Site

Information

DLR-Braunschweig

DLR

Site of Braunschweig/Göttingen

The main activities of the German Aerospace Center (DLR) joint sites of Braunschweig and Göttingen are aviation and transportation research. Located at the Research Airport Braunschweig, DLR continues the tradition of the Deutsche Forschungsanstalt für Luft- und Raumfahrt (DFL), founded in 1936, and employs there approximately 800 highly-qualified scientists and engineers. DLR Göttingen, established in 1907 as the Modell-Versuchsanstalt, later called the Aerodynamische Versuchsanstalt (AVA), employs approximately 350 experts in fundamental and application-oriented aviation research.

Range of Services

Unique high-performance facilities, research flight and automotive vehicles, flight simulators, air traffic simulation facilities, wind tunnels in the European DNW foundation (German-Dutch Wind Tunnels), mobile rotor test stands and test stands for material and noise tests are available for experimental research. Together with ONERA, DLR Göttingen operates the largest mobile ground vibration test facility in Europe.

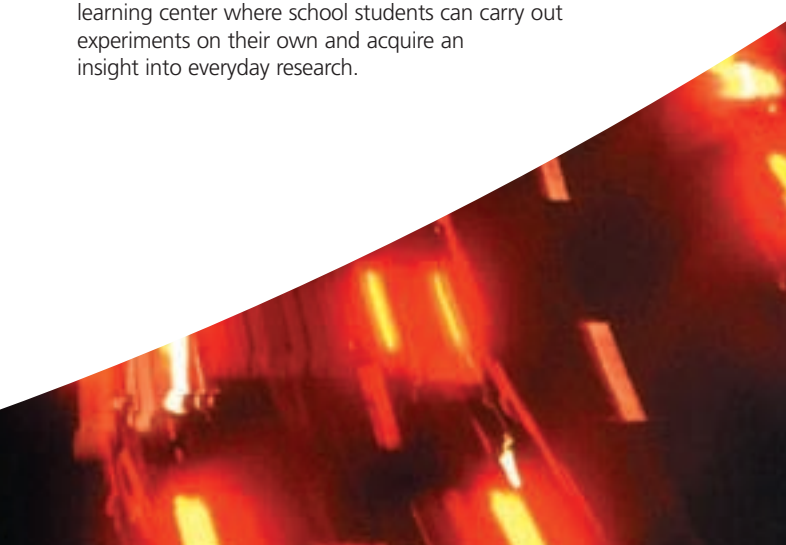
Test equipment for sophisticated, experimental technology is designed and manufactured in the modern workshops of SHT – Systemhaus Technik. An inhouse office of airworthiness surveys the safe and operation of the complex experimental installations in fixed wing aircraft and helicopters of the Braunschweig research flight departement. The certified Rail Site® provides DLR with the competence to support industry in the certification of their rail system components. Furthermore DLR consults users in the application of composite fiber technologies and new materials in industry.

Focal areas of research are:

- Improvement of the dynamic aircraft behavior and the operational safety of aircraft and helicopters
- Increase in the performance, safety and reliability of air, road and railway traffic
- Intelligent assistance systems for human operators of airborne and ground transportation systems
- Development of design principles and tools for low-drag and quiet air vehicles
- Development and realization of adaptable, damage-tolerant and cost-efficient high-performance structures for aerospace and ground transportation applications
- DLR in Braunschweig and Göttingen cooperates closely with TU Braunschweig, the University of Göttingen, other research establishments and in networks such as Research Airport Braunschweig and Measurement Valley Göttingen.

Apprenticeships, Continuing Education and the Promotion of Young Scientists

DLR is a certified establishment for apprenticeships, vocational training and continuing/college education. It provides school and job internships as well as industrial-technical and commercial apprenticeships. It also provides additional qualification for scientists by coaching them on their diploma thesis and enabling them to acquire their PhD. The DLR_School_Lab Göttingen is a curricular learning center where school students can carry out experiments on their own and acquire an insight into everyday research.



