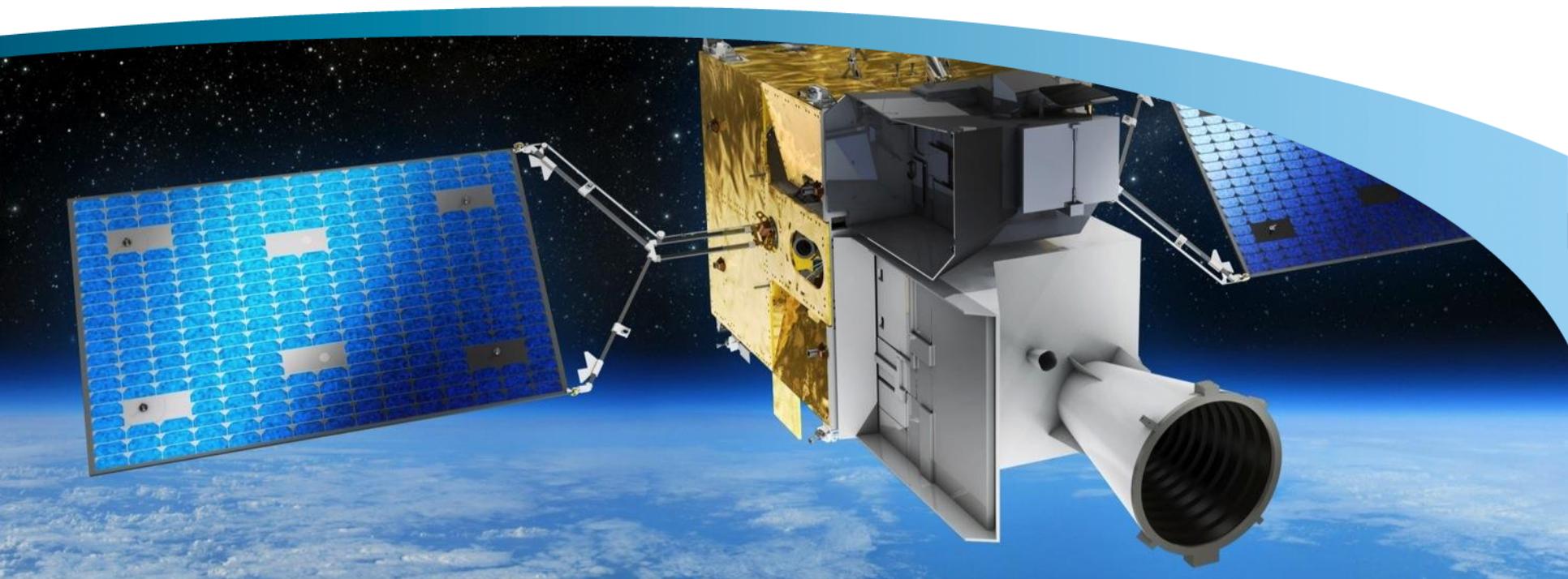


OHB SE & OHB System AG



SPACE SYSTEMS

# Finnish Space Industry Days 2019 Company Presentation

We. Create. Space.



## AGENDA

- OH B SE
- OH B System AG
- Introduction to selected projects
- How we buy (Procurement)

SPACE SYSTEMS

We. Create. Space.



SPACE SYSTEMS

**OHV SE**

We. Create. Space.

## Visionary. European.

- OHB SE is Germany's first listed technology and aerospace group
- Approx. 2,500 employees stationed around Europe
- Two system branches deliver sophisticated, custom-made technology and systems to international customers

### —Space Systems

Design and development as well as implementation of space projects

### —Aerospace + Industrial Products

Product and manufacturing for aerospace and telematics.



## Flexible. Consistent. Independent.

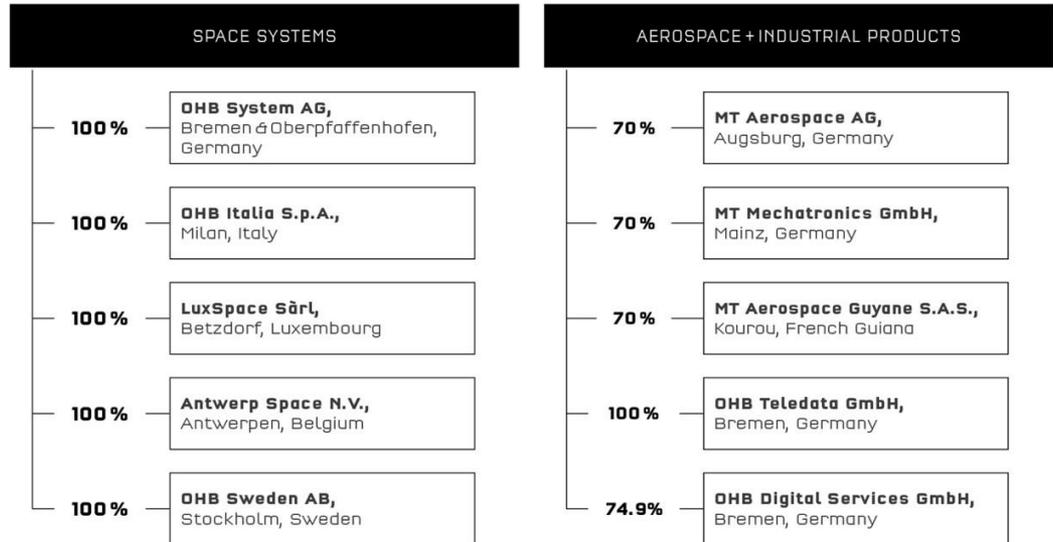
- Family-run company with the character of a medium-sized business
- From modest beginnings to an internationally recognized and consistent player
- Reliable and acknowledged source for high-tech products in Germany and Europe
- Independent entity in the European aerospace sector, contributing to all major space programs.



