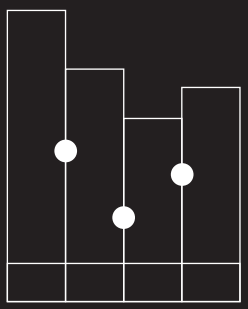
creating knowledge

2021_2022

Facts and insights

Ratios 2021

If you would like to learn more about our key figures, you can go directly to the annual report here.



TOTAL REVENUES
EUR 917 million

EBITDA
EUR 84 million

EBIT
EUR 47 million

EMPLOYEES
2,962
from more than 35 nations

Content

Understanding the world as a system.

The importance of data as a basis for understanding the complex relationships in our world has grown steadily in recent years. Researchers are using increasingly sophisticated analytical methods to understand global processes. Climate change and its effects are posing a long-term challenge for humanity. As the system developer and integrator of the EnMAP hyperspectral satellite, OHB will help to create a solid data base and enable a better understanding of and response to environmental problems. The satellite will collect high-precision information on changes in ecosystems and provide data that will reveal solutions to the global challenges of our time.

Marco R. Fuchs, CEO

The whole gamut of space

The major existential questions – why space can help to solve them

»Space applications provide unique data: from climate change and related impacts to early warning systems for natural disasters.«

Marco R. Fuchs
Chief Executive Officer

Born in 1962, Marco Fuchs has been CEO of OHB SE since 2000 and CEO of OHB System AG since 2011. After studying law in Berlin, Hamburg and New York, he was admitted to the bar as a lawyer and as an attorney-at-law. He subsequently worked as a lawyer in New York and Frankfurt at Jones Day.

In your view, what was the most significant event in the space industry in 2021 (excluding OHB's activities)?
MF: For one thing, there was the successful landing of the Mars rover Perseverance – landings on this planet are particularly difficult, so this is all the more impressive given the rover's enormous size and weight. For another, the launch of the James Webb space telescope – with its technical precision, it will give us unique insights into our solar system, and we will learn more about exoplanets and the composition of their atmospheres.

What already foreseeable trends (not only related to space) will play a role for OHB?
MF: Factors that pose global challenges and for which we need to find solutions together: climate change and the associated effects, ensuring food supplies for a growing global population or the early warning system for natural disasters: space applications provide unique data for these applications.

»One of our main advantages is our far greater agility and the speed with which we are able to make and implement decisions.«

Dr. Lutz Bertling
Management Board, responsible for Strategy, Corporate Development and Digitization

Dr. Lutz Bertling, who was born in 1962, has been a member of the Management Board since April 1, 2018. Prior to this, he was President of the Bombardier Transportation Group, Berlin and Chief Operating Officer at Bombardier Inc., Montreal. Between 1993 and 2013, Dr. Bertling worked for the Airbus Group (formerly EADS), most recently as CEO of the Eurocopter Group

Digitization has already fundamentally transformed many industries. What new technical possibilities hold the greatest potential for further progress in the future?
LB: Three major global problems – climate change, the need for connectivity and the personal safety of each individual – will only be solved with digital applications from outer space. Generating data requires digital intelligence on board the satellites as well as applications that turn information into valuable services. Autonomous mobility requires highly accurate navigation data as well as fail-safe and redundant connectivity. This is where satellites come into play. The same thing applies to the Internet of Things (IoT), where in remote areas, for example, assets can only be connected via satellites.

With regard to our project management, the processes and the way we work together will continue to change significantly as a result of the growing opportunities offered by digitization. Methods such as virtual/augmented reality, simulations and artificial intelligence will permanently alter development and manufacturing processes. Both sides will benefit from new possibilities such as high-performance (quantum) computing and data highways – including in space. We are only just beginning to tap the possibilities of digitization.

Obviously, your competitors are also interested in these potential growth markets. How is OHB standing up to them?
LB: This can best be summed up in three words: agility, focus and innovation. One of our main advantages is our far greater agility and the speed with which we are able to make and implement decisions. We use our resources in a focused and market-oriented way to target selected areas in which we are then able to assume a leading role. Another strength is our innovative prowess, which is primarily derived from our employees' creativity and enthusiasm – for more than two decades, this has yielded new customer-oriented solutions for a wide variety of problems.

Kurt Melching
Chief Financial Officer

Kurt Melching, born in 1962, has been a member of the Management Board since April 1, 2018. With OHB since 1988, Melching has been head and subsequently director of finance and controlling since joining the Company. Melching became Chief Financial Officer of OHB System AG in 2012 Since 2004 he has also been authorized signatory of the parent company OHB SE.

You are the CFO of a space company – how does your job at OHB differ from the tasks of a CFO at companies operating in other sectors?
KM: The space industry is extremely exciting, but also challenging. We hold management responsibility for highly complex and, in some cases, relatively long-term projects. It is fun to experience how we complete missions, manage projects and constantly improve while on our way. This makes my duties far more exciting and interesting than they would be in most other industries.

OHB SE has published a multi-year financial outlook for the first time since its IPO in 2001 – what prompted it to do so?
KM: In the past, we drew up annual business plans for three years in advance. This year, we broadened the planning horizon to gain a very concrete plan for achieving the financial targets for 2025 that we had formulated in 2020. The decision to publish this has to do with transparency considerations on the one hand and is also intended to strengthen confidence in our Company on the other.

Daniela Schmidt
Member of the Management Board responsible for sustainability, integrity, legal and corporate security

Born in 1982, Daniela Schmidt has been a member of OHB SE's Management Board since 2022. She has been with OHB SE as a legal counsel and attorney-at-law since 2014 Prior to that, Daniela Schmidt was employed as a lawyer at Jones Day and White & Case LLP in Frankfurt.

You were appointed to the Management Board of OHB SE with effect from January 1, 2022 – where do you see the greatest opportunities during your first year for shaping the areas for which you are responsible ?
DS: The ability to continuously adapt to rapidly changing requirements has been growing in importance in the recent past. In this way, we are facing the social challenges of our time. Especially with sustainability, I see great potential and large scope for development both in general and at OHB in particular given that the responsibility for this agenda now has a home on the Management Board for the first time.

This topic has recently received greater priority following the review of the Group strategy – what are your next steps in this regard?
DS: Sustainability at OHB encompasses both the responsible management of companies at the individual sites and the development of space solutions to address current global challenges. In doing so, we will first be tackling our own challenges and identifying our greatest potential in the transformation process so that we can develop and implement a tailored sustainability strategy.

»We set the right accents for our corporate culture by means of performance-based remuneration and a very high degree of flexibility in individual working conditions.«

Klaus Hofmann
Chief Human Resources Officer

Born in 1960, Klaus Hofmann has been a member of OHB SE's Management Board since 2015. Hofmann studied business administration at the University of Munich, after which he worked as a research assistant at the University of the Federal Armed Forces in Neubiberg. Between 1992 and 2011, Hofmann held various management positions in human resources with EADS/Airbus.

The search for the best young talent is one of the core ongoing tasks in your area of responsibility – what role is played by the fact that you are working in the space industry?
KH: The fascination and appeal of space offers a very favorable base for attracting top talents. Space offers a tangible opportunity for active contribution particularly in view of the global challenges ahead of us, notably climate change and the resulting awareness of the need for sustainability. The continuously high influx of unsolicited applications from qualified candidates testifies to this. This correlates the most clearly with an equally continuous positive news flow. Accordingly, we attach crucial importance to communications and make intensive use of multiple channels, particularly social media.

What does OHB do to assert itself when competing with other employers?
KH: The appeal of the space industry on its own is not sufficient to ensure high attractiveness as an employer. True, it is an important component, but it must be backed up by a modern mix of monetary and non-monetary incentives. We set the right accents for our corporate culture by means of performance-based remuneration and a very high degree of flexibility in individual working conditions (for example, weekly working hours of between ten and 44 hours are possible). As a system provider, OHB offers attractive activities in terms of content, as new, complex and demanding engineering tasks are always part of the day-to-day routine.

Shaping the future

OHB Group Strategy 2025

The Management Board of OHB SE unveiled the current "OHB 2025 – Shaping the future" strategy for the first time in 2020, launching it in the same year. In September 2021, it carried out an extensive internal review of the assumptions underlying the strategy and, in particular, of the targets adopted for 2025. Despite the protracted Covid-19 pandemic, it was subsequently able to confirm the main thrust of the strategy and the ambitious profitability targets; in fact, the growth target was adjusted slightly upwards.

The strategic measures will continue to be implemented this year. Right at the beginning of the year, OHB SE's governance bodies responded to the greater priority being attached to "ecological and social corporate governance" by creating a separate position on the Management Board. In addition, OHB has been able to enlarge its footprint in downstream applications with the acquisition of GEOSYSTEMS GmbH in 2022.

