

ATTAS

Advanced Technologies Testing Aircraft System



***The Flying Testbed for
Aeronautical Research***



Introduction



DLR, the aerospace research center and space agency, is the largest research organisation for applied sciences in Germany. With 4700 employees in eight locations aeronautics, space, ground traffic and environmental sciences are treated.

The aeronautical research is concentrated in Braunschweig comprising the Institutes of Flight Research, Guidance and Control, Design Aerodynamics, Structure and Materials and the Flight Operations Department.

At Braunschweig DLR operates the advanced flying simulator and technologies demonstrator aircraft ATTAS (Advanced Technologies Testing Aircraft System) as the primary testbed for a broad range of research activities as flight control, flying qualities, guidance, navigation and man-machine interface. ATTAS offers unique modifications and capabilities which make it a 'programmable' multipurpose testbed which can be configured to the specific needs of multiple applications.

DLR provides all scientific and technical know-how in conducting complex scientific flight tests and system evaluation.

Real flight tests as the last step at the end of a comprehensive research and development process give the final results to validate the design requirements and to minimize risks in product development

The Aircraft

The research aircraft ATTAS is based on a VFW 614 type aircraft - a short haul passenger jet developed in the early seventies by Vereinigte Flugtechnische Werke (VFW) at Bremen, Germany. The VFW614 turned out to be a very reliable aircraft with exceptionally good flying qualities. The cabin space and payload capabilities are ideally suited for experimental equipment installations and applications.

ATTAS, designed and developed by DLR and MBB from 1981 to 1986, proved as an efficient flying testbed in various research programs since 1986.

Technical Data

Span:	21,50 m
Length:	20,15m
Seats:	2+9
Engines:	RR M45H MK 501, 2x 32292 N
Max. Weight	20.965 t
Max. Endurance:	> 2,5 h +IFR reserve
Max. Speed:	292 KIAS, 0,63 Ma
Max. Altitude:	25.000ft



