German Aerospace Center

Knowledge for tomorrow – DLR at the Moscow Aerospace Show MAKS 2011

15 August 2011

The Moscow Aviation and Space Salon, MAKS 2011, takes place in Zhukovsky, south of Moscow, between 16 and 21 August 2011. The German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) is once again represented at Russia's national aerospace show this year. In a joint 100-square-metre German stand, DLR is presenting, among other things, research on quieter and more environment friendly air travel alongside re-entry and satellite technologies. "DLR and Russia are joined by a long-standing and successful partnership in aerospace research," explains Johann-Dietrich Wörner, Chairman of the DLR Executive Board. "We are happy to be at MAKS again and, for example, to be presenting the technology test carrier (Technologie-Erprobungsträger; TET). TET is scheduled to be launched from Baikonur on a Russian Soyuz rocket. This is just one example of the excellent collaboration between DLR and Russia."

DLR is presenting the following exhibits at the Moscow Aviation and Space Salon:

The Earth in three dimensions – the TanDEM-X mission

The TanDEM-X mission (TerraSAR-X add-on for Digital Elevation Measurement) is based on two almost identical Earth observation satellites, TerraSAR-X and TanDEM-X, both equipped with a modern high-performance synthetic aperture radar system. This makes it possible to observe the Earth regardless of the availability of daylight or the presence of cloud cover. TerraSAR-X was launched back in 2007 and TanDEM-X followed on 21 June 2010. The two satellites are orbiting in close formation – separated by only a few hundred metres – and will do so for three years at an altitude of 514 kilometres. During this period, the two satellites will generate a high-resolution Digital Elevation Model (DEM) of the entire land surface of the Earth. Funded by the German Federal Ministry of Economics and Technology (Bundesministerium für Wirtschaft und Technologie; BMWi), TanDEM-X is a PPP project conducted jointly by DLR and Astrium GmbH. The TanDEM-X project is a logical follow-up to national and international radar missions like X-SAR and SRTM and the successful execution of the national project TerraSAR-X. DLR is responsible for the project and mission management, the ground segment, the operation of the satellites and the project's scientific coordination.

The exhibit displays three application examples for the German radar satellites TerraSAR-X and TanDEM-X: for crisis management, the millimetre-precise measurement of land movements and the creation of a high-precision global terrain model. The model also illustrates land use mapping with the help of optical Earth observation sensors.

Re-entry technology: the EXPERT nose cap

With its development of the fibre ceramic nose cap for ESA's EXPERT space capsule, DLR has, once again, demonstrated its leading European position in re-entry technology. The cap passed all the tests at ESA and is now being prepared for launch. It is manufactured from ceramic materials which, in comparison with metals, are much more heat resistant, extremely light and dimensionally stable, even at high temperatures. This is particularly important during re-entry into Earth's atmosphere, as the heat load is at its greatest at the stagnation point of a re-entry capsule. The temperatures on the nose cap can reach up to 2100 degrees Celsius. Important instruments for taking measurements during re-entry are primarily integrated into the nose of the spacecraft. EXPERT is scheduled to be launched on a Russian Volna launch vehicle in the spring of 2012.

Technology testbed vehicle TET

The TET satellites are a core element of DLR's On Orbit Verification (OOV) programme. The engineers have developed a first satellite in the 150-kilogram class, using a satellite bus based on DLR's BIRD (Bi-spectral InfraRed Detection) satellites. TET-1 will be used to test new technologies in space. In this way, the satellites bridge the gap between testing on the ground and use in space. For this mission DLR has selected 11 payloads. These payloads are developed, in turn, by 11 different firms and institutions and contain the latest technologies; their use in space is being tested in the TET-1 mission. The areas of technology cover the next generation of solar cells, navigation instruments, batteries, cameras, communications equipment, a satellite drive system and computer hardware. TET-1 will operate in low-Earth orbit at an altitude of 520 kilometres. The mission is scheduled to be launched in September 2011.

DLR Low Noise Aircraft

Research into concepts and technologies for environment friendly aircraft is one of DLR's major activities. For example, innovative engines equipped with large, contra-rotating open twin propellers (Contra Rotating Open Rotor; CROR) promise to reduce fuel consumption considerably. What is more, laminar wing aerofoils allow for the reduction of friction drag. Optimising the arrangement of wings, tail assembly and engines may attenuate the noise generated by airplanes flying overhead by obstructing the spread of sound downward (shielding effect). Optimising the flight paths of arriving and departing aircraft may further reduce noise over sensitive areas. To evaluate the pros and cons of these concepts and technologies, the entire aircraft must be taken into consideration. It is for this purpose that DLR developed its Low Noise Aircraft concept shown here, aimed primarily at shielding engine noise through a particular arrangement of wings, fuselage, and tail assembly.

