# AVIATION
## PROFICIENCY

Australian
Air Force Cadets

Cadet / Instructor Notes

Rewrite Edition, 1st May 2007

# AVIATION (AVP)

**(14 Periods)**

**AVP 1 Aerodynamics AL: B**
**Period(s): 2**

a. With the aid of diagrams, identify the relationship between the four basic forces acting on an aircraft in flight during the following manoeuvres:

(1) Straight and level
(2) Climbing
(3) Descending, and
(4) Turning

Define "stalling angle" and describe:

(1) The symptoms affecting an aircraft when approaching stall, and
(2) The general characteristics of a stall

**AVP 2 Aircraft Design AL: C**
**Period(s): 1**

a. Using a diagram or model, revise (see ARB 1) the following features used in aircraft design:

(1) Anhedral
(2) Dihedral
(3) Wing Sweepback

With the aid of a diagram or model, identify the following secondary controls of an aircraft and state their basic use:

(1) Flaps (leading and trailing edge)
(2) Slats
(3) Slots
(4) Spoilers
(5) Speed brakes

**AVP 3 Aircraft Engines AL: B**
**Period(s): 2**

State the basic principles of operation and, with the aid of a diagram or model, identify the basic components of:

a. Four stroke cycle internal combustion engine

b. Basic turbo jet engine

**AVP 4** **Flight Instruments** **AL: B**
**Period(s): 1**

a. From a list, identify pressure and gyroscopic (suction and electrical) instruments used in a typical light trainer aircraft.

> **Note**: Pressure instruments are the ASI, altimeter and VSI. Gyroscopic instruments are the DI, rate of turn, turn co-ordinator and flight attitude indicator (artificial horizon).

Interpret colour codes on an ASI.

**AVP 5** **Circuits** **AL: B**
**Period(s): 2**

With the aid of a diagram, describe the circuit pattern and identify the following positions in a circuit:

a. Upwind leg

b. Crosswind leg

c. Downwind leg

d. Base leg

e. Final approach

f. Dead side of the circuit

**AVP 6** **Flight Rules and Conditions of Flight** **AL: B**
**Period(s): 2**

a. State visual flight rules (VFR) and visual meteorology conditions (aeroplanes) for operations below 10,000 feet.

b. State and apply the following rules requirements:

(1) Rules of the air (CAR 160 to 163)
(2) The requirements relating to the operations of aircraft on and in the vicinity of an aerodrome (CAR 166[1] and 166[3]) and the conditions relating to turns after take-offs.

**AVP 7** **Radio Telephony** **AL: B**
**Period(s): 1**

a. State the phonetic alphabet and the method of transmitting numerals.

b. Distinguish between a distress and an urgency message.

c. List examples of when a distress and urgency messages should be used.

d. State the prefix and details, which must be included in each message.

**AVP 8 Air Traffic Control** **AL: B**
**Period(s): 1**

Describe the functions of:

e. Air Traffic Services (ATS)

f. Control Tower

**AVP 9 Examination**
**Period(s): 1**

**AVP 10 Examination Review**
**Period(s): 1**

**AVIATION PROFICIENCY (AVP)**
**AVP 1 - AERODYNAMICS**
**2 PERIODS**

**Objective**

**1001.** a. With the aid of diagrams, identify the relationship between the four forces acting on an aircraft in flight during the following manoeuvres:

1. straight and level flight;
2. climbing
3. descending;
4. turning.

b. define “stalling angle” and describe:

1. the symptoms when approaching the stall
2. the characteristics of a stall

**Straight and Level**

**1002.** At a Constant Power Setting.

**The Forces**

**1003.** To fly straight requires the use of **AILERONS** to keep the wings level and the rudder to prevent yaw.

**1004.** To maintain the correct level (Altitude) the aircraft must have the correct power setting and a correct nose attitude-controlled by the elevator

**1005.** To maintain the correct straight and level all the forces are balanced. Those forces are:

**Lift** - from the wings

**Weight** - due to gravity

**Thrust** - from the propeller

**Drag** - resistance of aircraft through the air.

Therefore:

**Lift** = Weight

**Thrust** = Drag

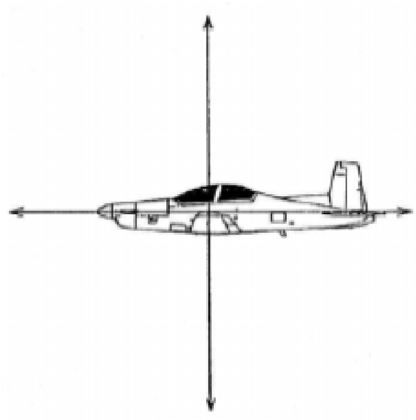


FIG 1.1. - THE FOUR FORCES - THE IDEAL ARRANGEMENT

**1006.** If each of these forces were exactly the same magnitude and acted through one central point in the aircraft no problems would arise. However, they all act at different positions and are of different magnitudes (FIG 1.1.).

**Positions through which the Forces Act**

**1007.** Lift acts at the centre of pressure. This will depend on the position of the wing on the fuselage and on the particular aerofoil shape as to its position on the chord. Its magnitude will depend on the aircraft's speed and angle of attack.

**1008.** Weight acts at the centre of gravity. This depends on the weight and position of every individual part of the aircraft and its load.

**1009.** Thrust acts at the centre of thrust. This will be in line with the propeller shaft or centreline of the jet. This depends on the position of the engine or engines. Its magnitude depends on the power setting selected by the pilot.

**1010.** Drag acts at the centre of drag. This depends on the position and amount of drag of all the separate parts of the aircraft. Its magnitude will depend on the aircraft's speed and angle of attack.

**1011.** A more likely distribution of the forces on an aircraft would be as shown in FIG 1.2.

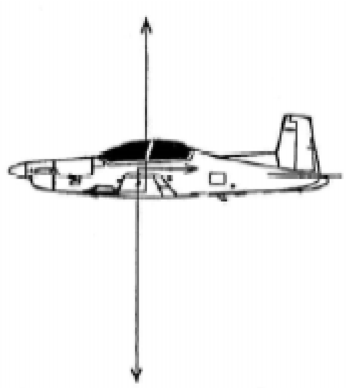


FIG 1.2

**1012.** The lift and weight, as they do not act at the same point, try to turn the aircraft tall over nose. In fact, in FIG 1.2., the lift/weight pair would win the tussle - for in an efficient aircraft the lift/weight forces are about ten times more powerful than the thrust/drag. To make them balance, the designer gives more leverage - ten times more - to the thrust and drag pair. (FIG 1.3.).

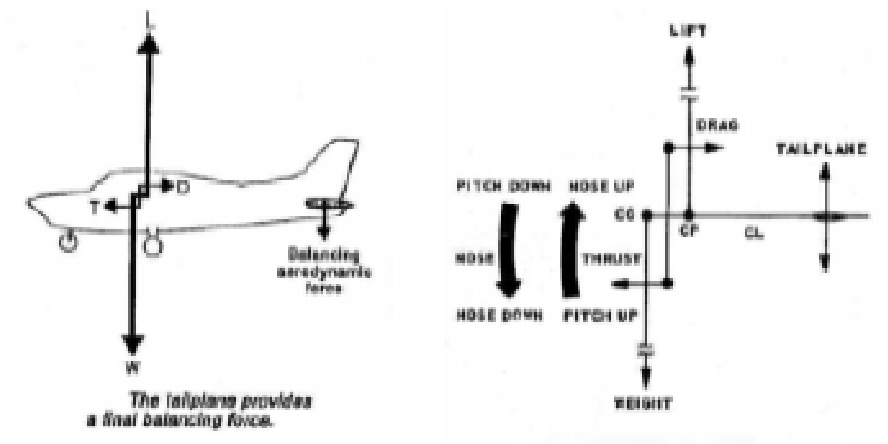



FIG. 1.3. - THE FOUR FORCES - THE FORCES IN BALANCE

**Maintaining the Balance**

**1013.** The aircraft is in balance at normal cruising speed, but the two pairs of forces will not remain balanced throughout a flight. If the pilot wants to increase speed, and the centre of pressure will move backwards and give a nose down tendency. The weight and centre of gravity will change as fuel is used up, and when any items carried are dropped. Turbulent air will also upset balance.

**Climbing**

**1014.** The four forces acting on an aircraft in a steady climb are still in balance, but distributed differently to those when in level flight. Weight now has a component which contributes to drag. Thrust must be increased to compensate for this. In a vertical climb weight and drag combine and the thrust required will be equal to weight plus drag. Since lift is not opposing weight, its vertical component is a reducing value as the angle of climb increases, until in a vertical climb lift would be zero (FIG 1.4.).

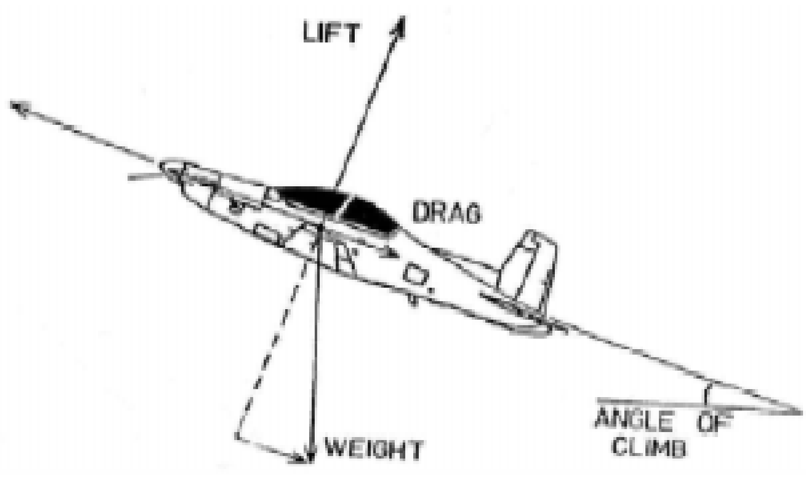



FIG 1.4. - FORCES IN A CLIMB

The forces - thrust is greater than drag - lift is less than weight.

**1015.** As the pilot raises the nose the angle of attack is increased, the forces are no longer balanced because both lift and drag have increased. If the same power setting is maintained as for ’straight and level’, the aircraft’s speed will decrease because of the increase in drag.

**1016.** Therefore thrust must be increased to allow the forces to balance. With increase thrust, the added power has two effects on the nose position:

a. the nose raises - caused by the increased slipstream over the tailplane and the increase in thrust over drag;

b. the nose to yaw - to the left due to the increase slipstream effect on the fin. (FIG 1.5.).

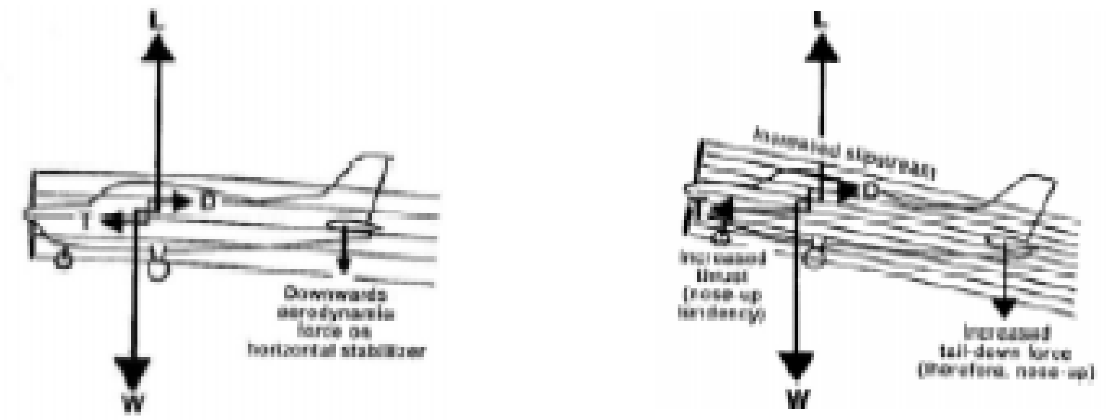



FIG 1.5. - INCREASING POWER CAUSES NOSE-UP TENDENCY

**Three Types of Climb**

**1017.** Normal or cruise climb - which allows for the aircraft to travel further in distance but not usually climb as high in a given time. The aircraft flies at a higher airspeed therefore providing better cooling for the engine and good forward visibility.

**1018.** Best angle of climb - this is used to reach maximum height for the distance travelled.

Note - in one minute - will not climb as high as best rate of climb. The pilot should check the instruments for overheating. This type of climb allows the pilot to clear any obstacles in the flight path.

**1019.** Best rate of climb - this allows the pilot to gain the maximum height in a given time - rather than the shortest horizontal distance.

