

## News Archive Transportation 2008

### Annual General Meeting 2008: DLR presents its research of the past 12 months

3 December 2008



Aeronautics, space, energy and transportation - these are the research areas of the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR). On 3 December 2008, a selection of exciting topics will be presented at DLR's Oberpfaffenhofen site, such as walking robots for Mars exploration missions, atmospheric research and Earth observation, the use of solar energy to produce hydrogen, and research into the next-generation train. The programme will give an overview of the work of the approximately 6 000-strong DLR staff over the past twelve months, as well as a view of things to come.

#### Architects of science - DLR conducts research for Europe

The different DLR sites take turns hosting the annual general meeting. During this year's event, 400 guests from science, industry and politics will learn about the research projects of the institutes and facilities in Oberpfaffenhofen and about the work of the other DLR sites in Germany.

"Its research activities make DLR to one of the architects of science, not just in Germany but also in Europe and beyond," says Professor Johann-Dietrich Wörner, Chairman of the DLR Executive Board. "By establishing extensive interdisciplinary links between its research areas and by teaming up with industry and other research institutions, DLR is able to offer socially and economically relevant contributions that help solve the problems of today."

Over the past twelve months, many of the projects at DLR's Oberpfaffenhofen site have been the focus of public attention: In February 2008, the Columbus research laboratory was permanently docked to the International Space Station ISS, at which point the Columbus Control Centre at DLR's German Space Operations Center (Deutsches Raumfahrt-Kontrollzentrum) in Oberpfaffenhofen assumed responsibility for the European space laboratory. New technologies in robotics and mechatronics, the 100th anniversary of microwave research and DLR's contribution to the joint German-Indonesian tsunami early warning system InaTEWS (Indonesian Tsunami Early Warning System) have influenced the course of this year's activities at DLR in Oberpfaffenhofen.

Next year, one of the central themes for research activities at DLR's Bavarian site will be the deployment of the new atmospheric research aircraft HALO (High Altitude and Long Range Research Aircraft). HALO heralds a new chapter in the history of German atmospheric research and Earth

observation. The combination of range, cruising altitude, payload and comprehensive instrumentation make the aircraft a globally unique research platform. The new member of DLR's fleet of research aircraft, one of the largest such fleets in Europe, is expected to arrive at the research airport in Oberpfaffenhofen on 19 December 2008.

### **Projects from DLR's research areas: aeronautics, space, energy and transportation**



Consistently putting renewable energies to full use

### **Global energy scenarios**

Decisions made in energy industry, energy policy and energy research have far-reaching and long-lasting effects. Political and economic decision makers need realistic and well-founded assessments of the energy supply of today and tomorrow to enable them take appropriate and forward-looking action. In 2008, DLR has evaluated options for a sustainable energy supply on behalf of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit) and on behalf of Greenpeace International, in its two reports: "Global energy scenario Energy [R]evolution" and "Pilot study 2008".

### **CO<sub>2</sub>-free hydrogen production**

Solar energy is by far the most widely available source of energy on Earth. Hydrogen, on its part, is an excellent energy carrier thanks to its high energy density. Moreover, the combustion of hydrogen produces only water and heat. Renewable hydrogen production using solar energy and the resulting storage of solar energy by this chemical energy carrier are therefore of the greatest technological and economic interest for the energy industry. Over the past months, DLR scientists have achieved hydrogen production in a 100-kilowatt pilot plant directly powered by solar energy. The pilot plant in Almería in Spain was commissioned in March 2008, under the auspices of the EU-funded Hydrosol II project.

### **Effective energy storage**

In collaboration with Züblin AG, DLR scientists have developed an energy storage system for solar power plants. Effective energy storage is an important condition for the deployment of renewable energies. On 16 September 2008, the German Aerospace Center (DLR) and its industrial partner Ed. Züblin AG presented a new thermal storage unit for solar power plants. The pilot system was built in Stuttgart and is based on the principle of storing heat in concrete. It offers a powerful and cost-efficient solution for commercial applications at temperatures of up to 400 degrees Celsius. Effective means of storing energy are indeed a key success factor for solar power plant technology. By combining a power plant with a heat storage unit, the running times of turbines can be extended into the night hours, or more generally into periods when less solar radiation is received. This represents a considerable increase in revenues generated by environmentally friendly power plants.