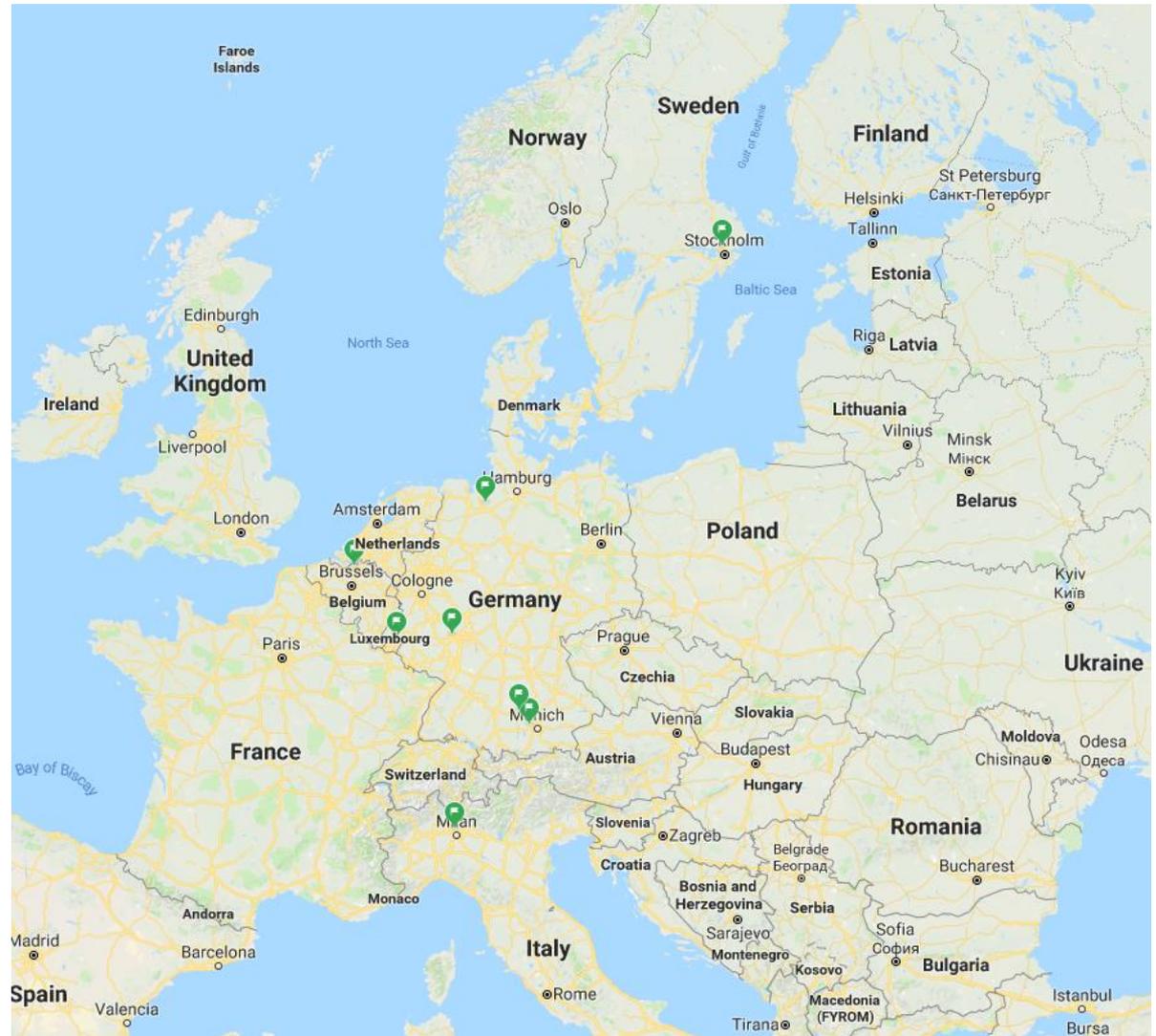
# United under one roof

The value chain of the two system branches **Space Systems** and **Aerospace + Industrial Products** of OHB SE includes:

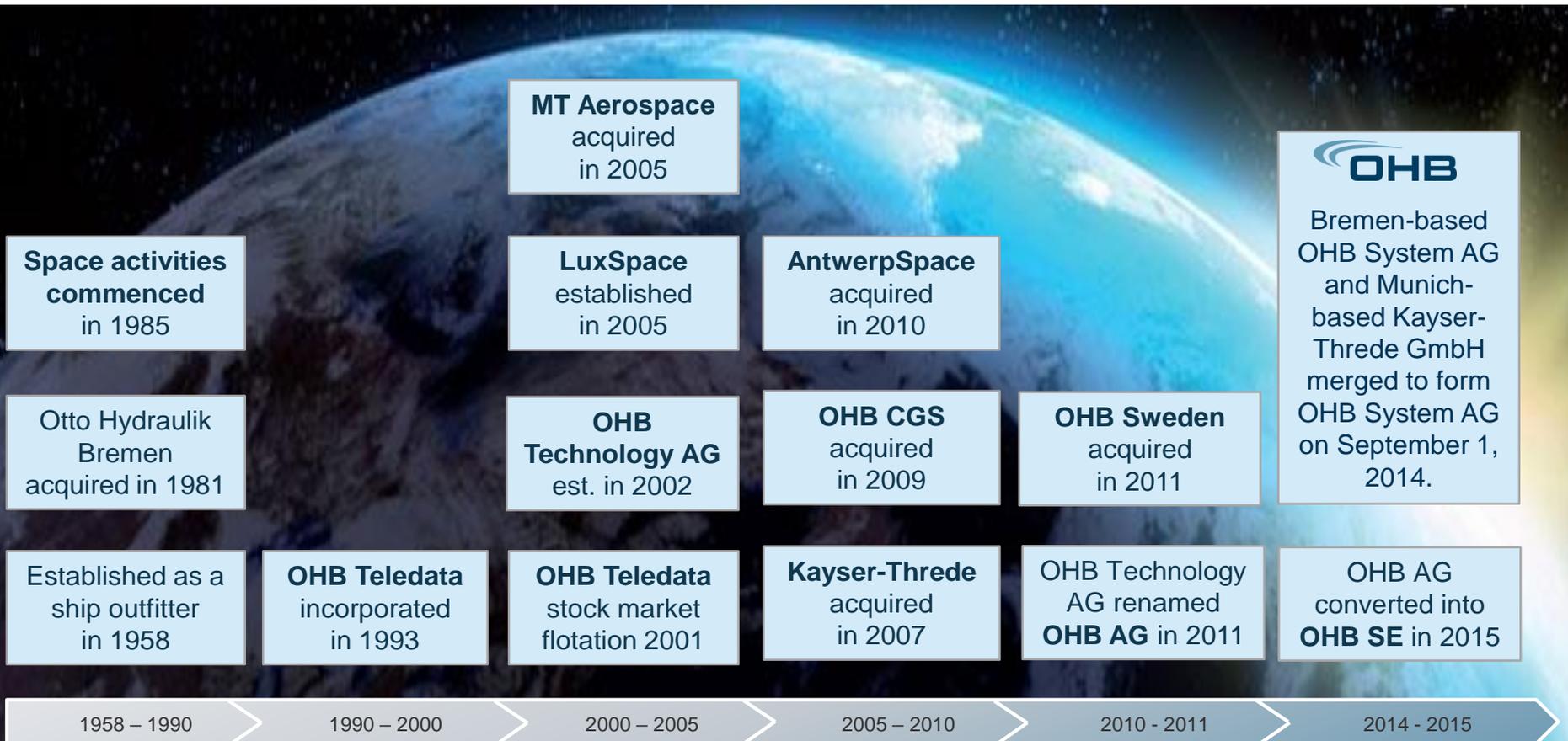
- Satellite design, manufacturing and operation
- Data transmission and processing
- Design, development and manufacturing of scientific payloads
- Structures for aerospace applications.