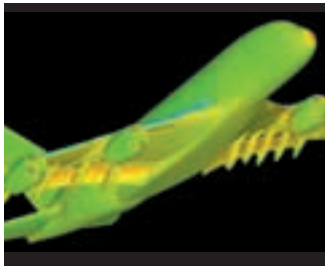
Institute of Aerodynamics and Flow Technology

The Institute of Aerodynamics and Flow Technology (AS) is the research institution of DLR dedicated to fluid mechanics in aerospace. The scien-tific workforce of 210 employees is distributed over three locations: Braunschweig, Göttingen and Köln.

The mission of the entire institute is the exploration, application, and assessment of advanced aerodynamics and flow technologies for efficient air and space transportation.

The institute is an important partner of the German and European aerospace industry. In Braunschweig, research and development efforts are focussed on the following disciplines:

- Aircraft design and assessment
- Development of "high-fidelity" methods for the numerical simulation of aerodynamics and acoustics for all types of air and space vehicles
- Development and assessment of aerodynamic design and optimization techniques
- Numerical and experimental analysis of aircraft aerodynamics, with respect to high lift systems, engine integration, high speed wing performance, wake-vortex interactions
- Aerothermodynamics of space vehicles
- Prediction and measurement of noise emission for aircraft, helicopters and corresponding components
- Development of noise alleviation technologies and procedures.



Computational Fluid Dynamics (CFD) on a transport aircraft

Major parts of the scientific work of the institute are carried out using sizable facilities: supercomputers and large computing clusters provided by the HLRS[1] and the DLR, wind tunnels operated by DNW[2] as well as the DLR itself, and the DLR's own fleet of flight testing aircraft.

[1]HLRS: High Performance Computing Center Stuttgart
[2]DNW: German-Dutch Wind Tunnels

Institute of Flight Guidance

Airport and Control Center Simulator (ACCES) for the development of new concepts regarding the strategic and tactical control of airport processes

The Institute of Flight Guidance deals with the analysis, development, testing and evaluation of components and systems for the guidance of aircraft with the goal of improving the safety, capacity, economic efficiency and environmental compatibility in accordance with individual needs.

The modeling, analysis, and evaluation of new concepts for the increase of the system performance of airports, airspace structures and flight safety procedures are the focal points of the work done here. The institute creates prototypes of cooperative, semi-automated assistance systems for the pilots, air traffic controllers and operators to provide support for complex, dynamic diagnosis, planning and decision processes in the area of air traffic management. These concepts are evaluated for later operational use in the local experimental environment including DLR test aircraft and remote airport facilities. The general goal is to establish an adequate transformation of the cognitive functions and processes of the human operator to intelligent systems supporting person oriented automation.

Institute of Flight Systems

FHS – Flying Helicopter Simulator

The Institute of Flight Systems carries out long-term scientific engineering research based on industrial air and spacecraft development. Its work is centered on linked analysis, modeling, simulation, integration and evaluation of flight systems that operate increasingly autonomously. Important research goals are: increasing the areas of application while taking technological, economic, safety and environmental boundary conditions into consideration, the adaptation of aircraft, helicopter or spacecraft to the abilities of the pilot as well as reduction of development risks for the manufacturer and of operational risks for the user by integrating and applying new technologies for increased automatization.

The institute concentrates on the development and availability of mathematical models as well as simulation and control procedures for the realization of an autonomous flight, development and application of efficient methods for system simulations on the ground, in the wind tunnel (with the aid of the mobile rotor model test facilities in the DNW) and in the air for the demonstration and evaluation of technologies, development and use of modern testing methods for the identification, analysis and optimization of flight equipment.

National, international and industrially coordinated flight and flight system property research is carried out at Braunschweig Research Airport with both of DLR's inflight simulators: ATTAS (fixed wing fly-by-wire flying testbed VFW 614) and FHS (rotary wing fly-by-light testbed EC 135). They are both unique to Europe and are used for the testing and demonstration of innovative technologies. In 2008 an Airbus A320 will complement DLR's fleet of research aircraft and offer unique opportunities for investigations in all areas of air transportation system research.

