Drives upgrade for wind tunnel **rescues project**

When a DC motor and controller failed on a wind tunnel at the Department of Aeronautics at Imperial College London during a limited time test project, it put the whole project at risk. A fast turnaround AC drives upgrade saved the day

The Department of Aeronautics at Imperial College has become renowned for its wind tunnels. The Department has a series of wind tunnels, covering speeds from just a few metres per second to Mach 9. Two of its best known include the Honda wind tunnel which is optimised for race car testing, and the Donald Campbell low speed wind tunnel. In addition there are four general purpose wind tunnels.

Among these is a 3ft x 3ft low speed wind tunnel with a maximum wind speed of 150ft/sec, used for a wide range of tests from models of drones, or designs for reducing fractal turbulence (on an aircraft wing or a wind turbine blade for example) to attenuating noise produced by machinery. Recently, testing has produced designs to reduce the drag on heavy vehicles, with a view to fuel saving. But the failure of the DC motor and controller on the wind tunnel put a limited time project being carried out by a PhD student in jeophardy.

Specialist Dynamotive was called in, having worked with the Department of Aeronautics before, notably on the high profile Honda Wind Tunnel. The comapny was asked to provide an AC solution – preferred for its reduced maintenance requirements – and a fast turnaround. A complete scheme comprising PLC controller, HMI, AC motor and a Control Techniques AC variable speed drive was installed within weeks, enabling the PhD student to collect all of his test data with time to spare. The 1.5

metre direct drive fan now produces an airflow from 0 to 40 metres/sec through a screen, a settling chamber, three honeycomb filters producing a smooth airflow, via a Hodograph contraction section to increase airflow and into the 3ft x 3ft testing section, with a turbulence level of just 0.05%.

The drive chosen was a 37kW Unidrive SP model, fitted with an SM Ethernet plug-in module to enable communications with the Proface touch screen colour HMI that Dynamotive supplied and programmed. In addition, Dynamotive also supplied a small PLC for control sequencing.

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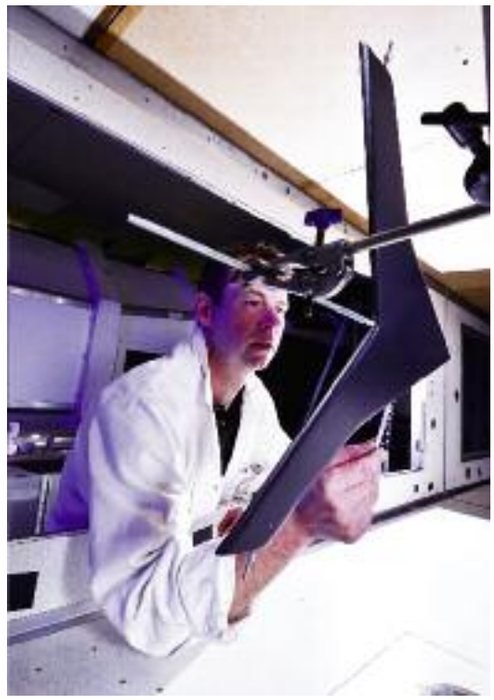
Temperature monitoring of the motor was also fed back via the PLC. A multi-port network switch enabled the Unidrive SP AC drive, the PLC, the HMI and the university's remote control PC to share the Ethernet network.

The 37kW motor was a special order through Emerson Control Techniques. It is a 6-pole unit pre-fitted with a 1,024 ppr TTL optical encoder that feeds back to the drive for the closed loop Vector speed control operation and with a force-ventilation fan module mounted to the non drive end of the AC motor's rotor.



This gives the extremely accurate low speed operation required by many of the university's experiments.

In remote control mode, the university closes the loop externally, taking into account differential pressure measurement feedback from the tunnel's test section area. It is then possible to use an algorithm to calculate actual wind speed in metres/second. The researcher can then issue a corrected rotational speed set-point via the AC drive that is monitoring fan speed via the encoder, until the desired wind speed for the experiment is achieved.

The HMI touch screen is programmed with a number of virtual pages, push-buttons and digital displays for RPM, drive and motor status and fan motor temperature. These are duplicated on the university's own PC control, which allows remote access if required for diagnostics and service.

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