

DLR Eurocopter EC 135 FHS

Flying Helicopter Simulator



German Aerospace Center
Flight Operations



Introduction

DLR is Germany's aerospace research center and space agency with about 4700 employees in 31 research institutes distributed over 8 main research centers in Germany. DLR performs basic research and operates large scale test facilities which include two Research Flight Facilities in Braunschweig and Oberpfaffenhofen.

The **DLR Flight Facility Braunschweig** is a major test site for aerodynamic research, in-flight simulation and testing of flight management and remote sensing systems.

The Facility provides a fleet of research aircraft including sailplanes and single-engine-piston aircraft, a Bo 105 helicopter, a twin engine turboprop DO228 and the two advanced flying simulator EC 135 FHS for helicopter and VFW 614 ATTAS for fixed wing aircraft.

The latter two are used as primary testbeds for a broad range of research activities such as flight control, flying qualities, guidance, navigation and man-machine interface.

ATTAS and FHS offer unique modifications and capabilities which make them 'programmable' multipurpose testbeds, that can be configured to the specific needs of multiple applications.

The DLR-Institutes of Flight Systems, Guidance and Control, Design Aerodynamics, Structure and Materials are also situated in Braunschweig and provide the complete scientific know-how in conducting complex flight tests and system evaluation.

Real flight tests in an early stage of a comprehensive research and development process give realistic results to validate the design requirements and to minimize risks in product development.

Especially the EC 135 'Flying Helicopter Simulator', as the worldwide first fly-by-light helicopter, features a ultra modern approach to this challenging task.

Aircraft System

The basic aircraft for the **F**lying **H**elicopter **S**imulator is a Eurocopter EC135 T1 CPDS, a modern, twin-engine, light helicopter. The bearingless main rotor and the fan-in-fin tail rotor ensure a very high dynamic response capability.

The conventional mechanical control system is replaced by a full authority digital flight control system using fly-by-light technology. This configuration complies with civil certification requirements.

An Experimental System is standard equipment and provides data recording and telemetry down-link as well as the ability of pilots control input modification.

The hierarchical system architecture allows easy changes of control laws without extensive qualification and testing.

The helicopter is fitted with external hard points and has space in the cargo bay to allow the connection of user hardware.



Performance

EC 135 T1 FHS

Overall length	12.20 m
Rotor diameter	10.20 m
number of seats	3
Max takeoff weight (MTOW)	2.835 t
Engines	2 x Arrius 2B1 (2 x 415 KW)
Max altitude (ISA):	6 km (20 000 ft)
Max range	480 km (260 nm)
Max endurance	2:30 h
Max Payload (1 h fuel)	500 kg
Max Payload (without Exp. Sys.)	640 kg
Max fuel	490 kg
Cruise speed at MSL	220 km/h (120 kn)

The operational envelope of the FHS is in general the same as for the standard EC 135 with minor restrictions at high speed and low height, if experimental software is in the control loop.

Flight-Test-Features

The helicopter is prepared to accommodate various user needs.

External Hard Points for easy Installation of User Equipment



Experimental System
Space for User Equipment available

Workstation for the Evaluation Pilot



Nose Boom with Pitot Static Probe and Vanes (α , β)



Workstation for the Flight Test Engineer

Experimental System

The Experimental System is designed as a modular multipurpose system. It consists of the following parts:

- Data Management Computer with Data Recording and Telemetry
- Experimental (Flight Control) Computer
- Graphics Computer with Displays
- Various Sensors (i.e. DGPS, Rotor-Data, Air-Data, etc.)

The Data Management Computer acquires and handles all signals for data storage, telemetry, displays and the experimental control algorithms. It passes data to a removable storage device and generates PCM telemetry data streams for transmission to a ground station. The Experimental Computer runs the user programs in order to execute flight control algorithms. Together with the Displays the Graphics Computer provides a user interface for the evaluation pilot and the flight test engineer.



Ground Based Simulator

The system simulator is primarily designed as a hard- and software in-the-loop test facility for the FHS. The main objectives are:

- Development, test, and preparation environment for engineers
- Tests and verification of new hard- and software components
- Pre-flight training and briefing of the crew

The simulator replicates the airborne environment of the FHS with a real cockpit obtained from a BO105 and a large field-of-view visual system. The EC135 itself, the fly-by-light system computer and some sensors are simulated. The emphasis was placed on a realistic EC135 mathematical model. Pilot controls and the complete Experimental System are the same as in the aircraft. It offers a perfect test facility for new equipment as all functions and connectors are identical.

Data Ground Station & Telemetry

The ground station consists of two modules, a telemetry and a data evaluation station. They are housed in two containers that can be transported to the actual flight test site. The telemetry station provides an automatic aircraft tracking antenna with video camera and communication equipment. PCM data, sent by the FHS, are received, recorded and transferred to the data evaluation station. The data evaluation station offers working places for three engineers. Each place is equipped with PC based data stations to allow real time data monitoring by quick-look or other appropriate software tools during the flight tests.



Service Braunschweig

The Flight Facility is an autonomous institution within DLR which intends to support scientists from in- and outside DLR in planning, setting up and conducting flight campaigns on their research aircraft. Besides the research flight operation various groups within the Facility offer a variety of related services to achieve this goal:

- Logistical support
- Support in integration and certification of user equipment
- Flight planning, flight permits
- Flight testing

The Flight Facility is a certified “LBA Maintenance Facility” (LTB) and thus authorized to perform maintenance and repair on the research aircraft. This fact is mandatory for the operation of aircraft in remote locations and extreme climatic environment.


DLR’s certification as “JAR21 Design Organization” (EB) assures that user designed sensors and instrumentation can be integrated and certified.

Infrastructure

The infrastructure associated with the Flight Facility is prerequisite for these services and can also be used by the visiting scientists.

- Two heated hangars (20m x 30m & 29m x 58m) with all necessary ground support equipment
- 6500 m² apron
- Mechanical and electronic workshop
- Fully equipped office for external users
- Hydraulic test bench
- Room for packing and storing of parachutes





Flight Facility Braunschweig

German Aerospace Center

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