DLR 2011 – research has high priority in Germany

26 January 2011

The missions and projects planned by the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) in 2011 underline the importance of research in Germany, specifically in the fields of aeronautics, space, energy, transport and security.

The worldwide use of alternative fuels on scheduled airline flights plays just as significant a role in DLR's activities as does research on the International Space Station (ISS). In these areas, German scientists can look back on a successful 10-year track record. The interdisciplinary approach to research at DLR is also reflected in the work it is doing on electric vehicles, a field where researchers from the transport sector are collaborating with their colleagues from energy research. The same applies to High altitude long range research aircraft (HALO) research activities scheduled for this year, which form part of one of DLR's main goals, protection of the environment.

"Evolutionary development of technology requires continuity, whereas revolutionary technology development requires autonomy. The 6800 employees at DLR uphold this as they work hard to resolve society’s problems and challenges," says Johann-Dietrich Wörner, Chairman of the DLR Executive Board. “In 2011, it is of paramount importance for DLR to help set the agenda for the future of Germany as a location for science and industry. In addition to current research, this also involves helping plan Germany's space programme and delivering decisive contributions to Germany's air transport strategy,” Wörner explains. Clear evidence of the international capabilities of DLR is delivered by its successful track record, with no fewer than 647 project applications submitted to the 7th EU Framework Programme for Research (2007-2013). At 34 percent, DLR's success rate is substantially above the average of 20 percent. DLR is also involved in the High Level Group for Aviation Research, which has been tasked with formulating a new vision for aeronautics research. With these measures, DLR will set an agenda that will allow it to continue collaborating successfully on European projects beyond 2014.

Aeronautics

Aeronautics research at DLR is dedicated to the air transport system as a whole, from the infrastructure to the aircraft. With this approach, synergies are leveraged from the various individual fields of research, and this has a positive impact on the system as a whole. One of the key topics in aeronautics is the use of the aeroacoustic wind tunnel, inaugurated in 2010. The Braunschweig Wind Tunnel is not only one of the quietest, but is also designed flexibly such that it is suitable for use with aircraft and road vehicles. This provides new possibilities for analysing even minor noise sources and their emission levels far better than before, and to proceed to the next step: the reduction of those emission levels.

The first campaign for HALO, DLR's atmospheric research aircraft, dubbed the 'Techno Mission', was concluded successfully in October 2010. Part of this mission was to conduct various scientific experiments, such as a new Lidar system of laser-based atmosphere sampling as well as several experiments to analyse trace gases in the atmosphere. In 2011, test flights will be conducted to obtain official approval for various external attachments, on the fuselage and also under the wings. After a series of scientific flights scheduled for the end of this year, HALO will be available from early 2012 for large-scale scientific campaigns with a range of user-specific modifications.

At the Centre for Lightweight Production (Zentrum für Leichtbauproduktion; ZLP) in the Lower Saxony town of Stade, extensive production capacity is being rolled out in 2011. The preparations include the commissioning of an autoclave for the hardening or curing of carbon-

fibre composite components as well as what a Fibre Placement Platform for the manufacture of composite structures.

Space

Space has become an indispensable part of daily life, and it contributes to solving some of society's key challenges.

This is an important year for DLR's space research and development activities, and for the launch of key missions for the DLR Space Agency team. The Space Shuttle will be retired in 2011 as it completes its final flight, and this is also the end an important chapter in the history of spaceflight. On one of its last missions, STS-134, the Alpha Magnet Spectrometer (AMS), in which Germany played a significant role at the development stage, will be transported to the ISS — a place where German researchers have really been making an impact. For the last 10 years, they have been among the most intensive users of the facility. Over the next few years, the ISS will continue to play an important role in research into weightlessness; that is, living and working in zero gravity conditions. At the European level, 2011 is when a final decision is to be made regarding extension of ISS use to the year 2020.