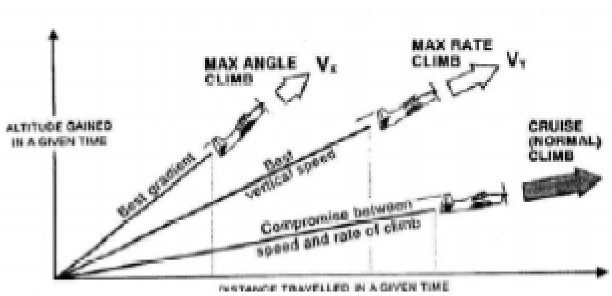



FIG 1.6. - THE DIFFERENT TYPES OF CLIMB

**Descending**

**1020.** Three types of descent:

1. the glide;
2. the powered descent;
3. the slip.

**1021.** The Glide is undertaken when engine power (thrust) is not used and the pilot places the aircraft into an accepted rate of descent.

**1022.** The powered descent is where power is used to control the rate of descent. This manoeuvre used when changing (lowering) altitude or when landing.

**1023.** The slips an uncoordinated flight condition with one wing lowered.

**1024.** Of the forces in a glide; thrust is zero as there is no thrust, therefore only three forces are acting:

Lift;

Weight;

Drag.

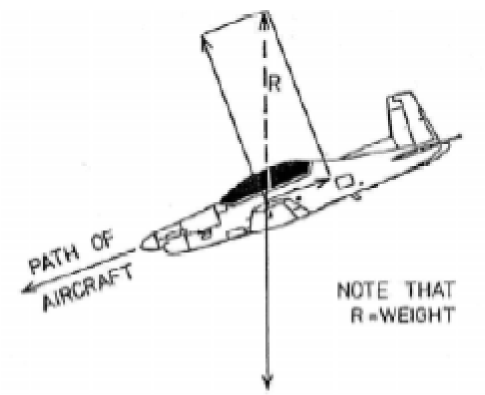



FIG 1.7. - FORCES IN A GLIDE

**1025.** To maintain a steady rate of descent, the nose must be lowered to establish the glide. Once the correct rate of descent has been established, the three forces will be balanced.

**1026.** On reducing thrust to zero, drag is greater than thrust, reducing the airspeed, which in turn reduces lift. Lift is now less than weight and the aircraft will descent due to gravity.

**1027.** Achieving maximum gliding range is when the aircraft is flown at the best angle of attack that is the best lift/drag ratio. Should the pilot change the angle of attack then the ratio reduces and the glide path will need to be steeper. The result being a reduced distance covered. (FIG 1.8.).

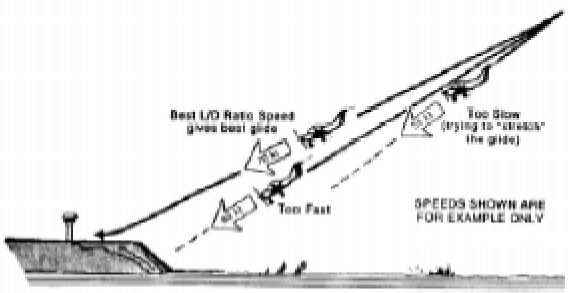



FIG 1.8. - GLIDE AT THE RECOMMENDED SPEED TO OBTAIN BEST STILL AIR RANGE

**Wing also affects the Glide Path**

**1028.** Headwind reduces the distance over the ground as the descent is steeper.

**1029.** Tailwind extends the distance as the aircraft's descent is flatter.

**1030.** Both can be adjusted to gain more distance by:

b. increasing the airspeed into wind and allowing the aircraft to penetrate further into the wind;

c. by gliding slightly below the recommended airspeed with the wind.

**1031.** The aircraft will remain aloft longest if flown at the correct speed, slowing down below this speed will decrease the time in the air.

**The Powered Descent**

**1032.** If during a glide we add power (thrust), the angle of the flight path can be reduced. The added thrust overcomes the weight component. The pitch becomes higher and the rate of descent reduced. To achieve the best rate of descent, the setting of power and the attitude need to be correct.

**1033.** During a landing, the pilot is adjusting the power and attitude with the control column.

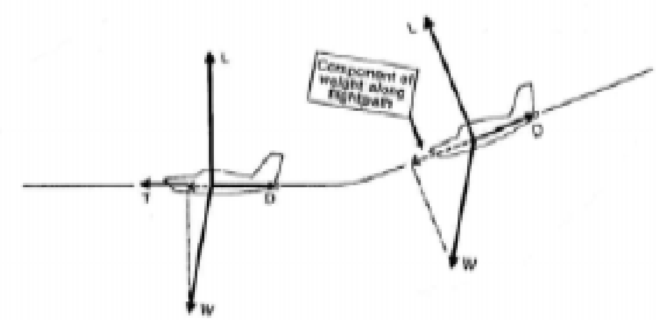
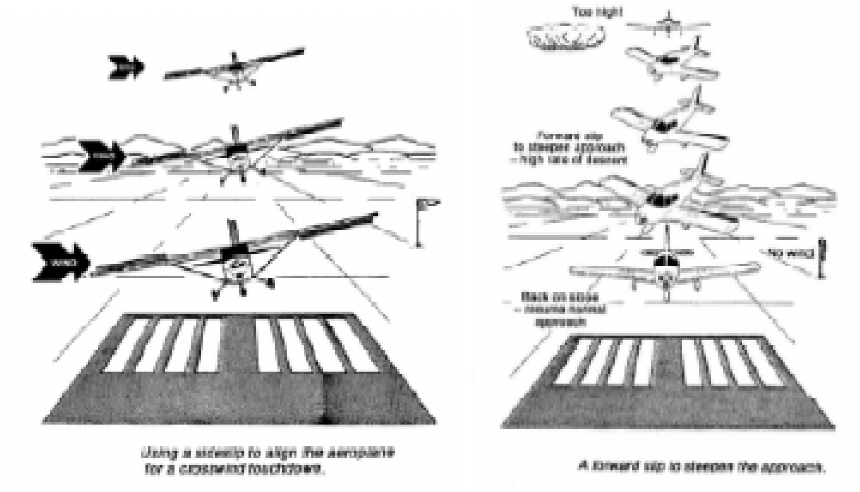



FIG 1.9. - ADDING POWER FLATTENS THE DESCENT

**The Slip**




**1034.** The slip can be used for two purposes:

a) to steepen the descent during approach to land - known as a forward slip

b) to counteract wind drift during a crosswind landing - known as a sideslip.

**The Turn**

**1035.** Types of Turns:

1. medium level turn;
2. climbing turn;
3. descending turn;
4. steep turn.

**1036** When an aircraft is banked by rolling the wings the lift is tilted and the horizontal component of the lift pulls the aircraft into the turn. The steeper the angle of bank - the larger the horizontal component. Similarly, the steeper the angle of bank - the tighter the turn.

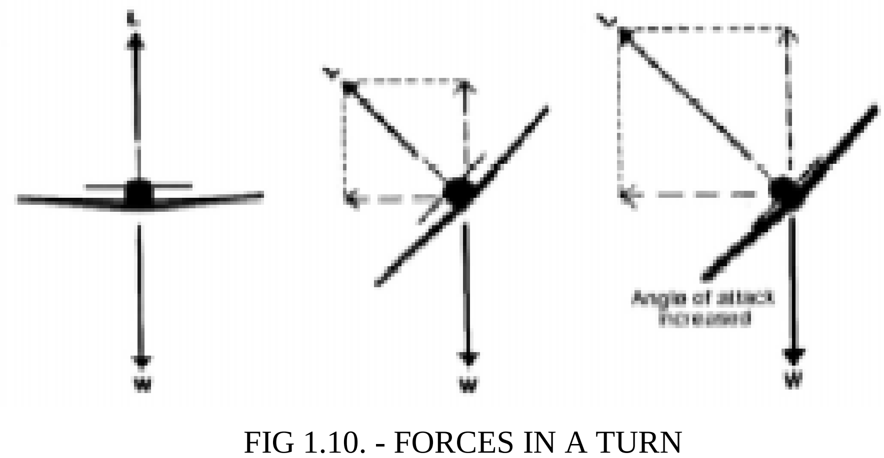



FIG 1.10. - FORCES IN A TURN

**1037.** In a turn the aircraft will tend to slip or skid sideways and this is overcome by the use of a rudder. Also because the lift is tilted in the turn, slight back pressure on the control is required to increase the size of lift and counter the weight force.

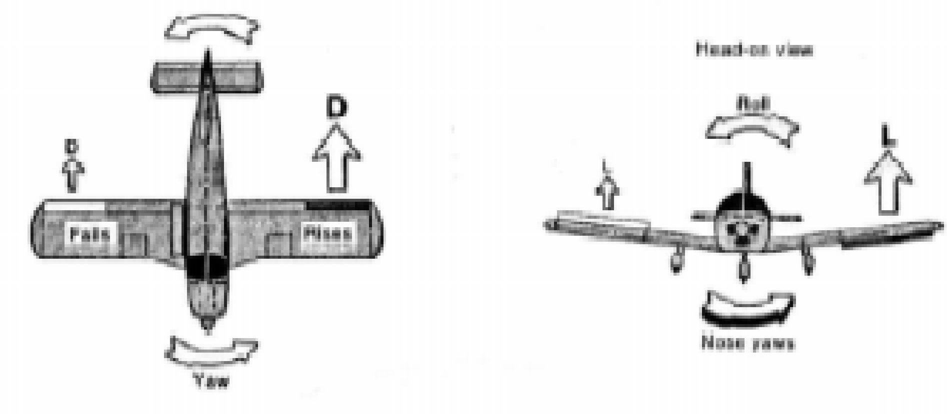



FIG 1.11.

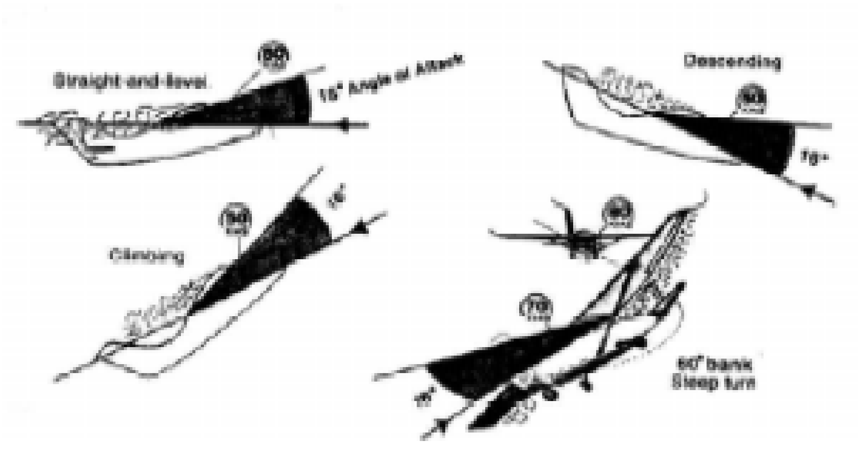
**1038.** In a steep turn drag increases and must be countered by an increase in thrust.

**1039.** It should be noted that as the pilot has increased the angle of attack by raising the nose, the stall speed of the wings has been raised due to increase in wing loading.

**1040.** When the pilot wishes to change height during a cross country, all that is needed is to lower the nose and slightly reduce power to descend or increase power and raise the nose to climb.

**The Stall**

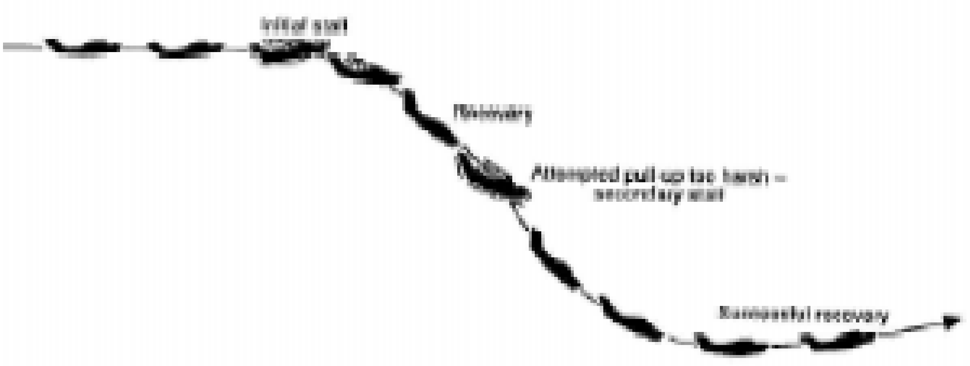
**1041**. As we are aware, most for conditions of flight we have a streamlined airflow over the aerofoil. The increase of flow velocity creates lift. The lifting ability of the aerofoil increases as the angle of attack increases - but only to the critical angle.