# Map of Sites



# Corporate development milestones



**We. Create. Space.**

**OH B SE**

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[info@ohb.de](mailto:info@ohb.de)

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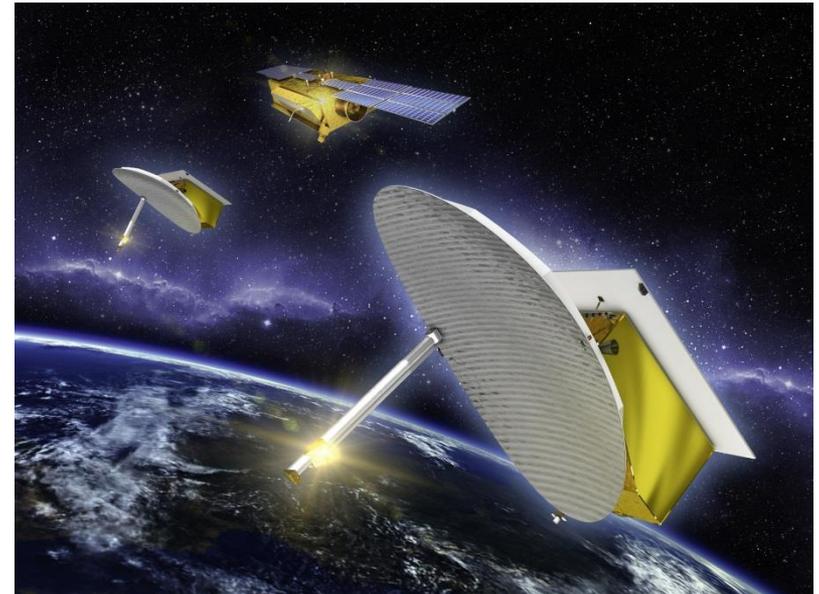
SPACE SYSTEMS

**OH B SYSTEM AG**

We. Create. Space.

## Business activities

- **Entire scope of space applications**  
Telecommunications, Earth observation, Reconnaissance, Navigation and Security, Science and Human Spaceflight
- **Complete range of project management**  
from small-scale payloads and missions to large-scale satellite and space infrastructures
- **Transfer of technology**  
into industrial applications in the field of process control systems for railway power supply.



# One company with two strong sites

## BREMEN SITE

- Galileo Hall: 1.630 m<sup>2</sup>  
of which 1244 m<sup>2</sup> ISO 8 integration area
- SAR-Lupe Hall: 922 m<sup>2</sup>  
of which 525 m<sup>2</sup> ISO 8 integration area
- Columbus Hall: 670 m<sup>2</sup> ISO 8
- Electronics-/EQ-Hall: 211 m<sup>2</sup>  
of which 35 m<sup>2</sup> ISO 7.
- Plato Hall: 960 m<sup>2</sup> ISO 8 integration area +  
147 m<sup>2</sup> ISO 8 labs, under construction



