NEREUS International Conference,
Bari, Puglia,
February27th-28th 2014

SPACE4YOU-

a Driver for

Competitiveness and Growth

SPACE SYSTEMS

Presentation of CGS S.p.A., Milano, and OHB System AG, Bremen

Giovanna Ober
Cornelius Schalinski

Agenda

- Cooperation of LSI with SME: Why? What? HOW?
- Meet OHB:
  - Overview OHB System, Bremen
  - Overview CGS SPA – COMPAGNIA GENERALE PER LO SPAZIO, Milano (Focus)
- Discussion: the answers to “Why, what, how”...
- Questions, please!

Structure of OHB AG

- Founding and managing family has Italian and German citiznship

- 5 companies of the OHB space group have complementary satellite and payload manufacturing capabilities ("S")

Space Systems			Aerospace + Industrial Products		
100%	**OHB System AG** Bremen Deutschland	S	70%	**MT Aerospace AG** Augsburg Deutschland	
100%	**Kayser-Threde GmbH** München Deutschland	S	70%	**Aerotech Peissenberg GmbH & Co.. KG** Peissenberg, Deutschland	
100%	**CGS S.p.A.** Mailand Italien	S	100%	**OHB Teledata GmbH** Bremen Deutschland	
100%	**LUXSPACE Sàrl** Betzdorf Luxemburg	S	74,9%	**megatel GmbH** Bremen Deutschland	
100%	**Antwerp Space N.V.** Antwerpen Belgien		100%	**Telematic Solutions S.p.A.** Mailand Italien	
100%	**OHB Sweden AB** Stockholm Schweden	S			

2459 Employees (June 2013)

OHB Group – No. 3 in Europe

- ESA's third "Large System Integrator"
- OHB's business is mainly focused on space
- OHB Group is an independent, family owned, family run business
- Position of OHB in Europe strengthened through acquisitions of projects and companies
- OHB concentrates on attractive markets (e.g. satellite constellations, and small, mini and micro satellites) and high-tech solutions
- OHB is involved in all major European space and infrastructure programs (e.g. Galileo, Meteosat 3G, Ariane 5, SmallGEO, Columbus/ISS, etc.)

No. 3 European space system company

Space sales in million	2011
1 EADS Astrium	$6,428
2 Thales Alenia Space	$2,680
3 OHB	**$636**

Source: Space News Top 50 (July 30, 2012)

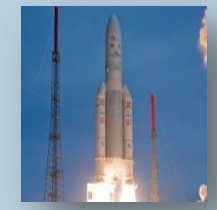
Two business units focusing on space systems and aerospace products

Space Systems

- **System integrator for space systems with design, engineering, integration and testing**
- Low earth orbit and geostationary **satellites** incl. scientific payloads for
  - **navigation, science,**
  - **communication** and **earth observation**
- **Manned** and **unmanned** space systems
- **Exploration**

Aerospace + Industrial Products

- **Engineering and manufacturing of aerospace products**
- Products for **aviation/aerospace** and industry, **antennas** & **mechatronics**
  - Propellant tanks & satellite tanks
  - Water & gas supply tanks for aircrafts
  - Booster casings (Ariane 5)
- Components for **aircraft engines**
- **Telematics**

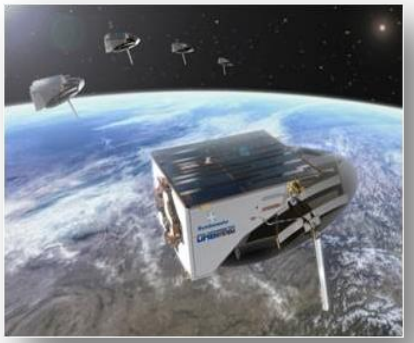


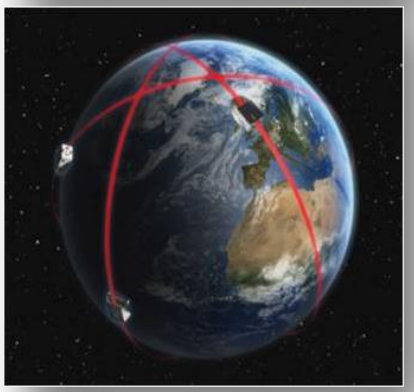
SPACE SYSTEMS

OHB System AG, Bremen, Germany

SAR-Lupe Radar Satellite Constellation

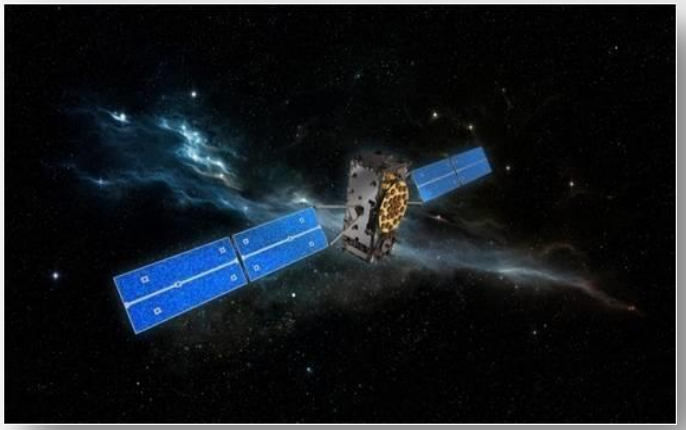
- First German satellite-based radar reconnaissance system
- Five radar satellites and a ground station
- Maximum geometric resolution < 1m
- Short system response time
- Ground station for satellite control and image processing in Gelsdorf (Germany) for the German MoD, until 2017
- Project completed on time and in budget: best value for money
- Satellites and ground station fully operational since December 2007, all satellites in service since July 2008
- Entire system officially handed over to the German Federal Armed Forces in December 2008
- More than 22 cumulative error-free years of satellite operation (8/2012)