**1042.** It is at this angle that the airflow is broken into turbulence over the wing, and the wing stalls.

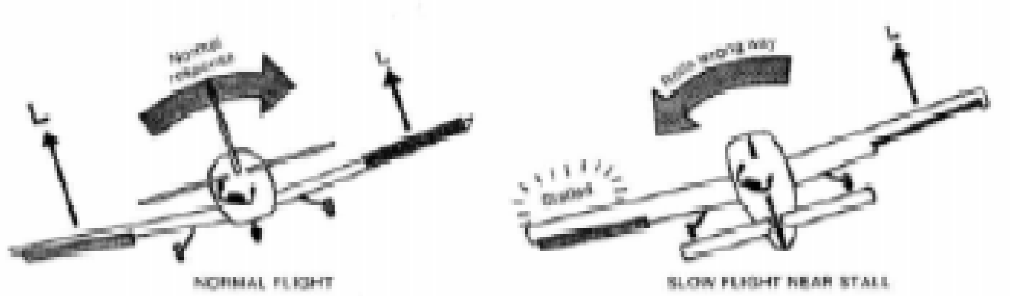
**1043.** The Centre of Pressure, which has been slowly moving forward as the angle of attack has been increasing, suddenly moves rearwards and there is a rapid increase in drag.

**1044.** As the aircraft is approaching the stall, the airframe may shake or buffet. This will indicate to the pilot that the aircraft is about to stall. The nose will drop and the aircraft will sink.

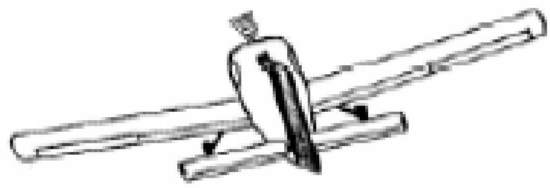



*Raising the nose too sharply during recovery may induce a secondary stall.*

**1045.** During a stall, the flight controls are less effective due to reduced airflow. Use of the elevator and rudder are required. A symptom of a stall can be a **wing drop**, which, if tried to be corrected with opposite aileron, causes further drop on one wing than the other, and the aircraft can develop into a spin. To overcome the wing drop, opposite rudder is applied. This overcomes the yaw effect.




*Near the stall, use of aileron may not pick up the wing.*



*Near the stall, prevent wing drop and further yaw with opposite rudder.*

**AVIATION PROFICIENCY (AVP)**
**AVP 2 – AIRCRAFT DESIGN**
**1 PERIOD**

**Objective**

**2001.** a. Using a diagram or model, revise (ARB1) the following features used in aircraft design:

1. Anhedral
2. Dihedral
3. Wing sweepback

b. With the aid of a diagram or model, identify the secondary controls and state their basic use:

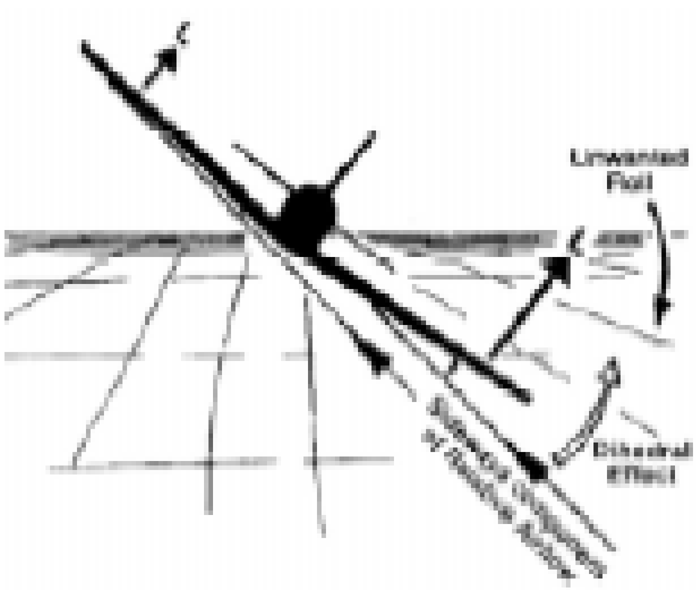
1. Flaps (leading and trailing edge)
2. Slats
3. Slots
4. Spoilers
5. Speed brakes.

**Anhedral**

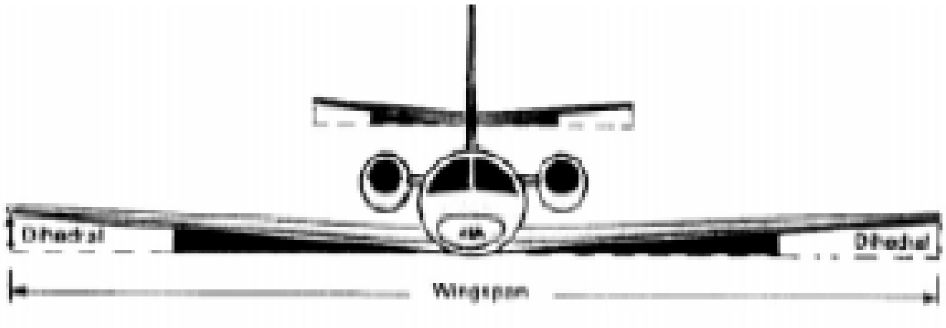
**2002**. Negative dihedral is known as anhedral and would have an unstable effect.

**Dihedral**

**2003.** When an aircraft is banked, the lift force is inclined, and produces a side slip into the turn. As such, the aircraft produces a rolling moment to restore the aircraft to its original position. The main contributor to LATERAL STABILITY is the wing the tips.



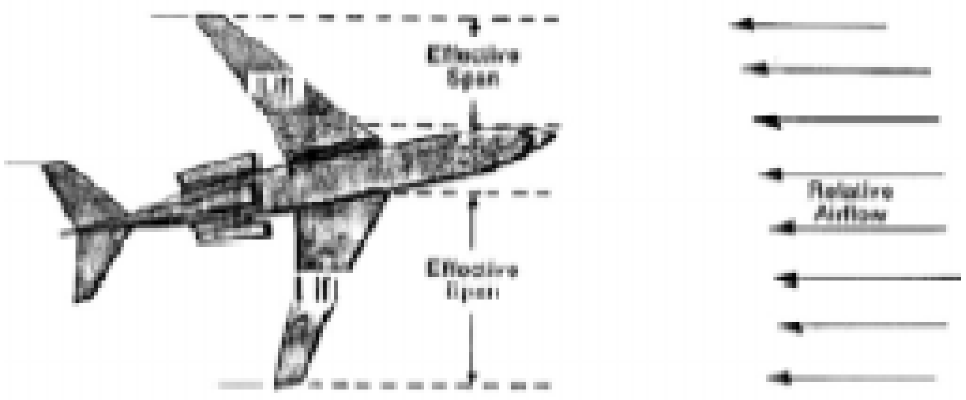

Dihedral corrects unwanted rolling.




*Dihedral*

**Wing Sweepback**

**2005.** This also increases lateral stability. As an aircraft sideslips in a roll, the lower wing has more of its span to the airflow and therefore creates more lift. This tends to restore the wings to a level position.

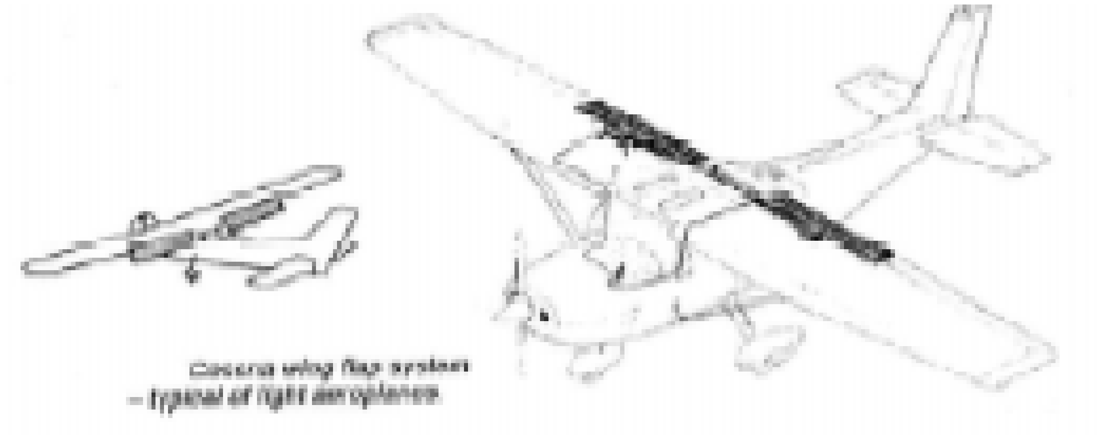



*Sweepback corrects uninvited roll.*

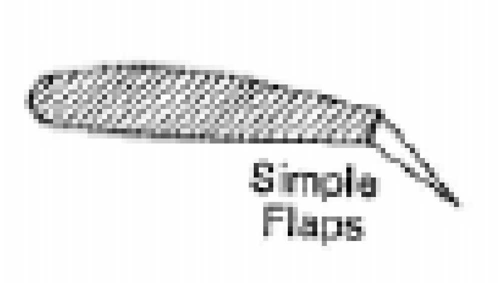
**Flaps - Leading and Trailing Edge**

**2006.** Trailing Edge flaps alter the camber of the aerofoil section. Most high speed aerofoils have a fairly straight mean camber line and hardly curved at all. Should the leading edge or trailing edge be able to be hinged downwards, then the aerofoil becomes more highly cambered and it can produce the required lift at a lower airspeed. This effect is primarily used for landings, however by lowering flaps at take-off, the aircraft can use a shorter run and a slower speed.

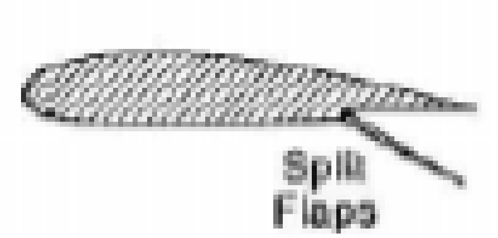
**2007.** Another advantage of flaps on landing is the pilot’s visibility is greatly improved due to the steeper angle of attack.



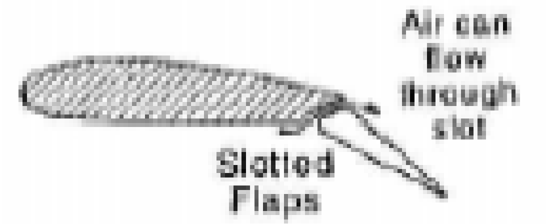

**2008.** There are various types of flaps:



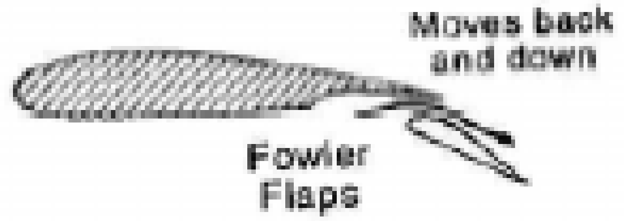

1. SIMPLE FLAP




2. SPLIT FLAP




3. SLOTTED FLAP



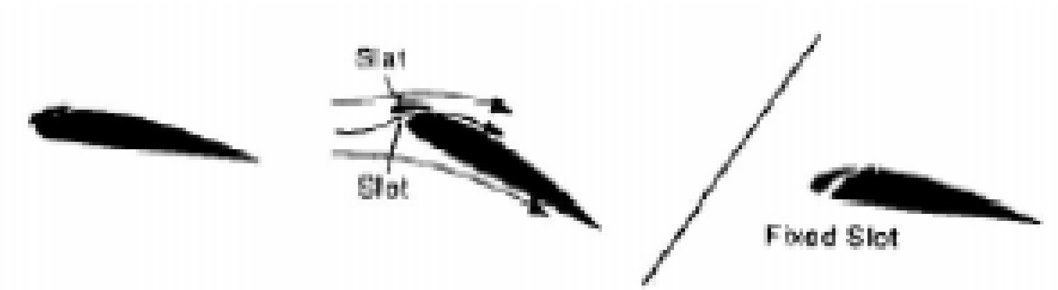

4. FOWLER FLAP

## Slats and Slots

**2009.** Some aircraft have leading edge devices that cause some of the high energy air from beneath the wing to flow through a slot and over the upper surface of the wing. This delays separation and the stall allowing the aircraft to fly at a greater angle of attack and a lower airspeed.