# One company with two strong sites

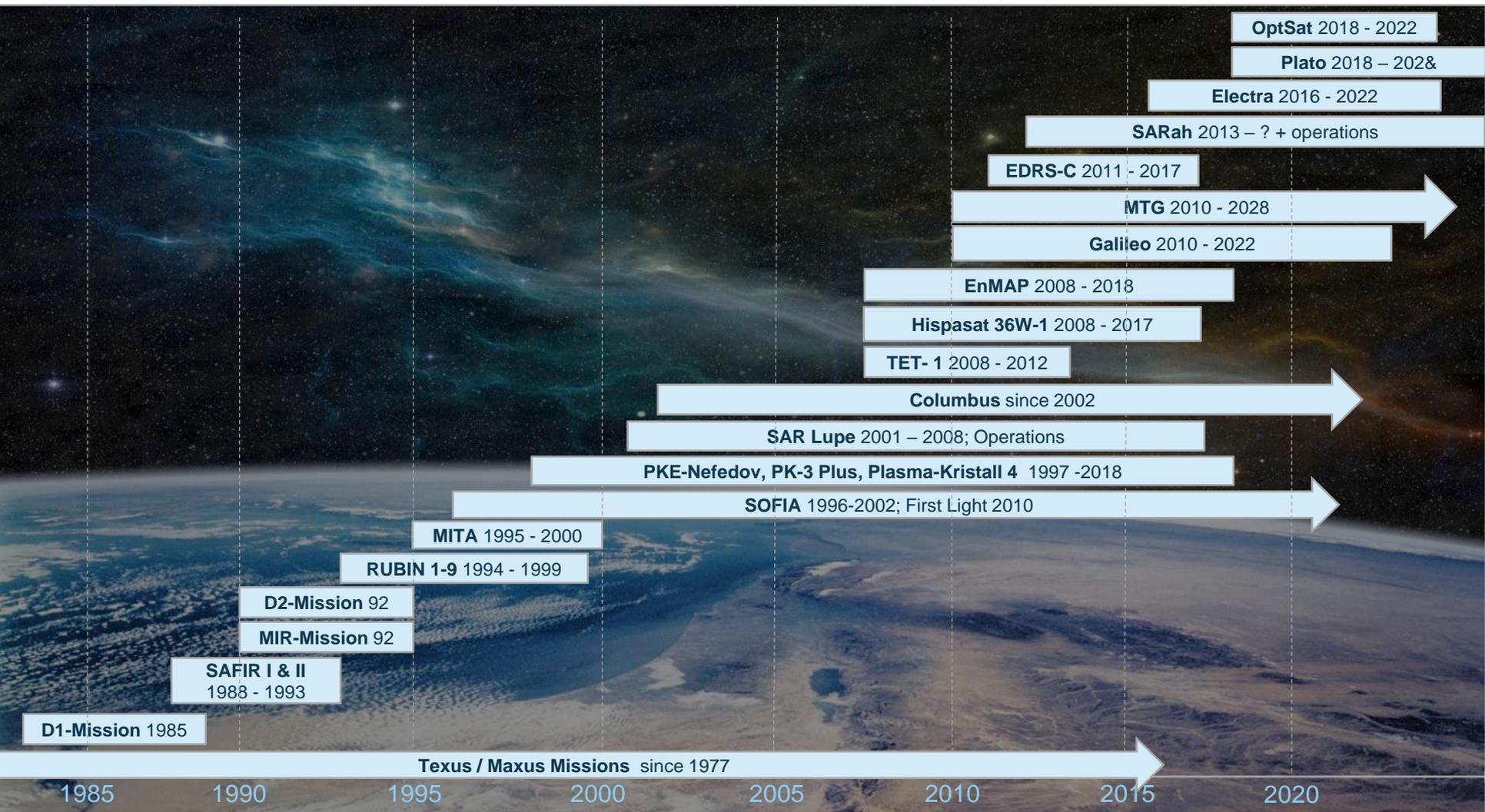
## OBERPFAFFENHOFEN SITE

- Integration Hall: 1.420 m<sup>2</sup>
  - 320 m<sup>2</sup> ISO8 integration area
  - 300 m<sup>2</sup> ISO5 integration area
- Electrical product manufacture:  
approx. 200 m<sup>2</sup> ISO8
- Laboratories:  
approx. 730 m<sup>2</sup>.

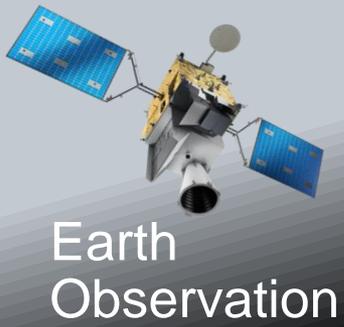


Pictures taken during commissioning phases of the two ISO 5 clean rooms (middle), the flight hardware storage area and the ISO 8 hall (bottom)

# Progression of project portfolio (selection)

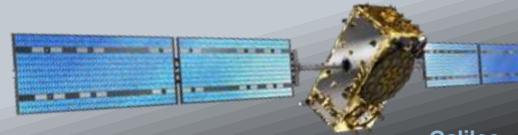


# Scope of activities



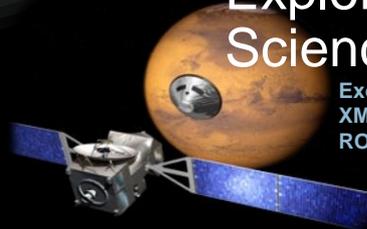
**Earth Observation**

CarbonSat / EnMAP / MTG



**Navigation**

Galileo



**Exploration / Science**

ExoMars / Euclid / PLATO /  
XMM-Newton / Herschel-PACS /  
ROSETTA



**Telecommunications**

HISPASAT / Heinrich Hertz / Electra



**Security**

SAR-Lupe / SARah / OptSat  
Athene



**Technology**

Robotics / TET /  
Precision clocks /  
Fiber optics



**Human Spaceflight**

International Space Station /  
DC4EU



## We. Create. Space.

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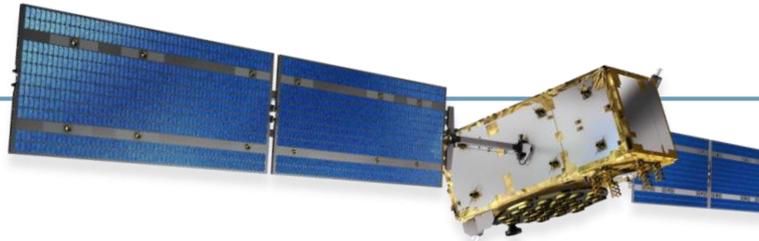




SPACE SYSTEMS

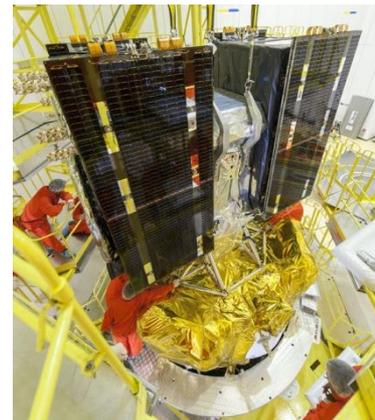
# Projects in brief

We. Create. Space.



# Galileo

- Prime contractor for design and realization of the satellites for the European satellite navigation system Galileo
- 22 satellites in orbit, further 14 satellites are ordered
- Customers: EU Commission and ESA
- The first pair of Galileo FOC satellites was completed in less than 4.5 years and launched 08/2014
- Navigation payload subcontracted to Surrey Satellite Technology Ltd., UK
- Platform based on experience gained from the SAR-Lupe project.



