DLR at the Paris Air Show 2013 in Le Bourget

17 June 2013

Future developments in space travel and aviation are the main reasons why the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) is attending the Paris Air Show in Le Bourget. From 17 - 23 June 2013 DLR will be present with 12 exhibits on a stand shared with the German Aerospace Industries Association (Bundesverband der Deutschen Luft- und Raumfahrtindustrie e.V; BDLI). DLR is exhibiting the largest member of its research fleet, the A320 D-ATRA (Advanced Technology Research Aircraft), in the static display at the exhibition. This is the third time that DLR has an exhibit at the Paris Air Show.

Earth in three dimensions

The TanDEM-X mission (TerraSAR-X add-on for Digital Elevation Measurement) is based on two practically identical earth observation satellites: TerraSAR-X and TanDEM-X. They are both equipped with Synthetic Aperture Radar (SAR) systems, a modern system allowing for Earth observation regardless of day or night and cloud cover. Terra-SAR-X was launched in 2007 and TanDEM-X followed in June 2010. Since then, the two satellites have been flying in formation, just a few hundred metres apart, for three years in their orbit, 514 kilometres above Earth. During this time they have been compiling a high-resolution 3D elevation model of the whole of Earth's surface. The satellite images are being projected on a three-dimensional ground relief on the DLR stand.

Capturing damaged satellites in space

The number of satellites in space is increasing; this means the risk of collisions is rising as well. The Deutsche Orbitale Servicing Mission (DEOS) will capture a tumbling, non-cooperative satellite by means of a manipulator system accommodated on a servicing satellite and will subsequently dispose of the satellite combination. This is done via a targeted ‘shot’ into a previously determined re-entry corridor, where both satellites burn up. In addition to inspection and maintenance, a system like this will be used, in particular, to remove space debris and even prevent it in the first place. In future, satellites will be disposed of in a controlled fashion at the end of their useful life.

German astronauts in space

At the stand, DLR is showing visitors a presentation that gives an overview of German astronauts. The individual missions are remembered with impressive pictures. The presentation finalises with Alexander Gerst, who will be flying on a long-duration mission to the International Space Station (ISS) from May to November 2014. He is to accompany expeditions 40 and 41 as flight engineer. Currently his special training for the mission is taking place in Houston, Moscow, Cologne, Montreal and Tokyo. In space, he will primarily conduct experiments in the European Columbus research laboratory, Columbus.

The Red Planet in 3D

The first all-European planetary mission, Mars Express, has been orbiting the Red Planet since 2003. It has already orbited Earth's closest neighbour more than 11,000 times. On board is the HRSC (High Resolution Stereo Camera). This special camera, manufactured in Germany and operated by DLR, is the first camera system to systematically acquire imaged of a planet in high resolution, in colour and in 3D. By 2014, a topographical image atlas of Mars will have been created with the pictures acquired with the HRSC. The HRSC and six other experiments on board Mars Express provide fundamental knowledge about the geological development and climatic history of Mars.

Spacecraft to investigate a comet

One of the most fascinating projects in space research is the European Space Agency's Rosetta mission, in which the spacecraft will fly to a comet, accompany it on its orbit and investigate it. The culmination of the mission is the landing of a small, autonomous daughter craft, Philae, on the Churyumov-Gerasimenko comet. The mission was launched on 2 March 2004. The probe is scheduled to land in November 2014. Philae was developed and built by an international consortium headed by the DLR. The mission will help us to learn more about the origin and development of our Solar System, and thus, even about our own evolutionary history.

Mobile asteroid lander

MASCOT (Mobile Asteroid Surface Scout) is an asteroid lander that is being developed at DLR under the direction of the Institute for Space Systems in Bremen. It will be launched on board the Japanese Hayabusa 2 spacecraft in 2014, and will reach the asteroid 1999JU3 in 2018, after a four-year journey. Upon arrival, MASCOT will investigate the characteristics of the closest asteroid to Earth on the spot using several scientific instruments. To do this, MASCOT must go to specific positions on the asteroid, and take measurements in several places. These tasks will be performed by a mobility system that is being developed at DLR's Robotics and Mechatronics Centre in Oberpfaffenhofen.

