



A comet landing, a German astronaut and alternative fuels for air traffic

23 January 2014

Knowledge for tomorrow – diverse research for the benefit of society

Researchers at the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) are driven by the desire to improve life on Earth. Among other things, they are working on aircraft that one day will produce less noise emissions and run on alternative fuels, while their more efficient turbines emit fewer pollutants. But DLR researchers are not simply concerned with improving airborne mobility, they also have their feet firmly on the ground, helping us reach our destinations in fast and green transportation, for instance in electric vehicles. And talking about transport, in May 2014 astronaut Alexander Gerst, is scheduled to embark on a six-month journey on board the ISS, where he will conduct numerous experiments in various fields, including biology and medicine, to name just two, that will contribute to improving life here on Earth. Alexander Gerst's mission – Blue Dot – expresses this desire. Viewed from far away in space, the Earth resembles an azure, vulnerable speck. The Rosetta spacecraft will send a wealth of new data back to Earth as it chases a comet, venturing deep into space during 2014. The European spacecraft will reach its destination, Comet 67P/Churyumov-Gerasimenko, after around 10 years of travel. One of the highlights will be the landing of Philae on November 2014. DLR played a major role in building the craft and operates the lander from its control centre in Cologne.

"What we see, and will continue to see, in DLR projects and missions during 2014 is our willingness to address the most important questions and challenges that our society faces and to continue shaping the future of Germany as a centre for business and science. Our research activities present new, solution-oriented opportunities for humankind and the environment," says Johann-Dietrich Wörner, Chairman of the DLR Executive Board. "DLR's strength lies in our capacity to work on issues both successfully and quickly through interdisciplinary cooperation." Over the last two years, DLR has provided its expertise in aviation research to further research in wind power. For many years now, DLR has concentrated on intense and extremely high-level research into the fundamentals and applications of aviation. Equipped with this experience, DLR scientists are able to apply this to research in wind energy to develop higher performance rotors and rotor blades.

Decisions concerning the Ariane launcher and a manned space transport system to the ISS are on the horizon

The upcoming Ministerial Council Meeting of the European Space Agency (ESA) in Luxembourg on 2 December 2014 is an important event for DLR and the German aerospace sector as a whole. In this meeting, the ESA member states will reach a final decision regarding the development of the European launcher Ariane 5 ME, and on the schedule for continuing to shape the Ariane 6 as its successor model. "Commercially speaking, Ariane 5 is the world's most successful launcher," says Wörner. "In the midst of a constantly growing competition in launcher systems, we are called on to preserve and boost Ariane's competitiveness. So we are in favour of developing the Ariane 5ME (Midlife Evolution)." ESA is investing roughly 800 million Euros in this development, with Germany providing around 20 percent. Compared with its predecessor Ariane 5, Ariane 5ME will be able to transport an additional roughly two tons of payload. It has a re-ignitable upper stage and is capable of launch to a variety of orbits. The costs of running the International Space Station ISS and Europe's contribution to the US Space Shuttle successor are additional topics on the agenda for the Ministerial Council Meeting. Within ESA, Germany foots the bill for almost 42 percent of the ISS operational programme (1.7 billion of 4 billion) and 52 percent of the ESA science programme 'European Programme for Life and

Physical Sciences' (ELIPS) (149 million of 288 million). "The European service module for the new NASA multi-purpose crew vehicle MPCV, which is based on ATV technologies, means that for the first time, Europe has become an indispensable partner in US exploration projects that reach beyond near-Earth space for the first time. Here, we expect the Ministerial Council Meeting 2014 to provide a final confirmation of the development of the service module," says Wörner.

Discover a selection of DLR research topics scheduled for 2014, from our space, aeronautics, transport, energy and security research areas.