**2010.** This is achieved with slats which form part of the leading edge whilst in flight, and are extended forward and/or down to form a slot.

**2011.** A fixed slot, which is built into the wing, is uncommon due to high drag during normal flight.

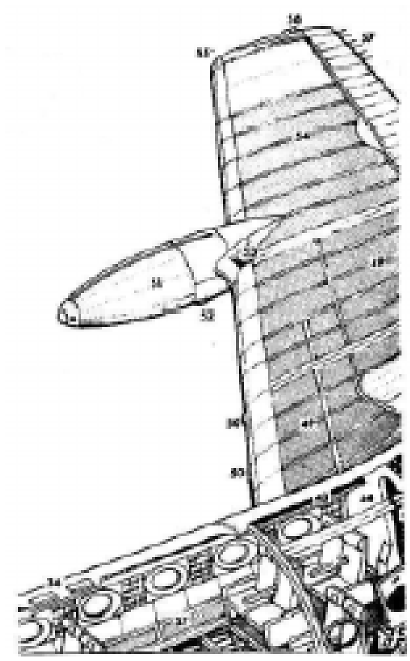



## Spoilers

**2012.** Spoilers are located on the upper surfaces of the wings of most jet transport aircraft and gliders. They are hinged control panels which disturb the upper lift producing part of the wing and therefore decreasing lift and increasing drag.

**2013**. They are used to reduce airspeed and/or steepen the descent without increasing speed.

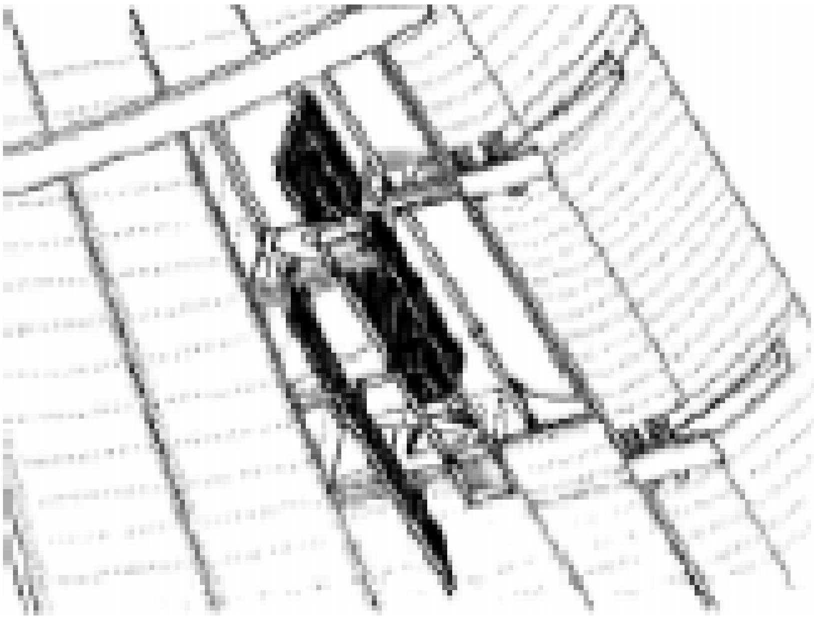
**2014.** Pilots deploy the spoilers just after landing to reduce the lift and assist the wheel brakes to be more effective due to the increase in weight.



Photograph shows the spoilers (50) near the wing root.

**Speed Brakes**

**2015.** Speed brakes are operated on landing and reduce the overall speed of the aircraft.



Picture shows the speed brakes located near the trailing edge

**AVIATION PROFICIENCY (AVP)**
**AVP 3 - AIRCRAFT ENGINES**
**1 PERIOD**

**Objective**

**3001.** State the basic principles of the operation and, with the aid of a diagram or model, identify the basic components of:

a. a four stroke cycle internal combustion engine;

b. basic turbo jet engine.

**Four stroke piston aircraft engine**

**3002.** This has a cycle of four operations:

1. induction;
2. compression;
3. expansion (or ignition)
4. exhaust.

FIG 3.1. shows the operation of the piston and inlet/exhaust valves during the four stroke cycle.

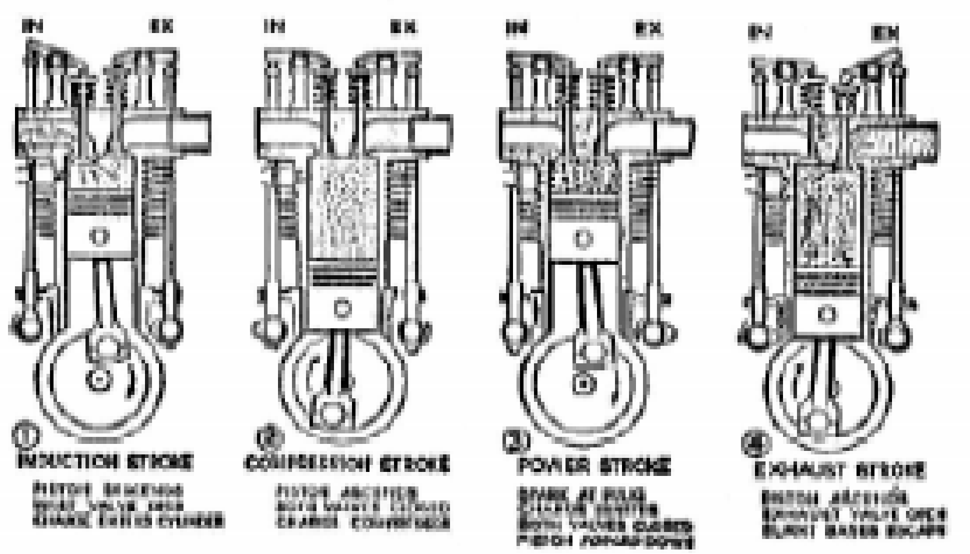



FIG 3.1. - THE FOUR STROKE CYCLE

**3003.** It can be seen that the inlet valve opens on the induction - down stroke, to allow a mixture of fuel and air into the cylinder chamber.

**3004.** Both valves remain closed during the compression stroke and the rising piston compresses the mixture into the small enclosed space above the piston, known as the combustion chamber.

**3005.** When the piston reaches the end of the compression stroke, the mixture is ignited by an electrical spark, the heat so generated rapidly expanding the mixture and forcing the piston down, thus turning the crankshaft.

**3006.** The inlet/exhaust valves are both closed throughout the compression and power strokes.

**3007.** At the beginning of the final up stroke of the cycle, the exhaust valve is opened and the burnt gases are released to the atmosphere. Complete sweeping of the cylinder by the piston during its upward travel cleans the cylinder of the burnt gases ready for the new charge of the next cycle. The inlet valve remains closed during the exhaust stroke.

**The Jet Engine**

**3008.** The sequence of induction, compression, expansion and exhaust can be applied to the turbojet engine.

Note that all these processes are occurring continuously in the engine, and the delivery is uninterrupted, unlike that of the piston engine.

**3009.** The turbojet engine has no reciprocating parts and is therefore mechanically smoother and the parts less stressed than in the piston engine.

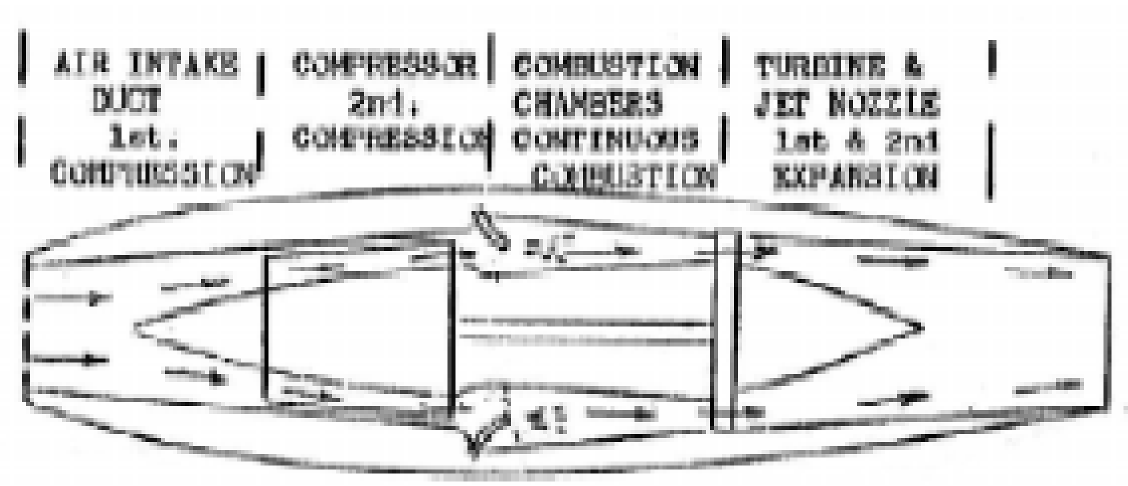



FIG 3.2. - SHOWS THE GENERAL MAKE-UP OF A BASIC GAS TURBINE ENGINE

**3010.** The incoming air is squeezed through the front fan (compressor) into the compression chamber to which is added the fuel and ignited. The gases expand and flow out the rear of the engine. To maintain the movement of the compressor another fan (rear turbine) is located at the rear and connected to the compressor by a shaft. The fan is turned by the hot gases passing through at a very high velocity. After passing through the turbine, the heated gases, still expanding, issue from the exhaust nozzle as a jet.

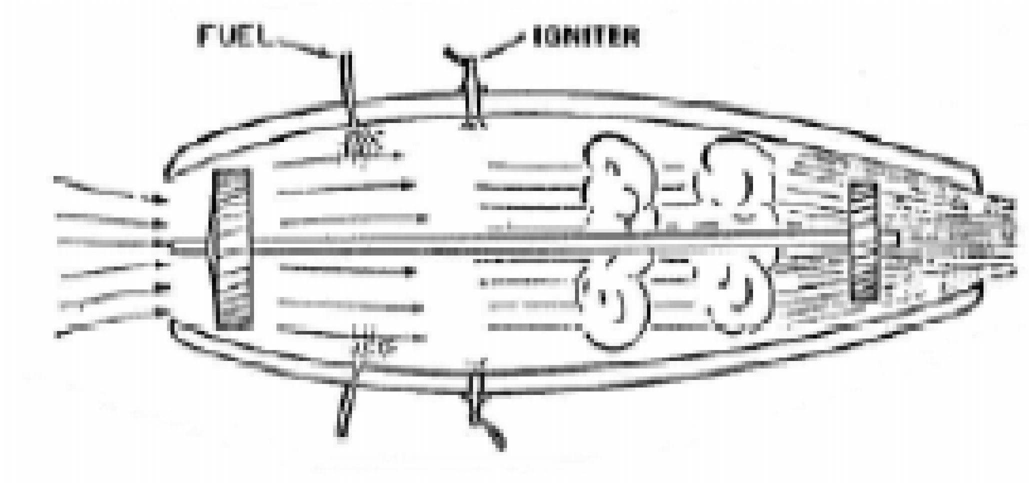



FIG 3.3.

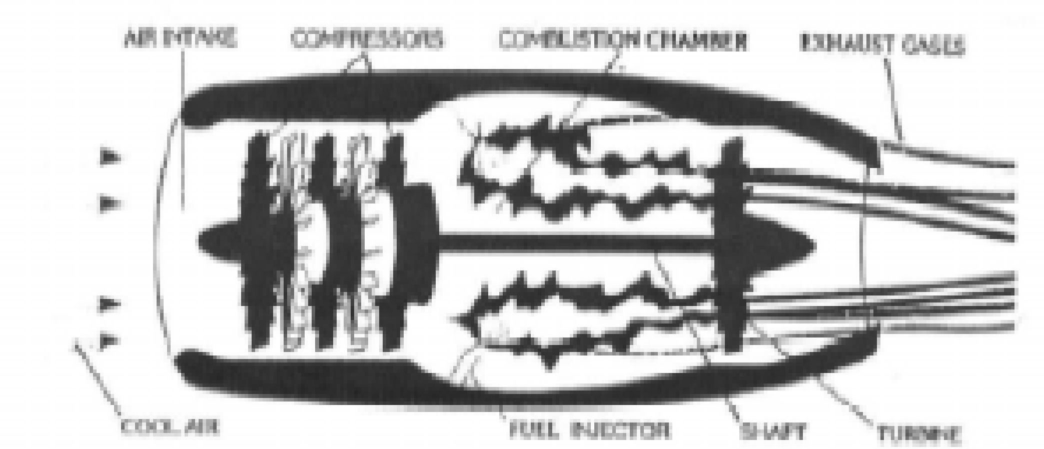



FIG 3.4

### Afterburning (Reheat)

**3011.** Additional power can be obtained by feeding fuel into the hot gases at the back of the engine behind the rear turbine. The fuel is ignited as soon as it comes into contact with hot gases, and heats them even more. The increased expansion of the air which was originally drawn into the front of the engine gives the aircraft extra thrust. This system uses a very large amount of fuel and is usually used to shorten take-off, to increase the rate of climb or to give extra speed for a short period of time.

