We. Create. Space.

SPACE SYSTEMS

SmallGEO

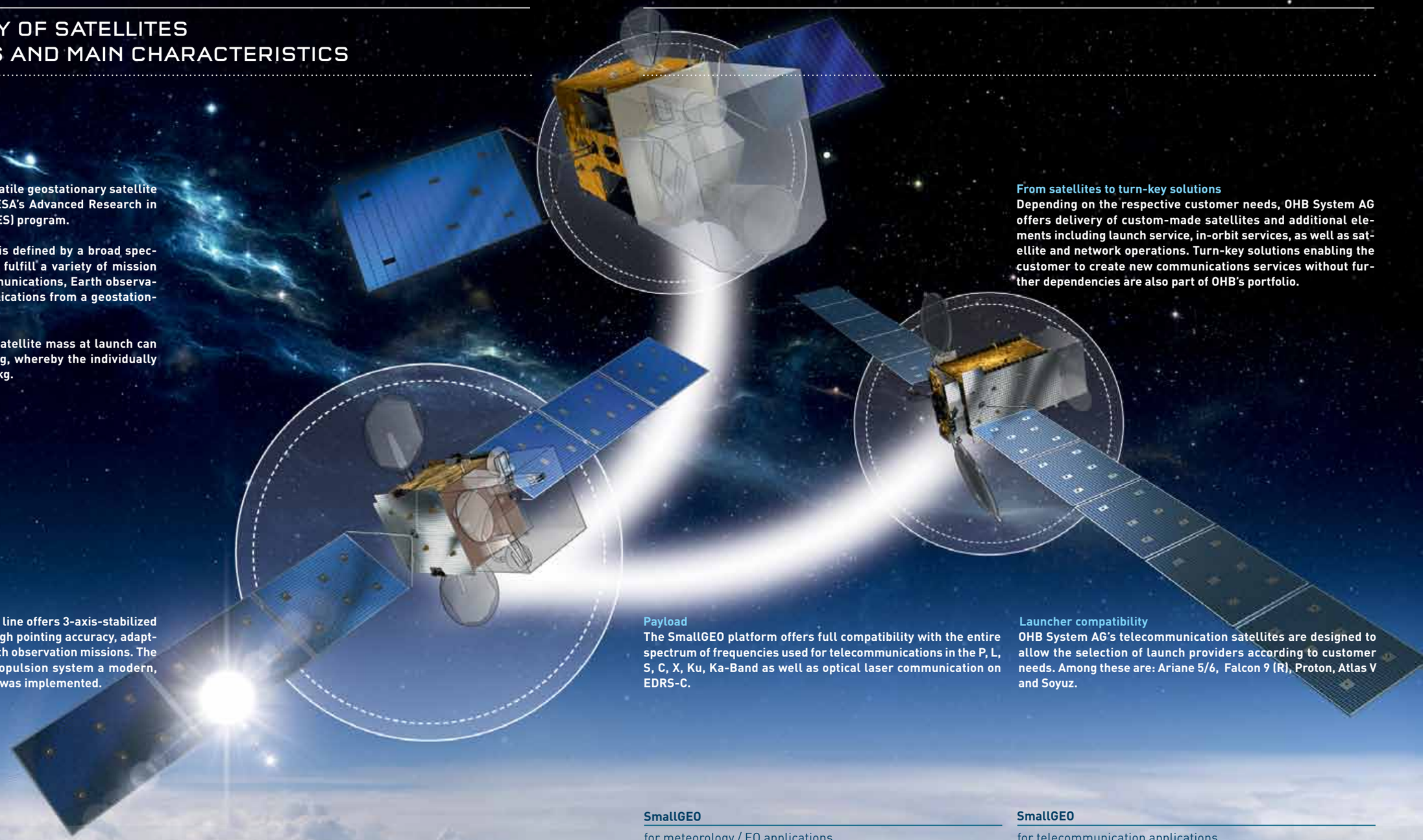
The multi-purpose geostationary satellite platform

SMALLGEO FAMILY OF SATELLITES
KEY ADVANTAGES AND MAIN CHARACTERISTICS

OHB System AG developed the versatile geostationary satellite platform called SmallGEO within ESA's Advanced Research in Telecommunications Systems (ARTES) program.

