AVIATION
BASIC

Australian
Air Force Cadets

Cadet / Instructor Notes

Rewrite Edition, 1st May 2007

AVIATION BASIC (AVB)

(11 Periods + visit)

GTW Recommends that AVB 4, 5 and 6 be conducted at an airfield and where possible involve the conduct of an Air Experience flight in order to consolidate learning.

AVB 1 Aviation History AL: B Period(s): 1

a. Describe briefly the history of aviation with respect to:

(1) Early flight
(2) Civil and commercial aviation
(3)]Military aviation, and
(4) Recreational aviation.

a. Describe the full range of basic types of aircraft emanating from the lighter-than-air and heavier-than-air categories.

AVB 2 Recreational Aviation AL: C Period(s): 1

Describe the recreational nature and types of activities associated with the following:

a. Powered flying

b. Gliding

c. Ballooning

d. Hang-gliding

e. Parachuting/skydiving

f. Ultra-light aircraft

g. Aeromodelling

AVB 3 Aerodynamics AL: B Period(s): 2

a. Identify the parts of an aerofoil shape:

(1) Chord
(2) Camber
(3) Leading Edge
(4) Trailing edge of a wing or mainplane

h. Using a diagram define:

(1) Relative airflow
(2) Angle of Attack
(3) Centre of Pressure

(4) Centre of gravity

i. State in simple terms, Bernoulli's Principle & establish its relationship to wing shape & the production of lift

j. Identify the four basic forces on an aircraft:

(1) Lift
(2) Weight
(3) Thrust
(4) Drag

k. State the five factors that affect aerofoil lift & their relationship.

AVB 4 Aircraft Design AL: B Period(s): 2

Identify the basic parts of, and the terminology used with, an aircraft's airframe with respect to:

a. Fuselage-including entry, emergency exits, aerials & static vents.

l. Wing - including leading & trailing edges, navigation lights, ailerons,

m. Flap trim tabs, tie down points and stall warning indicator.

n. Fuel caps, tanks, drains & vents.

o. Empennage (tail plane) - including elevator/stabiliser & trim tabs, fins, rudder & trim tabs.

p. Undercarriage - including struts, wheels, brakes, steering & ground handling points.

q. Engine - including Propeller, spinner, air intakes, cowling and exhausts.

r. Cockpit layout - including engine & flight controls, flight instruments, heat & ventilation controls main switches.

AVB 5 Aircraft Control AL: B Period(s): 1

a. Identify the following control surfaces:

(1) Aileron
(1) Rudder
(2) Elevator
(3) Trim tab

s. List the primary effects of the elevator, rudder and aileron flight controls on aircraft movement in flight about the longitudinal, lateral and normal (vertical) axes.

AVB 6 The Airfield & Safety Precautions AL: Period(s): 1

a. With reference to a diagram of an aerodrome used for training: **C**

(1) Identify movement areas
(2) Explain the significance of taxiway, runway and/or helipad markings

b. State the safety precautions to be observed: **A**

(1) When moving around an aircraft and on tarmac areas
(2) As an aircraft passenger

AVB 7 Aircraft General Knowledge AL: B/2 Period(s): 1

a. State the units used for distance in:

(1) Navigation - nautical miles (NM)
(2) Visibility - metres (m), kilometres (km)

c. Define a knot (KT)

d. Define wind velocity (MV)

e. Express time as a 4,6 and 8 figure group

f. State the unit for vertical measurement and differentiate between:

(1) Height
(2) Altitude
(3) Elevation

g. State the following methods of expressing direction:

(1) as a three figure clock
(2) as a two figure group for runways
(3) in the clock code

AVB 8 Airport Visit AL: 2 Period(s): As Req'd

Visit a local airport with the view to consolidating AVB, particularly AVB 3, 4, 5 and 6.

AVB 9 Examination Period(s): 1

AVB 10 Examination Review Period(s): 1

Note: Instructional videos are recommended for use during relevant sections of this syllabus.

AVIATION BASIC STAGE
AVB 1 - AVIATION HISTORY
1 PERIOD

Objectives

1001. Describe briefly the history of aviation with respect to:

a. Early flight;

b. Civil and Commercial aviation;

c. Military aviation;

d. Recreational aviation.

1002. Describe the full range of basic types of aircraft emanating from the lighter-than-air and heavier-than-air categories.

Early Flight

Powered flight now a reality

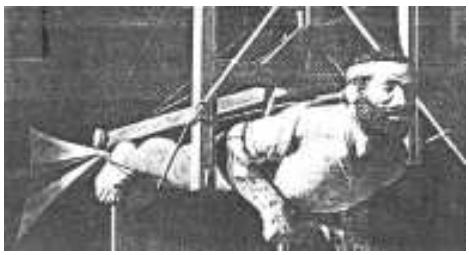
1003. Following all the early attempts to fly and the theories behind the principles of flight, on a cold Thursday, the 17th December 1903, brothers Orville and Wilbur Wright created history by flying 120 feet at a height of 10 feet. The flight was very erratic due to the difficult front (elevator) control.

1004. The world had to wait until 1906, when Brazilian Alberto Santos-Dumont flew 200 feet and the feat was reported all over the world.

Historical points of Aviation History

1005.

400-300BC	Chinese Fly Kites (first man made flying object);
200'sBC	Archimedes discovers Buoyancy (main Theory behind aerostatic lift);
1452-1519	Leonardo da Vinci designs flapping wings but never proceeded in making them;



1687	Sir Isaac Newton publishes Third Law of Motion (important theory behind aerodynamic lift and thrust);
1700's	Daniel Bernoulli's Theorem (main theory behind aerodynamic lift);
1709	Brazilian priest - Bartolomeu-de-Gesmao's practical demonstration of a hot air balloon in the court of King John of Portugal;
1783	The Montgolfier Brothers build the first manned Hot Air Balloon;

1804 Sir George Cayley flew the first successful model glider;

1891 Otto Lilienthal makes the first manned glider flight;

1891 Australian, Lawrence Hargraves experiments with models and manned gliders (his picture appears on the $20 note and a 5p stamp issued in his honour in 1965);

