E230 Aircraft Systems

Flying Blind

6th Presentation

School Of Engineering

Air Pressure Characteristics

- Aircraft uses air pressure to determine several flight information.
- As the aircraft moves faster, the wind impacting on the aircraft becomes greater.
- The higher the aircraft climbs, the thinner the air surrounding the aircraft.
- Pressure instrument uses such properties for measurements.

Forms of pressure

- **Static pressure (P_S)**
  - ambient pressure surrounding the aircraft
- **Dynamic pressure (P_v)**
  - moving air impacting on the aircraft
  - $\frac{1}{2}\rho v^2$
- **Total pressure (P_T)**
  - sum of static and dynamic pressure; $P_T = P_S + P_V$
  - $P_1 + \frac{1}{2}\rho v_1^2 = P_2 + \frac{1}{2}\rho v_2^2$

where ρ is the air density and v is the speed of the airflow

Sensing of Total and Static Pressure

- Pitot tube inlet senses the total pressure, also known as the pitot pressure.
- Static ports detect the static pressure

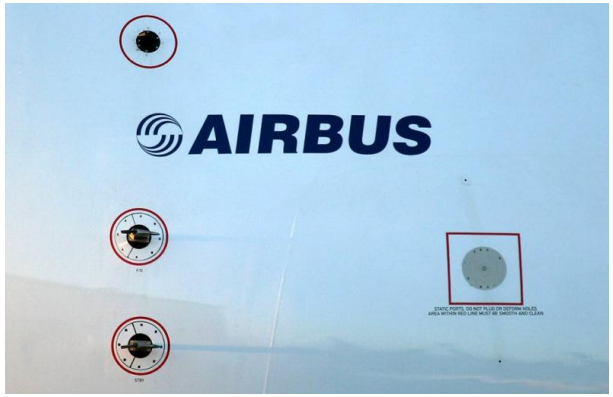
Location of pitot-static probe

Boeing 747

Boeing 747 – close up

Pitot probe covered

Location of pitot-static probe



Airbus 380

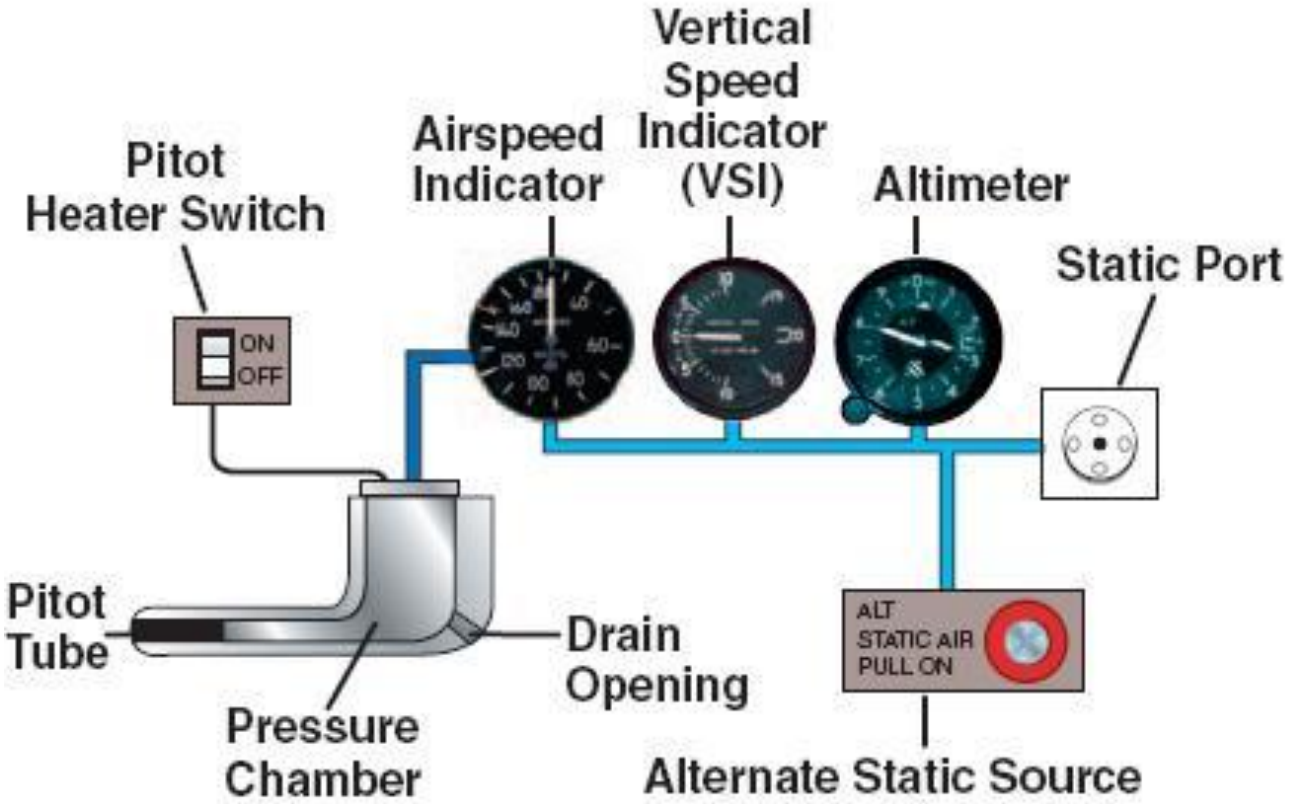
Static port

Pitot probe with AOA sensor

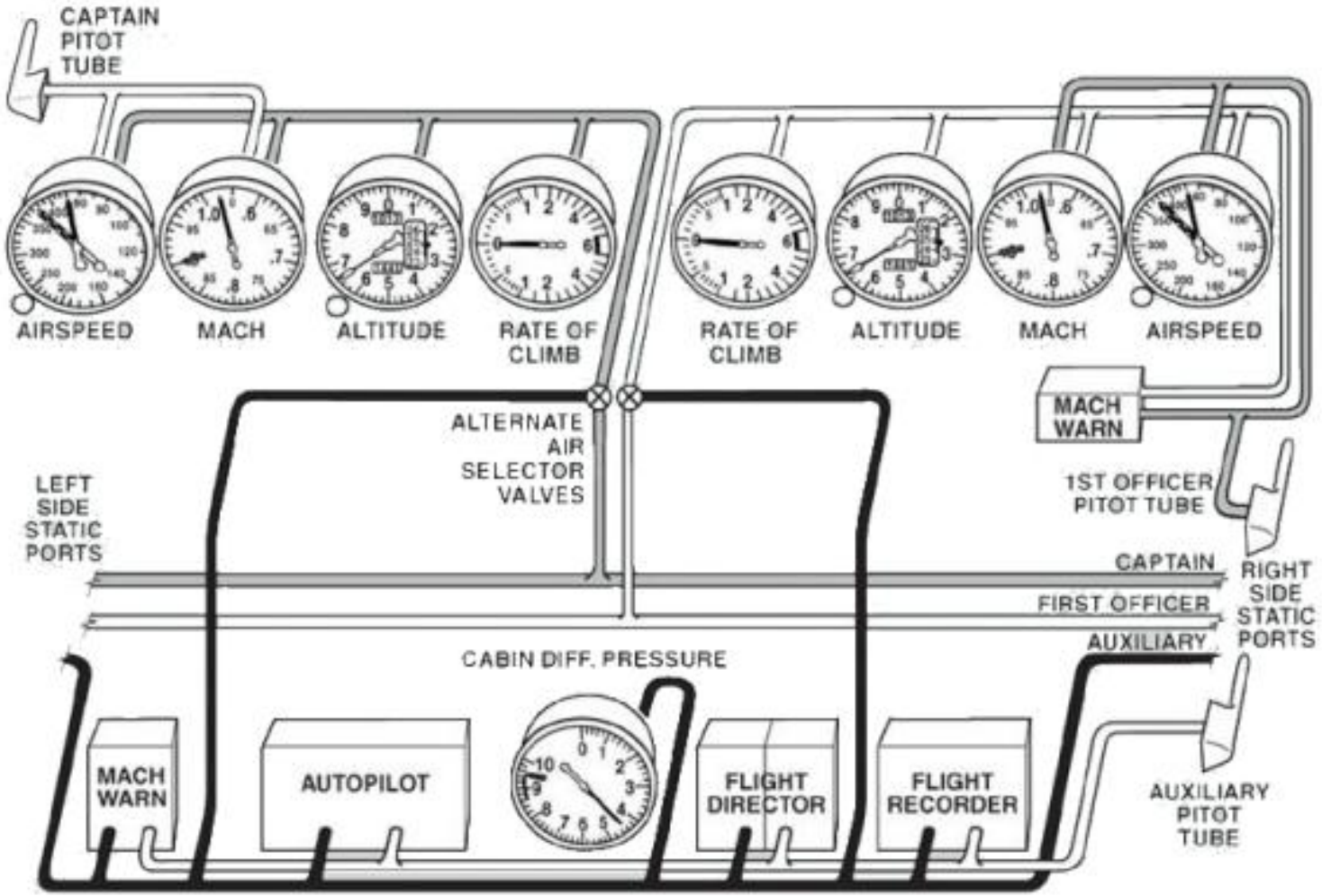
Flight data derived from air pressure

- Altitude
  - obtained from static pressure