**AVIATION PROFICIENCY (AVP)**
**AVP 4 – FLIGHT INSTRUMENTS**
**2 PERIODS**

**Objective,**

**4001.** a. From a list, identify pressure and gyroscopic (suction and electrical) instruments used in typical light aircraft.

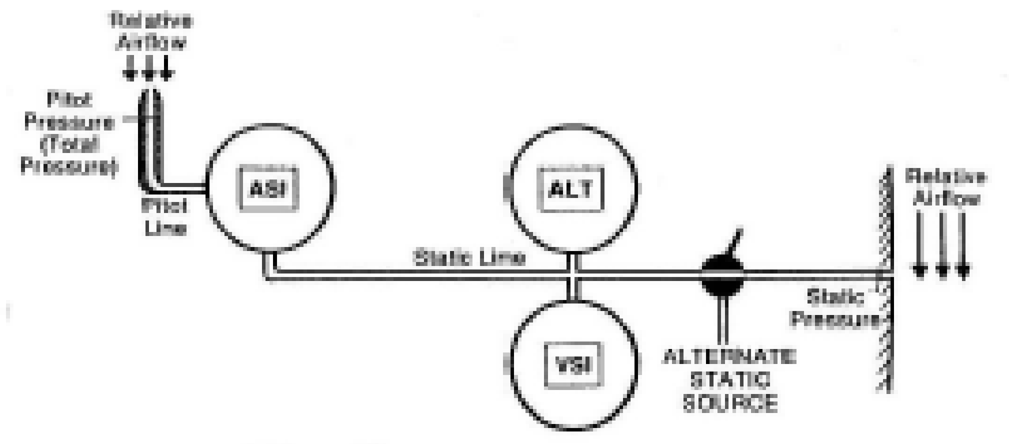
b. interpret colour codes on an ASI.

**Pressure Instruments**

**4002.** The following are pressure instruments:

1. Air Speed Indicator
2. Altimeter
3. Vertical Speed Indicator.

**4003.** The pitot tube mounted on the aeroplane, and provides the measurement of total pressure, and the static vent the measurement of static pressure.




*The pitot-static system.*

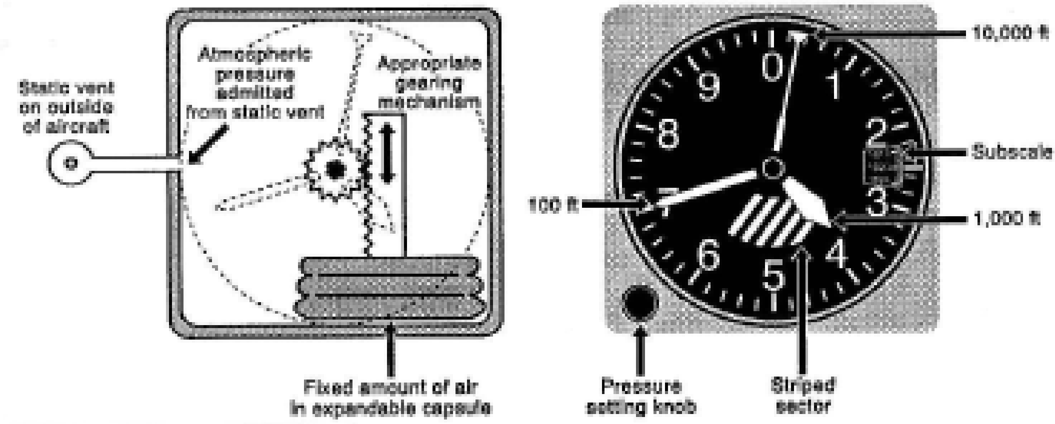
**Airspeed Indicator (ASI)**


*IAS (and TAS) indicator.*

**4004.** The Airspeed Indicator (ASI) - shows the pilot the airspeed commonly referred to as indicated Airspeed (IAS). It is related to dynamic pressure.

**Altimeter**

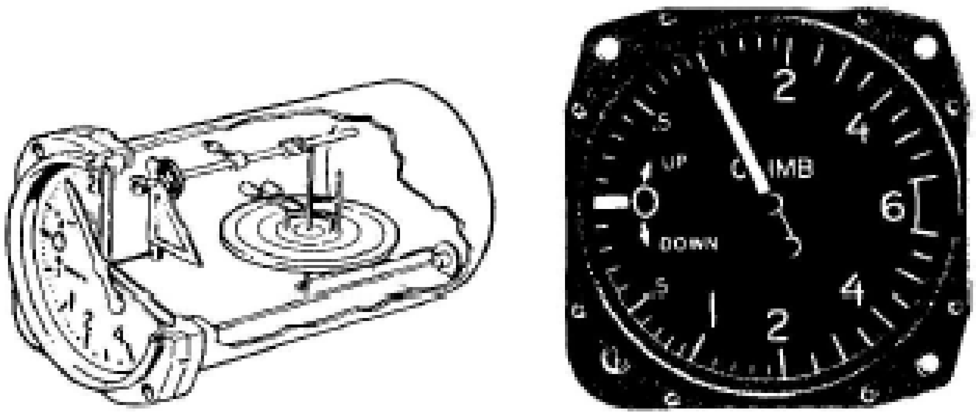
**4005.** Works on the principle that as the aircraft climbs, and the static pressure decreases, the sealed capsule expands and drives the pointer.




*The altimeter is a pressure-sensitive instrument.*

**Vertical Speed Indicator (VSI)**

**4006.** The instrument converts the rate of change in static pressure to a rate of change in altitude. Again as the aircraft climbs, the static pressure reduces and moves the pointer.



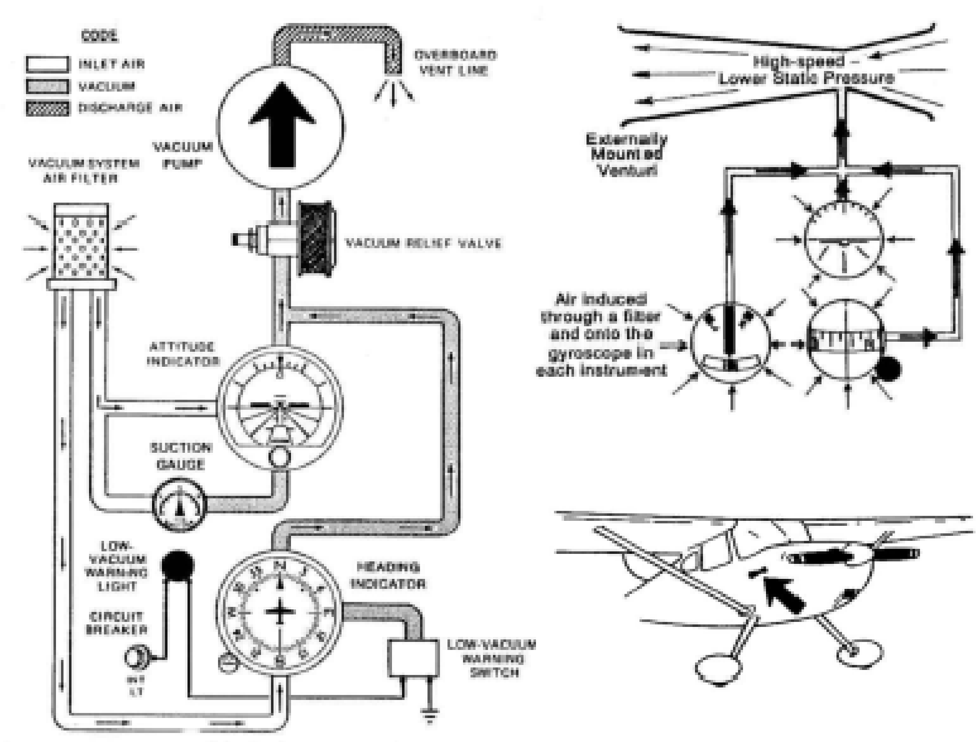

*The vertical speed indicator.*

**Gyroscopic Instruments.**

**4007.** The following are gyroscopic instruments:

1. Direction Indicator (or heading indicator/directional gyro)
2. Attitude Indicator (artificial horizon)
3. Turn coordinator and Indicator.

**4008.** The gyroscopes in the flight instruments are either spun electronically or by a stream of high speed air directed onto buckets cut into the perimeter of the rotor.

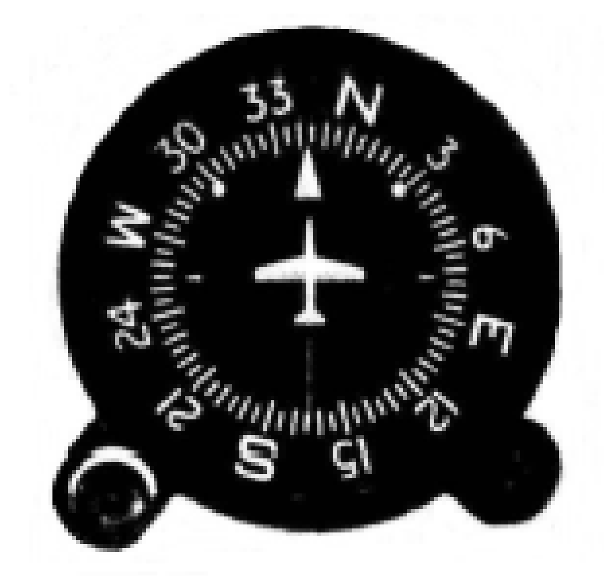



*A typical vacuum system.*

**Directional Indicator (DI)/Heading Indicator**

**4009.** This instrument should be continually aligned with the magnetic compass whilst in flight.

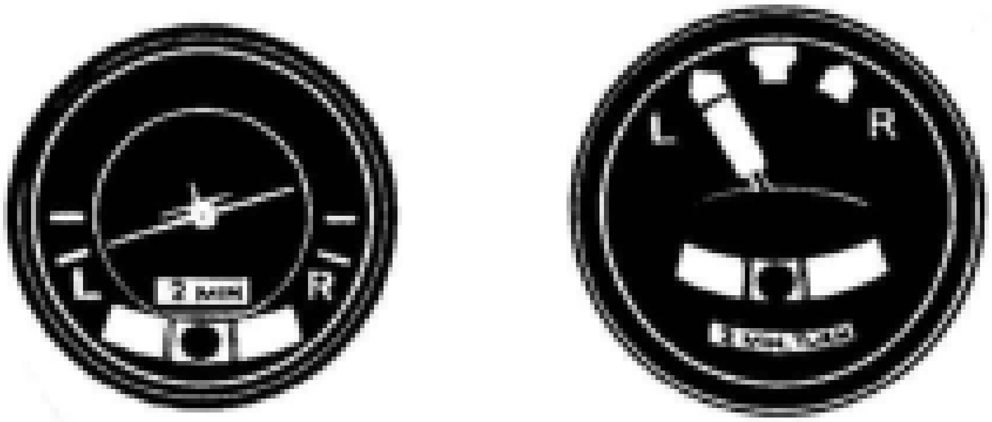
It is not subject to acceleration and turning errors, and is easy to read in turbulence.




