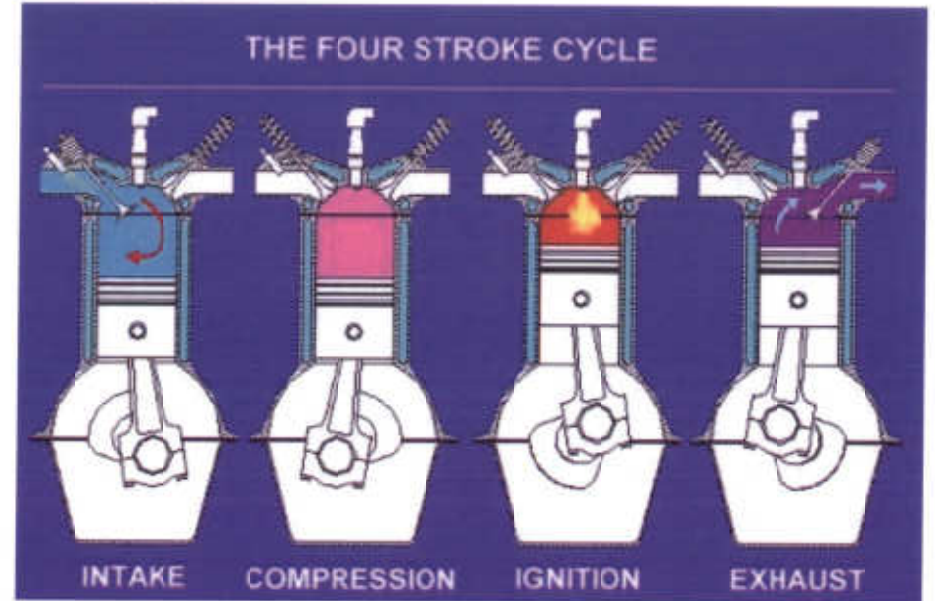
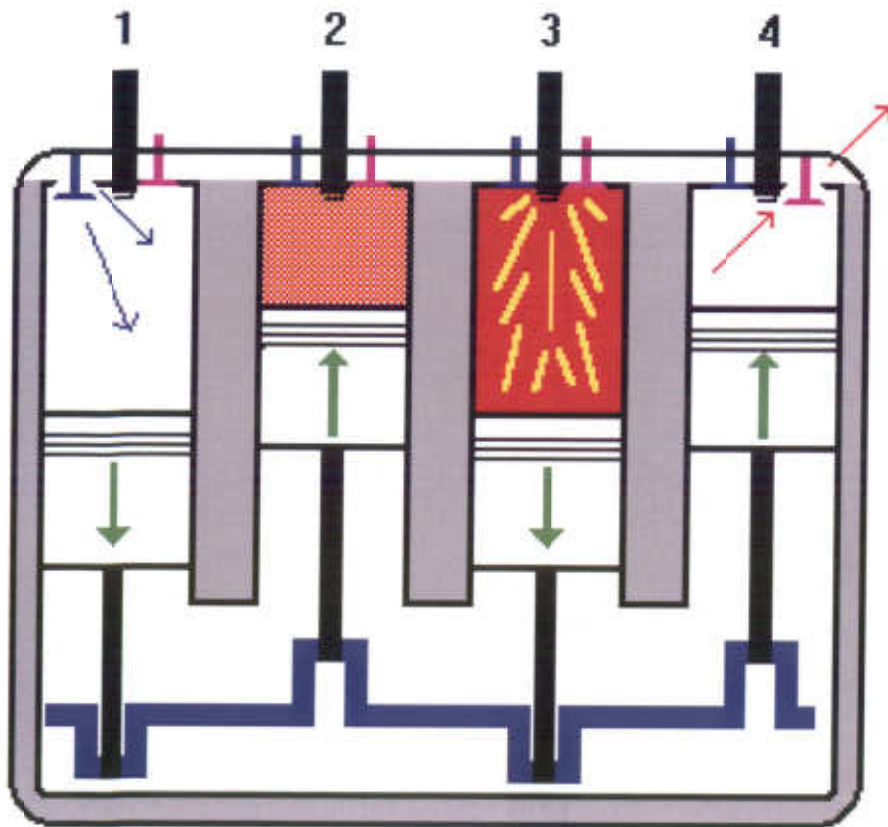




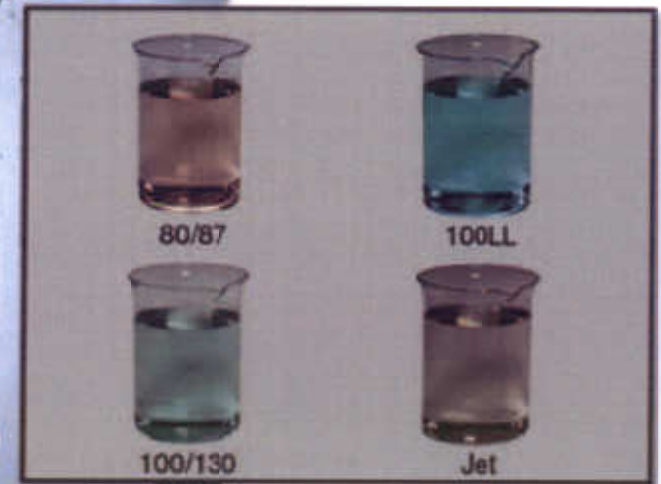


# Piston Engine



# Fuel

FUEL TYPE AND GRADE	COLOR OF FUEL	EQUIPMENT COLOR
AVGAS 80	RED	
AVGAS 100	GREEN	
AVGAS 100LL	BLUE	
JET A	COLORLESS OR STRAW	