Space

Rosetta – mission to an awakening comet

After 10 years in outer space, the arrival of the Rosetta orbiter and its landing craft Philae at their final destination, Comet 67P/Churyumov-Gerasimenko, is imminent. The international mission organised by ESA, the European Space Agency, is the first time that a spacecraft will accompany a comet as it awakens on its way to the Sun. And this is not the only premiere; never before has a spacecraft touched down on the surface of a comet to conduct direct, in situ ground measurements and analyses. The camera on board the orbiter and the first images acquired, will enable scientists to make a decision on the landing site in summer 2014. Philae is then scheduled to touch down on 67P/Churyumov-Gerasimenko in November 2014. An international consortium developed and constructed the refrigerator-sized landing craft under the leadership of DLR, and the DLR control centre in Cologne is responsible for its control and operation. Comets consist of primeval material, barely altered since the Solar System emerged 4.6 billion years ago, and so the mission should provide planetary researchers with valuable information.

Alexander Gerst on the ISS

'Blue Dot – Shaping the Future' – this is the mission motto under which Alexander Gerst (37) is set to be the next German ESA astronaut, taking off for the International Space Station (ISS) from the Baikonur Cosmodrome in Kazakhstan on 28 May 2014. The geophysicist is expected back on Earth on 10 November 2014, after 166 days in space. Gerst will have a role to play in roughly 100 experiments on behalf of all partners in ISS. 'European utilisation' has an allocation of up to 160 hours of crew time on board the ISS, during which Gerst will work on roughly 40 ESA experiments, including 25 under the auspices of German project scientists or with German industry participation. The experiments are in the fields of human and material sciences, biology, the physics of fluids and radiation dosimetry, although some are technological demonstrations or used for educational purposes and to promote young scientists. Alexander Gerst will also welcome the final ATV – ATV 5 Georges Lemaître (planned launch: 17 June, docking: 22 June, undocking: 15 December 2014), which, among other things, will transport the experimentation system EML, a DLR-ESA cooperation project, to the ISS. Gerst is charged with installing EML and processing the first samples. ATV-5 has also been chosen to transport the MFX/MagVector experiment, which DLR operates with funding from the German Federal Ministry of Economics and Technology (BMWi), to the ISS. Alexander Gerst will also install this equipment and then start and monitor the experiment.

MASCOT – setting off for asteroid 1999 JU 3

The Japanese orbiter Hayabusa 2 will set off on its space mission in December 2014 – taking along the lander MASCOT (Mobile Asteroid Surface Scout), scheduled to touch down on asteroid 1999 JU 3 where it will deploy its four instruments to conduct measurements at several locations. The lander will 'hop' across the asteroid surface with the help of a flywheel. In this mission, DLR will cooperate with the Japanese space agency JAXA and will therefore strengthen its cooperation with international partners. DLR developed the lander with the French and Japanese space agencies, CNES and JAXA. Among the instruments, DLR has contributed a wide-angle camera and a radiometer. The engineers subjected MASCOT to a gruelling series of tests in preparation for its mission. Among other things, the release mechanism of the landing craft was put through its paces in the zero gravity environment of a drop tower, and its structure was analysed in vibration and thermal tests. Delivery of the lander to the Japanese space agency is scheduled for spring 2014, following completion of the final tests. The DLR Microgravity User Support Center (MUSC) will monitor the landing craft during its mission.

Aeronautics

Alternative fuels – NASA and DLR plan joint research flights

Environment friendly and sustainable fuels for aviation; to achieve this goal, DLR researchers at the Institutes of Combustion Technology, Atmospheric Physics and Propulsion Technology are working on synthetic alternatives to the conventional aviation fuel kerosene. Coming together within IFAR, the International Forum of Aviation Research, the US space agency NASA and DLR are planning their first joint research flights to investigate alternative fuels. Setting off from Edwards Air Force Base in California for a two-week flight campaign in May 2014, the scientists intend to test how engines operate with various biofuel compositions. Renewable resources are suitable for the production of alternative fuels and emit lower levels of carbon dioxide into the atmosphere. Their combustion releases fewer soot particles and less sulphur. The DLR contribution to this German-American project is research aircraft Falcon, designed to measure changes in emissions and contrail properties when using alternative fuels in-flight. NASA is modifying a DC-8 to enable one of the four engines to burn alternative, synthetic fuels during flight tests. The coming years are likely to see additional cooperation with NASA in the field of alternative fuels as part of the new DLR project ECLIF (Emissions and Climate Impact of Alternative Fuels).