Institute of Composite Structures and Adaptive Systems

Research work at the Institute of Composite Structures and Adaptive Systems is focussed on the two areas mentioned in the institute's name.

Lightweight construction with fiber composite materials – from the material development up to the construction of prototypes – is treated as a closed process chain. The aim is to achieve a higher efficiency of the design and manufacturing processes in aircraft construction, i.e. to acquire a competitive edge for the European aircraft industry. A reduction in weight leads to fuel and therefore cost savings in addition to decreasing environmental pollution. At the same time, improved simulation processes allow for more reliable predictions with regard to component safety. Very advanced lightweight structures are being developed for, e.g., space probes and orbital systems in space flight.

In the field of adaptronics, the aim is to develop adaptable structural systems the shape of which can be actively controlled, and for which disturbing noise and vibrations can be suppressed. Such structures must be linked with sensors, actuators and powerful controllers in a way that it is optimal for the system. Oscillations and deformations are influenced directly where they occur and in a manner that is ideal for the weight and size of the structure. This way, the precision of machines is increased or the emission of noise from aircraft is significantly reduced. Adaptronics therefore enables considerable improvements in performance, economic efficiency and comfort of the technical system.

Both fast and reliable methods in structural analysis are developed, experimentally validated and applied in lightweight construction and adaptronics. Complex systems – even those applied in areas with extreme conditions – can be conditioned and tested with the exclusive facilities available at the institute.

Production of carbon-fibre fuselage sections

Institute of Transportation Systems

Dynamic driving simulator (above) and RailSiTe® (below)

At the Institute of Transportation Systems new trendsetting solutions for road and rail transportation are developed. The research activities aim at increasing traffic safety and travelling comfort and improving traffic flow. These are supported by cooperations in international networks as well as the operation of reference laboratories.

In the field of railway systems concepts and solution approaches for a secure and efficient system management as well as for an optimized application of train control systems are developed by using future oriented technologies. Questions of safety and availability of the systems and migration strategies are considered. In the experimental laboratory RailSiTe® (Rail Simulation and Testing) the solutions developed can be simulated and validated as well as evaluated regarding their operational effects. Functional tests can be performed by hardware-in-the-loop-tests of components and subsystems regarding their conformity to existing standards and their interoperability.

Driver assistance systems can improve the safety of road traffic. With the DLR ViewCar® driving in real traffic is analyzed with regard to understanding information processing and behavior of the drivers and the reactions of the surrounding traffic. Based on these results driver assistance systems are developed to support the driver in an adequate manner and to prevent errors and accidents. The concepts are implemented in a Virtual Reality Lab for fast and efficient testing of software prototypes followed by an evaluation in a dynamic driving simulator. Finally, the experimental vehicle FASCar is used to demonstrate these concepts in reality.

German-Dutch Wind Tunnels (DNW)

Amsterdam, Braunschweig, Göttingen, Köln, Marknesse

The foundation German-Dutch Wind Tunnels (DNW) operates the aeronautical wind tunnels of the German Aerospace Center (DLR) and the Dutch National Aerospace Laboratory (NLR). These wind tunnels are located at five sites in Germany and the Netherlands. The main objective of DNW is to provide customers with a wide spectrum of wind tunnel test and simulation techniques.

Maneuver simulation with an X-31 model in the NWB wind tunnel

With its twelve wind tunnel facilities DNW covers the speed range from low speed up to Mach 7 and Reynolds Numbers up to $15x10^6$. The Low-Speed Wind Tunnel NWB at Braunschweig site is the second largest with its nozzle exit area of 9.1 m^2 (97.5 ft^2). Airspeeds of up to 300 km/h (270 ft/s) are achievable due to the installed electric drive power of 1.6 Megawatts. The scope of NWB comprises aerodynamic and aeroacoustic tests on civil and military aircraft, spacecraft and helicopters as well as tests on missiles in scaled or original size. Measurements on cars and trucks, propulsion, engine integration, propellers and rotors complete the portfolio. NWB has continuously refined its measurement techniques over the years. Steady and unsteady aerodynamic measurements and as a further step non-intrusive measurement techniques such as PSP and PIV are to the customers' disposal. Various test sections with different floors and ceilings are available for special measurement methods like engine inlet flow, dropped stores in jettison tests, testing with ground effects and maneuver simulation.