The crew of the Mars500 mission, currently simulating a flight to our neighbouring planet, Mars, in the Moscow-based laboratories of the Institute of Biomedical Problems (IBMP), 'arrives' on the Red Planet in February 2011. On conclusion of the first phase of this isolation experiment, German researchers will present key findings, including the regulation of salt content in the human body and its effect on blood pressure. This should provide successful confirmation of the research conducted on the Russian Mir Station (up to 2000) and the ISS (since 2001) that has been funded by the DLR Space Agency.

Through its cooperation within the Swedish satellite mission PRISMA, DLR is also continuing to work intensively on rendezvous and docking technologies in 2011. The aim is to conduct a series of robot-assisted missions to deal with orbiting space debris and prevent its uncontrolled re-entry into the atmosphere. Missions and projects being funded and managed by the DLR Space Agency will complete critical implementation phases in course of 2011. This includes MERLIN, the Franco-German climate satellite, DEOS, a mission to test the technology associated with unmanned maintenance and controlled disposal of defective satellites, and ‘Heinrich Hertz’, a communications satellite project with which Germany will demonstrate its national expertise in the satellite bus and payload fields. In addition, the missions scheduled for last year for the German technology trials vehicle TET, the Shefex re-entry experiment and the EXPERT research capsule now all look set to launch during 2011.

Energy

Research into innovative new concepts for electricity generation is just one of the focal points of energy research at DLR. The German government has stipulated very clearly with its energy concept, that this is the path to follow. In turn, this will cause a growth in the need for ultra-efficient and inexpensive systems that are capable of delivering energy from renewable sources. DLR is strengthening its activities in the fields of solar-thermal power stations, which now have a large worldwide market. The plan is to substantially expand research into the related infrastructure by setting up additional test benches. Through these initiatives, DLR will further extend its competitive leadership position in the development of solar-thermal power stations.

DLR researchers wish to transfer expertise, particularly from the aeronautics sector, to promote the development of wind farms. Expertise in aerodynamics and aeroelasticity are of particular interest in this respect. The aim is to achieve substantial improvements in the efficiency of these systems. Gas turbine power stations are best suited to effect the transition to energy derived from renewable sources. With increased usage of renewable energy, power stations of this kind – that is, ones that can rapidly be put into operation to meet additional demand – are going to play an increasingly important role. Beginning 2011, DLR is investing more than five million Euro in test benches to develop remote gas turbine power stations, and is also ramping up its activities involving the use of alternative fuels. High-performance storage systems are required to enable energy from renewable sources to be used around the clock. These constitute a central element in the future of energy supply, which is why DLR in Stuttgart and at Almería, in Spain, will be pushing ahead with several projects in the course of 2011. On 17 January 2011, a new Institute of Battery Research was inaugurated in Ulm. Here, DLR is working on a new collaborative project with the University of Ulm, the Karlsruhe Institute of Technology and the

Centre for Solar Power and Hydrogen Research to progress the development of batteries from the bottom up - from basics through to practical application.

Transport

After more than 100 years of developing the internal combustion engine, electric vehicles are now showing signs of heralding a technological step change in transport systems. To enable this new technology to achieve greater acceptance, it is not sufficient to simply focus on the development of vehicle technology and infrastructure specific to the needs of electric vehicles. Comprehensive and systematic research is also required to meet this challenge.

DLR has enormous expertise in this field, with a unique range of know-how and many years of experience gained through close interdisciplinary collaboration of its energy and transport research specialists. For example, development work is progressing on innovative vehicle structures – vehicle concepts optimised for use with electric drives. With its Applications platform for Intelligent Mobility (AIM), DLR is building an open trans-regional platform for cutting-edge mobility applications, working jointly with the federal state of Lower Saxony, the city of Braunschweig and other partners. In early 2011, AIM enters its implementation phase, which is when the first sensors and communications stations are installed. The bundling of financial and technological resources at AIM makes it possible to use a broad portfolio of methods and technologies while at the same time cutting lead times and investment costs.

DLR has been set tough challenges for the development of its highly regarded concept for the Next Generation Train (NGT), a high-speed train of the future. It must be substantially faster, less expensive to run, quieter and more comfortable than an ICE3 train. DLR is seeking to meet a further challenge, that of transferring this ambitious approach to regional transport trains, for which it has coined the project title of 'NGT Regio', and is scheduled to commence work on this later in 2011.

