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# Instrument Panel And Pitot Static System

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***Abstract***
*The instrument panel Layout are divided are divided to three section, the section concerning the pressure and gyroscopic instrument and we call it pilot side, the second section concerning the engine performance and we call it center panel and the third section as the first section but for copilot side*
*The basic flight instrument panel consists of the following pressure instrument as Altimeter (ALT), Vertical (A.S.I), Mach meter*
*ii) Gyroscopic instrument as Attitude indicator Heading indicator, Tarn and slip indicator .*
*iii) Engine performance inflictors as Engine pressure ratio (E.P.R), engine tachometer circuit (R.P.M), Exhaust Gas temp retire (E.G.T), Circuit (R.P.M), Exhaust Gas temperature (E.G.T). Fuel flow (F.F), Fuel quantity (F.Q), and Engine oil pressure.*

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## I. Introduction

In the days of the first successful aero planes the problems of operating them and their engines according to strict and complicated procedures, of navigating over long distances day or night under all weather conditions, were, of course, problems of the future .

The y were, no doubt, envestigated by the enthusiastic pioneers of flight but weze perhaps somewhat overshadowed by the thrills of taking to the air, maneuvering and Landing .

Such aeroplanes as these pioneers flew were rather " stick and string " affair with some what temperamental engins, the whole combination being manoevered by apilot Lying, sitting or crouching precariously in the open, for the Luxury of a eockpit was also still to come .

Instruments designed specifically for use in an aerplane were also non-, after all, what instrument manufacturer at existent. the time had the necessity of designing, for example fast an instrument to show how a man and machine Could travel through the air? It is a little difficult, to exactly in what sequence instruments introduced into aeroplanes.

A magnetic Compass was certainly an earlyacquisition as soon aspilots attempted to Fly from A to B, and flying greater distances would have required information as to how much petrol was in the tank, So a Contents gauge was fitted, usually taking the form of glass sight gauge.

Somewhere along the Line the clock found it's place and was useful as ameans of Calculating speed from time distance method, and as an aid to navigation with such supplementary aids a pilot was able to go off into the third dimention flying mainly by his direct senses and afterwards boasting perhaps that instruments would not be needed anyway !

As other pioneers entered the field many divers aeroplane designs appeared, some which were provided with an pilot and a enclosure for the wooden board on which then. available instruments Could be mounted. Thus the Cockpit and instrument panel were born.

shortly before the outbreak of world war I, Some attention was given to development & instruments for use on well military and naval aeroplanes, and the first principals of air •navigation Were emerging with designs for instruments specially adapted for the purpose.

Cosequently, on a more instruments appeared the dashboards of Certain types of aeroplane including an altimeter, airspeed indicator and the first engine instruments-an r .p .m. indicator and an oil pressure gauge. During the war years very few new instruments were provided in the many types of aeroplanes. pitch and bank attitude, which Led to the introduction of the fore-and-aft level and the Cross-Level.

## II. Objective

To know the anstrument panel with three Section•

• It had already been found that pilots soon Lost their sense of equilibrium and had difficulty in Controlling an aeroplane when external references were obscured.

• Instruments Were therfore required to assist the pilot in circumstances which became known as "blind flying Conditions."

• The first and most important step in this direction was the development of the turn indicator based on the principles of the gyroscope.

• gyroscope instrument, in Conjunction with the magnetic Compass, became an extremely useful blind-flying aid, and when a bank indicator was Later added to the turn indicator.

• pilots were able, with much patience and "skill, to fly "blind" by means of a small group of instruments.

• However, Progress in the de sign of aeroplanes and engines developed to a stage where it was essential to provide more aids to further the art of blind flight.

•• An instrument was required which could replace the natural horizon reference and Could integrate the information obtained from the cross-level and the fore-and-aft Level.

It was also necessary to have some stable indication of heading which been or scorer of Serious would not be affected by accelaration and turning. manoeuvres which had for long been a source of serious errors in the magnatic Compass.

## III. Results and discussion

**pressure head :**

An aircraft at rest on the ground in still air is subject to normal atmospheric pressure which bears equally on all, parts of the aircraft.

- This ambient pressure is known a flight "static pressure". An aircraft in Level, Called " experiences an additional pressure dynamic pressure depends on the speed of the aircraft through , and its Value the air. the air and on the density a pitut pressure". The pressure is also known as