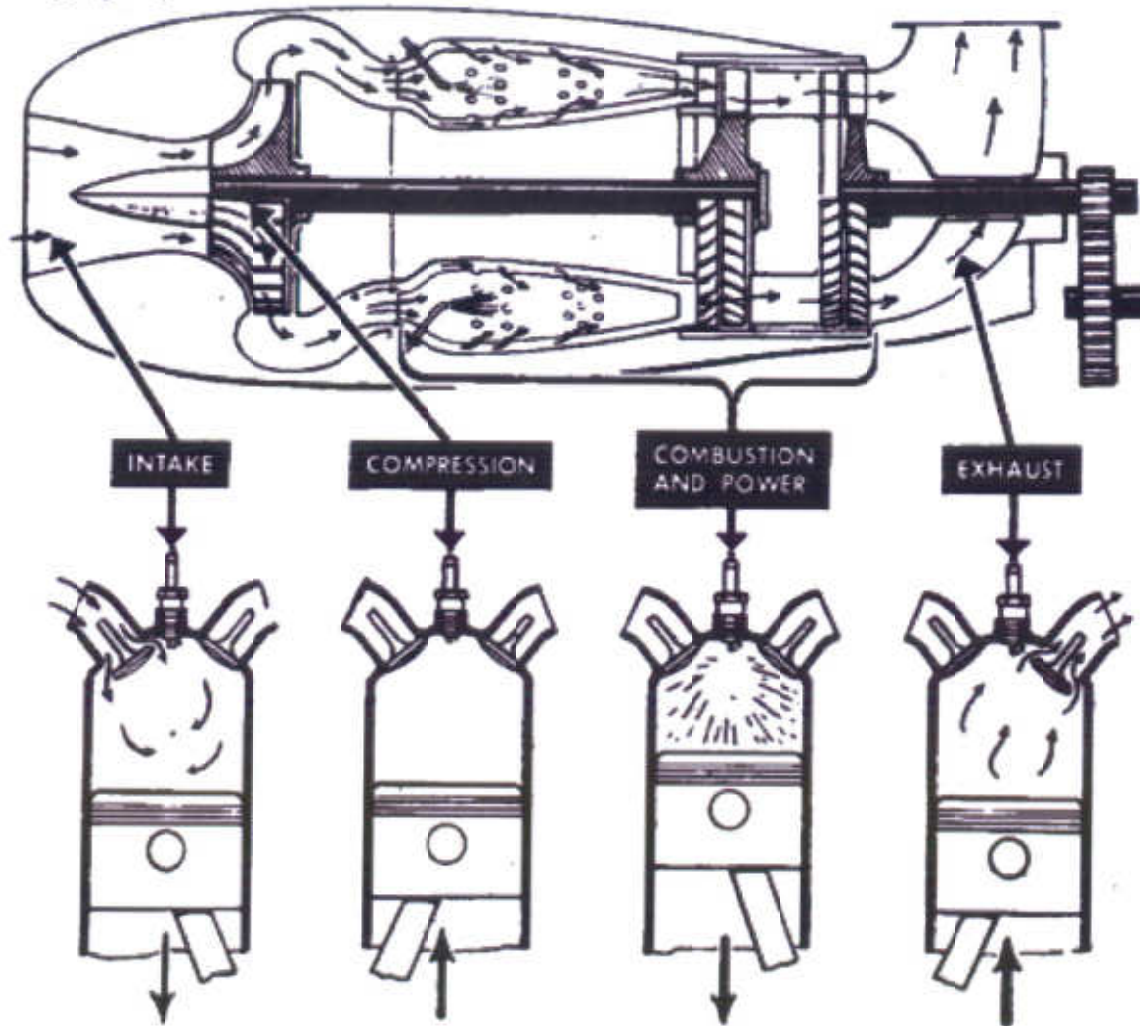


# Turbine Engines

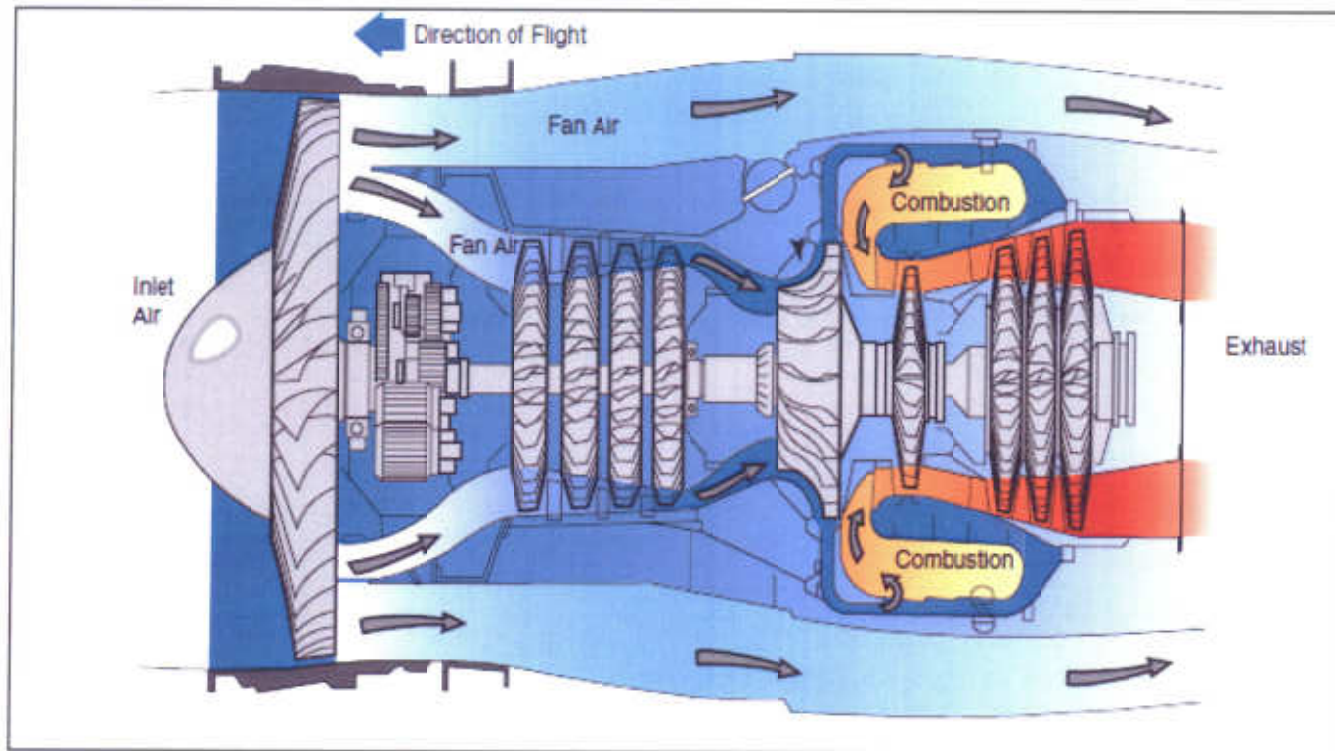
- develops thrust by accelerating a relatively small mass of air to very high velocity, as opposed to a propeller, which develops thrust by accelerating a much larger mass of air to a much slower velocity
- internal combustion engines and have a similar basic cycle of operation; that is, induction, compression, combustion, expansion, and exhaust

# Comparison of Engines

*Copyright by Autocar*



# Turbine Engine



Part of the expansion of the burned gases takes place in the turbine section of the jet engine providing the necessary power to drive the compressor, while the remainder of the expansion takes place in the nozzle of the tail pipe in order to accelerate the gas to a high velocity jet thereby producing thrust.

