We. Create. Space.

About OHB System AG

OHB System AG is one of the three leading space companies in Europe. It belongs to listed high-tech group OHB SE, where around 2,000 specialists and executives work on key European space programs. With two strong sites in Bremen and Munich and more than three decades of experience, OHB System specialises in high-tech solutions for space. These include low-orbiting and geostationary 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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We. Create. Space.

SPACE SYSTEMS

OHB Space Center “Optics & Science”

New premises at the Oberpfaffenhofen aerospace site (Munich area)

The new OHB Space Center "Optics & Science"
in Oberpfaffenhofen (Munich area)

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INTRODUCTION

Marco Fuchs
Chief Executive Officer of OHB System AG
and OHB SE

The aerospace center in Oberpfaffenhofen, located a stone's throw from Munich, is the new hub of activity for the Bavarian branch of OHB System AG. I am very pleased to say that many employees have settled in after only a few short weeks.

With this investment in Bavaria, we have firmly positioned ourselves and further deepened our roots in the region. Our partnership with the German Aerospace Center (DLR) is strengthened by our direct proximity to one another.

The name of our OHB space center – Optics & Science – is intended to indicate the excellent core competences and expertise of the OHB Group offered in Oberpfaffenhofen. The state-of-the-art technological center, with cleanrooms compliant with the ISO classes 8 and 5, is also designed for the integration of large optical space systems, and satisfies the stringent requirements of our clients. Our industrial unit for process control systems is also located at the center. This unit represents successful technology transfer from the space sector to industrial products and services.

It is a special honor for my family and myself that the Weßling local council has named the road leading to the new site after the founder of the company, Manfred Fuchs, as a reminder of the legacy created by my father.

Frank Negretti
Member of the Board of OHB System AG

The top-class cleanrooms, the variety of laboratories and test systems, and our production facilities for electronic components and mechanical parts place us in a position for a sustainable future.

I am likewise pleased by the attractiveness of the architecture of the site. With ample daylight, a range of communication zones and pleasant canteen facilities, the architecture also takes into consideration the "soft" factors, and in doing so, contributes to an appealing, creative and effective working atmosphere. I regard these aspects to be indispensable – after all, it is the ideas of our employees from different sectors, their interaction with each other, and the common implementation of ideas and plans to produce actual products that constitute the foundation of our commercial success.

The knowledge that we directly or indirectly create know-how with our products, that we test the limits of what is technically possible, and that we are involved in major international projects of great benefit to many people both in Europe and throughout the globe, continues to drive us forward.

For these reasons, along with all the relevant technical expertise, I want us to continue drawing on our pool of creativity, enthusiasm and passion to successfully achieve our lofty goals. These values have always been, and will continue to be, the basis of success and growth of our company.

As a medium-sized system provider, OHB System AG is one of the key independent role players in the European aerospace sector and a highly sought-after partner for both public and private clients. The company currently employs a good 1,000 people at its two sites in Bremen and Bavaria, which generated a turnover of almost 500 million euros in 2015.

A competitive mission expert and system integrator, OHB System AG pushes the boundaries into outer space even further with innovative and unconventional concepts. With a pragmatic and application-targeted approach, OHB continues to propel the space sector forward – along with its benefits for mankind. The objective that drives us onward is to make spaceflight easier, more efficient and more cost-effective. This entails the use of powerful, modularly-designed geostationary and low orbiting satellites for navigation, communication, Earth observation and reconnaissance. OHB is a pioneer in this regard. Our concept has long established itself and has become the benchmark for the sector.

OHB expertise in the area of optical instruments, human spaceflight and scientific exploration of other planets also points the way forward. This applies in particular to the Bavarian site.

The process control systems developed and implemented for Deutsche Bahn for reliable power supply of the railway networks are distributed throughout the entire national electrified section network.

OHB System AG contributes with its performance to the strong OHB SE family of companies and benefits as its subsidiary from the combined potential of a leading corporate enterprise in the European aerospace sector.

ARCHITECTURE

“Compact, elegant and functional: the OHB spacecraft has landed in the South”

Harm Haslob,
Architect at Haslob, Kruse und Partner

The outer façade of white Alucobond panels defines the entire building. It calls to mind the business foundation of OHB – spaceflight.

The horizontal window rows lend structure to the façade. The windows and building corners, some of which are chamfered, along with the dark elements, add a particular nuance to the building.

A generously dimensioned entrance area spanning two floors welcomes guests and staff members to OHB System AG. The sculptured winding staircase serves both to catch the eye and to provide passage to the conference rooms on the gallery level above and to the adjacent offices.

The building is divided into two sections: an office block with rooms of different sizes and aspects spread over five levels; and a hall and laboratory wing that also includes the electronic component production housed on three levels.