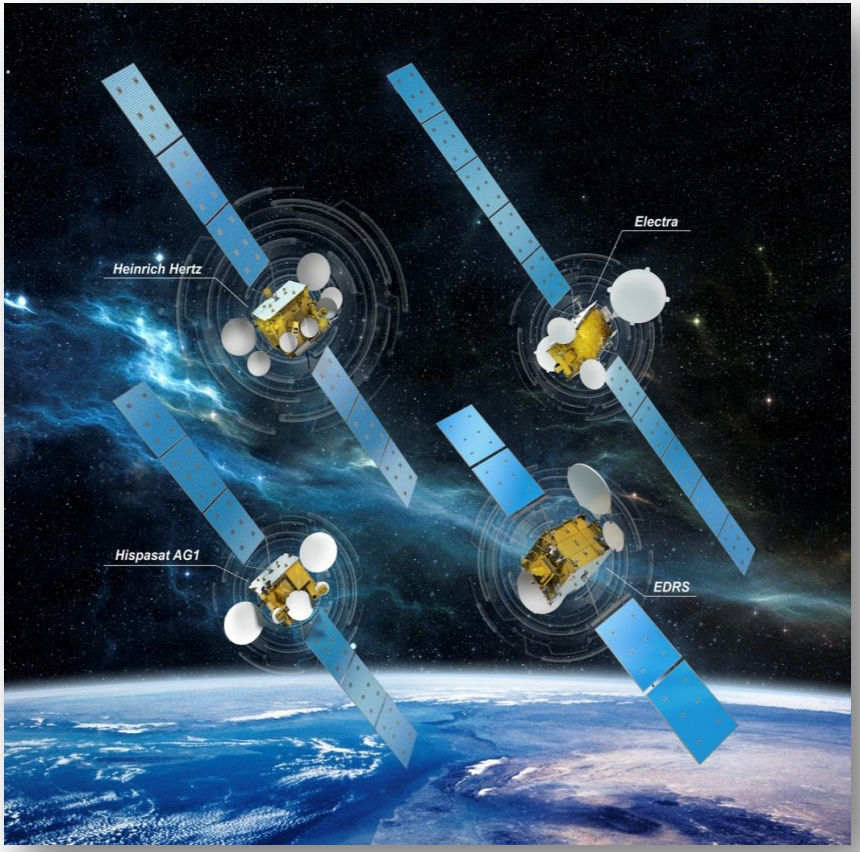
Satellites for the Galileo system

- Prime contractor for the development and construction of a total of 22 satellites; customers: EU Commission and ESA
- Navigation payload contracted out to Surrey Satellite Technology Ltd., GB
- Platform based on experience gained with SAR-Lupe
- Satellites scheduled for launch on board Soyuz/Ariane 5 from 2013 until 2015



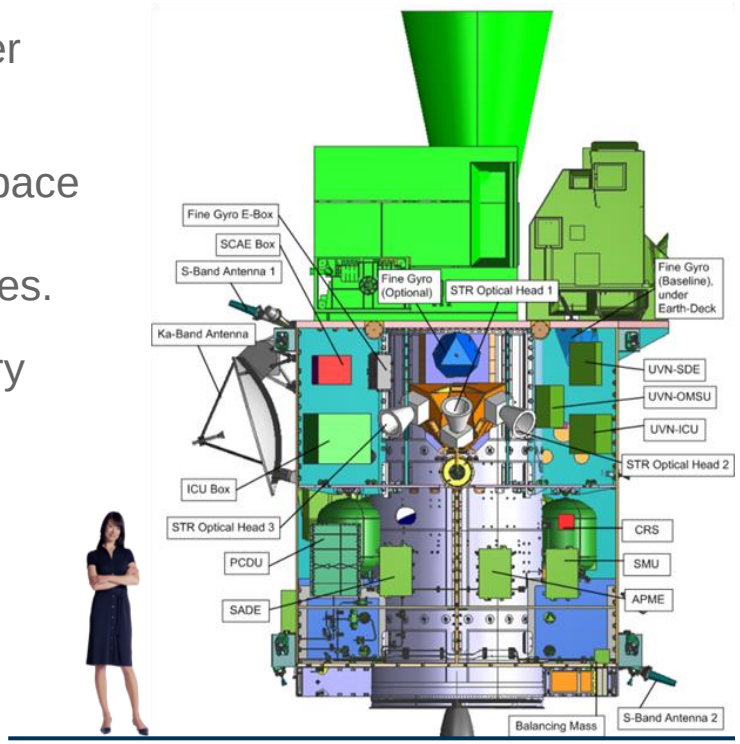
SmallGEO product line

- **OHB geostationary satellite platform solution**
  - Designed for geostationary satellites with a launching mass of 2 to 4 tons
  - Capability to provide end-to-end solutions for satellite telecommunications
- **Flexibility**
  - SmallGeo platform adaptable for other applications (earth observation, optical communications)
- **Status**
  - Platform developed with European partners within the ESA ARTES 11 programme
  - Four satellites in preparation at OHB
  - First SmallGEO launch in 2014 (Hispasat AG1)