# Turboprop Engine

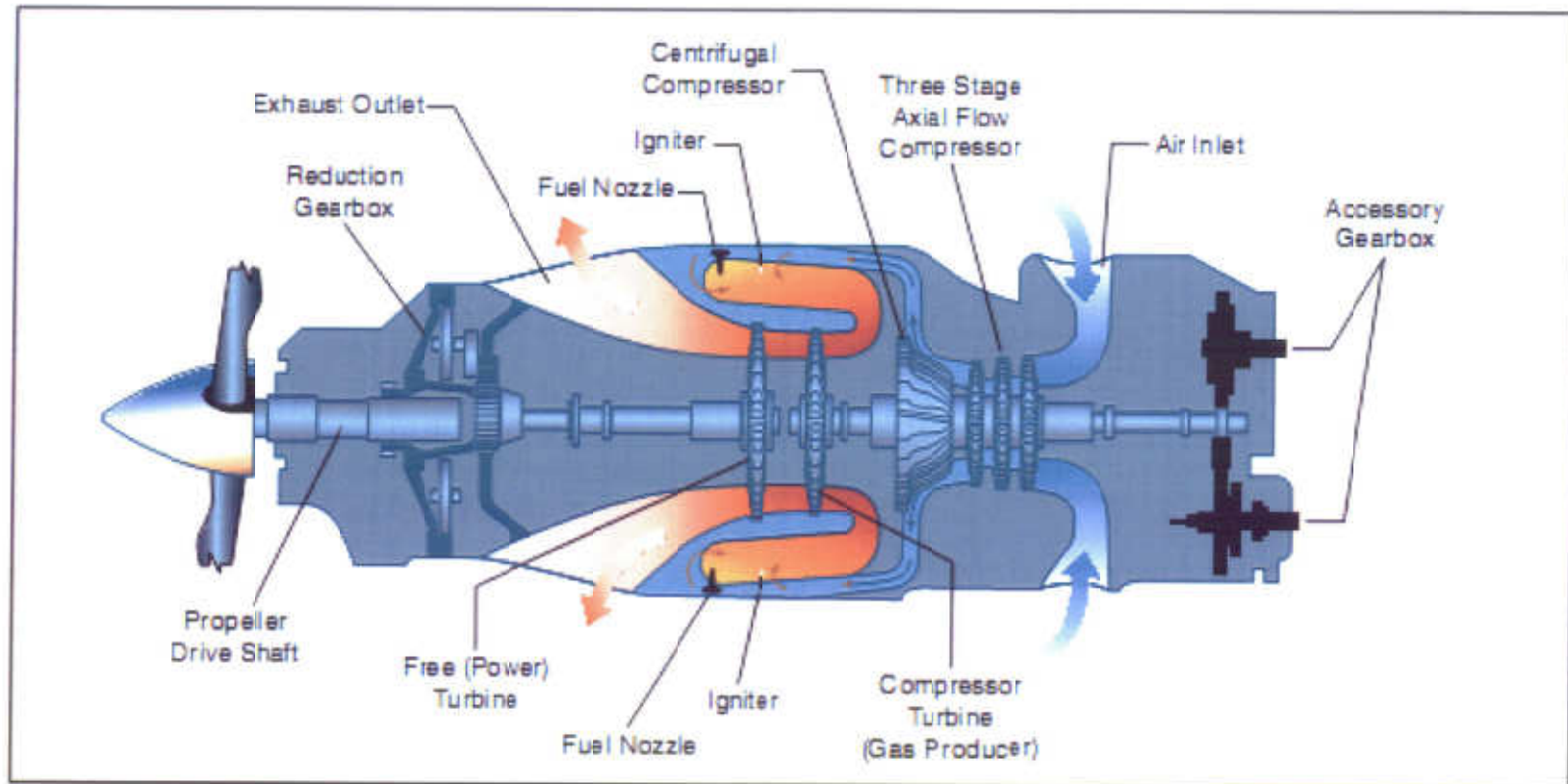
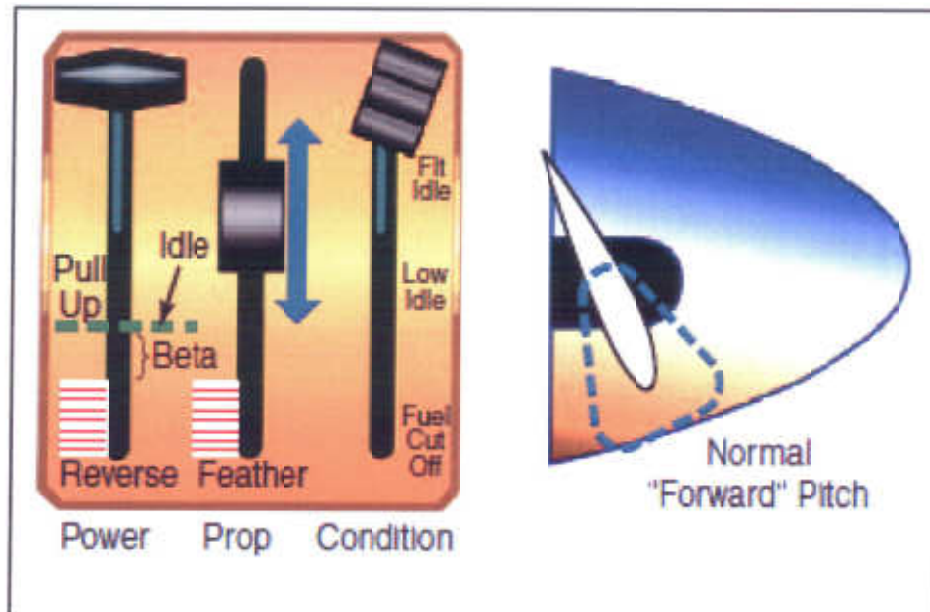


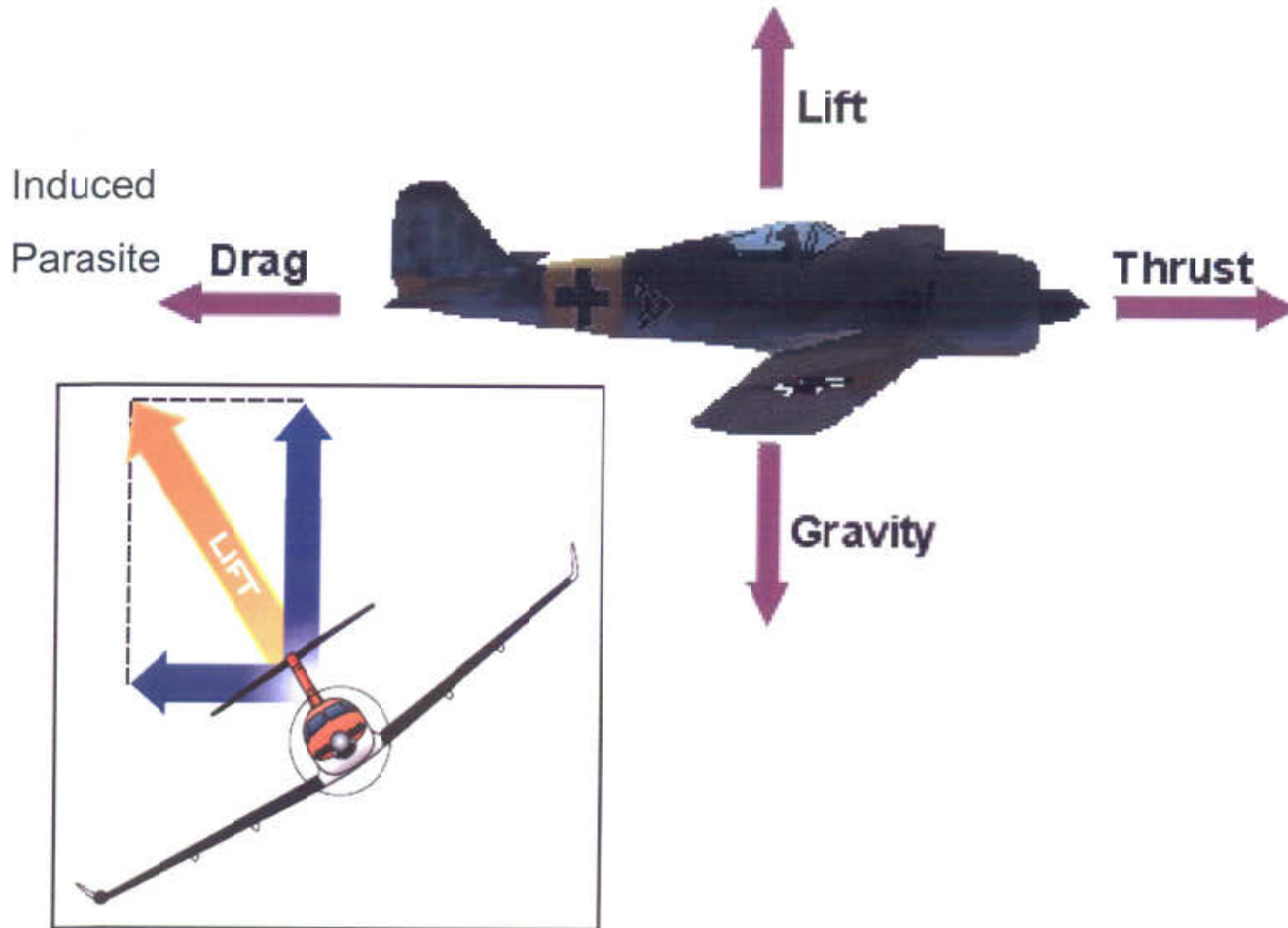
Figure 14-5. Split shaft/free turbine engine.

