



DLR 2012 – Research is an important investment for the future

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As one of Europe's leading research institutions, the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) will continue to align its research work with key issues concerning environmental protection, mobility, energy supply and security in 2012. The focus is to link results from basic research to innovative applications. Every DLR staff member is making a critical contribution to the scientific and economic standing of Germany – and Europe.

"Particularly in times of economic stress, it is important to strengthen research and innovation, with an emphasis on stabilising the base of industrial nations in Europe," explains Johann-Dietrich Wörner, Chairman of the DLR Executive Board. "German policy is on the right track – Germany intends to spend more on research in the coming years and, as such, is investing in its future." Wörner adds: "But in doing so, it is also essential to give thought to new forms of cooperation between the individual research institutions, to ensure an increase in the efficiency and speed of innovation. Such collaborations must be aligned with national and international trends and future tasks in science management."

This year will be marked by political decisions regarding the future of space flight in Europe, which will be the subject of discussion and decision-making at the ESA Ministerial Council meeting. DLR will be presenting its research results and representing Germany as a centre of research at national and international trade fairs and conferences. The second national conference on space robotics will take place in March 2012 and its central theme will be the use of robots in planetary exploration. Then, in May, an international meeting regarding the use of the International Space Station (ISS) will be held in Berlin. DLR will also be present at the Singapore Airshow and the International Air and Space Exhibition (Internationale Luft- und Raumfahrtausstellung; ILA) at the new Berlin airport.

The following priorities will shape DLR's research and projects in 2012:

Aviation

DLR is taking on the challenge of making the rapidly growing aviation sector efficient, environment friendly and sustainable. DLR's technology portfolio is based on 'Flightpath 2050', the European strategy paper that replaced 'Vision 2020' in 2011. This will exploit synergies between individual research areas and take important steps towards the future of air transport.

Biofuels for aviation

In April, the DLR Falcon research aircraft will fly into the exhaust plume of a Lufthansa commercial aircraft using biofuel and take measurements. As part of the Biofuel Project, in which Deutsche Lufthansa AG is already conducting long-term trials in regular service, these tests intend to demonstrate the effects of fuel on the engine and to directly compare the emissions from kerosene and biofuels. DLR is applying its expertise in aviation and energy research to this issue.

Weather and Flying

In March, the Weather and Flying project (Wetter und Fliegen) will come to an end after four years of research work. Weather can affect both the safety and the efficiency of aircraft. The aim of the Weather and Flying project was to support aviation during winter weather, thunderstorms

and turbulence, from the perspective of both the cockpit and the airport. As a result of the project, scientists developed a 'warning and evasion' system for aircraft.

flexiGuide – environment-friendly descent process with autonomous control

Summer 2012 will see the beginning of the first big pre-testing campaign in the flexiGuide project involving air traffic controllers. The intention is to use automated landing approaches to reduce fuel consumption, pollutant emissions and noise during landing. However, pilots need targeted support to implement this. DLR scientists want to use flexiGuide to create an optimum environment for the pilots.

Space

Beyond strictly national missions, it is now hard to contemplate spaceflight without international collaboration. The best way to deal with complex subjects is through joint research work. More important international projects in which DLR will be applying its skills and constantly expanding its network of partners will come in 2012.

NEOShield – hunting for near-Earth asteroids and comets

In this project, DLR is responsible for the coordination of national and international partners. NEOShield was launched in mid-January and, over the next three and a half years, will investigate the measures that can be employed to prevent near-Earth objects such as asteroids and comets from colliding with Earth. In doing so, the consortium, which received four million Euros in funding from the European Union, will investigate the properties of near-Earth objects and develop a strategy for an impending collision.

SHEFEX II – technology for re-entering Earth's atmosphere

The SHEFEX II (Sharp Edged Flight Experiment) spacecraft will complete its final tests in February and will be launched from the Norwegian Andøya Rocket Range in spring. The sharp-edged spacecraft will reach an altitude of 200 kilometres during its 10-minute flight and will then re-enter Earth's atmosphere. During the flight, DLR will test various thermal protection systems and record data for subsequent scientific analysis.

Galileo European satellite navigation system – initial location calculations

Following the launch of two more Galileo satellites in August, four of these spacecraft will then be circling the Earth. This will enable the first location calculations to be carried out using the European satellite navigation system. When the Galileo navigation system is complete, there will be 30 satellites at an altitude of 23,222 kilometres, 30 to 40 ground stations across the world and multiple control centres being used for precise location determination. Construction and operation is being financed by the European Union. All of the Galileo satellites will be operated from the DLR control centre in Oberpfaffenhofen.

Energy

Energy researchers at DLR are working on processes for generating power in an efficient and therefore more environment-friendly manner, and on increasingly replacing fossil fuels with renewable energy sources. The relevance of this research area to society has been increased by the recent changes in energy German policy.

Storage technology – a major pillar in the energy system

Reliable and cost-effective storage technologies are one of the biggest challenges in the development of renewable energy sources. A very promising storage concept involves generating hydrogen when there is an excess of power from wind and solar energy. To this end, DLR is working on new electrolyzers to produce hydrogen efficiently while responding flexibly to the fluctuating supply of renewable energy sources. Hydrogen can assume a critical role as an emission-free fuel source in the energy and transport sectors.

Energy system analysis – a basis for political decision-making

Energy policy and energy economics depend on reliable analyses and the prediction of trends in the energy market. DLR system analysts are using various scenarios to assess how energy consumption changes under various conditions, thus providing critical foundations for decision-making. In 2012, DLR's system analysts will conclude major studies – or interim results will be published – on scenarios for electric mobility, tackling the question of which locations are most

suitable to which power generators in the Mediterranean region, and on the public's acceptance of energy and infrastructure facilities in Germany.

