UAV takes to the skies with the help of a torque sensor

Development of a vertical take-off and landing unmanned aerial vehicle (UAV) is nearing completion. A non-contact digital torque sensor proved the solution for use on the test rig.

The low-cost, flexible search and surveillance unmanned aerial vehicle (UAV) is intended for military, homeland security, policing and environmental monitoring. It is rugged, immediately deployable and can be launched from the ground, ship or even moving vehicles. The vectored-thrust UAV platform is suitable for any situation requiring safe aerial viewing or sensor measurement.

It is being developed by SELEX Sensors and Airborne Systems (S&AS), a Finmeccanica company. "The TorqSense technology has been one of the key enablers for the development and implementation of the novel propulsion system on the Damselfy UAV" said Mark Agnew, Selex's Chief Engineer for UAV Systems.

Leading the project is Ashley Bryant, who started out wanting to build a flyable scale-model replica of the vertical take off Harrier jump jet, but quickly saw the potential for a professional UAV. Using a jet engine was out of the question, a 'cold fan' solution the only practical option.

"A jet engine combusts fuel to turn its turbine and create thrust," he explains. "Our cold fan is driven, via a drive shaft, by a miniscule but powerful two-stroke engine. Developing this technology required us to build a unique test rig, with an in-line torque sensor so that there were no out of balance forces coming into play."

A thorough review of available sensors showed that only the TorqSense system met all his needs. Other requirements included ease of mounting, so that the drive system could be taken on and off the rig frequently, and a need to interface with a PC so that real time performance data could be logged and analysed.

TorqSense met the requirements. Its digital measurement system uses two tiny ceramic piezoelectric quartz combs, resonating at fixed frequencies and fixed to its shaft. As the shaft rotates and torque is applied the combs distort and the resonant frequencies change proportionally to the applied torque. The frequency changes are digitally monitored by the electronics in a non-contact manner using a RF couple and a variety of outputs are available.

"Our development programme was speeded up because of the ease with which we could lift the drive on and off the test rig, and the fact that we could automate the data capture and analysis," says Ashley. "If it weren't for TorqSense we could not have kept to our development schedule, and would have suffered consequential budget stresses too."

In fact Ashley has been so impressed with sensor that he is considering adapting it to become a permanent feature of the UAV. "We would use the quartz combs in the usual way, but would integrate the electronic functions with the existing on-board controllers, so the weight gain would be tiny. We would then be able to monitor the drive conditions in flight through our existing remote control system, improving reliability and controllability."

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