DLR Airbus A320 ATRA taxis using fuel cell-powered nose wheel for the first time

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DLR and Airbus test electric nose wheel in taxiing test at Hamburg airport

On 30 June 2011, DLR's A320 ATRA (Advanced Technology Research Aircraft) taxied around Hamburg Finkenwerder Airport propelled by an electric nose wheel. In the taxiing tests, researchers and engineers from the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR), Airbus and Lufthansa Technik demonstrated a fuel cell-powered electric nose wheel. When installed in airliners, such nose wheels could significantly reduce noise and emissions at airports.

Up to 19 percent savings in pollutant emissions while on the ground

An airliner fitted with a fuel cell-powered nose wheel can, for example, move from its stand to the end of the runway without emitting pollutants and without using its engines. "This means that up to 17 to 19 percent of the emissions produced in airports can be saved and almost all noise can be eliminated during taxiing," explained project leader Josef Kallo from the DLR Institute of Technical Thermodynamics (Institut für Technische Thermodynamik) in Stuttgart. DLR is still working on detailed models for the calculation of potential savings at airports. "The potential saving at Frankfurt Airport from the use of electrically-driven nose wheels for Airbus A320 class aircraft is about 44 tons of kerosene per day," said Thorsten Mulhouse from the DLR Institute of Flight Guidance (Institut für Flugführung).

The fuel cell system installed on the ATRA for the tests delivers enough electrical power to move the 47-ton aircraft across the apron. To accomplish this, the fuel cell system powers two electric motors that are built into the rims of the aircraft nose wheel. As a direct electrochemical energy converter that generates electricity from hydrogen and oxygen, the fuel cell operates with significantly greater efficiency than an internal combustion engine coupled with a generator. During the tests in Hamburg, the researchers faced a number of technical challenges: "in order to get the airliner moving, a very large torque must be transmitted without making the wheel spin," commented Josef Kallo, regarding the task the engineers had to master in the tests. The drive motor synchronisation required for the nose wheel proved not to be a problem in testing.

Fuel and maintenance savings

Through the use of fuel cells, the time for which the aircraft's main engines are operated can be reduced, and hence the engine maintenance interval can be extended. On short-haul services, with up to seven take offs per day, using an electric drive for ground manoeuvring allows for a reduction in engine operating time of up to two hours per day.

Fuel cells have additional potential use in airliners and thus for reducing pollutant emissions. In another research project, DLR and Airbus are working on replacing the Auxiliary Power Unit (APU) with a fuel cell system. The APU supplies the on-board electrical and compressed air systems – among other things, the air conditioning – when the engines are not running.

DLR has been working under contract to the German Federal Ministry for Economics and Technology (Bundesministerium für Wirtschaft und Technologie; BMWi) on emission-free on-ground propulsion systems for aircraft for about three years. As part of the aeronautical research programme 'LuFo IV', DLR has collaborated with partner Airbus Deutschland GmbH to develop a fuel cell system suitable for aircraft and with Airbus and Lufthansa Technik to develop an electric nose wheel drive for an Airbus A320.

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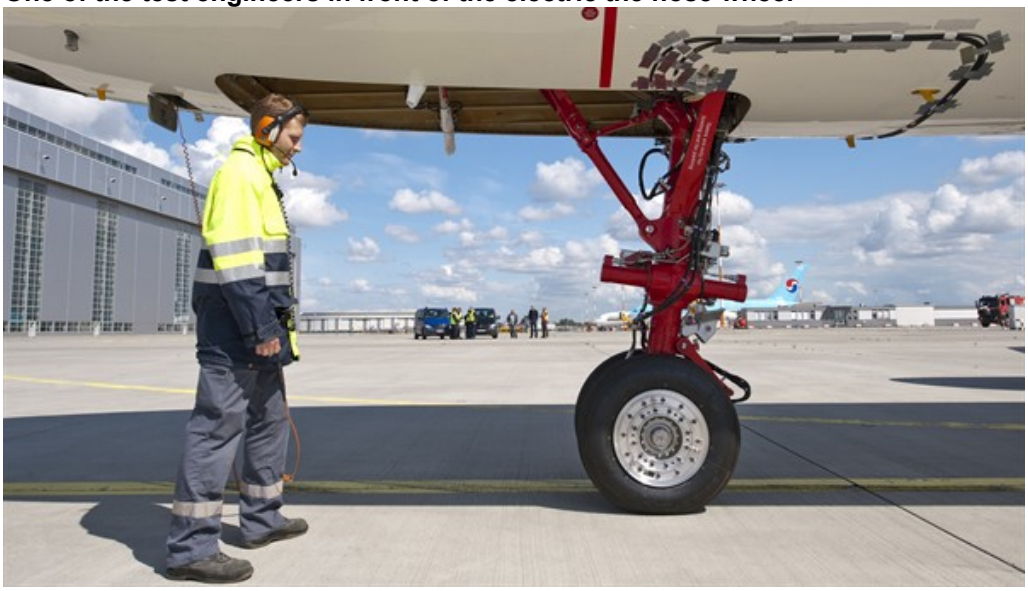
One of the test engineers in front of the electric the nose wheel



One of the test engineers in front of the electric nose wheel just before the testing began.

Credit: Airbus/ C. Brinkmann.

DLR fuel cell system

The DLR fuel cell system installed in the ATRA research aircraft.

Credit: DLR (CC-BY 3.0).

DLR research aircraft ATRA with electric nose wheel

The DLR research aircraft ATRA, equipped with a fuel cell-powered electric nose wheel during testing.

Credit: Airbus/ C. Brinkmann.

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