
DLR
Federal Ministry
for Economic Affairs
and Climate Action
ALL.TÄGLICH!
INNO
spaceEXPO
The exhibition

ALL.TÄGLICH!

Research in space. Space technology.
Simply out of touch with the real world? On the contrary! There is hardly any sector of our daily lives still being conceivable without research in space or services from space.

On the one hand, developments from space are an indispensable innovation driver, on the other hand, they have arrived in our daily lives long since. However, many people are not – or at least hardly – aware of the fact that technologies they use quite naturally almost every day and that assist them in better living, learning, working, and being mobile, have emerged from space research. This is what INNOspaceEXPO "ALL.täglich!" shows by presenting a variety of examples. Informative, interactive, and often surprising.

The exhibition "ALL.täglich!" has been conceptualised as part of the INNOspace® initiative of the German Space Agency at the German Aerospace Center (DLR) on behalf of the Federal Ministry for Economic Affairs and Climate Action (formerly: Federal Ministry for Economic Affairs and Energy). As a touring exhibition, it can be viewed successively in different cities all over Germany.

With four clicks through all information levels

Navigation and structure of the information levels of the large vertical touch screens

The question mark tags on the key visual indicate various subtopics of the main topic and will lead you there when you touch them.

After the first touch, you are on the quick information level of a subtopic. If, after reading, you are interested in a deeper understanding, just touch the button "Next".

After touching the button "Next", you can watch a brief explanatory video that imparts minimal compact knowledge on the main topic. When the video ends, you will be automatically rerouted to the information level ALL.täglich!

Here, you can acquire basic knowledge on the topic by scrolling up and down on the monitor. Brief texts, images, and videos illustrate the implementation of space technology in our daily lives.

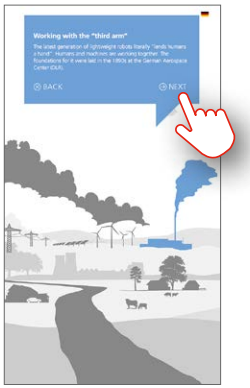
When scrolling further, you will arrive at the "Insider" area containing more in-depth information or scientific data. You may also access this level directly by touching the INSIDER button.

3

4

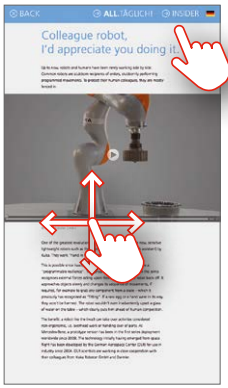
? ▶ NEXT ▶ ALL.TÄGLICH! ▶ INSIDER

Wohnen & Arbeiten

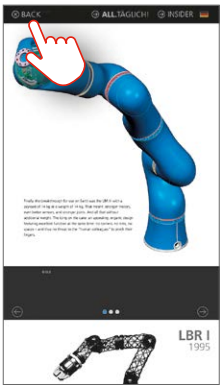


Quick information, check on interests

Explanatory video, approx. 60 sec.



Basic knowledge on the topic



Expert knowledge

The digital globe

Satellite-based Earth observation for selecting optimal traffic routes

The risks of natural hazards such as severe weather, volcano ashes in the atmosphere, or icebergs can be reduced by aircraft or ships selecting their route by means of satellite technology.

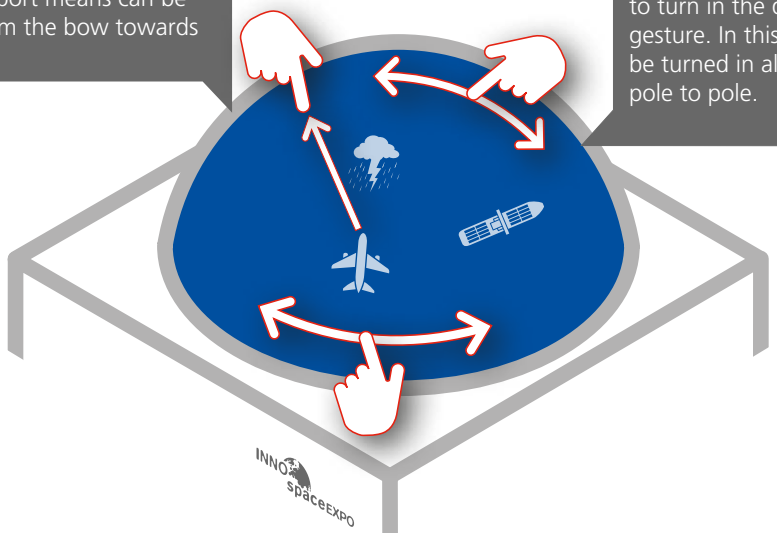
The educational games on the globe aim at finding the optimal route to the destination in competition with a satellite-controlled aircraft or ship. In doing so, both time need and fuel consumption should be as low as possible.

During the game, danger zones will occur. The frequency of such obstacles is the same for all players. They have a negative impact on speed or energy consumption.

The game ends when the total playing time (two minutes) has elapsed. The routes of the aircraft or ship controlled by the player and those of the satellite-controlled aircraft or ship can be called up and compared with each other.

Touching the aircraft or ship hot spots will open a window with a brief description of the game. After the game has been started, the route of the transport means can be altered by a swipe from the bow towards the desired direction.