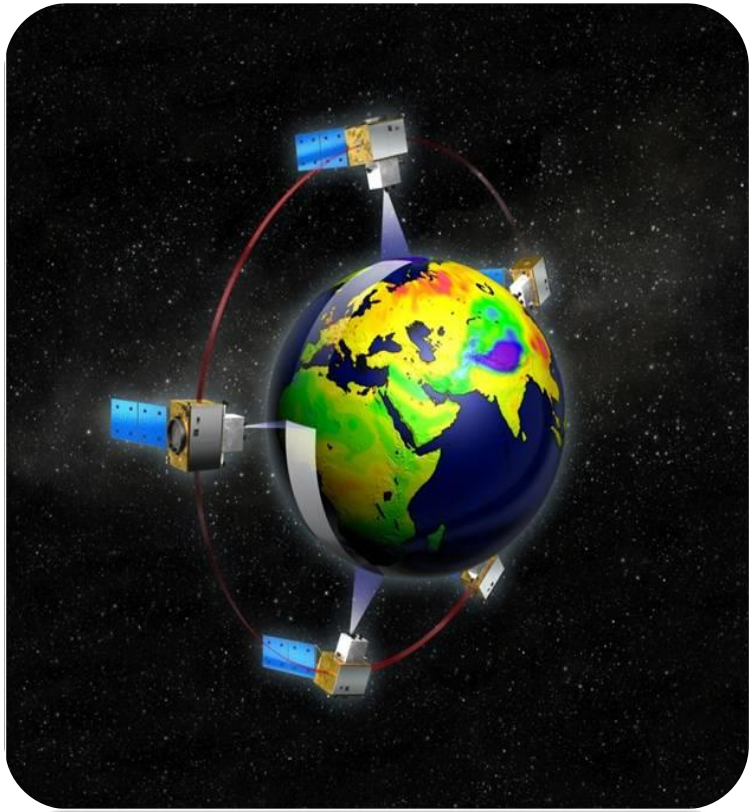
MTG: Meteosat Third Generation

- Customer: EUMETSAT / ESA
- Purpose: to improve weather forecasting via new imaging techniques
- The program comprises 4 imager satellites and 2 sounder satellites based on the SGEO platform
- In partnership with the prime contractor, Thales Alenia Space France, OHB System is responsible for the two sounder satellites and four further platforms for the imager satellites.
- The sounder payload is being supplied by OHB subsidiary Kayser-Threde GmbH, Munich
- Launches from 2017



CarbonSat Constellation

- Part of the ESA “Living Planet” earth observation program
- CO^2 monitoring spectrometer, LEO constellation
- Improved resolution (from 32 to 2km) and targeted cloud-free data
- Payloads:
  - Near-infrared spectrometer
  - Short-wavelength infrared spectrometer
- Evaluation with monthly update for operating services
- Proposal of a 5-satellite constellation with global coverage over 24 hours



Scientific payloads:

- C.E.B.A.S. (closed aquatic microcosm) - 3 flights on board the Space Shuttle
- WAICO (examination of the “waving and coiling” of the Arabidopsis roots - 2 series of experiments on board the ISS

Payload systems

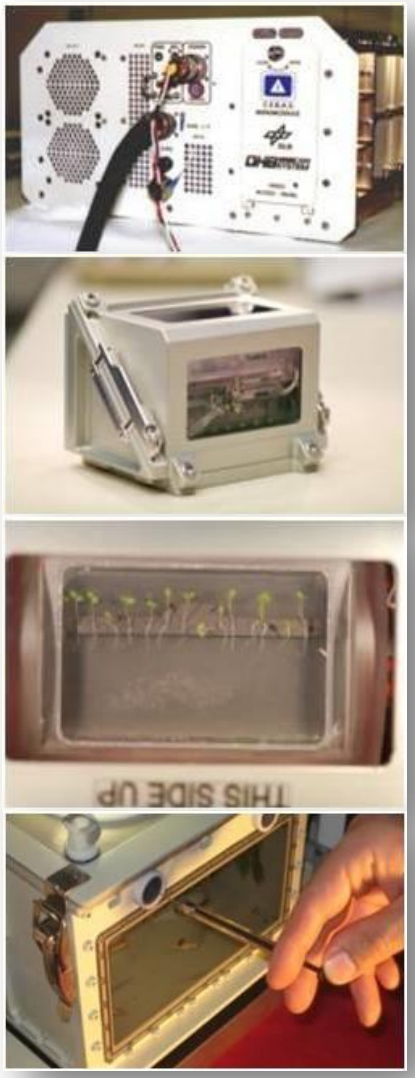
- ModuLES (Modular System Biological Research Unit)
- I-VED (“In-Vivo Embolic Detection”; detection of gas bubbles in the vascular system and other liquids)
- To research the effect of various environmental conditions (microgravitation, radiation etc.) on biological objects (e.g. human cells, microorganisms)

Sustainable key technologies: exploration, energy systems, “ecological life support”

- CELSS (Closed Ecological Life Support Systems)
- Biometric strategies for sustainable adhesives and smart surfaces
- Alternative energy supply strategies
- Automatic analysis systems
- Bio-monitoring (air and water quality)