DLR establishes technical committee on aircraft noise

As Germany's pre-eminent aviation research facility, DLR focuses intensely on a wide variety of questions relating to aircraft noise, and in this capacity is much in demand among industrial, political and administrative representatives, those affected by noise and environmental associations. Researching aircraft noise is a very interdisciplinary field that requires expertise in a range of subjects such as physics, engineering, medicine, psychology and traffic sciences. DLR is already the guiding light in researching aircraft noise, as it pursues this topic across all relevant disciplines, merging them within a uniform framework. DLR plans to boost its research activities in the field of aircraft noise, to create stronger networks and to tackle questions that remain unanswered. To do this, DLR has now created the Technical Committee for Aircraft Noise. "We are faced with questions that require greater focus and tighter interaction to calculate aircraft noise, the effects of aircraft noise, the sources of aircraft noise, aircraft configurations, and for developing flight procedures to optimise aircraft noise. This is where the committee will contribute to the research programme on aircraft noise," says Ullrich Isermann, Chairman of the Committee. "This is an important step towards treating the problem of aircraft noise efficiently and in a multidisciplinary capacity."

Test facility for next generation turbines

First-rate, high performance test facilities are needed for research and development of innovative engine technology; the aviation industry has an urgent need for suitable facilities. DLR is currently constructing a test facility for the next generation of turbines at its Göttingen site – NG-Turb (Next Generation Turbine). Among other things, scientists will use this globally unique facility to analyse newly developed turbine blades, cooling systems and materials. From engines for small business aircraft to the turbines found on the wide-bodied A380, the test stand will have the capacity to examine aircraft turbines in their original size and under realistic atmospheric conditions and Mach numbers. DLR joined with industry to analyse future focuses of turbine research to ensure that the layout of the facility meets client requirements. The turbine test facility is scheduled to open in spring 2014.

Energy

Boosting wind power through improved rotors and rotor blades

Wind energy is increasingly becoming an important mainstay in electricity supply. Tapping into their expertise from the world of aviation, DLR scientists have launched a large number of research projects on the topics of rotors and rotor blades since 2012, and have succeeded in raising project funds, so-called external funding, of over 20 million Euro. One of the projects that DLR will launch in 2014 goes by the name of WindMUSE. It will use computer simulation to look at innovative wind power systems and their behaviour, for instance under a variety of weather conditions. Researchers use this kind of simulation program to calculate the influence of various parameters within the systems and to prevent having to construct elaborate and expensive test facilities, especially in the early stages of development. Furthermore, DLR plans to continue expanding its test infrastructure designed for wind power research. In this field, DLR cooperates with Fraunhofer IWES and ForWind within an association for wind power research.

Hydrogen from wind and solar energy

On windy days, wind and solar power systems generate more electricity than the grid needs. Power to Gas systems can store the surplus electricity in the form of hydrogen. But wind and solar power facilities of this kind pose new challenges for electrolysis systems; they need to be up and running quickly when the wind picks up and throttled back when the electricity is needed in the grid. In this field, DLR is conducting research on Proton Exchange Membrane (PEM) electrolyzers that are able to reach full load operation inside of minutes. The PEM systems use same amount of energy to yield roughly 20 percent more hydrogen than current electrolyzers. One benefit of this kind of hydrogen production is that it can power fuel cell automobiles and therefore permit carbon-neutral driving. For this purpose, a test stand with a capacity of 50 kilowatts will be built in Stuttgart. Under realistic conditions, the researchers investigate the degradation of the materials and work on a longer shelf life. The researchers accompany these studies by computerised model simulations, which allows them to extrapolate their results for larger systems and a longer operating time. In its research, DLR is also supporting E.ON Hanse with the establishment of a Power to Gas system in Hamburg. The first megawatt PEM system will start operations here at the end of 2014, introducing natural gas into the municipal natural gas system.