Aircraft without leading edge slats – quieter and more environment friendly flying

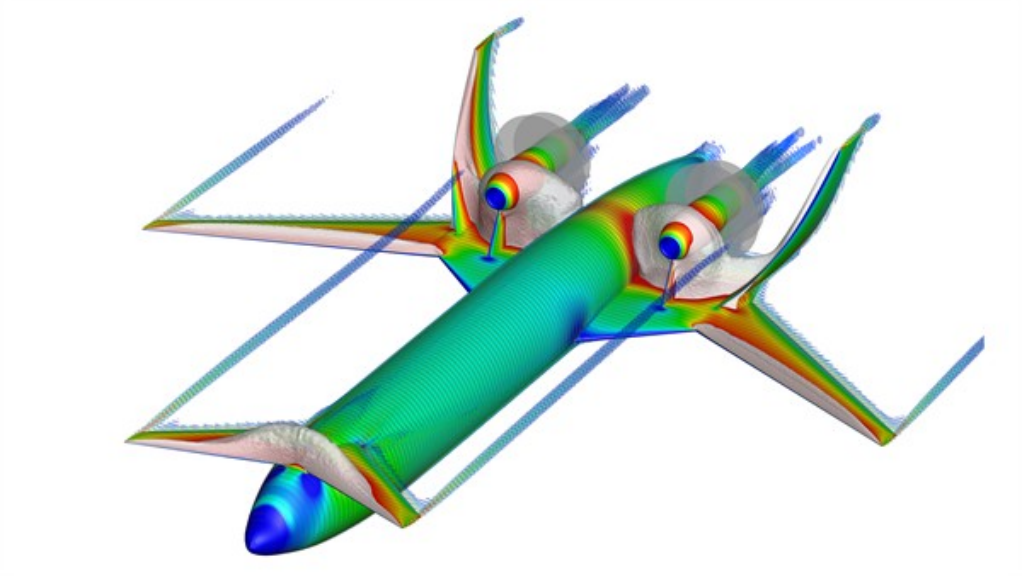
The volume of air traffic grows by five to six per cent every year. In order to make air travel quieter and more environment friendly, researchers at DLR, together with their partners Airbus, EADS Innovation Works and CASSADIAN Air Systems, have been conducting research on reducing the air resistance of aircraft and have developed an alternative to the conventional wing slat. A variable-form wing leading edge, making the slat superfluous, is to be used as an innovative high-lift system. As there is no slat in the 'Droop Nose' (variable-form wing leading edge), there is no gap between the wing and the slat when landing. As a result, air is prevented from flowing from the lower to the upper surface and the noise level is reduced. The extremely smooth surface of the wing also ensures that the airflow over it is as laminar (smooth) as possible, so the air resistance is reduced. The material tests have been completed and the new wing leading edge is currently being further developed to meet industrial requirements such as lightning protection, de-icing and resistance to bird strikes.

Contacts

Andreas Schütz
German Aerospace Center (DLR)
Corporate Communications, Spokesman
Tel.: +49 171 3126-466
Andreas.Schuetz@dlr.de

Lena Fuhrmann
German Aerospace Center (DLR)
Corporate Communications, Editor, Aeronautics Research
Tel.: +49 2203 601-3881
Fax: +49 2203 601-3249
Lena.Fuhrmann@dlr.de

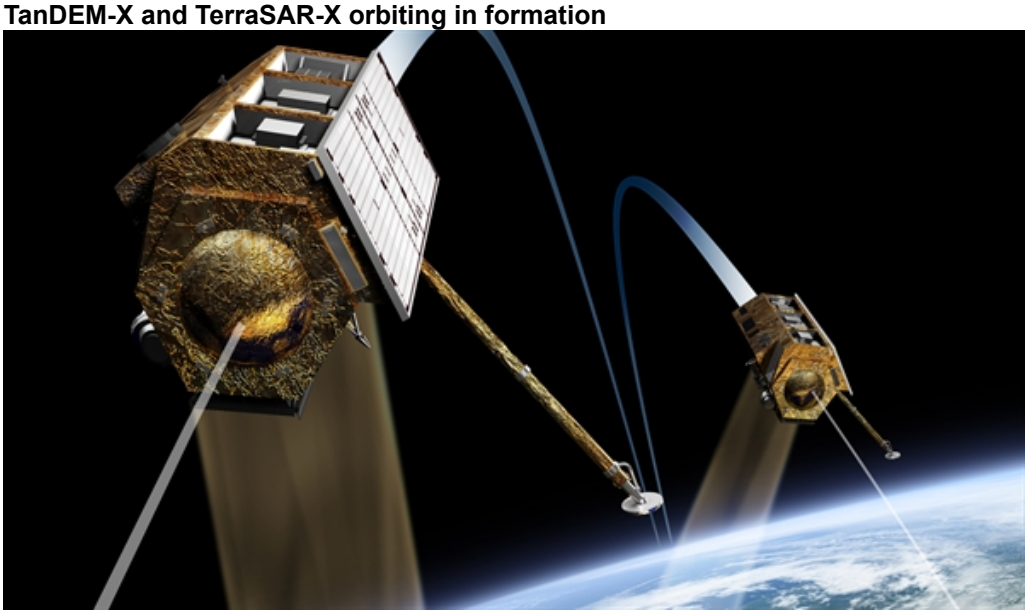
DLR Low Noise Aircraft



Local flow velocity, turbulence and supersonic regions around the DLR-LNA during cruising flight.

