

DLR FALCON 20-E5

Airborne Research Platform



DLR

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 Flight Facility Oberpfaffenhofen is exclusively dedicated to the provision and operation of aircraft for atmospheric research and earth observation and is Europe's largest operator for this kind of research platforms.

Among its fleet of highly modified aircraft the twin engine jet Falcon 20 E covers the largest flight envelope and is one of the few aircraft in Europe which is able to reach the stratosphere well above the cruise altitude of most airliners. The Falcon offers unique modifications and features which make it a true multipurpose sensor platform which can be configured to the individual needs of multiple applications.

DLR operates a huge pool of in situ and remote sensing instrumentation for environmental airborne research and offers access to various scientific institutes dedicated to atmospheric physics and chemistry, active and passive remote sensing, meteorology, modelling, as well as different calibration and test facilities.

Together with the Hercules C-130 of the Meteorological Research Flight (MRF) and the ARAT Fokker-27 of the Institut National des Sciences de l'Univers (INSU) the Falcon 20 of DLR was selected by the EC as a Large Scale Facility (LSF) within the 4th EC TMR (Training and Mobility of Researchers) program. The EC projects STAAARTE and CAATER allowed scientist from all over Europe direct access to this infrastructure during the last years.

Performance

The Dassault Falcon 20 is a very reliable and still modern aircraft. Its mechanical and aerodynamical robustness makes it an ideal research aircraft even under extreme situations like thunderstorm research or measurements in the contrail of other aircraft. The following table summarises the main technical data of the DLR aircraft.

Overall length	17.2 m
Wingspan	16.3 m
number of seats	2+10
Max takeoff weight (MTOW)	13.2 t
Engines	Garret TFE 731-5BR-2C (2 x 4750 lbs)
Max altitude (ISA):	13.7 km (45 000 ft)
Initial climb altitude(MTOW, ISA)	11.9 km (39 000 ft)
Max range	3700 km (2000 nm)
Max endurance	5:30 h
Max Payload (with max fuel)	1.1 t
Max fuel	4.0 t
Max speed (TAS)	917 km/h (0.865 Mach)
Min clean speed (TAS)	296 km/h (160 KIAS)



Aircraft System

The Falcon avionics has been permanently adapted to the increasing requests of scientific experiments as well as flight safety issues. Falcon avionics allow precision navigation and world wide unrestricted operation of this aircraft. The cockpit instrumentation contains:

- EFIS
- Turbulence Weather Radar
- TACAN
- Radio altimeter
- VHF, UHF and HF
- GNS-X Flight Management System
- GPS, VLF-Omega, LORAN C
- IRS (Honeywell Laserref)
- NDB 2
- VOR / DME
- 2 Transponder

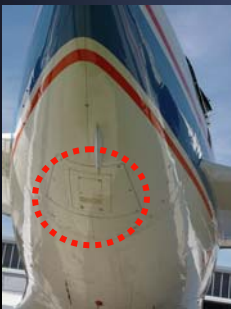


Modifications

The uniqueness of the DLR Falcon results from the various modifications on the aircraft structure, power system and sensor equipment. Over the years these modifications were constantly adapted to the needs of the scientific community.



new generation engines with **additional electrical generators (2x300A @ 28V)** (added in 1995)



hardpoint for radiometer installation



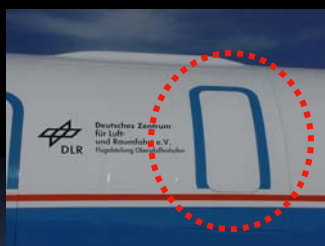
universal window interface at the right side of fuselage (220 mm dia.) (added in 1998)



4 hard points under the wings to carry up to 4 particle probes

1 hard point under the fuselage (external equipment, particle probes)





large opening at the left side of fuselage (250 mm x 570 mm)

1 large opening on top of fuselage (515 mm diameter), (added in 1997)



4 openings on top of fuselage (80 mm diameter)



meteorological sensor package (temperature, pressure, humidity, wind)



nose boom with flow angle sensor (CFK, 1.8 m length)



2 coverable large openings in the bottom of fuselage (515 mm diameter)



multiple temperature sensors and inlets for standard sensor package

Basic Sensors

As a research aircraft the DLR Falcon is equipped with a set of basic sensors to measure temperature, radiation, humidity, pressure and wind. The large experience on this field and a huge database of special flights and maneuvers guarantee for the high quality of the data.



Temperature:	Platinum resistance wire probes (fast / slow)
Humidity:	thermoelectrically cooled dew point sensor dielectric sensor Lyman- α absorption instrument
Pressure and wind:	flow angle sensor for 3D turbulence and wind measurements absolute and differential pressure sensors
Radiation:	pyranometer/pyrgeometer (up-/downward)

Data Acquisition

All aircraft and experimental data can be sampled and stored on the data acquisition and quicklook system developed by DLR. The system is optimized to work reliable even under extreme environmental and 'noisy' conditions.



- 126 analog data channels
- Up to 100 Hz sampling rate
- Avionics data via ARINC 429 about aircraft position (FMC), attitude (IRS) and outside conditions (ADC)
- serial and parallel interfaces to provide online data to the onboard experiments
- online data processing and user defined graphic quick look system
- redundant data storage on disk and tapes

Optional Sensors

In co-operation with other DLR institutes several sensor systems are available on request for:

- Remote Sensing
- Cloud Physics
- Air Chemistry

Since these sensors are not operated by the flight department their availability has to be negotiated with the responsible institutes



Service

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:

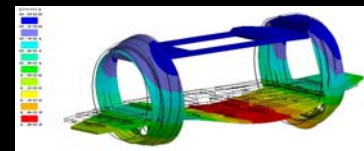
- Logistical support
- Support in integration and certification of user equipment
- Flight planning, flight permits
- High quality data evaluation of meteorological basic sensors and aircraft system data immediately after flight
- Certified calibration of pressure, temperature and humidity

The Flight Facility is a certified "Luftfahrttechnischer Betrieb" (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 "Entwicklungsbetrieb" (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.

- Heated hangar (50 x 30 x 6 m) with avionics and hydraulic workshop
- 6500 m² apron with refueling station for Jet A 1 and 100 LL
- Mechanical and electronic workshop
- Fully equipped office and lab rooms for external users
- Large environmental simulation chamber (pressure and temperature, 500 l) for testing of equipment
- Highly sophisticated calibration benches for pressure, temperature and humidity



Flight Facility Braunschweig

German Aerospace Center

DLR Flight Operations

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