The conference rooms are located on four levels. Large events and seminars can be held in the canteen, which is designed and equipped to serve as a multifunctional room. Access to one of the courtyards and to the patio facing south-east offer additional, appealing areas to meet and linger when the weather is favourable.

A number of open common areas provide an invitation to everyone to commuicate amongst each other, and are just as ideal for brief team meetings as for small company-internal celebrations of professional and private “milestones.”

This is also the case for the large foyer, which provides seating areas and conference desks for brief internal and external meetings.

1 North-east side of the building viewed from the roundabout at the intersection of Claude-Dornier- / Manfred-Fuchs-Straße.

2 The office block is spread over five levels. The main entrance is located on the south-east side of the building. The large glass façade can be clearly seen in the image.

3 The staircase made of contrasting materials leads from the foyer to the gallery with two conference rooms. The proximity to the reception area and canteen, together with the view across the special-purpose airfield in Oberpfaffenhofen are particularly attractive.

4 The patio area adjacent to the canteen is also located on the south-east side of the building. The access and delivery area are on the south-west side.

5 The three-storey cleanroom and laboratory area. Roller doors lead to the materials lock. From there, all materials and components are transported to the ISO8 flight hardware storage area, and then to the ISO8 hall or to one of the ISO5 cleanrooms.

The highlighting of the walls with the colours red and anthracite, the exposed concrete of the columns and the light-coloured wooden flooring emphasise the connection between the past and the future.

In regard to future developments, the office block as well as the laboratory and cleanroom wing of the building can be extended – appropriate plans have already been drafted.


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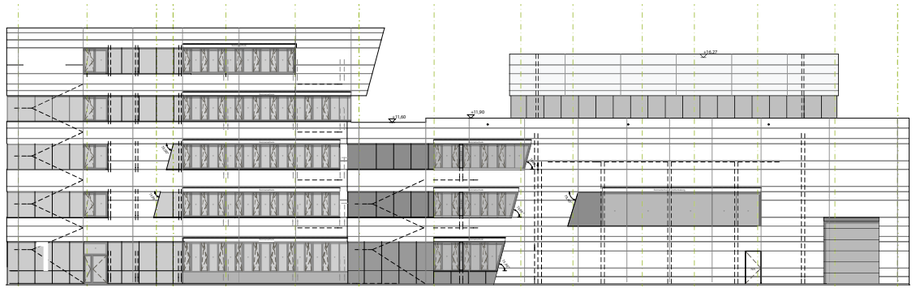
BUILDING VIEWS



1 View from the north-west – i.e., as viewed from the main street.
The cleanroom section can be seen on the right.

2 View from the south-west. Very bulky satellite containers can be moved in and out of the building through the large roller door on the far left.

The building is located on a site measuring 13,025 m², directly beside the Oberpfaffenhofen motorway exit and in direct proximity to the DLR (German Aerospace Center) site in Oberpfaffenhofen.

It has a gross useful area of 14,334 m² divided into a compact five-level office block on the north-east side and a three-level flat-roofed building on the south-west side. Each of the building sections features a courtyard for catching sunlight and enabling communication and interaction.

Administration and all development departments are housed in the office block, while the test and integration work is concentrated in the low-rise building section. Along with the large integration halls, this section includes all laboratories and production facilities. The building technology – housed on top in a single-level structure without windows – is likewise located in this section. As a consequence, the different development phases typical of a space project are separated from each other in logistical terms without having to dispense with the vital short distances between all participating departments.

Delivered articles and goods for customer deliveries (component parts, transport containers, finished products, etc.) are processed at the south-west side of the building with direct access to storage areas, laboratories and integration areas. The hall section also features a materials lock allowing even large satellite containers to be moved in and out through two large roller doors.

The inner rooms are designed in accordance with the technical requirements of the projects and the needs of the staff members. This includes the flooring type (conducting or low-abrasion coated floors), the load-bearing capacity (very heavy elements can be securely moved and fixed in position by means of available cranes and solid concrete floors), exposure to light (it is possible to work both in daylight and in dimmed conditions – for example, during measurements carried out using lasers or interferometers) and accessibility (special work areas, such as cleanrooms or laser measurement systems, are electronically secured and are only open to instructed staff members).

In general, the new building satisfies all infrastructure-related requirements for efficient development and testing in modern space projects.

3 Building with outer areas viewed from above (architect's plans).

4 Building with parts of the outer areas viewed from above (aerial view).

5 Aerial view of the building. Part of the neighbouring DLR Oberpfaffenhofen site can be seen in the background.

SEMINARS & EVENTS

1 A conference room fitted with video conference equipment on the first floor. The balcony leads to one of the courtyards and is accessible during conference breaks.