The energy of the hot, high velocity gases is converted to torque on the main shaft by the turbine rotors. The reduction gear converts the high r.p.m.—low torque of the main shaft to low r.p.m.—high torque to drive the accessories and the propeller.

# Turboprop

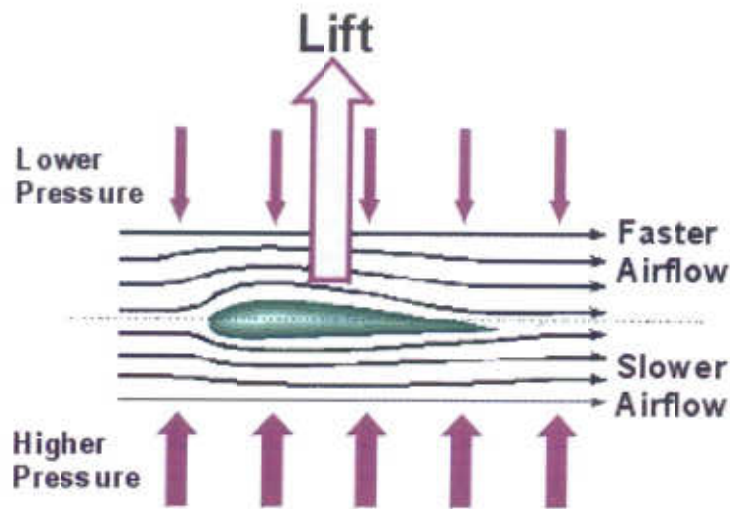


# Forces in Flight





# Airfoil and Lift



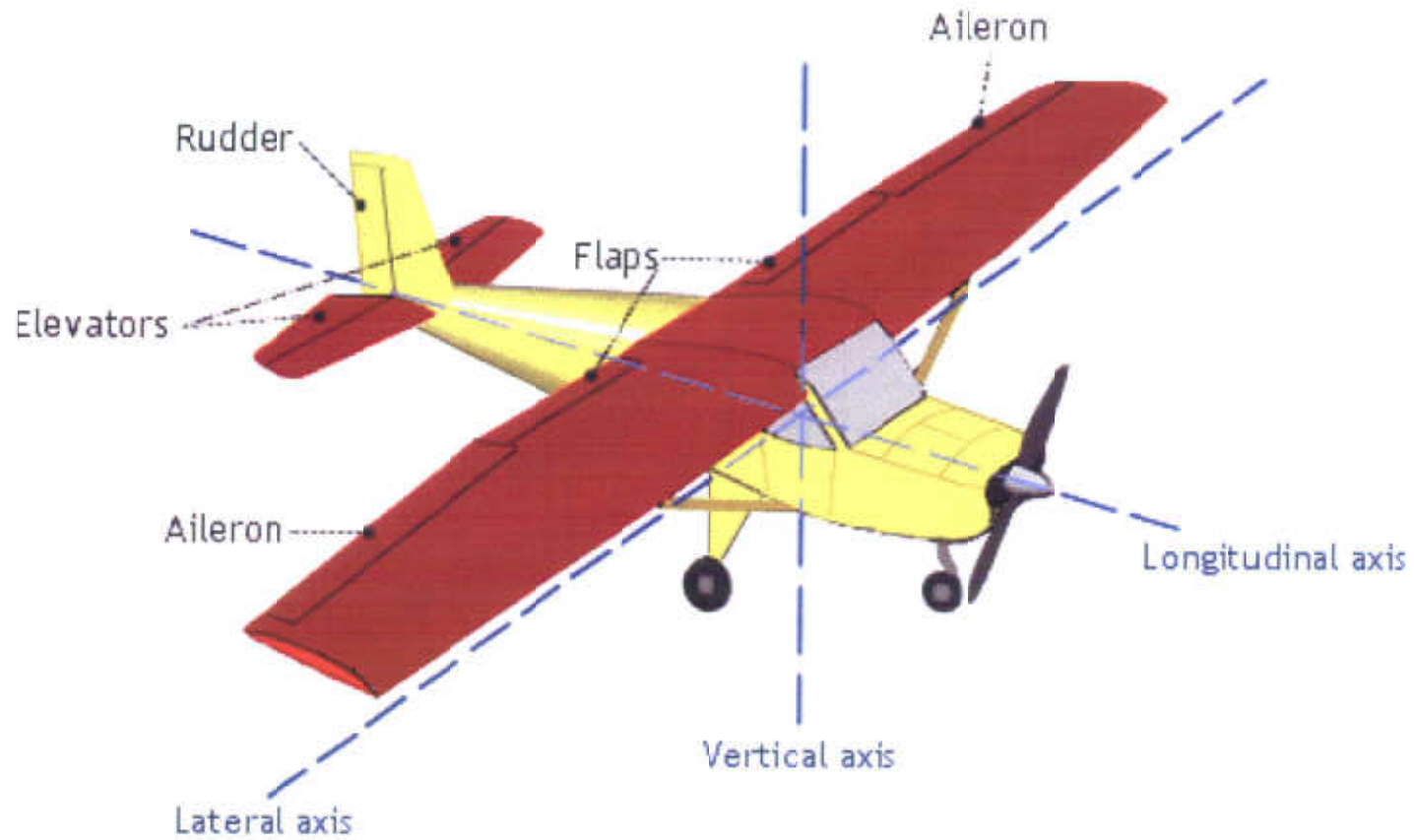
Theories on the generation of lift have become a source of great controversy.

Some believe that as the wing moves through the air, the airfoil's shape causes the air moving over the wing to travel faster than the air moving under the wing. The slower airflow beneath the wing generates more pressure, while the faster airflow above generates less. This difference in pressure results in lift.

Others believe in the "Newton" position that lift is the reaction force on a body caused by deflecting a flow of gas.

NASA believes lift is a force generated by turning a moving fluid (air)

# Control Surfaces



# Propellers



- Very complex because the propeller is like a rotating wing
- The tip moves faster than the hub. So to make the propeller efficient, the blades are usually twisted. The angle of attack of the propeller airfoil at the tip is lower than at the hub because it is moving at a higher velocity than the hub.
- Propellers produce force through application of both Bernoulli's principle and Newton's third law, generating lift or a difference in pressure between the forward and rear surfaces of the airfoil-shaped blades and by accelerating a mass of air rearward.