Scope
- End-to-end space system provider
- Develop downstream portfolio
- Extend satellites and systems portfolio
- Extend rocket customer base, full launcher

Growth
- Organic and inorganic growth
- M&A focus on downstream
- Extend footprint in commercial market

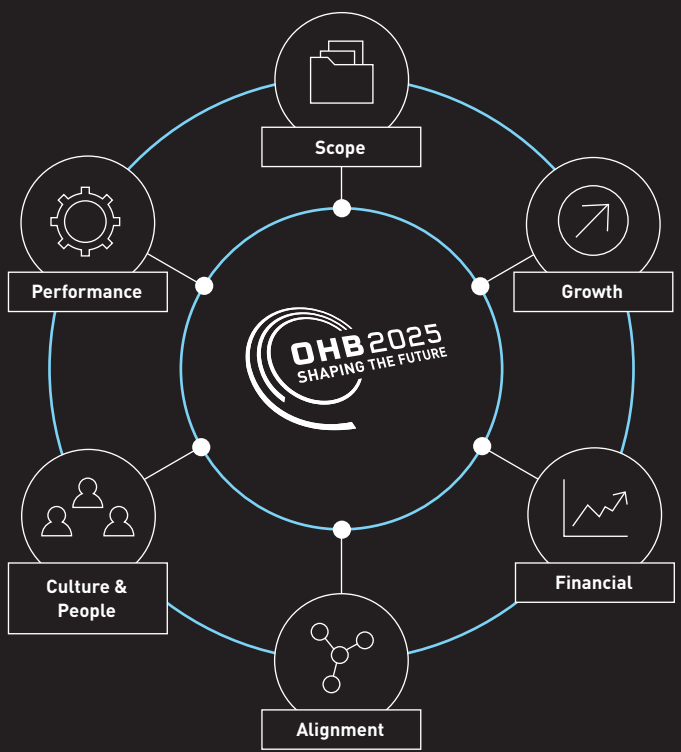
Financial
- Total revenues >EUR 1,500 million
- EBIT >= 8%
- FCF >= net profit

Alignment
- Use synergies
- Streamline product portfolio
- Group functions & competence centers

Culture & People
- Foster OHB culture: Get things done together, entrepreneurship
- Top attractive employer
- Environmentally and socially responsible

Performance
- Improve product quality and project management
- Deliver best value for money systems

GROUP STRATEGY



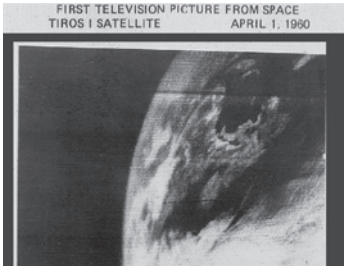
As time goes by

Revolutionary weather data

What seems fairly straight forward today was revolutionary in 1960: using the Earth observation satellite TIROS 1, NASA demonstrated how valuable satellite data is for life on the Earth. Then as now, weather forecasts were seen as one of the most promising applications for space-based observations. TIROS proved to be extremely successful, leading to the development of increasingly sophisticated meteorological observation satellites. In Europe, the third-generation Meteosat (MTG) satellites are soon to be placed in a geostationary orbit. The 30-fold increase in the data rate compared to the second generation, the far more precise observation data and the lighting sensors promise to revolutionize weather forecasting once again in the future.

*** TIROS: Television Infrared Observation Satellite**

Weather observation from outer space then and now: Whereas TIROS observed the Earth in a rather coarsely grained and colorless way, today we can paint a fair more detailed picture of weather systems using Meteosat, among other things.



Small boxes with a great impact: Both RUBIN and GMS-T were developed, built and sent into space in a very short time.

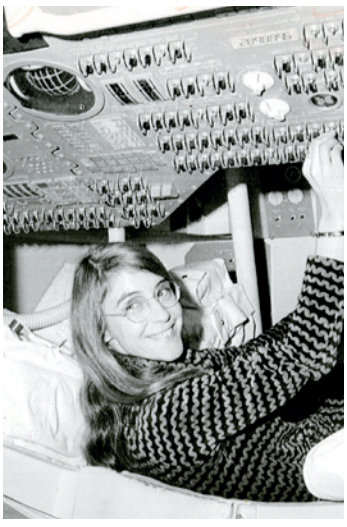
Unconventional ideas

Although they are not as much in the spotlight as Galileo, MTG or SmallGeo, they are nevertheless of great importance for our DNA: what we're referring to is the small RUBIN experimental satellites. First and foremost, it is important to ensure that even the smallest space on board launchers is not wasted and to develop a payload that fit into this space as effectively as possible. Unconventional approaches are often required in the short time available and with only a small budget. Back in 2000, for example, OHB had already sent what were then brand-new modems for the end-to-end control of satellites into space. They were originally intended for monitoring the temperature and location of refrigerated consignments. At the beginning of 2021, it was possible to place the GMS-T satellite into full operation with the latest technologies from mobile communications as well as high-frequency and computer technology in a project lasting only seven months.

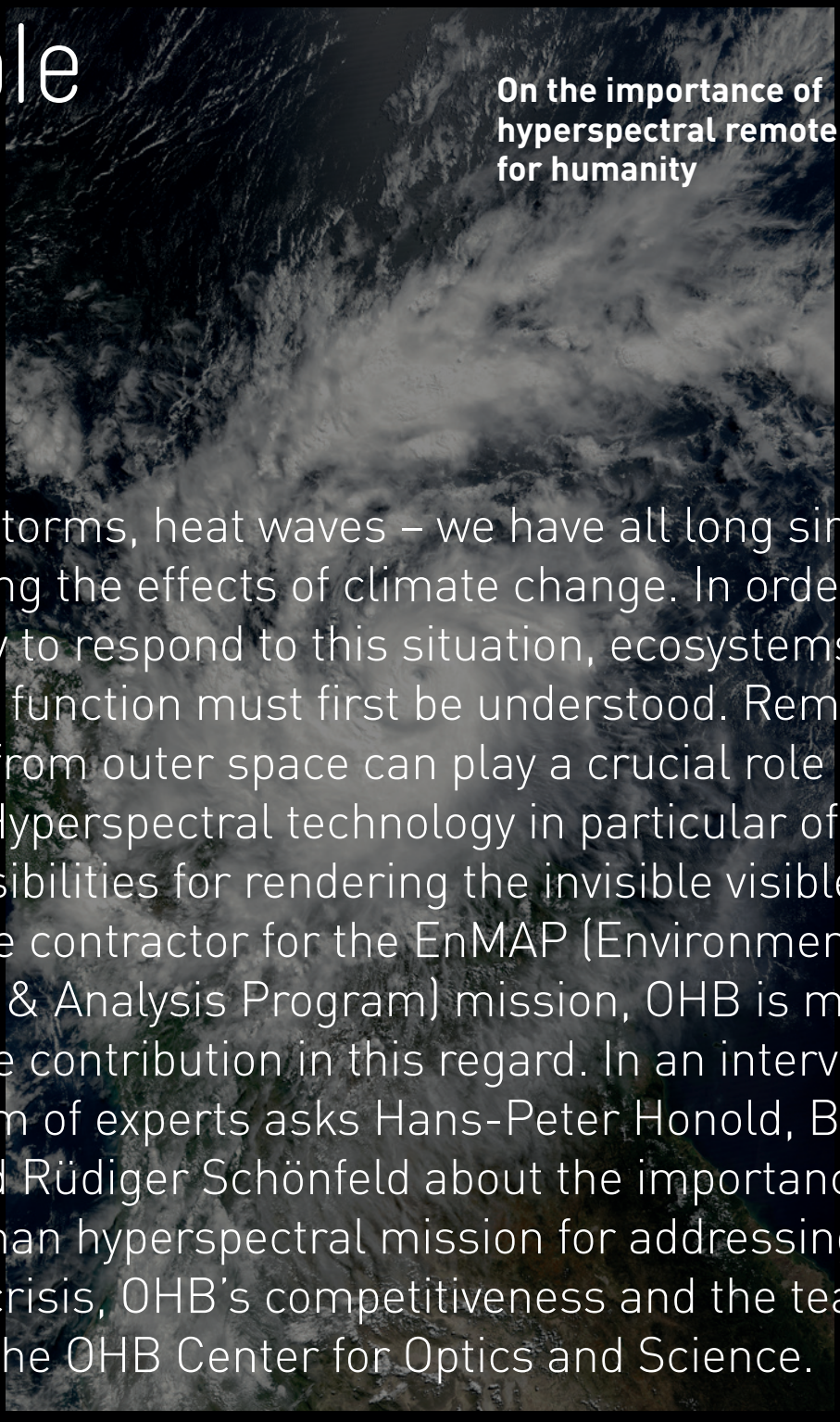
Bare-bones journey to the moon

Today we smile at figures such as two megahertz of computing power or 74 kilobytes of memory. Yet, these were the truly groundbreaking parameters allowing the Apollo mission to successfully complete its lunar landing mission in 1969. It is frequently stated that the on-board computer used had less power than a calculator or the first Gameboy. That's true. By the same token, however, it also means that the programmers at the time, first and foremost the mathematician and programming pioneer Margaret Hamilton, had to be very clever in order to achieve a lunar landing using such modest technical means. In accordance with Moore's law, which has now reached its physical limits, there have been new microchip generations since the mid-1960s at intervals of around 18 months. Consequently, OHB satellites are currently in service with around 64 MHz and 16 Gigabits of mass storage.

Margaret Hamilton made history as head of software programming for the Apollo 11 mission.



Making the invisible visible



On the importance of hyperspectral remote sensing for humanity

Floods, storms, heat waves – we have all long since een feeling the effects of climate change. In order for humanity to respond to this situation, ecosystems and how they function must first be understood. Remote sensing from outer space can play a crucial role in this regard. Hyperspectral technology in particular offers new possibilities for rendering the invisible visible. As the prime contractor for the EnMAP (Environmental Mapping & Analysis Program) mission, OHB is making a decisive contribution in this regard. In an interview, the OHB team of experts asks Hans-Peter Honold, Bernhard Sang and Rüdiger Schönfeld about the importance of the German hyperspectral mission for addressing the climate crisis, OHB's competitiveness and the team spirit at the OHB Center for Optics and Science.

Bernhard Sang
OHB Expert for
Optical Missions and Instruments

»Looking forward, hyperspectral data can help to determine the growth cycles of plants and thus to increase crop yields.«

Climate change is clearly on our doorstep. Does humanity have a problem?
BS: Climate change is definitely a challenge for humanity. This is because the growing population and human activities in all parts of the biosphere are reaching the limits of the available resources. Whether it's clean air with a low proportion of climatically harmful gases such as carbon dioxide and methane, clean water or land-based ecosystems such as forests or agriculture – the great task facing current and future generations will be to complete the transition to resource-saving management in all these areas.