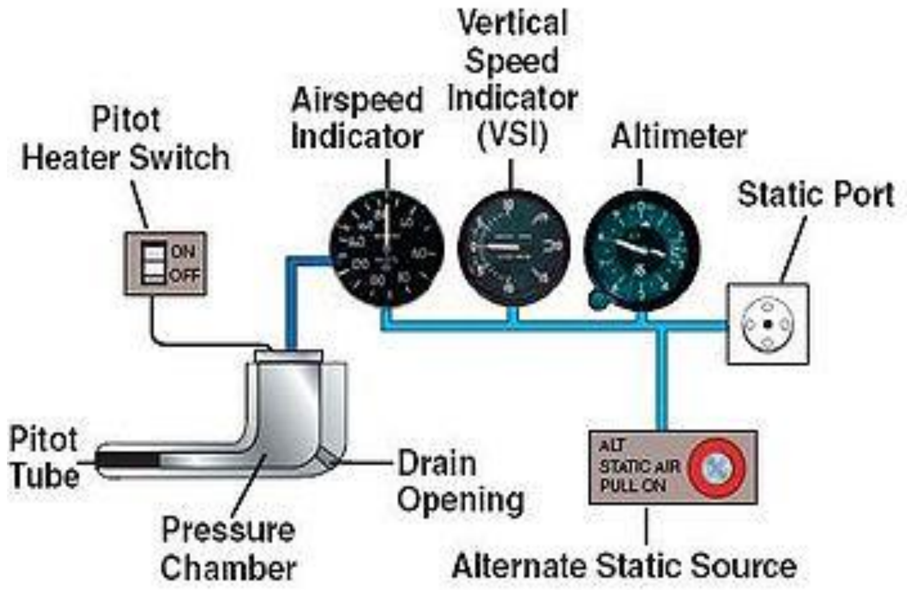
- Two of the pressure-dependent flight-instruments, the altimeter and Vertical speed indicators, operate solely on static, pressune, where as airspeed indicator and mach meter, utilise both static and pitot pressures.

- Inside an aircraft - pressure and temperature.are Seldom the same as the out-side of the aircraft So pitot and static pressures must be Sensed by devices mounted on the outside of are the aircraft

:Pitot-static heads-

- An open-ended tube parallel to the Longitudinal axis of the aircraft is used to sense the total pressure (static pluse dynamic.(

- This device is a pitot-tube mounted in a Pitot head. The open end of the tube faces. into moving airstream, the other end Leading to airspeed capsules The in A.S.I. and machmeter. airstream is thus brought to reset in the tube, re generating the extra (dynamic presun) which together with the static pressure a the tube provides the required already in pressure. A static head consists of a tube with it's forward end sealed but with holes or slots cut insides. These slots do not face into the airflow and therefore, they sense only the static pressure to the pressure supplies the static pressure instruments.



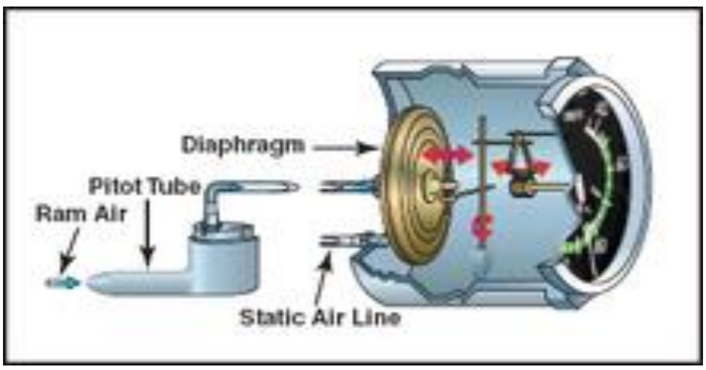

The pressure all meter. a simple, reliable pressure gauge calabrated to indicate height, the pressure at a the weight of the Column of air o paint depends on Vertically upwards from the point to the cuter Limit which extends of the onmosphere, the higher a the an aircraft is flying, shorter the Column is, of air above it and Consequently the Lower is theatmospheric pressure at the pressure, and by measuring the pressure thealtimeter height.

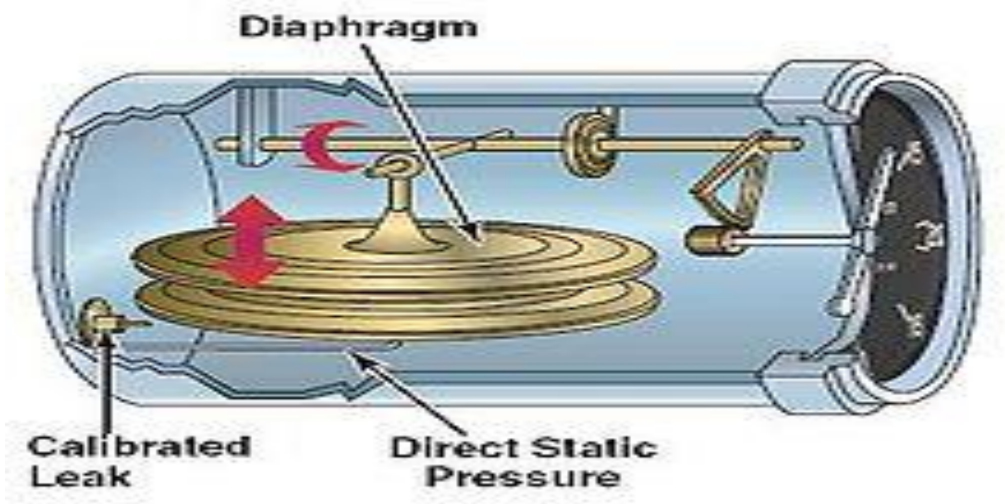
unfortunately the relationship between and height is not Linear one, so the calibration of the altimeter scale is not a simple matter. Pressure the stat situation is further Complicated by high and Low pressure weather the systems measure which reduce pressure differences in the horizontal plane, forthermore, the temperature of the air at the surface and temperature Lapse rate in the air above vary Considerably; this affects air density which in turn affects pressure.