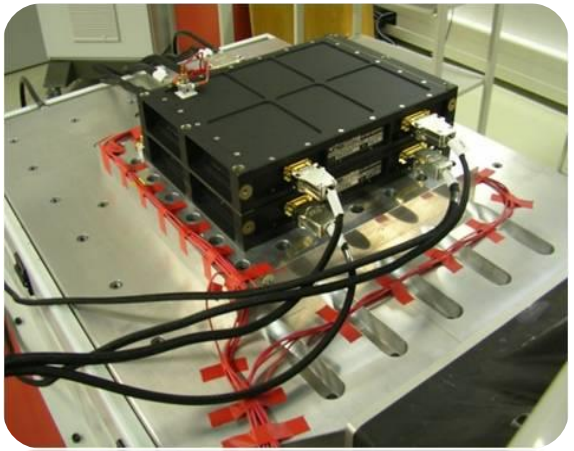
Applications

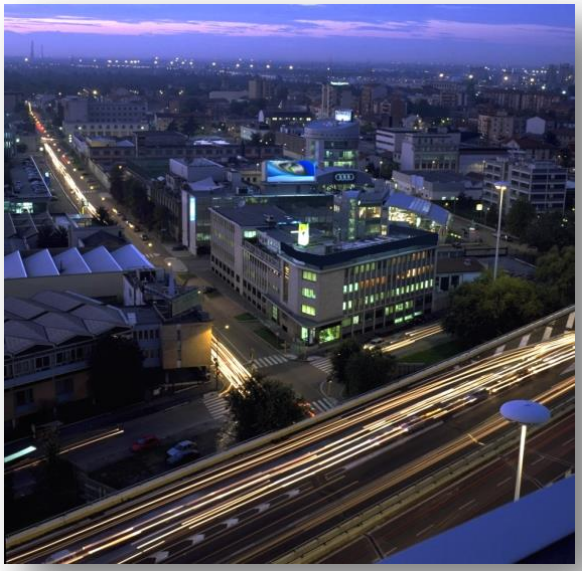
- AquaHab® (further development of the C.E.B.A.S., for ground-related purposes, e.g. ecotoxicology)



Security for communications and satellites

- OHB System provides security systems for all control centers for all German military satellite missions:
  - **SAR-Lupe:**
    - Server for simple command authentication system
    - Encryption unit for TC and TM handling (classification: SECRET)
    - High-speed decryption and storage of SAR data
    - OHB with remote access to the encryption system
  - **SatcomBW Phase 2:**
    - Special encryption unit for use by DLR mission control
    - Multiprotocol TC and TM handling up to classification: SECRET
  - **Galileo:**
    - OHB provides the security units for the Galileo satellites





SPACE SYSTEMS

CGS SPA – COMPAGNIA GENERALE PER LO SPAZIO, Milano, Italy

Main Business Domains

- Satellites for scientific and application missions.
- Scientific applications payloads.
- ISS utilization activities.

Key data (fiscal year 2013)

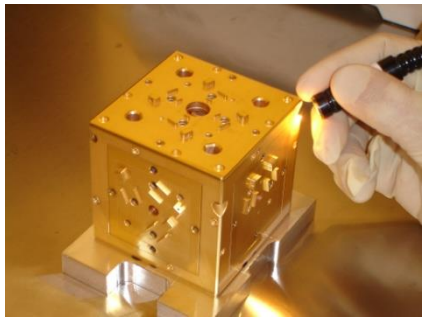
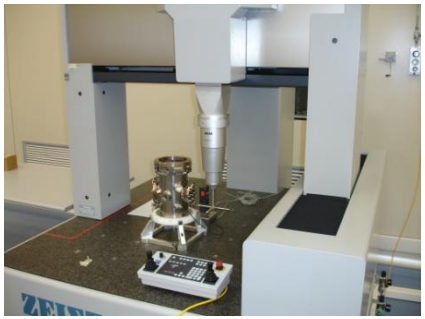
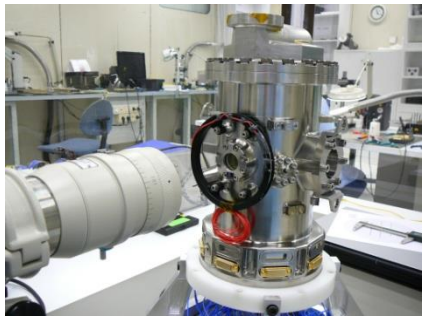
- Total revenues: 47,5 M€
- Employees: 175

In space Business since 1981. ISO-9001 certified.

LISA Pathfinder: Inertial Sensor Package

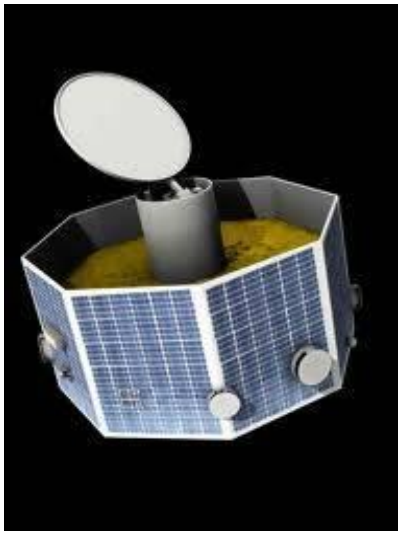
LISA Pathfinder is the precursor of NGO mission which objective is to empirically demonstrate the existence of gravitational waves.

