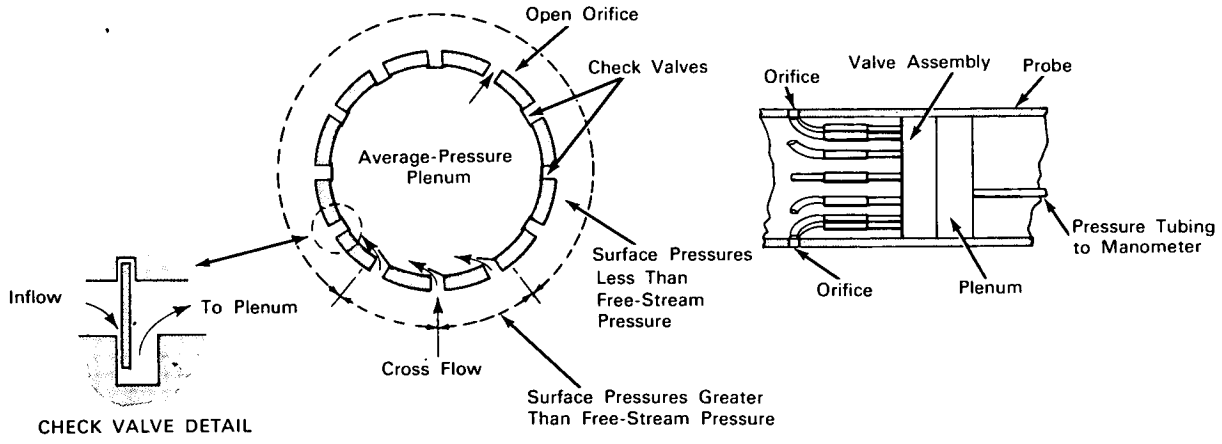
NASA TECH BRIEF

Averaging Probe Reduces Static-Pressure Sensing Errors



The problem: Providing an orifice probe that will accurately sense the free-stream static (ambient or barometric) air pressure on an aerodynamic surface which does not have a preferred angle of inclination to the direction of the airstream cross flow. The design must not include the use of automatic rotating or swiveling mechanisms, which, although capable of operating with fair accuracy, present mechanical problems.

The solution: A probe (in the form of a body of revolution) that senses the free-stream static pressure by averaging the high (windward) and low (leeward) aerodynamic pressures admitted to a plenum through circumferentially spaced orifices. The windward pressures enter through orifices fitted with simple internal check valves.

How it's done: The orifices are uniformly spaced around the circumference of the probe to ensure the sensing of local aerodynamic pressures in windward, leeward, and side directions when the probe is inclined in any plane. Most of the orifices are fitted with internal check valves designed to permit inflow of the air from the windward direction and to prevent outflow from leeward and side surfaces. A number of orifices without check valves (only one valveless or open orifice is illustrated for simplicity) are spaced at appropriate intervals along the circumference. All of the orifices are connected to a common pressure plenum. The average air pressure developed within the plenum under equilibrium conditions of cross flow into the valve-controlled orifices and outflow from the open orifices is approximately equal to the static pressure. A pressure transducer (e.g., a manometer) connected to the plenum gives a measure of this pressure.

Notes:

1. The basic probe and experimental modifications incorporating several orifice assemblies at different locations along the axis of the probe were tested in a wind tunnel. The test results show that probes of

(continued overleaf)

this type are capable of yielding consistent static pressure measurements on aerodynamic vehicles (at subsonic through low supersonic speeds) which operate at moderate inclinations in any plane.

2. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Langley Research Center
   Langley Station
   Hampton, Virginia, 23365
   Reference: B65-10114

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Source: Virgil S. Ritchie
(Langley-36)