### **The fuel cell takes off**



Member of the DLR research aircraft fleet: the Airbus A320 D-ATRA

In spring 2008, DLR and aircraft manufacturer Airbus for the first time successfully implemented a fuel cell system to act as the auxiliary power supply for the hydraulic pumps on board its new A 320 ATRA research aircraft (Advanced Technology Research Aircraft). As the fuel cell only uses hydrogen and oxygen to generate electrical power, no harmful emissions are created. At the ILA in Berlin, DLR and Airbus presented DLR's new ATRA research aircraft to the general public for the first time. DLR is planning a new implementation of the fuel cell technology in collaboration with aircraft manufacturer Lange Aviation. Together, they are building a motorglider that will take off and fly independently using electrical power generated by fuel cells. The maiden flight of this technology demonstrator is expected to take place in early 2009.

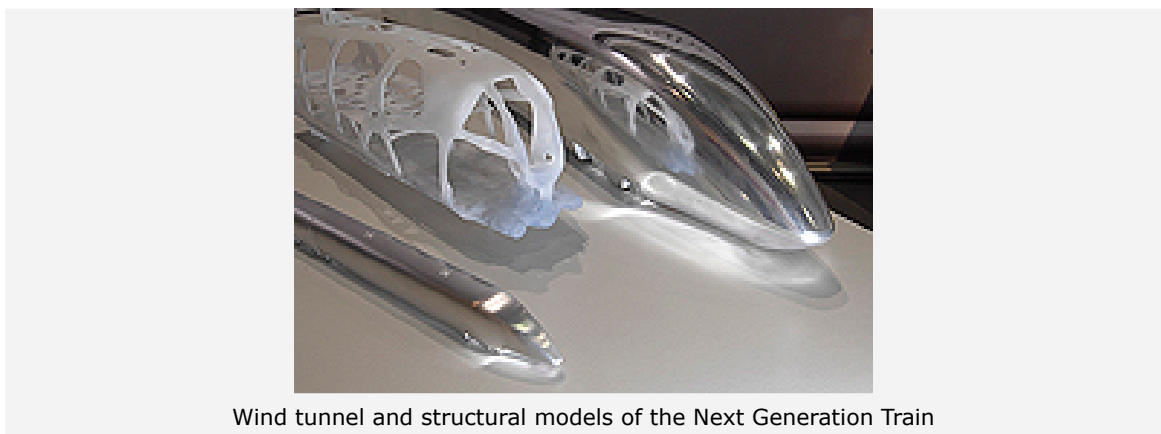
#### **Expertise and innovation in aeronautics research**

Through its collaborative project "Efficient airport 2030" and additional contributions to "Cabin technology and innovative fuel cell application", DLR is prominently involved in the Aviation Cluster Hamburg. Apart from the Institute for Air Transport Concepts & Technology Valuation (Institut für Lufttransportkonzepte & Technologiebewertung), which is jointly operated by DLR and the Technische Universität Hamburg-Harburg, four other DLR facilities in the field of aerospace research take part in this cluster.

#### **C<sup>2</sup>A<sup>2</sup>S<sup>2</sup>E simulation centre**

At the C<sup>2</sup>A<sup>2</sup>S<sup>2</sup>E simulation centre (Center for Computer Applications in AeroSpace Science and Engineering) at DLR's Braunschweig site, a high-performance computer for aeronautics research was brought into operation. One of the objectives of this 30 million euro project, which is jointly funded by Airbus, the German federal state of Lower Saxony, and DLR, is to develop processes, methods and numerical techniques which will enable a high-precision simulation of an aircraft, covering the entire flight envelope. The cluster computing configuration designed for C<sup>2</sup>A<sup>2</sup>S<sup>2</sup>E is making its world premiere; it achieves about 46.6 trillion operations per second.

