Wireless sensor essential for keeping drones going on long flights

High performance drones that can stay aloft for extended periods need super-reliable controls or risk being lost mid-flight. A test rig for developing the next generation of long-mission drones uses a wireless torque sensor that allows rapid set up and rapid testing.

Drone technology is continuing to develop rapidly to meet the new and evermore demanding applications. Traffic monitoring, topographic surveying and military surveillance all demand drones that can fly for hours and even days at a time. Such drones are based on fixed wing aircraft designs with high levels of powerless glide potential so that the battery pack is not constantly driving lift rotors, allowing long duration flights to be completed. Instead power is conserved for positioning flight control surfaces and running the propeller when required.

A test rig for putting the drives of their control surfaces through demanding proving regimes has being developed by Deva Technologies in Wrexham. The testing programme is based on amalgamating the results from a great many individual tests, so the rig had to be designed for ease of set-up thus minimising time and effort between actual tests. To this end it is based upon a wireless TorqSense from Sensor Technology Ltd so that the test pieces can be swapped in and out in a matter of minutes. Medium altitude long endurance (MALE) drones or UAV (unmanned aerial vehicles) typically fly at 10,000ft to 30,000ft for 24hrs to 48hrs. The duration of their flights means their controls must be reliable and accurate otherwise the risk of losing the craft would be unacceptably high.

Ian Maher of Deva Technologies says: "High performance servo motors are used to position the flight control surfaces. Our test rig's role is to put the motors through long duration tests to make sure they stay within specification, even after prolong exposure to the arduous operating conditions they are likely to encounter."

The TorqSense transducer constantly measures the power output at the motor shaft and this is compared to the instantaneous current draw. By taking many individual readings over the duration of the test period an accurate torque-load curve can be plotted for each motor and compared with the expected values.

TorqSense does not need to physically contact the shaft it is monitoring. Instead sensing is achieved through a radio frequency link. Two tiny piezoelectric combs are attached to the shaft of the motor under test, perpendicular to one another and at 45° to the axis of the shaft. These form half of a Wheatstone bridge circuit, which is in radio contact with the other half in the main body of the TorqSense.

"When the shaft rotates a phenomenon known as Surface Affect Waves causes one comb to expand and the other to contract, changing their electrical resistance in proportion to the speed of rotation," explains Ian. "This unbalances the bridge and generates a signal indicating the torque value.

"It imparts no extra load onto the shaft, so measurements are true, and calculations are simple. The rig produces data in real time and records the torque curve for analysis and traceability."

Significantly, because TorqSense is essentially wireless it is easy to set up, there being no cables there is no need for delicate and fiddly slip rings. This means test rigs can be both set up and operated easily.

Ian again: "It also means we can just as easily take the TorqSense off one test rig and fit it to another. Thus, we expect to use each one on multiple projects."

TorqSense is available from Sensor Technology Ltd, who invented the concept and developed it into today's sophisticated and adaptable instrument. TorqSense uses wireless technology to capture real time data streams from rotating shafts and can be used in a wide variety of applications from drone and aircraft flight control actuation systems, to green energy and automotive testing.

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