1903 Orville and Wilbur Wright make the first powered heavier than air flight;

1909 Louis Bleriot first man to fly the English Channel;

1910 First Australian designed and built airplane flown in Victoria by John Duigan;

1913 Igor Sikorski built and flew the first four engined plane;

1919 Englishmen Alcock and Brown cross the Atlantic;

1919	Sir Ross and Keith Smith fly the Vickers Vimy from England to Australia in 27 days 20 hours. Airtime of 135 hours 55 minutes;
1934	Sir Charles Kingsford-Smith and Charles Ulm fly from America to Australia in the Southern Cross;
1939	The first successful jet powered flight took place in Germany;
1947	The first Supersonic flight was made by Charles Yeager;

1953	The North American F-100 Super Sabre made the first level supersonic flight by a jet plane.

Civil and Commercial Aviation

1006. Design, strength and power were the main ingredients that were needed to change the 'warbirds' into commercial airliners. Development of drag free bracing and struts, plus more powerful engines gave hope to a real change in aviation.

1007. On 22 March, 1919, the first international passenger service between London and Paris was recorded. Such Companies as Air France, Deutsche, Lufthansa, Imperial Airways, KLM and Sabena were formed as national airlines.

1008. Major points of Civil and Commercial History:

1919	KLM, the Royal Dutch Airline is the first Commercial Airline established;
1921	Airlines of Western Australia established;
1922	Qantas (Queensland and Northern Territory Aerial Services Ltd) established;

1936 Douglas DC-3 aircraft entered airline service. They are the most widely used airliners in history;

Photo taken by: RAF

1952 De Havilland Comets, the world's first large Jetliners began service;

1968 Russian pilots flew the world's first supersonic transport, the Tu-144;

1970 The first wide bodied airliner, the Boeing 747 entered airline service;

1976 Concorde, the British-French built Supersonic Transport (SST) aircraft enters service.

Military Aviation

1009. Aircraft were first used in an observation role, and on 19 August, 1914, a B.E.2B biplane and a Bleriot x1 monoplane flew the Royal Flying Corps reconnaissance flight. England, France and Germany quickly realised that the use of this type of reconnaissance could assist with advice of troop movements, supplies and enemy positions.

1010. Development began at a rapid pace, with fighters and bombers being added to the range of aircraft.

1011. Major points of Military history:

1793 The French Government authorises an Air Arm;

1794 Balloons first used for Military reconnaissance;

1849 The first air raid using balloons took place over the city of Venice;

1911 The first air raid using planes took place over Libya;

1914 Australian Flying Corps established at Pt Cook, Victoria;

1915	The first fitting of armament to aircraft took place;
1918	Great Britain establishes the Royal Air Force. This was the air force independent of the army or navy;
1921	Royal Australian Air Force established;
1939	First turbojet to fly - German Heinkel He17B;

1947	Speed of sound broken in US by Charles Yeager in a Bell X-1 aircraft.

Recreational Aviation

1012. Major points in Recreational Aviation history:

1783	Introduction of Ballooning;
1891	Introduction of Gliding;
1903	Introduction of powered flight;
1917	Introduction of parachuting.

Basic Types of Aircraft

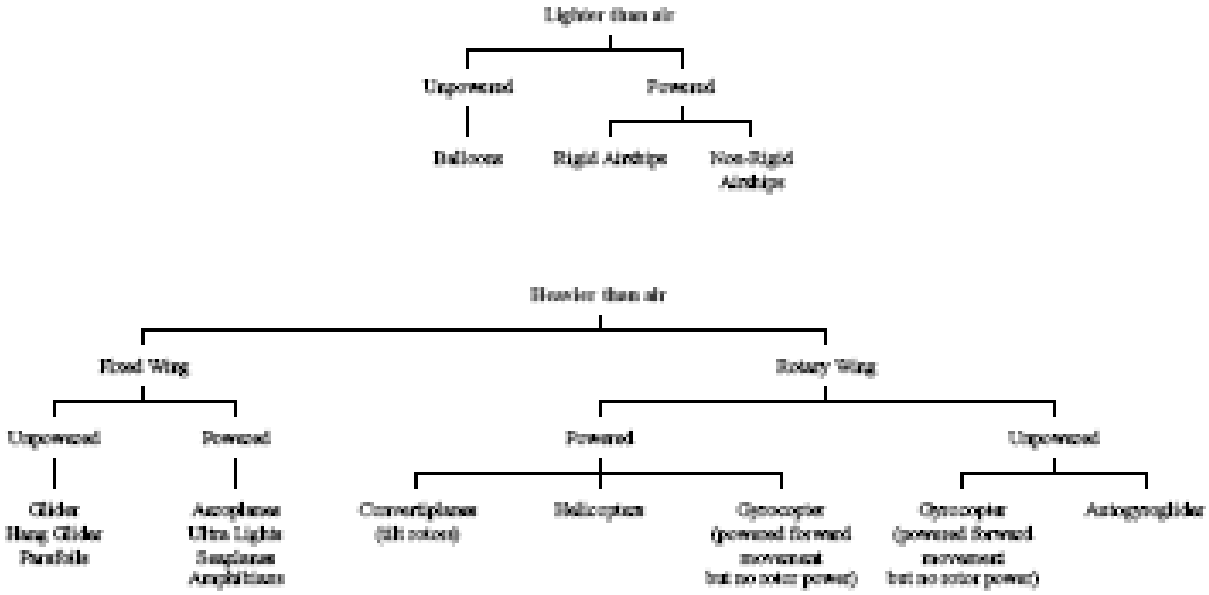
1013. All man-made machines that can attain flight are collectively termed “aircraft” From the diagram below, it can be seen that aircraft are divided into two main categories:

(a) Lighter than air

(b) Heavier then air.

Each of these categories has its own “Family tree”.

1014. Do not dismiss the lighter than air category as something of a bygone era. Several small airships are still operating around the world. Free ballooning is an established sport and kite balloons, in the form of barrage balloons are still an effective deterrent to low flying aircraft. Meteorology practice releases thousands of free balloons daily to carry weather reporting transmitters aloft.