- CGS role:
  - Electrode Housing development
  - Inertial Sensor Head design and development
  - Inertial Sensor Subsystem integration
  - Thermal and Self-gravitation system level activities design
- Launch planned for 2015.

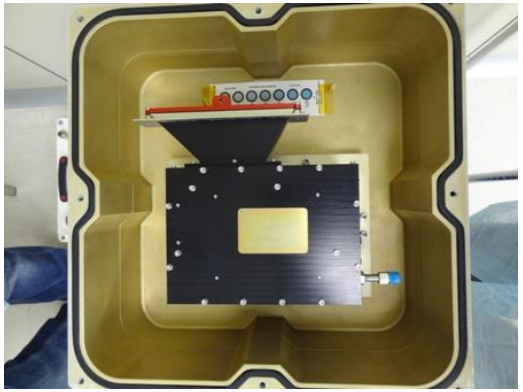





BepiColombo: CGS P/L Contributions

Four instruments which will fly on board the BepiColombo to investigate the Mercury's surface-exosphere-magnetosphere system.

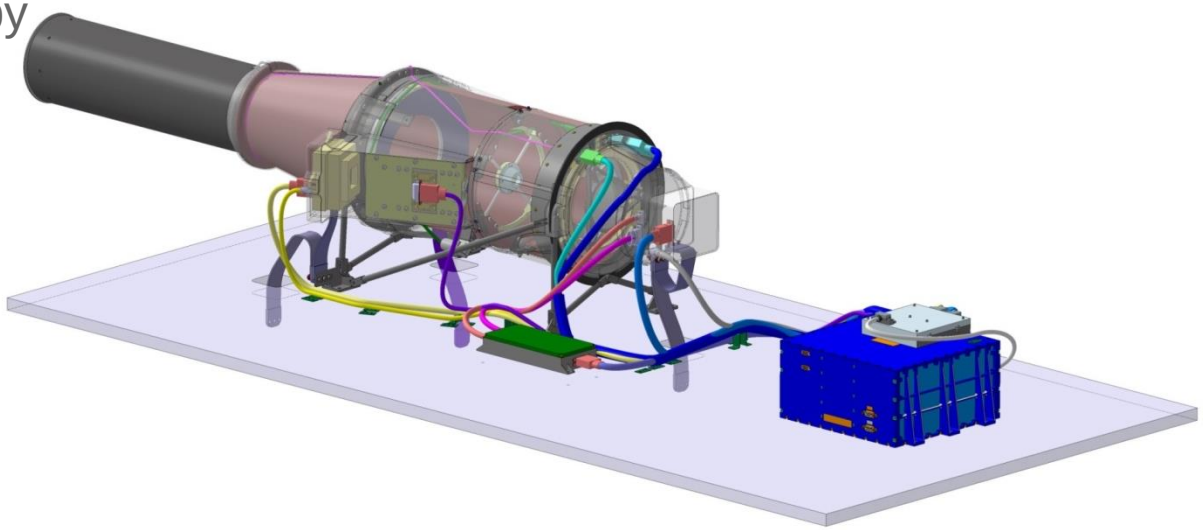


- Prime Contractor for the whole instrument suite (SERENA) constituted of:
  - ELENA (Emitted Low-Energy Neutral Atoms)
  - STROFIO (STart from a ROtating Field mass spectrOmeter)
  - MIPA (Miniature Ion Precipitation Analyser)
  - PICAM (Planetary Ion CAMera)
- Responsible of ELENA (Emitted Low-Energy Neutral Atoms) detector.
- Mission envisaged for 2015, arrival on Mercury 2020, mission lifetime: 1 year.



Metis (phase C/D)

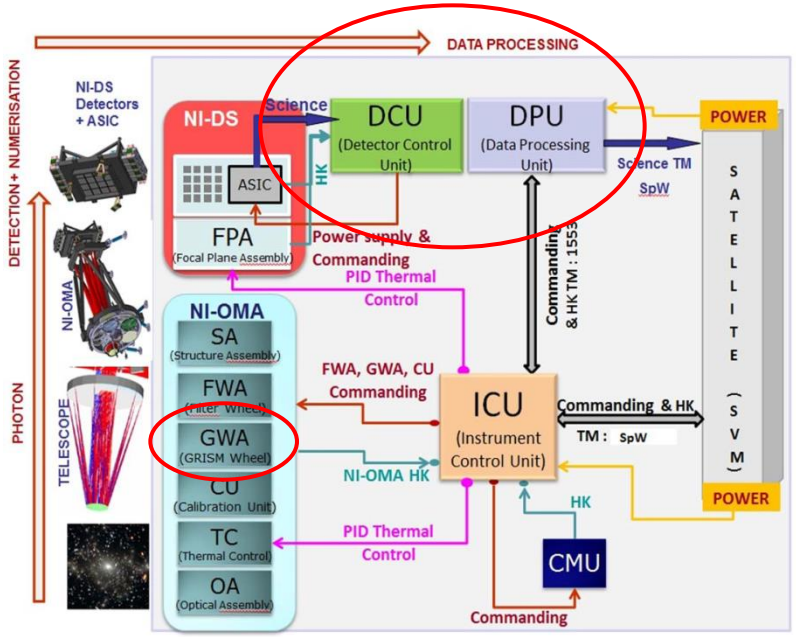
- inverted-occultation coronagraph, Metis is an Italian contribution to the ESA mission Solar Orbiter aimed to the exploration of the Sun and of the inner heliosphere
- Primeship by CGS in charge, among the other, of the instruments System Design and Project Office
- Industrial team constituted by TASI and five SME (ALTEC, AIEM, Antares, TEMIS, SITAEL) in addition to CGS