Design Organization

Braunschweig, Oberpfaffenhofen, Göttingen, Köln, Stuttgart, Berlin

DLR is the only European research institution that operates a Design Organization where modifications are made on its aircraft and helicopters, particularly the "flying simulators" VFW 614/ATTAS and EC 135 ACT/FHS, for fields of research. It has been approved as the National Design Organization LBA.NJA.005 by the Civil Aviation Authority Luftfahrt-Bundesamt (LBA). DLR is licensed to certify type modifications for flight test purposes on its own experimental aircraft. Therefore the Design Organization operates an Airworthiness Office staffed with in-house personnel, i.e. certification and design engineers in all relevant engineering disciplines.

The Design Organization develops modifications for research activities for users from DLR research institutes, external research establishments, the industry and government authorities/agencies. That comprises the development, type investigation and supplemental type certification of interior and exterior test equipment/attachments or modifications in compliance with applicable airworthiness requirements. The capabilities of the Design Organization are the indispensable prerequisite for the efficient operation of the DLR aircraft fleet in all areas of flight environmental research.

The Design Organization itself grants the supplemental type certification for minor changes within the legally allocated area. Therefore it administrates governmental tasks and acts as part of the administration authority of the Federal Republic of Germany. For major changes The Compliance Program is adjusted with the LBA. Once the supplemental type investigation is finalized and the Design Organization has issued a safety statement the main proof-of-compliance documents are submitted to the LBA. The Civil Aviation Authority can accept the submitted proof-of-compliance documents without any additional revision. Based on these documents the authority grants the supplemental type certification for the major change.

Technology Demonstrator Do 228-101 for laminar flow on commercial aircraft

Flight Operations

Inflight simulator ATTAS

The Flight Department in Braunschweig operates nine aircraft for research purposes: the VFW 614 ATTAS jet aircraft, the EC135 FHS helicopter, two DO 228 turboprop aircraft, one BO105 helicopter, two single-motor propeller aircraft as well as one research glider. These are either objects of research themselves in the areas of aerodynamics, flight mechanics, structural mechanics and flight guidance or they serve in cooperation with the in-house Design Office as experimental measurement carriers for DLR institutes or external contractors.

The Flight Department in Braunschweig has all facilities necessary for the construction and approval of aircraft modifications, for the integration and flight authorization of user equipment as well as for the preparation and implementation of measurement campaigns worldwide.

The ATTAS and FHS "flying simulators" have an exceptional position with which the properties of future aircraft and helicopters are determined in advance and the latest technologies can be tested.

In 2008 an Airbus A320 will join the operational fleet to further enhance DLR's capabilities in air transportation system research.

SHT – Systemhaus Technik

The Engineering Systems House "Systemhaus Technik" (SHT) is a facility for engineering and integrated production of scientific equipment.

Efficient, state-of-the-art technical workshops are available at five DLR locations to support the research activities of all DLR institutes and facilities. These workshops are consolidated under the auspices of SHT and offer a wide range of services from consulting on the development and production of scientific testing equipment to assembly at testing facilities.

The strengths of SHT lie in the following areas of application:

- experimental engineering (e.g. Epistle model, space glider model, ICE model)
- systems (e.g. for multi-axis model support, air heaters, CCD cameras)
- system components (e.g. for fly-by-wire sidestick controllers, carbon-fibre nozzles)
- test support (e.g. at test banks and testing facilities and during flight and space flight operations)

In the case of queries or requests that SHT cannot cover by itself, SHT coordinates the provision of the desired service, offering package solutions through networks and strategic cooperations with internal and external partners.

Highly complex testbed for wind tunnel research

Simulation and Software Technology (SISTEC)

The institution „Simulation and Software Technology“ (SISTEC) is DLR's central facility for Software Engineering. Current activities focus on component-based software development for distributed systems, software technologies for embedded systems and software quality assurance.