The SmallGEO family of satellites is defined by a broad spectrum of possible configurations to fulfill a variety of mission objectives. These include telecommunications, Earth observation and laser-communication applications from a geostationary orbit.

Depending on the propellant, the satellite mass at launch can vary between 2,500 kg and 3,500 kg, whereby the individually permitted payload can be up to 900 kg.



System
OHB System AG's SmallGEO product line offers 3-axis-stabilized geostationary satellites with very high pointing accuracy, adaptable for telecommunication and Earth observation missions. The design-lifetime is 15 years. As propulsion system a modern, high-efficient, full electrical design was implemented.

From satellites to turn-key solutions
Depending on the respective customer needs, OHB System AG offers delivery of custom-made satellites and additional elements including launch service, in-orbit services, as well as satellite and network operations. Turn-key solutions enabling the customer to create new communications services without further dependencies are also part of OHB's portfolio.

Payload
The SmallGEO platform offers full compatibility with the entire spectrum of frequencies used for telecommunications in the P, L, S, C, X, Ku, Ka-Band as well as optical laser communication on EDRS-C.

Launcher compatibility
OHB System AG's telecommunication satellites are designed to allow the selection of launch providers according to customer needs. Among these are: Ariane 5/6, Falcon 9 (R), Proton, Atlas V and Soyuz.

SmallGEO

for meteorology / EO applications

- Launch Mass: 3,800 kg
- Bi-Propellant System
- Payload capacity: up to 650 kg, 1,350 W
- Ka-Band and S-Band
- Design-lifetime: over 10 years
- Mission: 6 platforms for Meteosat Third Generation (Imager mission and Sounder mission).

SmallGEO

for telecommunication applications

- Launch mass up to 3,500 kg
- Full electric propulsion configuration
- Payload capacity: 900 kg, 10 kW, 60 transponders
- From L- to Ka-Band
- Design-lifetime: 15 years (propellant life up to 20 years)
- Mission: H36W-1, EDRS-C, Electra, Heinrich Hertz.

SMALLGEO TELECOMMUNICATION SATELLITES
HISPASAT 36W-1

The first SmallGEO-satellite, H36W-1, was built under a public-private partnership between ESA, OHB System AG and the Spanish satellite operator Hispasat.

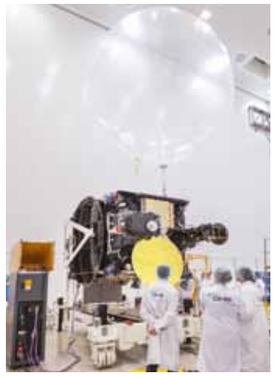
With H36W-1, Hispasat supplies the Iberian Peninsula, the Canary Islands as well as South America with media services. The satellite is now part of HISPASAT's existing fleet of geostationary communications satellites. The satellite is designed for a mission duration of 15 years.

Industrial partners include Tesat-Spacecom, RUAG Space Switzerland, IABG, OHB Sweden, OHB Italia, Luxspace, and German Space Operations Center (GSOC), operated by the German Aerospace Center (DLR).

A unique feature of the SmallGEO platform is its modular structure. The satellite can be fitted individually in accordance with the customer's specific requirements without any major modifications to the satellite bus. Short integration times make it possible to react swiftly to new market needs and reduce costs. The relatively low complexity of the system ensures high reliability in tandem with reduced program risk.

SmallGEO has been developed as an optimum platform for communications payloads. With its modular design, SmallGEO also provides a cost-efficient basis for other applications such as Earth observation or meteorology.

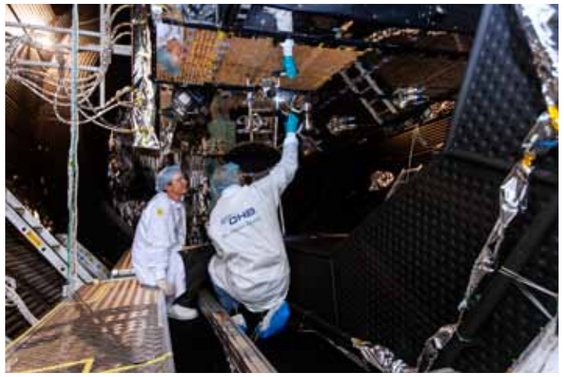
Test campaign (antenna alignment) at test house IABG in January 2016.

