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DLR Stuttgart at a Glance

DLR

DLR in Stuttgart

DLR is the national aeronautics and space research centre of the Federal Republic of Germany. Its extensive research and development work in aeronautics, space, energy, transport and security is integrated into national and international cooperative ventures. In addition to its own research, as Germany's space agency, DLR has been given responsibility by the Federal Government for the planning and implementation of the German space programme. DLR is also the umbrella organisation for the nation's largest project management agency.

DLR has more than 700 employees in six institutes at the DLR site in Stuttgart. The main research areas include high performance structures made from ceramic fibre, polymer and hybrid composites, innovative road and rail vehicle concepts, laser system development, energy storage and conversion technologies, gas turbines and combustion processes and the development of receivers for solar power plants.

The research conducted here is supported by an extensive infrastructure with unique test rigs and large-scale research facilities.

More information:
DLR.de/en/Stuttgart

Image: DLR/Eppler

Networked in Baden-Württemberg

DLR Stuttgart is a major player in the Baden-Württemberg scientific community, supporting the innovative power of Stuttgart and Baden-Württemberg.

Research since 1954
The DLR site in Stuttgart has its origin in the Research Institute of Jet Propulsion Physics, established in 1954 at Stuttgart airport. Since 1961, the site has been located in the Pfaffenwald in Stuttgart-Vaihingen. As a result of its geographic proximity to the University of Stuttgart, together with the close collaboration in research and education, the DLR site has become an important part of the scientific community in Stuttgart.

Cooperation with industry and government
DLR's research infrastructure is also available for collaborative use with industry, supporting the transfer of technical and scientific expertise. DLR Technology Marketing encourages intensive networking with partners from business and industry associations for the development of new products and securing jobs. DLR scientists and the Technology Marketing Department are active in numerous professional associations and networks and undertake consulting assignments in the relevant policy areas.

Overview of the site
The DLR institutes and facilities introduced in the following pages are:
- Institute of Structures and Design
- Institute of Vehicle Concepts
- Institute of Technical Physics
- Institute of Engineering Thermodynamics
- Institute of Combustion Technology
- Institute of Solar Research
- Large-scale research facilities
- Promoting young talent
- DLR_School_Lab Lampoldshausen/ Stuttgart
- Technology Marketing
- Engineering Facility Systemhaus Technik