SISTEC has two departments and is located in Braunschweig and Köln.

Software Quality Assurance and Embedded Systems (Braunschweig)

Modern software-technology for research

The department Software Quality Assurance and Embedded Systems supports R&D projects in their entire lifecycle by application of software engineering methods and the setup of software quality management processes. This includes the selection, adaptation and implementation of appropriate project-specific tools. For areas where no tools are available, new quality assurance tools and tool chains are developed.

A further activity is embedded safety critical software for real time applications. To fulfill the strong requirements on system and software safety management the research focuses on effective quality assurance and testing methods. With a Software-in-the-Loop testbed, tests and safety analysis process based on simulations can be automatically performed in simulated “real“ operational scenarios with great test depth.

Distributed Systems and Component Software (Köln)

The department focuses on component-based software development for distributed systems. The main themes are component-based software development, management systems for scientific data, flexible creation of graphical user interfaces for simulation codes, and distributed computing – Grid-Computing.

Technology Marketing

Technology changes markets. Markets influence technologies and products. DLR's Technology Marketing sees itself as an intermediary for innovative DLR technologies and is a partner of the industry in technological developments.

Research in the key areas of aerospace, traffic and energy requires a high degree of technological competency. Important key technologies of the future are researched at the DLR institutes. When selecting its main area of research, DLR looks at market requirements and makes investments in the development of future technology applications.

DLR Technology Marketing develops DLR technologies within industrial cooperations that are further developed to market-oriented applications. DLR Technology Marketing enables companies to have direct access to DLR research and development competencies. It also carries part of the technical development risk. DLR Technology Marketing determines in a systematically competent manner the market potential of DLR research topics and at the same time enables a risk financing of company-specific innovations.

Not only the progressive technologies but also the research competence of the DLR provides companies in the industry with the best prerequisites for them to take advantage of methods and services for their innovative products. Companies with complex tasks in research and development areas as well as technical problems will find a competent partner in DLR Technology Marketing.

DLR Technology Marketing supports companies as business partners with its team of scientists, engineers, business persons and lawyers who consult companies on all issues.

Successful technology transfer project: Helicopter with exterior payload

DLR Braunschweig – how to find us

DLR's Braunschweig facility is located northeast of Braunschweig city center between airport and the A2 autobahn. How to get to DLR Braunschweig:

By car: From the A2 autobahn, take the exit "Braunschweig-Flughafen" and follow the signs to DLR.

By train: Three bus routes leave the main train station, Braunschweig Hbf for DLR:
- 411 (direction Lamme)
- 419 (direction Hauptbahnhof)
- 439 (direction Weststadt Donaustraße)

Get off at the bus stop "Kastanienallee" and continue from there by taking bus number 413 (in the direction "Luftfahrtbundesamt") to DLR.

By plane: Braunschweig airport is nearby but the nearest major airport is Hanover. From Hanover airport it takes approximately 45 minutes by car to get to DLR Braunschweig or about two hours by public transport.

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DLR at a glance

DLR is Germany´s national research center for aeronautics and space. Its extensive research and development work in Aeronautics, Space, Transportation and Energy is integrated into national and international cooperative ventures. As Germany´s space agency, DLR has been given responsibility for the forward planning and the implementation of the German space program by the German federal government as well as for the international representation of German interests. Furthermore, Germany's largest project-management agency is also part of DLR.

Approximately 5,100 people are employed in DLR´s 27 institutes and facilities at eight locations in Germany: Koeln-Porz (headquarters), Berlin-Adlershof, Bonn-Oberkassel, Braunschweig, Goettingen, Lampoldshausen, Oberpfaffenhofen, and Stuttgart. DLR also operates offices in Brussels, Paris, and Washington, D.C.

Deutsches Zentrum
für Luft- und Raumfahrt e.V.
in der Helmholtz-Gemeinschaft

German Aerospace Center
in the Helmholtz-Gemeinschaft

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