

## ATM-Simulation

Air Traffic Management Simulation



The "ATM-Simulation" department (simulation for air traffic management) was established to support the professional research and development in the Institute of Flight Guidance. The ATM-Simulation analyses and evaluates new concepts and technologies for air traffic management in real environments. For that, an integrated complex of onboard and ground simulators is used. In addition, the department sees itself as a qualified unit which carries out scientific work in the fields of simulation technologies in aviation and transport, measuring and evaluation techniques in complex systems in association with the human operators and test scenarios for air traffic control procedures.

Figure: DLR Antenna Tower

### Data link station

The famous landmark of the data link station is the antenna tower which is 30 metres high and is situated in the north of the Koppehaus. A parabolic antenna with a diameter of 3 metres can be moved in two axes and is installed on the upper platform. This installation is controlled by the data link station on the ground floor of the Koppehaus. During flight tests, research aircraft are equipped with transmitters sending a data stream on 2.4 GHz to the data link station which is - in addition to information transmission - also used for aircraft tracking. That is why the parabolic antenna is always aligned towards the aircraft and thus allows optimal data transmission. A second parabolic antenna of 2 metres is attached to the downlink re-

ceiving antenna pointing to the same direction. This so-called uplink antenna transmits a signal from the ground to the test aircraft. A bidirectional data connection is set up which allows an integration of the flying aircraft system into the computer network of the DLR site. Depending on the flight level the range of the data link is about 270 km, at a data rate of up to 4 Mbit/sec.

### Apron and Tower Simulator (ATS)

The Tower Simulator serves to simulate the work of flight controllers on airports, managing start, landing and taxiing of aircraft. Important components of the simulation are the visual system which reproduces the view out of the window of the tower as well as the radar screen on which the controller can recognize the position of all



aircraft. The Tower Simulator serves to research and develop systems which are able to support controllers in doing their challenging work. The simulation facility consists of a traffic simulation engine for moving any kind of aircraft in the air and on the ground as well as two vision systems such that experiments with two groups of controllers including hand-over procedures are possible.

### Airport and Control Center Simulation (ACCES)

A new unique research facility has been built-up in the DLR Institute of Flight Guidance recently; the Airport and Control Center Simulator ACCES.



New concepts for controlling of airport processes on tactical and strategic work level shall be developed and tested - embedded in a simulation environment. A major aim of these activities is an airport management showing improvements in efficiency, flexibility and reliability compared with the existing systems from the user's point of view. As a flexible tool for research and development ACCES can also be used for other tasks such as the development of new air traffic control procedures (e.g. the Virtual Tower).

### Radar Simulation, ATMOS (Air Traffic Management and Operations Simulator)

In order to take countermeasures against the bottlenecks to be expected in air traffic, DLR carries out research for the coordination and automation of the air traffic management. The

ATMOS is used for analysis and validation of new planning and management systems by

- Analysis of ATM procedures and translation into dynamic test scenarios,
- Implementation and test of new air traffic control tools, and
- Development and application of evaluation procedures for performance data.

Up to 5 radar controller positions can be involved in the simulation runs assigned to different control sectors. Each position is equipped with a 28" screen displaying the traffic situation, another screen for flight strips or planning HMI (human machine interaction) and other devices (e.g. for communication). Eight pseudo pilot stations are part of the ATMOS for inserting pilot's reactions on controller clearances into the system.

### Cockpits

In the Institute of Flight Guidance several cockpits are operated for experimental validation of ATM procedures and equipment. E.g. the Generic Experimental Cockpit (GECO) is a modular simulator with a flight mechanics model on the basis of the VFW614 aircraft (ATTAS) which is used in DLR. This model can easily be modified in order to simulate other types of aircraft (e.g. A320). The geometry of the cockpit as well as the installed input devices correspond to those of an Airbus A320. As the cockpit is made of wood, additional or completely new devices or displays can be integrated.



The cockpit is equipped with five 12 inch LCD high-resolution displays permitting a resolution of up to 1280x1024. They are controlled by high-performance graphics computers. These displays are connected to the signal source via a matrix switch box. Due to that fact, the layout on all displays can variably be combined. Furthermore above the left seat a modern head-up-display (HUD) is installed such that new approach and taxi procedures are possible.

### Experimental Cockpit and Flight Test-Bed ATTAS



In order to validate and evaluate on-board ATM systems and methods DLR has the skills and capabilities

- to analyse the requirements and map it to an experimental set up
- to set up modifications into the experimental installations in the ATTAS
- to manage flight experiments with the ATTAS test-bed as well as
- to evaluate the experiments and to put together the results.

One of the powerful tools for the research on cooperative ATM is an experimental cockpit (e-cock)

- which can easily be equipped with appropriate displays and instruments,
- which can intensively tested by pilots on the ground, and
- for the tests it can be used as a substitute cockpit in the cabin of the ATTAS. Nearly all manoeuvres can be flown from this position behind the normal ATTAS cockpit.

Figure on the top left: One of two Visual Systems of ATS

Figure on the bottom left: The Airport and Control Center Simulation ACCES

Figure in the middle: The Generic Experimental Cockpit GECO

Figure on the top right: DLR Experimental Cockpit with ATTAS

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