2 The foyer offers plenty of room for a get-together and a coffee before the start of a conference or seminar, as shown here at the OHB SE Capital Market Day at the beginning of 2016.

3 The canteen is suitable for large events, offering projectors integrated into the ceiling along with screens and a sound system. The area can be subdivided as required – for example, it can be split into a seminar area and a section for lunch.

4 The Chief Executive Officer of OHB SE, Marco Fuchs, in discussion with analysts, bankers and economic journalists at the Capital Market Day 2016.

5 The reception area in an uncluttered black-and-white design is generously dimensioned. The reception staff are the first point of contact for guests, and are also on hand to assist all employees.

6 With a number of seating groups, a coffee bar and exhibits, the foyer is an inviting space to spend some time. The area is used for internal meetings and brief appointments, and also offers sufficient space for receiving guests.

7 A conference room on the ground floor, directy accessible from the canteen area. The courtyard with wooden planks and greenery can be used during breaks from meetings.

COMMUNICATION ISLANDS & OFFICES

1 A bright corridor on the third floor. The offices on both sides are furnished with ceiling-high glass elements in the corridor to encourage communication.

2 The red paint indicates a kitchenette area. The two white standing tables in the area are designed as communication islands. The illumination over the tables also makes it easy to study documents.

3+4 The glass walls of the offices allow ample light in the wide corridor, where three seating groups present themselves for use for discussions and brief consultations.

5 The winding staircase, designed like a sculpture, leads from the foyer to the gallery where there are two conference rooms. Stripes across the ceiling-high glass walls provide adequate privacy.

6 The gallery on the second floor provides an interesting view of the special-purpose Oberpfaffenhofen airfield. The three seating groups can be used during conference breaks.

7 The canteen during lunchtime. Acoustic design makes it possible, even during the busiest periods, to hold conversations with colleagues or guests.

8 An office on the third floor. The other wing of the building can be seen across the atrium through the rear windows. The windows on the right look out across the flat roof towards the south-west.

9 The two groups of standing seats and high tables located in a quiet area in front of two offices leading to the courtyard are ideal for brief meetings and informal discussions.

10 A number of exhibits in the foyer create a flair of space flight. There are a comfortable seating area, a coffee bar and four small conference desks for brief meetings. Colleagues arrange to meet here for lunch, for short talks or for a coffee.

ISO8 & ISO5 CLEANROOMS

The OHB space center "Optics & Science" is involved in numerous missions with ESA and DLR regarding Earth observation, science, human spaceflight, astronomy and planetary exploration. Cameras and optical instruments play a vital role in practically all of these missions. They generally operate in the visible and infrared spectrums, but sometimes also in the ultraviolet or X-ray spectrum. The instruments must be integrated and tested under cleanroom conditions. To this end, the building has a number of laboratories of different dimensions and purity classes that are used in the relevant test and integration phases.

At the heart of this section of the building are the two large cleanroom halls adjacent to one another built to comply with the ISO5 class. Each room is 150 m² large and is equipped with ISO5-compliant cranes (hook height: 4.5 m) and decoupled floors to protect against seismic movement. Particle count as well as temperature and humidity can be separately controlled to a high degree of accuracy. There are also control rooms outside the clean rooms, connected by cable ducts, with viewing screens, directly adjacent cleanliness test rooms, emergency power and nitrogen supplies, and high-speed doors for direct supply of components and test equipment measuring up to 4 metres in height.

The size, equipping and logistical planning of these ISO5 cleanrooms are set up to satisfy the demands of the coming years and decades. For example, one of the two rooms is furnished with a floating granite base fulfilling class VC-E requirements for protection against seismic movements. The base is 4 m x 7.5 m in size and has a mass of 42 tonnes. It is mounted on air bearings and can absorb all vibrations down to a value of 3 µm/s, which enables even the most sensitive optical and interferometric measurements to be performed with the greatest precision.

In combination with the fine control of temperature (+/-0.5 °C) and humidity (+/-10%), this ISO5 cleanroom is unique in the space sector in Europe, and is also suitable for the most demanding of optical satellites.

ISO8 & ISO5 CLEANROOMS

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1 ISO5 class cleanroom with 150 m². The room is divided into two halves, each of which is mounted on decoupled floors to prevent vibration. As a result, very precise optical measurements can be carried out at the same time on both halves.

2 Integration hall in the ISO8 class with 300 m², a ceiling height of 7 metres and a 10-ton ceiling crane. The hall is divided into three sections, each with its own power supply, control room and decoupled floor. Consequently, a number of separate projects can be run simultaneously and fully independently of each other.

3 Flight hardware storage area compliant with the ISO8 class with direct access to the ISO8 hall, an ISO5 hall and to the main materials lock. The components and systems delivered by the subcontractors are subjected to an incoming goods inspection and then stored until their integration.

