Instruments Points

Pitot and Static systems

- Static pressure error varies with greatly with mach number

Air Speed Indicator

- Calibrated for ISA
- IAS -> CAS (corrected for position error and instrucment error) -> EAS(Coorected for compressibility) -> TAS (corrected for dencity)
- White arc :Vs0(stalling speed with flap and gear extended) – Vfe(flap extended)
- Green arc : Vs1(stall with flap and grear retracted)-Vno (normal operating)
- Yellow arc: Vno(normal operating) – Vne (never exeed)
- Blue line (optimum climb speed with one engine inoperative)
- St-venant's formula used to calibrate anemomoeters

Altimeter

- Tolarence of servo altimeter at sea level ±60ft
- Colder – over read, Warmer – underread
- Capsule (vaccume or very low pressure) , casing (static pressure)
- CTM below tropopause, CMT in inversion

Mach Meter

- $LSS = 38.94\sqrt{temp\ in\ K}$
- K® = C® + 273
- Principle (Pt-Ps) to Ps
- 2 diaphrams

Vertical Speed Indicator

- ROD for 3 degree slope = TAS *10/2

ADC

- $Static\ Air\ Temeprature = \dfrac{Temperature\ measured}{.2 \times recovery\ factor \times Machnumber^2}$, all temperatures absolute

GyroScopic Instrumetns

- Properties inertia and gyroscopic precision
- Rotation speed 9000 – 12000 rpm
- Gyro drift : wandering in horizontal plain
- Gyro topple : wandering in vertical plane
- Real wander : when the sin axis moves from a fixed point in space
- Apparent drift : due to rotation of earth = 15sin(latitude)
- Apparent topple : due to rotation of earth = 15cos(latitude)

Directional Gyro
- 2 degrees of freedom horizontal spin axis
- Spin axis tied to the yawing plain of the aircraft with the help of air jets
- Transport wander due to change in position on the earth
- Drift due to rotation of earth : 15 sin (latitude) degrees/hour In northern hemisphere –ve southern hemisphere +ve ie northern hemispthere gyro N moves right
- Drift due to latitude nut : 15 sin latitude degrees/hour in northern hemisphere +ve southern hemisphere –ve acting agains drift due to rotation of earth
- Transport wander$= \dfrac{East\ west\ component\ of\ Speed\ in\ knots\ \times\ \tan(latitude)}{60}$, eastwards –ve in northern hemisphere westewards +ve in northern hemisphere

Slaved DG
- Gets directional signals from the flux valve and sends to error detector
- Error detector generates singlas amplified for correcting
- Signals turn the torquw motor to precess the gyro
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  Sensor part of flux valves contain 3 pickup coils

Artificial Horizon
- Uses earth gyro
- Spin axis maintained earth vertical
- Roll 360 degree and pitch ±75 or 80 degrees freedom
- Erection in air operated with the help of vanes and in electrical merury level switches
- Angle for rate 1 turn = tas/10 +7

Turning error
- Very complex
- 90 degrees pitch up and bank less
- 180 degrees pitch up and bank more
- 270 degrees pitchup and bank more
- 360 degrees correct attitude
- On rolling out after a steep turn nose up opp bank shown momentarily

Acceleration
- Acceleration in constant heading will show pitchup with right bank

Turn and bank indicator

Rate gyro
- One gymbal 2 axis of movenet
- Freedom of movement about longitudinal
- No movement in yaw.
- Kept horizontal with springs

- While yawing the force is precessed 90 degrees to make the gyro topple
- Radius of turn = $\frac{TAS}{rate\ of\ turn}$

Magnetic Compass

Terrestrial Magnetism
- Blue pole north, Red Pole south

Magnetic Compass
- Quadrangle deviation caused by induced magnetisation of soft iron corrected using soft iron
- Compass swinging to find magnetic deviation
- Magnetic variation (difference between TN and MN) got from isogonals on chart

Properties
- Horizontality : ability to align north
- Sensitivity : point accurately to the north
- Aperiodicity : come back to north after being disturbed

Acceleration errors
- Acceleration errors show apparent turn to the closer pole
- Error minimum in the north south direction
- Maximum in east west direction

Turning Errors
- Turning through the nearer pole compass sluggish
- Turning through the further pole compass lively
- Clockwise turn under read
- Anti clockwise over read

Radio Altimeter
- Gives height of aircraft from ground directly below

Principle
- Fm wave beamed below at 20 – 40 degress width
- Reflected wave pickedup by second antenna
- Difference btw when signal is sent and signal is received gives height
- Frequency used 4200mhz and 4400 mhz
- Frequency sweep 500 times a second
- Maximum height 2500ft
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