Lighter than air
Unpowered
Powered
Balloons
Rigid Airships
Non-Rigid Airships
Heavier than air
Fixed Wing
Rotary Wing
Unpowered
Powered
Powered
Unpowered
Glider
Hang Glider
Parafoils
Aeroplanes
Ultra Lights
Seaplanes
Amphibians
Convertiplanes (tilt rotors)
Helicopters
Gyrocopter (powered forward movement but no rotor power)
Gyrocopter (powered forward movement but no rotor power)
Autogyroglider

AVIATION BASIC STAGE
AVB 2 - RECREATIONAL AVIATION
1 PERIOD

Objectives

2001. Describe the recreational nature and types of activities associated with the following:

1. Powered flying;
2. Gliding;
3. Ballooning;
4. Hang gliding;
5. Parachuting/sky diving;
6. Ultra-light aircraft;
7. Aero modelling.

Powered Flying

2002. The immediate aim would be to be granted a Private Pilot Licence (PPL) which will allow the carrying of passengers anywhere in Australia.

2003. To obtain the PPL the CASA syllabus has divided the flying training into four parts:

- Part 1 - basic flying training to solo standard with the part 1 knowledge test (Air Legislation) to be passed prior to going solo;
- Part 2 - the extension of flying skills with the part 2 written test prior to being allowed to go solo into the training area;
- Part 3 - further training prior to taking the General Flying Progress Test (GFPT) with the part 3 written test of the BAK prior to taking the GFPT.
- Part 4 - further navigation flying and theory study leads to a CASA set theory examination and Private Pilot Flight test. Upon successful completion, the issue of PPL.

2004. Powered flying can be used for recreational activities with local flying clubs, or continued studies and further flying training can lead to commercial aviation.

2005. The AAFC offers cadets Powered Flying Courses during school holidays. The main aim is for cadets to achieve 'solo' status and then continue their flying on weekends at their local Flying Club. The cost to fly in the Air Training Corps ranges from $80 - $110 per hour compared to between $150 - $170 per hour at outside Clubs.

Gliding

2006. Gliding is an excellent introduction to flying and used mainly as a recreational sport. Glider pilots contest each other on a worldwide basis for altitude, distance and endurance skills and records. Being a pure form of flight, it will enhance the skills of those pursuing a career in powered flight.

2007. Again the Australian Air Force Cadets conducts Gliding Courses during school holidays, and cadets can achieve 'solo' status. After solo cadets can join Gliding Clubs to continue their flying. Costs range from $40-$50 per half hour flight.

Ballooning

2008. Those interested in this sport will find that the balloon is entirely at the mercies of nature with the exception of ascending and descending. Commercially the balloon has also proven to be a popular venture for those who wish to explore the skies in a noiseless serene atmosphere. A list of Clubs can be found in the Yellow Pages, and the cost of a 45-60 minute flight is approximately $75 per person.

Hang Gliding

2009. This sport is spreading faster than a bush fire. The Hang Glider pilot is the new pioneer on the last frontier of aviation. This new breed of low income and high hopes are picking up the art of building and flying light weight, foot launched, man carrying wings. This sport entails the flying of one man (usually) ultra light gliders at altitudes near the earth’s surface.

2010. Hang gliding may be accomplished in a "no wind" condition. The pilot is suspended below the wing (Hang) so that he may avail themselves to foot launching and landing. Often hang gliders are referred to as "Kites" because many of the first ones were kited or towed and the trapeze bar control was borrowed from water ski kite people.

2011. The Hang Gliding Federation of Australia administers the sport. To learn to fly would cost approximately $3000 from beginning with full instruction.

Parachuting/Skydiving

2012. History tells us that Leonardo Da Vinci designed a parachute using a pyramid of cloth. He made many models but it is unknown if he made any for humans. In Italy in 1617, Fouste Veranzo jumped from a tower in Venice using a square wooden framework covered with canvas.

2013. The man credited as being the first parachutist was Andrew Garnerin. On October 22, 1797 he climbed into the basket of his parachute which was slung under a hot air balloon. Taken aloft to 2000' he then cut it loose and landed safely. The world record for a jump is 31, 333 metres (102000') from a balloon in New Mexico. It was done by Fomitcheva in 1960.

2014. The Australian Parachute Federation exists to administer parachuting. Its aim is to promote and maintain a high level of safety, and encourage participation and excellence in performance.

2015. The AAFC offers cadets the opportunity to learn to parachute during school holidays. Clubs outside the AAFC assist in the training and costs range from $250 - $350 for theory and several jumps. The total course covers theory, three jumps with two instructors, five jumps with one instructor; all from 12000' and then a solo jump from 3500'. The total course cost approximately $1450 (including gear hire).

Ultra-light Aircraft

2016. Ultra-light flying is an aeroplane that is below a maximum take-off weight (ie. pilot, aeroplane, fuel and whatever else is on the aircraft) of 450 kilograms. Some ultra-lights, due to the imagination of the designer, look positively odd, some conventional and others very heavy. They can range from powered hang glider wings, (usually called trikes) to normal wings and parachutes with engines; the world of ultra-lights is continually changing.

2017. To provide a reasonable level of safety, ultra-lights can fly up to 5000' outside controlled airspace. Pilots can land in paddocks, do their own maintenance and design and build their own aircraft.

2018. There are Flying Schools in each State and they are associated with the governing body - Australian Ultra-light Federation. This body issues pilot licences and registers aircraft.

Aeromodelling

2019. Model Aircraft flying became an activity in the early 1930's as a spectator sport in Australia. The models were free flying gliders or rubber powered aircraft. The small petrol engines became available in the mid 1930's and enabled aircraft to larger in size.

2020. America and England were the major source of supplies, with Jim Walker of USA inventing the control line model. In 1950, Walter Good, also from USA, produced the first radio controlled model. Radio controlled flying is by far the most popular activity today.

2021. Most Clubs now own their flying fields, with the Constellation Model Flying Club in SA being the first to do so in 1970.

2022. Other types of Aero modelling are:

1. Scale models, many as large as one third size the original; and
2. Pylon racing, with models reaching speeds in excess of 200mph. Free indoor flying, in old airship hangers, is available overseas.