4 ISO5 cleanroom measuring 150 m² with completely laminar vertical air flow and very high levels of thermal stability. The room can also be fully darkened. It features an integrated granite base on air bearings on a separate foundation for integration and characterisation of large and sophisticated instruments (high-resolution or hyperspectral optics, for example) with guaranteed air purity all the way down to the ground level. The granite base has a referencing system for precision positioning of modules and their position characterisation. Two adjacent checkout rooms, each measuring 30 m², facilitate control of the complex installations (instruments and test equipment) from the outside.

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ISO8 & ISO5 CLEANROOMS


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1 The ISO5 halls have been designed with three airlocks ensuring compliance with the purity class. The design concept covers everything from cleanroom underclothing and clothing to the subsequent air shower. Contamination carried by staff is reduced as much as possible in this way.

2 Before entering the cleanroom, personnel must pass through the air shower, where any particles or fibres are blown off by a large number of air jets covering the entire cabin area using large volumes of pure air.

3 The cleaning laboratory is used to remove light contamination from instruments, hardware and packaging as well as for the development and validation of cleaning processes. Along with the ultrasonic baths and an industrial washing machine, there are also fume cupboards (laboratory extracters) for bonding, coating and material inspections. The glass panel provides a line of sight to the adjacent analysis laboratory, which focuses on verification and control of the purity levels in regard to particle and molecular contamination.

4 The clean bench room is designed for the transportation of material to and from the ISO5 hall. Inspections and work preparation of hardware before it is moved into the cleanroom also take place here.

5 Tests on hardware performed in the cleanroom are mostly controlled from control rooms. These rooms have viewing windows and are regulated in terms of temperature and access. They enable speedy deployment of electronic equipment, measurement devices and computers without endangering the stringent purity requirements of the cleanroom. Electrical connections and signal links are housed in concealed floor ducts. A specific control room is allocated to each of the integration islands in the ISO8 hall and ISO5 halls.


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BUILDING TECHNOLOGY

The continuous, safe and reliable operation of ISO8 and, in particular, ISO5 cleanrooms demands the use of specialised technology. The building technology of the OHB space center "Optics & Science" has been designed in accordance with these demands: the systems required for appropriate conditioning of the outer air before it can be impelled into the ISO halls are located in an area measuring a total of 1,000 m². This building technology encompasses equipment for filtering, dehumidification, temperature control, humidification and distribution of the airflows, which are separately prepared and permanently monitored for each of the three ISO halls and the other ISO laboratories in the building.

An alternating amount of fresh air is mixed with the circulating air in accordance with the use of the corresponding cleanroom at the time (day/night, number of persons and equipment present in the room, requirements regarding the stability of the climatic conditions, laminar or turbulence operation). The systems critical to the operation are also designed with redundancy. With these measures, stable operation is guaranteed throughout the whole year, even under changing outdoor conditions.

The status and correct functionality of all system components are monitored centrally by means of a building management system that records and presents all critical data. Relevant parameters are likewise set and regulated in the building technology in compliance with the applicable project requirements.

Verification protocols, which generally form part of the documentation to be handed over to a customer at the end of a project, are also recorded in the building technology. As a result, not only monitoring, but also the programming and documentation of the control parameters for the ISO halls are safeguarded automatically for the most part.


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1 Plenum chamber of the ISO5 cleanroom. Here, the MTG (Meteosat Third Generation) project is its first user. Air preconditioned in regard to humidity and temperature is blown through the plenum chamber and impelled into the cleanroom through the filter units. The ceiling is fully equipped with filters.


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2 Plenum chamber of the ISO8 hall. The accessible ceiling allows maintenance of each individual filter without interruption of ongoing system operation.


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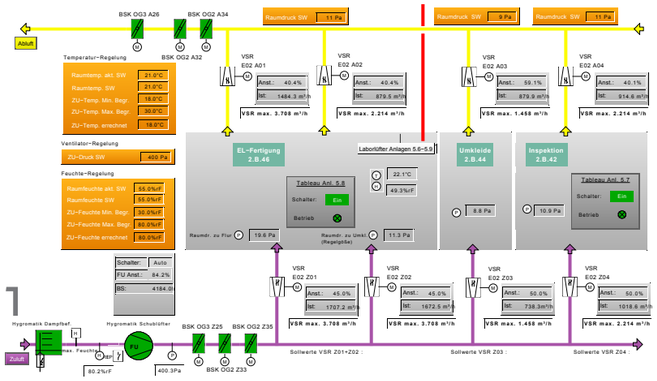
3 Plenum chamber of the ISO5 cleanroom, used for the first time for the EnMAP project. In order to achieve the best possible temperature stability, each filter has been additionally fitted with a special attachment cooler/heater. In this way, the direction and temperature of the parallel airflows can be adjusted and regulated in response to the incoming thermal loads.