Credit: DLR (CC-BY 3.0).

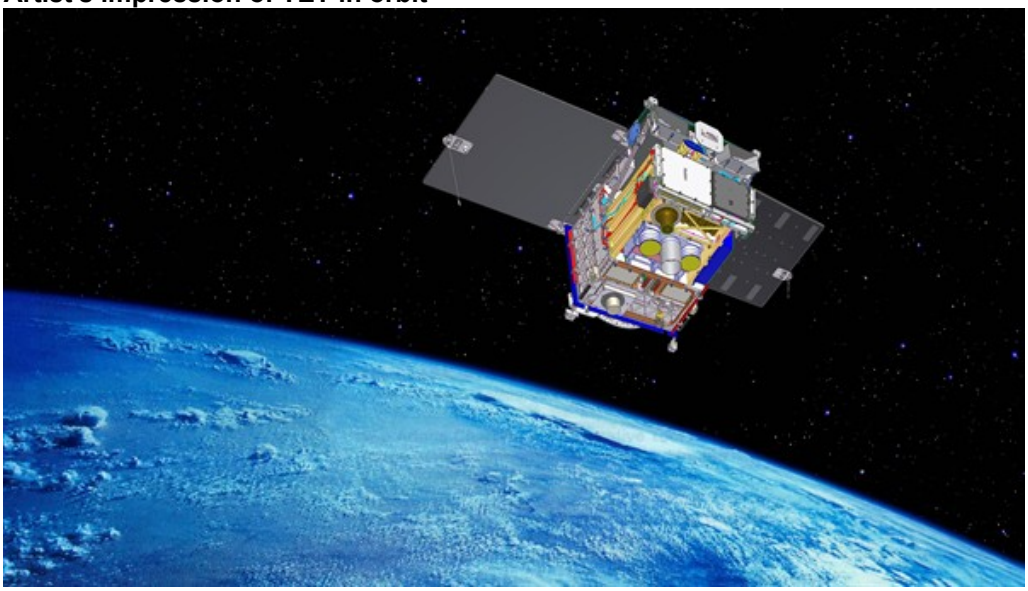
TanDEM-X and TerraSAR-X orbiting in formation



TanDEM-X and TerraSAR-X orbit in formation to acquire data for a highly accurate global digital elevation model.

Credit: DLR.

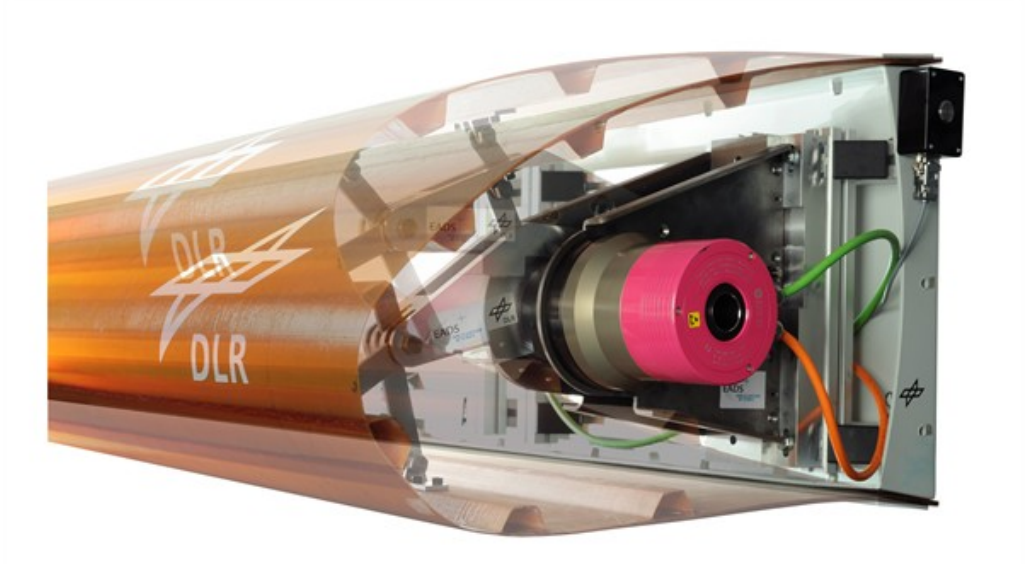
Artist's impression of TET in orbit



The TET-1 satellite is 58 centimetres wide, 67 centimetres long and 88 centimetres high. TET-1 is the first German microsatellite to demonstrate the viability of technologies in space and is based on the DLR BIRD (Bispectral InfraRed Detection) satellite launched in 2001.

Credit: Kayser-Threde.

The 'Smart Droop Nose'



Structural design with morphing – an enabling technology for lower emissions and reduced noise.

Credit: DLR (CC-BY 3.0).

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