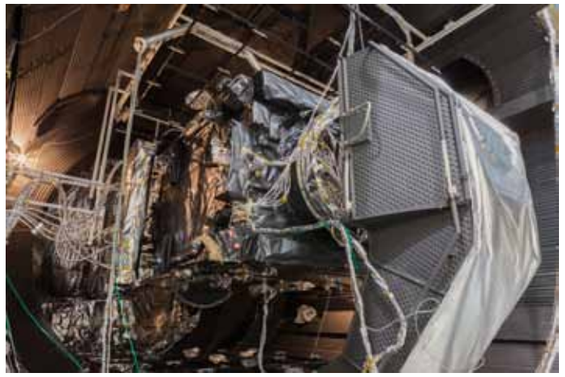


"I am very proud to be part of the team that developed the technologies necessary to build H36W-1 and I am looking forward to contribute to the other SmallGEO projects at OHB." Dr Dieter Birreck, Project Manager H36W-1, OHB System AG

SMALLGEO TELECOMMUNICATION SATELLITES
HISPASAT 36W-1

Tests in the Space Simulation Chamber of IABG were completed in June 2016.





"H36W-1 is the first of its kind and has several technical firsts. I would like to thank ESA, DLR and Hispasat for the trust placed in OHB System and its industrial partners." Guy Perez, CTO of OHB System AG

SMALLGEO TELECOMMUNICATION SATELLITES
HISPASAT 36W-1

The payload of H36W-1 comprises:

- 20 transponders in Ku-band and additional capacity of 3 transponders in Ka-Band
- Communication antennas (4): Antenna reception active reconfigurable (RedSAT; developed by ESA with Spanish industry), two deployable antennas in Ku-Band and one fixed in Ka-Band.
- Advanced payload (RedSAT) with on-board processing.

Launch & orbit position:

- Satellite mass at liftoff: 3200 kg
- Satellite dimensions: 3.7 x 1.9 x 2 m
- Launched from Europe's Spaceport, Kourou (French Guiana) with a Soyuz,
- H36W-1 was successfully handed over to the customer Hispasat in June 2017.

Transfer of Soyuz launcher


H36W-1 during antenna range test at Ottobrunn test facilities in September 2016.

"With support by DLR, ESA and our industrial partners, OHB has produced a powerful, state-of-the-art telecommunication satellite."
Dr Ingo Gerhard, Director Telecommunication Satellites, OHB System AG

"H36W-1 is a major milestone in the history of OHB. The last telecom satellite "Made in Germany" was realized a good 20 years ago. With SmallGEO, German industry is reentering the telecom satellite market." Marco Fuchs, CEO of OHB System AG

SMALLGEO TELECOMMUNICATION SATELLITES
HEINRICH HERTZ

The Heinrich Hertz satellite mission is a key mission for OHB System AG. OHB is mission prime contractor of DLR's first national telecommunication satellite mission.

The SmallGEO mission enables in-orbit verification of communication technology development as well as infrastructure for German institutional and governmental use with a hosted payload of the German Federal Ministry of Defence (BMVg).

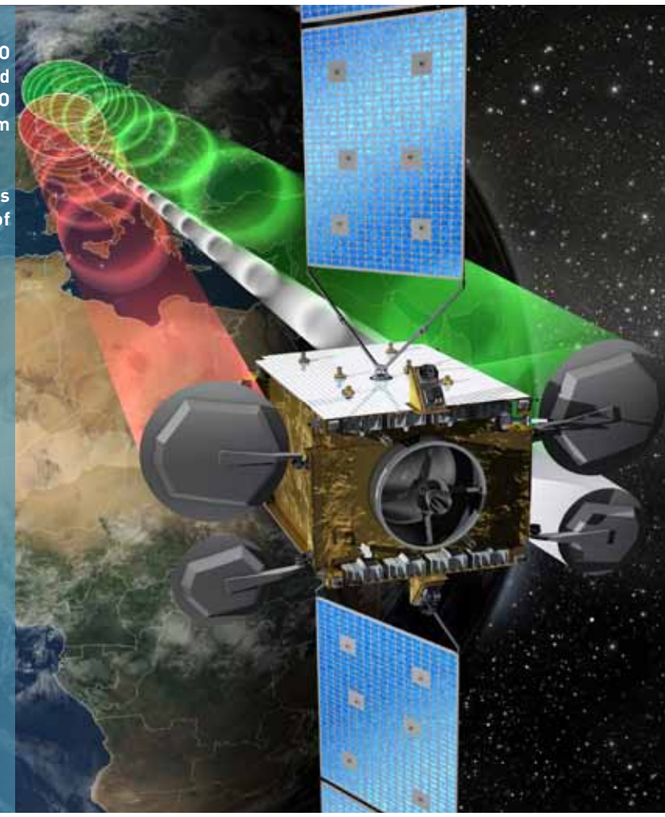
The Heinrich Hertz mission is aiming beyond the limits of conventional repeater technologies enabling numerous participating institutions and companies to develop prototype units and thus, as a result, paving the way for highly flexible and efficient payload configuration.