MERLIN: French-German climate mission

Under the direction of DLR and the CNES, industry and science are working on the MERLIN (MEthane Remote sensing LIdar missioN) satellite mission to investigate the levels of methane in Earth's atmosphere. The mission will make an important contribution to climate change research from 2016 onwards. Germany is developing and building an Integrated Path Differential Absorption LIDAR (Light Detection And Ranging) system based on state-of-the-art laser technology. By sending impulses at two wavelengths, the measuring device determines the content of the greenhouse gas, methane, on its path between the satellite and the ground.

Positive effect of negative sweep

By 2020 aeroplanes should be 50 percent more fuel-efficient. With LamAiR (Laminar Aircraft Research) project, DLR has developed a passenger aircraft configuration with the wings swept forwards, which may help to achieve this aim. This forward sweep will enable a mainly laminar, i.e. low turbulence airflow around the wings, which will lead to a significant reduction in air resistance. A wind tunnel measurement campaign was carried out with a scaled model as part of the NumEx project to determine the dynamic flight characteristics of such an aircraft configuration.

Tail fin with boundary layer suction

An aeroplane is faced with air resistance when landing. The DLR Institute of Aerodynamics and Flow Technology and the DLR Institute of Structures and Design also demonstrate how this can be reduced in the LamAIR project: air is sucked through a micro perforation with holes with a diameter of no more than 50 microns in the outer skin of the rudder. This significantly reduces turbulence. By extending this concept to the whole aircraft, the total air resistance can be reduced by 15 percent. The associated reduction in fuel consumption results in a reduction in operating costs and ensures compliance with stricter emission regulations. A model on the DLR stand demonstrates how this works.

Landing approaches of the future

In flight tests, DLR has tested a system that will enable satellite-supported precision landings for automatic landings with no visibility for the first time ever. Until now, airport capacity has been restricted to traditional instrument landing systems (ILS), when it is foggy or in the event of blizzards. Three times more flights must be diverted or cancelled in these conditions than when operating with good visibility conditions. The aim of the new system is, therefore, to eliminate these restrictions to a large extent. To do this, for the first time in 2009, the DLR Institute for Communication and Navigation set up a ground control station at the Braunschweig-Wolfsburg Airport, based on what is called a Ground Based Augmentation System (GBAS). The experimental system analyses signals received from satellites, and provides correction values for the aircraft.

Aircraft of the future

What will aircraft of the future look like? Scientists at DLR are also looking into this question. One possible version is what is called a Blended Wing Body (BWB), which is an aircraft with a fuselage that merges seamlessly into the wing. These aircraft should have more space for passengers, be lighter and consume less fuel. DLR scientists have integrated the fuselage and the cabin design on the computer for the first time, and created a theoretical basis for the extended integrated aircraft design

Alternative fuels for aviation

Fuels based on natural gas (Gas-to-Liquid, GtL) or biomass (Biomass-to-Liquid, BtL) will become increasingly important in future as a result of scarcer stocks and the higher costs of traditional kerosene. Such synthetic fuels also offer the opportunity to optimise their combustion properties and pollutant formation regardless of fuel by specific interventions into their composition. At Le Bourget, DLR is demonstrating two flames, one with traditional kerosene and one with GtL-based fuel. One thing that it is good to note is the different tendencies of the two fuels to form soot: the GtL fuel demonstrated forms much less soot due to the significantly lower number of aromatic carbon dioxides.

