

PITOT/STATIC SYSTEM

PITOT TUBE:

Measures dynamic and static pressures and is positioned to be clear of the slipstream and facing the line of flight.

THE AIRSPEED INDICATOR IS THE ONLY INSTRUMENT CONNECTED TO THE PITOT PRESSURE SOURCE.

STATIC TUBE:

Measures static pressure and the tube is vented to allow air pressure inside the instrument case to equalize with the outside air pressure. The vents are located on opposite sides so as to not be affected by turbulence.

ASI, ALTIMETER, VSI USE STATIC PRESSURE.

ALTIMETER

Measures the pressure in the atmosphere, which is the weight of the air above you at any given altitude. This weight will change as the aircraft climbs or descends causing the altimeter to register a change.

Made up of a stack of aneroid capsules each set at standard sea level. As the altitude changes these capsules expand and contract moving gears and thus the hands on the altimeter change.

Errors:

Pressure:

- The atmospheric pressure changes when flying from place to place. If not corrected, the altimeter will be inaccurate

Temperature:

- The altimeter is constructed to work on the values of the ICAO standard atmosphere (15°C), the temp is not always at this value.

Mountain Effect:

- When flying near mountains, winds can be gusty and cause a drop in local pressure. Consequently, the altimeter will not give an accurate altitude indication.

AIRSPEED INDICATOR

Tells the pilot how fast they are travelling through the air and not over the ground and is measured in knots and miles per hour. Measures the difference between pressures in the pitot and static tubes.

The reading on the airspeed indicator is referred to as the Indicated Airspeed (IAS). True airspeed (TAS) is the calibrated airspeed corrected for airspeed indicator error due to density and temperature.

The instrument is made up of an aneroid capsule which measures the pitot pressure. The interior of the case is sealed and the static pressure is measured there. The changes in dynamic pressure (pitot) cause the aneroid capsule to expand and contract. This movement is transmitted to a connected linkage that moves the hand on the ASI.

Calibrated airspeed:

Is indicated airspeed corrected for instrument errors and installation errors in the pitot static system.

Equivalent airspeed:

Calibrated airspeed corrected for compressibility factor.

Markings:

- Red: Velocity never exceed (V_{ne})
- Yellow: Caution (V_{no})
- Green: Normal (V_{sl})
- White: Flaps (V_{fl})

Errors:

Density:

- Atmospheric density varies and as a result this will change the accuracy of the ASI.

Position:

- Eddies that form as air passes over the wing are responsible for error.

Lag:

- The slowness of the working parts are responsible for this error.

Icing:

- Ice formation blocking either the pitot or static tube could give inaccurate readings.

Water:

- Water could block the tubes causing inaccurate readings.

VERTICAL SPEED INDICATOR

Indicates the rate of climb and descent and is measured in feet per minute.

Measures the change in pressure between the capsule (atmospheric pressure) and the case of the instrument. The capsule will expand and contract which is then transmitted by linkage to the dial of the instrument.

The instrument tends to lag and will only show an accurate rate after 6-9 seconds.

VARIOMETER

A very sensitive rate of climb indicator that is used to find thermals. Works on the same principle as the altimeter: the higher the altitude the less the static pressure.

MAGNETIC COMPASS

Consists of two north-seeking magnets, which are attached to a float, which is also attached to a compass card. This complete magnet system is mounted on a pivot and is free to rotate. The whole assembly is mounted within the compass bowl, which is filled with alcohol to reduce the weight of the compass card and the magnets. The lubber line indicates the direction the aircraft is heading and is in line with or parallel to the longitudinal axis of the aircraft.

GYROSCOPE

It is a rotor, or spinning wheel, rotating at high speed in a universal mounting, called a gimbal, so its axle can be pointed in any direction.

Gyroscopic Inertia:

The tendency of a rotating body to maintain its plane of motion.

Precession:

The tendency of a rotating body, when a force is applied perpendicular to its plane of rotation, to turn in the direction of its rotation 90° to its axis and take up a new plane of rotation parallel to the force applied.

GYRO INSTRUMENTS

THE HEADING INDICATOR

The heading indicator or directional gyro is an instrument designed to indicate the heading of the airplane and because it is steady and accurate, to enable the pilot to steer that heading with the least effort.

THE ARTIFICIAL HORIZON

The artificial horizon or attitude indicator provides the pilot with an artificial horizon as a means of reference when the natural horizon cannot be seen because of cloud, fog, rain or other obstructions to visibility. It shows the pilot the relationship between the wings and nose of the airplane and the horizon of the earth.

TURN AND SLIP INDICATOR

- Needle indicates the direction and rate of turn.
- Ball indicates slipping or skidding
- If the ball is opposite to the needle in a turn you are skidding. With the ball and needle on the same side the turn is slipping.

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