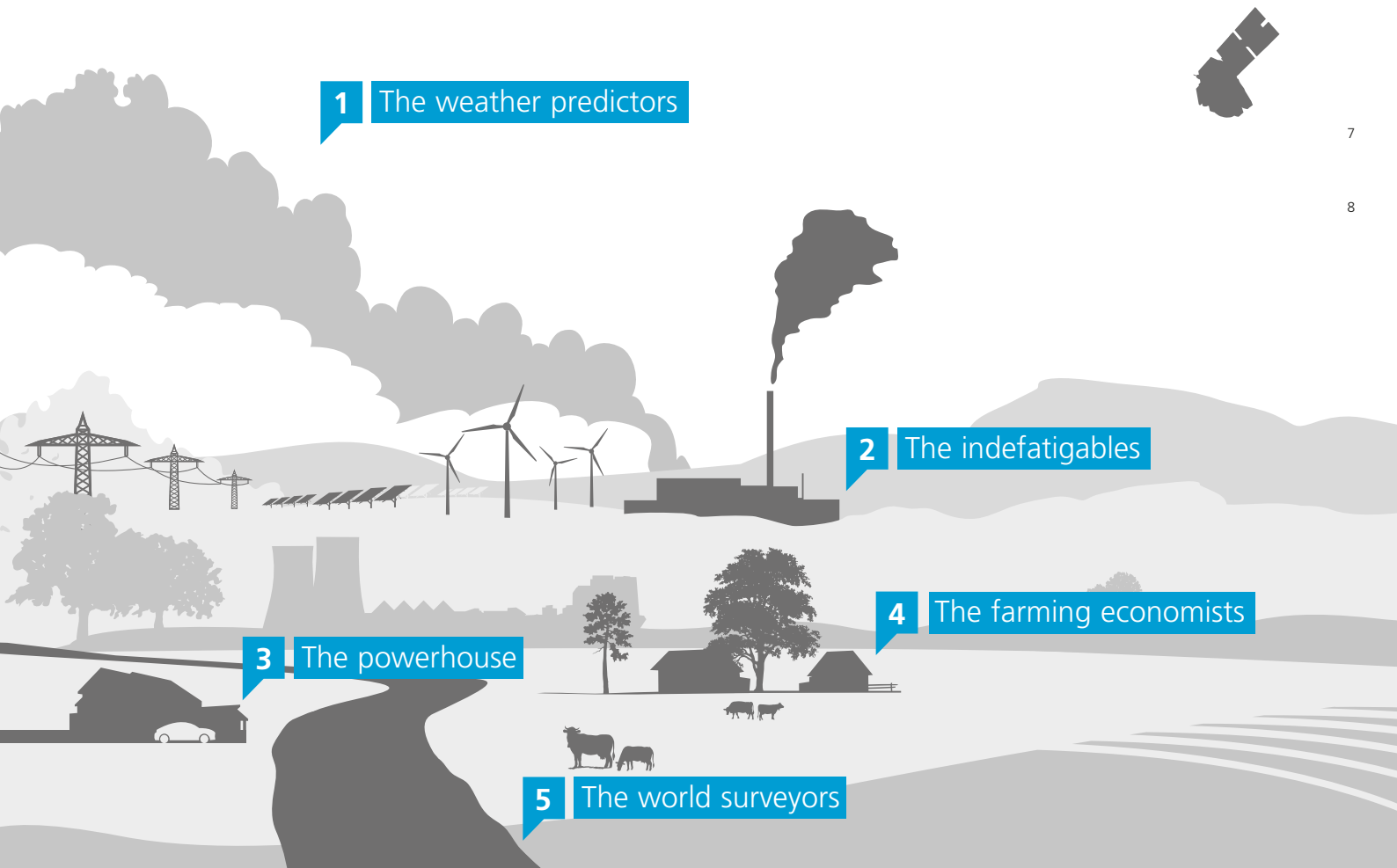
A slow swipe (one finger) on the globe's surface will cause the globe to turn in the direction of the swipe gesture. In this way, the globe can be turned in all directions and from pole to pole.



Please note:
The system is not capable of reading several swipe gestures at the same time. The digital globe is an interactive dome projection with infrared touch technology.

City, country, and river ... viewed from space.

Space-proven technologies assist us in getting a better understanding of what is happening on our planet: the impacts of climate change become clearer, natural phenomena can be understood more precisely. Space flight research also shows the impact of humans on the environment – both in a positive and a negative way. And it shows ways towards a more efficient use of existing resources.



1 The weather predictors

For decades, satellite images have assisted us in making reliable weather forecasts. Both the image quality and the quality of the forecasts are constantly getting better. Today, a network of weather satellites is covering the entire Earth. There are two types of weather satellites complementing each other: geostationary ones and polar orbiting ones. The most important for us are those from the Meteosat and the MetOp series. For weather forecasts "made in Germany" that are ten times as reliable as they were 50 years ago.

2 The indefatigables

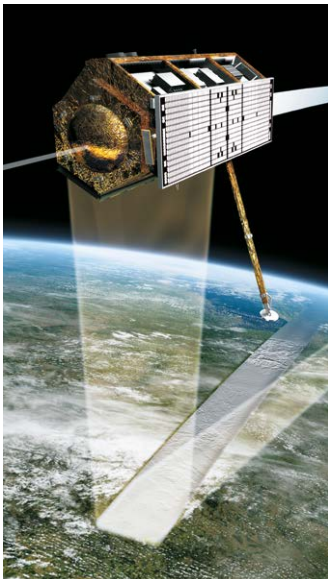
The latest generation of lightweight robots literally "lends humans a hand". Humans and machines are working together, for instance in the automotive industry or in medicine. The foundations for this achievement were laid in the 1990s at the German Aerospace Center (DLR). The aim was to develop a lightweight "henchman" to be employed on board a space station in order to facilitate the work of the astronauts.

3 The powerhouse

In the energy mix of the future, regenerative energies are supposed to take the lead. However, the sun and the wind won't work at the touch of a button. Hydrogen complements the assortment of green energies. The fuel cell makes it an almost inexhaustible source of energy – and an ideal reservoir for other types of energy. At home and on the go. The discovery of 1838 celebrated its first breakthrough in space flight.

4 The farming economists

If fields could "talk", this would enable truly sustainable agriculture, for less employment of fertilisers and better harvests. With their instruments that use light, laser, and radar, satellites make fields talk. They even discern how well plants are doing. The LIDAR laser technology that is – among other things – employed in this process, furthermore helps on Earth in keeping living rooms clean, or results in archaeological sensations.