ATRA, DLR's research aircraft

DLR is exhibiting the A320 D-ATRA research aircraft in the static display at the Paris Air Show. ATRA is the largest member of the fleet and has been in operation for DLR since the end of 2008. The aircraft has been and will be extensively modified for use as a research and test aircraft. The focus of the research conducted is, amongst other things, testing aeroelastic-measuring processes, investigating inner space acoustics, measuring airflow noise, measuring turbulence (laminisation) on the wings and on the fins, and measuring wake turbulence. This is air turbulence caused by the uplift exerted on the wingsehen.

Contacts

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

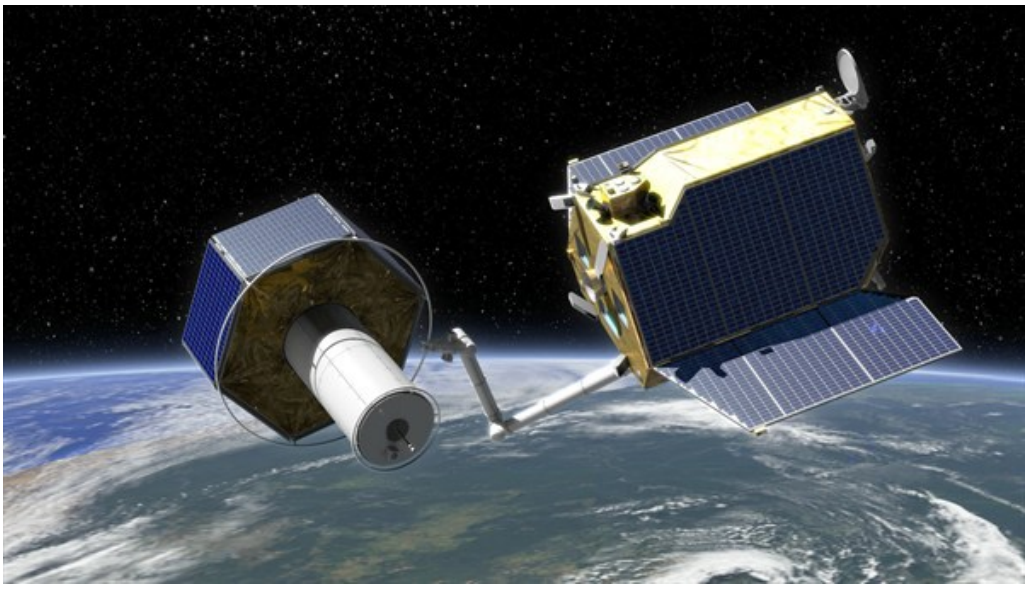
Manuela Braun
German Aerospace Center (DLR)
Media Relations, Space Research
Tel.: +49 2203 601-3882
Fax: +49 2203 601-3249
Manuela.Braun@dlr.de

DLR research aircraft A320-232 "D-ATRA"

ATRA (Advanced Technologies Research Aircraft) is an indispensable part of German and European aeronautics research. The new research aircraft, equipped with a fuel cell system, will help to research the pressing challenges of the future for a clean and efficient air transport.

Credit: DLR (CC-BY 3.0).

