



2013 – international collaborations and diverse research projects

24 January 2013

The German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) is using knowledge for tomorrow to shape the future of our society today. DLR is a world-renowned partner for research and will continue to develop its international network in 2013 by establishing new collaborations with research institutes and universities. An important step in this direction is taking over the chair of the ESA council and heading the International Charter on Space and Major Disasters in the current year.

"The growing demand on research made by society must go hand in hand with self-determination and responsibility in science. This means more ventures for DLR, and choosing new ways of thinking about tasks and technologies," says Johann-Dietrich Wörner, Chairman of the DLR Executive Board. "It requires defining strategic objectives and not default operational tasks and activities," he comments.

The following DLR research projects represent just a small part of the missions planned for 2013.

Aviation

Efficient, environmentally friendly and sustainable - requirements of modern mobility and the way we intend to move forward. DLR will be shaping the future of air travel with aviation research based on the European strategy paper 'Flightpath 2050' and the German Federal Government's future aviation strategy.

Flying despite volcanic ash - DLR develops satellite-supported prediction process

In the spring of 2010 an ash cloud settled over Europe as a result of the eruption of Icelandic volcano Eyjafjallajökull. To prevent volcanic eruptions from having such a dramatic impact on air travel in future, DLR is launching Project VOLCATS (VOLCanic Ash impact on the air Transport System) in 2013. This involves developing a satellite-supported process between now and 2016 that will quickly determine the distribution of ash in the air and provide reliable information on heavily and lightly ash-contaminated areas. VOLCATS is intended to be the foundation for flexible air traffic management where, in the event of a crisis such as a volcanic eruption, temporarily ash-free and hence safe areas for air traffic can be opened up. In addition, researchers are developing an ash warning system for airliners that alerts upon an unexpected entry into an ash cloud.

HINVA - maximum lift test with the DLR ATRA

Slats and flaps are fully deployed in the approach to landing. This gives an aircraft the greatest possible lift. To better understand this flight phase, DLR's A320-200 ATRA carried out successful flight tests in the slow flight regime at Airbus Toulouse in 2012. The test flights are continuing in a second campaign. DLR, Airbus and the Technische Universität Berlin are organising the flights in close collaboration. In addition, the researchers are pooling data from specially coordinated wind tunnel tests in the European Transonic Wind tunnel (ETW) and are carrying out numerous digital flow simulations. The scientists want to predict the maximum lift of aircraft more accurately; future aircraft configurations and high lift devices should provide further aerodynamic improvements. The data currently used still comes from test campaigns from the 1980s and 1990s. For the first time, the activities in the HINVA project will combine the three methods of high lift research: flight tests, wind tunnel tests and simulation computations.

Research for next generation turbines

Researching and developing innovative propulsion technologies requires top quality, high performance test rigs: the aviation industry has an urgent need for suitable test facilities. At its Göttingen site, DLR is currently building a test rig for next-generation propulsion systems: NG-Turbs (Next Generation Turbines). At the globally unique facility, scientists will be investigating things such as newly developed turbine blades, cooling systems and materials. In tandem with industry, DLR has been analysing future foci in turbine research to set up the facility in line with customer requirements.

Space

International collaborations will also define German space research in 2013. Flights with Indian and Russian launchers and a Japanese-German asteroid mission are planned.

AlSat: observing shipping worldwide with the 'flying antenna'

The deployable helix antenna is four metres long, and the AlSat microsatellite will be using it from summer 2013 to keep an eye on ship traffic worldwide. The sensitive antenna receives signals from the ships' automatic identification systems - radio data that every ship has been sending since 2000 and that includes information such as the ship's name, position, size and speed. While previous terrestrial reception systems lose contact with the ships after a short time because of their limited range, and commercial satellites have not previously been able to carry out reliable positioning when there is a lot of ship traffic, AlSat is primarily intended to be able to track it in regions of heavy use, such as the North Sea and the Mediterranean. With accurate observations from the satellite operated by the DLR Institute of Space Systems in Bremen, shipping routes can be optimised in future and collisions prevented. It will be launched from Sriharikota in India.