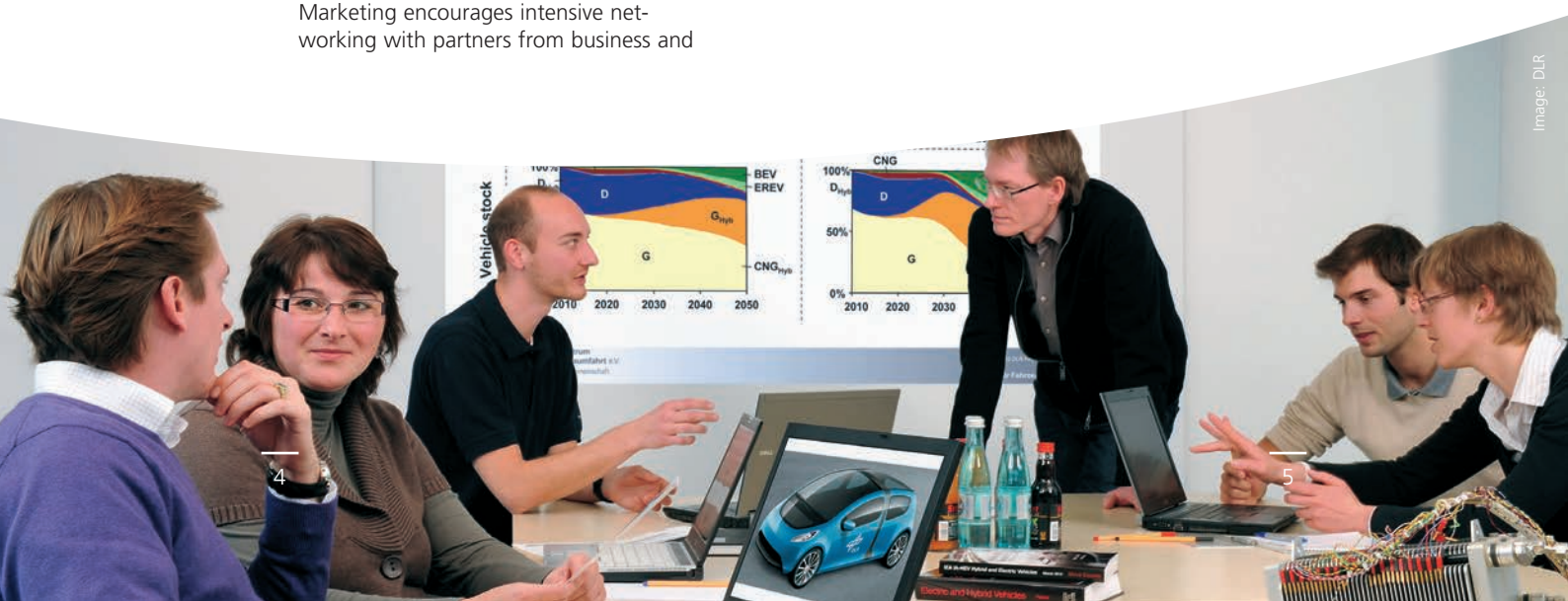


Image: DLR

Institute of Structures and Design

The Institute of Structures and Design develops high-performance structures for the aerospace, vehicle construction and energy technology sectors. The focus here is on the development of ceramic fibre and polymer composite components and hybrid structures.

Efficient and cost-effective
The Institute develops new lightweight concepts based on fibre composites for wings, fuselage, tail and engine components of future generations of aircraft. For this, the entire production chain – from materials to robot-supported, automated manufacturing – is modelled. The aim is to increase the efficiency of aircraft using lighter structures and, thus, achieve a cost-effective manufacturing process.

Safety in the event of a crash or impact
The Institute also focuses on investigating the integrity of highly stressed, load-bearing structures under crash or impact conditions – in the event of a bird strike, for example. The structural concepts derived for aircraft, helicopters, cars or trains are aimed at securing maximum safety for the passengers.

Versatile hi-tech ceramics
Structures made of fibre-reinforced ceramics have a high degree of damage tolerance. Using manufacturing processes developed at the Institute, ceramic structures that can withstand large mechanical loads and temperatures of up to 2000 degrees Celsius can be produced. Such materials are used, for example, in friction applications, jet engines for aircraft or in components for power plants.

Thermal protection for spaceflight
Fibre-reinforced ceramics are ideal for use in space applications due to their high performance. The Institute develops components for space propulsion systems and thermal protection systems for spacecraft re-entry. The research work extends from structural development to research on test stands and flight experiments.

