

Gyroscopic Instruments, Vacuum and Electrical Systems

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Version 0.1 – 2/5/03

Gleim section 2.8

Gyroscopic Instruments

- Gyroscopic instruments contain a gyroscope and rely on the principle of *rigidity in space*. A spun-up gyroscope will tend to maintain its 3-D orientation even when its harness is rotated.
- There are three gyroscopic instruments in most airplanes: the attitude indicator, the turn coordinator, and the heading indicator or directional gyro.
- Gyroscopes are spun either by air flow from a vacuum system, or by an electric motor
- Air flow for a gyroscope is provided by an engine-driven vacuum pump
- Electricity for an electric gyroscope is provided by the main airplane electrical system

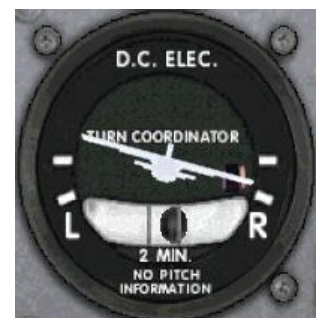
The Attitude Indicator

- The attitude indicator (AI), also called the artificial horizon, displays the airplane's position relative to the horizon on two axes: pitch and roll
- The AI is usually vacuum-driven
- **During level flight, or while on level ground before flight, the miniature airplane should be adjusted (up or down) to be even with the horizon from the pilot's point of view**
- The background of the AI contains a blue region, representing sky, and a brown region, representing ground
- **The plane's pitch and bank can be determined by looking at the relationship between the miniature airplane and the background**



The Turn Coordinator

- The turn coordinator (TC) contains a turn indicator and an *inclinometer*
- The turn indicator consists of a gyroscope that is set at a 45 degree angle. **The miniature airplane represents the motion of the airplane around the roll and yaw axes**, and in a constant turn shows the rate of turn.
- The turn indicator is usually electrically driven
- The inclinometer consists of a ball immersed in a fluid and shows the direction of "down" and thus the quality of aileron/rudder coordination



The Heading Indicator

- The heading indicator consists of a gyroscope oriented to show the airplane's movement around its vertical axis
- There are a variety type of heading indicators
- The most common in training airplanes is the directional gyro (DG)
- The DG is usually vacuum-driven
- **Due to friction, the DG's gyro will precess over time and begin to indicate erroneously. Because of this, the DG's heading must be readjusted periodically throughout the flight to agree with the magnetic compass.**



Electrical System

- Most airplanes are equipped with a 14- or 28-volt electrical system
- The electrical system consists of the following components:
 - A *battery* is used to supply initial power before the airplane engine is started, including to the starter motor. It is also used in an emergency if the alternator fails in flight.
 - An *alternator* is used to supply the main electrical power once the airplane engine is started
 - One or more *busses* that carry electrical current to various appliances (radios, lights, displays)
 - A *master switch* connects the battery and/or the alternator to the main bus
 - A *radio master switch*, if present, connects the main bus to the radios and navigation equipment
 - A *load meter*, if present, displays the number of amps of current being drawn by electrical equipment from the alternator.
 - An *ammeter*, if present, displays the number of amps of current going to or being drawn from the battery
- The radio master switch should not be turned on while the engine is being started to avoid damage from electrical surges
- If no radio master switch is provided, all radios should be turned off before engine start