Security

In early 2010, DLR established its Security Research programme. One aspect of this is defence-related research, aiming to safeguard evaluation and consultancy expertise with regard to technologies relevant to technical defence needs. Another aspect is to work on research assignments and projects focusing on civil security, which also supports technologies, systems, concepts and skills as well as associated capabilities relating to active and passive security in the event of an enemy attack. Civil security research at DLR also encompasses crisis and disaster management.

In 2011, DLR will produce a technology roadmap for the security sector that covers all areas of expertise at DLR and addresses existing and future security-related scenarios. This includes advising government departments on how to access and make use of 'Geodata'. The portfolio is to be employed in close collaboration with users to improve the way future conflicts and crises are managed. Examples being the use of unmanned drones in support of disaster relief efforts and the investigation of new technologies to enhance the security of the 'airports of tomorrow'.

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The low-speed wind tunnel at Braunschweig

On 2 December 2010, the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) opened the world's most powerful aero-acoustic wind tunnel in collaboration with German-Dutch Wind Tunnels (Deutsch-Niederländische Windkanäle; DNW). Scientists use wind tunnels to investigate the aero-acoustic properties of objects such as aircraft engines and wings. Not only is the Braunschweig wind tunnel one of the most powerful of its kind, but also it is so versatile that it can be used for cars as well as planes. This presents new possibilities in which to record and reduce sources of noise pollution.

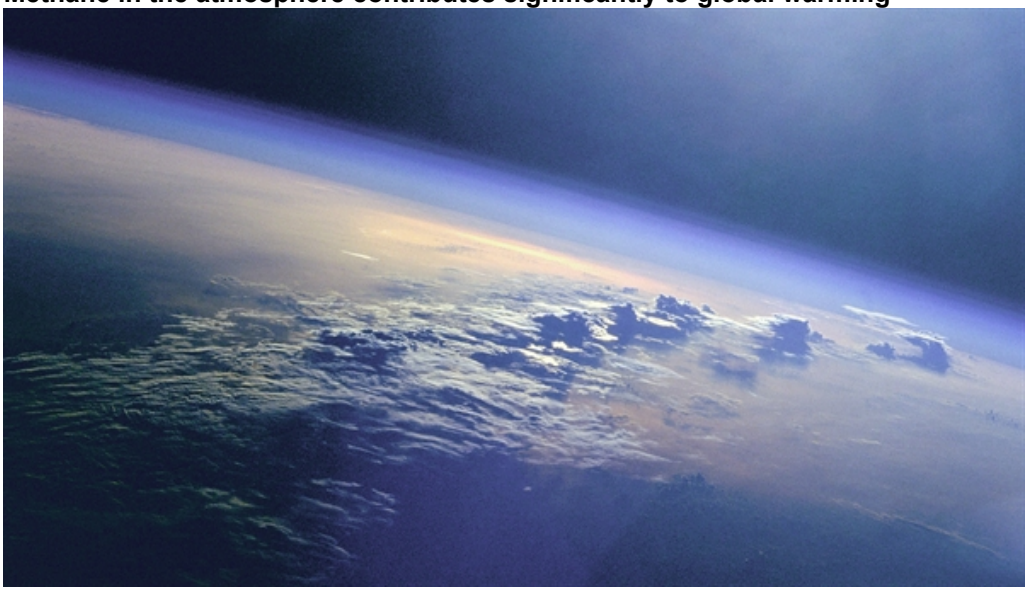
Credit: DNW.

HALO during its landing approach

The high-altitude research aircraft HALO (High Altitude and Long Range Research Aircraft): The modified business jet, a Gulfstream G 550, landed on 21 January 2009 at its home airfield in Oberpfaffenhofen.

Credit: DLR/A. Minikin.