Contact:
DLR.de/bt/en
+49 (0) 711 6862-444

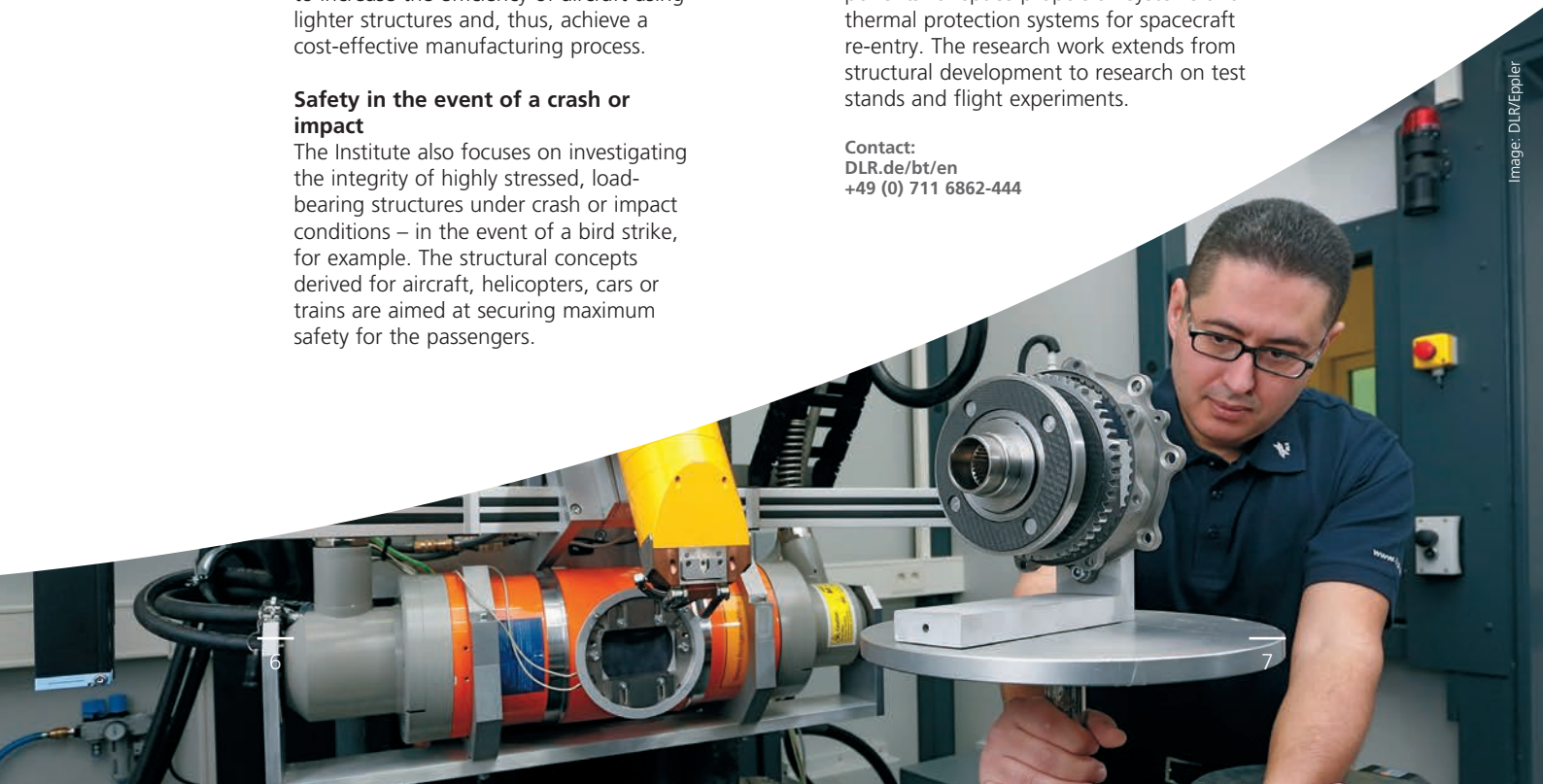


Image: DLR/Eppler

Institute of Vehicle Concepts

The Institute of Vehicle Concepts addresses the development of future technologies for road and rail vehicles. The Institute's contributions range from conception and design through construction and simulations to the presentation of research demonstrators, components and vehicles.

Emission-free engines
Hybrid drives, fuel cell systems and electric power from waste heat increase energy efficiency and point the way towards emission-free mobility. The Institute conducts research and development work to optimise the energy consumption of future vehicle concepts for road and rail transport. For this, research is currently being carried out to optimise the conversion of chemical to electrical energy, on the secondary utilisation of energy and on the bi-directional transformation of electrical into mechanical energy.

Lightweight structures for efficient vehicles
The Institute draws on DLR's aerospace expertise in the fields of lightweight structures and hybrid concepts for the development of new road and rail vehicles. This is based on multi-material construction methods and new hybrid strategies. Weight savings reduce fuel consumption, while simultaneously enhancing vehicle safety.