2022. There are State, National and World championships held each year.

AVIATION BASIC STAGE
AVB 4 - AERODYNAMICS
2 PERIODS

Objectives

4001. Identify the parts of an aerofoil shape:

a. Chord;
b. Camber;
c. Leading edge;
d. Trailing edge of a wing or mainplane.

4002. Using a diagram define:

a. Relative airflow
b. Angle of attack
c. Centre of pressure
d. Centre of gravity.

4003. State in simple terms, Bernoulli's Principle and establish its relationship to wing shape and the production of lift.

4004. Identify the four basic forces acting on an aircraft:

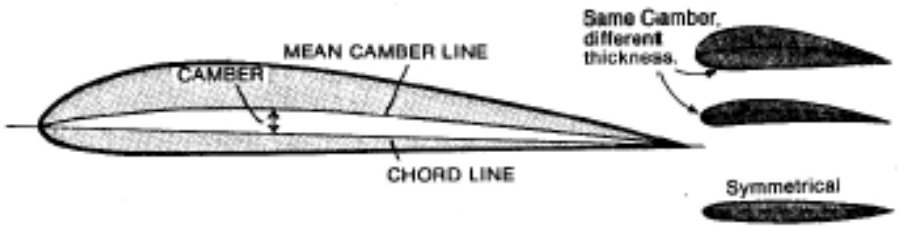
a. Lift
b. Weight
c. Thrust
d. Drag

4005. State the five factors that affect aerofoil lift and their relationship.

Aerofoil Shape

The Chord

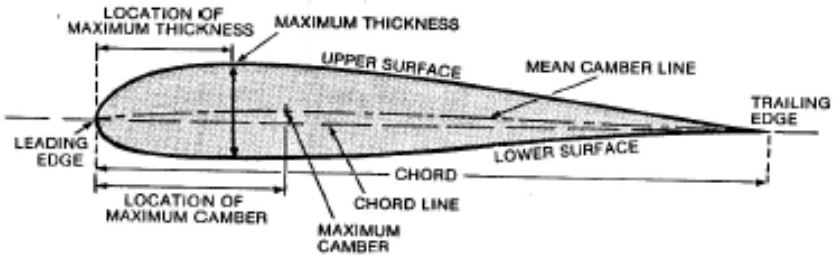
4005. The chord line is the straight line joining the leading edge and the trailing edge of the aerofoil. The length of the chord line is called the CHORD.



Camber

4006. The mean camber line gives a picture of the average curvature of the aerofoil.

4007. The CAMBER is the distance between the mean-camber line and the chord line.



Leading Edge

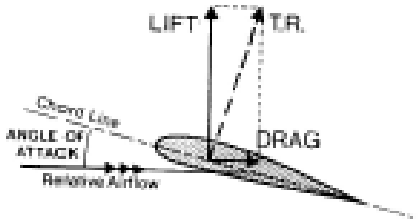
4008. The front edge of a wing is termed the Leading edge.

Trailing Edge

4009. The rear edge of a wing is termed the Trailing edge.

Relative Airflow

4010. Is the air that strikes by virtue of the relative velocity between the air and the wing. Relative airflow is always opposite to the flight path.

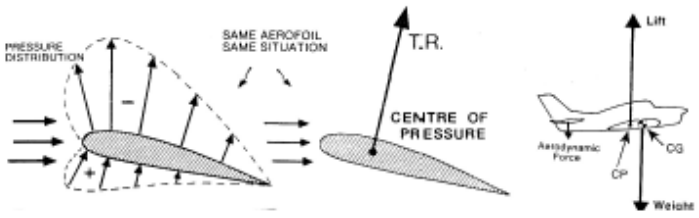


Angle of Attack

4011. Is the angle between the chord line of an aerofoil and the relative airflow.

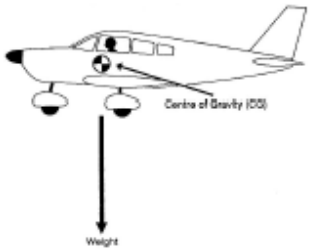
Centre of Pressure

4012. The total reaction of the aerodynamic forces on the aerofoil can be considered to act through the centre of pressure. It is that point on the chord line of an aerofoil through which total lift is said to act.



Centre of Gravity

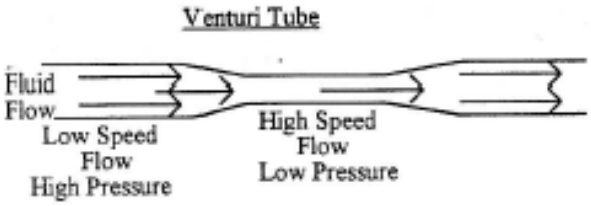
4013. The Centre of gravity is the balance point of the aircraft. It is usually located close to the longitudinal centre line of the aircraft and a fourth of the way back from the leading edge of the wing. The centre of gravity moves back and forth as the aircraft has passengers or cargo loaded or unloaded.



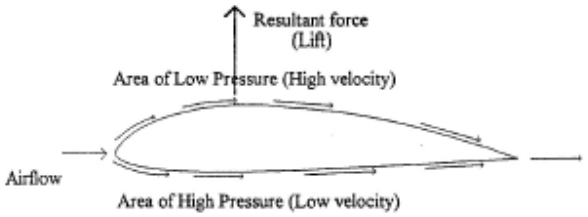
Bernoulli's Theorem

4014. The total energy in a streamline flow remains constant.

Kinetic energy (motion) + Potential energy (pressure) = constant

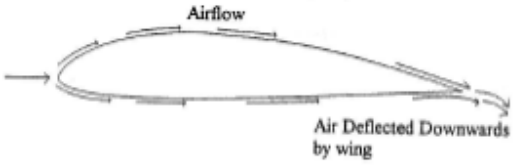


For any increase in relative velocity (kinetic energy) there is a corresponding reduction in pressure (Potential energy). he air flowing over the wing travels further than air flowing under the wing, therefore it must travel faster than the air under the wing. The high pressure below the wing and the low pressure above the wing gives the resultant force of lift.