The Heinrich Hertz satellite mission relies on the SmallGEO platform configuration providing orbit transfer using a hybrid high thrust bi-propellant propulsion for transfer to GEO combined with a highly efficient electrical propulsion system used for north-south station keeping.

This platform embarks the Heinrich Hertz payload with a mass of about 430 kg and provides continuous payload power of 3.6 kW over a mission lifetime of at least 15 years.

Heinrich Hertz satellite mission key features:

- **Dual purpose mission undertaken by the Space Administration of the DLR on behalf of the German Federal Ministry for Economic Affairs and Energy (BMWi) and with participation of the German Federal Ministry of Defence.**
- **Stringent reliability and security requirements for the military mission.**
- **The scientific mission features cutting-edge technologies for flexible payload configurations:**
  1. **Gaining in-orbit heritage for new technologies and devices**
  2. **Providing in-orbit laboratory for scientific users**
  3. **Allowing verification of on-ground technologies.**



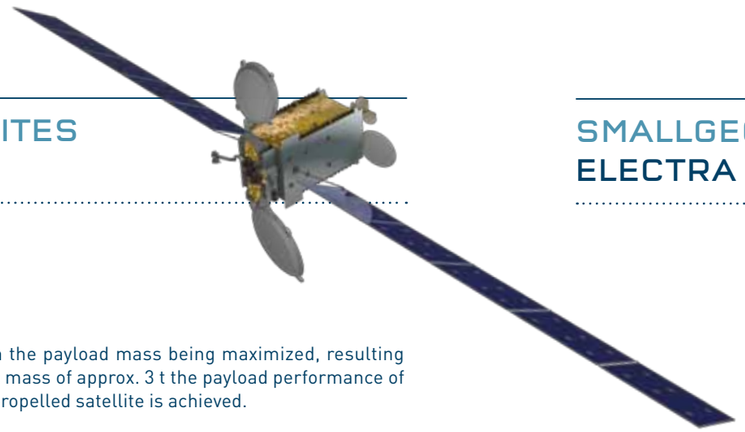
The Heinrich Hertz satellite mission is intended to verify payload and platform technologies such as:

- Highly efficient multistage plasma thrusters for station keeping
- High-speed, in-orbit reconfigurable onboard processors
- High power Ka/Ku-Band amplifiers with tuneable output power
- Ultra-lightweight reflector antenna fully based on carbon fibre reinforced plastic (CFRP) structures.

Thus, the Heinrich Hertz mission is aiming at improving payload capabilities by deploying innovative technologies in a smart way in order to exploit a given bandwidth beyond the limits of conventional repeater technologies.

Primary objective of the military mission is to provide reliable and secure communication services to the German Federal Ministry of Defence (BMVg). The particular needs are served with a dedicated military communication payload.

SMALLGEO TELECOMMUNICATION SATELLITES
ELECTRA



Electra of OHB System AG is the first mission application of the fully electric propulsion platform SmallGEO.

Electric propulsion satellites enable the owner of the satellite to choose between cost of the launch, payload mass and transfer time in an unparalleled way thus fitting into a large variety of business cases.

Using an electric propulsion system saves up to 70% of propellant mass compared to chemical propulsion and has a direct effect on costs for the launch. On the other hand, taking additional propellant on board allows for the extension of satellite life in orbit and makes Electra even more commercially attractive.