BUILDING TECHNOLOGY



1 The central building management system visualises the current state of the different plants and systems at a central position, enabling them to be controlled and programmed from the desktop. The screenshot shows monitoring of the laboratories in the electronic equipment production during the calibration phase.

2 Building technology above the cleanroom block. The first preparatory stage of the air distribution for the offices, canteen, electronic equipment production and conference rooms can be seen in the picture.

3 The chiller for cooling the cleanroom halls as part of the building technology.

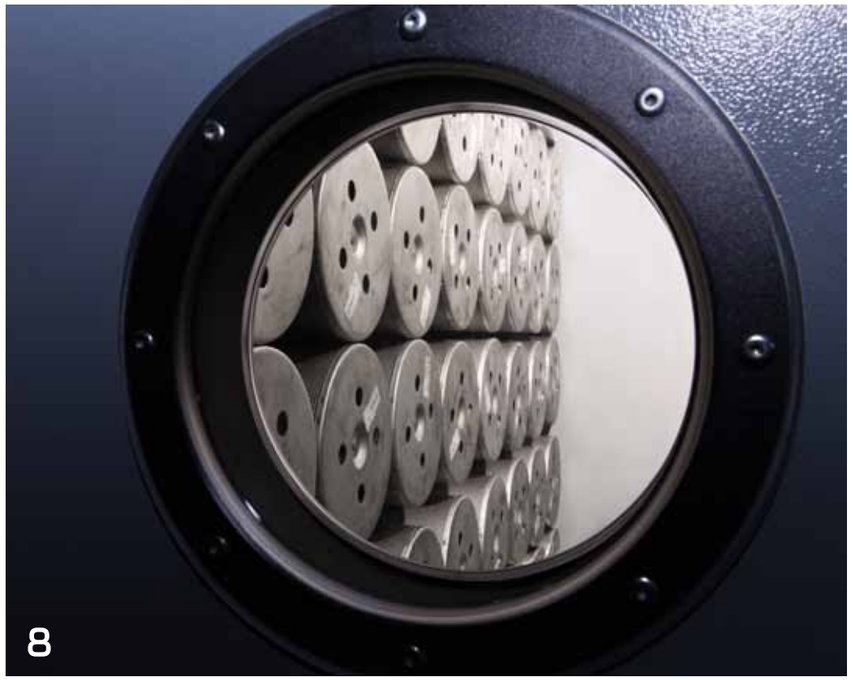
4 Distribution of the prepared, filtered air for the cleanrooms and ISO-controlled laboratories.

5 One of the two redundant air-conditioning plants for provision of conditioned air for the ISO8 hall.

6 Pump system for supply of the recirculation coolers in the ISO halls, laboratory rooms and attached coolers in the plenum chamber.

7 Heating distribution with pump stations. Heating is provided by heat pump or gas-fired heater as required.

8 Activated carbon filter stage for reduction of airborne contamination from the outside.



LABORATORIES & TEST FACILITIES

The laboratory area is located centrally on the second floor of the hall and laboratory wing. It is spacious and houses all development and test facilities necessary for space systems: laboratories for predevelopment, electronics development, software-/FPGA design, mechanics, thermal/vacuum experiments, inspections, work preparation, a focal plane laboratory and laboratories for integration of systems for sounding rockets and planetary exploration.

All rooms are equipped with the appropriate fittings and devices, such as safety workbenches, extractors, test benches, thermal ovens, etc. The laboratories are used for preparatory work or specific follow-up examinations that cannot otherwise be performed during the integration work in the ISO area on the ground floor or that would interfere with the integration work carried out there.

For this reason, the laboratories are also fitted with all necessary technical equipment, such as ESD floors, access control, air-conditioning, nitrogen supply, and emergency power. Some of them are themselves equipped to comply with ISO8 or ISO5. The laboratory area extends on the second floor to over 550 m² in addition to the optics laboratory located separately on the ground floor with 100 m² and the analysis laboratories for specifying purity levels measuring 50 m².

1 The mechanisms laboratory is equipped with computer workstations and a clean bench to assemble and test mechanisms.

2 The work preparation laboratory has workplaces with different equipment including a clean bench, fume cupboards, computer workstations and wash basins.

3 Part of the work preparation laboratory is used for inspection of components and hardware by the quality assurance department. The black-finished clean bench provides ideal conditions, also for inspection of transparent glasses and critical surfaces. A permanently integrated inspection microscope allows more expansive examinations.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LABORATORIES & TEST FACILITIES

The ISO5 class Focal Plane Assembly (FPA) laboratory, measuring 50 m², is located on the second floor and has a high-precision thermal and humidity control system. It can be completely darkened and used in two separate zones. Three test benches are provided for electro-optical characterisation of focal planes and measurement of scattering functions on optical surfaces.