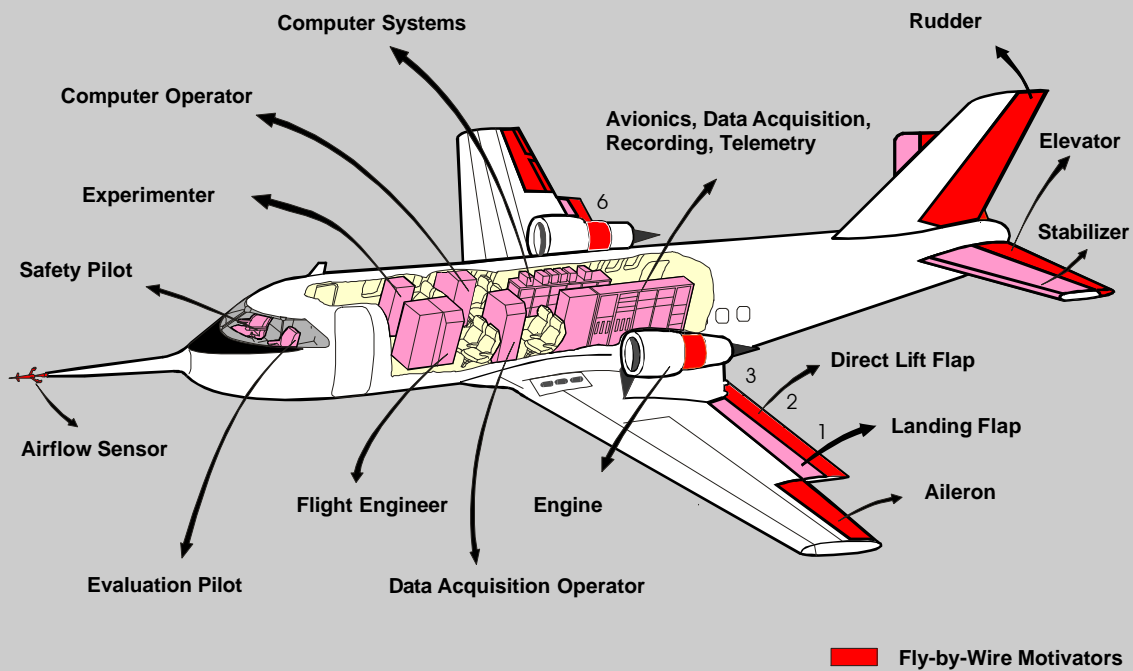
Objectives

Primarily ATTAS was designed as a flying simulator and technologies demonstrator aircraft with a broad range of demonstration capabilities. To be as flexible as possible ATTAS got a fly-by-wire- system in parallel to the mechanical flight control system. This system allows to alter flight control functions very easily by reprogramming the flight control computer. Additionally specific data interfaces allow to implement subsystem hardware on customer's request. Safety is provided by a right hand seated safety pilot who can recover the airplane by disconnecting the fly-by-wire system in any situation.

ATTAS is able to serve as a testbed in order to demonstrate functions and systems under real flight conditions. Flight tests were conducted in the following research areas:

- Digital Flight Control
- Control Law Design and Evaluation
- Flight Envelope Protection
- Automated Flight
- Flight Management
- Flying Qualities
- In-Flight Simulation
- 4- D Navigation
- Pilot Assistance Systems
- Enhanced/ Synthetic Vision
- Air Traffic Management & Control
- Navigation, Communication
- Man/Machine Interfacing
- Pilot/ Aircraft Modelling Techniques
- Laminar Flow Experiments
- Engine exhaust jet measurements





Modification and Features

The main modifications and installations comprise

- a freely programmable duplex-electro-optical fly-by-wire flight control system
- full fly-by-wire control of all control surfaces including both engines, landing flaps and stabilizer
- six direct lift control flaps
- left hand side evaluation pilot's cockpit for fly-by-wire control, two-axes sidestick, column/wheel and programmable displays
- on-board experimental computer system, model-following control system
- data acquisition, recording and telemetry systems
- free cabin space (5 m²) for user equipment,
- interfaces to link customer's subsystems
- Devices for safe flight under experimental conditions
- In-flight APU providing electrical power for the experimental equipment
- ATTAS can be operated in the fly-by-wire mode within basic aircraft's flight envelope including approach and landing

Experiment Computer

VME-bus based Power PC computer free for customer's purpose. Input/ output data interfaces allow easy software and user hardware implementation.

In-Flight Simulation

The IFS technique provides the capability to evaluate the flying qualities of specific aircraft characteristics in-flight under real environmental conditions with realistic visual and motion cues. In-flight simulation programs can simulate aircraft characteristics in a linear or non-linear mode. Complete aircraft six-degrees of freedom models with control system, engine characteristics and artificial gusts are simulated in real time. An advanced model-following control system which has access to all primary and secondary control surfaces drives ATTAS to follow exactly the programmed model response. Left hand side evaluation pilot's cockpit features a complete cockpit environment with sidestick or column/wheel configuration and programmable display formats. Further, test pilots, flight engineers and students can experience the influence of stability and control parameters modifications directly in-flight. This technique turned out as extremely valuable during flight control system development of new aircraft. It allows test pilots to fly a new airplane design long time before the first flight, and to minimize the development risk in an early development stage under the most realistic conditions possible.