# Instrument Rating

- An Instrument Rating is a rating that is added to a Pilot License
- Allows a pilot to fly under Instrument Flight Rules or IFR.
- It requires additional flight training in weather and use of instruments
- Most significant value of flying under IFR is the ability to fly in instrument meteorological conditions (such as inside clouds).
- Additionally, all flights operating in Class A (above 18,000 feet) airspace must be conducted under IFR.
- An instrument rating is also required when operating under Special Visual Flight Rules (SVFR) at night.

# Licenses

- Private: a pilot who flies for pleasure or personal business without accepting compensation for flying except in some very limited, specific circumstances
  - only incidental to that business or employment
  - Type rating generally needed to fly a jet or an aircraft heavier than 12,500 lbs

# Licenses

- Recreational: a pilot who is restricted to flying short distances.
  - Carry no more than one passenger
  - within 50 nautical miles from the departure airport and limited longer distance flights
  - No more than 180 horsepower plane and no retractable landing gear
  - During daylight hours
  - Can not exceed an altitude of more than 10,000 feet MSL or 2,000 feet AGL, whichever is higher

# Aircraft Categories and Class

- Categories of aircraft include:

- airplane,
- rotorcraft,
- glider,
- lighter-than-air,
- powered-lift,
- powered parachute, and
- weight-shift-control aircraft.



- Airplane class ratings include:

- single-engine land,
- multi-engine land,
- single-engine sea, and
- multi-engine sea.

Rotorcraft class ratings include:  
helicopter, and  
gyroplane

# VMC

- VMC means that the visibility (distance one can see) and cloud separation meets certain minimum requirements. If conditions are below these minima, Instrument Meteorological Conditions prevail and only operation under IFR is authorized.
- In Class B airspace: visibility at least 3 statute miles, and clear of clouds.
- In Class C, D and E airspace less than 10,000 feet MSL: visibility at least 3 statute miles, and at least 500 feet below, 1000 feet above, and 2000 feet horizontal separation from clouds.
- In Class E airspace, at or above 10,000 feet MSL: visibility at least 5 statute miles, 1000 feet above, 1000 feet below and 1 statute mile horizontal separation from clouds.
- In Class G airspace, the rules are more complicated:
  - 1200 feet or less AGL, day: visibility at least 1 statute mile, and clear of clouds.
  - 1200 feet or less AGL, night: visibility at least 3 statute miles, and at least 500 feet below, 1000 feet above, and 2000 feet horizontal separation from clouds.
  - More than 1200 feet AGL and less than 10,000 feet MSL, day: visibility at least 1 statute mile, and at least 500 feet below, 1000 feet above, and 2000 feet horizontal separation from clouds.
  - More than 1200 feet AGL and less than 10,000 feet MSL, night: visibility at least 3 statute miles, and at least 500 feet below, 1000 feet above, and 2000 feet horizontal separation from clouds.
  - More than 1200 feet AGL and above 10,000 feet MSL: visibility at least 5 statute miles, 1000 feet above, 1000 feet below and 1 statute mile horizontal separation from clouds.