The laboratory is suitable for development-related measurements as well as for the production and characterisation of flight hardware. As individual detector units, which are at the heart of imaging systems, are also assembled and tested here, the most stringent purity requirements apply. These requirements are satisfied in a separate 20 m² area in the laboratory by means of strict specifications regarding numbers of personnel and optimised processes.

The laboratory also has a test unit for measuring the effects of particles, surface quality and roughness on the imaging properties of optical surfaces. The principal focus is on the measurement of production tolerances and their effects on optical performance.

Cold (-170 °C) and hot temperatures (up to about +170 °C) can be achieved in different vacuum layouts in the t**hermal/vacuum or environmental test laboratory**, which is likewise located on the second floor. In addition, different temperature profiles can be applied or high temperatures can be used to clean the products of highly volatile materials.

A special feature is a cleanroom built in the laboratory as a room-in-room system. This cleanroom has horizontal airflow and satisfies purity classes up to ISO5. The basic layout of the cleanroom includes an optical table and a liquid nitrogen cryostat, and is used for the preparation of critical components for thermal test campaigns.

An ISO8 environment can be guaranteed if required in the **planetary protection laboratory** on the second floor. The laboratory also meets the requirements for integration of mechanisms and optics, for which a sterilised or almost germ-free environment is mandatory. This applies, for example, to the components in the second part of the ExoMars programme – the so-called landing mission.

1 Thermal/vacuum laboratory under ISO8 conditions. The thermal conditions prevailing in space to which components and systems are exposed over a specified duration can be simulated in the chambers.

2 ISO5 cleanroom as a room-in-room system in the thermal/vacuum laboratory.

3 Access through an additional airlock.

4 The focal plane laboratory with ISO5 class cleanroom conditions is used for development, assembly and testing of camera systems.

5 The equipping of the focal plane laboratory, which can be completely darkened, is supplemented by an optical test bench to measure the scattered light properties of surfaces.

6 A section of the planetary protection laboratory can be used for working in a sterilised or almost germ-free environment.

LABORATORIES & TEST FACILITIES

Measuring close to 100 m², the **optics laboratory** on the ground floor provides space for optical equipment for space applications in all project phases to be set up for optical measurements. Preliminary experiments can already be carried out in early stages, while breadboards can be integrated and optically tested. This ensures a high level of design certainty and minimises risks in the subsequent implementation phase. Alignment strategies and procedures can be developed using test set-ups during the implementation phase. Optical flight hardware can also be set up and characterised in the optics laboratory insofar as the size of the equipment and cleanliness requirements of the project permit. Otherwise, the large neighbouring ISO8 and ISO5 cleanrooms are alternatively available. The optics laboratory is also particularly suitable for the installation, validation and commissioning of so-called optical ground support equipment (i.e., optical test units for functional testing of flight hardware).

Optical surfaces and components can be characterised by means of spectrometers, interferometers, a radiometrical measuring station and straylight test stand. The optical simulations and analyses are fed with these data in order to further improve their quality. In addition, the infrastructure enables optical components produced by subcontractors to be subjected to an incoming inspection.

The laboratory can be segmented into three independent sections by use of variable laser protection curtains so that work can be carried out on different projects and set-ups at the same time. Cleanroom conditions compliant up to the ISO8 class can be produced for the entire room if required. A cleanroom class of up to ISO6 can even be achieved locally with the three available clean benches to enable flexible adaptation to the requirements of the corresponding project.

The optics laboratory is equipped with state-of-the-art technology including optical tables, clean benches, theodilites, electronic and visual autocollimators, alignment telescopes, interferometers, wavefront sensors, polarimeters, spectrometers, wavelength and straylight measurement equipment, laser beam profilers, lasers for different wavelengths, CCD cameras and lenses, integrating spheres, equipment for high-precision bonding using micro-dosing instrumentation, a variety of microscopes and a range of opto-mechanical, optical and fibre-optical components.


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1 Area 1 of the optical laboratory with an optical table, two clean benches, strain scope, spectrometer and microscopy workstations.


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2 Area 2 of the optical laboratory with a clean bench and monochromator, radiometric measuring station and an optical table.

3 Optical table in area 3 of the optical laboratory with equipment for the development of alignment strategy of the optical instrument for the Meteosat Third Generation (MTG) satellites.