Integrated concepts
The Institute identifies, analyses and promotes new vehicle technologies for future road transport, integrates them into innovative, sustainable vehicle systems and conducts integrated analyses in terms of energy, emissions, costs and benefits within a social context.

Contact:
DLR.de/fk/en
+49 (0) 711 6862-488

Image: DLR/Eppler

Institute of Technical Physics

The Institute of Technical Physics develops laser systems for the aerospace, security and defence sectors.

Lasers to track space debris
Space debris is one of the most serious threats to spaceflight. For this reason, the Institute is developing a laser-based monitoring system to determine the orbital paths of debris particles. This orbital data can be used to assist satellites in performing avoidance manoeuvres, thus preventing collisions with space debris. The Institute also conducts research into the use of lasers for removal of space debris from orbit.

Remote detection of harmful substances
The Institute is developing laser-based stand-off detection methods to identify hazardous substances – be they chemical, biological or potentially explosive – from a safe distance. Thus, in the event of an emergency, appropriate countermeasures can be taken promptly, decreasing threats to the population, rescue teams and the environment.

Long-range laser effectors
The Institute is designing and testing high-power laser systems in continuous wave and pulsed operation mode – based on thin-disc lasers – for the use of laser radiation over distances of many kilometres. In addition to power scaling, the objectives include the optimisation of beam quality and the development of eye-safe laser concepts.

Laser propulsion for spaceflight
Another focal area at the Institute is the investigation of laser micro thrusters, which are being studied and assessed for use in high-precision attitude and orbit control of satellites and satellite swarms.

Contact:
DLR.de/tp/en
+49 (0) 711 6862-773

Image: DLR/Eppler

Institute of Engineering Thermodynamics

The Institute of Engineering Thermodynamics paves the way for the energy storage industry of tomorrow. The Institute is developing the scientific basis of electrochemical and thermochemical energy storage technologies using a symbiotic interaction of laboratory experiments and computer simulations. It also investigates efficiency, cost and sustainability of future energy systems. In cooperation with industry, the Institute develops innovative technologies, such as fuel cell systems for aircraft and high temperature storage for 'green heat'. Finally, the Institute acts as an advisor to the German government and industry on energy policy issues.

Energy storage
The Institute has the objective of furthering the development of electrical, chemical and thermal storage systems. Commercial storage concepts are of vital importance for the use of renewable energy sources, for electromobility and for increasing energy efficiency. Storage systems in solar power plants enable them to continue to provide electrical energy even at night or compensate for the fluctuating output from wind energy sources, which can remain in use continuously. In the industrial sector, the targeted use of waste heat significantly reduces fuel consumption. A key task on the route to electromobility is the development of next-generation batteries. The focus here is on the development of lithium-air and lithium-sulphur batteries.

Energy conversion
Fuel cells are gaining importance as efficient electrochemical energy converters – for stationary energy supply or for mobile applications. For example, they are used for energy production in hybrid power generators or for supplying power on board aircraft. In addition, the Institute is researching processes for generating and storing hydrogen and synthetic hydrocarbons as cost-effectively as possible.

Energy technology assessment
The Institute demonstrates the various technical and structural possibilities that can be used as components of a sustainable power supply system. To do so, the researchers analyse a wide variety of technologies and their potential. On this basis, they develop scenarios and formulate options for activities that pave the way towards an affordable, safe and environmentally friendly future energy system.

Contact:
DLR.de/tt/en
+49 (0) 711 6862-359

Image: DLR

Institute of Combustion Technology

The Institute of Combustion Technology researches new concepts for decentralised energy supply and combustor systems for gas turbines in aircraft engines and power plants. New fuels, such as those based on biomass, are also part of the focus, as is increasing the reliability of combustion processes and reducing pollutant emissions.

Understanding combustion processes
The basis for the development of new, low-emission combustion systems is an accurate understanding of the chemical and physical processes that occur during combustion. Detailed insights into these processes help optimise the design of the combustion chamber. Lasers are used to enable flame structures and velocity fields to be analysed at high temporal and spatial resolutions. The Institute also investigates chemical reaction mechanisms, such as the elaborate sequence of molecular reactions during combustion. The results are used as the basis for numerical simulations on high-performance computers. Numerical methods developed at the Institute assist with the development and investigation of new combustion technologies.