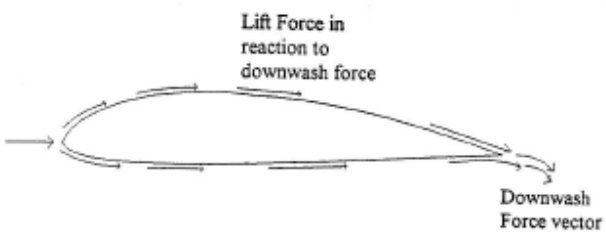


4015. Newton's Third Law of Motion

For every action there is an equal and opposite reaction.

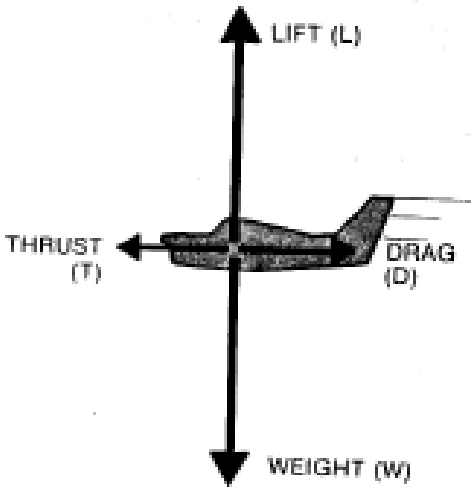


or the air to be forced down the wing, the air must impart an equal but opposite force on the wing.



Lift

4016. Lift is the component of the Total Reaction at right angles to the relative airflow. It is varied by the shape (camber) of the wings. Its point of application is the centre of pressure. Production of lift is dependent on two theories: 1) Bernoulli's and 2) Newton's third law of Motion.

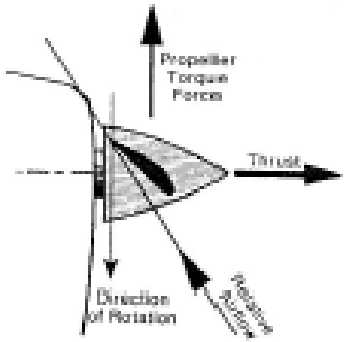


Weight

4017. Like all objects on this planet, an aeroplane has WEIGHT, which is a force that acts vertically towards the centre of the earth through the centre of gravity of the aeroplane. Whilst on the ground the aeroplanes weight is supported by ground reaction, whereas the weight of an aeroplane in the air is supported by the LIFT.

Thrust

4018. Thrust is provided by the engine acting either through a propeller or a jet and is the force, which propels the aircraft forward. The propeller pulls the aircraft through the air by generating a horizontal lift force acting through the centre of pressure of the propeller shaft.

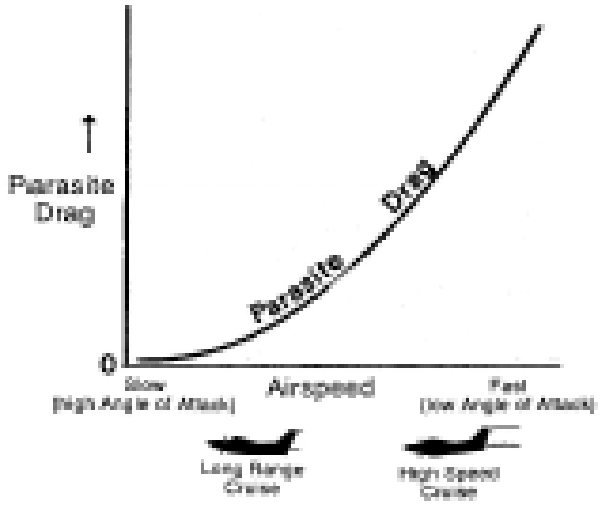


Drag

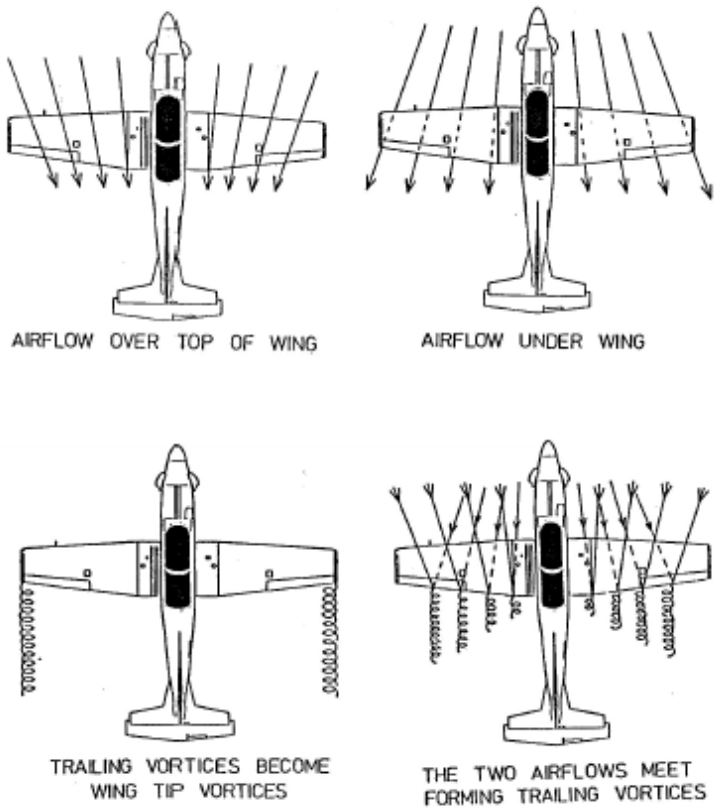
4019. Drag is the force which opposes the forward movement of the aircraft. Its point of application is also the centre of pressure. The total drag acts parallel to the relative airflow in the opposite direction to the aircraft's movement. Drag increases rapidly with increased speed of the aircraft. It is the air resistance caused by the design of the aircraft. There are two types of drag - **induced,** which is the drag associated with lift, and **parasite drag**, which is the sum of all other kinds of drag.