MASCOT - hopping across the asteroid

The MASCOT asteroid lander is reaching the final straight; in early 2014 the flight model will be delivered to the Japanese space agency JAXA and MASCOT will then be sent to asteroid 1999 JU 3 with the Hayabusa-2 spacecraft. The 10-kilogram landing capsule will be ejected from the probe at an altitude of 100 metres, will land on the asteroid and orientate itself. It will then hop back and forth, carrying out measurements directly on the surface with four instruments. DLR is contributing a camera and a radiometer. The structure was developed by the DLR Institute of Composite Structures and Adaptive Systems in Braunschweig; the Institute of Robotics and Mechatronics in Oberpfaffenhofen gave the lander its hopping and orientation abilities. This year, the final tests will take place at DLR Bremen, before the lander is sent on its journey.

SoziRob - using robots to reduce stress

Exercise is essential for survival on long missions in space. Physical activity can help to reduce stress, stimulate the mind and prevent bad moods. But exercising in space also creates difficulties. This is where Project SoziRob comes in; robots, more specifically the robot head Flobi and humanoid robot Nao, act as social interaction partners. The robots encourage sport and offer guidance and commentary. How do people in this situation respond to various robotic systems, compared to virtual agents or mobile devices? Project SoziRob, sponsored with funds from the German Federal Ministry of Economics and Technology (Bundesministerium für Wirtschaft und Technologie; BMWi), should find answers to these questions.

OMEGAHAB - laboratory in space

In April 2013 a Russian BION-M3 return capsule will be launched into space carrying biological and zoological experiments from the Universities of Erlangen and Hohenheim and financed with funds from the BMWi. The four-litre OMEGAHAB aquarium has two chambers connected by a membrane filter to enable the exchange of oxygen and carbon dioxide. Besides aquatic plants, which are used to produce oxygen, snails, water fleas and tilapia will be on the flight, and their behaviour under space conditions will be studied.

Energy

DLR energy research is concerned with innovative techniques for generating power, the development of energy storage systems and modelling future energy systems. The focus in doing so is on new energy storage systems and using renewable energy sources.

Energy stored in the smallest space

Energy storage systems are a key component for a sustainable energy economy. DLR researchers are developing thermal and thermochemical storage systems, adiabatic compressed air storage systems and next-generation batteries. In the laboratories at the new CeraStorE Competence Center (Competence Center for Ceramic Materials and Thermal Storage in Energy Research), which is being inaugurated in spring 2013, DLR researchers are developing things such as new thermochemical storage systems that are capable of absorbing large quantities of heat energy in the form of chemical energy. Such a reaction is seen in everyday life when slaking lime. At CeraStorE, energy and materials researchers are jointly developing and testing new materials for the energy sector.

Solar power generators - expertise for power generators in North Africa

DLR researchers are putting their capabilities in aviation to work on more efficient wind energy facilities. In doing so they can transfer their experience in the automated production of carbon fibre reinforced composites in aircraft construction to the manufacture of rotor blades. Carbon fibre reinforced structures can make rotor blades up to five times more rigid and yet lighter. At the DLR Center for Lightweight Production Technology (Zentrum für Leichtbauproduktionstechnologie; ZLP) in Stade, scientists are developing new components for rotor blades on a new, 45-metre long, wing-shaped rotor blade, with wind turbine manufacturer NORDEX. In addition, this wing shape can be used to test the stability of different reinforced composite construction materials such as new resins on large rotor blades.

Lighter and bigger - DLR researches rotor blades with carbon-fibre reinforced components

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Transport

Transport research is a major part of DLR's work. Mobility is one of our everyday needs; it generates employment and a substantial proportion of economic added value. However, traffic also has a series of negative consequences - noise and exhaust fumes take their toll on people and the environment. Reducing these is a task for researchers at DLR..