Climate-friendly power plants
The Institute operates test rigs for investigating combustion processes under real power plant conditions. New power generator concepts based on gas turbines offer low emissions, are flexible with regard to the fuel used and are highly efficient. In combination with renewable energy sources such as wind and solar energy, they can compensate for power fluctuations and thus enable a continuous, reliable supply of energy.

Designer fuels for aircraft
Synthetic alternatives based on carbon, natural gas or biomass are expected to gradually replace kerosene in aviation. These fuels can be developed in such a way that they are superior to kerosene in terms of environment friendliness and technical performance. The Institute is investigating the combustion properties of these new aviation fuels.

Contact:
DLR.de/vt/en
+49 (0) 711 6862-308

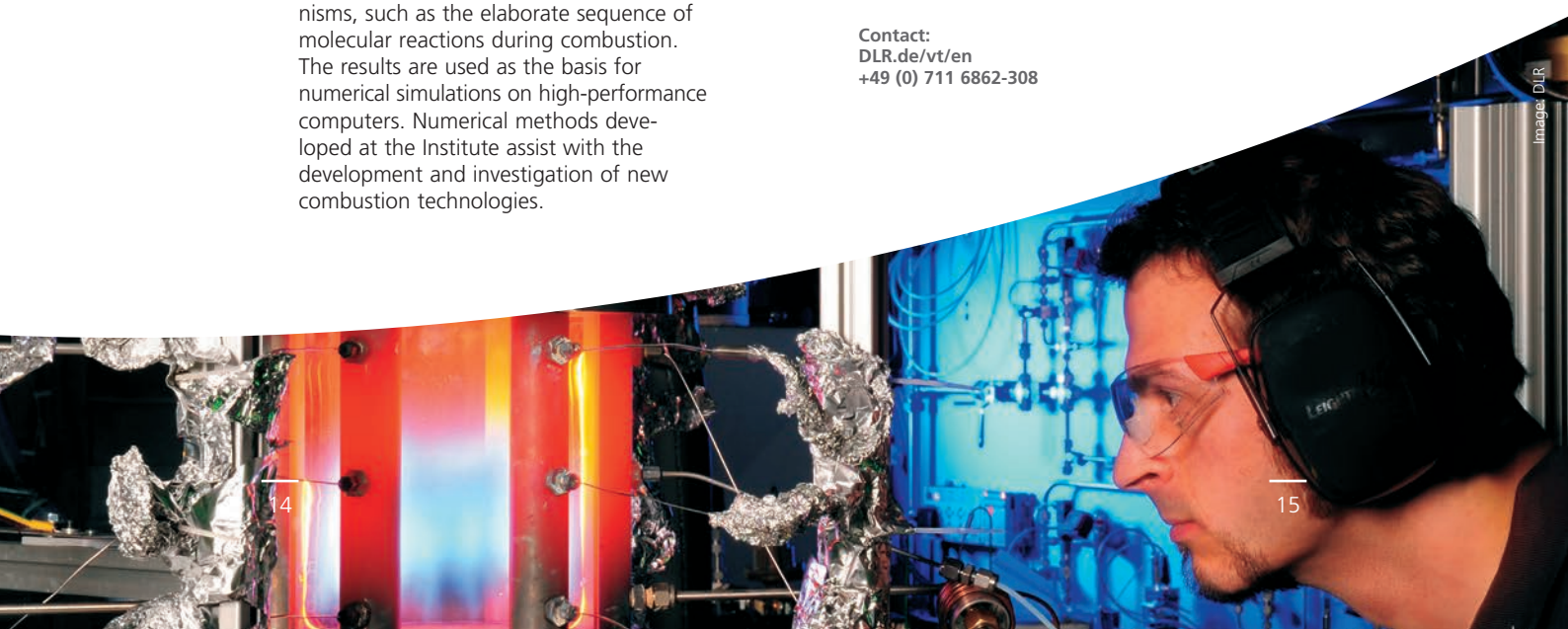


Image: DLR

Institute of Solar Research

The Institute of Solar Research develops concentrating solar systems for the generation of heat, power and fuel for a sustainable energy supply.