5 The world surveyors

Flood waters occur more and more frequently and get increasingly stronger. The German radar satellite TerraSAR-X keeps track of floods – and assists helpers and rescuers. However, radar satellites can see even more – they are capable of detecting uplifts and subsidence down to the range of millimetres. The data is used, for example, for early warning of earthquakes, volcano observation, or in building projects.

Correct distance/speed

The LIDAR laser technology is not only used on board satellites, but also on board vacuum cleaning robots. They survey the room, create a 3D model and thus know the position of furniture. Future self-driving cars bank on this technology as well. And today, the laser guns used in traffic surveillance, since with light, positions and thus speeds can be measured as well.

Oxygen sniffers

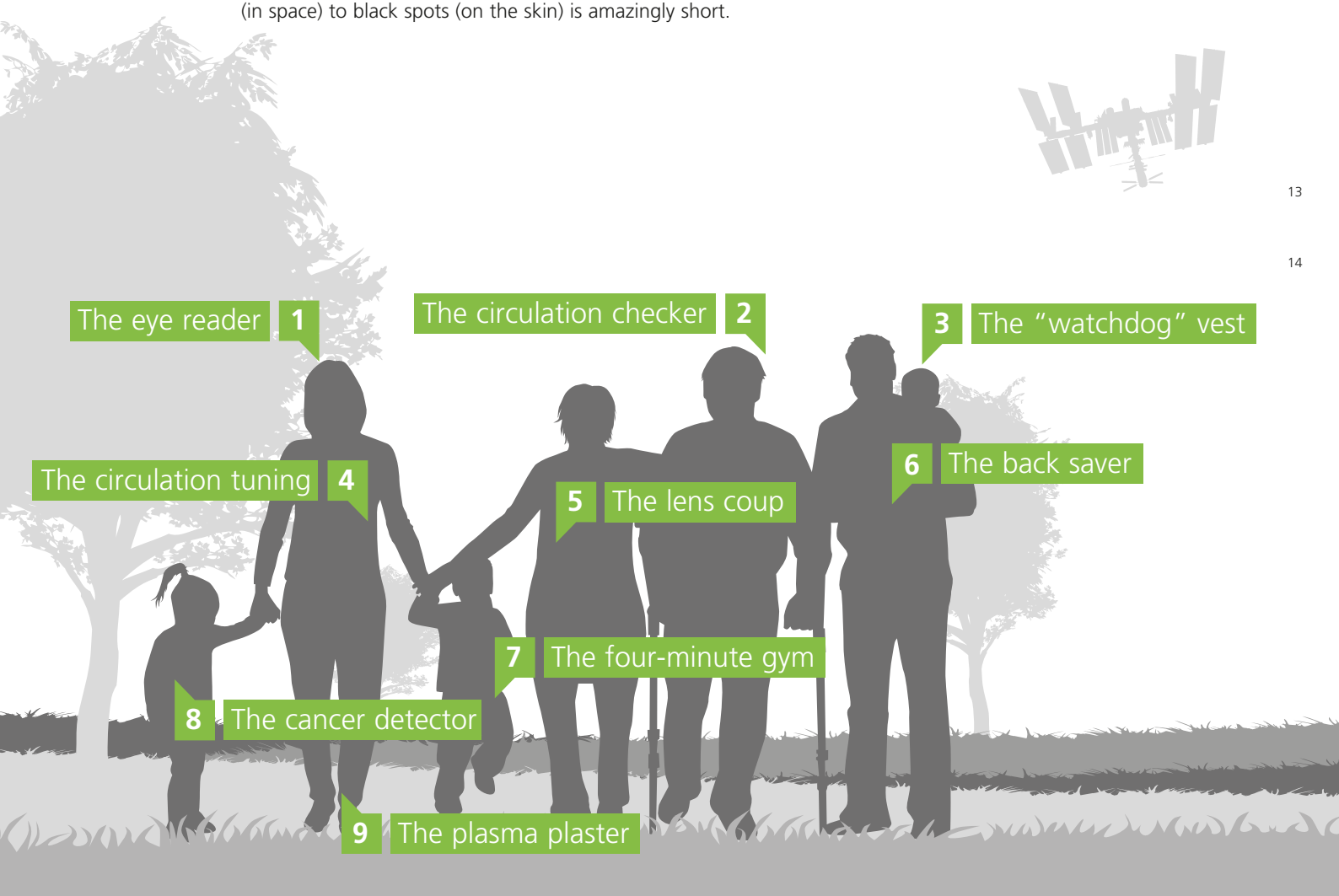
In the orbit in which the ISS is circling the Earth, there are small quantities of highly reactive oxygen atoms which might damage spacecraft. To measure their concentration, special space-proven oxygen sensors have been developed at the Institute for Space Systems of Stuttgart University. Today, these robust sensors are the size of ants only and assist, among other things, in making heating systems more economical or glass production more efficient.

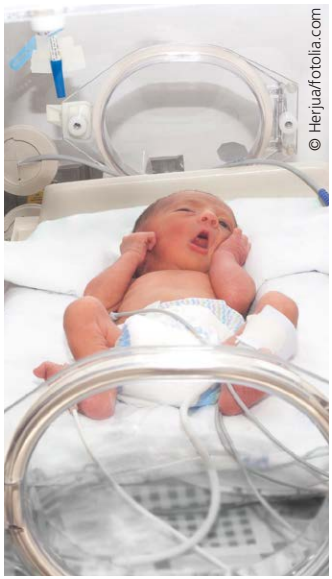
The sun collectors

Regenerative energies play the lead in a "green" energy mix of tomorrow. Solar energy, for example. Since the sun sometimes makes itself scarce in our region, we have to get more out of it when it happens to show up. And we must "harvest" it wherever possible. This is feasible with the solar cells of the future – developed for space flight – like the concentrator solar cells or thin-film solar cells shown here.

From weightless to painless.

What keeps astronauts in space fit and healthy can benefit people on Earth as well. Whether better vision, more stable circulation, more effective early diagnosis of skin cancer, muscle building, or new therapies for back pain: in terms of health, all generations can benefit from innovations from space flight. And even the way from black holes (in space) to black spots (on the skin) is amazingly short.