For example with the payload mass being maximized, resulting in a total satellite mass of approx. 3 t the payload performance of the 5 t chemical propelled satellite is achieved.

Electra's satellite design is optimized for the market below 10 kW to meet the demand of an attractive commercial market segment combined with affordable launch cost.

Electra addresses the objectives in the commercial telecommunications space industry with a significant reduction of the price per payload power in orbit by utilization of low-cost launch opportunities.

Electra represents a competitive product for the telecom market.

OHB System AG succeeded in winning Europe's largest telecommunication satellite operator, SES S.A., as their first customer for the Electra platform.

Development and qualification of the Electra configuration are realized within a public private partnership (PPP) between:

- ESA
- SES S.A.
- OHB System AG.

OHB's industrial partners in this project include:
Jena Optronik, Rockwell Collins, MT Aerospace, INVENT, EIS, IABG, SCISYS, Technomar, L&H, Galore, Carl Stahl, Eickworth, Jelba, Air Liquide and Airbus.

Status
The hardware phase of the platform development was begun in February 2016 and will be completed by 2019. SES S.A. plans to launch the satellite in 2022.

Compared to classical concepts, Electra enables, more flexibility with regard to:

- Launcher (single, dual, stacked)
- Injection scenarios (SubGTO, GTO, SSTO)
- Payloads (C-,Ku-/Ka-Band, flexible)
- Scalability (mass, power consumption, dissipation).

Electra will offer the customers a step towards more efficiency regarding:

- Price per payload power in orbit
- Cost of the launch
- Procurement & AIT lead time.

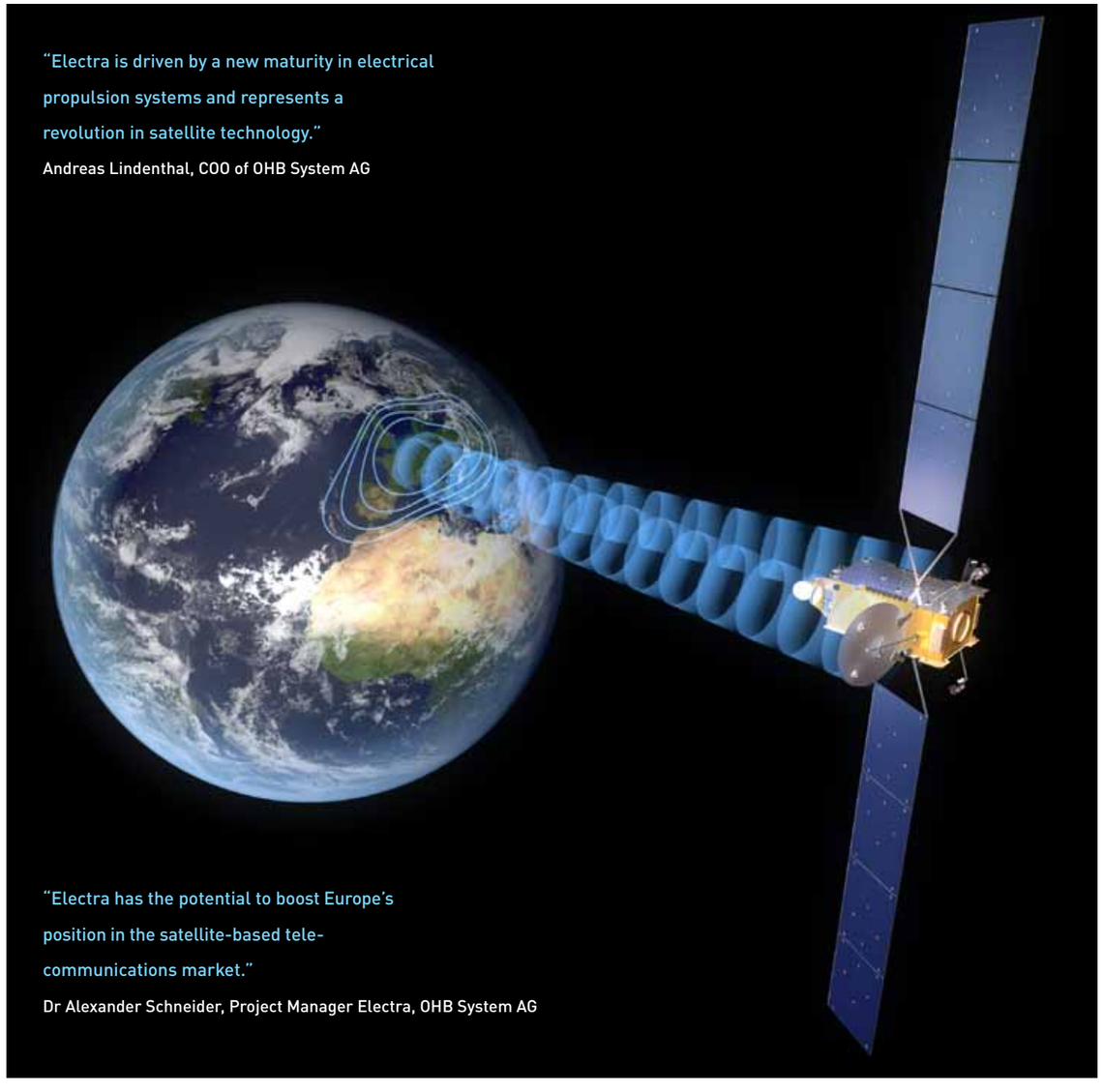
Electra supports a wide range of commercial telecommunication missions:

- Payload mass of up to 900 kg
- Payload power of up to 10 kW
- Payload conductive dissipation of up to 5 kW
- Accommodation of up to 60 transponders
- Accommodation of 4 large side deployable and 4 Earth deck reflectors.

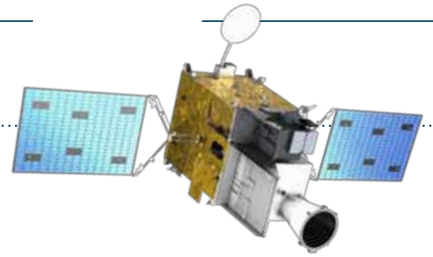
Electra is / will be the perfect fit for:

- Ariane 5 lower position
- Falcon 9 & Heavy (single or dual)
- Falcon 9 reusable
- Proton light
- Ariane 6.

SMALLGEO TELECOMMUNICATION SATELLITES
ELECTRA



SMALLGEO TELECOMMUNICATION SATELLITES
EDRS-C



The development and realization of the European Data Relay System (EDRS) by the European Space Agency (ESA) in the frame of their ARTES program will set a new standard for space-based communication services. A constellation of geostationary satellites will receive the data of Low Earth Orbit (LEO) satellites and transfer them to ground.

The geostationary position of the relay satellites will provide the following advantages to future Earth observation applications:

- Higher data-rates
- Longer contact times for data dump
- Real time access to data
- Data security due to encrypted data down link.

OHB System is prime contractor for the dedicated EDRS-C satellite which is based on the SmallGEO platform.

A considerable number of design adaptations were implemented for EDRS-C. These include:

- Adaptation of the payload capacities for medium-sized missions of 300 kg payload mass
- Enlargement of the modular telemetry product-line to S- and Ka-Band, as well as implementation of secure encryption electronics
- Implementation of an optical payload.

The dedicated EDRS-C satellite will embark a Data Relay Payload including a Laser Communication Terminal (LCT) for the inter satellite link and a Ka-Band antenna for the data transfer link to the ground stations in Europe. Data will be transferred at up to 1,8 Gbps. Furthermore, a hosted payload from the telecommunication satellite operator Avanti Communications named "HYLAS-3" is embarked on the satellite.

The contract between OHB System AG and its customer Airbus DS for Phase C/D/E was signed in May 2013. The data relais payload including the LCT are supplied by Tesat-Spacecom.

"The modularity and flexibility of SmallGEO is the enabler for OHB's future activities in the global market – covering the whole range from telecommunications to Earth observation and science missions."

Dominik Lang, Director Marketing & Sales, OHB System AG

SMALLGEO SATELLITES FOR METEOROLOGY
METEOSAT THIRD GENERATION

OHB System AG will deliver all six satellite platforms for the next generation of European weather satellites, the Meteosat Third Generation (MTG) constellation. This platform is based on the SmallGEO platform.

