AFS/SimSys
Simulators for training, research and development
Advanced Function Simulator

Air navigation services constitute a complex system: Even a minor change to the technical facilities or operational procedures can have profound effects on the entire system. It would therefore be unwise to change the existing system without first understanding the implications. This can be effectively accomplished by conducting high-fidelity simulations. This is the objective of the Advanced Function Simulator (AFS).

A development of DFS, this simulator is a vital tool for testing, evaluating and analyzing all aspects of the system from the introduction of hardware components such as new displays to new or optimised software functions, and new or modified operating procedures.

The Advanced Function Simulator, which became operational at the beginning of 1997, is constantly being expanded and optimised to address new simulations. A recent example is a simulation commissioned by EUROCONTROL, where DFS used the AFS to test the approach procedures that could be implemented at Frankfurt Airport using ADS-B functions. For VAFORIT, a new generation ATM system developed at DFS, AFS is being used to test and optimise the system.

Not only is it applied to validate new systems and procedures and for research and development, but it is also the driving force behind other DFS simulators. NEWSIM, the DFS ATM training simulator, emerged from the AFS. Prototypes are being developed using the AFS, which are later used for implementing training systems. One of the ways in which DFS applies the simulator is to test new functionalities such as data link, which later become part of the training simulators.

The AFS allows different airspace environments to be created. The users define the setup of the airspace and create or select flight plans of their choice for a specific simulation exercise. The simulation itself is divided into two areas. The AFS calculates four-dimensional trajectories and profiles for aircraft and uses these to produce radar and flight plan data. These data are then displayed at controller working positions. The AFS has twelve fully equipped controller working positions. Mimicking the operational environment, controllers are in contact with simulation pilots using a radiotelephony system. In this case, it is a flexible voice-over-IP-based simulation of actual capabilities.

During the simulation, all required data are recorded and stored in databases. The outcome of the simulations can be objectively evaluated based on the analysis of this data. The technical components and infrastructure of the AFS are easily adapted and expanded to quickly test new functions, operational procedures and adjust user interfaces.
Simulation System for Operational System

DFS is aware that, while simulations with simulated components can provide a high degree of fidelity, there is no substitute in some cases for using the actual operational system components. To address this issue, DFS developed the Simulation System for Operational System (SimSys). This system makes use of the AFS' ability to drive and interoperate with ATM systems. To be more exact, it uses the part of the AFS which generates radar and flight plan data, thus simulating the external environment of an ATM system. This information is exchanged with the operational system during a dynamic simulation exercise. Users of ATM systems such as the DFS P1/ATCAS are then able to experience actual interactive behaviour of the system and are actually dealing with simulated traffic under live operational conditions.

DFS has already enjoyed success with the SimSys on several occasions. The company used SimSys interconnected with P1/ATCAS to aid in the relocation of the Düsseldorf control centre to Langen, to introduce the ATM system P1/ATCAS in Bremen and Munich control centres and to consolidate Frankfurt Approach in Langen. In each case, the air traffic controllers and flight data specialists had the opportunity to become familiar with the operational system and its capabilities while at their real future working positions. The SimSys is also being used for implementing the ATM system VAFFORIT which will become operational at the Karlsruhe control centre in 2010.

The controllers in Karlsruhe can become familiar with the new system at the new working positions until VAFFORIT is in operation. Also it is the basis for the VAFFORIT introduction program. Other applications are also possible. SimSys could, for example, be used for certifying ATM systems.

At the Langen, Bremen, Munich and Karlsruhe control centres both SimSys and NEWSIM capabilities are currently available to address test, training and simulation needs.
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