4 The circulation tuning

For fighting peripheral artery occlusive disease (PAOD) that may lead to heart attacks, strokes, and smoker's legs, a therapy helps that has its origin in space medicine. It has been developed by EADS of Bremen to help astronauts suffering from cardiovascular disorders occurring in microgravity: the blood is sucked into the legs through a vacuum; then the heart must pump strongly. This exercises the heart and the arteries.

1 The eye reader

Laser surgery on the eyes requires absolutely precise localisation of the pupil in order to be able to perfectly control the laser. The eye tracking technology has been developed in Germany for space flight to better understand the sense of balance. For astronauts get "seasick" in space. On Earth, this technology assists physicians also in the diagnosis of impairment of the sense of balance, the cause of which could be migraine or tumours.

2 The circulation checker

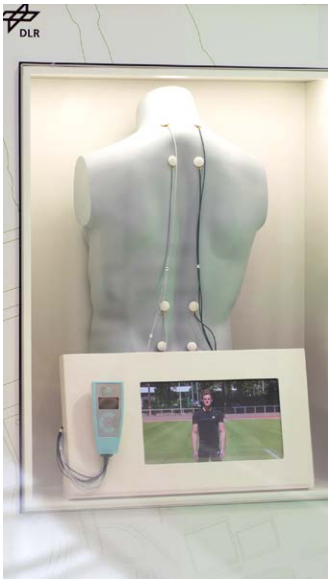
Detecting circulatory insufficiency. With sensors from the ISS. Taking a breath is difficult? Climbing stairs is exhausting? The reason for this and the severity of the condition can be found out by breathing analysis: it is measured how much air is inhaled and exhaled, and what amount of oxygen and carbon dioxide is contained in the exhaled air. A novel tiny sensor that had initially been developed to protect spacecraft from corrosion enables manufacturing mobile equipment.

3 The "watchdog" vest

Premature babies have to be continuously monitored to ensure proper care and treatment in the incubator. The technology for this application was partly developed by German space experts to continuously keep an eye on the bodily functions of the astronauts on the ISS. For example, the core body temperature is measured gently from outside instead of invasively. In artificial respiration, a chest strap can help that visualises breathing and lung fill.

5 The lens coup

Varifocal lenses help against presbyopia. The best lenses for this purpose are produced one-off based on the exact data of one's own eyes, precise down to a thousandth of a millimetre. The technology used for measuring the eye, the so-called wave front technology, emerged from astronomy. The possibility of manufacturing high-precision varifocal lenses traces back to a cutting procedure that had been developed for the mirror of the ROSAT X-ray satellite.



6 The back saver

Back pain due to microgravity? Unfortunately a daily experience for many astronauts. However, the technology that helps them is also well received on Earth: sonoSens, a system featuring ultrasound electrodes to be affixed on the back. It has been developed for the German-Russian MIR '97 mission. Today, on Earth the system assists in diagnosing the causes of back pain or in preventing them, respectively.

7 The four-minute gym

In microgravity, not even one's own body has a "weight". Muscles and bones in astronauts are unchallenged – and atrophy. The "remedy" helps on Earth as well – the GALILEO training device that has been developed for the International Space Station ISS. The muscular activity of a 10,000-metre run is achieved in less than ten minutes. This device also helps children suffering from brittle-bone disease to leave the wheelchair.

8 The cancer detector

Skin cancer is often fatal, especially if identified too late. Malignant melanomas can be identified more reliably and earlier using software that has been programmed for the evaluation of X-ray sources in space, within the framework of the German X-ray satellite mission ROSAT. During this mission, images were searched for supernovas – for the software, the image of a birthmark and that of a galaxy surprisingly are quite similar.

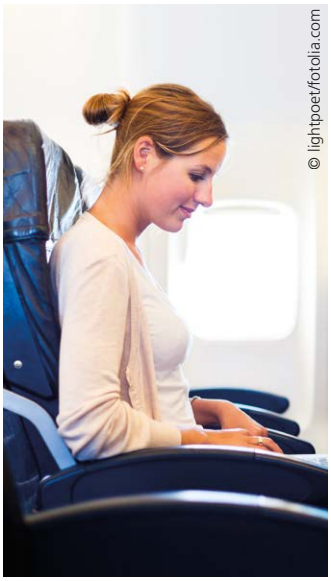
9 The plasma plaster

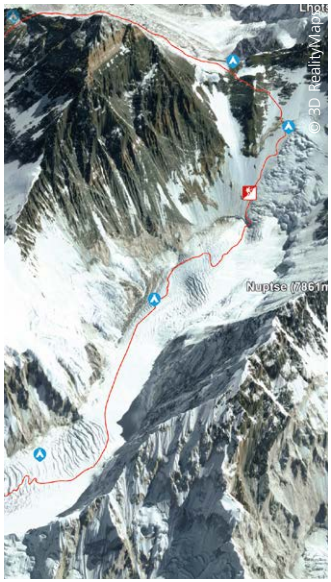
Wounds heal faster and better when they are disinfected. However, disinfection is often painful and it does not always work in full, above all in case of large, open wounds and resistant germs. The solution: "plasma care". The device produces "cold plasma", a mix of electrons, ions, and excited atoms. Plasma enters the cells of bacteria or viruses and destroys them. This technology is based on insights gained in German plasma crystal experiments (PC) on the ISS.

Space flight research … helps in crossing great distances.

TRAVEL & LEISURE

Those who travel have … many questions: what temperature is it at the holiday resort? Is the sun shining? Is the sea clear or is there a risk of algae slicks? Do we possibly have to expect volcano eruptions, tsunamis, or tropical diseases? When planning holiday and leisure, nobody can get around space applications. Space technologies assist everyone in arriving safely at the holiday resort. And even travel times pass by in a flash.