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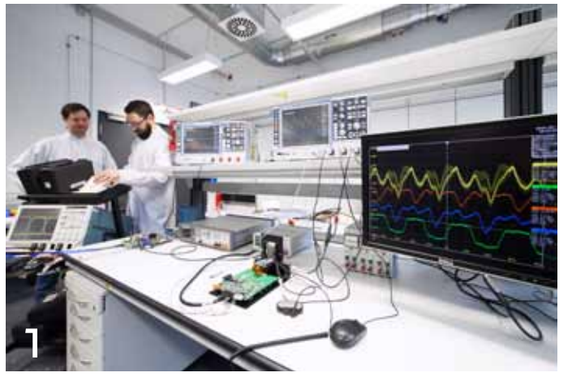
LABORATORIES & TEST FACILITIES

The electronics development and software/FPGA laboratories are located on the second floor in an area of about 150 m². All electronics development and test functions required during a project can be performed in these laboratories – from measurement of individual components to printed circuit board tests to verification and acceptance of complete systems.

The two newly equipped laboratories offer laboratory benches, including special measuring stations for EMC (electromagnetic compatibility) and magnetisation measurements, nitrogen fittings, different power supplies and a conducting floor. The rooms can be darkened as required. Development and simulation equipment, such as MentorGraphics, are provided. Used together with the available pool of measuring equipment (spectrum analysers, noise measurement systems, signal simulators, etc.), the specified performance of all electronic systems developed at the company can be verified.

Units developed and supplied by subcontractors are likewise verified and tested for full operability in the laboratories. All measurements required for the release of components for integration into the overall system are performed in the electronics laboratory. The integration then takes place in one of the large ISO integration halls on the ground floor.

In the predevelopment laboratory focus is laid on fiber-optical systems and on development and setup of opto-electronic subsystems. Characterisation of laser diodes using appropriate measurement equipment (wave meters, optical spectrum analysers and various power meters) is a principal feature. In addition, ultrashort pulse laser systems are developed and calibrated for measurement and data transmission concepts.



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The service systems supplied by OHB for the micro-g research sounding rocket projects TEXUS and MAXUS, funded by DLR and ESA, are integrated and tested in the **TEXUS integration laboratory**. They comprise the service and recovery system as well as a range of ground operation devices. The laboratory also provides for the integration and testing of the autonomous OCAM camera system. OCAM is used on Ariane, Sojus and Vega launchers for image and video recording, as well as for data transmission to ground stations.

1 Electronics development laboratory: typical measurement system for measurement and qualification of electronic components.

2 Measurement station with test setup in the electronics development laboratory.

3 Integration work on the the MAXUS recovery system (HARS) in the TEXUS integration laboratory.

4 Performance of a fit-check in the TEXUS integration laboratory: MAXUS rocket tip (HARS forward ogive) with the rear section of the high-altitude recovery system (aft-ogive).

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ELECTRONICS PRODUCTION

1 Digital measurement microscope with transparency unit for inspection and documentation of boards and components.

2 Solder and inspection workstation for printed circuit board component mounting.

3 Special workplace for shaping component connections and repair and modification of electronic components.

4 Inspection of a harness for qualification using a mock-up.

OHB has a long tradition of producing electronic boards and modules. Ever since the company was founded, components have been mounted on printed circuit boards and cables manufactured to then be integrated as modules at the corresponding site. Thanks to decades of experience in the space and railway sectors, stable production processes and qualification systems were able to be established in the areas of printed circuit board production and harness manufacture. Valid solder qualification compliant with the ESA standard ECSS-ST-Q-70-08/38 has been available since 1999.

The electronics production spanning an area of 190 m² is located on the second floor of the building. All rooms are equipped in compliance with the ISO8 standard. The environmental parameters of temperature, humidity and particle count are continuously monitored. The workplace layout is flexible to serve the individual project needs. Each workplace is connected to a central supply of pressurised air and nitrogen and has a soldering fume extractor.

5 Harness production with six workplaces, cable production on a mock-up, solder and inspection workstation.

6 Vapour phase soldering for production of highly reliable solder connections and a pick-and-place machine for small series production.

7 Fume cupboards for cleaning printed circuit boards or for bonding and coating work.

MECHANICAL PRODUCTION

The mechanical production area is located in a separate building about 3 km away in the industrial estate of the neighbouring district of Gilching.

A number of automatic 5-axis CNC milling machines along with conventional milling machines are housed in an area of approximately 500 m². The mechanical production area also has different lathes and box column drills in addition to a lapping machine and a Trouvaille cutting machine. The range of machinery is further extended by a high-precision CMM measuring machine to give a total count of about 15 machines. Different storehouse rooms for unfinished and finished products, along with a machine control room, complete the mechanical production facilities.

In accordance with the requirements of the products to manufacture, all space structures and structural parts are produced, measured and delivered ready for flight in sizes of up to about 0.5 m x 0.5 m x 0.3 m.

Structural parts for use in a space environment are generally made of high-quality aluminium or titanium. The CAD designs developed and released in the design department located in the main building are transferred directly to the CNC machines by electronic data link, where they are milled and finished within a short space of time.