Using the power of the Sun
The focus of the research work is solar thermal power technology. Special mirrors focus the solar radiation onto the top of a tower or onto a tube to heat a thermal transfer medium. This high-temperature heat can be used as industrial process heat or to generate power. The generation of solar fuel via concentrating solar power is another subject of the research. The main tasks of the Stuttgart-based working groups are the development of receivers, systems and concentrators for solar tower plants and the process development for line focus systems. The Institute's main office is located in Cologne.

Contact:
DLR.de/sf/en
+49 (0) 711 6862-8020

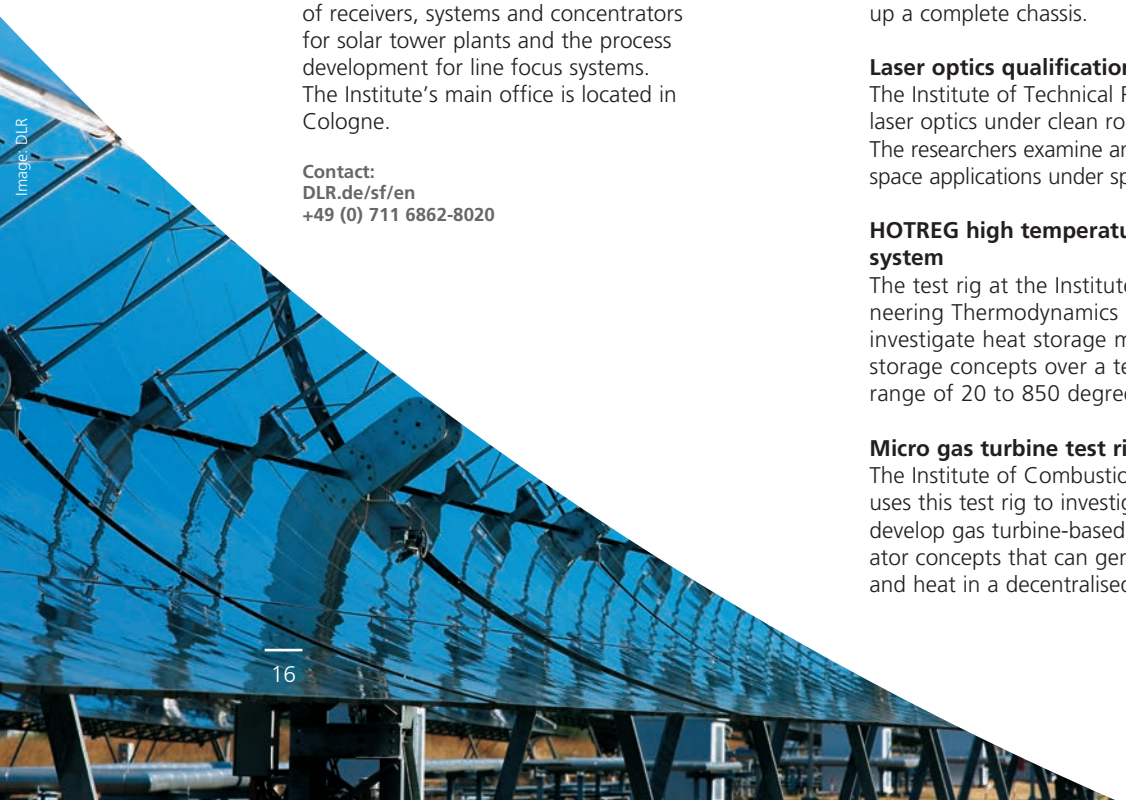


Image: DLR

Large-scale research facilities

Test rigs and large-scale research facilities support the research at DLR Stuttgart. Examples are:

Computed tomography (CT)
The Institute of Structures and Design uses two CT units to study parts and components non-destructively and in three dimensions – from large metal components to the smallest material samples.