1 The flight companions

Disoriented at the airport? How can I get to the gate? Online on board via broadband Internet? Flying greener? There are many areas where air traffic can be optimised. DLR does research and fosters indoor navigation (NavVis), optimisation of traffic flows at the airport to achieve shorter waiting times (TOMS and TAM), solutions for the Internet via satellite (SANTANA) and more economical aircraft engines through new high-performance materials.

2 The disaster rescuers

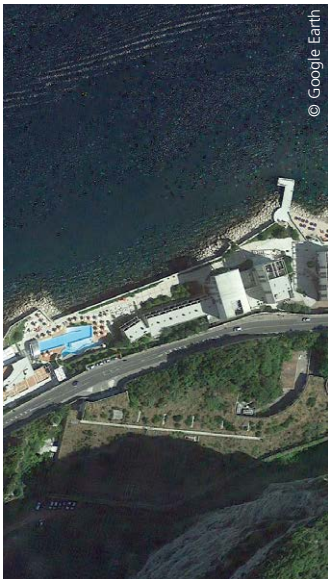
Every minute counts for rescue operations in case of disaster. Thanks to latest overview maps established from satellite data (among others, from European weather satellites and German optical and radar satellites), fast and effective help is possible. They are established by the DLR Centre for Satellite-Based Crisis Information and by the European Copernicus Emergency Management Service within the charter "Space and Major Disasters".

3 The app diver

A diver's dream coming true: high-resolution water quality maps of diving sites such as the Great Barrier Reef in Australia – up to a depth of 30 metres, updated on a daily basis. The data for this purpose is delivered by EOMAP, a spin-off of DLR, which uses the Earth observation data from satellites. Not only for divers but also for water protection all over the world. The picture shows Lake Titicaca, the water quality of which is monitored from space since it is endangered by littering.

4 The summit conquerors

Hiking in the mountains is fun if all conditions match one's expectations: where are the most attractive routes? Will there be enough (optionally too much or too less) snow? Do we have to expect a sudden change in weather? And what about the situation on the road to the destination? Clever apps – partly with mars-proven technology – will help. And they are based on, for example, data from remote sensing satellites such as "WorldView" and "RapidEye".



5 The decision guides

What does the brochure of the travel business actually reveal? Or better: what does it withhold? Those who rely on the view from above that satellites always have receive a better impression of what is awaiting them at the holiday resort. Thanks to "MetOp" and "Copernicus", for example. With the help of satellite data, built-up areas can be recognised but also water quality, air quality, and forests – and even the risk of malaria can be predicted.

Hazardous volcano ashes

On Iceland, a volcano erupts; the ash cloud brings air traffic to a halt since the ashes are a great threat to aircraft engines. The MetOp satellites have instruments on board that can detect sulphur dioxide – and thus volcano clouds. The DLR Earth Observation Centre collects these data in real time and can derive corresponding information that can contribute to flight warnings or all-clear signals. For a safer flight.

The malaria preventers

One million people die from malaria every year, particularly in Africa. How high is the risk at the destination at present time? The MALAREO project, in which Remote Sensing Solutions GmbH of Baierbrunn takes the lead, aims at making forecasts on how the risk of malaria develops locally from the combination of environmental data based on Earth observation data (among others from the German RapidEye satellites) – to improve fighting this disease.

The viewers of the depth

Satellites can even "see" what is happening the seabed. Coastal waters and inland waters are monitored worldwide and the water quality or oil pollutions are made visible through a combination of different data. These bathymetric maps, i.e. maps of the seabed and of the benthos (living organisms existing in the soil zones of waters), are "made in Germany" and help scientists and authorities by providing daily updated information.

Around the world in 80 ~~days.~~ seconds

MOBILITY & COMMUNICATION

Neither at work nor in leisure and everyday life we are willing to wait a long time for a service, a product, or a piece of information. The world has become a "global village": data is transmitted in real time, complex processes are closer and closer clocked and interconnected, and transport routes are tracked and monitored to the minute. All that is possible because the data flow takes a "shortcut": via space.

1 The knowers from space

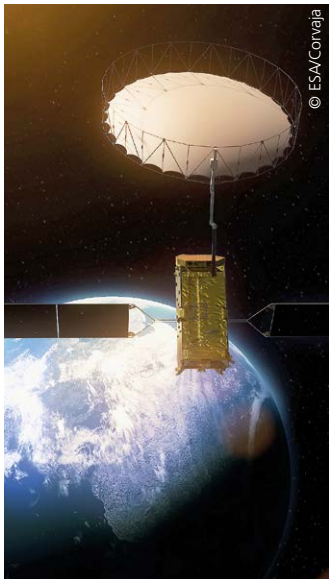
2 The aviation automation enhancers

3 The data highway in space

4 The guides

5 The freight optimisers

6 The part accelerators



1 The knowers from space

Starting 2020, the next generation of satellite navigation systems will be fully operational with the European system Galileo. With a precision in the metre range – with additional technology on the ground even in the centimetre range – hitherto impossible applications are rendered possible. For example, the fully automated landing of ships or accident prevention systems for cars. These services of the future are being tested under real conditions today.

2 The aviation automation enhancers

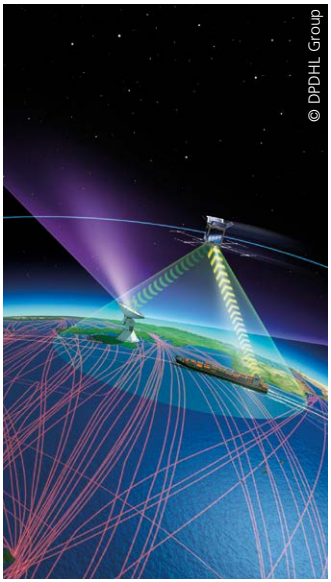
How to supply rural regions more easily? For instance, by using unmanned flight objects. DLR is working on autonomously flying cargo drones which are supposed to start, fly and land by themselves – even in worst weather conditions. The only requirements are satellite navigation and high precision maps. To enhance airspace control ESA is developing precautionary measures – for which the use of space flight technologies is absolutely essential.

