Name Tags

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Discuss in Groups

What do you think each of these instruments does and why each one might be important?
The Six Pack

1. Consists of 6 instruments
   a. Airspeed Indicators
   b. Attitude Indicators
   c. Altimeter
   d. Turn Coordinator
   e. Heading Indicator (DG)
   f. Vertical Speed Indicator
Glass Cockpit
Pitot-Static System
# V-Speeds

Refer to important airspeeds of an airplane

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_A$</td>
<td>Design maneuvering speed</td>
</tr>
<tr>
<td>$V_{FE}$</td>
<td>Maximum flap extended speed.</td>
</tr>
<tr>
<td>$V_{NE}$</td>
<td>Never exceed speed</td>
</tr>
<tr>
<td>$V_{NO}$</td>
<td>Maximum speed for normal operations</td>
</tr>
<tr>
<td>$V_R$</td>
<td>Rotation speed</td>
</tr>
<tr>
<td>$V_S$</td>
<td>Stall speed</td>
</tr>
<tr>
<td>$V_{So}$</td>
<td>Stall speed or minimum flight speed in landing configuration</td>
</tr>
<tr>
<td>$V_X$</td>
<td>Speed that will allow for best angle of climb</td>
</tr>
<tr>
<td>$V_Y$</td>
<td>Speed that will allow for the best rate of climb</td>
</tr>
</tbody>
</table>
Airspeed Indicator

1. Compares ram air from pitot tube to static source to compute speed
Airspeed Indicator

Discuss in groups what each of the colored arcs refer to.

Hint: V-Speeds?
Gyroscopes

1. Gyros use rapid spinning motion to achieve rigidity in space

2. **Precession**
   a. The forces applied to a gyro will be seen 90° ahead of the force in the direction of rotation
   b. Causes some error to be introduced into gyroscopic instruments

3. Gyros can be **engine driven** or **electrically driven**
Attitude Indicator

1. Also known as artificial horizon
2. Shows bank and pitch of airplane
3. Run by engine-driven gyro/vacuum system
4. Errors:
   a. Tumble when limits exceeded
   b. Acceleration = pitch up
   c. Deacceleration = pitch down
   d. Bank angle and pitch error after a 180° turn
Heading Indicator (Directional Gyro)

1. Aligned with the magnetic compass at the beginning of each flight
2. Due to friction and precession, it must be reset every 15 minutes
Slips

Slipping Turn
Ailerons counter underbanking tendency

Down aileron creates higher angle-of-attack

Up aileron creates lower angle-of-attack

Not enough rudder causes slip
Skids

Skidding Turn
Ailerons counter overbanking tendency

Up aileron creates lower angle-of-attack

Too much rudder causes skid

Down aileron creates higher angle-of-attack
Turn-Coordinator/Slip-Skid Indicator

1. Runs off of **electric gyro** in most cases
2. Shows the **rate of a turn** (how fast you complete a 360° turn)
3. The Ball indicates whether the airplane is in coordinated flight
   a. At high AOA where airplane has left turning tendency
   b. In turns where ailerons are creating unequal amounts of drag
Altimeter

1. Uses static pressure to determine altitude
2. Reads like a clock
3. Local altimeter setting is set in the **Kollsman window**
4. If not altimeter setting is read, set to the current field elevation
Measures of Altitude

1. **True Altitude** - Actual distance above sea level
2. **Pressure Altitude** - Altitude above the standard datum plane or when altimeter is set to 29.92 inHg
3. **Density Altitude** - Pressure altitude corrected for non-standard temperature
4. **Absolute Altitude** - Distance between the aircraft and the terrain
Non-Standard Temperature
Vertical Speed Indicator

1. Displays the rate of climb in feet per minute
2. Normal climb rate in a piston aircraft is between 500 and 1000 fpm
Vertical Speed Indicator

1. Operates off of the static system
2. Uses a calibrated leak to create unequal pressure outside and inside of the instrument
How might the airspeed indicator react with the following blockages in the system? How might these blockages occur?
Pitot-Static Discussion

Discuss the implications of the following blockage on the pitot-static system
True North vs Magnetic North

1. True North and Magnetic North are not the same
2. The magnetic variation is published based off location
Magnetic Variation

Discuss in groups where magnetic variation will be highest and where it will be lowest.
Magnetic Compass

1. Points to magnetic north without any extra power source
2. The compass floats in a case of fluid that reduces friction and vibration
3. Subject to errors:
   a. Dip errors
   b. Magnetic variation
   c. Magnetic deviation
   d. Turning & Acceleration Errors
Magnetic Compass: Acceleration Errors

Occur on East/West Headings

Accelerate North Decelerate South
Magnetic Compass: Turning Errors

Occur most noticeably as you approach headings of directly north or directly south

Undershoot
North
Overshoot
South
Tachometer

1. Displays how many rotations per minute the engine is running
2. Used for setting cruise power and ensuring peak performance
Fuel Indicators

1. Tell you how much fuel is in the tanks
2. Can be erroneous, so it is important to cross-check with all information available
Navigational Instruments
Radios & Transponder
Quick Look at the G1000
Requirements for a VFR Day Flight

A TOMATO FLAMES

- Airspeed indicator
- Tachometer (per engine)
- Oil Pressure Gauge (per engine with pressure system)
- Manifold Pressure (per engine)
- Altimeter
- Temperature gauge (per air-cooled engine)
- Oil temperature gauge (for each air-cooled engine)

- Fuel gauge
- Landing gear position indicator
- Anticollision lights (After 1996)
- Magnetic compass
- ELT
- Safety Belts
Instrument Flying

1. Allows one to fly an airplane without visual references
2. Performed by using an instrument scan to interpret the flight condition based on the instrument indications
Discus in groups how each instrument shows the specified flight condition.

**Bank Instruments**
1. Attitude Indicator
2. Turn Coordinator
3. Heading Indicator
4. Magnetic Compass

**Pitch Instruments**
1. Attitude Indicator
2. Altimeter
3. Vertical Speed Indicator
4. Airspeed Indicator
Questions?
Next Time

1. Tuesday, October 25th @ 6:00 p.m.
2. Topic: Airports/Airspace