Euclid (phase B/C1)

- Euclid is part of the ESA Scientist program Cosmic Vision 2015-2025.
- 1.2 m diameter telescope and two scientific instruments, **VIS** (visual imager) and **NISP** (near-infrared spectrometer and photometer).
- Mapping the geometry of the **dark Universe**

- CGS is in charge of the Italian contribution to the mission:
- **NISP instrument:**
  - Detector Processing Unit and Detector Control Unit including on-board S/W (bootstrap e kernel)
  - Grism Wheel Assembly
  - Instrument EGSE
- **VIS instrument:**
  - Command and Data Processing Unit

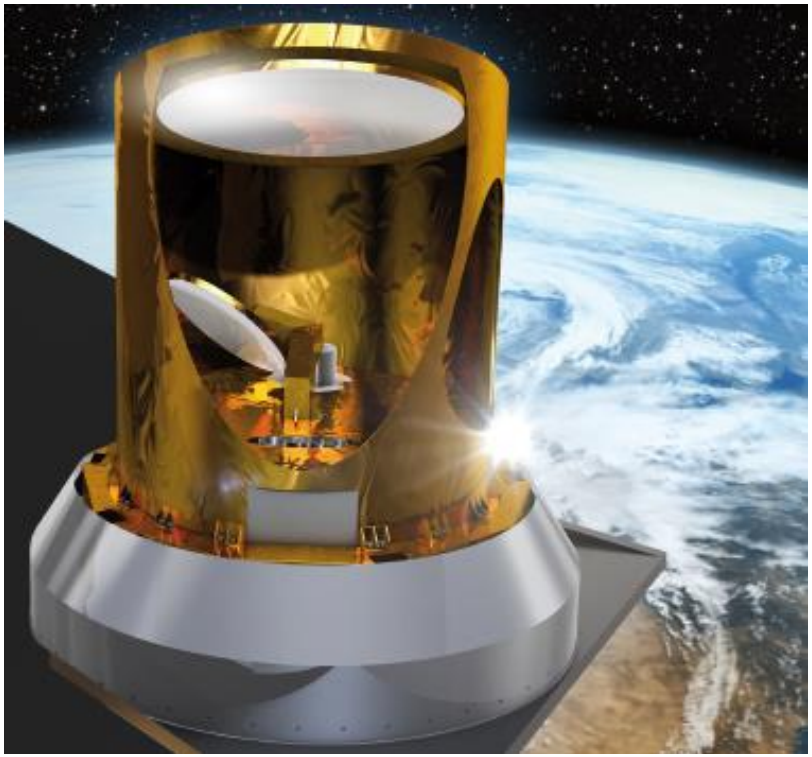


MicroWave Imager (MWI)

- CGS has been selected by ESA as Prime Contractor for Design & Development of the MicroWave Imager (MWI) instrument for MetOp-SG
- Direct Customer will be MetOp-SG Sat B prime (to be selected by ESA in 2014) Final Customer ESA/EUMESAT
- Delivery of 1 STM, 1 EM, FM1 and FM2 (+ Option: FM3)

- Core Team:
  - CGS: Instrument System Engineering, Mechanical/Thermal Design, Electronics, AIT
  - Astrium (F): Radio Frequency Assembly
  - Space Engineering (I): Antenna

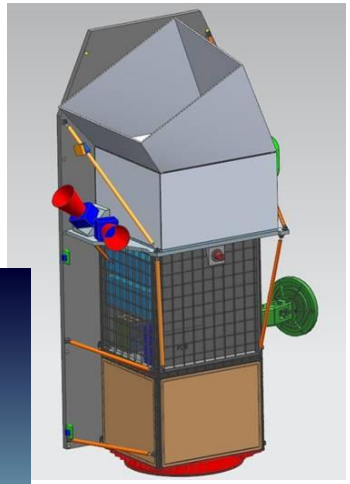
- Program Planning:
  - KO: April 2014
  - MWI PFM delivery: Q4 – 2019
  - MWI FM2 delivery: Q3 - 2021
  - Launch SAT B1 Q2-2022
  - Launch SAT B2 Q2-2029 (TBC)

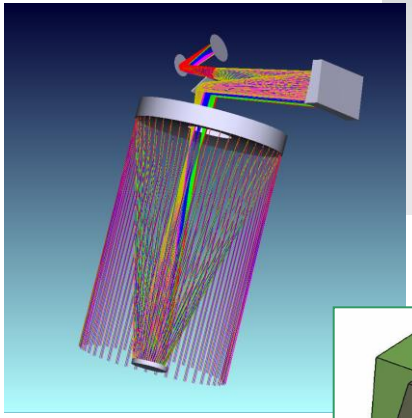


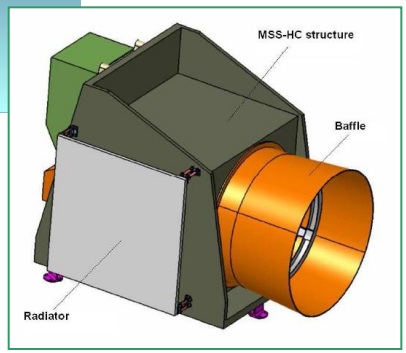
PRISMA and EnMAP: Hyper-spectral missions

PRISMA

- ASI Earth Observation Mission with an hyper-spectral payload and panchromatic camera.
- 5 years lifetime
- Orbit: SSO, 620km. Mass at launch: ~ 700 kg.
- Electrical power: 450 W (average), 1kW (peak).
- Daily img. capab.: 108.000 km2 (-Band downlink)
- CGS Prime Contractor, satellite integration, platform development.