Transport

Through town, stress-free – driver assistance systems and traffic management

Driver assistance systems can make travelling by car less stressful, more predictable and safer. These systems are taking charge of an increasing number of tasks, providing drivers with important additional information. Traffic in urban areas is particularly complex, and intelligent traffic management can ease the strain on infrastructure in these localities – for instance by communicating with the vehicle at traffic lights – and hence improve traffic flow. DLR traffic researchers are working on designing this kind of cooperative driver assistance systems to enable road users to communicate with each other and the infrastructure and therefore to boost cooperation between all participants. From 2014 on, the large-scale research facility 'Application Platform Intelligent Mobility' (AIM) will provide a real test environment in the city of Braunschweig. Deploying sensor systems for traffic observation, special test routes, simulations and intervention facilities, the platform will enable analysis of the traffic situation in Braunschweig and the testing of new technologies. The associated project UR:BAN also focuses on researching driver assistance and traffic management in urban areas. Thirty-one partners from the automobile and supply industries, electronics, communication and software companies, universities and research institutes will come together at DLR Braunschweig to present the current findings of their research on 14 May 2014.

500 electric vehicles in daily use – DLR analyses user behaviour

DLR is the central research partner within the InitiativE-BB project centred in Berlin-Brandenburg and intended to analyse how 500 publicly subsidised electric vehicles are used. Scientists at the DLR Institute of Traffic Research focus on how the electric vehicles are used, what the drivers experience and which attitudes prevail. Additionally, the researchers continuously log technical parameters in 200 of these vehicles. Among other things, the aim of the project is to enable a prognosis on the future spread of electric vehicles in Germany and, from this, the possible environmental impacts. DLR also uses data acquired from the InitiativE-BW project in Baden-Württemberg to analyse regional differences. Launched in January 2014, the project is set to run for three years. In 'PluG-inn', another project on the topic of electric mobility, DLR traffic researchers are developing a concept for how charging stations for electric vehicles should be deployed regionally in order to meet the user's needs.

DLR analyses mobility behaviour and environmental impact and will present the results

DLR traffic researchers are intent on understanding current and future mobility behaviour, and so they ask how people's behaviour impacts the transport system. What changes do new technologies, trends and political policies bring? They also question the consequences of traffic noise and exhaust gases for human beings and the environment. One of the aspects that DLR researchers analysed in the VEU project (traffic development and the environment) was the noise generated along busy roads, rail tracks and waterways, tracing the repercussions from where the sound emerged to its impact on residents. They analysed in medical studies the extent to which traffic noise leads to sleep disorders and consequences for our health. Topography, wind and weather are important factors in how sound spreads and although they are fundamental and important processes for planning effective noise and environmental

protection measures, they have found insufficient consideration in the analysis methods available to date. DLR researchers will present the results of their research project VEU project (traffic development and the environment) at DLR in Cologne on 26 February 2014.

Security

Safe society – preventing crime

Each year in Germany, burglaries and the constant rise in this form of crime cause damage extending to approximately 500 million euros. The police have only limited resources for prevention and investigation. Prompted by an alarming rise in organised criminality involving car theft in the region, the Braunschweig Police Directorate joined with the DLR Institute of Air Transport and Airport Research to cooperate in developing software designed to optimise patrols (TAG – patrol deployment generator). The software permits efficient allocation of patrols to areas under threat, while minimising resource drain. Several police stations in the Braunschweig region plan to start testing this patrol service in the first half of 2014.