How can environmental observation from outer space help?
BS: Space-based environmental observation has an unbeatable advantage: the vantage point. In space, you're located very far away from the objects you want to observe, but this distance gives you a large-scale global perspective. Since the ecosystems in the biosphere are all more or less globally interconnected, this perspective is of great importance. We humans have been learning about these ecosystems for several decades through an iterative process involving observation and modelling. Models of this kind, which usually cast light globally on certain aspects such as the carbon cycle, are called the "digital twin Earth" and are receiving extensive funding from the European Union so that they continue to be developed. They map existing knowledge, integrate data, model human activity and, for example, allow long-term forecasts to be made for climate change. By improving these types of models and using them to simulate certain scenarios, humanity will learn to understand the terrestrial system and, on this basis, to manage the biosphere more sustainably. These models are based on global data covering certain environmental parameters that can only be collected via space-based observation.

What makes hyperspectral technology so important for solving environmental problems?
BS: Hyperspectral Earth observation is an "end-to-end" method for Earth observation. Rather than a single image, the entire interaction of sunlight with the Earth's surface and the atmosphere is continuously recorded. The reflected light contains a lot of information about the way it interacts with the ground and the atmosphere, which can be detected very accurately by means of hyperspectral remote sensing. For example, the condition of a plant can be determined much more accurately than with current methods. Since the hyperspectral sensor records the entire spectrum, data pertaining to very different questions can be processed by one and the same sensor. This includes water quality, the condition of forests, local methane concentration or geology. This makes it a "Swiss army knife", so to speak, a universal tool for optical remote sensing.

So, does this mean that there are universal ways in which it can be used?
BS: Yes, definitely. One of the greatest problems facing humanity is nutrition. We have a growing world population but we do not have a growing planet and the availability of agricultural land is depleted. Looking forward, hyperspectral data can help us to observe plant growth cycles and thus to increase crop yields through more efficient farming. In addition to food, of course, people also need drinking water. The data will also help us to assess the quality of inland waters and help to preserve soil quality. And, of course, it will be possible to assess the condition of forests more accurately. As one of the first hyperspectral satellites, EnMAP will open the door to a deeper understanding of climate change and its impact on terrestrial and aquatic ecosystems.

Hans-Peter Honold
Project Manager EnMAP

»In fact, at the beginning, we did not know what we were facing, where we would be exceeding human boundaries and what was technically feasible.«

At the OHB Center for Optics and Science, many employees have been working on the EnMAP mission for about 15 years. What does this project mean for the team and for OHB?
HPH: EnMAP is a pioneering achievement. We have created a real piece of hardware from a vision. In fact, at the beginning, we did not know what we were facing, where we would be exceeding human boundaries and what was technically feasible. This experience has strengthened us and welded us together, while providing a basis for other projects in Oberpfaffenhofen. Our team have always worked closely and the mission has forged close ties between many people over a long period of time. Many colleagues have brought a vision to fruition with EnMAP. The strong motivation arose from their willingness to identify with the project and their courage to march on without allowing themselves to be intimidated by the complexity of the task. The development of this satellite has left deep traces on and defined the Oberpfaffenhofen site. Through EnMAP, we now know that we no longer need to shun major challenges.

Technologically, what has been the greatest challenge in recent years?
HPH: One major challenge was obviously the complete development and production of the hyperspectral instrument consisting of a telescope and a spectrometer. This is the first time in the Company's history that we have developed an entire instrument of this complexity with development requirements extending to individual parts. This was a major step forward for OHB. On this path, we have been able to amass a great deal of knowledge and skills which are already benefiting other projects.

Let's glance into the future: Imagine it is the beginning of April 2022 and EnMAP is headed for space on board a Falcon-9 – how do you think you will be feeling?
HPH: This moment will definitely be like no other. For me and many of my colleagues, this project has been like a child, our baby. We have been working on this mission for a long time and now this child is learning to walk and becoming independent. We must let go. We are firmly convinced that our baby will perform well; after all, we have invested a great deal of energy in teaching it.

With EnMAP, OHB has developed and built a full-scale technological system. Does this mission merely mark the beginning?
RS: Absolutely. Although some advancements have already been made in the EnMAP technology, we have primarily learned what is decisive in the development of such complex instruments and missions. This broad knowledge paved the way for us to receive a contract from ESA for the development of the payload for the CHIME hyperspectral mission. Even though CHIME initially appears to be an entirely different beast, the knowledge and skills that we have amassed by working on EnMAP have been extremely helpful. In short, without EnMAP, there would be no CHIME.

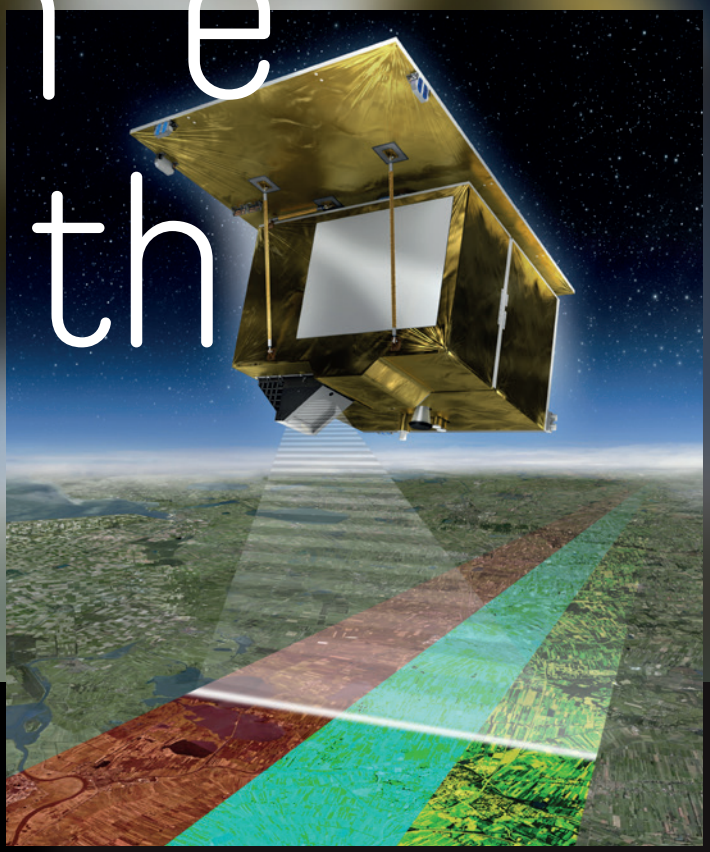
Are there any other ideas for leveraging the skills gained from EnMAP and CHIME in the marketplace?
RS: Everything we have learned gives us the basis for developing ideas for high-performance solutions. So, we're already developing the next-generation optical instruments. On top of this, we are able, for example, to design a microsatellite with roughly the same performance as the EnMAP sensor and can take even more images, but it has only one-fifth of the mass. Performance over time can be improved by creating constellations. And this is yielding further potential for OHB Digital in the form of downstream services for commercial users. Looing forward, OHB could offer a complete package and provide not only the image but also the information product. Through the use of suitable algorithms, the data can be used to obtain information that can help to improve agricultural and forestry yields, render pipeline leaks visible, or help in the search for mineral resources.

Does this mean that EnMAP data will help us not only to understand the Earth but also to live in harmony with its resources?
RS: Yes, that just about sums it up. With EnMAP, we have a system that produces a great deal of data and can generate fingerprints of the Earth's surface. We probably aren't yet even aware of all the possibilities that this data will offer us. EnMAP is also a demonstrator: we are yet to learn what information the data holds. I am firmly convinced that, in view of the growing social challenges and the increasing commercial use of satellites, OHB will go on to complete many more hyperspectral missions. This competence has been acknowledged in the industry for quite some time and strengthens our reputation.

»With EnMAP, we have a system that produces a great deal of data and can generate fingerprints of the Earth's surface.«

Rüdiger Schönfeld
Director Earth Observation Systems

A new superhero for the Earth



How the German mission is helping EnMAP to identify environmental problems

EnMAP
Our Earth in more than just colour.

Superpowers are not only an essential part of a good Hollywood film; humanity also needs superhero powers to tackle the environmental and climate crisis. OHB System AG in Oberpfaffenhofen has developed and built a superhero known as EnMAP on behalf of the German Space Agency at DLR with funding provided by the German Federal Ministry for Economic Affairs and Climate Action (BMWK). The mission is under the scientific direction of GeoForschungszentrum Potsdam (GFZ). Three DLR institutes and facilities have been tasked with constructing and operating the ground segment: the German Space Operations Center in Oberpfaffenhofen will be carrying out and monitoring satellite operations, while the German Remote Sensing Data Center and the Remote Sensing Technology Institute will be responsible for archiving, processing and validating the satellite data and making it available for scientific research. Starting in spring 2022, the Earth observation satellite will be using imaging spectroscopy to diagnose the Earth's surface and record environmental changes.

EnMAP will become an environmental observer for ...

... the forest
Data provided by EnMAP will improve forest management. This includes forestry mapping, monitoring of deforestation, the calculation of carbon storage and recording and predicting pest infestation. This benefit is of great significance given that detrimental environmental influences have been increasingly placing stress on our forests. So far, most of the damage has been assessed visually on site by forest officials – a gigantic act as 90 billion trees are spread over an area of 11.4 million hectares. Here, EnMAP will help to "scan" forests and thus determine the health of the trees and plants from an altitude of 640 kilometers.

... agriculture
The mission will be able to monitor harvests, improve the mapping of agricultural land, calculate crop losses and future yields and identify potential agricultural land.