4020. Parasite drag consists of skin friction, form drag and interference drag. Skin friction relates to the surface area of the aircraft as it moves through the air. Form drag results when the airflow actually separates from the surface, eddies are formed, and the streamlined flow is disturbed. Interference drag is the additional drag produced by the mixing of airflow at junctions, such as the fuselage and wing roots or the tailplane and fuselage etc.

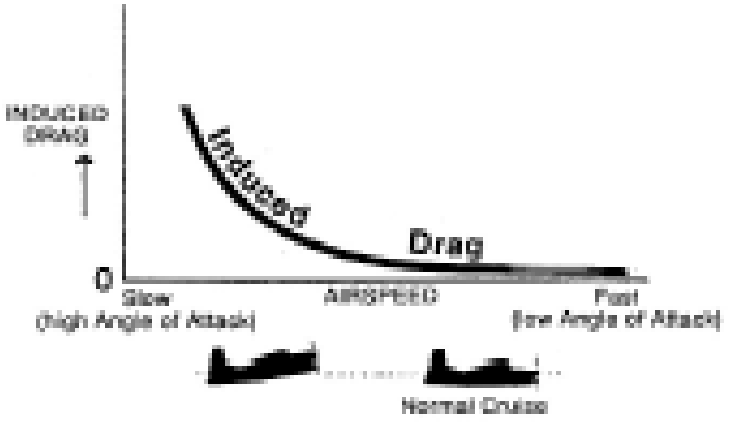
4021. Parasite drag increases with airspeed.



2022. Induced drag is related to the angle of attack and is at its greatest at slow speeds. As we have learnt, to create lift we have a lower static pressure on the upper wing surface than underneath the wing. As the air flows rearwards, there is a spill around the wingtip from high to low pressure. This causes a flow of air around the wing. They are called **wingtip vortices** at the wing tips, and are at their greatest at this point.



4023. Induced drag reduces with airspeed.

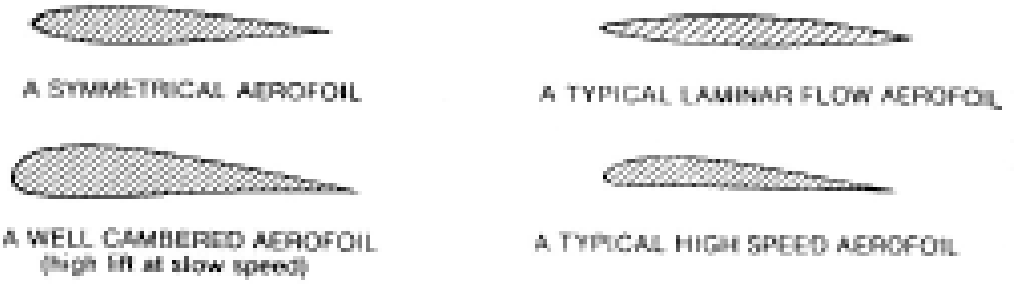


Factors affecting the Production of Lift

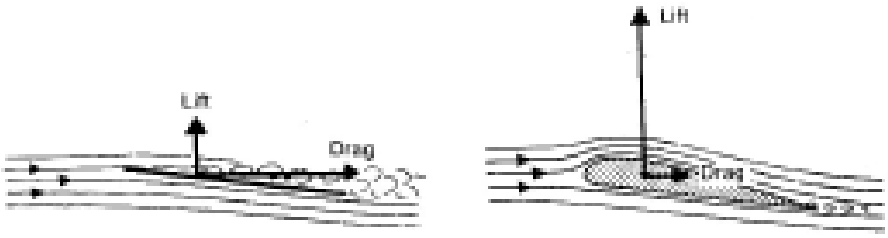
4024. The formula for Lift = CL (co-efficient of lift) x 1/2.rho.v2 x S.

Wing shape & angle of attack

4025. Most wings are not shaped like a flat plate as this is not the ideal aerofoil. A flat shape will break up the streamlined flow and cause turbulence/eddying, thereby greatly increasing drag. A curved aerofoil surface generates more lift, less drag and is stronger in structural strength than a flat wing.



4026. The angle of attack is the angle between the chord line of an aerofoil and the remote relative airflow.



4027. Bernoulli's principle associates a decrease in Static Pressure with an increase in Velocity.

4028. Therefore the shape of Aerofoil and its Angle of Attack determine the distribution of velocity and therefore the distribution of the static pressures over the surface.

Air Density (rho) or (p)

4029. The performance of an aircraft depends on AIR DENSITY. Air expands when it becomes less dense and when compressed, it becomes denser. As we ascend into the atmosphere the pressure decreases and allows the air to expand, therefore it becomes less dense. The converse happens as we descend. The more dense air we have then the more lift (and drag) and conversely the less dense the air the less lift (and drag).

Aircraft Speed/Velocity (V2)

4030 The faster the aircraft travels the more lift and drag. The slower the aircraft travels the less lift and drag. If the speed is doubled both lift and drag increase fourfold for a constant angle of attack. If it is halved both lift and drag decrease to a quarter of their previous values for a constant angle of attack.

4031. A good example is by putting your hand out of a moving car and face it flat into the airstream. As the car increases speed, so does the pressure (Dynamic) increase against your hand.

Wing Area(s)

4032. Wing surface area refers to the size of the wings. The larger the surface area the more lift and dag. If the pilot wishes to vary the lift varying the angle of attack and/or the speed (velocity) can do it.

AVIATION BASIC STAGE
AVB 5 - AIRCRAFT CONTROL
1 PERIOD

Objectives

5001. a. Identify the following control surfaces:

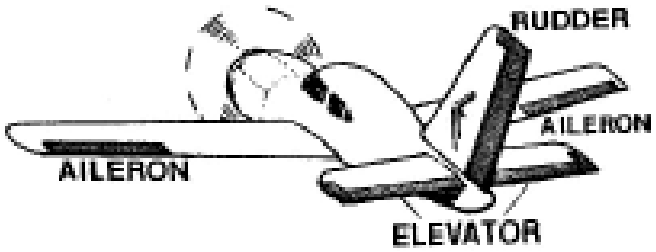
(1) Aileron;

(2) Rudder;

(3) Elevator;

(4) Trim tab.