Dynamic component test facility
In the dynamic component test facility (crash facility), large components and substructures for light- to medium-weight vehicle designs can be tested under realistic conditions, without the need to set up a complete chassis.

Laser optics qualification centre
The Institute of Technical Physics qualifies laser optics under clean room conditions. The researchers examine and test optics for space applications under space conditions.

HOTREG high temperature storage system
The test rig at the Institute of Engineering Thermodynamics is used to investigate heat storage materials and storage concepts over a temperature range of 20 to 850 degrees Celsius.

Micro gas turbine test rig
The Institute of Combustion Technology uses this test rig to investigate and develop gas turbine-based power generator concepts that can generate power and heat in a decentralised way.

Promoting young talent

DLR Stuttgart actively supports the training of young scientists and engineers. Through teams, joint projects and the participation of DLR scientists in the learning process, there is close cooperation with technical colleges and universities – particularly the neighbouring University of Stuttgart.

Joining DLR Stuttgart
Students can undertake internships in the research areas mentioned here or complete their thesis with professional support. The institutes encourage doctoral students via the DLR_Graduate_Program, in which they offer training and support.

Training and study
Together with the Baden-Württemberg Cooperative State University, DLR Stuttgart offers a Bachelor of Engineering qualification in the disciplines of mechanical and electrical engineering. Courses in precision mechanics, systems electronics and business management offer career prospects in an exciting scientific environment. The interest of young people in the natural sciences and engineering is sparked early under the Baden-Württemberg BOGY programme and the nationally-organised Girls' Day.

DLR_School_Lab Lampoldshausen/Stuttgart

In the DLR_School_Lab, middle and secondary school pupils can learn about areas of research at DLR and carry out experiments with the technical support of DLR scientists.

Research up close
In a hi-tech laboratory at the rocket engine test site in Lampoldshausen, school classes can explore their experimental skills in practical, realistic experiments. In doing so, they learn about fundamental working methods in the natural sciences – observing, measuring, modelling and simulation – and how they are interconnected. In this way, the students get a realistic image of the working world and the activities conducted by physicists, chemists and engineers in research, as well as a feel for the significance of scientific work and research.

Contact:
DLR.de/schoollab/lampoldshausen_stuttgart
+49 (0) 6298 28-206

Image: DLR/Eppler

Technology Marketing

DLR Technology Marketing provides the interface between research and industry. It is responsible for the cross-sector transfer of DLR technologies into applications, and fosters contact with innovative enterprises of any size.

Together with the DLR institutes and the earliest possible involvement of partners in industry, DLR Technology Marketing transforms research results into usable technologies, investigates markets and trends, develops innovative ideas, secures competitive advantages through property rights, concludes agreements on the commercial exploitation of DLR technologies and provides assistance with the set-up of DLR spin-offs.

Contact:
DLR.de/tm/en
+49 (0) 711 6862-512

Engineering Facility Systemhaus Technik

The Engineering Facility Systemhaus Technik is available to the DLR institutes and facilities for any technical questions regarding scientific research materials – from consultancy through to advice on development and manufacturing and the assembly of complex units.

The Engineering Facility Systemhaus Technik is an important part of DLR's technical infrastructure. It has a certified management system based on DIN EN ISO 9001 and DIN EN ISO 14001 and is designed for constant improvement of its services.