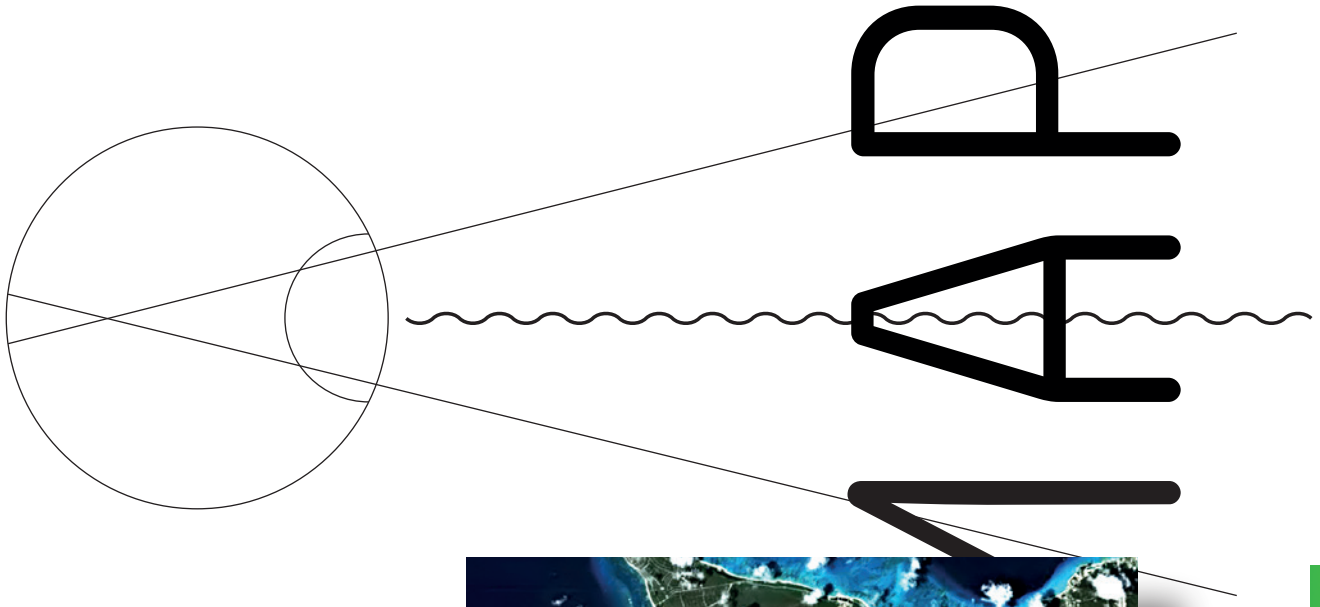
... land management
Land planning will benefit from EnMAP's data. In addition, the severity of land degradation, i. e. the deterioration of soil ecosystem services, will be assessed. Erosion maps and cadastral maps or the registration of land ownership and land use rights can be created using the data.

... water management
EnMAP will also aid water resource management as its data will help to map water and river basins. Flood control and disaster management will also benefit from this.

So far, most of these tasks have been carried out locally – a mammoth task for which EnMAP's remote sensing capabilities will lead to decisive improvements – and thus new superpowers.

The Earth in a myriad of colors: How does EnMAP work?

In order to understand how satellites observe the Earth, it important to first consider how human sight works. The information carrier for this purpose is the spectrum of electromagnetic radiation emitted by the sun. This ranges from hard X-rays with extremely short wavelengths (< 0.1 nanometers) to long radio waves (> 1 kilometer). Solar radiation reaches its highest intensity at wavelengths of between 380 and 780 nanometers. In the course of evolution, the human eye has adapted to this and is able to perceive precisely this range, which is why it is commonly referred to as "visible light". Some of the remaining wavelength ranges are absorbed by the Earth's atmosphere, while others reach the Earth's surface but are not perceptible to the human eye. These include UV and infrared radiation for example.



From the human eye to hyperspectral Earth observation

Irrespective of their perceptibility to the human eye, all types of radiation penetrating the atmosphere interact with the Earth's surface and thus provide information about its composition. However, the human eye can only absorb a fraction of this information due to its limited sensitivity to the solar spectrum.

The retina inside the eye has three different types of color receptors or cones, whose visual dyes have absorption peaks at different wavelengths but overlap to some extent in their sensitivity. The brain processes the activation of the individual cone types caused by the composition of the incoming radiation, translating it into a color image.

And what do the "eyes" of Earth observation satellites see?

Technical multispectral instruments usually have a higher spectral resolution than the human eye, but even a standard digital camera is a multispectral instrument. Like the human eye, the sensors in a digital camera can differentiate between blue, green and red light and thus reproduce the visual impression created by the eye. By contrast, however, far more complex multispectral instruments with up to fifteen color channels are used for Earth observation. They can usually detect different wavelength ranges of visible light and infrared radiation.

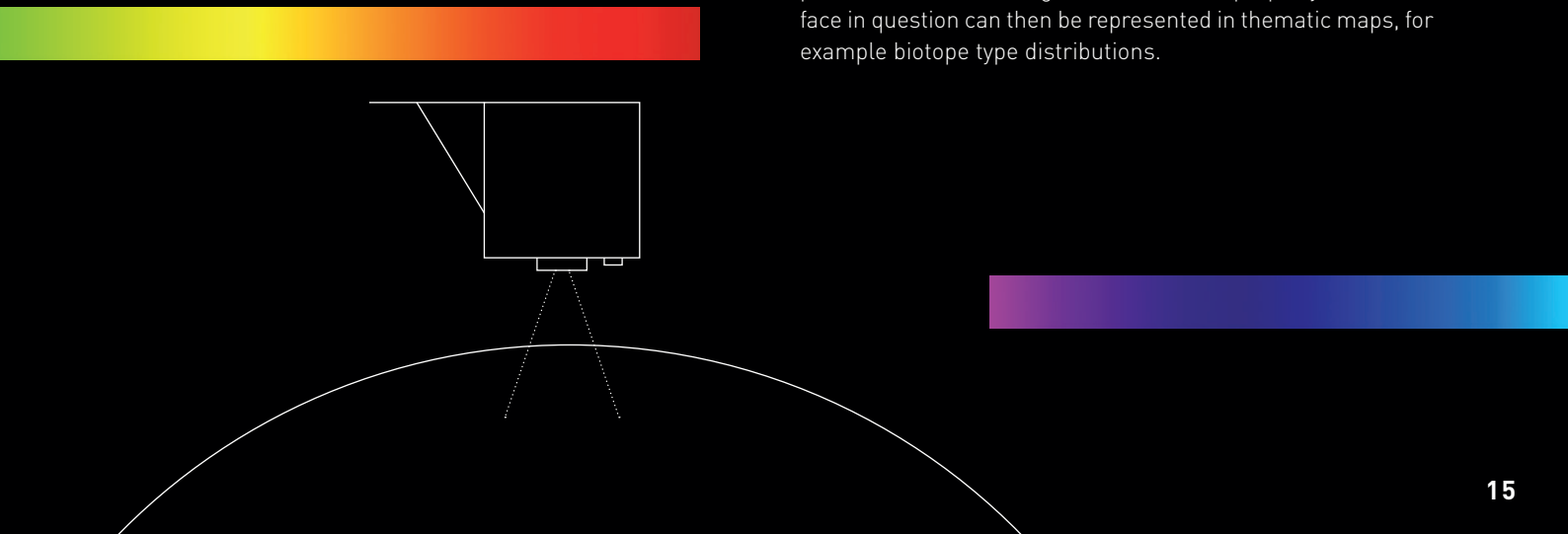
What makes a hyperspectral satellite so special?

Hyperspectral remote sensing detects a large number of bandwidths along the light spectrum. This provides a rich treasure trove of data with a high spectral resolution that makes it possible to detect things and properties that are not visible to conventional imaging sensors. This makes it possible to render the invisible visible.

With the EnMAP instrument, a continuous spectrum and thus a kind of "spectral fingerprint" of objects can be recorded. For example, different types of vegetation and different soil conditions can be identified on the basis of their characteristic absorption and reflection properties. The information density is so great that, for example, it is possible to distinguish plant groups and sometimes even individual plant species or rock compositions from a distance of several hundred kilometers. At the same time, the health of vegetation can be determined on the basis of the way infrared light is reflected: The leaves of healthy plants produce chlorophyll, which reflects six times more strongly in the infrared range than in the range of visible (and particularly green) light. This makes the EnMAP environmental mission looks pretty colorful. While the human eye sees three color channels and customary multispectral satellites four to ten color channels, the hyperspectral Earth observations performed by EnMAP use over 240 continuous spectral bands at wavelengths between 420 and 2450 nanometers and a ground resolution of 30 m × 30 m (1 image pixel = 30 m × 30 m).

And then what? What becomes of all this superpower?

This data is mainly used in geographical remote sensing and environmental sciences. Hyperspectral data is usually not utilized for direct observation. Rather, it is evaluated and consolidated with other data sources in complex mathematical processes. The resulting information on a property of the surface in question can then be represented in thematic maps, for example biotope type distributions.



5 reasons why the EnMAP project is an investment in OHB's future

EnMAP is also kind of a pioneer. As a pioneer, it needs to tackle every imponderability by offering creative solutions, thus paving the way step by step, gaining experience and learning for the future. As OHB System AG's first hyperspectral mission, the environment observer is therefore also an investment in the Group's future.

Here are the five main reasons why the hyperspectral satellite is a trailblazer for the future:

→ 1

OHB is expanding its own capabilities for designing, developing and assembling a high-precision telescope suitable for hyperspectral applications

Telescopes form the heart of every optical Earth observation satellite. In order for this central element to work properly and deliver high-precision data, it must be able to withstand the severe mechanical strains during the launch phase and the large temperature differences in orbit. In order to make the components of the aluminum telescope as resistant as possible to temperature changes, a special multi-stage thermal treatment has been developed and tested for EnMAP. In addition, the EnMAP project team have systematically amassed, conserved and passed on their expert knowledge of materials, manufacturing technologies, assembly skills and precision adjustment, all of which is now being leveraged in the CHIME, PLATO and other projects.