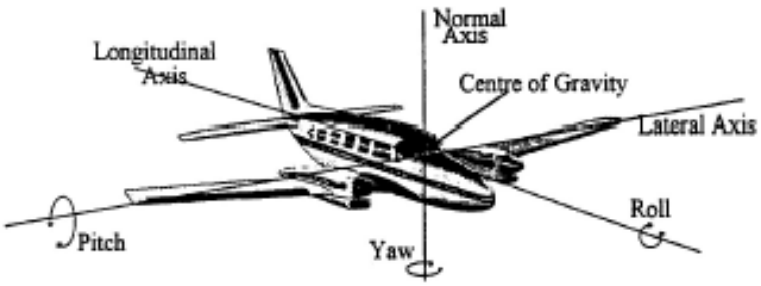
b. List the primary effects of the elevator, rudder and aileron flight controls on aircraft movement in flight about the longitudinal, lateral and normal (vertical) axes.



Ailerons

5002. They control the lateral (ROLL) movement of the aircraft. To bank an aeroplane the control column is moved to the left or right. This moves the ailerons, which are situated at the trailing edge of the wings normally at the outer edge near the wing tips. To bank to the left, the left aileron goes up causing a decrease in lift on the left wing, at the same time the right side aileron goes down causing an increase in lift and the aeroplane will bank to the left.

5003. This is the primary effect; the secondary effect is to cause YAW, as during a bank the nose will have a tendency to slip sideways.



Rudder

5004. The rudder controls the directional (YAW) movement and is controlled through the rudder pedals.

5005. This is the primary effect of rudder movement, the secondary effect is to produce a roll as yawing of the nose to one side will cause the outer wing to speed up, increased lift is the result and a consequent slight rolling.

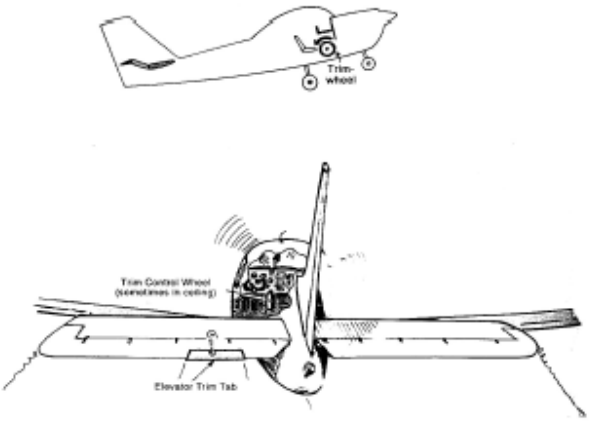
Elevator

5006. The elevators control the lateral (PITCH) of the aircraft.

5007. The up and down movement of the nose is known as PITCH and can be controlled by the movement of the control column fore and aft, thereby moving the elevator, altering the aerodynamic force produced by the tailplane and changing the pitch of the aeroplane.

Trim tab

5008. The elevator trim tab is located on the trailing edge of the elevator, and is operated by a trim wheel between the front seats. It allows the aircraft to be flown with little pressure on the control column.



AVIATION BASIC STAGE
AVB 6 - THE AIRFIELD AND SAFETY PRECAUTIONS
1 PERIOD

Objectives

6001. a. With reference to a diagram of an aerodrome used for training:

(1) Identify movement areas

(2) Explain the significance of taxiway, runway and /or helipad markings

b. State the safety precautions to be observed:

(1) When moving around an aircraft and on Tarmac area;

(2) As an aircraft passenger.

General Layout

6002. Airfields are so placed as to assist the smooth flow of aircraft movement on the ground and in the air. Runways are placed to take into account the local prevailing winds so aircraft can have consistent "into wind" landing and takeoff conditions most of the time.

6003. Built up areas are also taken into account as in the case of emergency, aircraft must be given adequate opportunity to land in the event of an engine failure.

6004. The layout of a typical airfield provides for ground movement of aircraft to their specific runways via taxiways leading to or alongside of the runway and generally includes run-up bays for pre-flight checks. Wind socks are placed so that pilots can check wind direction from both on the ground or overlying an airfield. The diagram over is a simplified RAAF Airfield. (ORP means Operational Readiness Platform).

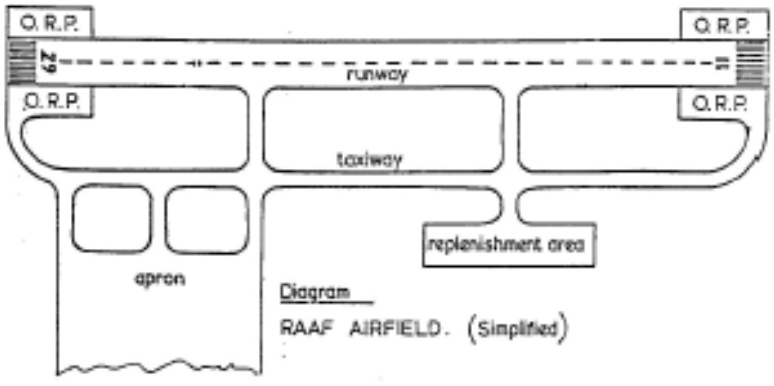


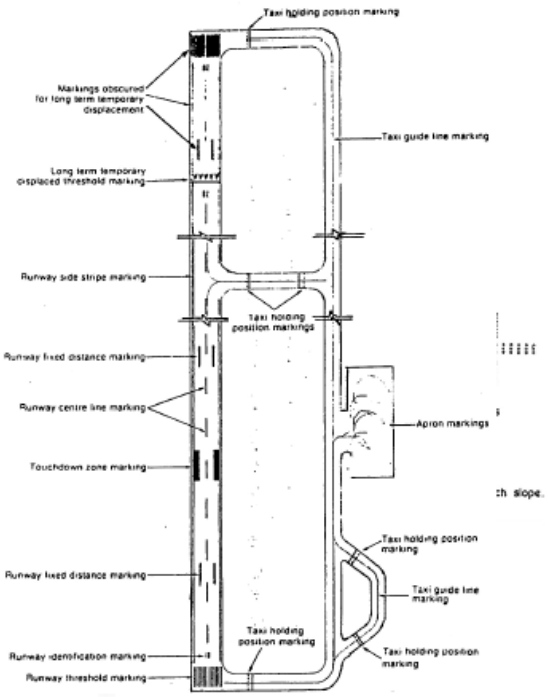
Diagram
RAAF AIRFIELD. (Simplified)