**Results of Calibration**

with all these variables it becomes necessary to assume average or standared conditions, base the calibration formula on these, and the apply Corrections appropriate to the deviations from standard Conditions for ISA "International standared atmosphere,"

a) at mean Sea Level
pressure 1013.25 millibar
temperature +15 c$^o$
b) From 11 km to 20 km (65617 feet)
A Constant temperature of -56.5 C$^o$
c) From M.S.L. up to 11 km (36090 feet).
Temperature falling at 6.5 c$^o$per km
(1.98 c$^o$ per 1000 feet)
d) from 20 km to 32 km (104987 feet)
Temperature rising at 1c$^o$ per km
(0.3 c$^o$ per 1000 feet)






Temperature rising at 1 c° per km
(0.3 c° per 1000 feet)

with these assumptions, the pressureCorresponding to any given Level in theISA can be calculated from theCalibration Formula, graphs or tables Can be produced showing high in terms of pressure under standared Conditions. these Can be used for the manufactures Calabration of the altimeter scale.

Basically, the Laboratory Calibration Consists of applying o series of pressure to the altimeter and checking that the instrument indicates the respective Levels which Correspond to these pressuresin the ISA.

**Construction:**

Simple altimeter-

static pressure is fed into the case of the instrument from the static Source. As hight increases, static pressure decreases the Capsule expands under the Control of a leaf spring, A mechanical linkage magnifies this Capsule expansion and Converts it to rotational movement of a single pointer over the height scale. The linkage incorporates a temperature Compensating device to minimise errors Caused by expansion and Contraction of the Linkage and changing in spring tension due to fluctuation in the tempested of the mechanism.

Sensitive altimeter :-

The simple altimeter is almost a thing of the past, most aircrafts being equiped with three pointer or sensitive type .

the principle of operation is similar to that of the Simple altimeter but there are the following refinements .

a) A bank of two or three Capsules give the increased movement necessary to drive three painter. These are grater loo, Io, 1, the Smallest indicating 1000 feet the next 1000 feet Largest Loco feet Per revolution, per revolution and the per revolution .

b) Jewelled bearings are fitted, reducing friction and associated Lag in indications.

c) A Variable datum mechanism is built in. this, with the aid of a setting knob, enables the instrument to be set to indicate heigh above any desired pressure datum .

**Altimeter setting :**

It should be remembered that the altimeter indicates height above the pressure Level Set on the sub-scale. Settings Normally used.

**Q.F.E**

This is aerodrome level pressure, which when Set on the subscale should cause the altimeter of an aircraft on the ground to Read Zero, assuming error.

In there is no instrument flight, with Q. F. E. set, the altimeter Should indicate height the aerodrome OFE reference datum, provide I.S.A. Conditions obtain between aerodrome level and the aircraft and there no other altimeter errors.

In praetics, Q.F.E. is used man mainly for Circuit flying and give a good inelication of height above the aerodrome, any errorsinvolved being only small.

**Q.N.H :**
This setting is used mainly in flight below transition altitude/level.

It is an equivalent M.S.L pressure Calculated by air traffic Control from aerodrome level pressureassuming ISA Conditions prevail between drome Level and MSL.

aero with Q.N.H. set on the sub-scale, the altimeter of an aircraft on the aerodrome indicates aerodrome elevation, that is height AMSL, (if ther is no instrument error).

In flight the altimeter will indicate altitude but this will only be the true altitude if the mean temperature in the column of air beneath the aircraft is the same as in ISA. Conditions (assume there are different from standard indicated altitude, Some times Called Q.N. H. altitude, may deviate Considerably from the true altitude.

## IV. Conclusion

To make air safety is a term encompassing the theory, investigation and categorized of flight failures.
To prevention of such failures through regulation and training.
Insure and understand the air safety hazards.
Foreign object debris (FOD) includes items in the aircraft structure during manufacture/repairs.
Debris on the runway and solids encountered in flight (e.g. hail and dust).
Such items can damage engines and other parts of the aircraft.
Ice and snow can be factors in airline accidents.
In 2005, south west airlines flight 1248 slid off the end of a runway after landing in heavy snow conditions, killing one child.
Even a small amount of icing or coarse frost can greatly impair the ability of a wing to develop adequate lift.

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