→ 2

Team work is trumps: Multidisciplinary process pool skills during the design phase

The EnMAP telescope consists of a highly stable and extremely lightweight housing structure made of aluminum, four optical mirrors, which are also made of aluminum, and other components such as bipod mirror holders and optical diaphragms. Three of the mirrors have a complex aspherical optical surface, the fourth mirror is planar and serves as a deflecting mirror so that the optical beams are collected in the small installation space. With the EnMAP team's pioneering work, a multidisciplinary process was used for the first time in the development and design of the system, combining the disciplines of optics, structural and thermal engineering and design with the help of a specially developed software program. Since then, the software program and the pooling of competencies have been standard practice at OHB.

→ 3

Fits perfectly, doesn't wobble and is bombproof: Highly stable precision bonding technology for EnMAP also copes with high temperature fluctuations

In order to maintain the optical quality of the mirrors and to simultaneously anchor them firmly while ensuring that they remain adjustable, the EnMAP team have developed mirror mounts, known as bipods. These bipods are attached to the mirrors with a high-precision adhesive technology. This decouples the mirror surface from the thermomechanical forces as far as possible, ensuring that the surface retains its optical shape.

→ 4

Optimum operations even in the harsh conditions of outer space: a highly accurate adjustment and alignment concept for the optical elements of the instrument

High-performance optical systems consist of multiple optical components that must be positioned and adjusted in a mechanical carrier with micrometer accuracy. This is because the instrument must achieve top optical performance that comes very close to the theoretically best possible performance. To this end, the project team have developed a concept that also makes it possible to build up instruments for future projects efficiently and with the same AIT (Assembly, Integration & Test) design.

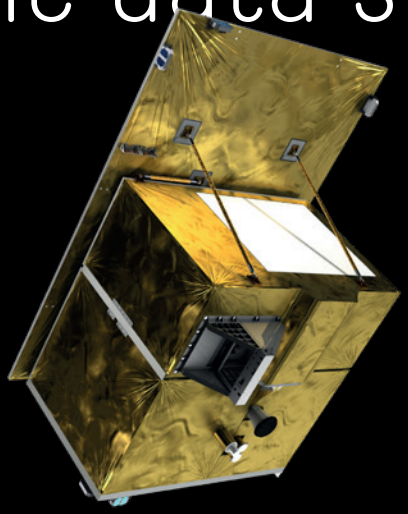
→ 5

A feel-good temperature: development of cooler control electronics by OHB

In order for the highly sensitive infrared camera to work properly, its detector must be cooled to a temperature of –125 °C. This is done using control electronics developed by the EnMAP project team itself. This in-house development is a key factor in the success of the mission and can also be used for future projects. It is supplemented by high-precision thermal stabilization of the entire instrument using a climate control system. In order to allow for the changing thermal environment in orbit, the thermal control system uses innovative and controlled heat pipes ("mini loop heat pipes"). Ultimately, this ensures the necessary optical performance. The advantage is that this approach saves energy and consequently also mass and installation space compared with conventional methods.

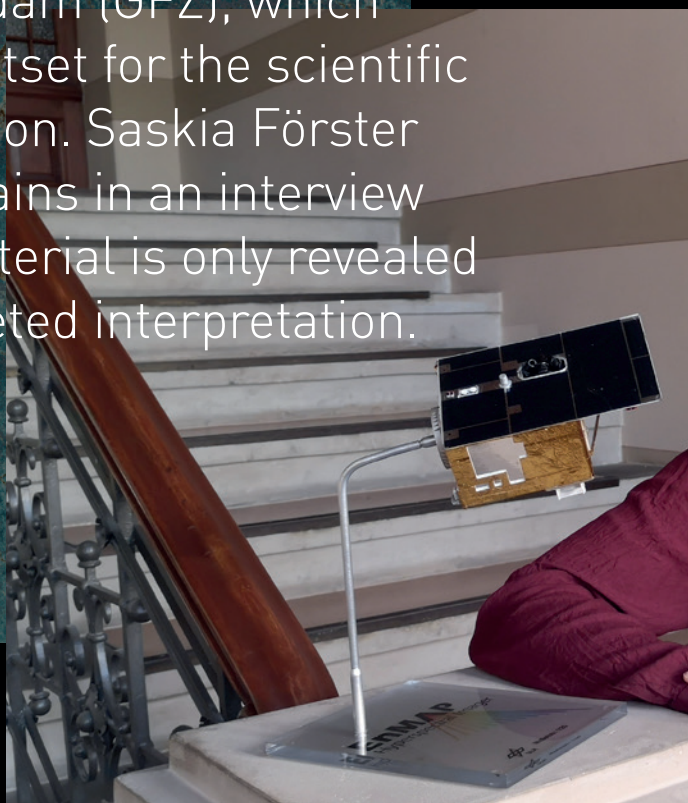
Southern part of the city of Mumbai (India), recorded by the hyperspectral instrument of the ESA satellite Proba-1

The data specialists



The EnMAP data will be rigorously checked and future users trained at the German Geoscience Center Potsdam.

A satellite must be developed, built and operated. However, an experienced scientific partner is required to interpret the data in a meaningful way. For this purpose, the German Space Agency at the German Aerospace Center (DLR) has brought on board the German Geoscience Center Potsdam (GFZ), which has been responsible from the outset for the scientific management of the EnMAP mission. Saskia Förster is a geoecologist at GFZ and explains in an interview why the true value of the data material is only revealed through comprehensive and targeted interpretation.



»As a partner of the DLR, the GFZ has been responsible from the outset for the scientific management of the EnMAP mission and has contributed to the development of the satellite.«

Saskia Förster
Geoecologist at GFZ

To what extent is GFZ involved in the EnMAP mission?
SF: GFZ has been DLR's scientific partner since the beginning of the mission. One task was to simulate the expected data. The simulator was developed at GFZ and helped OHB to define the EnMAP instrument. In addition, we have developed a number of algorithms for preprocessing the data and evaluating it for specific applications. Many of the algorithms are now part of what is known as the EnMAP box, which was also developed in the EnMAP scientific program. This package is subject to the open data policy and is therefore freely available to all users.

When can we expect to receive the first data?
SF: If the satellite launches as scheduled in April, it will take a few weeks for us to collect data. After that, we will be ready to send our validation teams into the field – one of GFZ's tasks is to independently validate the data in addition to the ground segment at DLR. This makes us the quality controllers.

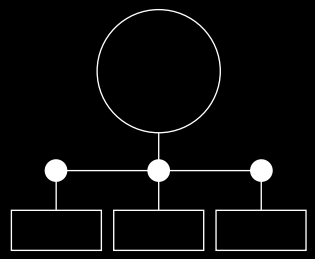
How will future users be helped in interpreting the data?
SF: We offer future users training in hyperspectral remote sensing. As a rule, this will take the form of online training. A basic course has been online since November. If you would like to find out more about the training courses, you can do so on the enmap.org website. Further courses for applications relating to water, agriculture, soils etc. are being prepared. Looking forward, we would also like to train staff at public authorities, for example in the environmental departments. This can be useful when, for example, it is necessary to measure the water quality in a certain region. Until now, people have often been sent out to take samples. That's all very well, but it's no more than point-by-point detection. The advantage of remote sensing is the ability to record environmental parameters over a large area.

So EnMAP will help to improve environmental protection?
SF: Yes, definitely. And in this respect, we are combining a public and commercial benefit because more and more companies are specializing in special applications such as the rehabilitation of mining areas or the removal of pollutants from the environment. A further great advantage of hyperspectral remote sensing is the ability to distinguish between different materials. Overall, however, we will definitely be able to come up with many more use cases. It won't become evident until in the course of the mission what benefits we can derive from the data. One thing is clear: we have some very busy months ahead of us.

enmap.org

OHB organisation

OHB SE is a European space and technology group and one of the major independent forces in this industry. With its more than 40 years of experience in the development and implementation of innovative space systems and projects as well as its range of specific aerospace and telematics products, the OHB Group has positioned itself excellently and is well positioned to compete internationally. The Company has locations in key ESA member countries. These locations allow it to participate in numerous European programs and missions.