Maritime security – monitoring shipping lanes from space

The small research satellite AISat, developed and built at the Institute of Space Systems in Bremen, is scheduled for launch into space from the Satish Dhawan Space Center in spring 2014. This will make AISat the first international satellite to enable monitoring of global ship movements using the Automatic Identification System (AIS). This is a true premiere, as deployment of a so-called high-gain helix antenna will permit reception of signals from maritime distress beacons (AIS-SART) in addition to Class-A and Class-B signals from commercial and non-commercial ships. One of the purposes behind this research work is to develop the capacity to use satellite-assisted AIS reception even in busy shipping lanes and hence to make an important contribution to ship route optimisation and providing safety along these shipping lanes.

Research centre for satellite-assisted real-time services and new communication and navigation systems in shipping

Hot on the heels of launching research work within the project 'R&D for maritime security and suitable real-time services' in 2012, DLR plans to officially inaugurate the second research centre focusing on this topic in March 2014. Around 15 scientists from the German Remote Sensing Data Center and the DLR Institute of Communications and Navigation are conducting relevant research at the Neustrelitz site. The main focus will lie on improvements in using satellite data to track ships, icebergs and oil slicks on the high seas and in coastal waters and on passing on this information to ships and authorities responsible for safety in shipping lanes. Industry insiders speak of satellite-assisted real-time services, as mere minutes pass between recording, analysis and transmission of the satellite data. The second focus is on developing state-of-the-art and extremely precise, failsafe communication and navigation systems for international shipping.

Contacts

Andreas Schütz
German Aerospace Center (DLR)
Corporate Communications, Spokesman
Tel.: +49 2203 601-2474
Fax: +49 2203 601-3249
andreas.schuetz@dlr.de

Dorothee Bürkle
German Aerospace Center (DLR)
Media Relations, Energy and Transport Research
Tel.: +49 2203 601-3492
Fax: +49 2203 601-3249
Dorothee.Buerkle@dlr.de

DLR Falcon research aircraft



In May 2014, the DLR Falcon research aircraft will take part in joint flight trials with NASA. It is planned that emissions and changes to condensation trails during the use of alternative fuels will be measured.

Credit: DLR (CC-BY 3.0).

The European Rosetta spacecraft



A total of 11 instruments on the spacecraft 'Rosetta' and 10 experiments on the lander 'Philae', including several involving DLR, will gather data during the first close encounter with a comet.

Credit: ESA.

Philae landing on the comet



In 2014, the Philae lander on board the European Rosetta spacecraft will reach comet 67P/Churyumov-Gerasimenko. The goal of this first landing on a comet is to learn more about the formation of the Solar System.

Credit: DLR (CC-BY 3.0).

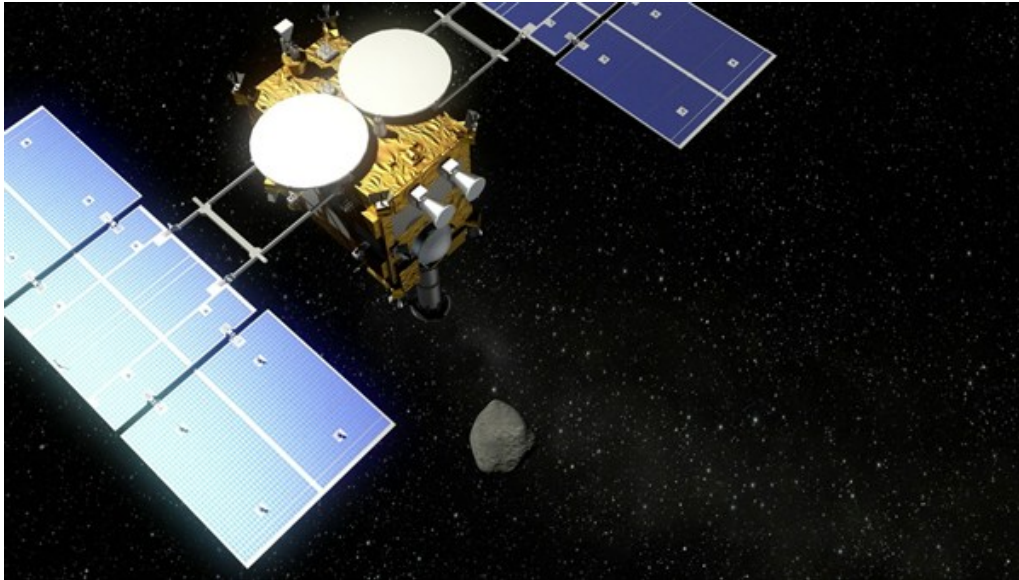
Alexander Gerst during training in Star City near Moscow