The FOC (full operational capability) phase of the Galileo program is being funded by the European Union. The European Commission and the European Space Agency ESA have signed a delegation agreement under which ESA acts as the design and procurement agent on behalf of the Commission. The views expressed here do not necessarily reflect the official position of the European Union and/or ESA. "Galileo" is a registered trademark owned by the EU and ESA and registered under OHIM application number 002742237.



## SmallGEO product lines

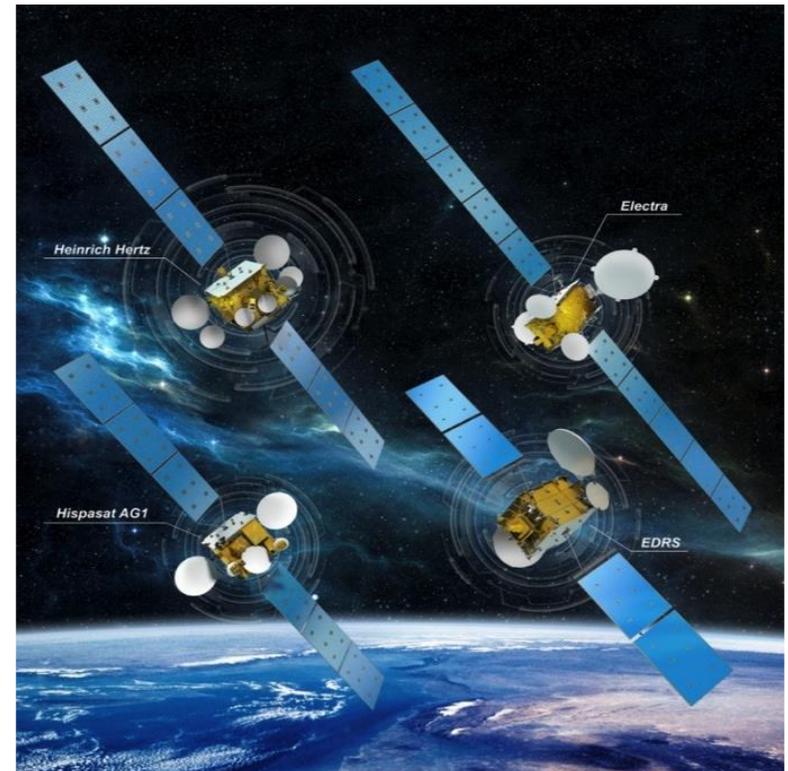
Communication, data and video transmission on land, water and in the air

### FAST: short delivery periods

- Conventional propulsion system (chemical or hybrid)
- Payload capacity of up to 450 kg, 4.7 kW and 30 active transponders
- From L to Ka band
- Service life of more than 15 years

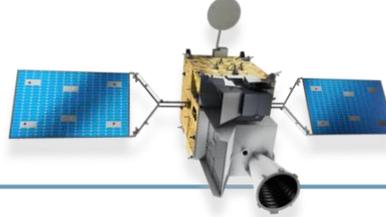
### FLEX: maximum payload

- Fully electric propulsion configuration
- Payload capacity more than 600 kg, 8 kW equivalent to 40 active transponders, service life of up to 20 years
- Dedicated ESA ARTES 33 programme Electra.



