

Pilot Assistance



The **Institute of Flight Guidance of DLR** pursues research and development of advanced on-board and ground-based concepts, solutions and procedures to ensure the safe, efficient and economic conduct of the rapidly growing air traffic.

In order to maintain the high level of safety in air traffic and to facilitate the required increase of capacity in the forthcoming years, new solutions for optimal co-operation and integration of highly developed on-board flight guidance technology and ground-based air traffic management have to be developed.

Situational awareness, support from intelligent systems or components, adequate share of work and responsibility, and smooth interaction between semi-automated systems and pilots / air traffic controllers are of key importance to success.

Experts and professionals from various domains, modern technical equipment and tools, a simulation complex able to cover each phase of a flight from "gate-to-gate" and several test aircraft for the ultimate proof of new ideas are available at the **Institute of Flight Guidance of DLR** to meet the demands of the users.

Intelligent Pilot Assistant

The continuous growth of civil air traffic, accompanied by new ATM procedures and philosophies, on the one hand and the growing complexity of military missions on the other hand all put new demands on the aircrews. Many systems have been designed in the past to solve individual tasks, but this approach is reaching its limits.

One approach to overcome those limits is a pilot assistant system, an integrated system which combines all required assistant functions under a single human machine interface. Key features of such systems are situation assessment functions which allow automatic reaction in critical

situations. This feature greatly reduces pilot workload in situations where support is most needed and where conventional systems require too much input, since they don't recognize the situation and therefore are unable to derive the required actions themselves.

The **Intelligent Pilot Assistant** is developed at the Institute of Flight Guidance to provide a framework in which new assistance functions can easily be added and combined with the existing functions. The development of this system is based on the experience gained with the Crew Assistant for Military Aircraft (CAMA), a pilot assistant system jointly developed by the University of the German Armed Forces, EADS Germany GmbH, the Elektronik- und Logistik GmbH and DLR. The CAMA system combines all assistant functions for a military transport mission in one integrated system and has received high notes in simulations with military pilots.

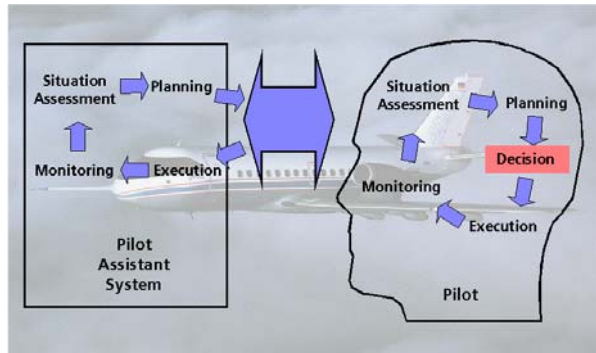


Figure: The Recognize - Act - Cycle

For the **Intelligent Pilot Assistant** a generic architecture based on object oriented methods and providing templates for function modules has been developed that significantly reduces development and integration costs for new assistant functions. Based on this architecture a pilot assistant "gate-to-gate" is being developed to assist the aircrew continuously during all phases of flight. Several assistance modules for specific "gate-to-gate"-tasks are already implemented and adopted the generic assistant architecture. Four of these modules are demonstrated within DLR's demonstration cockpit.

Advanced Flight Management System

The strategic trajectory generation as well as the automatic guidance along this trajectory according to schedule is the domain of the Flight Management System (FMS). As today's FMS suffer from the poor or not existing interfacing with the aircrew and ATC an **Advanced Flight Management System (AFMS)** is being developed based on the Experimental FMS developed within the Programme for Harmonized Air traffic management Research in Eurocontrol (PHARE).

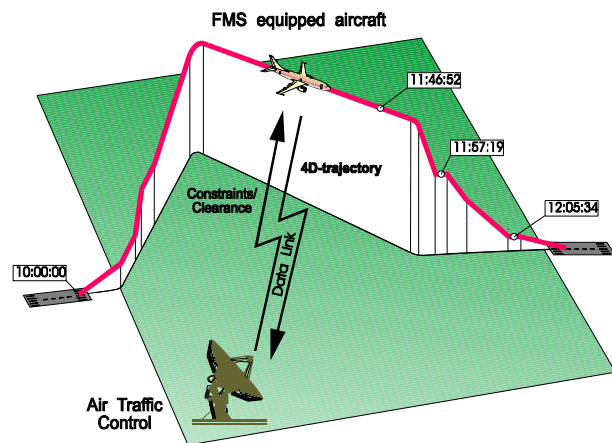


Figure: Co-operative Flight Management

The conventional Flight Management functionality is extended by co-operative elements, which connect traffic planning modules on the ground to flight planning systems on board the aircraft via data link.

The main features of the AFMS are:

- Computation of 4D-trajectories on board considering
 - constraints received via data link from ATC,
 - aircraft performance parameters,
 - economical criteria, etc.
- negotiation of the flight plan with ATC/ATM by means of data link connection, and
- 4D-guidance capabilities along the negotiated trajectory.
- FLS approaches including noise abatement approach procedures like Low Power Low Drag or Continuous Descent Approaches

TARMAC-AS

DLR's *Taxi And Ramp Management And Control - Airborne System (TARMAC-AS)* supports the pilot during taxiing. It combines an on-board stored airport map with a graphical display of air traffic control advisories.

The system offers the following functions:

- airport is depicted including runways, taxiways, parking positions and buildings,
- cleared taxi route is displayed as text and a green "follow-me" line,
- state of runway occupancy and state of other aircraft are signaled by different colors,
- warnings are displayed in case of runway incursions, deviations from the cleared taxi route, and conflicts with other traffic participants.

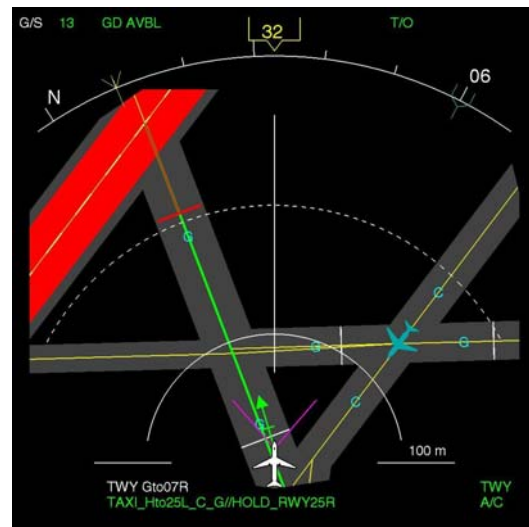


Figure: Taxi Guidance Display

**Deutsches Zentrum
für Luft- und Raumfahrt e.V.**
In der Helmholtz-Gemeinschaft

Institut für Flugführung

Lilienthalplatz 7
D-38108 Braunschweig
Tel.: (0049) 0531/295 - 2163
Fax: (0049) 0531/295 - 2550

E-Mail: bernd.korn@dlr.de
<http://www.dlr.de/fl>