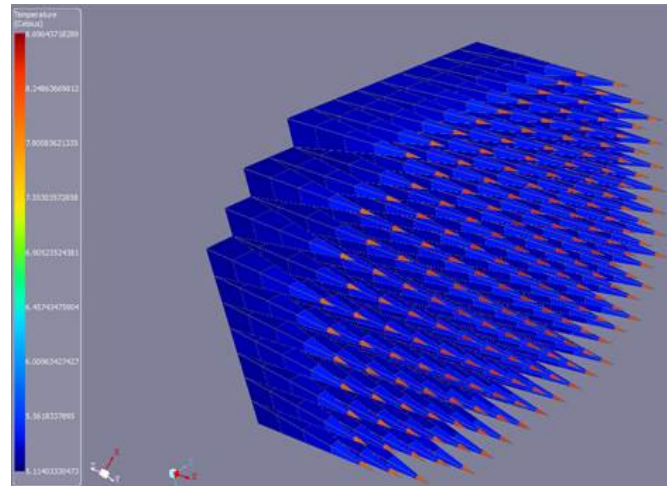


# Thermal design, Analysis and Verification Capabilities

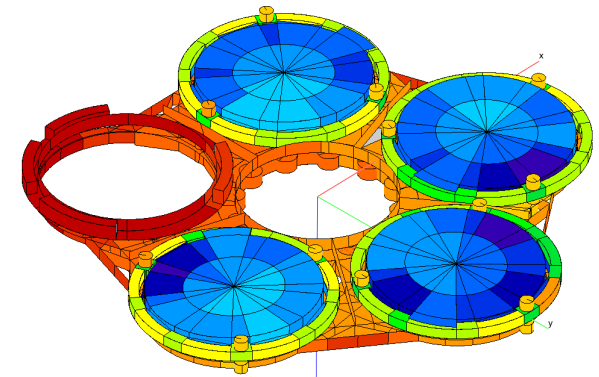
- Thermal Design and analysis at equipment, subsystem, system and mission level based on standard tools or self-developed and validated tools (e.g. frequency domain thermal analysis and transfer function)



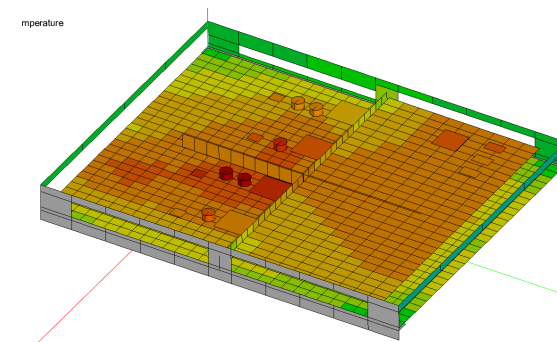
MWI – Sun intrusion study



MWI – OBCT thermal model



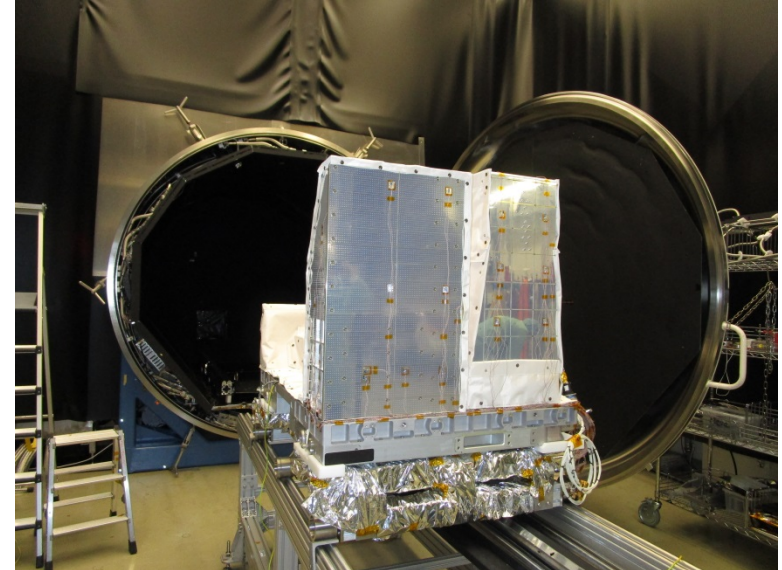
EUCLID GWA thermal model



MWI-FEE board thermal model

# Thermal design, Analysis and Verification Capabilities

- Thermal Test planning, test specification, setup preparation, test execution and reporting:
  - Unit/sub-unit level ( electronics boxes, single boards, batteries, mechanisms, sensors);
  - Subsystem level
  - System Level (e.g. Satellites)
- Good experience in the procurement process and sub-contractor /supplier management for:
  - MLI /SLI (Multi Layer Insulation / Single Layer Insulation)
  - Heater/thermostats
  - Heat Pipes/Loop Heat Pipes
  - Coatings (paints, tapes, surface treatments)



ASIM thermal vacuum test

Key feature	OHBI experience
Low cost scientific mission	✓
Optical payloads	✓
Stable thermal and mechanical design (with low CTE materials)	✓
Active controlling spacecraft temperature to <math><0.1\text{K}</math>	✓
A network of thermal sensors to monitor all structural elements	✓

- OHB Italia works in close cooperation with space agencies, research institutes and large industrial groups.
- Consolidated technical expertise at system, instrument and equipment level has been demonstrated in several missions operated in the past and currently under operation or in the development phase.
- The TOLIMAN mission can take advantage of the engineering capabilities available at OHB Italia, in particular, but not limited to, in the structural, thermal, optical, mechanical and mechanisms areas.
- For instance these competences can be effectively implemented for the TOLIMAN space telescope temperature control and thermal stability to limit the impact of various forms of systematic noise