More efficient solar power generators using direct steam generation

In a parabolic trough generator, the Sun's radiation is focused and converted into thermal energy for power generation. With direct solar steam generation, the steam that subsequently drives the turbines is generated in the mirror field itself. Though this entails new challenges for the technology in the facilities, solar-thermal power generators have the advantage of being able to produce energy more efficiently and cost-effectively. This technology has been substantially developed by DLR. The research and development work will continue to be expanded in 2012, and will include the creation of a new test facility at the Spanish research centre in Almería.

Transport

In terms of transport research, DLR focuses on the use of new forms of energy and the subject of intermodality – the use and networking of different modes of transport. In this regard, DLR can cover the entire transport system with its research areas – air, road and rail – and all from the perspective of environment-friendly transport planning and organisation.

Transport Development and the Environment

In the Transport Development and the Environment (Verkehrsentwicklung und Umwelt; VEU) research project, DLR is collaborating with the Karlsruhe Institute of Technology (KIT) to analyse the effects of transport policy measures and technological innovation on European passenger and commercial goods transport until 2030. The researchers are identifying trends and are developing a set of tools to assess the consequences of transport evolution on the environment and on society. Effects on climate, air quality and noise pollution play just as much of a role in this as commercial development and the economical significance of the transport sector.

New electric mobility cluster

The complex subject of electric mobility is a continuous subject of research at DLR and is combining inputs from the energy and traffic research areas. The spectrum covers new vehicle construction methods and engines, the integration of electric mobility into the transport system, system analysis, questions concerning communication and navigation, and strategies for specific business models relating to products and services involving vehicles. The wide range of activities at DLR that address electric mobility are being grouped into a cluster in 2012. The aim is to contribute to the successful implementation of electric mobility through increases in efficiency and the removal of constraints.

Next Generation Train

The Next Generation Train (NGT) continues to be a key element of DLR transport research. DLR researchers aim to optimise designs for double-decker high-speed trains that travel at up to 400 kilometres per hour. Under the NGR Region project DLR researchers are working on developing a rail vehicle used for shorter distances and travelling at speeds of up to 230 kilometres per hour. In 2012 the focus will be placed on investigating structures made of combinations of materials, which minimise deformation in a collision yet remain stable and safe. To achieve this, DLR transport researchers are working with a variety of materials such as wood, aluminium and glass or carbon-fibre reinforced composites.

Security

DLR security research is a cross-functional task encompassing every aspect of aviation, spaceflight, energy and transport research in terms of security- and safety-related issues. This area covers both innovative organisational concepts and appropriate action strategies.

Maritime security

DLR's expertise in the areas of Earth observation, communication and navigation, flight guidance and harbour safety have been incorporated into a research project that has received six million Euros in funding and encompasses numerous areas of focus. Its aim is to support the implementation of the 'National Maritime Technologies Master Plan' and the 'National Security Research Programme'. As part of the project, eight DLR institutes will make contributions to the subjects of environmental protection, piracy and the security of European external frontier.

Lasers track down space debris and natural objects in orbit

Germany is a leading space-faring country in Europe that currently operates some 40 satellites and payloads. The concomitant responsibility under international law is expressed in the requirement that Germany must ensure safe operation and disposal or controlled re-entry of its satellites. But with over 700,000 pieces of debris in orbit, collision-free operation is no simple task. Researchers at DLR are working on the first steps towards a laser-based system to track this debris and systematically catalogue it.

Warning the population in the event of a disaster

Over the past 30 years, the number of deaths and injuries during disasters has been substantially reduced. The establishment and improvement of early warning systems that are able to inform the affected population has made a significant contribution to this. In this regard, DLR has been leading the Alert4All (A4A) project, along with a total of 11 European partners. A4A has the aim of improving the effectiveness of alerting and communicating with the population in times of crisis. Furthermore, solutions to adapt warning systems to foreseeable crises, integrating current and future technologies and taking into consideration trends in the social behaviour of those affected are being developed.

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NEOShield - hunting for near-Earth asteroids and comets



NEOShield, an international cooperation being led by DLR, will investigate the properties of near-Earth objects and develop a strategy to prevent collisions with Earth.

Credit: NASA/JPL/JHUAPL (Montage: DLR).

Falcon 20E research aircraft



In April 2012, the DLR Falcon research aircraft will fly into the exhaust plume of a Lufthansa commercial aircraft using biofuel and take measurements. This is part of the Biofuel Project, in which Deutsche Lufthansa AG is already conducting long-term trials in regular service.

Credit: DLR.

Production of hydrogen at DLR



Electrolysis test stand with DLR-developed electrodes for alkaline water electrolysis. DLR researchers are working on more efficient methods of producing hydrogen by electrolysis.

Credit: DLR.

Artist's impression of the Next Generation Train



Behind the Next Generation Train lie scientific questions in the areas of aerodynamics, structural dynamics, vehicle dynamics, propulsion, energy management, materials science and lightweight construction. The aim is to develop and gain approval for efficient high-speed train designs with greatly reduced specific energy consumption and improved passenger comfort and noise characteristics.

Credit: DLR.

Commitment to dealing with disaster: the DMT



DLR has developed an innovative situation assessment and management system for disaster control. Referred to as Disaster Management Tool (DMT), it captures and disseminates any important information in the event of a crisis – and is small enough to be carried by hand. This image shows the DMT being used on a practice mission in Cyprus to assess the strength of a dam.

Credit: DLR (CC-BY 3.0).

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