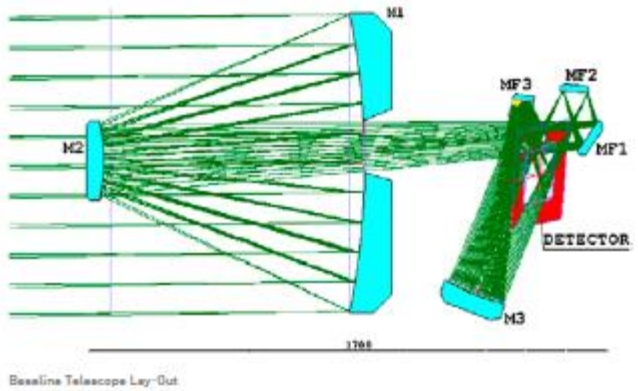


EnMAP

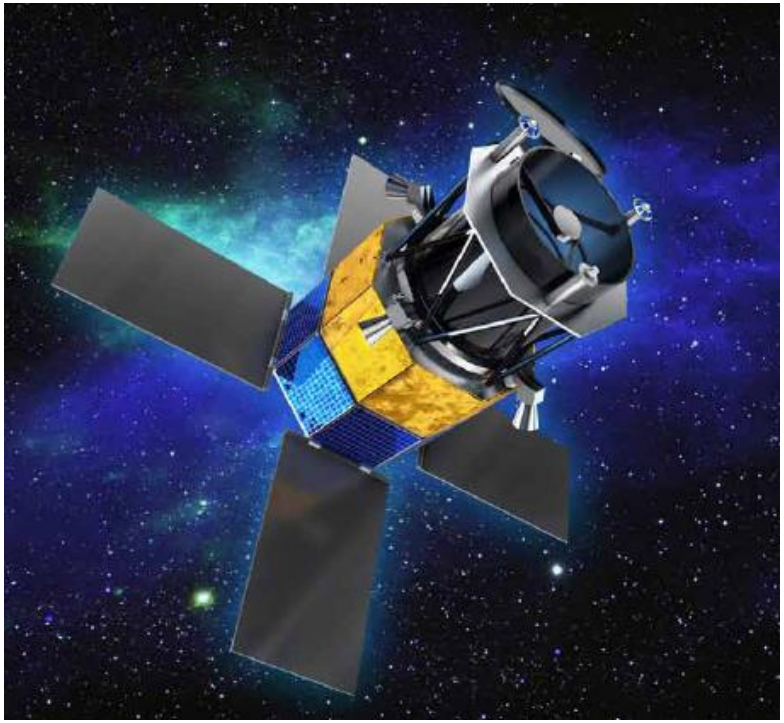
- Delivery of the Satellite Management Units (2FM) for the EnMAP Platform.

OPSIS

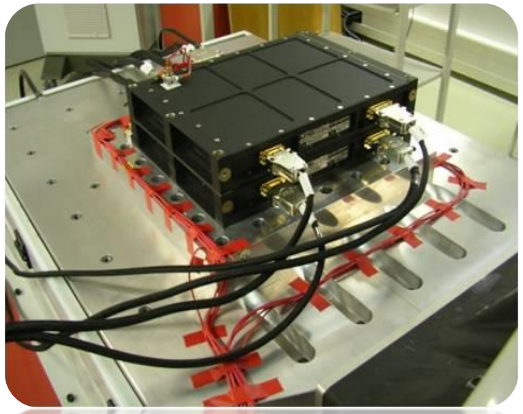
- ASI mission for Optical System for Imaging and Surveillance awarded through competitive tender (CGS vs Thales)
- Phases A/B1 contract started in July 2012
- OPSIS is a submeter resolution Earth observation mission



Baseline Telescope Lay-Out

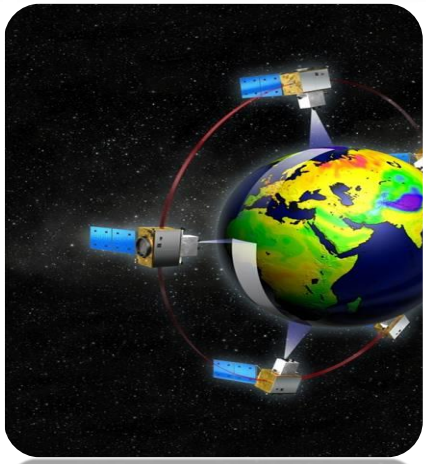


Cooperation of LSI with SME:



- **WHY**

1. Technology is driver for continous renewal and growth for space systems
2. SME provide new ideas, innovative solutions that can lead to new generation of satellite systems