#### **Next Generation Train**



Wind tunnel and structural models of the Next Generation Train

What does the train of the future look like? The train of the future should be fast, energy saving, safe and comfortable. Moreover, it should also be easy to integrate it into the more efficient rail system of the future. In September 2008, DLR demonstrated its interdisciplinary expertise at InnoTrans 2008, the world's leading trade fair for rail transport technology. In collaboration with the rail vehicle industry and the railway operators, it sets itself the task of reconciling these sometimes conflicting demands, for

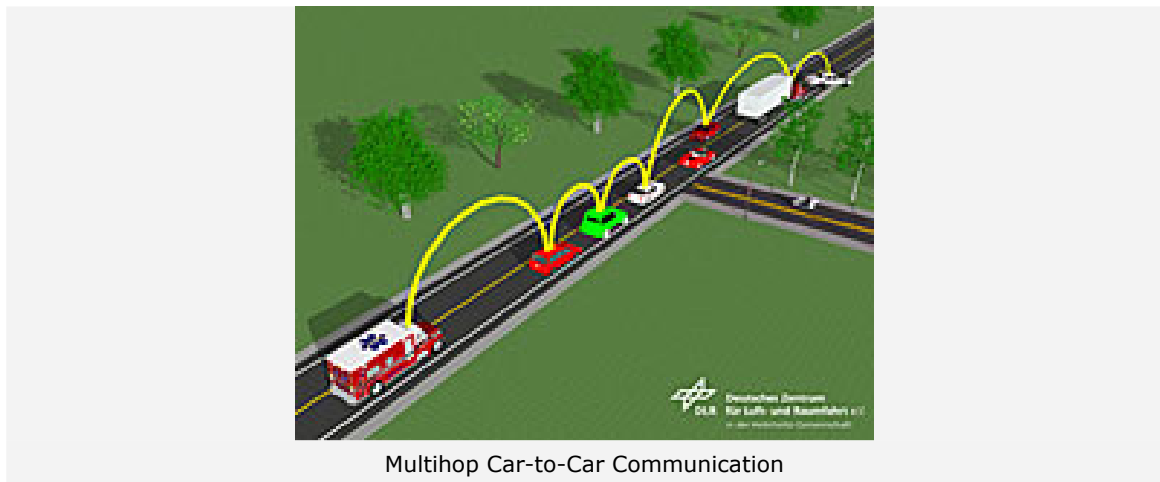
instance in the Next Generation Train project. Aerodynamic design plays a key role here: Drag optimisation, crosswind stability and noise generation in the high-speed range are the issues that need to be addressed. Combined with safe designs for chassis and passenger compartments, as well as minimisation of the wear and tear brought about by wheel/rail contact, this research lays solid groundwork for the train of the future. This in itself is not enough, however: In order to be able to combine drastic energy saving on the one hand and higher speeds on the other, intelligent energy management and systematic lightweight design are required. For the former, DLR has developed a software tool for full-system modelling. For the latter, DLR's research focuses on multifunctional materials, hybrid structures and carbon fibre reinforced plastics for surface applications with high bending stiffness. The DLR scientists also strive towards cost-efficient production processes for these materials, and their integration into flexible, modular vehicle platforms.

#### Communication as a means to enhance safety and operational efficiency

Improving communications is an important issue for all transport modes. DLR researchers are offering an innovative solution for regional railway lines. Cost- and maintenance-intensive technology of the railway infrastructure, in combination with short headways, makes secondary lines uneconomical. For their Railway Collision Avoidance System (RCAS), DLR scientists are approaching this issue by incorporating positioning technology into the railway vehicle itself rather than into the railway infrastructure. RCAS can warn the trains located on a given railway section of potential collisions - a system that can, at limited cost, improve safety on railway sections which have not been extensively automated.

For road vehicles, an experimental wireless communication network for inter-vehicle communication (car-to-car communication) was taken into operation in 2008. DLR and its partners in the CAR 2 CAR Communication Consortium are pressing ahead with the development of this system. The CODAR technology (Cooperative Object Detection And Ranging) is used to collect and analyse the information provided by the different sensors on board the vehicles, and process it further in line with the current traffic situation. In this way, the driver can be warned of especially dangerous situations ahead, such as the end of a tailback behind the next bend, or a vehicle about to emerge from a hidden side road. Another example is where vehicles in front register a drop in the ambient temperature below freezing point: rain detected by a sensor on the windscreen wipers will then be interpreted as a warning of ice. Other control functions the DLR experts are working on include adaptive cruise control.

