



## Generic Experimental Cockpit (GECO)

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The Generic Experimental Cockpit is a modular fixed-base cockpit simulator with interchangeable flight-mechanical models.

These are changed depending on the application required and represent aircraft which are available in the DLR test aircraft fleet. The simulator can, for example, simulate a fixed-wing aircraft, such as the Airbus 320-ATRA, as well as a rotary wing, such as the Eurocopter 135-FHS.

The GECO is particularly used to conduct human-in-the-loop simulations in order to evaluate new display and control concepts. Research also focuses on the development and evaluation of innovative operational procedures that can be applied in the future using new technologies. Examples include multi-modal systems as well as systems for the GPS-based determination of position, manoeuvring-area lighting, air-ground communication, collision detection and avoidance as well as new sensors and enhanced vision systems.



Head-up display

## Technical background

The geometry of the cockpit shell corresponds to that of an Airbus A320. However, the GECCO uses high-resolution large-format LCD displays. Besides the standard cockpit equipment (such as side sticks, nose wheel tiller, thrust lever, flaps, gear, brakes), the installed control elements are also compatible with future developments in cockpit systems and as such conform to the design of an Airbus A350. This means, for example, that both pilots have keyboards and cursor control equipment. The radio management panels are fitted with displays and are freely programmable.

The outside view is simulated using three high-resolution projectors that project an image onto a mirror system with a six-meter diameter. This allows an area of  $180^\circ$  by  $40^\circ$  to be displayed, giving a realistic perception of depth (collimated visual system). To simulate the outside view, the DLR tool ALICE is used, which enables the detailed 3D modelling of landscapes, airports and sensor data.



Interior view of the GECCO in "fixed-wing-configuration"

The simulator is fitted with a complete 4D flight management system (FMS) that makes the high-precision, four-dimensional guidance of the aircraft possible. The standard cockpit displays are complemented by additional taxiing guidance and FMS displays. All of these displays and systems allow complete control of content and communication with other systems. Although the cockpit simulator is designed as an independent computer system, it can be connected to all platforms in the Institute, such as the DLR tower simulator, and those of other facilities, such as the GPS simulation from the DLR Institute of

Communications and Navigation. Different modules for simulating traffic in the air and on the ground can be added as the project requires. Furthermore, an eye-movement measuring device is integrated that enables the pilots' gaze behaviour to be closely analysed.

A special feature for research in the field of enhanced vision systems is the head-up display (HUD), which allows primary flight information to be projected into the pilot's field of vision. As a result, pilots no longer have to turn their gaze away from the window to receive important information. This is particularly helpful in the final phase of bad weather approaches. HUDs can also display additional images from sensors; they are considered the technology of the future, also in terms of improved surface movement guidance.



Helmet-mounted display

The GECCO can be converted into a helicopter simulator. The helicopter is equipped with a state-of-the-art helmet-mounted display (HMD) which is used for research in the field of enhanced vision for helicopters. Just as with the HUD, important information is projected into the field of vision of the helicopter pilots, thereby providing support during low visibility such as in brownout situations.

# Air Traffic Validation Center

Simulators, sensor systems and flight testing equipment together form the Air Traffic Validation Center of the DLR Institute of Flight Guidance. The entire center offers researchers the right tools for testing and evaluating new ideas, concepts and technologies for all areas of air traffic management. It allows each development step to be continuously reviewed, from the initial idea down to the testing of prototypes and their implementation under realistic conditions.

The Institute of Flight Guidance performs long-term engineering research preceding industrial developments in the field of flight control and air traffic management. Its main areas of research are operational procedures, technology development and human-centered automation. The goal is to ensure a safe, efficient, environmentally friendly and reliable air transport system.

## DLR at a glance

DLR is the national aeronautics and space research centre of the Federal Republic of Germany. Its extensive research and development work in aeronautics, space, energy, transport and security is integrated into national and international cooperative ventures. In addition to its own research, as Germany's space agency, DLR has been given responsibility by the federal government for the planning and implementation of the German space programme. DLR is also the umbrella organisation for the nation's largest project management agency.

DLR has approximately 8000 employees at 20 locations in Germany: Cologne (headquarters), Augsburg, Berlin, Bonn, Braunschweig, Bremen, Bremerhaven, Dresden, Goettingen, Hamburg, Jena, Juelich, Lampoldshausen, Neustrelitz, Oberpfaffenhofen, Oldenburg, Stade, Stuttgart, Trauen, and Weilheim. DLR also has offices in Brussels, Paris, Tokyo and Washington D.C.

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