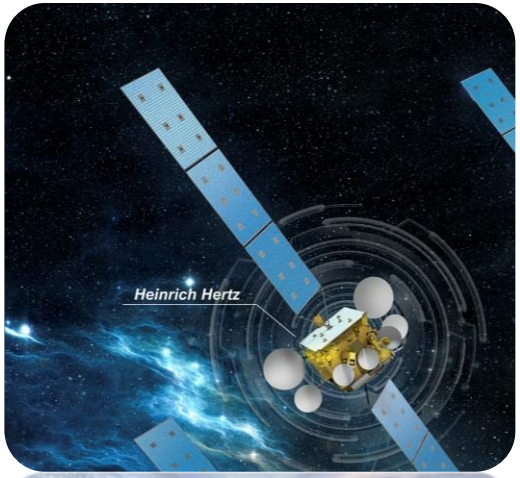
- **WHAT**

1. Everything that makes satellites (constellations) smarter, smaller, and more cost effective
2. Hardware, software, processes… - from (sub-)system to component level
3. … what was never done before (because everybody „knew“ it is „impossible“)

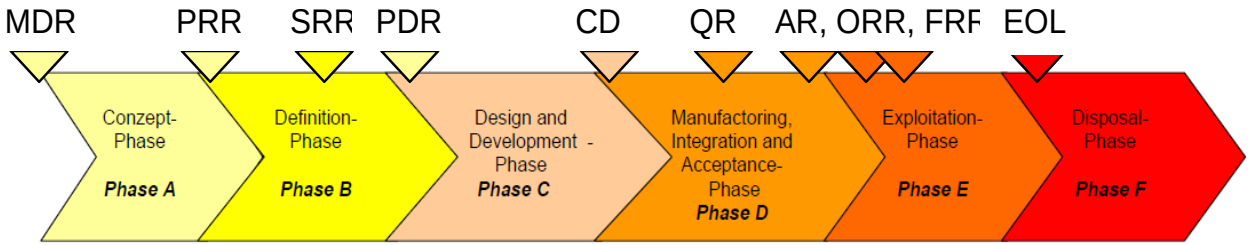
Cooperation of LSI with SME:

- **HOW**

1. SME comes up with an idea…. - or:
2. OHB comes up with an idea… - then:
3. Cooperation my be based on technology studies led by SME and supported by OHB, - or
4. OHB takes lead and receives substantial support by SME partner(s)
5. Funding lines:
   - ESA: Artes, GSTP, …
   - H2020 space calls
   - National funding (e.g. ASI for CGS plus partners)
   - Bilateral funding, to prepare for future ESA activities
6. Procurement practice: OHB supply chain management (see next pages)

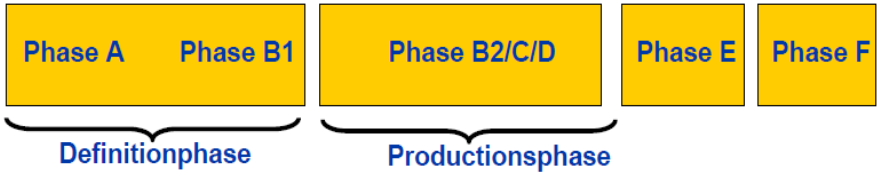


ESA- Space Project Life Cycle



A. Full Cycle, broken down in Phases

B. Combined Predevelopment and Implementation Phases



C. Combined Development, Manufactoring, Integration and initial Exploitation Phase

AR – Acceptance Review
CDR – Critical Design Review
FRR – Flight Readiness Review
MDR – Mission Definition Review
ORR – Ops Readiness Review
PDR – Prel. Design Review
PRR – Prel. Requirements Review
QR – Qualification Review
SRR – System Requ. Review

How to handle procurements: Supply Chain Management at OHB System

Autonomous team

Project oriented coordinatio

SCM Office

- Supply Management
- Export Compliance
- Consulting Services

Head of SCM

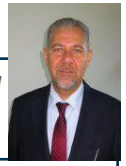
Procurement Managers

- EDRS-C*
- Electra*
- EnMAP*
- ExoMars 2016
- ExoMars 2018
- Galileo FOC
- Galileo Evolution
- HAG1*
- Heinrich Hertz*
- MTG*
- SARLupe2

Team MTP

- Propulsion
  - Monoprop
  - Biprop
  - Electrical (TBC
- Structure
  - CT
  - Panels
  - Tertiary
  - Commodities
- Thermal
  - MLI / OSR
  - Commodities
- MGSE
- Environmental Test Campaign
- Launcher (TBC)

Team Electronics / Avionics



- Compute
  - SMU
  - RTU
- AOCS
  - Sensors
  - Actuators
- Power
  - Solar Generato
  - Battery
  - PCDU
- Electronic commodities
  - EEE parts
  - Harness
- Software
- EGSE
- Ground Station (TBC)

Team Payload / RF

- Telecommunication P/L
- Earth Observation P/L
- Navigation & Science P/L
- TT&C / Communication
  - Antennas
  - plifier

* Disciplinary not allocated to SCM

Your input is valuable…(what you always wanted to know, but were too shy to ask…)

Invitation to Discussion with:

Giovanna Ober (CGS, Milano)

Cornelius Schalinski (OHB System, Bremen)

Grazie, danke, merci, thank you!