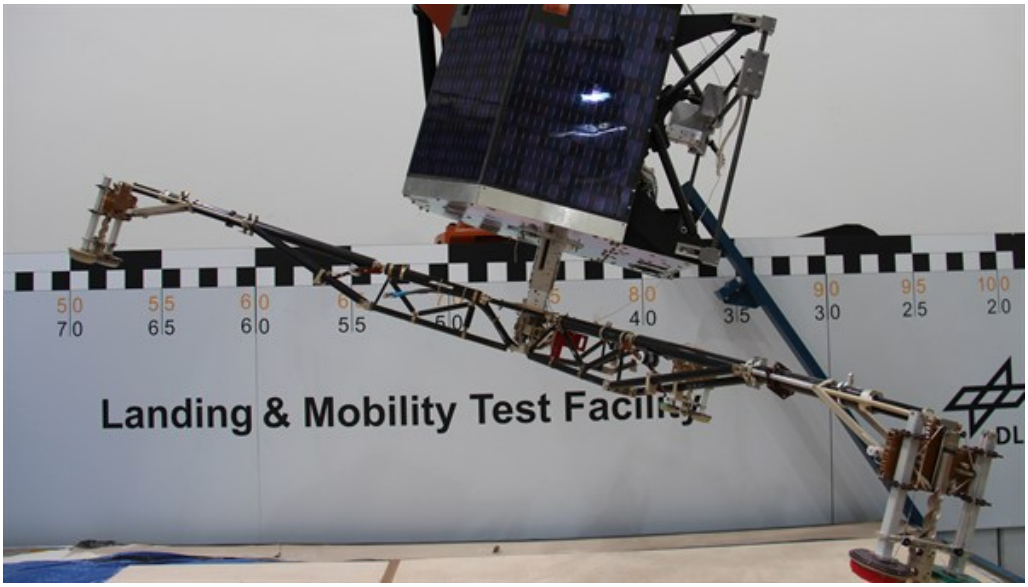
DEOS



Tthe German Aerospace Center (DLR) developed with partners from research and industry the German Orbital Servicing Mission (DEOS), whose launch is planned for the end of 2017 or the beginning of 2018. DEOS will capture a tumbling, non-cooperative satellite by means of a manipulator system accommodated on a servicing satellite and will subsequently dispose of the satellite combination. In future, satellites will be disposed of in a controlled fashion at the end of their useful life.

Credit: Astrium GmbH.

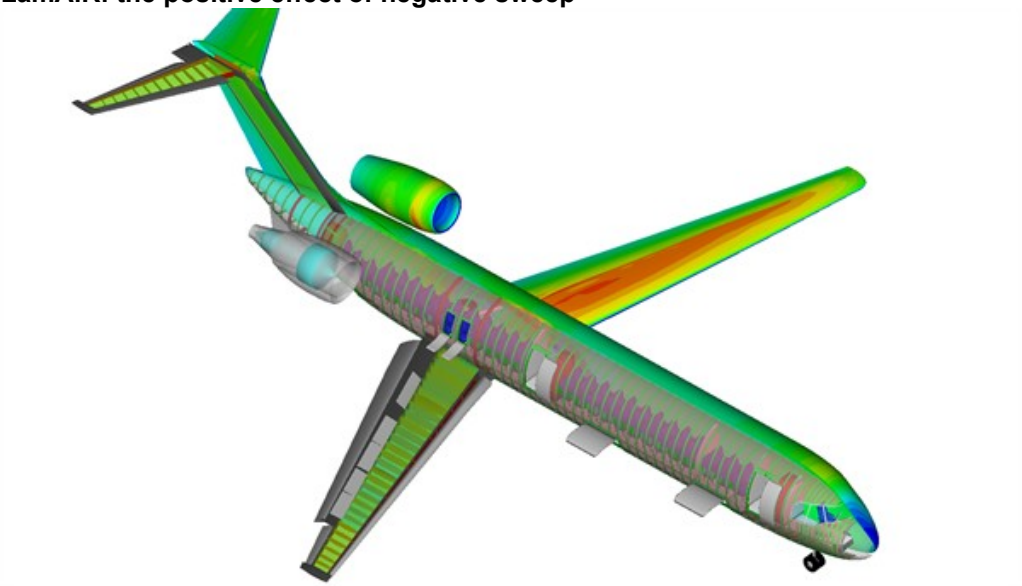
'Philae' comet lander



The refrigerator-sized comet lander Philae, on board Rosetta, will arrive in November 2014 in unknown territory. While the original Philae soars through space en route to comet 67P/ Churyumov-Gerasimenko, DLR engineers are testing models in Bremen and Cologne, to be prepared for the first ever landing on a comet.

Credit: DLR (CC-BY 3.0).

LamAiR: the positive effect of negative sweep



Under the LamAiR project, DLR has developed a passenger plane configuration with a forward-swept wing.

Credit: DLR (CC-BY 3.0).

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