Smart probes make sense

**Burnsville**

With the advent of fly-by-wire flight controls, the sensing and computing of altitude, airspeed, angle of attack, and other air data has become "flight critical".

Air data is an essential part of the control laws contained within the flight control computers, and to ensure its availability, designers are faced with the prospect of installing several expensive central air data computers to provide the required redundancy.

Rosemount believes it has an answer in its distributed air data system (Dads), which replaces the central computers with "smart" pressure probes linked by digital databus to the flight control computers, where air data computation takes place.

In a conventional air data system, pitot-static probes are plumbed back to the instruments or to a central air data computer, where transducers convert the pneumatic signals into digital format. Rosemount's Dads eliminates the plumbing by colocating the pressure transducer with the skin-mounted probe.

Replacing pneumatic plumbing with a digital databus—1553 or Arinc 429—saves weight and avoids maintenance headaches such as leak checking, says Rosemount. Pneumatic lag is also avoided. As each probe can "talk" to each flight control computer via the databus, redundancy is greatly improved, the company argues.

Behind the development of Dads are the rapid advances in electronics. A transducer requiring six circuit cards two years ago now requires only two, enabling it to be built into the probe. This transducer then converts pneumatic signals into digital messages for transmission on the databus. All that is required to perform air data computation within the flight control computer or inertial reference system is a single card, says Rosemount.

Dads has, however, required the development of a transducer that can maintain accuracy outside the relatively benign environment of the avionics bay, out on the skin of the aircraft where vibration is high and the temperature range wide. Rosemount believes it has succeeded in this.

The probe transducer unit, to give the smart probe its proper name, weighs 3.63 kg and has a quoted mean time between failures of 12,700 hr. It is a multifunction probe, in that it measures not only pitot and static pressures, but also two additional pressures from which angle of attack and angle of sideslip can be derived.

An aircraft with triple-redundant flight control computers would require only two multifunction probes plus a total temperature probe, the company argues. Quadruplex redundancy would require an additional multifunction probe. This results in the required redundancy without a proliferation of probes or air data computers, and saves weight and drag.

The company's distributed air data system has already been fitted to two aircraft, the Grumman X-29 and Rockwell B-1B, and is specified for a third, the Bell/Boeing V-22 Osprey. While the X-29 forward-swept-wing demonstrator uses separate pitot-static and angle-of-attack probes, the B-1B uses Rosemount's multifunction probes—three sets of two, in fact, to get average values over what is a large aircraft.

Stability enhancements to the B-1B would have required four central air data computers, at a cost of around $850,000 each, says Rosemount.

The US advanced tactical fighter (ATF), and the European fighter aircraft (EFA) will almost certainly do away with central air data computers, Rosemount believes. EFA is likely to perform the air data computation within its flight control computers.

The European fighter aircraft is likely to use a distributed, rather than centralised, air data system.