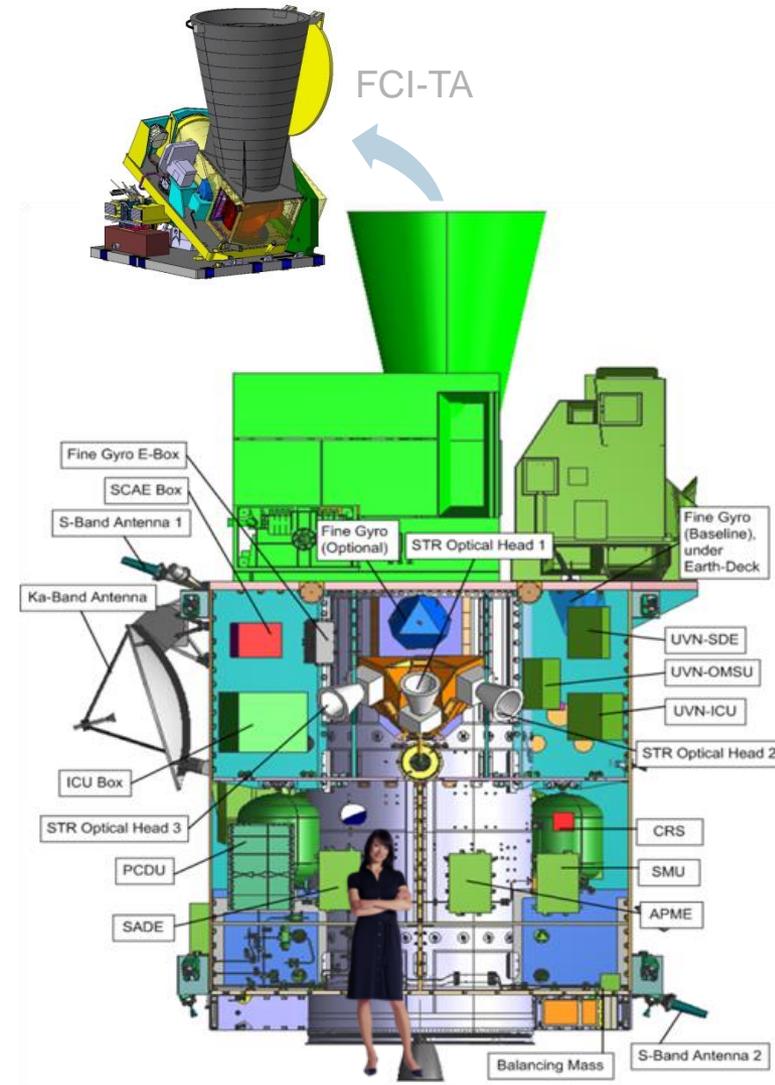


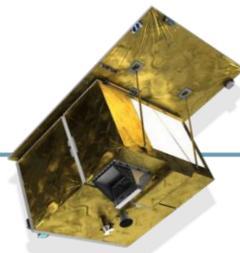
Hispasat 36W-1	EDRS-C	Heinrich Hertz	Electra
Customer: Hispasat S.A./ ESA	Customer: Airbus Defence & Space Services	Customer: German Aerospace Center (DLR)	PPP between ESA, SES S.A. and OHB System AG
Realization under the ARTES 11 program	ESA ARTES 7 program: European data relay satellite system for complementing the Sentinel earth observation satellites under the EU Copernicus program (formerly GMES)	Economical/technical part of the payload for testing innovative communications and platform technologies in the Ku and Ka band in space and on the ground	Part of the ESA's ARTES 33 program
Ku and KA band TV transmission applications	Optical satellite links with data rates of up to 1.8 Gbps, downlink in Ka band		SmallGEO satellite with fully electrical propulsion system for transfer manoeuvres and attitude control
	Additionally: hosted payload for Avanti Communications Group plc	Military payload part for the German federal armed forces	Increased payload capacity compared to the chemical propulsion version, resulting in optimized launch costs



# MTG: Meteosat Third Generation

- Customer: EUMETSAT / ESA
- Purpose: to improve weather forecasting by means of new imaging techniques
- Scope: 4 imager satellites and 2 sounder satellites (based on SGEO platform technology)
- First 3-axis-stabilized weather satellite in GEO
- OHB System in Bremen is responsible for the 2 sounder satellites (IRS) and 4 platforms for the imager satellites (FCI)
- OHB System in Munich is the principal contractor for the IRS payload and the largest subcontractor for the FCI-TA (telescope assembly).

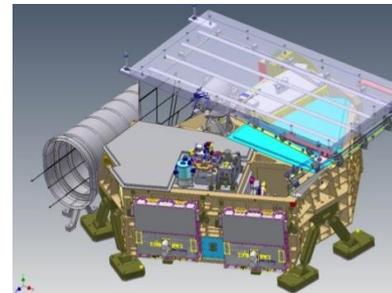
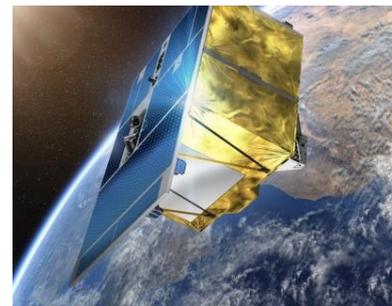




## EnMAP

(Environmental Mapping and Analysis Program)

- New type of hyperspectral sensor system for use in environmental observation for a better understanding of the Earth's ecosystem
- First hyperspectral sensor with sufficient signal-to-noise ratio to generate high-quality data for global Earth observation purposes
- More than 200 spectral bands in visible and near infrared range
  
- Customer: DLR
- Principal contractor: OHB System AG, Oberpfaffenhofen.



## SAR-Lupe for the German federal armed forces

- First German satellite-based radar reconnaissance system
- Customer: German Federal Ministry of Defense
- Five radar satellites and a ground system
- High geometric resolution: < 1m
- Short system response time
- Ground station for satellite control and image processing in Gelsdorf (Germany)
- 5 satellites and ground station fully operational since 2007
- Satellites operated by OHB at Gelsdorf since 2007
- 10-year Contract for the operation of the SAR-Lupe satellites ended on November 30, 2017
- Contract for an extension of the operating period signed on November 30, 2017.



## SARah - successor to SAR-Lupe

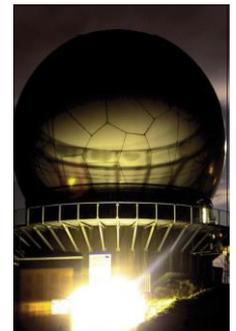
- Contract for the development and manufacturing of the SARah system awarded in July 2013
- Constellation comprises 3 advanced technology radar satellites
- Customer: German Federal Ministry of Defense represented by BAAINBw (Federal Office of Bundeswehr Equipment, Information Technology and In-Service Support)
- OHB System will be supplying two reflector SAR satellites, elements of the ground system and two ground stations
- Sub-contract awarded to Airbus Defence & Space for one phased-array SAR satellite.



Space segment with two reflector satellites and one phased-array satellite



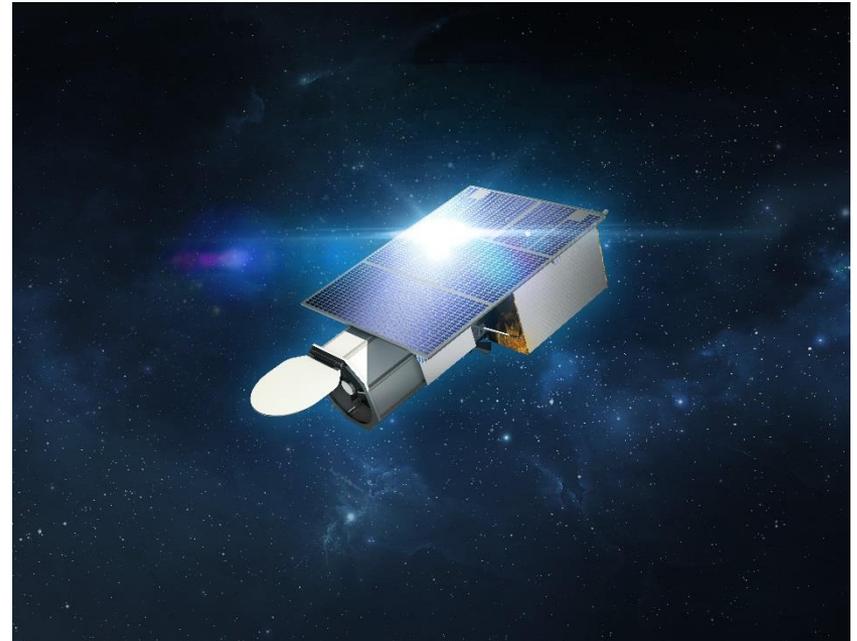
Ground segment in Gelsdorf



Ground stations

## OPT-SAT

- OHB is the prime contractor for the development of a satellite system for global electro-optical reconnaissance composed of a space and a ground segment
- Customer is the Federal Republic of Germany
- The contract has a budget of up to EUR 400 million
- The contract was signed on November 27, 2017.