The Systemhaus Technik Engineering Facility offers the following services for the development and implementation of technical systems at DLR:
- Systems consultation
- Engineering
- Electronics/Mechatronics
- Manufacturing
- Test support

Contact:
DLR.de/sht/en
+49 (0) 711 6862-8381

Image: DLR

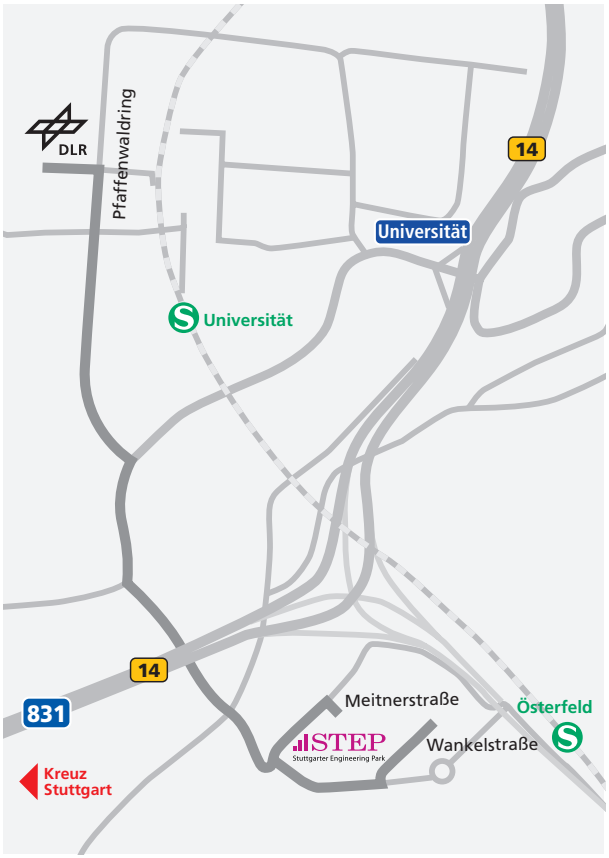
DLR Stuttgart – how to find us

How to find the DLR site in Stuttgart-Vaihingen:

By train:
- From Stuttgart main station, take the S-Bahn (Line S1, S2 or S3) towards ‘Herrenberg’, ‘Filderstadt’ or ‘Flughafen/Messe’ (Airport/Exhibition Centre).
- Once you arrive at the ‘Universität’ stop (‘Universitätszentrum’ exit), turn left and continue to Pfaffenwaldring.
- Turn right and follow Pfaffenwaldring for 300 metres.
- You will find DLR Stuttgart on the left side of the street.

By car:
- Take the A8 or A81 motorway towards ‘Stuttgart Zentrum/Stadtmitte’.
- Take the A831/B14 to the ‘Universität’ exit.
- After exiting, turn left at the junction and follow Universitätsstraße.
- After 800 metres, turn right into Pfaffenwaldring.
- You will find DLR Stuttgart on the left after 600 metres.

From the airport:
- From Stuttgart-Echterdingen Airport, take the S-Bahn (Line S2 or S3) towards ‘Backnang’ or ‘Schorndorf’.
- Arrive at the ‘Universität’ stop (‘Universitätszentrum’ exit).
- Continue as described for arrival by train.
- Or take a taxi (travel time from the airport to DLR Stuttgart is approx. 30 minutes).



DLR **Deutsches Zentrum für Luft- und Raumfahrt**
German Aerospace Center

Stuttgart site
Pfaffenwaldring 38–40
70569 Stuttgart

Telephone: +49 (0) 711 6862 0
Telefax: +49 (0) 711 6862 636

DLR at a glance

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DLR has approximately 8000 employees at 16 locations in Germany: Cologne (headquarters), Augsburg, Berlin, Bonn, Braunschweig, Bremen, Göttingen, Hamburg, Jülich, Lampoldshausen, Neustrelitz, Oberpfaffenhofen, Stade, Stuttgart, Trauen, and Weilheim.
DLR also has offices in Brussels, Paris, Tokyo and Washington D.C.

Deutsches Zentrum für Luft- und Raumfahrt
German Aerospace Center

Contacts

Head of the Stuttgart site
Dr. Anke Kovar
E-mail: anke.kovar@dlr.de

Stuttgart Communications Officer
Denise Nüssle
Telephone: +49 (0) 711 6862 8086
E-mail: denise.nuessle@dlr.de

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