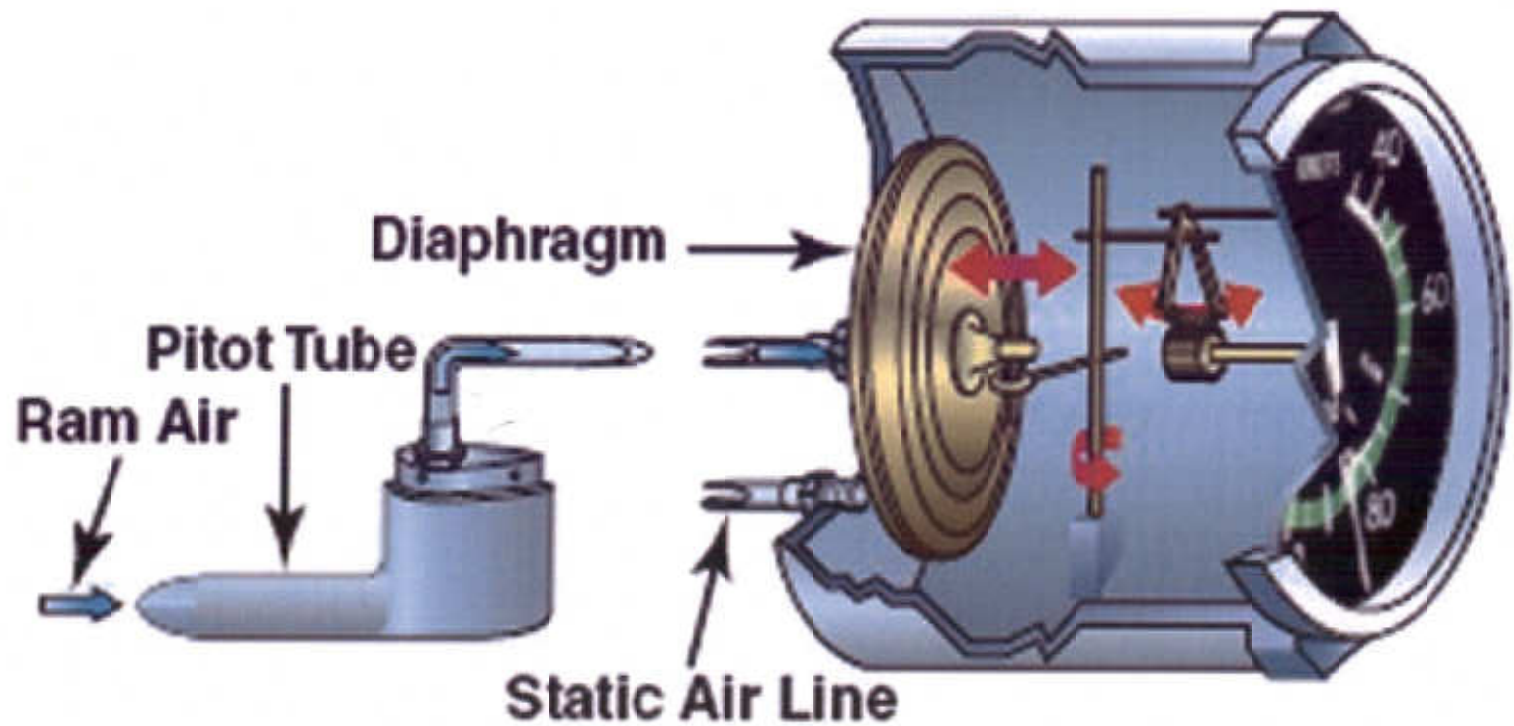




# Airspeed Indicator



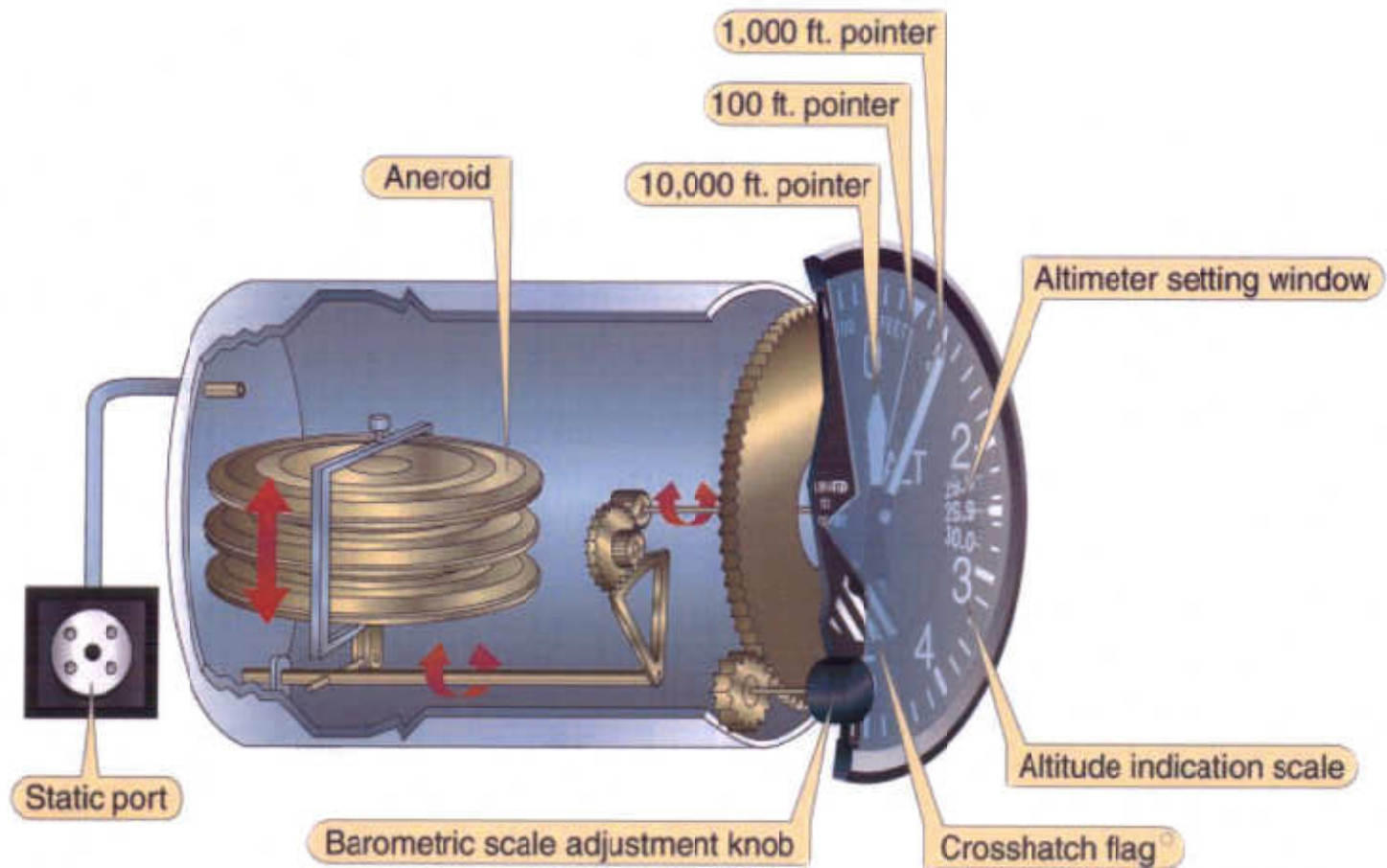
# Airspeed Indicator



# Altimeter

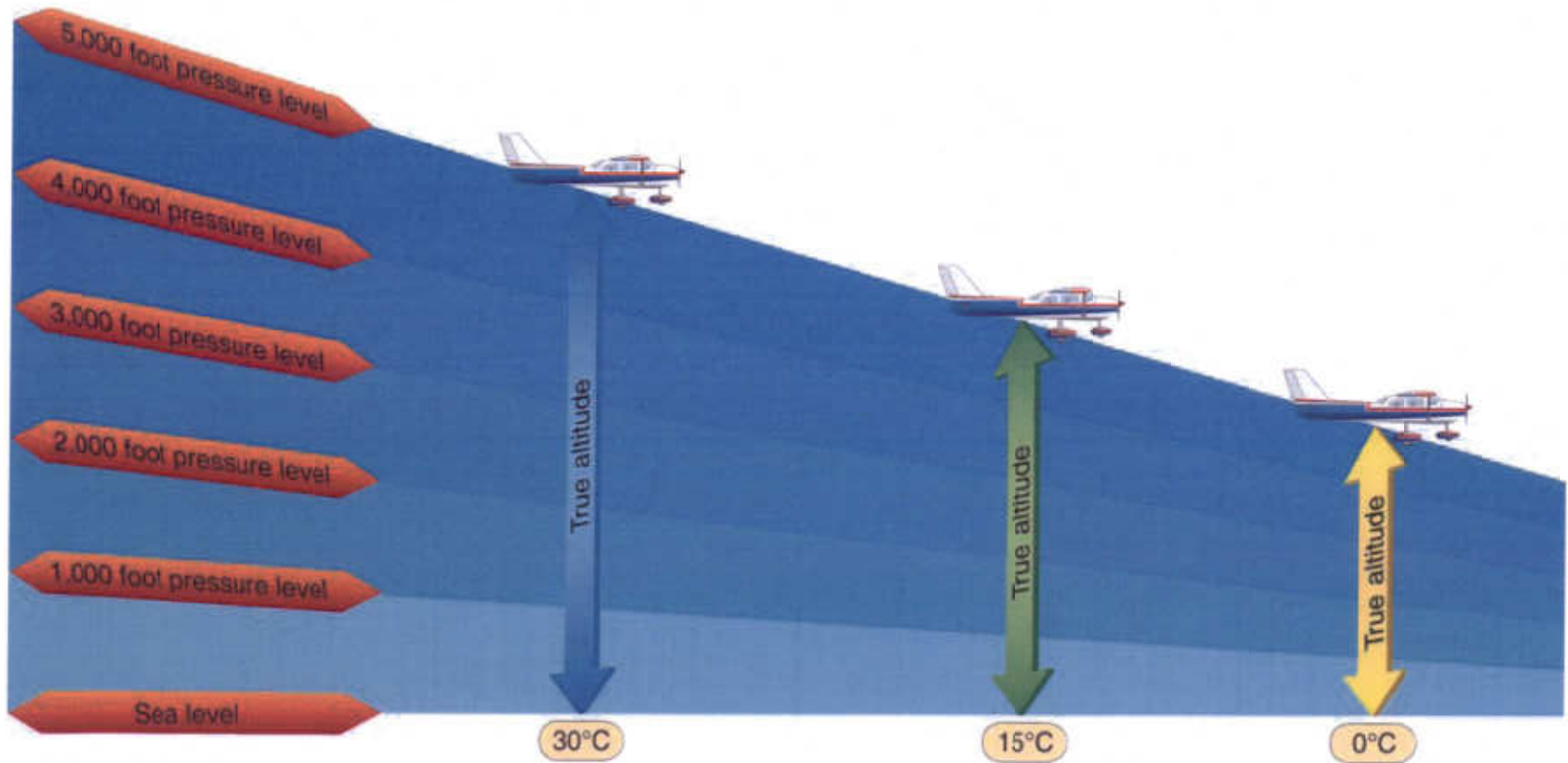


# Altimeter



● A crosshatched area appears on some altimeters when displaying an altitude below 10,000 feet MSL.