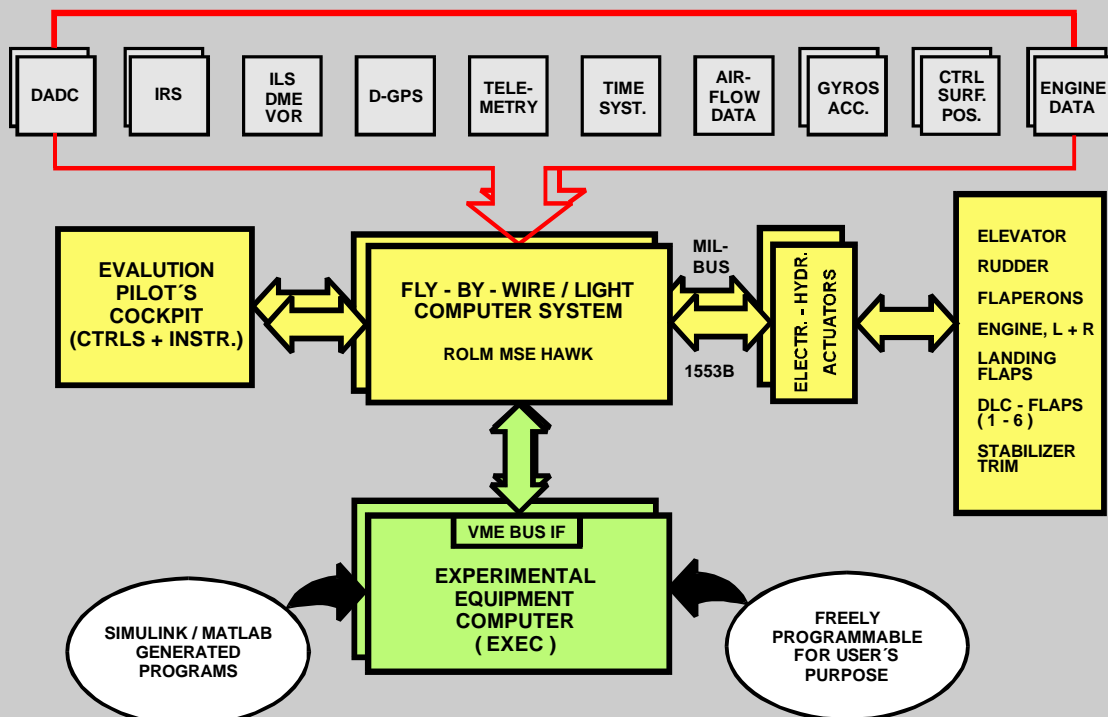
Experimental Rear Cockpit

Additionally, a rear cockpit can be installed in the cabin and plugged into the fly-by-wire system. This generic one man cockpit with large flat panel displays provides all the flexibility to modify the cockpit layout and to investigate modern cockpit systems in order to conduct man machine interfacing research.



Flight Management

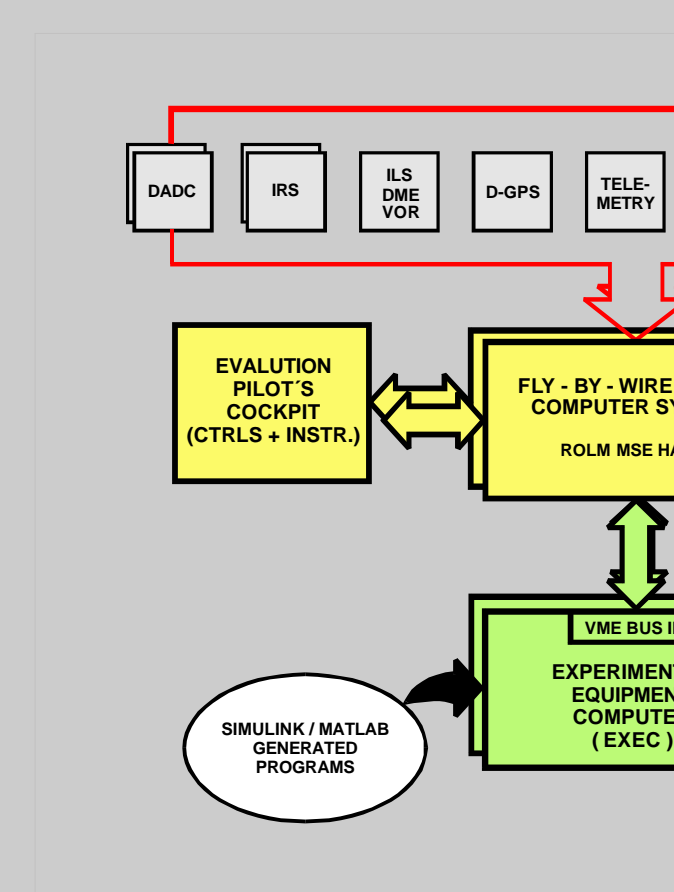
Flight management functions for automated guidance and control are available in order to control the airplane in the longitudinal and vertical plane. Additionally, precise 4-D guidance can be performed. Up and down data links ensure to control the aircraft from a ground based control station.