In order to fulfil the high pointing stability requirements of an Earth observation application and to comply with the communication infrastructure operated by EUMETSAT, the platform was adapted and upgraded for the MTG mission. The three-axis stabilized platform for geostationary satellite applications is compatible with a total satellite launch mass of approx. 3,800 kg.

The MTG space segment consists of six satellites carrying two different payload suites: four "Imager" satellites dedicated to the Flexible Combined Imager (FCI) Mission and two "Sounder" satellites dedicated to the InfraRed Sounding (IRS) Mission.

OHB System AG's prime contractor and system responsibilities include:

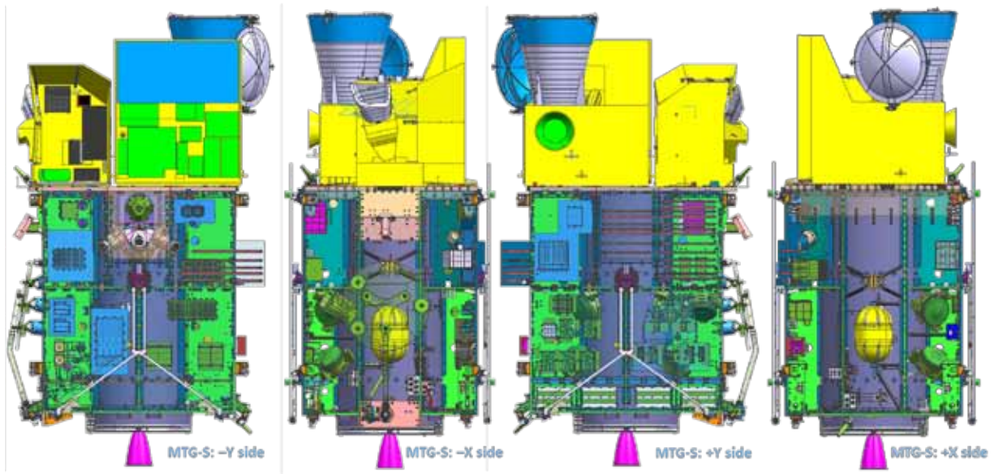
- MTG common platform
- MTG-S mission
- MTG-S satellites
- IRS payload
- Telescope assembly of the FCI instrument.

The MTG program is established as a common undertaking between EUMETSAT and the European Space Agency (ESA). OHB System AG is contributing to the MTG program via subcontract to Thales Alenia Space, France.

MTG COMMON PLATFORM	
Geostationary Platform	4 x MTG-I Platform, 2 x MTG-S Platform
PF Dimensions (mm)	2,560 x 2,296 x 3,084
Performance:	
• Mass	980 kg
• Battery	3,470 Wh Capacity
• Power	950 W Average Consumption
• Absolute Pointing Error	0.06°
Propulsion:	Bi-Propellant System
• Propellant Tanks Capacity	2035 kg
Communications:	Ka-Band (400Mbps) + S-Band (4kbps)
• Solar Arrays	2 Wings: Full deployment in 1 step

MTG-SOUNDER SATELLITE	
Nominal / Extended Mission Life time	8.5 years / 10.7 years
Storage Phase	10 years
Launcher Compatibility	Ariane 5 /Falcon 9
Launch Mass	3,800 kg
• Propellant Mass	2,005 kg
Average Power Consumption:	2,100 W
• Battery Capacity Limit (DoD)	75%
Satellite Characteristics:	
• Dimensions (mm)	2,876 x 2,296 x 5,105
IRS (OHB-M) Optical Instrument	Imaging Fourier Spectrometer
UVN (ESA/Airbus DS) Optical Instr.	Ultraviolet and Near Infra Red Imager

MTG-IMAGER SATELLITE
Telescope Assembly of the FCI Instrument



Drawings of the MTG-Sounder satellite in a 360°view





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About OHB System AG

OHB System AG is one of the three leading space companies in Europe. It belongs to the listed high-tech group OHB SE, where around 2,400 specialists and system engineers work on key European space programs. With two strong sites in Bremen and Oberpfaffenhofen near Munich and more than 35 years of experience, OHB System AG specializes in high-tech solutions for space. These include small and medium-sized satellites for Earth observation, navigation, telecommunications, science and space exploration as well as systems for human space flight, aerial reconnaissance and process control systems.

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