# Altimeter



# Vertical Speed Indicator

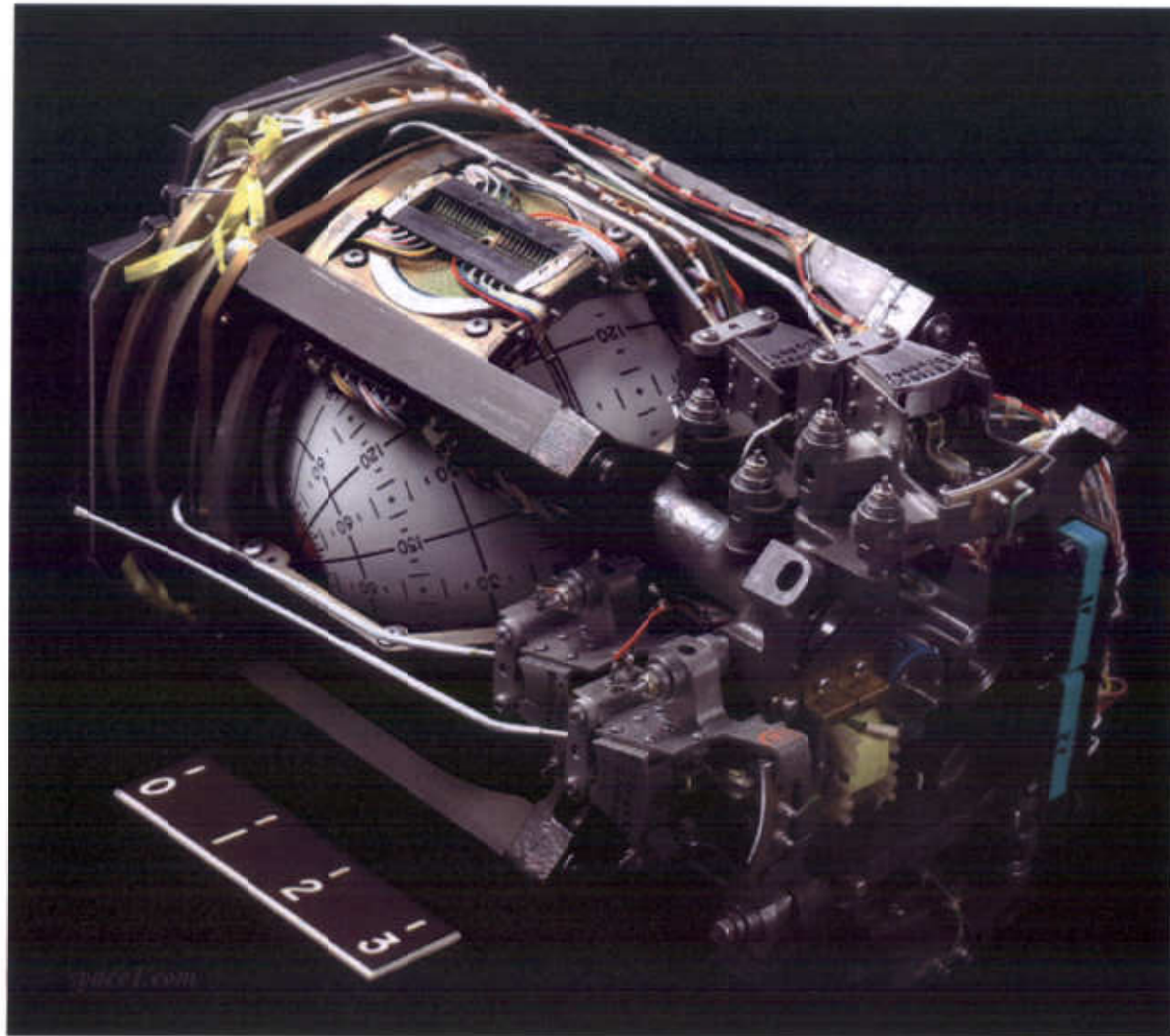


# Attitude Indicator

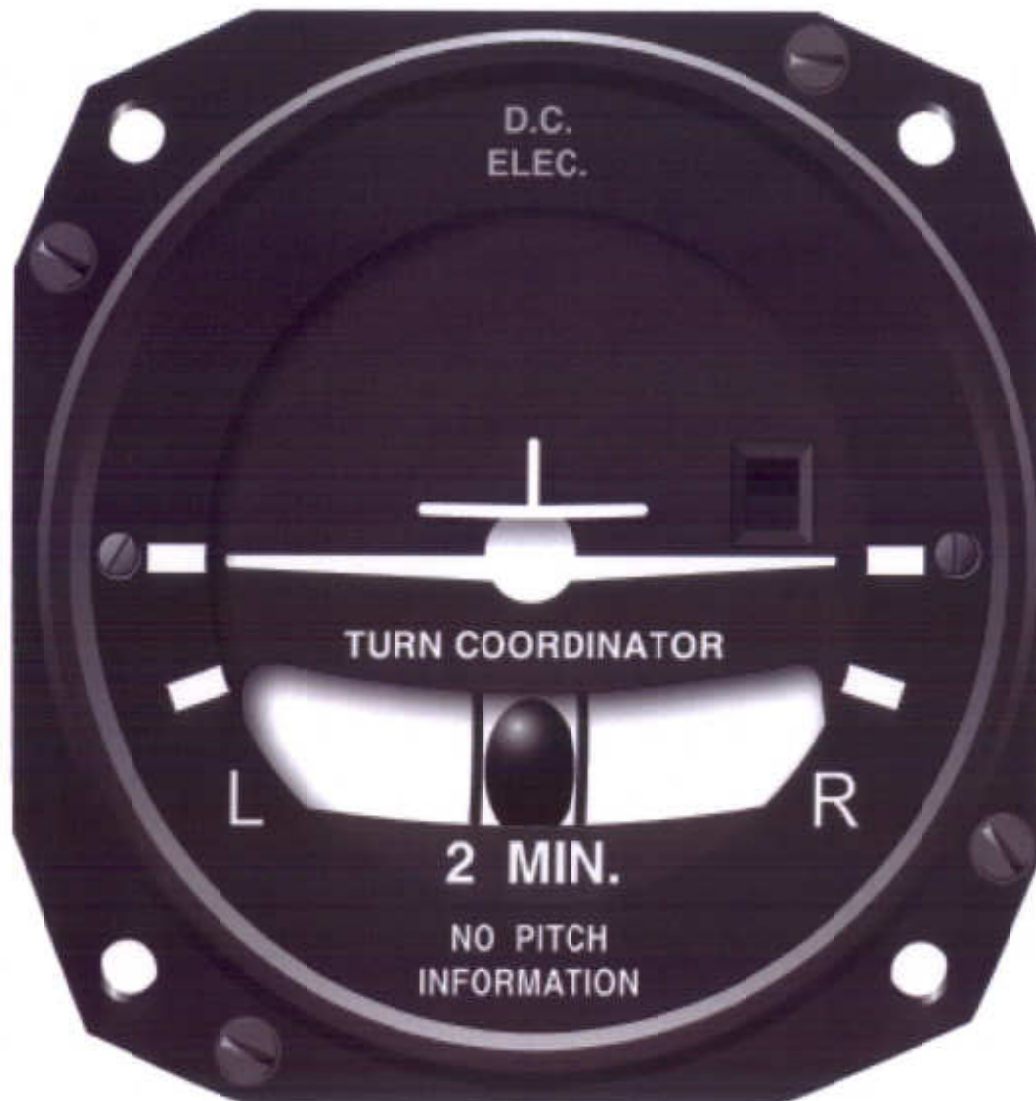




# Attitude Indicator



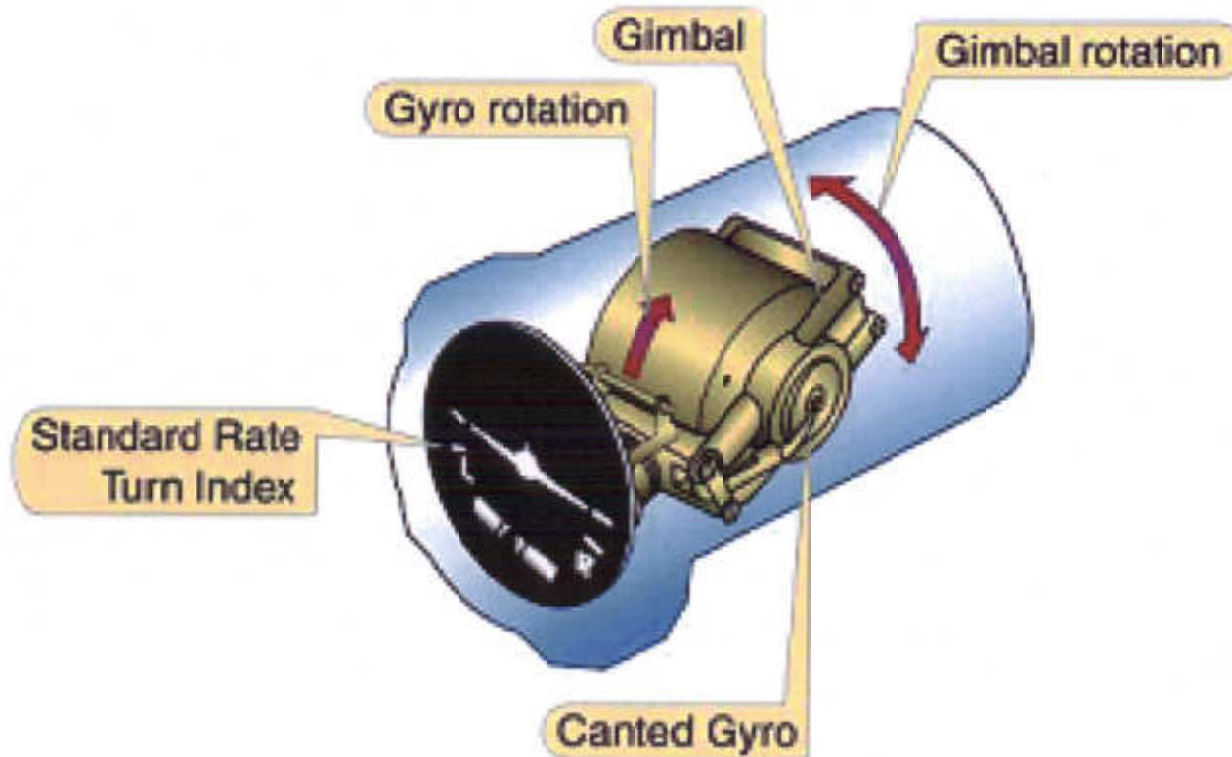
# Turn-and-Slip Indicator Turn Coordinator



First shows the rate of banking and once stabilized, the turn rate

# Turn Coordinator

## Turn Coordinator



# Compass



# Compass Errors

**Deviation** – Deviation represents aircraft specific