Electro-optical satellite

## OPT-SAT

- OHB in Bremen is responsible for the overall system and the ground segment
- OHB Bremen is responsible for the manufacturing of the satellite platform and the integration work at the satellite level
- The electro-optical instrument will be developed and integrated at OHB Oberpfaffenhofen
- Environmental testing of the optical instrument and the satellite will be performed at IABG
- With OPT-SAT, OHB is implementing a national design approach with a very high share of German content



Integration hall in Bremen



ISO 5 integration hall for optical instruments in Oberpfaffenhofen

# PLATO

- **PLAnetary Transits and Oscillations** is a space observatory
- Launch: 2026
- Mission duration: 4.5 + 4 years
- Launcher: Ariane 6.2
- Orbit: Sun-Earth L<sub>2</sub>
- Type: multiple refractors  
2,250 x 2,250 °  
500 – 1.000 nm
- The mission goals are to search for planetary transits across up to one million stars, and to discover and characterize rocky extrasolar planets around stars. The emphasis of the mission is on earth-like planets in the habitable zone around sun-like stars where water can exist.



## PLATO

- The PLATO payload is based on a multi-telescope approach, involving a set of 24 "normal cameras" working at a readout cadence of 25 seconds and monitoring stars fainter than apparent magnitude 8, plus two "fast cameras" working at a cadence of 2.5 seconds, and observing stars between magnitude 4 to 8.
- The cameras are refracting telescopes using six lenses; each camera has an  $1,100 \text{ deg}^2$  field and a 120 mm lens diameter. Each camera is equipped with its own CCD staring array, consisting of four CCDs of  $4510 \times 4510$  pixels.
- The 24 "normal cameras" will be arranged in four groups of six cameras with their lines of sight offset by a  $9.2^\circ$  angle from the +ZPLM axis. This particular configuration allows surveying a total field of about  $2,250 \text{ deg}^2$  per pointing. The satellite will rotate around the mean line of sight once a year, delivering a continuous survey of the same region of the sky.



# ExoMars

ESA programme with 2 missions to Mars

**ExoMars-Mission 2016** comprises an orbiter and a lander demonstration module

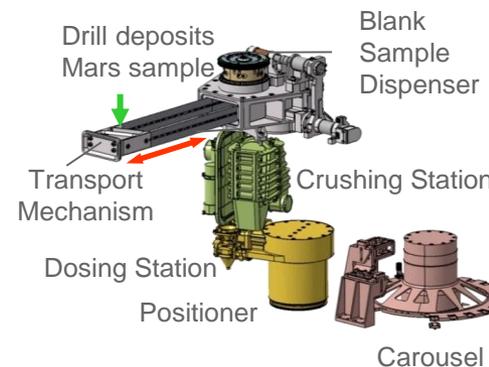
OHB System contribution:

- Core module of the trace gas orbiter (TGO) (thermal- and propulsion system, structure) successfully delivered early 2014

**Follow-up mission 2020** with a rover landing on Mars to search for signs of life

OHB System contribution:

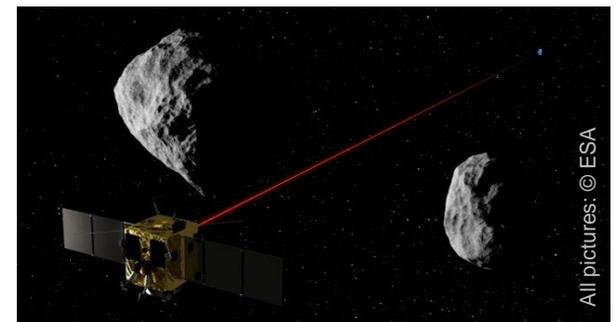
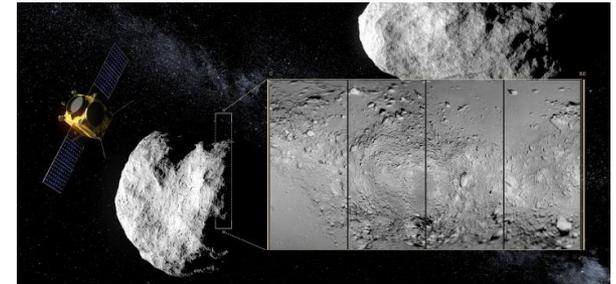
- Carrier
- Sample preparation and distribution system
- Analytical Laboratory Drawer
- High Resolution Camera
- RAMAN/RLS.



# Asteroid Impact and Deflection Assessment (AIDA)

- Asteroid mission characterizing the binary asteroid Didymos and demonstrating asteroid deflection
- Collision of NASA's DART spacecraft with the asteroid moon and measurement of the resulting path deflection, along with further impact parameters by ESA's AIM
- Mission start October 2020 determined by the asteroid's flight path, reaching Didymos in July 2022.

Science Objectives	Characterize Didymos (inertia & constitution) and investigate origin of binary asteroid
Asteroid Impact Risk Mitigation	Determine the DART momentum transfer (asteroid deflection)
Technologie-Demonstration	Demonstrate deep-space laser telecommunications as well as ISL (Inter-Satellite Link). Perform lander experiment.



