

ENVIRONMENTAL SURVEILLANCE WITH UAV - MALE SCAUT PROJECT

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Abstract (Topic: Flight Mechanics – UAV)

Despite in military field the employment of UAVs for reconnaissance operations is already consolidated, in civilian field the possibility of employment of such vehicles for environmental surveillance operations is still in phase of study and evaluation.

In the initial phase of this activity, the main obstacle was represented by the lack of codes of certification related to the project/construction/management to guarantee the UAVs safety levels for the general public not inferior (better if superior) to those currently guaranteed by the air transport system for passengers.

After the events of September 11 and the following decadence of the national safeties because of terrorist actions, the risk that such flying systems fall in the hands of the terrorist organizations has determined a further type of threat for the safety of citizens and has become another.

Therefore, in addition to the not indifferent problems related to the characteristics of "safety", further not indifferent problems related to the characteristics of "security" have been now added.

The SCAUT project (System of Automatic Control of the Territory), for a long time in progress at the Department of Aerospace Engineering of the University of Pisa, has had as a first objective the evaluation of the impact of the requisite of safety and security on the dimensions, weights and flight characteristics of UAVs of MALE category. It has reached the preliminary project phase of an updated reference configuration to keep in mind the evolution of the previous requirements.

Subsequently the construction of a flying model has been done in scale ½ in comparison to the reference configuration (max. take-off weight 60 kg) to experiment on it the fundamental components for the UAV flight constituted by:

- Fuel feeding system
- Electric power generation system with redundancy regards to engine damage
- Control system with redundancy regards to a generic command surface damage (aileron, equalizer, rudder, flap)
- Air Data System (IAS, altitude, vertical speed)
- Autopilots (acquisition and holding of IAS, heading, vertical speed, altitude)
- Guidance system (waypoint and/or VOR)
- Telemetry (uplink, downlink - range around 30 km)
- Video camera for the manual control together with its videolink system
- Flight Termination System (parachute)
- Flight Management System on PC 104 with functions of:
 - Artificial intelligence for the management of the above systems
 - Autonomous monitoring of the health of onboard systems
 - Automation of aircraft emergency procedures including
 - Mission Changing in case of non catastrophic damage
 - Interruption of flight in case of catastrophic damage
- Transportable ground station for flight control and mission setting.

The purpose of this paper is to introduce the updated version of the preliminary project of the UAV with particular attention to the criterions of safety and security taken as reference to define its configuration, the dimensions, the weights and the flight characteristics.

Subsequently the model in scale ½ will be introduced together with the its components and the ground station for the flight control and the guidance control.

Finally, some simulations of mission will be discussed in the presence of various levels of damages to the onboard systems with consequent re-planning of mission or interruption of flight using the test bed available at the Department with the scale model used as an "iron bird" (simulations with hardware in the loop).

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