

It is apparent to all those involved in the aerospace industry that the continuous evolution of new avionic systems and aeronautic techniques that the on-board Air data Instrumentation in the latest aircraft are day by day becoming more extensive and complex, which in turn demand more performance capabilities from the associated test equipment.

D. Marchiori, DMA, has been operating in the business of design and manufacture of Air Data Test instrumentation for over 60 years since 1938, continuously evolving new designs to meet the changing needs of increasingly sophisticated test equipment. DMA is now acknowledged to be one of the most significant manufacturers of Air Data Test Sets; and we know from experience that the flexibility of the test equipment we produce is one of the most important criteria that influences customers to select a particular product over an alternative which may be on offer. We recommend that our Website, www.DMA-Aero.com is visited to enable a full understanding of the extensive product range to be appreciated.

As an example of the features currently being requested for today's ADTS the following items are just some of the important and popular features;

- Today the accuracy required of a flight-line ADTS on the static / altitude channel which is to be used to certify an aircraft that is to fly into an RVSM regulated area is required to be better than 0.1hPa (+/- 0,003”Hg). This high accuracy, previously considered difficult to achieve even in a Laboratory environment, is now available on rugged flight-line instruments and has been responsible for taking out of business some manufacturers who find themselves unable to meet this accuracy level, DMA offers a range of instruments which do provide the necessary accuracy for RVSM regulations.

- One of the latest requirements for an ADTS is the capability to control simultaneously three different pressures; this is needed with the newer aircraft types which are now using a new Pitot/Static Tube, commonly called a SMART PROBE, which in addition to the usual pitot static ports also has ports for the AoA (Angle of Attack) pressure. These Smart Probes are becoming popular as an alternative to the traditional moving vane AoA sensors. DMA has developed for this application the MPS35 tester which can be used either as a three channel pressure generator or as a traditional pitot-static dual channel pressure generator.

DMA have for some considerable time offered multiple pitot-static ports with remote control of these ports from the operators keypad and in the AoA configuration the 4+4 output ports are designed as follows: two static ports for the AoA pressures, two static ports for Static pressures and 4 pitot ports for total pressures.

- When used as a traditional dual channel pressure generator the MPS35 offers the following advantages:

The ability as described above for multiple lines, incorporated within the test set, to be switched automatically. This provides a quick leak test system and facilitates the troubleshooting for multi probe aircraft, all controlled from the keypad of the test set or the test set remote hand terminal.

When the 3 channels are required it will not then be necessary to re-train an operator for the use of a completely new equipment when the AoA feature becomes relevant, but only to train him on the use the features associated with the AoA mode of operation.

It will obviously not be necessary to purchase a different ADTS for testing those aircraft that are using the traditional dual channel Pitot/Static probes.

Other important features of the D. Marchiori equipment include:

- The ability for the Operator key press routines to be memorized by the instrument. This means that regularly performed test routines can be repeated exactly as defined by the recorded routine.
- The option of an in-built Flash Memory card for recording test results. Combined with the above key press routines this enables the DMA instruments to be considered as “documenting calibrators” which are welcomed by QA authorities as valuable record keeping devices.

- Operation of the test sets via totally separate, wireless, remote control. This is done using the “Bluetooth” protocol and allows control of the ADTS via a PDA, a small palm style pc or by a Notebook pc. This in turn permits the operator to configure as many programmed test routines as are necessary, to provide versatile / intelligent user screens, better suited to his own requirements, and also to be able to save the test results in the PDA to manage them later in a PC in spreadsheets or other versatile programs for results analysis.

- An internal battery giving in excess of 1 hour, or 4 hours, operation remote from an ac supply. This is a very valuable capability when quick tests need to be carried out, for example exploratory leak tests when there is no readily available ac power present.

- Due to the very low volume involved in the pitot/static systems it is very difficult to be able to detect a leak and then determine which system the leak is coming from. The use of the multiple isolators already mentioned will facilitate leak detection troubleshooting.

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There can be instances where the unwelcome situation of negative airspeed can be encountered during the leak testing of aircraft pitot-static systems. This can lead to damaged cockpit instruments and avionics. Care has to be taken by the operator of the test equipment to ensure that this does not occur, but accidents can happen.

DMA have now introduced a testing mode, which allows the two channels of altitude and airspeed to be tested without the possibility of negative airspeed values being created.

When testing for leaks in an aircraft system it is traditionally the normal practice to have both the pitot, airspeed, and static, altitude, in the measure mode, having first raised the parameters to the desired test values.

To protect against this negative Qc, negative airspeed; generally the two parameters are tested independently.

For example the altitude / static, channel would be tested with zero airspeed in the airspeed / pitot, line and the resulting altitude leak rate established

Similarly the airspeed / pitot channel would be tested with ground level altitude equivalent value in the altitude / static line.

However, it has to be remembered that even testing in this fashion, the interaction of the static and pitot lines produces effects on the airspeed value while simply testing the altitude channel.

If, for example, a test on the static channel is carried out at 20,000ft, and the pitot line is at ground level, then as the altitude value increases so also does the airspeed to several hundred knots.

If there is a leak in the altitude line when the MEASURE mode of testing is selected then not only will the altitude value decrease but so also will the airspeed.

This will not result in negative airspeed, (-ve Qc) but it illustrates the interaction taking place. If for any reason the testing should be carried out on both channels simultaneously then the possibility of negative airspeed becomes a real threat to the system.

An example would be a situation where perhaps the altitude test value was 20,000 ft and the airspeed test value was 300 knots. These values as pressures equate to approx. 465hPa absolute (13.75 insHga) in the altitude line and 153 hPa differential (4.53 insHgd) in the airspeed line.

Should there be a large leak now in the altitude channel then as soon as the altitude has dropped by a pressure equivalent to the airspeed differential pressure of 153 hPa, which is equivalent to approx 5,000ft, then the negative airspeed situation is generated.

DMA have now introduced a method whereby the two systems can be leak tested while at elevated test values yet ensure that there is no likelihood of introducing negative airspeed.

This is achieved by allowing testing of the pitot / airspeed, or static / altitude, channels for leaks while holding the channel not being leak tested in the CONTROL mode.

- The ease maintenance and calibration of the instrument are also basic criteria for the selection of any test equipment. All the DMA Air Data Test Sets can be calibrated in with only two pressure points for static line and two for pitot line; the two points calibration is possible by using an internal sophisticated linearizing process to reduce any linearity errors to less than 20 ppm of fs.
- The high reliability of DMA equipment is achieved by design criteria which minimizes the number of components, always keeping in mind the second law of thermodynamic which states that: the work dissipated generates entropy. Increasingly a very good criteria to evaluate an equipment design may be based on the power consumption. The lower the value of the power consumption the better is the design. The MPS series of instruments have a low power consumption which allows them the possibility of being operated also on internal batteries, which for the majority of testers exceeds 4 hours.
- However, even the most reliable of equipments can have failures; this is the reason why D.Marchiori try to use wherever possible commercial components which can be easily sourced in the market; it is not uncommon for very expensive equipment to be unused for long periods of time simply due to the problems of obtaining components which have a long delivery time or are even obsolete, such as memories, processors and displays.