The training of German ESA astronaut Alexander Gerst includes instruction in the use of special spacesuits. The image shows Gerst trying on the Russian Sokol space suit that he will wear during his six-hour flight to the ISS in a Soyuz spacecraft.

Credit: ESA.

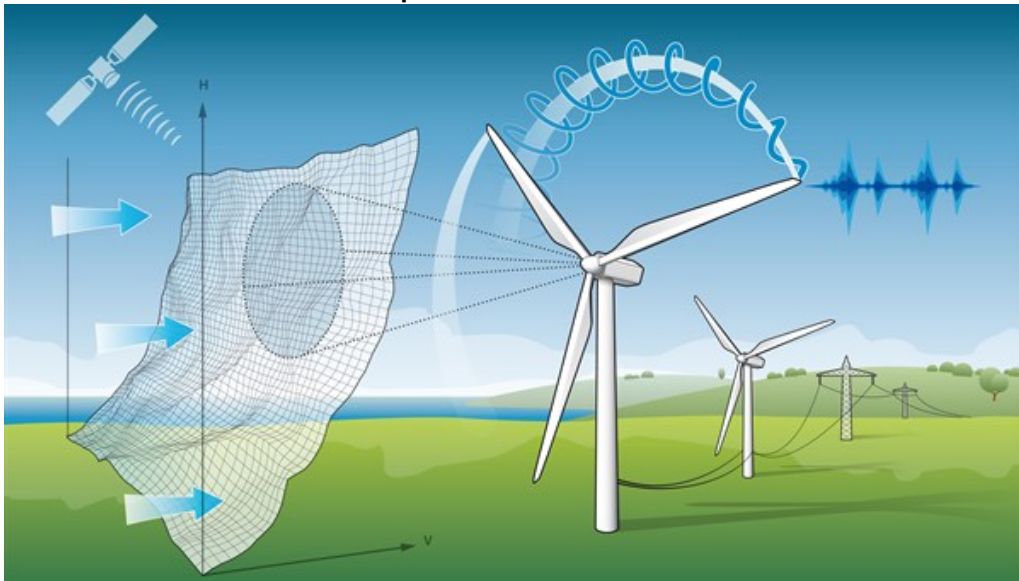
Reconnaissance mission to an asteroid



The Japanese Hayabusa 2 spacecraft will launch in 2014 to visit the asteroid 1999 JU 3. On board will be the German Aerospace Center (DLR) developed MASCOT (Mobile Asteroid Surface Scout), which will land on the asteroid and perform measurements with its four instruments.

Credit: DLR (CC-BY 3.0).

