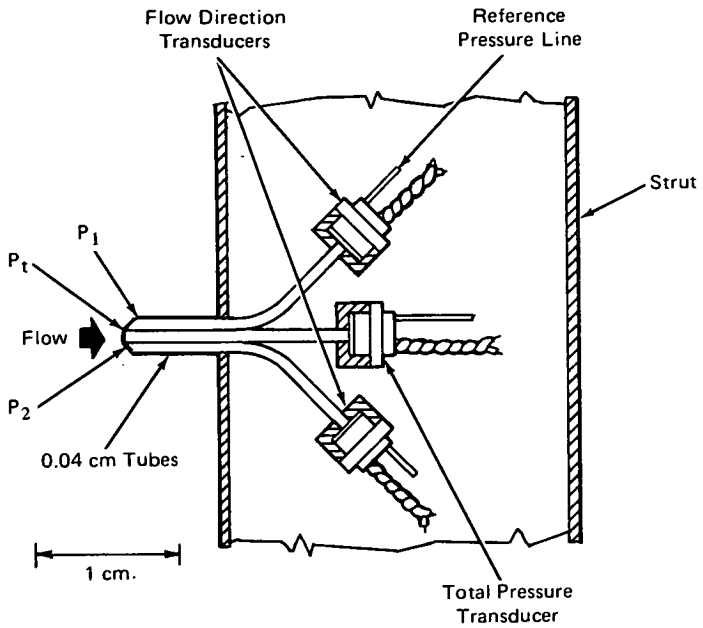
NASA TECH BRIEF

Lewis Research Center

Nonsteady Flow-Direction Measurement



3-Tube Strobe

A probe has been developed for the measurement of flow direction as well as total pressure for nonsteady flow.

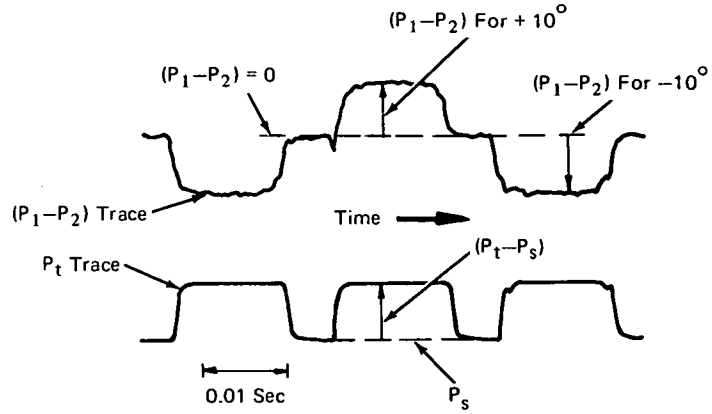
One of the quantities usually required in experimental fluid mechanics is fluid velocity. In all but the simplest experiments, a measurement of steady flow direction is required together with measurements of total and static pressure. Recent jet engine inlet experiments have required the measurement of flow direction and total pressure for nonsteady flow.

Flow direction for steady flows is continuously determined by the use of a pressure probe which has symmetrically oriented taps that are sensitive to flow direction. The probe shown in the figure is a 3-tube assembly using two bevelled tubes to sense flow direction and a central square-ended tube to measure total pressure. The probe is fixed, and flow direction is determined from a correlation based on the relationship between probe pressures and flow direction.

For nonsteady flow, the steady-state flow probe described above is modified by using miniature pressure transducers mounted within the probe support very close to the tube inlets, to shorten response time. The speed of response is dependent on the internal volume between the tube inlet and the pressure transducer location. The graph shows traces of the electrical output of the transducers when the probe is immersed in a gas stream whose flow direction alternates rapidly from $+10^\circ$ to -10°.

Nonsteady flow direction in two planes may be obtained by the addition of a pair of bevelled tubes perpendicular to those shown.

(continued overleaf)



Flow Direction And Total Pressure Traces

Typical test data indicate that, within its response capability, the probe measures the nonsteady flow direction to within 0.5°, as well as the nonsteady total pressure.

Notes:

1. Development of such probes to measure nonsteady flow direction requires a well-defined, nonsteady flow source in which to calibrate the probes. Such a nonsteady flow direction generator is described in the technical support documentation for this Tech Brief.
2. The following documentation may be obtained from:
   National Technical Information Facility
   Springfield, Virginia 22151
   Single document price $3.00
   (or microfiche $0.95)
   Reference: NASA-TM-X-52962 (N71-18632), Non-Steady Flow-Direction Generation and Measurement.
3. Technical questions may be directed to:
   Technology Utilization Officer
   Lewis Research Center
   21000 Brookpark Road
   Cleveland, Ohio 44135
   Reference: B72-10403

Patent status:

No patent action is contemplated by NASA.

Source: L. N. Krause and R. L. Summers
Lewis Research Center
(LEW-11499)