SPACE SYSTEMS

OHB System AG
Bremen & Oberpfaffenhofen, Germany
100%

- **OHB Sweden AB** Stockholm, Sweden 100%
- **LuxSpace Sàrl** Betzdorf, Luxembourg 100%
- **OHB Hellas mon.E.P.E.** Athens, Greece 100%
- **OHB Italia S.p.A.** Milan, Italy 100%
- **Antwerp Space N.V.** Antwerp, Belgium 100%
- **OHB Czechspace s.r.o.** Brno, Czechia 100%

AEROSPACE

MT Aerospace AG
Augsburg, Germany
70%

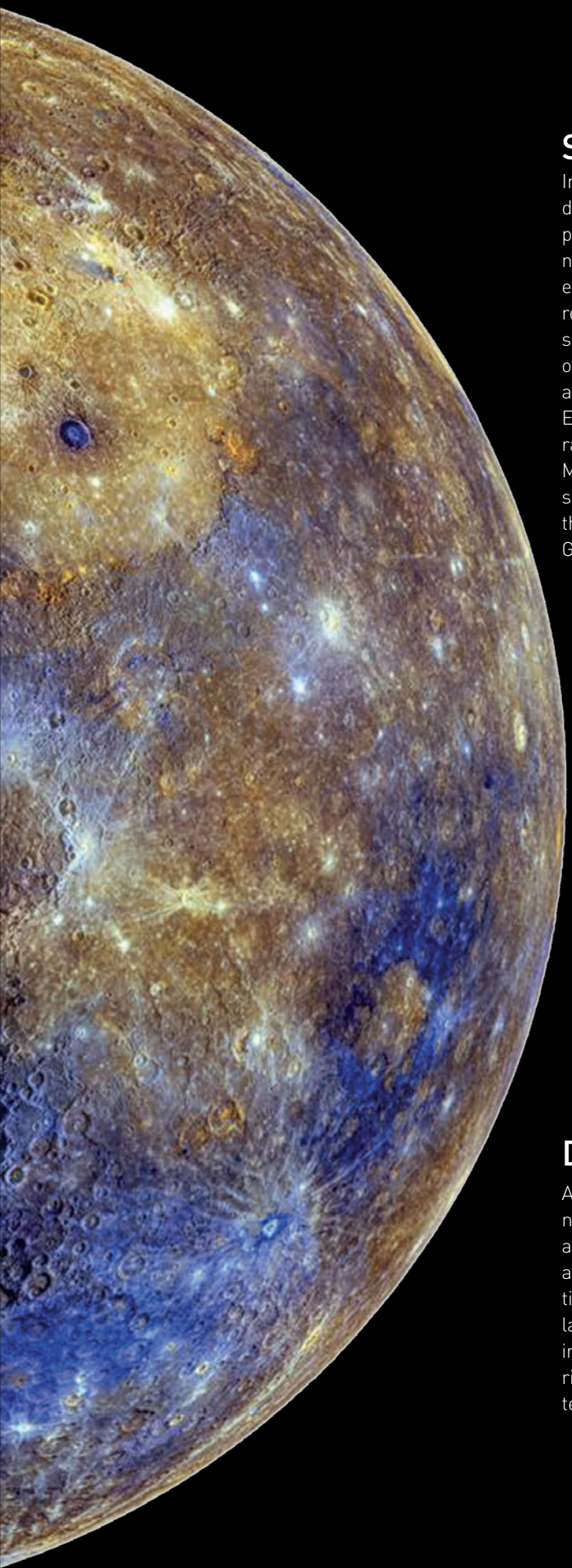
- **ATC Space s,r,o,** Klatovy. Tschechien 34.3%
- **Rocket Factory Augsburg AG** Augsburg, Germany 55%
- **Aerotech Peissenberg GmbH & Co. KG** Peissenberg, Germany 34.3%
- **Aerotech Czech s.r.o.** Klatovy, Czechia 34.3%
- **AT ENGINE MEXICO S.A.P.I. DE C.V.** Hermosillo, Mexico 17.5%

DIGITAL

OHB Digital Connect GmbH
Bremen, Mainz & Gelsdorf, Germany
100%

- **OHB Teledata GmbH** Bremen & Oberpfaffenhofen, Germany 100%
- **OHB Chile SpA** Santiago de Chile, Chile 100%
- **OHB Digital Solutions GmbH** Graz, Austria 100%
- **OHB COSMOS International GmbH** Bremen, Germany 100%
- **MT Aerospace Guyane S.A.S.** Kourou, French Guiana 70%
- **OHB Infosys GmbH** Bremen & Oberpfaffenhofen, Germany 100%
- **OHB Digital Services GmbH** Bremen, Germany 74.9%
- **GEOSYSTEMS GmbH** Germering, Germany 100%
- **Blue Horizon Sàrl** Betzdorf, Luxembourg 100%

☐ **Non-consolidated**



SPACE SYSTEMS

In the "SPACE SYSTEMS" segment, the focus is on the development and implementation of space projects. In particular, this means the development and production of near-Earth and geostationary satellites for navigation, science, communications, Earth and weather observation and reconnaissance including scientific payloads. Reconnaissance satellites and secure broadband radio transmission of image reconnaissance data are core technologies for the application domains security and reconnaissance. In the Exploration division, studies and concepts for the exploration of our solar system are developed with a focus on Mars, the Moon and asteroids. In the field of astronautical space, the focus is on projects for equipping and operating the International Space Station ISS and the future Lunar Gateway.

AEROSPACE

The focus of the "AEROSPACE" segment is on the manufacturing and development of products for the aerospace industry. Here, OHB has positioned itself as a key supplier of aerospace structures and is, among other things, the largest German supplier for the Ariane program as well as an established manufacturer of components for satellites and aircraft. Our participation Rocket Factory Augsburg AG is currently developing a promising microlauncher as a system provider.

DIGITAL

A broad portfolio of service activities characterises the new "DIGITAL" division, including satellite operations, IT applications based on satellite data (so-called downstream applications), e.g. in the areas of maritime and rail logistics or autonomous mobility, as well as the procurement of launches and provision of IT services. In addition, OHB is involved in major projects for radio telescopes as an experienced supplier of mechatronic systems for antennas and telescopes.

Our locations

Deutschland
Augsburg
Bremen
Germering
Mainz
Oberpfaffenhofen
Salem

Belgium
Antwerp

Greece
Athens

Italy
Benevento
Milan
Rome

Luxembourg
Betzdorf

Austria
Graz
Vienna

Sweden
Stockholm

Czech Republic
Brno
Klatovy

Chile
Santiago de Chile

French-Guiana
Kourou

GERMERING (GEOSYSTEMS GmbH)

At 33, the youngest child in the OHB family is already quite grown up. The geo-IT specialists are not bringing the stars down from the sky for us, but they are transferring terabytes of data from Earth observation satellites into living 3D landscapes.

AUGSBURG (MT Aerospace)

Each Ariane 6 launcher has 114 welds made using the particularly stable friction stir welding process; 87 of them are manufactured by MT Aerospace. This corresponds to around 330 of the total of some 500 meters of friction stir weld on each launcher.

Proportion of employees

Germany
83%

Rest of Europe
14%

Rest of world
3%

CHILE

Chile is home to more than more than 70% of the world's infrastructure in the field of telescopes.
(Source: Conicyt Astronomy Program)

BREMEN

Our production site coordinator walks on average 27,500 steps each day.

LUXEMBOURG

The flight model of the 2014 successfully completed "Manfred Memorial Moon Mission" will hit the far side of the moon in the first half of 2022. Then hardware from Luxembourg will be there - even if no longer "in one piece".

STOCKHOLM

The nominal mission duration of the ODIN satellite was two years, in the meantime the satellite has been delivering data since 21 years (only once during this already by a factor of 10 extended "lifetime" the computer had to be restarted).

AUGSBURG (RFA)

The fuel tanks of the newly Rocket Factory One launcher are being manufactured by a supplier for breweries.

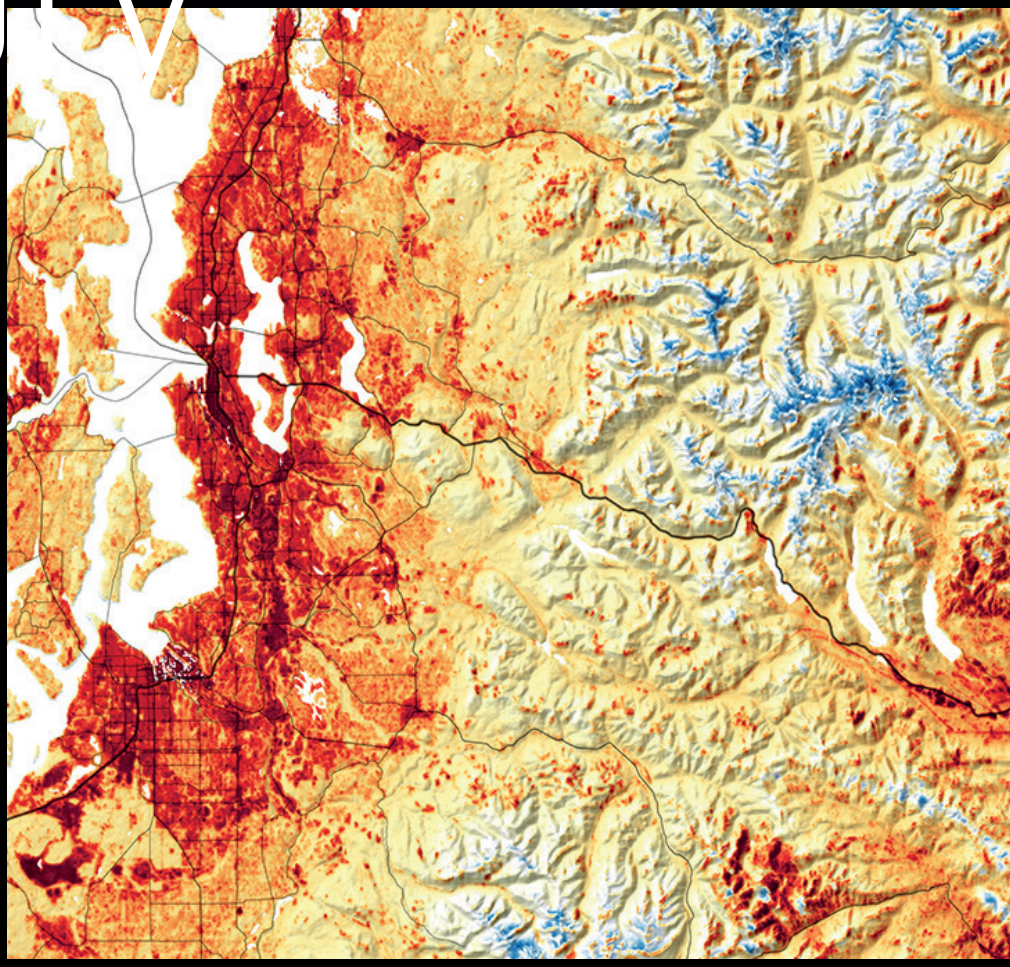
GRAZ

Since the former company TeleConsult Austria has been renamed OHB Digital Solutions due to the acquisition by OHB, no one calls there by mistake any more in order to conclude a telephone contract.