User Interfacing

MATLAB/SIMULINK designed experiments can be directly implemented to the ATTAS Experimental Equipment Computer (EXEC) by using SIMULINK/Realtime Workshop autocoding function. Generalized interfacing to the ATTAS testbed is ensured by standard program procedures. The EXEC can also be used for self coded programs with LAN interfacing to other experimental equipment.

Further, hardware interfaces as ARINC 429 and DMA (VME-Bus) are available in order to connect customer's hardware systems.



Data Acquisition and Handling



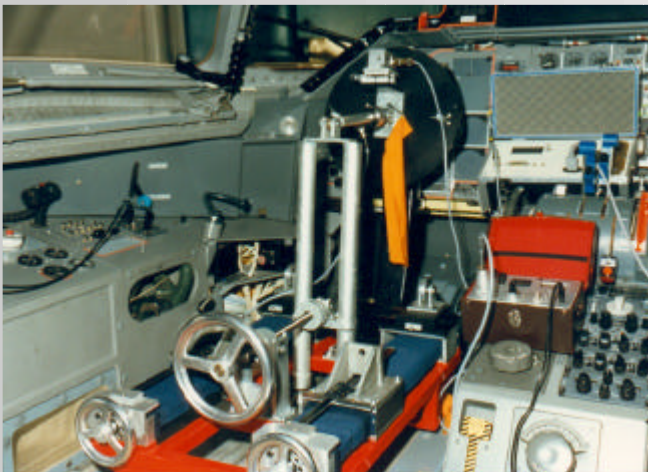
The data acquisition system is modular and flexible, new sensors can be implemented in short time. The operator has quick software access to gains and offsets as well as to built-in test and calibration facilities.

All aircraft and experimental data as avionics data from Inertial Reference Systems, Air Data Computers, D-GPS and NAV-Systems as well as all control surface positions, hinge moments, pilot's commands, airflow data, engine data, accelerations, body fixed rates and experimental data are recorded on-board on a disk in real time with 10 Hz. An on-board quicklook system based on a real time data base allows to monitor and evaluate the experiment during the flight test.

If required telemetry data are recorded on the ground.

Airflow (angle of attack, sideslip, dynamic pressure) is measured by a 5-hole probe mounted on a long noseboom providing undisturbed air flow measurements.

The high accuracy of the acquired data is ensured by regular calibrations performed with specific equipment either on-board or in the calibration lab. After flight all data are archived and can be provided in different standards for further data processing and analysis. Normally CDF standard is used.



Powerful data analysis programs developed at DLR, like XDIVA and ESTIMA, provide a large amount of functions to evaluate data in the time and frequency domain.



ATTAS Simulator

All flight test programs are verified before flight in the ATTAS fixed base simulator which provides full representation of all ATTAS functions and systems (hardware-in-the-loop). The simulator comprises a complete ATTAS cockpit, on-board computers, data interfaces, aircraft simulation, visual system and operator stations. Experimenter's software programs or hardware will be tested under the whole ATTAS environment in real time. Flight test procedures are trained and optimized with the test crew. This approach gives full potential in preparing flight tests and provides the basis for efficient flight test conduction.

Service & Infrastructure

ATTAS flight test operation is conducted by a joint team of personnel from the Institute of Flight Research, the Institute of Guidance and Control and the Flight Operation Department. The scientific experimenter is assisted in software implementation, ground and flight testing, data acquisition and data pre- and postprocessing.

Further, 1000 data channels can be transferred via PCM-telemetry to the ground station where the data are recorded and displayed for flight test monitoring. Telemetry antenna with automatic tracking of the aircraft provides data receiving within a range of more than 200 km (depending on altitude).

External electrical power is available in the hangar and on the apron for experiment installation, preparation and ground tests.

DLR is authorized by the German Aviation Certification Authority (LBA) to modify the aircraft and to integrate test equipment.

DLR provides all personnel and infrastructure for aircraft operation, maintenance and repair at aircraft's home base Braunschweig.

DLR has direct access to the Braunschweig airport.





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Map

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