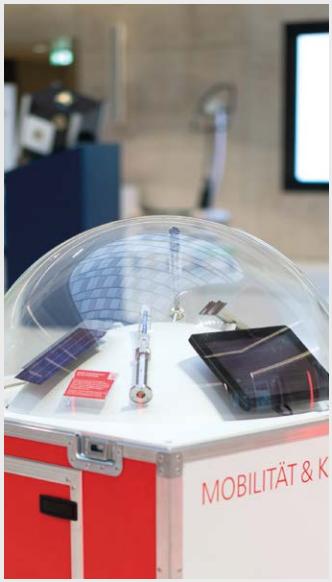
3 The data highway in space

Fascinating details. Highresolution images. This causes huge amounts of data that need stable and fast data links. The next generation of data transmission comes into play today: laser. Transmission via satellite. Today, satellites are equipped with laser technology from Germany. It is comparable to transmission via glass fibre – however, without a cable, which is ideal in case laying cables is not an option.

4 The guides

Those who order a new games console online, possibly play computer games on it the next day. Its way to the local dispatch warehouse, however, was much longer, maybe over a month when coming from Asia. Completely satellite-supervised supply chains using "clever" software solutions make processes faster and safer, like, for example, the Smart Truck developed in a cooperation of DLR and DHL, or temperature-controlled containers carrying vaccines for Africa.





5 The freight optimisers

Almost 40 per cent of the freight within the EU is transported at sea by ships. Customs bureaucracy gets ships stuck at the port for days since the customs officers might not know whether the ship has called a non-EU port on its way. With "Space-based AIS for Blue Belt", ships are tracked by satellite (e.g. with the German AISat-1) to enable customs officers to wave through intra-European freight faster in the future – this makes sea freight more attractive.

6 The part accelerators

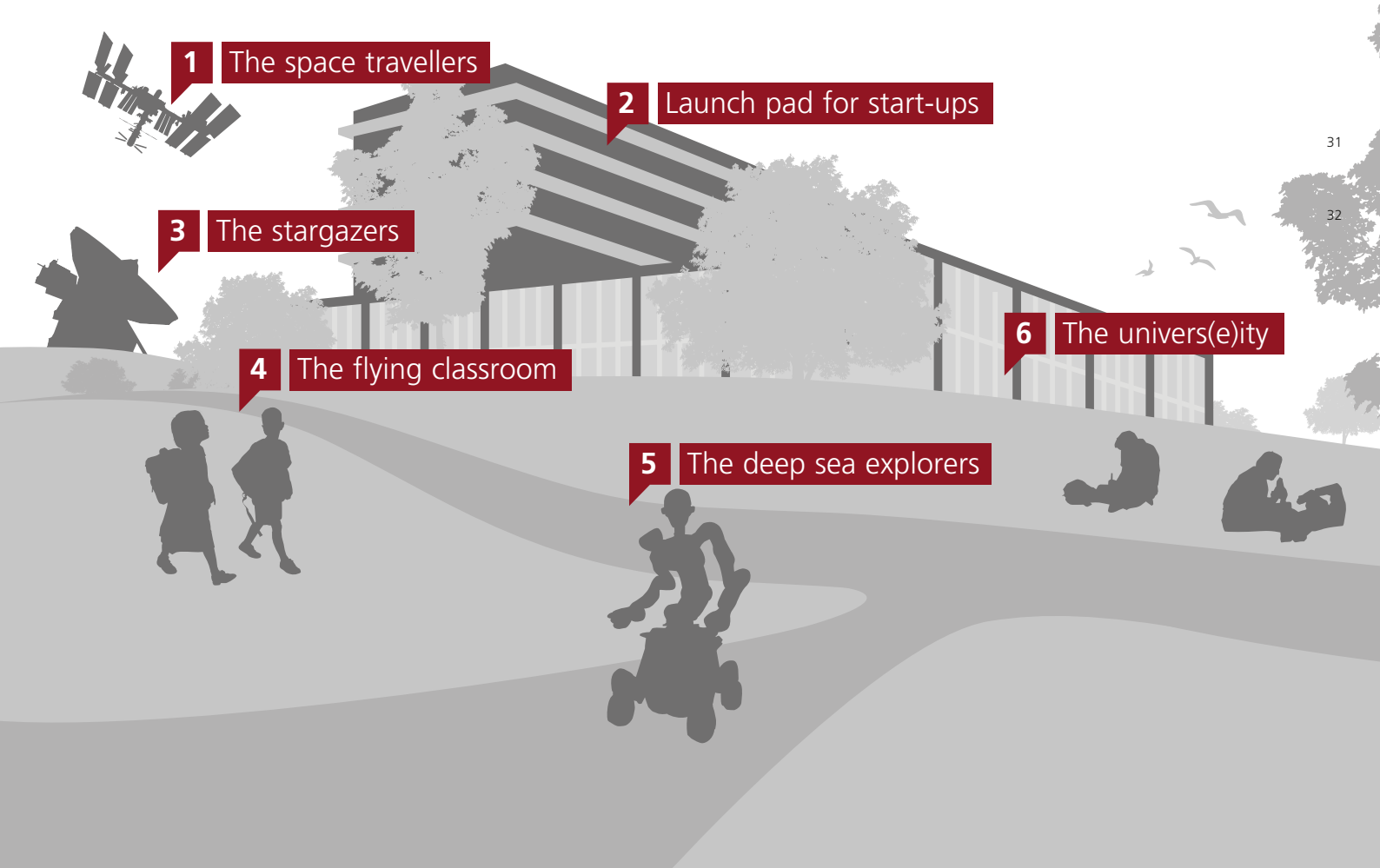
Global delivery chains are complex and well-matched in a tightly clocked manner. From one country, raw materials are delivered that have to be transported by ship to another country for further processing. Until, in the end, a computer chip and a casing meet in final assembly, months might pass by, and every component has a different lead time. To make sure that all components are on stock in due time, freight routes are optimised by satellite technology.