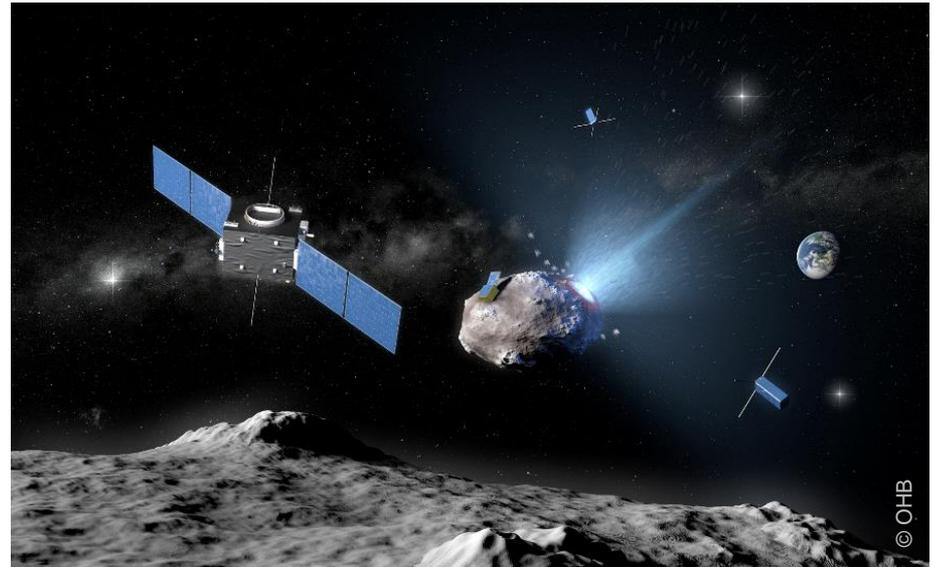
All pictures: © ESA

## Asteroid Impact Monitoring Mission (AIM)

- AIM is ESA's contribution to AIDA, an ESA-NASA cooperation to characterize the binary asteroid Didymos and to demonstrate asteroid deflection
- OHB as industrial prime is responsible for the overall spacecraft design and the whole AIT activities.

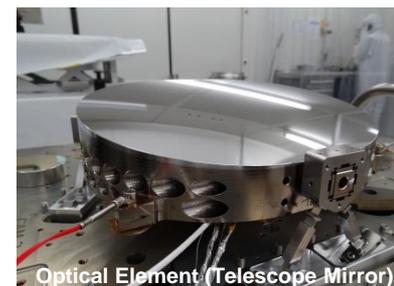
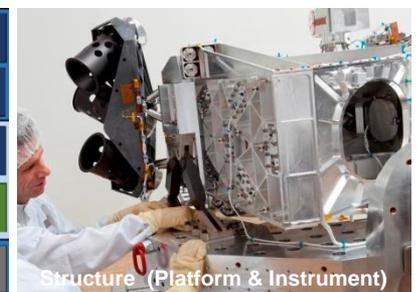
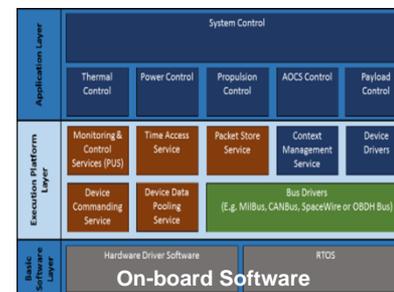
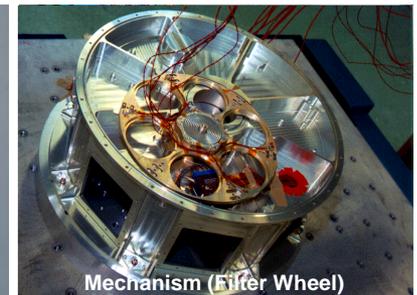
Scientific and technology payloads are provided by independent partners:

- High- and Low-frequency radars  
HFR & LFR (France)
- Thermal Infrared instrument TIRI (DLR)
- MASCOT-2 Lander (DLR)
- Laser Terminal OPTEL-D (Switzerland).



# Equipment Design and Development

- The OHB engineering and AIT know-how is complemented by in-house equipment and product developments in several areas:
  - Optics
  - Electronics & Avionics
  - Mechanisms
  - Software
  - Simulators
  
- Space-qualified mechanical and electrical manufacturing and up-to-date integration and test facilities (ISO8 and ISO5) complete the in-house portfolio.
  
- Until today, successful operations of OHB developed equipment accumulates to more than 600 years in-orbit time.





SPACE SYSTEMS

# Procurement

We. Create. Space.

## How we operate

- OHB System AG acts as a system prime on several levels:
  - Mission Prime: complete satellite mission with in-orbit delivery including ground segment
  - Satellite Prime: completely responsible for the satellite
  - Payload Prime: complete responsibility for the payload, today mostly optical but also telecommunication
- OHB System performs the program and the AIT of the system in-house.
- Most of the equipment are sourced according to our / customer needs.
- The majority of our equipment is sourced within Europe.



## What we procure (1/4)

- Electric Power Subsystem (EPS)
  - Solar Array
  - Solar Array Deployment Mechanism
  - Battery
  - Fuse Box
  - PCU
- Data Handling Subsystem (DHS)
  - On-board Computer
  - Remote Terminal Units
  - Satellite Security Unit
  - Drive Control Unit (DCU)
  - Storage & Compression
- Telemetry & Telecommand Subsystem (TTR) [mostly S & Ku band]
  - Horn Antenna
  - SSPA
  - Transmitter & Receiver

## What we procure (2/43)

- Attitude and Orbit Control System (AOCS)
  - Gyro
  - Reaction Wheels
  - GNSS
  - Sun Sensor
  - Magnetometer / Magenetotorquer
  - Star Tracker
- Structure & Thermal Subsystem (SThs)
  - Central Tube
  - Al Panes
  - Al Panels w/o heatpipes
  - CFRP Panels
- Thermal Control Subsystem
  - Deployable Thermal Radiator
  - MLI

## What we procure (3/4)

- Electrical Propulsion Subsystem (EPPS)
  - Xenon Tank
  - Propulsion Power Unit
  - Electrical Thrusters
  - Thor boom
  - Latches, valves, filters, pressure regulators & transducers
- Chemical Propulsion Subsystem (CPPS)
  - Tank
  - Thrusters
  - Latches, valves, filters, pressure regulators & transducer

## What we procure (4/4)

- Mechanical Ground Support Equipment (MGSE)
  - Containers
  - Satellite handling frame
  - ...
- Electrical Ground Support Equipment (EGSE)
  - Satellite Simulator
  - Different SCOE

## What we are looking for

- We are procuring major building blocks of a system (unit level)
- We are looking for suppliers with qualified products
- We are looking for suppliers with flight heritage of their products
- We are looking for high TRL levels on the platform side
- We are considering geo-return

## Contacts

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