#### Driver assistance and new vehicle concepts



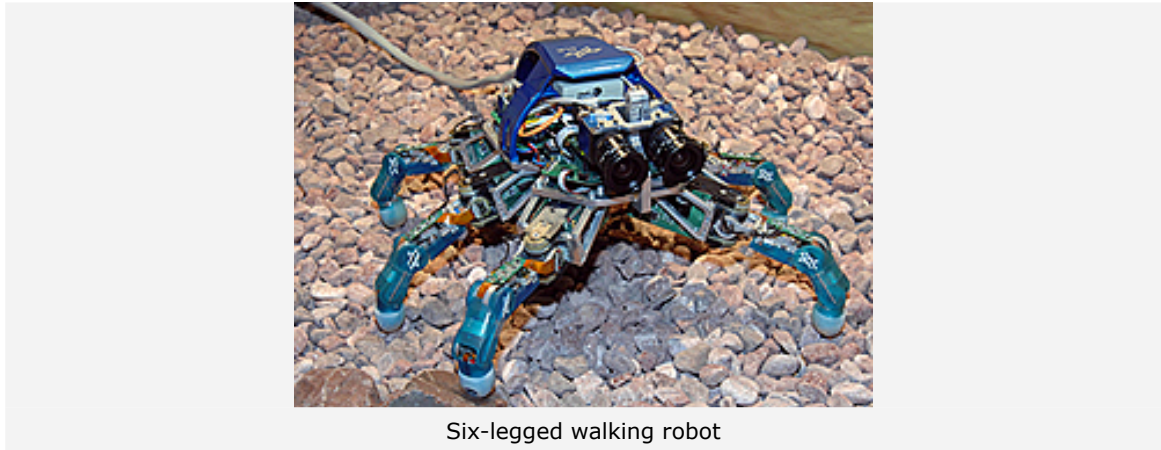
Car-to-car communication is part of the DLR transport research programme relating to road user assistance. Through this programme, DLR is building up its own expertise on traffic behaviour and traffic flows, while at the same time contributing to European traffic research projects. An exhibition at the DLR headquarters in Cologne-Porz in April 2008 gave an insight into DLR's activities in this field. On display were details of test setups for assistance systems, as well as exhibits documenting the development of a mechatronic chassis for enhanced safety. If the vehicle's behaviour does not match the behaviour that would be expected based on the driver's steering input, a mechatronic chassis, in which mechanical and electronic functions work together, can induce a countermovement. This makes countersteering easier for the driver, and thus improves driving safety.

This is just one of the many new developments in transport research - from traffic growth to traffic data acquisition and from traffic management to new vehicle concepts. In order to create reliable and energy-efficient assistance systems, DLR scientists are exploiting the dynamic potential of the chassis to the full. Criteria with regard to wear and tear and to comfort are also taken into account. All this will be made possible by a ground-breaking functional integration of existing sensor and actuator technology.

### **SAR-Lupe, Germany's first satellite-based reconnaissance system, now completed - DLR in charge of commissioning again**

On 22 July 2008, the fifth German reconnaissance satellite of the SAR-Lupe system lifted off successfully from the Russian Plesetsk Cosmodrome south of Archangelsk. About half an hour later, the Russian Cosmos-3M launch vehicle released the radar satellite into its low Earth orbit, about 500 kilometres from the ground. The first communication between the German Space Operations Center of the German Aerospace Center (DLR) in Oberpfaffenhofen and the satellite showed that the satellite is functioning faultlessly. DLR had also been in charge of commissioning the first four SAR-Lupe satellites.

### **The DLR Crawler - a six-legged walking robot**



The legs of the DLR Crawler are based on the fingers of a robot hand developed by DLR (the DLR Hand II). The Crawler is used as a test bed for the development and evaluation of different gait and control strategies, and as a preliminary version of future exploration robots. Thanks to their modular design, their range of integrated sensors and the six degrees of freedom in their fingertips, the fingers of the DLR Hand II are particularly well-suited for this first prototype. The Crawler is automatically controlled in real-time using exploration and navigation algorithms which are based on stereo camera images. The data can also be used for 3D modelling of the Crawler's surroundings.

### **Satellite data for international crisis management**

On 2 May 2008, tropical cyclone 'Nargis' swept over Myanmar (Burma) and left behind a path of destruction. Official reports noted a death toll of more than 30 000 people alongside 40 000 missing. Using data from the new German radar satellite TerraSAR-X and the Japanese satellite ALOS, the full extent of the flooding could be accurately mapped out. The resulting maps were used for the preparation and coordination of international relief efforts. Disaster relief could be provided through the joint efforts of the United Nations (UN), the German Aerospace Center (DLR), the World Food Programme (WFP) and ITHACA (Information Technology for Humanitarian Assistance, Cooperation and Action; Politecnico di Torino).

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