magnetic field errors and is different on each heading, but it is not affected by the geographic location. A compass correction card shows the deviation correction for any heading.

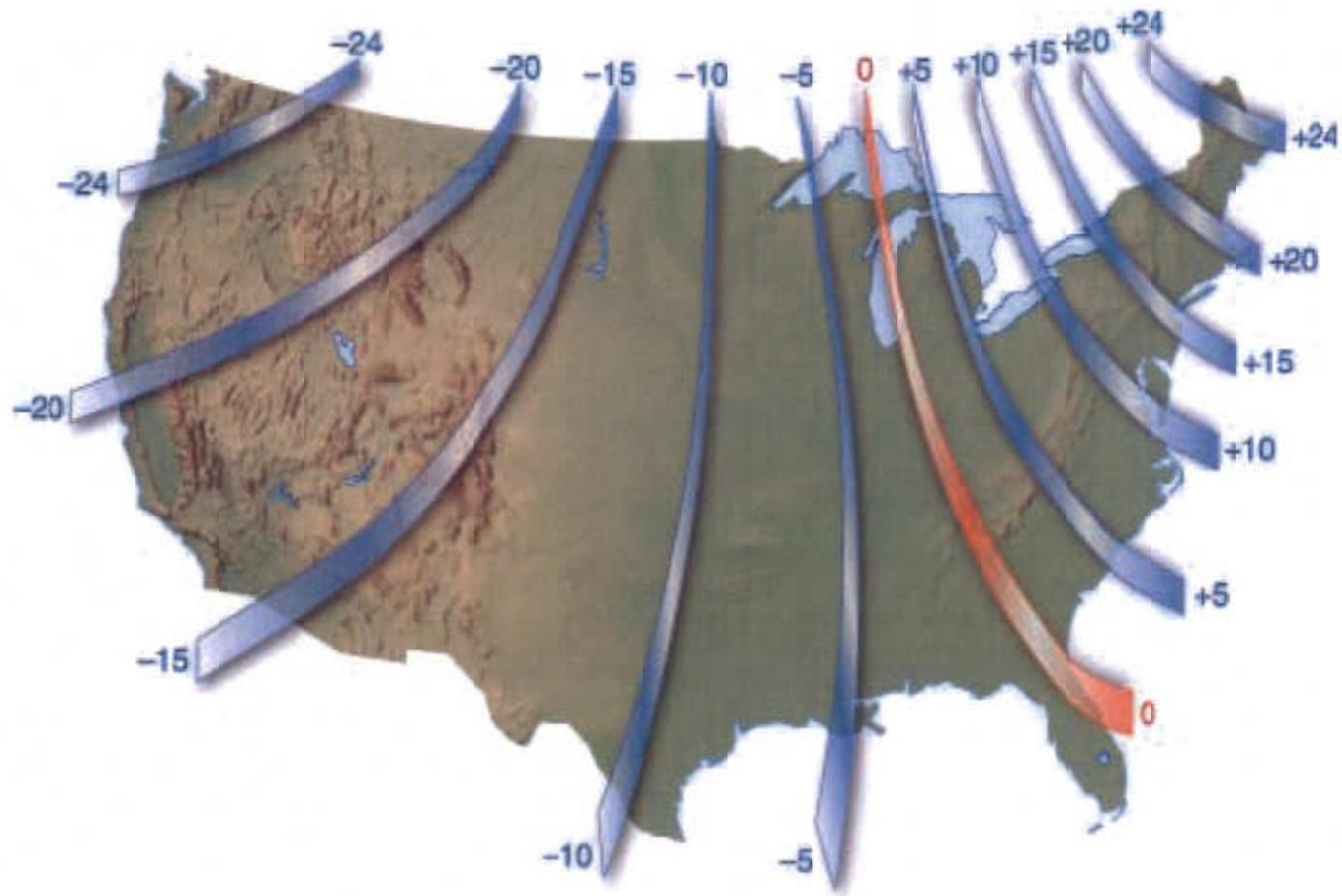
**Dip Errors** – Acceleration Errors

Northerly turning error



Acceleration = North rotation  
Deceleration – south rotation  
North Lags – South Leads

# Compass Variation



Add West / Subtract East







# Comm / Nav Radios