MILAN

The inertial sensor of the "Lisa Pathfinder" mission was so powerful that it could isolate the sound caused by a fly at a distance of one meter.

Our equity story



Top: Booming demand for consumer goods and Covid-19-related supply chain constraints contributed to a backlog of cargo ships in 2021. This picture taken on October 10 shows dozens of ships close to the port of Los Angeles.

Bottom: Exceptional heat events occur in most summers around the world, but the heat wave depicted here in the Pacific Northwest (United States; summer 2021) was extraordinary. In several cities, new temperature records were broken during a heat wave that the National Weather Service referred to as "historical and dangerous".

A _ Benefits of space applications
B _ Development of the space market
C _ OHB's position
D _ Strategic objectives and implementation
E _ Proven profitability
F _ Growth outlook 2025

A

Benefits of space applications

Space applications are becoming more and more relevant: precise and fast information on developments on the Earth provide the necessary data for making informed decisions and for understanding and forecasting processes. Using satellite data, services are developed to provide specific information on a wide variety of factors, such as weather and climate as well as natural resources and for disaster and crisis management. Trends such as digitization are also spurring demand for additional communication capacities in space.

B

Development of the space market

A conservative analysis by the industry experts at Euroconsult projects an average annual growth rate of 6.3% for the global space market in the period from 2016 to 2030. Several other organizations go as far as to forecast double-digit annual growth rates.

This is reflected in the fact that the space budgets of the European Space Agency ESA and the European Commission are currently larger than ever: The ESA has a budget for 2022 of EUR 7.2 billion (including shares attributable to partner organizations), marking an increase of 10% over the previous year. The European Commission's budget for space applications in the current multiannual financial framework stands at EUR 14.8 billion, 17% more than in the previous financial framework.

2014 – 2020
EUR 12.6 billion

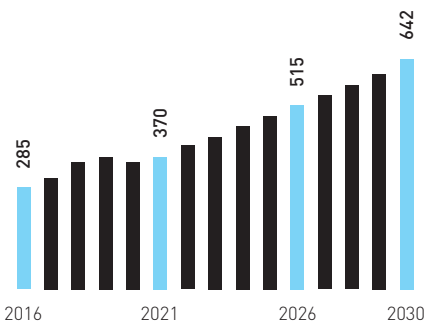
2021 – 2027
EUR 14.8 billion

Space budgets of the European Commission

2021
EUR 6.5 billion

2022
EUR 7.2 billion

Budgets of ESA



Global space market
Growth in USD billion

C

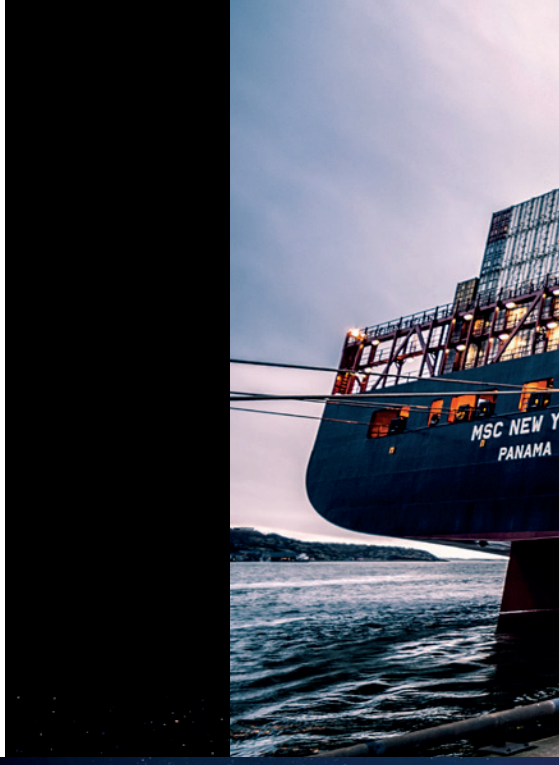
OHB's position

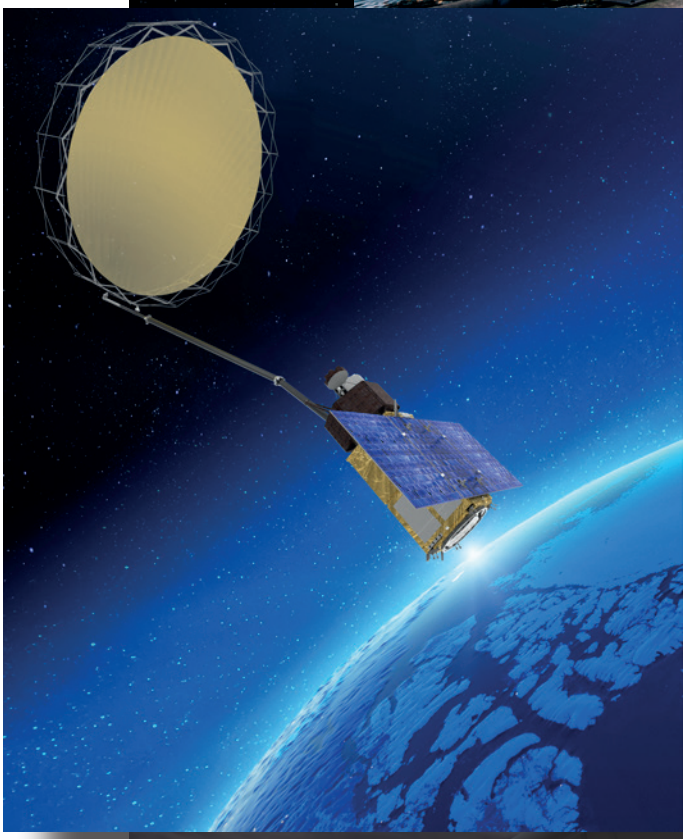
The OHB Group companies have been broadening their skills and experience over the last few years to meet the expected market changes:

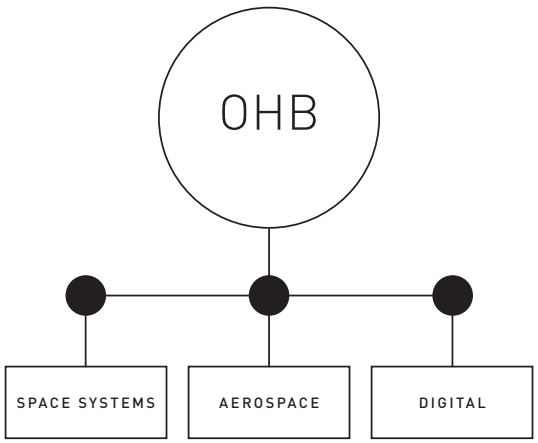
In the SPACE SYSTEMS segment, OHB is very well positioned, especially in the field of Earth observation, thanks to various missions that have been carried out and will make a significant contribution to a better understanding of environmental changes such as climate change in current projects such as the EU's Copernicus program. The companies' broad positioning ensures that all solutions can be provided for all space applications.

The AEROSPACE segment is a supplier for various launcher programs. New business opportunities are emerging from the ongoing accumulation of skills and experience in the growth markets that have been identified.

The DIGITAL segment offers a portfolio of forward-looking services and solutions. The skills pooled in this segment are increasingly addressing non-space applications. OHB is therefore increasingly making its expertise available to other markets as well. At the same time, the OHB companies are working continuously on developing additional capabilities in the interests of an even better range of applications and services.







Top: The DIGITAL companies have a portfolio of solutions and services targeted at various industries, including the maritime sector.

Center: Artist's impression of the CIMR satellite, which will be measuring parameters such as the temperature and salinity of individual water layers and the concentration of sea ice.

Below: Artist's impression of the European Ariane 6 launcher in its configuration with four boosters

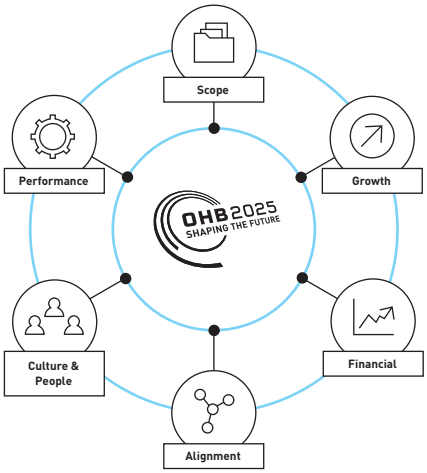
The SpaceLink system

D

Strategic objectives and implementation

In September 2021, the Management Board carried out an extensive review of the assumptions underlying the Group strategy "OHB 2025 – Shaping the future" and of the targets defined in it. Subsequently, it was able to confirm the main thrust of the strategy and the ambitious profitability targets for 2025; in fact, the growth target was adjusted upwards slightly.

The strategic measures will continue to be implemented this year. With regard to the planned expansion of commercial activities, a significant milestone was reached in 2021, when OHB System AG's bid for the US SpaceLink project was accepted, underscoring OHB's competitiveness in the commercial sector.

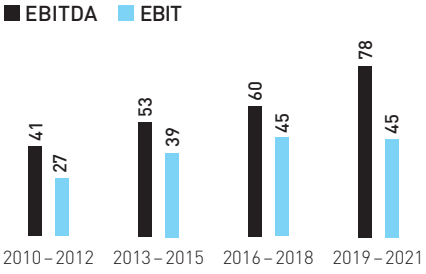


Group strategy
"OHB 2025 – Shaping the future"

E

Proven profitability

Since its IPO in 2001, OHB SE has not executed any cash capital increase. The Group's strong growth in recent decades has been financed out of its cash flow (cumulative operating cash flow of EUR 308 million and free cash flow of EUR 193 million). In addition, the Company has continuously distributed a dividend to its shareholders since 2005 (with the exception of 2020 due to the Covid-19 pandemic).