*The heading indicator.*

**Rate of Turn/Turn coordinator**

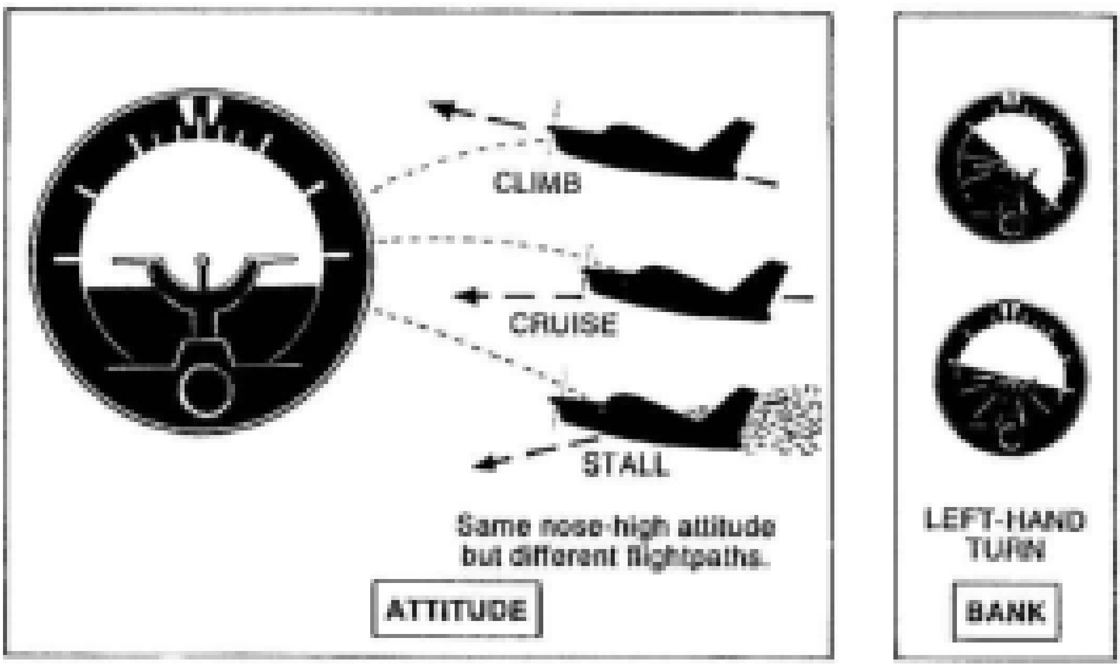
**4010.** Both these instruments indicate the aircraft's rate of turn and *not* the angle of bank. It also indicates the roll rate. The coordination ball is simply a free ball and moves like a pendulum bob.




*The modern turn coordinator and the older turn indicator, each indicating standard-rate turns to the left.*

**Attitude Indicator (Artificial Horizon)**

**4011.** Indicates the changes in attitude of the aircraft. It shows the pitch attitude and bank angle.




*The attitude indicator shows pitch attitude and bank angle.*

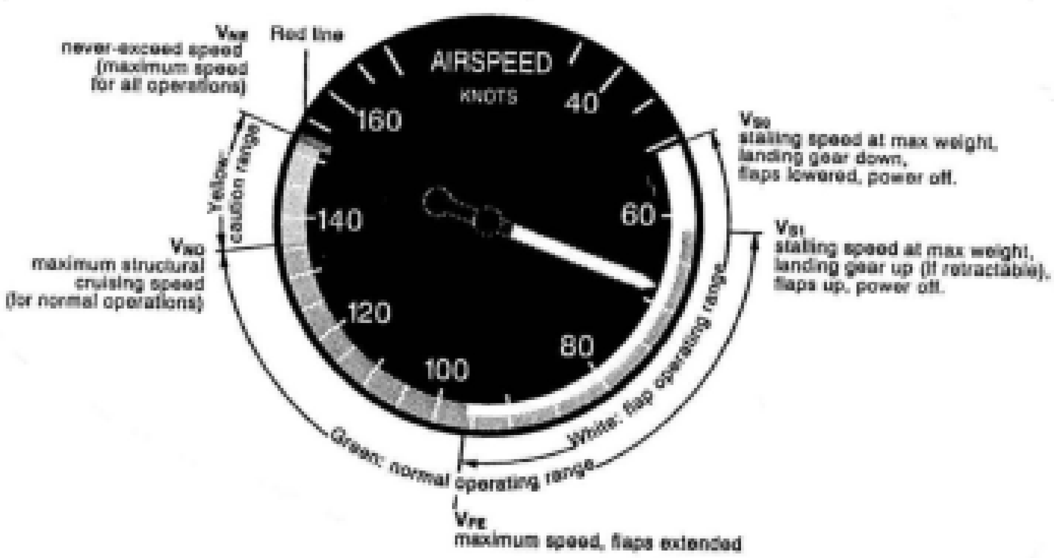
**Colour Coding**

**4012.** Green arc indicates the normal operating speed range. That is from stall speed at gross maximum weight with flaps and landing gear up. Vs1 .. to normal operating limit speed (or maximum structural cruise speed) .. Vno.

**4013.** Yellow arc denotes the caution range and extends from Vno up to Vne, which means never exceed. Aircraft operating at these speeds should be flying in smooth air only.

**4014.** White arc gives the flap operating range. This is from stall speed with max gross weight in landing configuration. full flap, landing gear down, wings level and power off .. Vso .. up to max flap extension speed .. Vfe.

**4015.** Red radial line indicates the Vne .. never exceed speed. Should an aircraft experience gusts of wind, turbulence etc the aircraft’s design load factors could be exceeded.




*Indicated airspeed is what we read on the ASI.*

**AVIATION PROFICIENCY (AVP)**
**AVP 5 – THE CIRCUIT**
**1 PERIOD**

**Objective**

**5001.** a. With the aid of a diagram, describe the circuit pattern and identify the following positions in a circuit:

1. Upwind leg
2. Crosswind leg
3. Downwind leg
4. Base leg
5. Final approach
6. Dead side of the circuit.

**The Circuit**

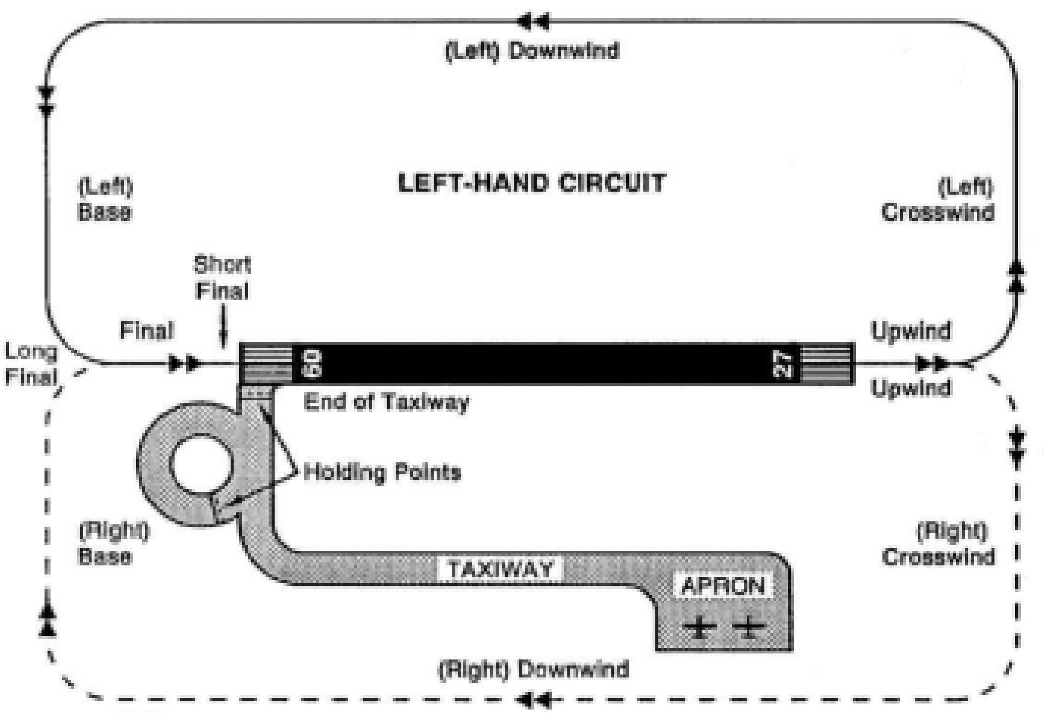



FIG 5.1. - RIGHT HAND/LEFT HAND CIRCUITS

**Takeoff - upwind**

**5002.** Takeoff is made into wind. An aircraft climbs straight ahead to a height of 500’ before commencing a left turn onto Crosswind leg. Generally circuits are flown to the left, as pilots in command are seated in the left hand seat, and gives better vision. Some airports have duel runways - i.e. Parafield has runways marked 21L(left) or 21R(right) and aircraft are required to turn left or right at 500’ respectively after taking off.

**Crosswind**

**5003.** The aircraft continues to climb to circuit height, 1,000', and level out. Should the crosswind be strong, the pilot should point the nose slightly into wind to save from being blown off track.

**Downwind**

**5004.** Downwind is flown at circuit height parallel to the runway. During this leg, the pilot makes a radio call, which tells the air traffic controller the aircraft's position and intentions. The pilots will also do their downwind landing checks, to ensure the aircraft is ready to land.

**Base Leg**

**5005.** The pilot turns onto "Base" when they are at a point relative to the aircraft's performance, the aircraft is placed in a descent, power reduced and flaps used to control the aircraft's attitude. Generally, aircraft will descend to between 500' and 700' before turning onto "final".

**Final Leg**

**5006.** During this leg, the pilot adjusts the flaps and power to ensure the aircraft does not under/over shoot the runway. Final leg completes the circuit once the aircraft has landed.

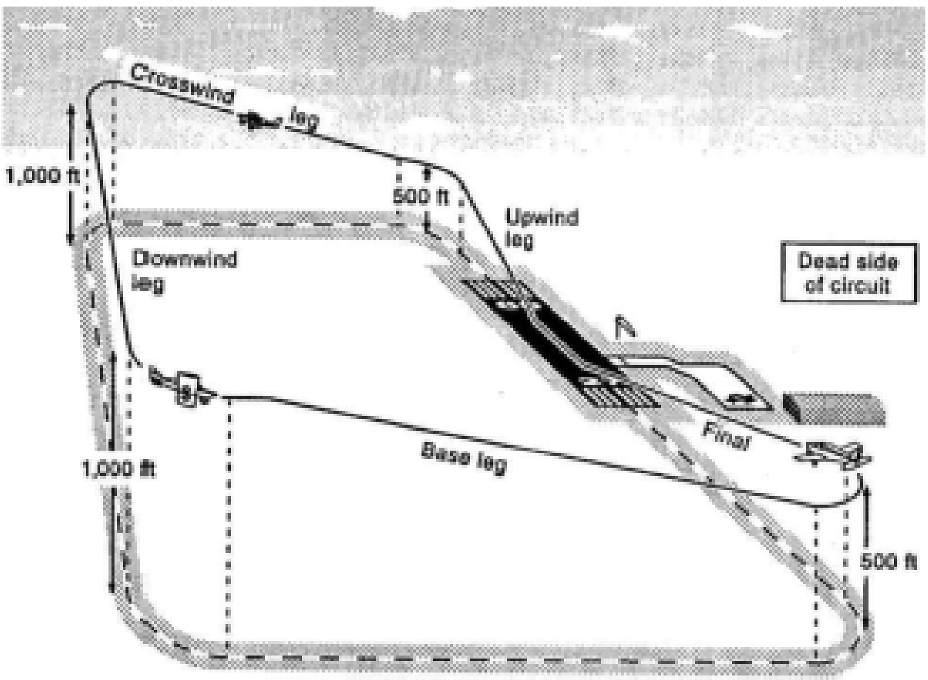



FIG 5.2. - THE NORMAL CIRCUIT PATTERN IS FLOWN AT 1,000 FT AAL

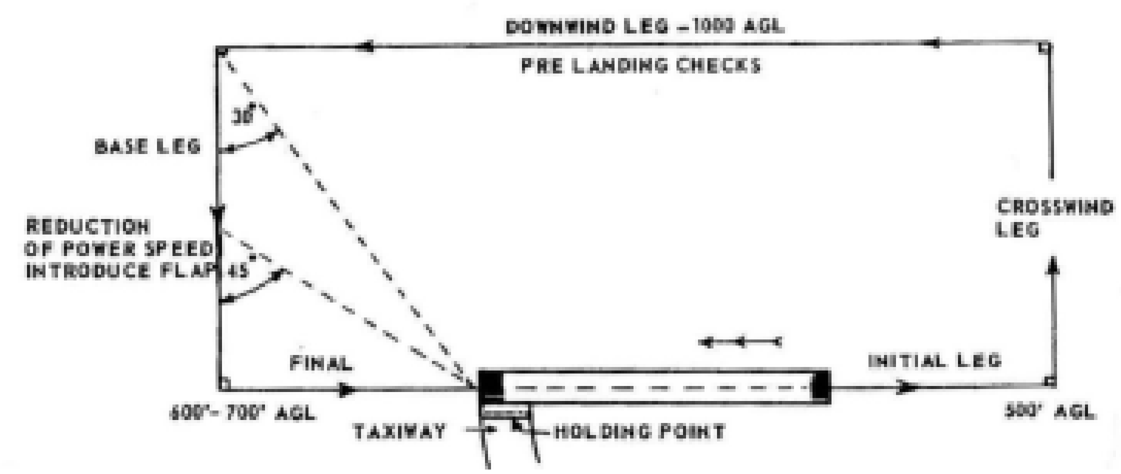
**Use of Circuit**

**5007.** The circuit has been designed to assist the smooth flow of traffic around an airport. It should be seen that if pilots were left to their own resources, accidents would frequently occur, so a standard set of rules allows for good separation and entry into a circuit area.