Extraterrestrial technology

On the ISS, on board satellites and rockets, research is done on novel materials, since microgravity provides unique neutral testing conditions. Shown here: silicon crystals that have been melted on board a rocket. They could make solar cells more efficient in the future. Or new semiconductors made of gallium-germanium that could supersede the silicon technology in computer chips. Or new metals that have been melted in space at 2,000 degrees Celsius.

Thanks to space: knowing

Space has been fascinating humans ever since – and still, it is sparking the spirit of research. In space, we are looking for the answers to the big questions: regarding the beginnings of time and space, the evolution of life on Earth, or traces of life on other planets. Space flight faces the inquiring mind with highest challenges – and rewards it: with the results of courageous missions such as Rosetta or with insights derived from innovative, high-precision telescopes in space. Curiosity and thirst for knowledge cannot be awakened soon enough.



1 The space travellers

Aerospace not only employs our imagination but also thousands of people that are working, among other places, at the institutes of the German Aerospace Center (DLR) to render manned space flight possible in the first place – they are presented at this station. Many insights and technical achievements emerge only from the questions that are raised by a flight to and a sojourn in space.

2 Launch pad for start-ups

Un-earthly success with ideas from space flight? DLR fosters innovation through cross-sectoral cooperations, internal networking events, innovation competitions, spin-offs, and the support of research projects. As an incentive for young scientists, the DLR Founders' Prize and the special prizes at Galileo and Copernicus Masters are being offered.

3 The stargazers

Space. The final frontier. And large parts of it still unexplored. In our galaxy alone: 100 millions of stars. At least. Space flight – in particular the launch of probes into our solar system and beyond – is still a young science. Room for plenty of pioneering work. At this station, we present the missions that have enhanced or will enhance our knowledge yesterday, today, and tomorrow.

4 The flying classroom

The German Aerospace Center (DLR) is one of the largest and most modern research facilities for aerospace in Europe. We are glad to pass on our enthusiasm to young discoverers of all ages to foster their interest in natural sciences. At school and after school – from the paper glider to the self-constructed satellite. This station presents the offers for the age groups.

5 The deep sea explorers

Too hard, to cold, too warm, or too dangerous? Robots work under water, on land, in the air, and in space as well – and all that under conditions that would be life-threatening for humans. That makes them ideal helpers for discoverers. Robotics is continuously perfected for aerospace as well as maritime research, for example, in the ROBEX project, where space research and deep sea research come together, since the challenges are similar.

6 The univers(e)ity

From the campus to the cosmos: the aircraft of tomorrow, satellites and probes, environmental research, cosmic neighbourhood, future traffic systems, renewable energies, robotics, new materials, and space medicine – from the first semester to PhD fellowship you can benefit from the offers of the DLR during your studies.

Satellite puzzle

Earth observation, weather, navigation, communication: which satellite is capable of what? Not so easy to keep track of it. Right then: join in and put together the pieces of this virtual satellite puzzle!

If all parts are arranged properly, as a "reward" you will get a complete overview.

LIDAR

Light plus velocity = speed of light? Unfortunately, it is not that simple. Nonetheless, the period a laser impulse needs for returning to its initial point enables a reliable measurement of velocities and distances. The technology is called LIDAR – first used 1971 for drawing up a map of the lunar surface. Today, for instance driving assistance systems, archaeologists and the police count on it.

Take a chance? Go ahead!