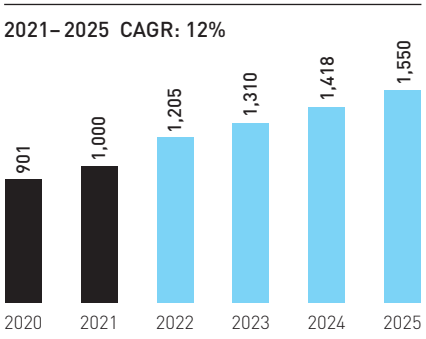


Development of profitability ratios (annual averages) in EUR million

F

Growth outlook 2025

In the light of the growth prospects of the European and global space market, the positioning of the OHB companies and their expected business opportunities, the Management Board has for the first time provided guidance for the current year as well as an annual outlook for the Group's three main performance indicators.



Development of total revenues in EUR million

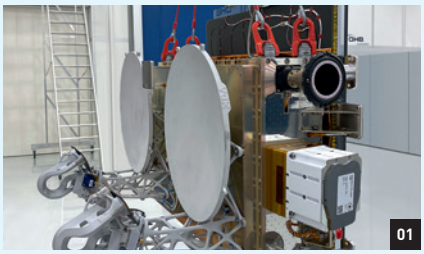
Review

(→01) **January 20, 2021**
Satellite successfully launched after an extremely short implementation period
The GMS-T satellite – a prototype for a planned telecommunications constellation in a low-Earth orbit – was launched less than seven months after the start of engineering and successfully put into operation a few days later.

(→02) **February 11, 2021**
Strategy 2025: DIGITAL division launched
After being announced in the previous year, the third reporting segment, DIGITAL, was presented at the capital market day. It builds on existing activities, diversifies the Group's range of solutions and opens up new growth opportunities.

(→03) **March 9, 2021**
OHB Sweden and ESA signed a contract for the Arctic Weather Satellite
The satellite is a prototype for a constellation designed to improve weather forecasts for the polar regions. Assembly of the constellation could commence following the launch in 2024.

(→04) **Double opening ceremony: expansion in Italy and Augsburg**
On March 24, a new ISO 8 clean room with an area of 360 sqm was inaugurated in Milan. On March 30, Rocket Factory Augsburg celebrated the opening of new and larger facilities on the former Osram site, the place where the energy-saving lamp was invented.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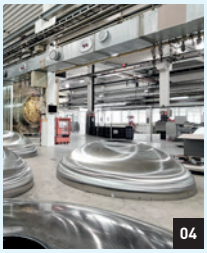
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05


06


07


08

(→05) **April 30, 2021**
MT Aerospace (MTA) signed a contract for the delivery of components for Ariane 6
ArianeGroup awarded MTA a contract for series production of components for tanks and various structural parts of the new European launcher. With a production share of around ten percent, MTA is one of the largest suppliers.

(→06) **May 6, 2021**
MTA developed future technical standards for additive manufacturing processes in space
On behalf of ESA, MTA will be developing standardized additive manufacturing processes for components and structures required in space over the next three years. The innovative manufacturing possibilities give MTA the opportunity of building up and expanding further skills in this area at an early stage.

(→07) **May 25, 2021**
OHB delivered its contributions to the Lunar Gateway
The European part of the Lunar Orbital Platform Gateway is expected to be fully integrated in the space station by 2027. It forms the starting point for lunar landings in the 2020s and 2030s. Among other things, OHB is developing a system for xenon refueling in space – an international premiere.

(→08) **May 26, 2021**
Virtual annual general meeting
Unfortunately, the annual general meeting again had to be held in digital form in 2021 due to the Covid-19 pandemic. The Management Board and the Supervisory Board convened at the Bremen headquarters to answer shareholders' questions.

(→ 09) **July 7, 2021**
MT Aerospace (MTA) and Boeing intensified their partnership
Since 2013, MTA has been a supplier of components for the part of the NASA Space Launch System (SLS) for which Boeing is responsible. Both sides want to expand their partnership in the coming years to include further parts for the US company's launcher and commercial satellites.

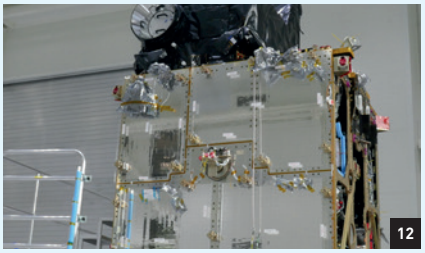

09

(→ 10) **July/August 2021**
Rocket Factory Augsburg (RFA) cleared further hurdles on its way towards its first launch
In July, the RFA tested its entire propulsion unit over a burning time of eight seconds. This is the industry benchmark for full functionality of a propulsion unit. In August, the first-stage hull successfully completed testing to simulate the enormous stresses of space.


10

(→ 11) **August 2021**
Platform and payload module of the Heinrich Hertz satellite successfully integrated
The two largest components of the telecommunications satellite were successfully linked to each other at the beginning of August. The mission, which is being carried out by the German Space Agency at DLR on behalf of the German Federal Ministry for Economic Affairs and Climate Action and with the participation of the German Federal Ministry of Defense, is to be launched in 2023.


11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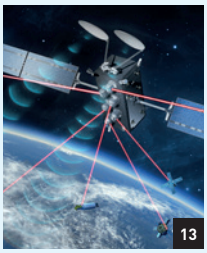
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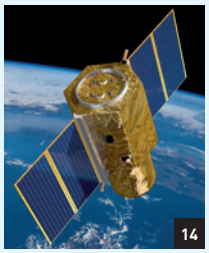
14


15

(→ 12) **September 2021**
Progress on the future of weather forecasts
The first of a total of six European next-generation weather satellites assembled by OHB successfully completed various tests in addition to the integration of the platform and camera module. The launch is scheduled for autumn 2022. The Meteosat Third Generation will provide weather data for the next 20 years.

(→ 13) **Successful OHB bid for the construction of a relay constellation**
OHB was able to prevail over international competitors thanks to its many years of experience, competence and reliability. The constellation of US operator SpaceLink Corp. will provide a rapid and permanent connection to the Earth for the low-orbit satellites of institutional and commercial customers.

(→ 14) **Involvement in the operation of the Luxembourg Earth observation system**
The OHB subsidiaries OHB Digital Connect and LuxSpace are participating as members of the LUXEOps consortium in the operation of the satellite system and the related ground segment including image processing and maintenance.

(→ 15) **December 5, 2021**
Galileo launch
The final satellite launch of the year was reserved for the Galileo program: built by OHB, flight models 23 and 24 reached their target orbit a few hours after a perfect launch from the European spaceport in Kourou (French Guiana) – shortly afterwards, their full functionality was confirmed.

Financial calendar and trade fair dates 2022

March 23
Annual press conference (AR 2021)
Analysts conference (AR 2021)

May 11
3-months report /
Analysts conference

June 1
Annual general meeting

August 11
6-months report /
Analysts conference

November 10
9-months report /
Analysts conference

November 21 – 23
DZ Bank conference, Frankfurt / M.

November 28 – 33
German equity forum

Satellite 2022
21.03. – 24.03.2022
Walter E. Washington Convention Center, Washington DC
We look forward to meeting you at Satellite 2022.
satshow.com

AFCEA Fachausstellung
30.03. – 31.03.2022
World Conference Center Bonn
Visit us in the foyer Entrance area, booth F14.
afcea.de/fachausstellung

Breakbulk Europe
17.05. – 19.05.2022
Rotterdam Ahoy
Visit us at the joint booth of Bremen Ports in hall 1, booth 1F21-G20.
europe.breakbulk.com/home

Living Planet Symposium 2022
23.05. – 27.05.2022
World Conference Center Bonn
More information to follow
lps22.esa.int

Tag der Industrie (#TDI22)
20.06. – 21.06.2022
Verti Music Hall,
Mercedes Platz, Berlin
More information to follow
bdi.eu/tdi

ILA Berlin
22.06. – 25.06.2022
Berlin Schonefeld
Visit us in Hall 6 and in the Space Pavilion.
ila-berlin.de/en

SMM Hamburg
06.09. – 09.09.2022
Fair Hamburg
More information to follow
smm-hamburg.com

73rd Astronautical Congress (IAC)
18.09. – 22.09.2022
Paris Convention Centre
Visit us in the exhibition hall, booth F8.
iac2022.org

InnoTrans 2022
20.09. – 23.09.2022
Fair Berlin
Visit us in Hall A, booth 280.
innotrans.de/en

Space Tech Expo Europe
15.11. – 17.11.2022
Fair Bremen
Visit us in Hall 5, booth J27.
spacetechexpo.eu

Imprint

OHB SE
Manfred-Fuchs-Platz 2 – 4
28359 Bremen
Germany

Phone: +49 (0) 421 2020 - 8
Fax: +49 (0) 421 2020 - 700
E-Mail: info@ohb.de

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CONTACT

OHB SE
Manfred-Fuchs-Platz 2 – 4
28359 Bremen

Phone: +49 (0) 421 2020 - 7200
Fax: +49 (0) 421 2020 - 613
E-Mail: ir@ohb.de

Marco Fuchs, CEO
Martina Lilienthal, Investor Relations

ohb.de

OHB SE
Manfred-Fuchs-Platz 2 – 4
28359 Bremen, Germany
Phone: +49 (0) 421 2020 - 8
info@ohb.de