



## Emission-free airports – DLR develops a fuel cell-powered electric nose wheel for commercial aircraft

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### Ready for testing on the DLR A320 research aircraft

Thanks to a fuel cell-powered electric nose wheel, aircraft will be able to save fuel while significantly reducing airport noise. A quiet and emission-free tarmac will be possible. After three years of development at the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR), the system is now ready for its first rolling tests with the DLR A320 ATRA (Advanced Testing and Research Aircraft).

"The fuel cell-powered electric nose wheel reduces the emissions produced by aircraft at airports by up to 27%, and noise levels during taxiing by up to 100%," explains Josef Kallo, the project manager for the emission-free, fuel cell-powered nose wheel at the DLR Institute of Technical Thermodynamics (Institut für Technische Thermodynamik). Aircraft fitted with this nose wheel will be able to approach their apron locations travelling in both forward and reverse directions, as well as taxi to their take-off positions without needing towing vehicles or using their main engines.

### Successfully tested in the laboratory

The nose wheel drive system, which has already undergone successful testing in the laboratory, comprises two highly efficient electric motor units built into the rims of the aircraft's nose wheel. The fuel cell system responsible for delivering electrical energy is capable of powering the nose wheel of an aircraft weighing up to 70 tons. The fuel cells, which are direct electrochemical energy converters, produce electricity from hydrogen and oxygen and are significantly more efficient than an internal combustion engine with a coupled generator.

When used for short haul journeys involving up to seven take offs and landings per day, electrical manoeuvring on the ground could allow for savings of between 200 and 400 litres of kerosene per day. Reducing the operating time of the engines will also have a positive effect on their maintenance intervals. With an average time of up to 34 minutes (depending on the airport) on the ground between landing and take off, it will be possible to reduce the operating time of the engines by 1200 hours per year.

The new nose wheel drive will also mean a reduction in noise levels at airports; with its low-noise fuel cell system (silent, apart from fan noise), the electrical unit will drive the aircraft almost silently across the tarmac.

### Partners Airbus and Lufthansa Technik support technology development

For about three years, DLR has been working on behalf of the German Federal Ministry for Economics and Technology (Bundesministerium für Wirtschaft und Technologie; BMWi), on emission-free ground propulsion systems for aircraft. As part of the German aeronautical research programme LuFo IV (Luftfahrtforschung), DLR has been working with its partner, Airbus Deutschland GmbH, to develop an aircraft-grade fuel cell system and an electric nose wheel motor for an Airbus A320. The construction of the entire system was overseen by Airbus and installed in a special test vehicle by Lufthansa Technik AG of Hamburg.

"The highly specialised knowledge of both aeronautical partners has played a crucial role in the design, construction and operation of the nose wheel drive system," says Josef Kallo.

Successful tests, both in the laboratory and under realistic conditions on the dynamometer, have already demonstrated the performance capabilities of the system as a whole.

### **Rolling tests with the research aircraft, ATRA, scheduled for April**

The tests to be carried out with ATRA, the DLR research aircraft, are scheduled for April 2011 and will take place in Hamburg, again with the support of Airbus and Lufthansa Technik.

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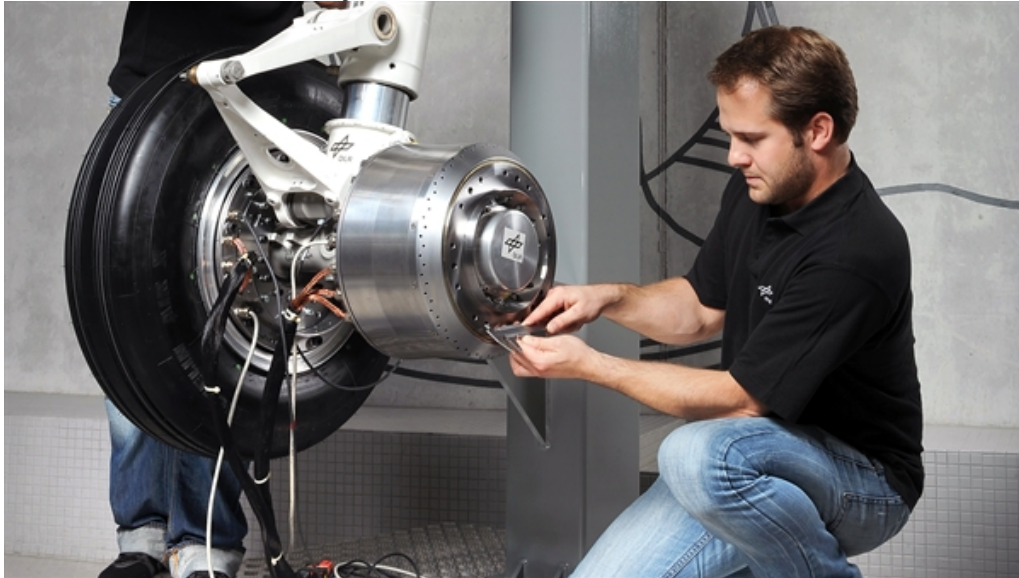
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### **Electric nose wheel drive system for Airbus A320**



The nose wheel drive system has already undergone successful tests in the laboratory, and comprises two highly efficient electric motors that are built into the rims of the aircraft's nose wheel.

Credit: DLR (CC-BY 3.0).

### Nose wheel drive – fuel cell system



A fuel cell system delivers electrical energy capable of powering the nose wheel of a 70-ton aircraft.

Credit: DLR (CC-BY 3.0).

### Soon moving without a towing vehicle – DLR ATRA



Ready for the first rolling tests with the DLR Airbus A320 research aircraft, ATRA (Advanced Testing and Research Aircraft). Aircraft fitted with this nose wheel will be able to approach their apron locations travelling in both forward and reverse directions, as well as taxi to their take-off positions without needing towing vehicles or using their main engines.

Credit: DLR (CC-BY 3.0).

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