**Dead side**

**5008.** A circuit has a "dead" side. That is the airspace on the opposite side of the runway in use.

**5009.** Aircraft arriving at an aerodrome which is unmanned must overfly the airport at 1,500’ above aerodrome level, check for wind direction and then fly to the dead side and then descent to the required height to enter the circuit.



**AVIATION PROFICIENCY (AVP)**
**AVP 6 - FLIGHT RULES & CONDITIONS OF FLIGHT**
**2 PERIODS**

**Objective**

**6001**. a. State Visual Flight rules and Visual meteorology conditions (aeroplanes) for operations below 10,000ft

b. State and apply the following rules/requirements:

1. rules of the air (CAR 160 TO 163s)
2. the requirements relating to operation of aircraft on and in the vicinity of an aerodrome (CAR166(1) and 166(3) and the conditions relating to turns after take-off.

**Visual Flight Rules.(VFR)**

**6002.** The Air Services Australia (formerly Civil Aviation Authorities) set down regulations under which visual flights can be made. They are designed to assist the pilot to maintain attitude, avoid other aircraft and to navigate their aircraft. There are different rules when flying within controlled (CTA) or outside controlled (OCTA) airspace.

**6003**. Visual Flight Rules are located in Aeronautical Information Publications (AIP), RAC (Air Traffic Rules & Services) section para 20 - FLIGHT RULES.

**6004**. This paragraph reads - VFR flight may only be conducted:

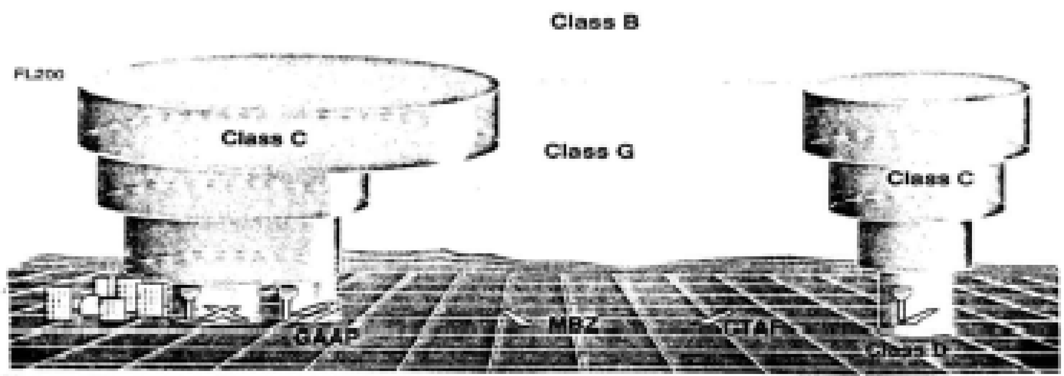
a. in VMC,
b. in airspace classifications other than Class A (above FL245),
c. provided that, when operating at or below 2000ft above ground or water, the pilot is able to navigate by reference to the ground or water,
d. at sub-sonic speeds, or
e. in accordance with the speed restrictions identified at RAC Section 50.

**6005.** Australia’s airspace is divided into either controlled or outside controlled airspace, and classified into different classes. The Classes are shown on the chart below. Note Class G is non controlled airspace.

| Class of Airspace | Application |
|---|---|
| Class A | Controlled airspace generally above FL245 in airspace classified as an Oceanic Control Area (OCA). |
| Class B | Controlled airspace above FL200 not classified as an OCA. |
| Class C | Controlled airspace at and below FL200 excluding airspace designated as Class D and those control zones in which GAAP are used. |
| Class D | Control zones of defined dimensions, generally below 1,500FT AGL, around designated aerodromes. |
| GAAP Control Zones | Control zones of defined dimensions where special procedures (GAAP) apply to allow for high density general aviation aircraft operations. |

**6005.** This is also in RAC, paras 21, subsections 21.1 - 21.5 and covers aircraft flying in Controlled Airspace, GAAP Aerodromes and Non- Controlled Airspace.

# Australia's Airspace




| Airspace Type | Clearance | Radio | Transponder | VMC Criteria |
|---|---|---|---|---|
| Class B Controlled airspace | Yes | Yes | Yes (in radar coverage) | Visibility 8km, clear of cloud. |
| Class C Controlled airspace | Yes | Yes | Yes (in radar coverage) | Visibility 8km above A100, 5000m below A100, distance from cloud 1500m horiz., 1000ft vert. |
| Class D Controlled airspace | Yes | Yes | No | Visibility 5km, distance from cloud 1500m horiz., 1000ft vert. |
| Class G Uncontrolled airspace | No | Yes for IFR, VFR ≥A050 or MBZ or when using reduced VMC criteria | No | Visibility 8km above A100, 5000m below A100, distance from cloud 1500m horiz., 1000ft vert. |
| GAAP Controlled airspace | Yes (take-off clearance, circuit entry or transit instructions) | Yes | No | Visibility 5km, clear of cloud |

**6006.** Aircraft flying under 10,000’ are flown with reference to mean sea level (MSL). The local QNH is set on the subscale of the altimeter and will read the elevation of the airport above mean sea level. This setting is generally used by pilots using the local training area or by those flying circuits at the aerodrome.

**6007.** When a pilot receives a meteorological report for a proposed route, it will read:

| | | | | |
|---|---|---|---|---|
| e.g. | 1014 : | 1016 : | 1016 : | 1017 |
| | 20UTC | 00UTC | 04UTC | 08UTC |

**6008.** These are the pressure readings for every four hours for a particular airport.

**6009.** Therefore when travelling to that airport, the pilot would place the required reading on the subscale at the appropriate time, and the altimeter will read the pressure height above sea level at that point.

**6010.** It is most important for pilots to have consistent subscale settings as it maintains correct separation and safety.

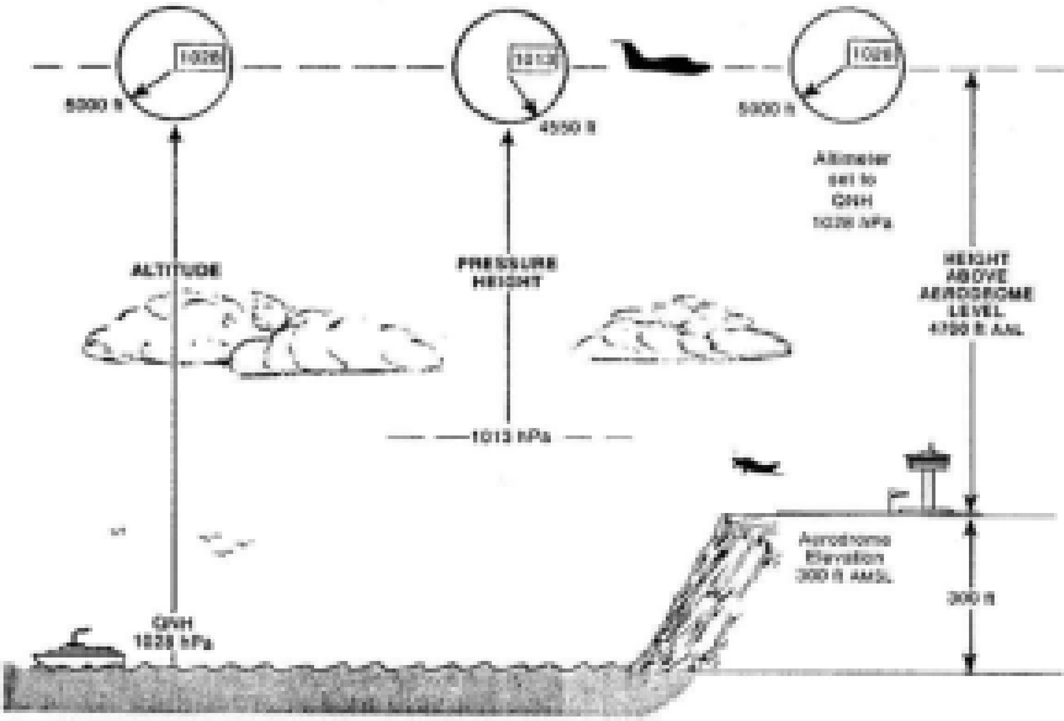



FIG 6.2. - THE ALTIMETER DISPLAYS HEIGHT ABOVE WHATEVER PRESSURE LEVEL IS SET ON THE SUBSCALE

## Rules of the Air

**6011.** Rule 160 reads: “an ‘overtaking’ aircraft means an aircraft that approaches another aircraft from the rear on a line forming an angle of less than 70 degrees with the plane of symmetry of the latter”. This means that that if, flying at night, an aircraft’s position is such that the other aircraft can not see the forward navigation lights of the other aircraft.

**6012.** The basic rules of the air are specified in the Civil Aviation Regulations and it is the pilot's responsibility to see and avoid other aircraft, and to avoid passing over or under, or crossing ahead of it, unless well clear.

**6013.** The basic rules are applied as follows:

a. when two aircraft are converging at approximately the same height, the aircraft having the other on its right shall give way (Aircraft only);

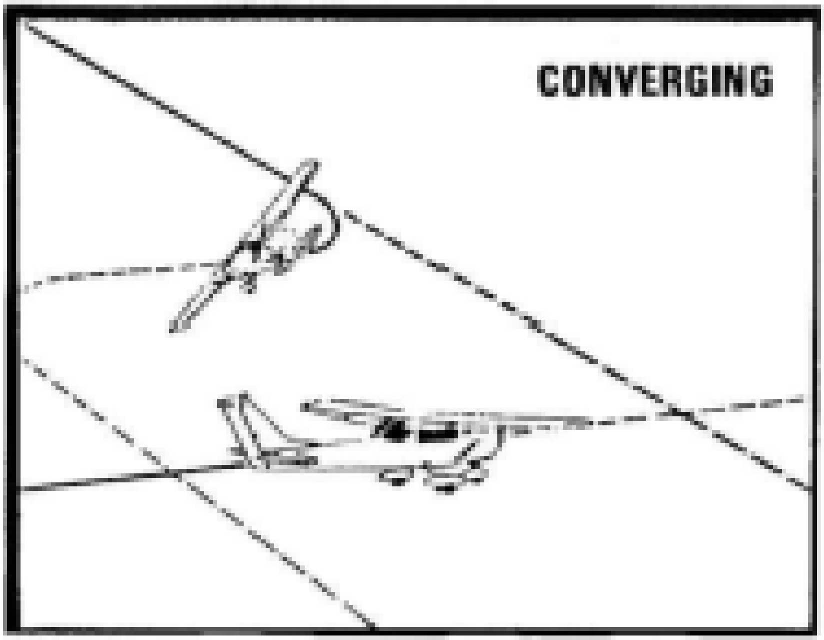



FIG 6.3. – CONVERGING

b. in any case, powered aircraft shall give way to gliders and less manoeuvrable aircraft, including aircraft towing other aircraft. In the same way, gliders shall give way to balloons;

c. to avoid other aircraft, the aircraft giving way shall alter heading to the right rather than passing over, under or ahead of the other aircraft, unless well clear;

d. when two aircraft are approaching head on, or approximately so, and there is danger of collision, each shall alter its heading to the right, (no exception for gliders);

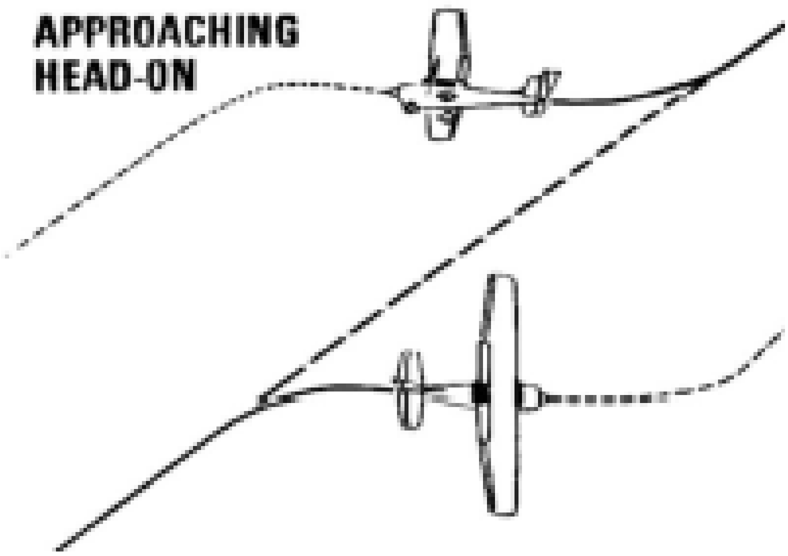



FIG 6.4. - APPROACHING HEAD-ON

e. when overtaking an aircraft, the pilot shall overtake it to the right hand side of the other aircraft;

