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# Progress in aviation research - quieter flying with less environmental impact

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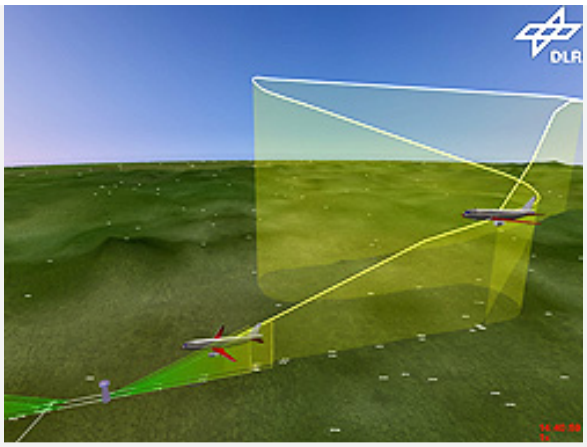


Landing profiles

One of the primary objectives of the aviation research team at the German Aerospace Center (Deutsches Zentrum für Luft und Raumfahrt; DLR) is to make flying quieter and to reduce its environmental impact. DLR came a step closer to this goal with the culmination of the FAGI (Future Air Ground Integration) project. In the future, a modified flight approach procedure with improved environmental credentials should help cut noise levels and save fuel.

A noise reduction of between three and five decibels and fuel savings of up to 500 kilograms per landing can be achieved, provided that pilots have access to an environment-friendly approach path during landing. In approaches of this kind, known as CDAs (Continuous Descent Approaches), the aircraft descends continuously - much like a glider – from its cruising altitude to final approach without interrupting its descent profile or applying more thrust. The pilot leaves the engines idle throughout the descent and only increases thrust slightly just before landing so that landing can be aborted if necessary. "This procedure demands a lot from the aircraft's systems because it must take important parameters such as flight pattern, altitude, airspeed and weather conditions into account," explains Alexander Kuenz, Project Manager at DLR's Institute of Flight Guidance in Braunschweig.

CDAs are most efficient when the initial planning of arrival times is undisturbed from additional air traffic controllers' directions during the whole descent. Thus, full benefit in reduced fuel consumption and noise emissions can be achieved. Without instructions from air traffic control, separation of inbound aircraft is simply not possible during peak times. This is why these more environment-friendly landing paths are only followed at busy airports during off-peak times, for instance, late at night.

**FAGI supports environment-friendly approach even at peak times**

The FAGI test flight team in front of the ATRA

In the FAGI project, researchers at the DLR Institute of Flight Guidance in Braunschweig have been developing a concept which will simplify the work of air traffic controllers and will enable aircraft to take environment-friendly approach paths even at peak times. Aircraft with modern 4D equipment (three spatial dimensions plus time) are able to execute a CDA without the need of air traffic controllers to stack inbound aircraft on direct approaches. Instead, the precise arrival time is agreed with the air traffic controller prior to commencement of the CDA and the aircraft executes the agreed approach without further consultation. The air traffic controllers may then focus on the aircraft that are not 4D-capable and stack CDA approaches and final approaches accordingly. Highly developed assistance systems support them in this task. Planning is handled by a new kind of flight approach manager developed as part of the FAGI project. This system continuously analyses the situation in 4D and makes proposals for the optimum way to manage air traffic. During the entire approach, CDA aircraft do not receive any further instructions from air traffic control, leaving them free to fly in their optimum profile.

Landing procedures of this kind depend firstly on precise and reliable navigation of the aircraft; this capability was verified during the project with a series of test flights. Interdisciplinary collaboration between the DLR Institutes of Flight Guidance and Communication and Navigation has examined the 4D management capability of the air traffic controller employed, in conjunction with ultra-precise modern satellite navigation systems.

**Simulation test of the system**

Air traffic controller during a simulation

The entire system was tested and evaluated during simulations with eight certified air traffic controllers from three countries in the course of a comprehensive simulation campaign. At DLR's facilities in Braunschweig, over the course of a one-hour trial, the entire volume of inbound aircraft to a passenger airport was simulated using a mix of conventional and CDA-capable aircraft. This trial employed the Future Aeronautical Communications Traffic Simulator (FACTS) data link simulator – a project of the DLR Institute of Communication and Navigation in Oberpfaffenhofen. The objective of FACTS was to implement a simulation system for radio communication in the aviation sector. When it comes to air traffic safety, radio communication has an important role to play. To assure a realistic scenario for the radio transmission of 4D data – for example, the scheduled arrival time, between pilot and air traffic controller – the FACTS radio simulation was incorporated in the FAGI simulation environment. This made it possible to investigate whether the performance of the radio system was adequate to facilitate the procedures developed in FAGI.

"The assistance systems and the concept were well-received by the air traffic controllers, who found them helpful and easy-to-use. FAGI demonstrated that, if you have modern technology on board the aircraft and on the ground that is able to communicate effectively, landing can be accomplished quietly and with much less environmental impact, even at times of heavy air traffic," states Project Manager Kuenz. Now, at a time of rising air traffic volumes, the successful conclusion of FAGI is an important step towards the future of air travel.

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