

UAV Technologies



Unmanned Aerial Vehicle (UAV) – a technical challenge

Unmanned Aerial Vehicles (UAVs) play a more and more important role in military aviation. Their area of activity ranges from sensor platforms, to relays and as carriers of weapon systems. But UAVs also have an enormous potential in civil use, for example in coastguard, police, environmental and forestry relevant duties.

For instance border controls or civil infrastructures, searches for missing people, general reconnaissance, object tracing or in the tracking of pollution or fire sources.

The acceptance of UAVs and their operational mission is only possible, if their security level is at least

equivalent to the security level of the manned aviation. On the basis of the special separation of operator and aircraft, great demands are made on all components of the complete system of the UAV:

- ▶ Aircraft with Flight Control System
- ▶ Avionic system for remote-controlled and autonomous operation
- ▶ Data link for control and data transfer
- ▶ Ground control station

ESG is a technology consultant and competence centre for avionic systems; we are also a specialised systems company for mission avionics and simulation systems. Therefore we are working intensively with the key

ACTIVITIES AND COMPETENCES OF ESG IN THE UAV AREA:

- ▶ Design of data link concepts and network management
- ▶ Research of security aspects in data transfer
- ▶ Development of autonomous on board mission management systems
- ▶ Development of man-machine interfaces for the operator
- ▶ Research of innovative technologies and operational processes for certification guidelines

ESG Concept

For the allocation of intelligent and autonomous system functions, ESG has developed a Mission Management System (MMS). The concept of ESG is to provide the UAV with as much own-intelligence so that the controlling intervention of the operator is reduced to a minimum and the UAV can act autonomously in a case of emergency.

Here the intelligent on-board component is realised following the model of human action.

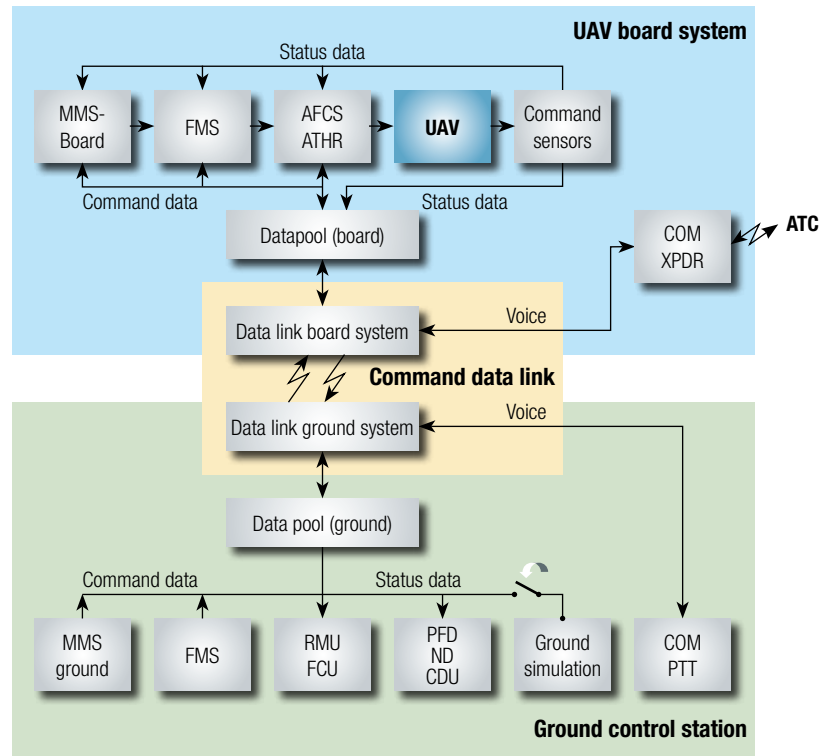
The system is able to:

- ▶ acquire a survey of the actual situation
- ▶ identify conflicts against the background of its actual task
- ▶ generate conflict solutions
- ▶ perform conflict solutions for the operator or even autonomous implementation

Functions of the MMS

MMS is a distributed system with the functionality distributed between the UAV and ground station. It provides the following functions:

- ▶ situation based, autonomous decision making as key function
- ▶ autonomous processing of all conflict situations by
 - conflict identification on basis of a functional chain of situation diagnosis and conflict valuation
 - execution of derived conflict solutions in certain (emergency) situations
- ▶ recommendation of respective conflict solutions to the operator
- ▶ prediction of autonomous system behaviour in the ground station in case of data link loss



UAV experimental system

Demonstration in technology projects

The concept of this intelligent MMS was realised in a demonstrator and approved successfully in simulation exercises as well as in flight tests.

ESG has developed a ground station, which uses an interface between the operator and UAV. This ground station permits the surveillance and control of the UAV and its systems

Testing results

- ▶ UAVs can be operated securely together with the civil aviation in controlled airspace
- ▶ The intelligent MMS permits the autonomous treatment of conflict situations as for example the flight to a backup airport after data link loss

ESG UAV services:

- ▶ Implementation of technical and operative studies
- ▶ Research of concepts via simulation
- ▶ Realisation of demonstration systems
- ▶ Testing of experimental systems

Further ESG UAV activities

- ▶ Concepts for discharged, flying sensor platforms
- ▶ Research into cooperative, autonomous skills of UAVs
- ▶ Research into the "Sense and Avoid" problem
- ▶ Cooperation with national and international consortiums on the subject of UAV