- Rate of climb
  - obtained from changing static pressure
- Airspeed
  - obtained from pitot and static pressure

Simplified Pitot Static System



Pitot-static system in commercial airliner

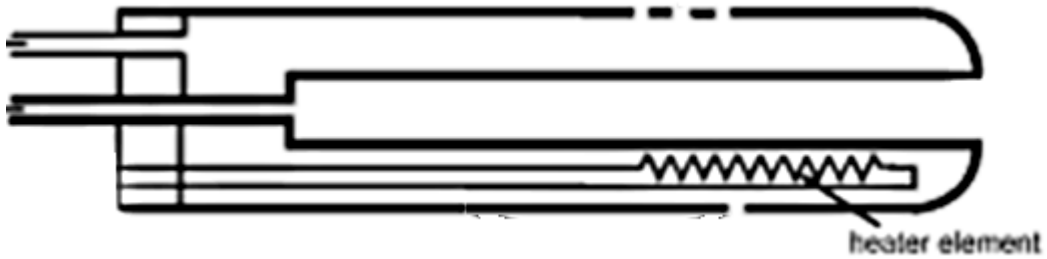


Causes of error in pressure measurement

- Disturbance of airflow near the inlets due to aircraft maneuvers
- Formation of shock waves during high-speed flight
- Blockage of static ports or pitot ports
- Icing on probe

Ways to minimize measurement errors

- Locate static ports away from pitot tube
- Place static ports on both sides of fuselage to average out maneuver-induced errors
- Place pitot probe ahead of aircraft nose to avoid shock waves (for supersonic aircraft)
- Heat up pitot probe to prevent icing



Maintenance of Pitot-Static System

- Check system for any trapped moisture
- Purge system of any blockages
- Ensure that the pitot probe is covered when aircraft is on ground to prevent FOD from entering
- Check system for any leaks

Learning Objectives

- Apply the properties of air for measurements
- Explain the different forms of pressure exerted on aircraft
- Identify the location of pitot probes & static ports
- Describe the functions of pitot static system
- Describe possible measurement errors and ways to minimise them
- List the maintenance requirements for pitot static system