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A mix of a helicopter and a passenger aircraft – DLR studies the aircraft of the future

1 July 2010

The wind tunnel model on the rotor test stand

Taking off from the centre of one town and landing in another without passing through large airports – with tiltrotor aircraft, this is no longer just a dream. This combination of helicopter and airplane can

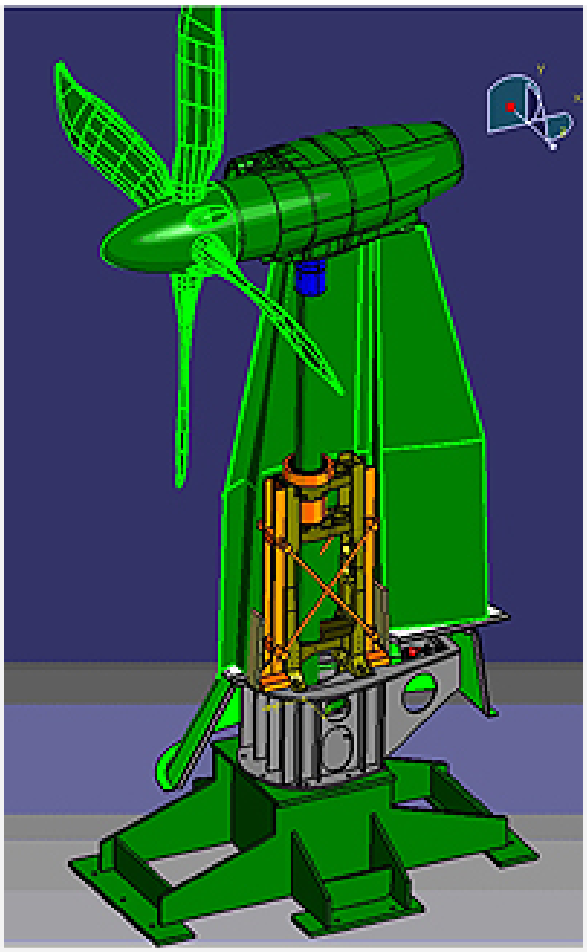
help in handling the continually increasing traffic to airports. The German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) Braunschweig is working on just such an aircraft as part of the EU's Novel Innovative Competitive Effective Tilt Rotor Integrated Project, NICETRIP.

Tiltrotor aircraft can help to relieve the load on airports, since they combine the advantages of helicopters and conventional airplanes. They take off vertically, so that they can be operated from nearly all helipads. Then, at a certain altitude, the rotors tilt and the aircraft flies in the relatively inexpensive manner of a normal airplane. This gives it an advantage especially for short trips: passengers can fly directly from one city centre to another, quickly and economically.

In order to change its behaviour from that of a helicopter to that of a fixed wing aircraft, it employs tiltable engines at the ends of its flight surfaces. "Just like a helicopter, the engines are directed upwards during take off and landing, so that it flies vertically like a helicopter," explains Hans-Jürgen Langer, project leader and member of the Helicopter Division of the DLR Institute of Flight Systems. "When the pilot has climbed to the right altitude and is ready to switch to high speed flight, he tilts the engines forwards. In this configuration, the aircraft flies like a conventional propeller-powered plane. The engines are then turned upwards again for vertical landing."

DLR Braunschweig takes over the wind tunnel model from NLR

The NICETRIP project is bringing together the technical know-how of the European partners from research and industry in tiltrotor aircraft design, and putting existing mathematical and physical models to the test. Right from the preliminary stages of the project, it was evident that it was essential to build a wind tunnel model in order to research tiltrotor technology. This was the only way researchers could investigate the aerodynamic interactions of the rotor, wing and control surfaces and determine important flight mechanics parameters, such as efficiency and handling or stability.



Computer model of a tiltrotor propeller nacelle

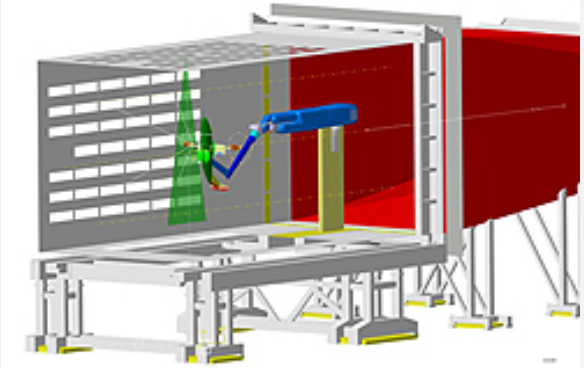
DLR's Dutch partner, the National Aerospace Laboratory (NLR) has contributed a wind tunnel model that is currently being prepared for measurements at the DLR Institute of Flight Systems. Researchers are working on the handover, data processing and control of the model. In other preliminary work, the DLR Institute for Aerodynamics and Flow Technology is computing the predicted behaviour of the model in the tunnel. The results of these calculations will be tested in the wind tunnel.

The DLR Institute of Aeroelasticity, Göttingen, is running vibration tests on the current wind tunnel model of the tiltrotor, in order to ensure its dynamic stability during the trials. The researchers at Göttingen are also investigating the whirl flutter of propeller nacelles, in the context of NICETRIP, using previous wind tunnel tests. This is especially critical for tiltrotor configurations.

Models as precursors of prototypes

In order to create the most realistic conditions in the wind tunnel, the model is equipped with a fully operational engine. The control parameters and surfaces can thus be set as they would be in actual operating conditions, in order to deliver the most precise measurements.

This is especially important because a first demonstrator of the tiltrotor aircraft is scheduled to be built by the end of the decade, on the basis of these tests. Based on the Enhanced Rotorcraft Innovative Rotorcraft Achievement, ERICA concept, a ten-ton prototype is to be built. Up to 22 passengers should be able to be carried at speeds of up to 650 kph by this aircraft. "That's almost twice as fast as a conventional helicopter. And the aircraft's range should be twice as long," says Langer.



Fast descent configuration

The new aircraft will not be the first tiltrotorcraft ever built. Another aircraft of this type, the Bell-Boeing V22 Osprey, is a military vehicle, in contrast to the intended application of the NICETRIP aircraft. And the BA 609 (Bell-Agusta), a business aircraft for up to six passengers, is currently undergoing through reliability trials.

With its total of 30 project partners from nine countries, DLR is developing the first civil passenger tiltrotor aircraft in the world – a significant step towards the passenger air transport of the future.

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