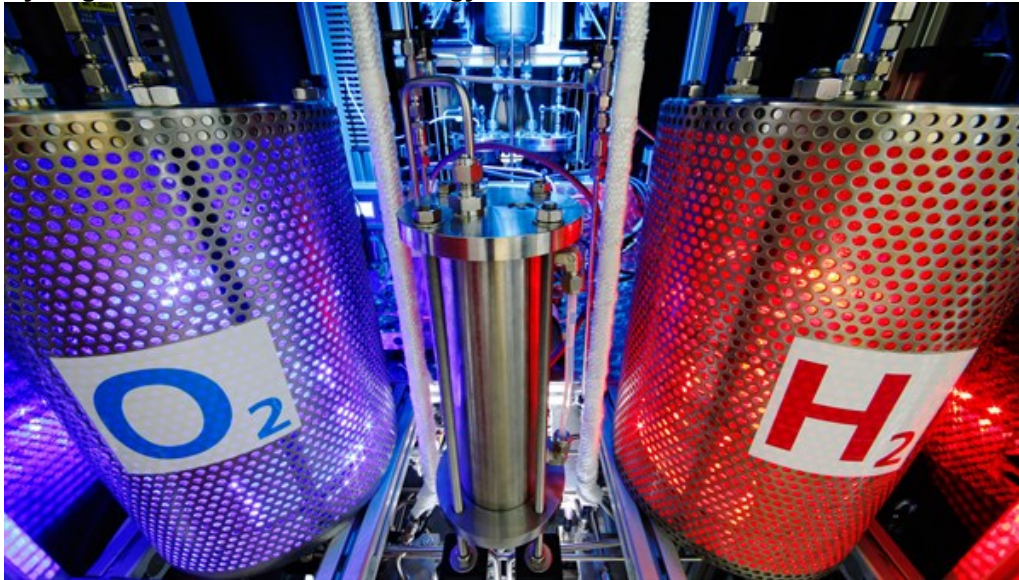
Quieter wind turbines and the optimisation of rotor blades



The Lower Saxony Ministry of Science and Culture is promoting the development of a research wind farm in Lower Saxony at the German Aerospace Center (DLR) with 10 million euros. DLR scientists want to develop quieter wind turbines and optimise rotor blade designs. In addition, precise wind forecasts using satellite data and lidar measurements will allow better system control.

Credit: DLR (CC-BY 3.0).

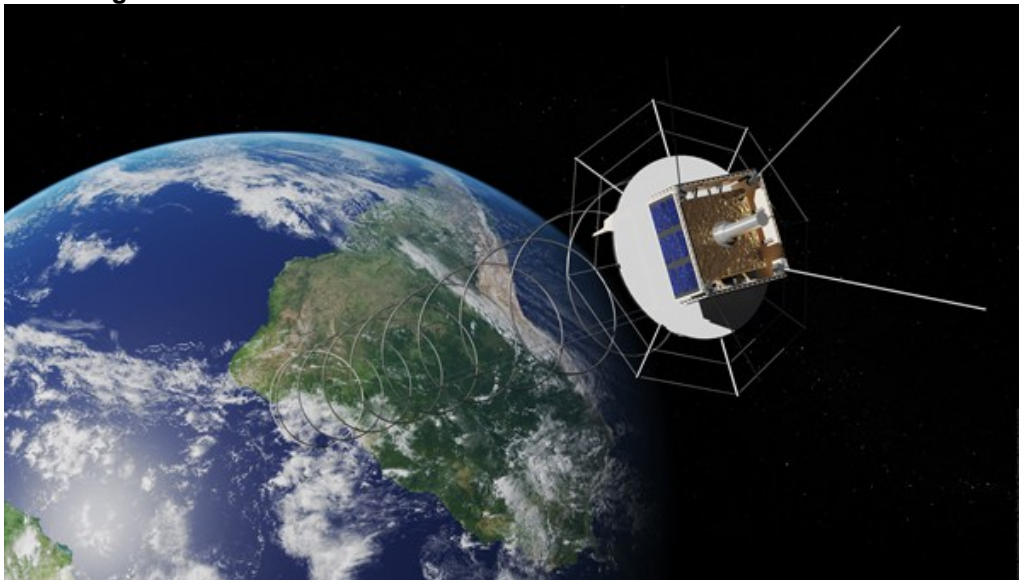
Hydrogen from wind and solar energy



Proton Exchange Membrane (PEM) electrolyzers can go from start-up to full load operation within minutes and thus adapt to the fluctuating supply of wind and solar power.

Credit: DLR/Ernsting.

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).

Contact details for image and video enquiries as well as information regarding DLR's terms of use can be found on the DLR portal imprint.