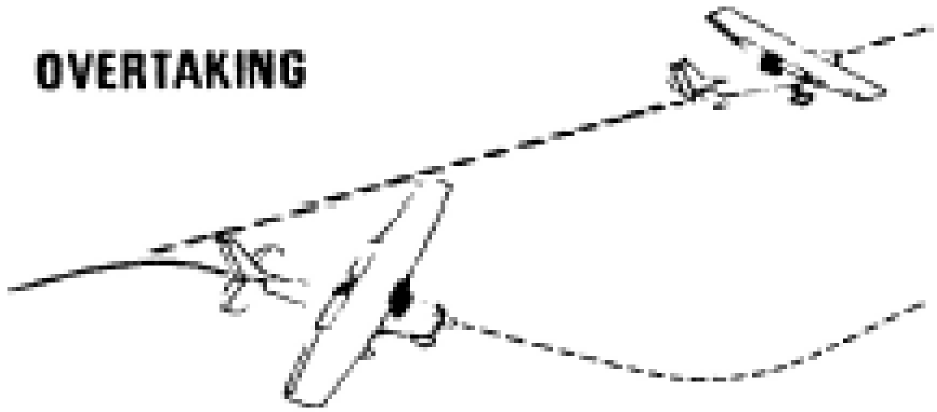



FIG 6.5. – OVERTAKING

f. in keeping out of the way of other aircraft, the pilot shall avoid passing over or under it, or crossing ahead of it, unless well clear;

g. a landing aircraft has right of way over other aircraft;

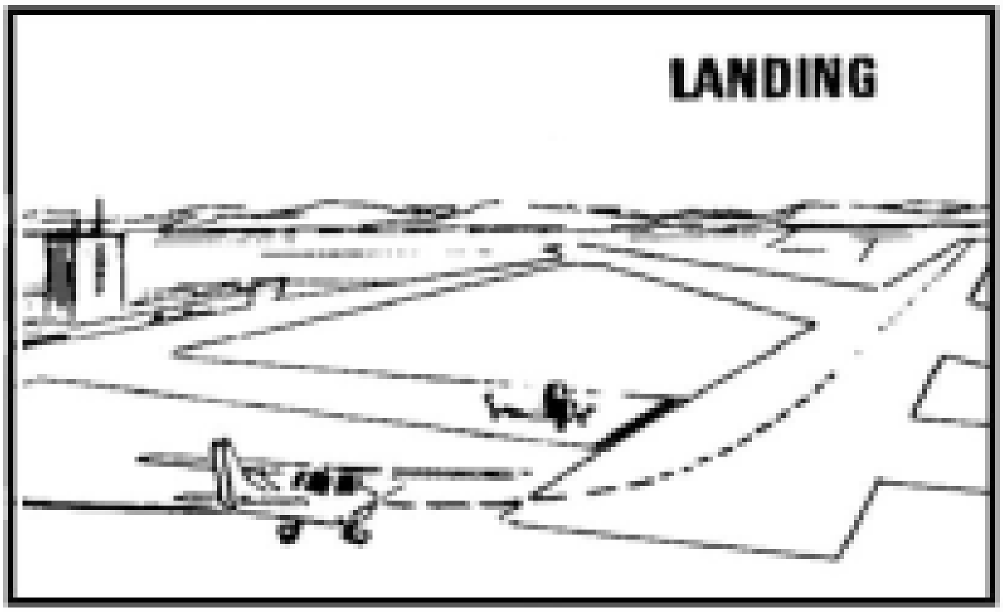



FIG 6.6. – LANDING

h. with two aircraft on approach to land, the lower aircraft generally has right of way, but shall not take advantage of the lower height to cut in front of, or overtake another aircraft on approach to land;

i. when taxing, be careful and give way to the right. Overtake other aircraft, if desired, by passing on the left hand side of it to allow the pilot in command in the left seat of the other aircraft to see you.

**6014.** Operations on and in the vicinity of an aerodrome:

a. conform with the circuit traffic pattern;

b. when flying OCTA, join the circuit on the upwind, Crosswind or downwind legs. Aircraft are required to complete three legs when joining the circuit;

c. all turns must be to the left unless otherwise directed;

d. normally land and take off into wind;

e. final approach should be straight for at least 500 metres from the aerodrome;

f. after take off climb straight ahead on the runway extended centreline to 500’ above aerodrome level;

g. use only the landing areas for take off and land (e.g. not for taxiing nor the taxi areas for landing).

**6015.** Rule 163 (1) & (2) state: “An aircraft must not be flown so close to another aircraft as to create a collision hazard”. “An aircraft must not be operated on the ground in such a manner as to create hazard to itself or to another aircraft”.

**AVIATION PROFICIENCY (AVP)**
**AVP 7 – RADIO TELEPHONY**
**2 PERIODS**

**Objective**

**7001**. a. State the phonetic alphabet and the method of transmitting numerals

b. Distinguish between a distress and urgency message and :

c. List examples when each should be used

d. State the prefix and details which must be included in each message.

**7002.** Pronunciation of letters and figures are in accordance with the following:

| **Letter** | **Word** | **Transmitted as** |
|---|---|---|
| A | ALFA | AL fah |
| B | BRAVO | BRAH VOH |
| C | CHARLIE | CHAR lee |
| D | DELTA | DELL tah |
| E | ECHO | ECK oh |
| F | FOXTROT | FOKS trot |
| G | GOLF | Golf |
| H | HOTEL | Hoh TELL |
| I | INDIA | IN dee ah |
| J | JULIET | JEW lee ETT |
| K | KILO | KEY loh |
| L | LIMA | LEE mah |
| N | NOVEMBER | NoVEMber |
| O | OSCAR | OSS car |
| P | PAPA | Pah PAH |
| Q | QUEBEC | Keh BECK |
| R | ROMEO | ROW me oh |
| S | SIERRA | See AIR rah |
| T | TANGO | TANG go |
| U | UNIFORM | YOU nee form |
| V | VICTOR | VICK tah |
| W | WHISKEY | WISS key |
| X | X-RAY | ECKS RAY |
| Y | YANKEE | YANG key |
| Z | ZULU | ZOO loo |

| Number | Transmitted as |
|---|---|
| 0 | ZE-RO |
| 1 | WUN |
| 2 | TOO |
| 3 | TREE (OR THREE) |
| 4 | FOW-er |
| 5 | FIFE |
| 6 | SIX |
| 7 | SEV-en |
| 8 | AIT |
| 9 | NIN-er |
| Decimal | DAY-SEE-MAL |
| Hundred | HUN-dred |
| Thousand | TOU-SAND (OR THOUSAND) |

**7003.** When transmitting numbers, the following as some examples:

| Number | Transmitted as |
|---|---|
| 10 | ONE ZERO |
| 75 | SEVEN FIVE |
| 583 | FIVE EIGHT THREE |
| 600 | SIX HUNDRED |
| 5000 | FIVE THOUSAND |
| 7600 | SEVEN THOUSAND SIX HUNDRED |
| 11000 | ONE ONE THOUSAND |
| 18900 | ONE EIGHT THOUSAND NINE HUNDRED |
| 38143 | THREE EIGHT ONE FOUR THREE |

**7004.** When transmitting time the correct pronunciation is as follows:

| Time | Transmitted as |
|---|---|
| 0003 | ZE-RO ZE-RO ZE-RO THREE |
| 0920 | ZE-RO NIN-er TOO ZE-RO |
| 1500 | WUN FIFE ZE-RO ZE-RO |
| 1643 | WUN SIX FOW-er THREE |
| 1718 | WUN SEV-en WUN AIT |

**Distress and Urgency Messages.**

**7005.** The radiotelephony distress signal MAYDAY of the urgency signal PAN PAN is used at the start of the first distress or urgency communication, and also required at the start of any further communication.

**7006.** Distress (MAYDAY) is when an aircraft, in the opinion of the captain, is threatened by serious and/or imminent danger and requires immediate assistance.

**7007.** An urgency condition (PAN PAN) is reported by the captain to either a particular ground station or broadcast blind if applicable. The nature of urgency is covered in 7009.

**Examples of Distress & Urgency**

**7008.** Distress (MAYDAY) examples are:

a. fire in flight

b. structural failure

c. explosive decompression

d. loss of control

e. fuel exhaustion

f. engine failure (single engine aircraft)

**7009.** Urgency (PAN) examples are:

a. lost or experiencing navigational difficulties

b. VFR aircraft operating - in cloud *

  - above cloud *

  - at night *

c. rough running engine

d. low fuel

* If these result in loss of control, then it would obviously be more appropriate to use a 'MAYDAY' call.

**Distress & Urgency Calls**

**7010.** The details of a distress call are:

a. 'MAYDAY' spoken three times then followed by the message.

b. name of unit being addressed

c. identification of aircraft

d. position and time

e. heading, airspeed and altitude

f. aircraft type and distress

g. pilot's intentions

h. any other information that might facilitate the rescue.

**7011.** The details of an urgency call are:

a. 'PAN PAN' spoken three times then followed by the message.

b. the name of unit being addressed

c. aircraft call sign, and type of aircraft

d. present position, altitude and heading

e. nature of urgency condition

f. pilot's intentions

g. any other useful information

**AVIATION PROFICIENCY (AVP)**
**AVP 8 – AIR TRAFFIC CONTROL**
**1 PERIOD**

**Objective**

**8001**. Describe the functions of:

a. Air Traffic Services (ATS)

b. Control Tower

**Air Traffic Services (ATS).**

**8002.** The Authority may establish, maintain and operate a service, which is known as 'Air Traffic Control".

**8003.** The functions of Air Traffic Control are:

a. to promote safety and efficient conduct of flight operations

b. to promote the safe movement of aircraft on manoeuvring areas

c. to expedite and maintain an orderly flow of air traffic

d. to provide operational information service

e. to notify appropriate organizations in need of assistance.

**8004.** Other functions of Air Traffic Control are to provide a traffic advisory service, traffic avoidance advice, traffic information, and a flight information service.

**8005.** The Authority may designate:

a. an aerodrome as a controlled aerodrome, and

b. airspace within defined horizontal and vertical limits as a control area, and

c. airspace within defined horizontal and vertical limits as a control zone.

**8006.** Air Traffic Control is to provide:

a. an aerodrome control service at a controlled aerodrome, and

b. an air traffic control service in a control area or a control zone.

**8007.** An aircraft shall comply with air traffic control instructions.

**8008.** An aircraft shall not:

a. enter, operate in, or leave a control area,

b. operate outside a control area as a result of a diversion out of that control area in accordance with Air Traffic Control instructions, or

c. enter, operate in, or leave a control zone or operate at a controlled aerodrome, except in accordance with an Air Traffic Control clearance in respect of the aircraft.

**8009**. The pilot in command is responsible for the compliance with air traffic control clearances and air traffic control instructions.

## Enroute Control Service

**8010.** Is provided for flights in designated control area by en route control centre sectors and certain aerodrome control towers using separation standards. It is achieved by the issuance to aircraft of air traffic control clearances, instructions and information.

## Arrivals Control

**8011.** Provides air traffic services to all aircraft within its designated area of responsibility. It shall establish the sequence of arriving aircraft as planned by the Flow Controller.

**8012.** Arrivals shall coordinate the level assigned with Approach Control and then hand off the arriving aircraft to Approach before the aircraft reaches 30NM from the aerodrome, or at the transfer point designated in local instructions.

## Approach Control

**8013.** Provides air traffic services to arriving aircraft within its designated area of responsibility.

## Control Tower

**8014.** Tower is a generic term which includes Aerodrome Control, Surface Movement Control and the Mobile Aerodrome Control Vehicle.

**8015.** The areas of responsibility may be:

a. the aerodrome traffic zone

b. the surface areas, including runways, grass strips and taxiways, but excluding aprons

c. Helicopter operation, as defined for such operations, but excluding apron areas.

d. providing Approach Control services

**8016.** The areas of responsibility shall be:

a. responsible for alerting the safety services in the event that they are required

**8017.** The tower controller shall accept arriving aircraft from the approach controller after having been provided with the disposition of arriving traffic and landing sequence if not previously advised.

**8018.** When weather conditions permits, the aerodrome controller may provide separation based on visual observations as coordinated with APPROACH provided that:

a. the tower controller is in agreement and accepts responsibility for the provision of such visual control;

b. where required, the aircraft concerned are on the aerodrome control frequency;

c. where required, specific airspace is released to the tower controller for the purpose of providing such control.