In the final stage, the parts are provided to the integration section if no further steps, such as surface treatment, hardening, coating, etc., are to be carried out elsewhere.

1 Preparing the 5-axis CNC milling machine.

2 Some of the machinery in the mechanical production area.

PROCESS CONTROL SYSTEMS

The function of the process control systems (PCS) is automation of the electrical mains supplies for traction power in the railway sector. The latest station control and information technologies are employed in this pursuit. In the highly equipped integration rooms, system solutions for the customer, Deutsche Bahn, are developed, intensive factory acceptance tests (FAT) are carried out and training courses are held.

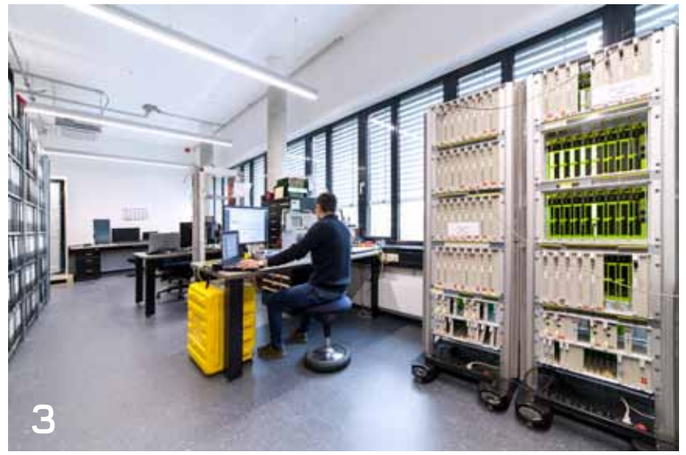
The connection of the rooms to broadband public communication networks enables the customer's systems in the field to be remotely maintained at regular intervals or as required. In this way, the customer can be provided with support to resolve incidents by remote servicing.

1 The integration room for communications technology is equipped with a full image of the process infrastructure of the customer, Deutsche Bahn DB Energie. In this room, software updates and extensions are tested and error scenarios reproduced. Thorough analyses provide quick-working measures for error correction.

2 In the integration room for substation automation systems (SAS), SAS systems are installed, integrated with other function components (protection technology, for example) and tested. The primary technical process of DB Energie is simulated in the test environment for the latest generation of SAS, which meets the international IEC 61850 standard.

3 Integration of 3rd-generation SAS: the core testing of the configuration, parameterisation, database and locking of the system are performed in this room before delivery and commissioning in the switchgear system on site.

4 The PCS has its own separately secured computer center with a reference system for the computer systems installed in the customer's central control centers. From a secure, isolated environment, the customer's process data network is tested, weaknesses are pinpointed, and IT security functions and configurations are developed and tested.



IMPRESSIONS

1 The main entrance in Manfred-Fuchs-Straße 1 at the south-east side of the building. The patio, a pleasant area to spend some time when the weather is good, can be seen in the background. It can be directly accessed from the canteen, and offers the opportunity to get some fresh air when eating.

2 The winding staircase, colour scheme and the wooden and exposed concrete materials are the elements with which our staff as well as business partners of many years are familiar with from the two previous sites in Munich.

3 Detailed view of the façade design. At the third floor level, there are two patio areas on the flat roof that can be openly accessed from the corridor.

4 The two recessed balconies on the fourth floor can be accessed from the neighbouring offices and corridor.

5 The road leading to the company was named by the Weßling local council after the founder of OHB, Manfred Fuchs. The photograph was taken in December 2015 after the unveiling of the road name sign. On the right is Marco Fuchs, his mother, Christa Fuchs, and his sister, Romana Fuchs Mayrhofer.

6 ISO8 hall with row of windows and roller door. The materials lock behind the door is used to supply the cleanroom area.

7+8 The winding staircase is designed like a sculpture and delights with contrasting materials.

LOCATION

OHB Space Center"Optics & Science"
in Oberpfaffenhofen in Bavaria:

Address and contact details:

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Manfred-Fuchs-Straße 1
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Telephone: +49 8153 4002-0
Fax: +49 8153 4002-940
info.oberpfaffenhofen@ohb.de

Construction Company:
KT Grundstücksverwaltungs GmbH & Co. KG
Investment: over 30 million euros
Architects: Haslob, Kruse und Partner, Bremen
Start of construction: November 2013
Opening: December 2015
Size of property: 13,025 m²
Total useful area: 14,334 m²

Location: Industrial estate at the Oberpfaffenhofen special-purpose airfeld approx. 25 km west of Munich on the A96 Munich-Lindau motorway (Oberpfaffenhofen exit).
Approx. 56 km from the Munich international airport.

EUROPEAN SPACE IMAGING