Greater ranges for electric vehicles using free piston linear generators

On 19 February 2013, the Institute of Vehicle Concepts in Stuttgart will present the free piston linear generator. The free piston linear generator is an essentially new range extender that can be used in electric vehicles to increase their operating range. It works like a conventional combustion engine, but instead of initially converting the linear movement of the pistons into the rotation of a crankshaft, it generates power directly. In free piston linear generators, different fuels with a correspondingly high level of efficiency and low exhaust emission can be used. The researchers in Stuttgart are the first to successfully operate such an energy converter.

Warning train drivers in good time - RCAS system developed further

The Railway Collision Avoidance System (RCAS) warns train drivers in good time if their trains are on a collision course. To do this, researchers combine data from the GPS satellite navigation system, a digital map of the rail network and other data from sensors on the train to continually monitor the position of the train on the line. Trains fitted with RCAS can exchange this information directly with one another via an autonomous radio network. Overall, the development status of RCAS has advanced to the point where marketing of the system has begun. The DLR spin-off company Intelligence on Wheels took it over in 2012.

Less noise through intelligent train formation

People living next to railway lines, especially freight lines, are exposed to high levels of noise from rail traffic. DLR researchers are taking measurements both along the lines and in a wind tunnel to determine where the noise that locals find particularly disturbing is. In doing so, not only the level of noise but also its frequency play a critical role. Measures to reduce noise or prevent its propagation can be deployed in a targeted way using this knowledge. Hence, for example, the noise load of a train can be limited by intelligent arrangement of the wagons. Identifying lighter wagons also provides an opportunity of forming particularly quiet trains for use in heavily populated areas.

Security

Besides politics and economics, science and research are playing an increasingly important role in meeting society's security requirements. Highly developed technologies, systems, concepts and competences originating from science are today allowing conflict and crisis situations to be managed.

Lasers track down hazardous substances

Both the deliberate and the unintentional release of chemical, biological, radioactive, nuclear and explosive (CBRNE) hazardous substances pose a threat to civilian safety. Ground- and air-supported detection and the identification of such hazardous substances save lives, especially in inaccessible areas or where access presents risks. After natural catastrophes, in the event of industrial accidents or suspicions of targeted attacks on large congregations of people, laser-based processes enable timely, large-scale, discreet and safe detection over large distances. A core competence of the DLR Institute of Technical Physics lies in the development of wavelength-specific laser systems. As part of the DLR LAIRDIM project (Laser-based Airborne Detection, Identification, and Monitoring of biological and chemical hazardous substances), various processes are being investigated under realistic environmental conditions at the optical test range in Lampoldshausen.

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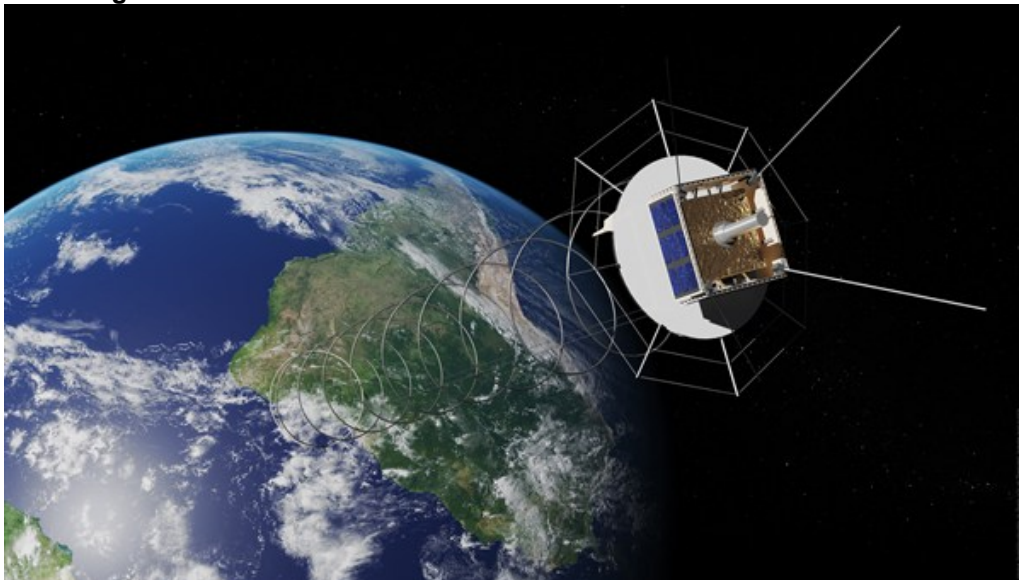
Wing of research aircraft Airbus ATRA Messensorik