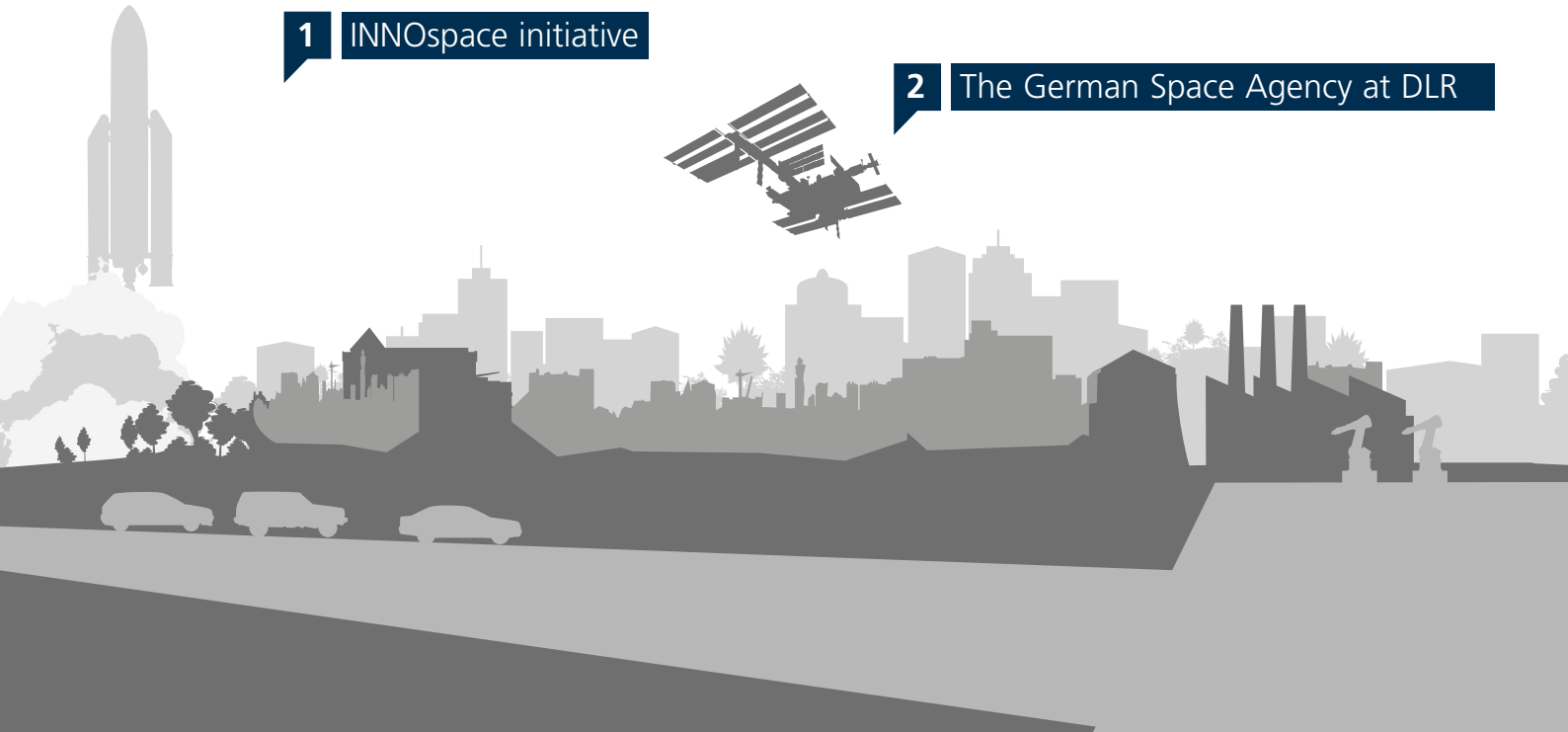
Space for innovations: DLR INNOspace

Space flight creates innovations that are used in our daily lives on Earth, without their origin from space being known: medicine, transport, mechanical engineering, safety, energy, and many more fields benefit from innovations that are based on satellite technology or have their origin in the exploration of space and in research under space conditions. Space flight is an important innovation driver for Germany – and a key for opening up new markets. To make better and more target-oriented use of the transfer potentials, the German Space Agency at the German Aerospace Center (DLR) started the INNOspace® initiative on behalf of the Federal Ministry for Economic Affairs and Climate Action (BMWK, formerly Federal Ministry for Economic Affairs and Energy, BMWi) in 2013.

INNOspace® is an initiative within the framework of the "National Programme for Space and Innovation" of the Federal Ministry for Economic Affairs and Climate Action (BMWK, formerly BMWi) and, since 2014, has been forming a part of the new High-tech Strategy of the Federal Government.

1 INNOspace initiative

2 The German Space Agency at DLR



1 The INNOspace initiative

How do new products and technologies emerge from inventions pointing the way to the future? How do developments and innovations from space flight find their way to other economic sectors and fields of application? How can the space flight sector learn from inventions in other industrial sectors? By information, communication, and cooperation. The German Space Agency at DLR fathered the initiative INNOspace®. It aims to create stimuli for innovation and technology transfers between space flight and other economic sectors. The exchange of knowhow and technologies is intended to be bidirectional. In this way, multiplier effects will help to tap new markets and to create economic added value in downstream markets and outside the framework of space flight. The measures include, among other things, symposiums, workshops, idea and concept competitions, innovation and transfer projects as well as this exhibition.

2 The German Space Agency at DLR

Space flight has captured people's imagination since time immemorial, like in 2014 the "Blue Dot" mission of German astronaut Alexander Gerst or the Rosetta mission, during which, for the first time in the history of humankind, a landing probe touched down on a comet. Missions like these give answers to the question how life came to Earth and if there are other life forms in the universe, in what shape our environment and our climate are, or how telecommunication or navigation services can be improved. To answer these and many more questions, the German Space Agency at DLR headquartered in Bonn establishes and implements the German space flight programme on behalf of the federal government. For topclass research and technology "made in Germany".

INNOnet

The initiative INNOnet combines space research with everyday use on Earth. The three cross-sectoral INNOspace networks Space2Motion, Space2Agriculture, and Space2Health provided the examples shown: wound disinfection by cold plasma, soil properties and qualities measured directly from the tractor, and an extremely flexible robotic arm that even works „around the corner". One box, four edges, three fascinating exhibits.

WALL#E & Skith

Pardon? This is meant to be a satellite? So small? Yes, indeed, but at the same time, completely "oho!": this technology demonstrator is full of high end solutions – or rather it is NOT! Precisely those missing cables and energy storage make it so special. Instead of them: wireless communication between all functional elements inside the satellite (Skith) – and the energy demand is fully covered by the outer casing (WALL#E). The first step towards small, efficient, and low-priced satellites of tomorrow.

CIMON

May I introduce myself? My name is ... CIMON, "Crew Interactive Mobile Companion". The ISS astronauts' AI fellow is an assistant and a tutor supporting the crew in experiments on board – and in case of need, CIMON is even able to cheer up the astronauts.

"Astro-Alex" did already conduct experiments being assisted by CIMON – and you can go ahead, too: under the guidance of Alexander Gerst and CIMON, just launch a rocket and by the way you catch the propulsion principle!

Pictures of the exhibition

Interactive. Informative. Surprising. Playful. Each station invites for discovering, in fast forward mode with brief videos or with expert knowledge straight from science. Edited for easy understanding.

Exciting is what's inside: for the exhibition, numerous exhibits (also from space) have been collected that could not be seen so far in this combination. Here's where space flight research and our daily lives are closely linked.

Whether the original stage of a student experimental rocket along with the flown experiment, eye tracking application from space medicine, or material from the space laboratory: each exhibit stands for knowledge transfer into our daily lives.

The history of weather satellites

**Space and everyday life –
how do they come together?
Find out with the aid of the exhibits.**

Exhibit Lenders

The German Space Agency says thank you:

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About DLR

DLR is the Federal Republic of Germany's research centre for aeronautics and space. We conduct research and development activities in the fields of aeronautics, space, energy, transport, security and digitalisation. The German Space Agency at DLR plans and implements the national space programme on behalf of the federal government. Two DLR project management agencies oversee funding programmes and support knowledge transfer.

Climate, mobility and technology are changing globally. DLR uses the expertise of its 55 research institutes and facilities to find solutions to these challenges. Our 10,000 employees share a mission – to explore Earth and space and develop technologies for a sustainable future. In doing so, DLR contributes to strengthening Germany's position as a prime location for research and industry.

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