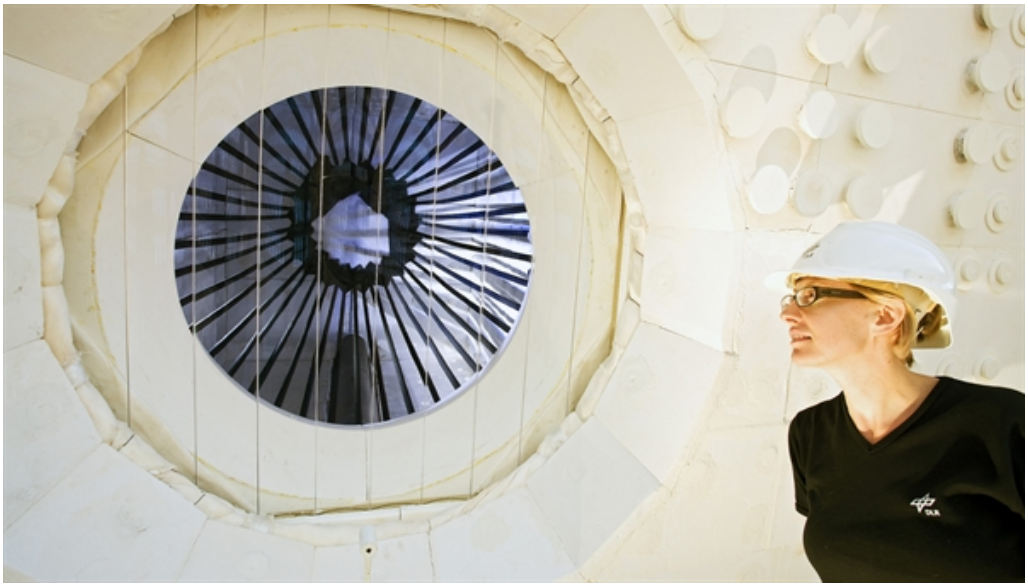
Methane in the atmosphere contributes significantly to global warming



The German-French climate satellite will measure methane concentrations. This gas contributes to global warming in the same way as carbon dioxide, but its effect is 25 times greater. When it comes to the human-induced increase in quantity in the atmosphere, methane has clearly overtaken carbon dioxide. Since pre-industrial times, the methane in the atmosphere has more than doubled – while the increase in carbon dioxide over the same period has been 'only' 30 percent. As with carbon dioxide, methane is one of the gases for which emissions are to be reduced under the Kyoto Protocol.

Credit: NASA.

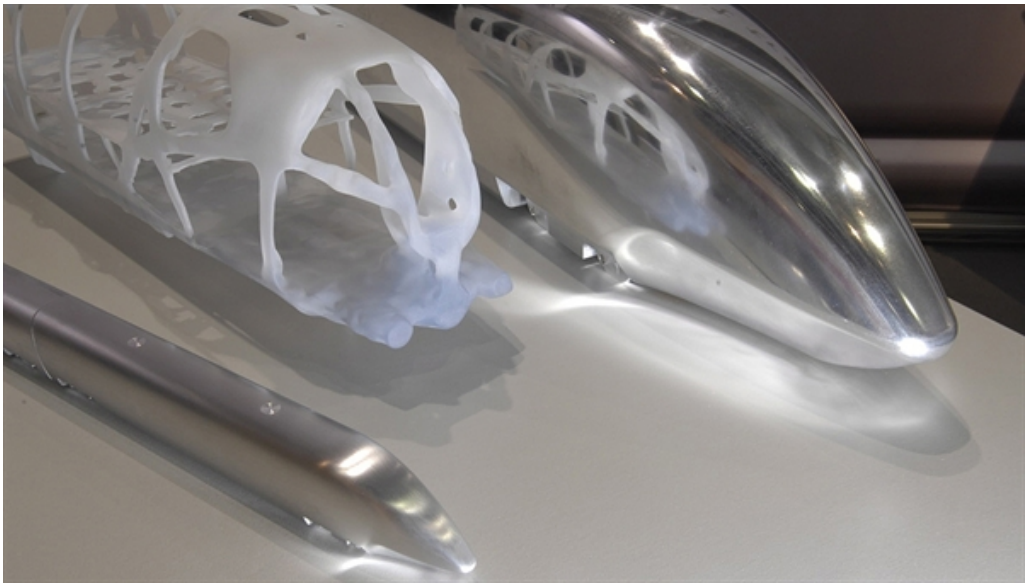
Visual check of the dark absorber tubes in the radiation receiver