The scientists want to predict the maximum lift of aircraft more accurately; future aircraft configurations and high lift devices should provide further aerodynamic improvements.

Credit: DLR (CC-BY 3.0).

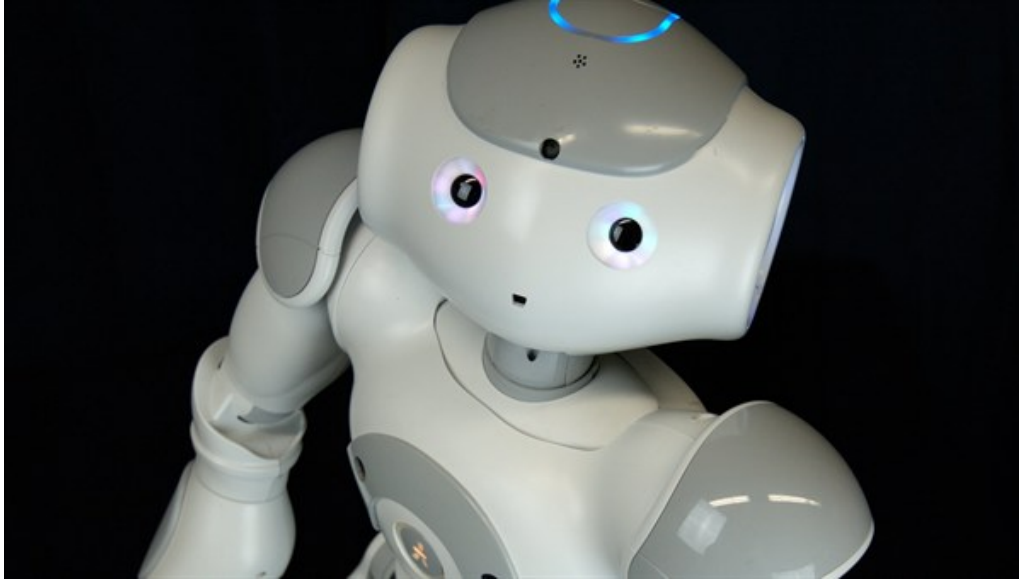
Following maritime traffic with AISat



With a deployable, four-meter-long helix antenna, the German Aerospace Center (DLR) AISat satellite will be used to receive radio signals from ships. It is expected to launch aboard an Indian rocket in 2014.

Credit: DLR (CC-BY 3.0).

SoziRob



Project SoziRob, funded by the DLR Space Administration, will study the social interaction between robots and humans. The humanoid robot Nao, developed by scientists at the University of Bielefeld, will act as social interaction partner and will encourage sport and offer guidance and commentary.

Credit: Universität Bielefeld.

Research for more efficient solar power plants – DUKE test facility



Since the beginning of 2013 at the Plataforma Solar de Almería research site in Spain, DLR researchers have been testing a new system in which steam to drive a turbine is generated directly in the receiver tubes of parabolic troughs.

Credit: DLR (CC-BY 3.0).

Free piston linear generator



The free piston linear generator is similar to a conventional internal combustion engine, but the linear motion of the piston is not converted to rotary movement of a crankshaft, but instead directly generates electricity.

Credit: DLR (CC-BY 3.0).

DLR project LAIRDIM



For the DLR project LAIRDIM (Laser-based AIRborne Detection, Identification and Monitoring of biological and chemical hazardous substances), different methods for identification of hazardous materials will be tested at DLR Lampoldshausen.

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