



## Quiet and fuel-efficient landing – simulator tests for a new pilot assistance system

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For new, quieter descent procedures, pilots must adhere precisely to a predetermined sequence of actions during the landing phase. The German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) has developed a pilot assistance system that optimises landings, making them safer, quieter and more fuel-efficient. The system was tested by a number of pilots in flight simulations, and the results assessed.

Landing an aircraft involves the full commitment of the crew; it is one of the flight phases with the highest pilot workload. Speed and height must be adjusted, and the flaps and undercarriage deployed. "If the pilot does all this at the precisely calculated times, part of the landing phase can be completed with the engines at flight idle," explains Sven Oppermann from the DLR Institute of Flight Systems. "This makes the aircraft much quieter and saves fuel." In reality, things can be quite different. Weather conditions, visibility, the weight of the aircraft and instructions from air traffic control all influence landings, with the result that no one landing is like any other – the pilots have to decide at which point to carry out what action on the basis of their experience. The new assistance system developed by DLR supports the pilots through every step of the landing phase. Taking into consideration external factors, it indicates when the speed should be adjusted and the flaps or undercarriage deployed via a display in the cockpit; this optimises the descent.

### Initial research in the new DLR simulator centre

To see how the system works in practice, trials were held in the moving flight simulator at the DLR Institute of Flight Systems. Four external professional pilots from Air Berlin and Volkswagen and three DLR test pilots each carried out 11 descents into Frankfurt Airport in the A320 cockpit under varying conditions, such as different wind speeds and glide slope angles. This was the first research carried out using the Air Vehicle Simulator (AVES) in the simulator centre, which was opened in the summer of 2013.

"Besides making numerous interesting suggestions for integrating the system into everyday flight operations, the pilots provided primarily positive feedback," Oppermann is pleased to say of the reports following tests in the simulator. "They felt the system and the display were a great help, especially during difficult tailwind situations, and they regard it as a useful aid for assessing the entire approach phase."

Initial evaluations have demonstrated that using the newly developed assistance system during the test approaches can yield an average fuel saving of up to 11 kilograms per descent. Furthermore, the approaches are more precise and the potential for reducing noise levels during descent was demonstrated in the simulator tests. The use of speed brakes, which occurs frequently in practice and generates a great deal of noise, could be avoided altogether by using the assistance system.

The system will undergo further tests in flights with the DLR Advanced Technology Research Aircraft (ATRA) during the summer of 2014.

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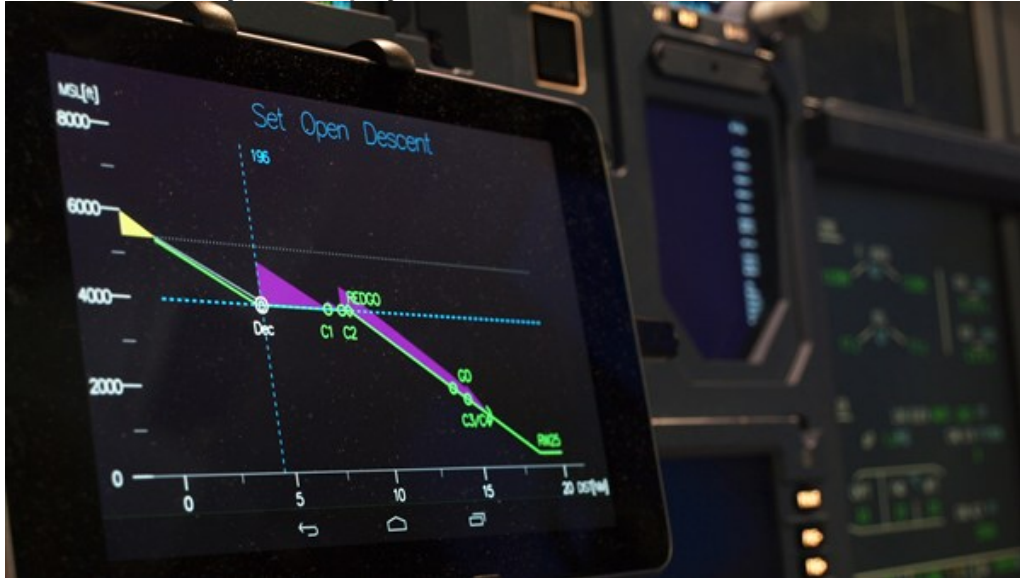
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### Pilot assistance system display



The display of the recently tested pilot assistance system shows the pilot proposals for an optimum landing.

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### View from the A320 cockpit



Cockpit of the A320 simulator. At the left centre of the image is the display of the recently tested pilot assistance system.

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### The simulator centre at DLR Braunschweig



The new simulator centre at the DLR Institute of Flight Systems.

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### Simulator center AVES (Air Vehicle Simulator)



The simulation center is home to a moving and a stationary simulator with an interchangeable cockpit.

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