Last visual check: DLR employee Miriam Ebert checks to ensure that the ceramic fibres protecting the radiation receiver are well sealed. The test power station Solhyco has been constructed in a 60-metre-high solar tower at the Plataforma Solar de Almería in southern Spain. The sunlight that the mirrors direct on to the radiation receiver in the tower heat the absorber tubes to 800 degrees Celsius. The radially arranged black tubes conduct this heat to a 100-kilowatt micro gas turbine, which drives a generator that in turn produces electricity.

Credit: DLR (CC-BY 3.0).

Wind tunnel and structural model of the Next Generation Train

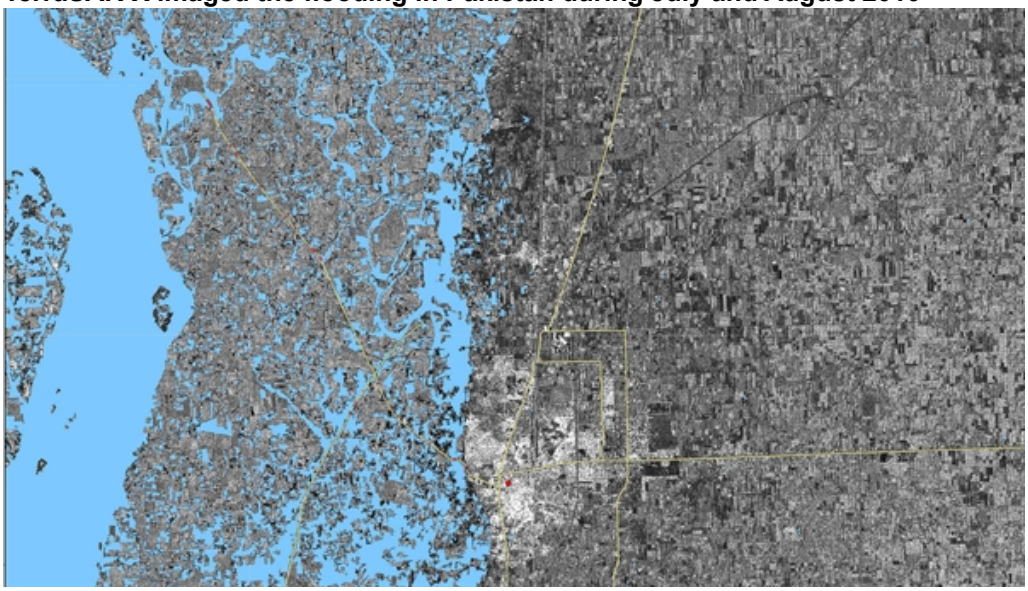


The trains of the future need to be efficient, safe and cost-effective. To this end, DLR combines skills in, among other things, aerodynamics, lightweight construction, energy management and communications.

Using wind tunnel models (coloured silver in the illustration), crosswind stability and possibilities for drag optimisation are investigated. A draft design has been prepared (light lattice structure) for the topological optimisation of the train structure, from which conclusions about the main load paths in the carriage body can be drawn. This gives important information for the selection of the manufacturing and assembly technologies to be used for the Next Generation Train.

Credit: DLR (CC-BY 3.0).

TerraSAR-X imaged the flooding in Pakistan during July and August 2010



In July and August 2010, the province of Khyber Pakhtunkhwa in Pakistan was affected by severe flooding; TerraSAR-X mapped the flooded area. There were estimates of at least 1300 dead and more than 3700 houses destroyed, with 45 bridges washed away. The flood directly affected more than a million people.

Credit: DLR / Infoterra GmbH, ESA, ODM. Acquisition date: 6 August 2010.

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