Essential Markings

6005. AERODROME GROUND SIGNALS

GROUND SIGNAL	DESCRIPTION	WHERE DISPLAYED	MEANING
	Horizontal white dumb-bell	Adjacent to wind direction indicator.	Use hard surfaced (asphalt concrete, sealed, primed, coral or gravel) runways, taxiways and aprons only.
	White Cross	(i) Adjacent to wind direction indicator. (ii) On manoeuvring area.	(i) Aerodrome completely unserviceable. (ii) An area marked by a cross or crosses with the limit delineated by markers is unfit for use by aircraft.
	White Double Cross.	Adjacent to wind direction indicator	Gliding operations in progress.

RUNWAY AND TAXIWAY MARKINGS



Taxiway

6006.

a. Taxiway markings are painted in yellow;

b. taxiway centre lines may be painted with a continuous yellow line;

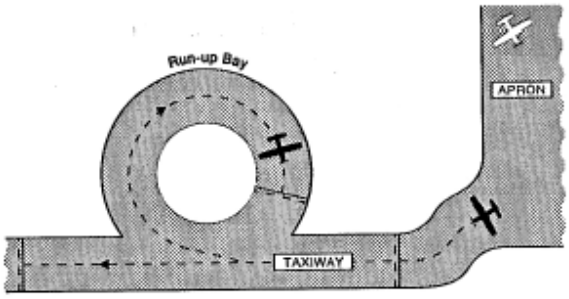
c. taxiway edging may be painted with a double yellow line to mark the difference between soft and hard holding surfaces;

d. taxiway holding lines are painted across the width of the taxiway, one line continues, the other a dashed line. Sometimes a holding SIGN may be located on the edge of the taxiway, with white letters on a red background;

e. cone markers or gable markers may also be used to mark the boundaries of taxiways, tarmac aprons and runways. An alternative is a solid painted line.

Holding Bay

6007. Prior to take-off an engine run-up is required to check various instruments and controls, this is done in a holding bay. These bays may be marked in the same way as the taxiway.



Permanent Threshold

6008. This marking is used at the end of sealed or concrete runways. Referred to as

"Piano Keys", (consisting of a series of parallel longitudinal white lines) they are always used when the width of the runway is 30 metres or more. The marking is sometimes used for runways of less width.

Runway side stripe and end markings

6009. A solid white line indicates the edges of a sealed or concrete runway.

Unusable runways

6010. A totally unusable runway will have a large white cross at each end (X).

Helipad Marking

6011. Indicated with a large white circle.

Precautions on Tarmac and around aircraft

6012. This section mainly refers to either visits to airports, or as part of a maintenance crew working on flight lines or tarmac areas on both civilian and military airfields. In both cases the following precautions should be observed:

a. **BEWARE** of propellers, always treat them as LIVE and do not touch or move them unless you are qualified to do so;

b. **BEWARE** of jet engine intake suction, always stay well clear and outside of the designated "Danger" area. Most jet engines have their particular danger zone area painted on the side of the engine cowling in red;

c. BEWARE of jet blast, this normally is a much larger danger area than intake suction. The jet blast area will vary with engine speed;

d. When working or moving around a manned aircraft be careful of the following:

- speed brakes;
- bomb bay doors;
- ejection seats;
- operating radar domes;
- any armament on or around the aircraft;

e. DON'T:

- smoke near aircraft;
- carry loose objects in unzipped or unbuttoned pockets;
- play with propellers;
- put hands in or on control surfaces;
- step on 'NO STEP' areas;

f. Always watch out for other traffic on the tarmac like towed aircraft, maintenance vehicles, fuel tankers, catering trucks and general tarmac approved vehicles.

Precautions as an aircraft passenger

6013. References for the following were extracted from CAA 20.16.3:

a. no smoking is permitted at any Australian airport terminal;

b. no smoking is permitted on any domestic flight and smoke detectors are fitted in aircraft toilets should a person try and beat the rules;

c. the fastening of safety belts is mandatory for take-off and landing and it is normally advised that they remain fastened during flight for safety reasons like unexpected turbulence or sink;

d. the seats are to be in an upright position during take-off and landing;

e. know the location of emergency exists and the nearest one to you;

f. know the location of your life jacket and the correct procedure to put it on;

g. make sure you are aware of the fact that in case of depressurisation or cabin smoke an oxygen mask will drop from the overhead compartment. Know how to put it on;

h. make sure that your luggage and cabin luggage is not over its allowable size and weight;

i. ensure that if your cabin luggage cannot be placed in the overhead storage lockers that it is placed in front and under the seat in front of you;

j. beware of "Dangerous Goods" not allowed on or near aircraft.

6014. Most of the above rules apply to domestic and overseas airlines, however, a lot of them also apply to travelling in light aircraft with one addition, and that is that you could find yourself in the front seat next to the pilot and have a set of duel controls in front of you. Keep feet away from rudder pedals and hands away from the control column or yoke.

Cadets on Military Tarmacs

6015. The tarmac area is where aircraft load, unload, refuel, start up & close down, taxi in from & out to the runway. Aircraft can be serviced, including the running of engines. It is important that all cadets appreciate the danger of being on the tarmac.

6016. The tarmac area is out of bounds to all cadets unless they have the authority for a visit, working detail or air familiarisation flight. Cadets require the permission of the Detachment Commander for any Flight in a service aircraft.

6017. Headwear should not be worn on the tarmac area.

6018. Cadets are generally briefed before entering aircraft on the tarmac area. It is important that all instructions are understood and adhered to at all times.

AVIATION BASIC STAGE
AVB 5 - AIRCRAFT GENERAL KNOWLEDGE.
1 PERIOD

Objectives

7001.

a. State the units used for distance in:
   (1) Navigation - nautical miles (NM)
   (2) Visibility – metres (m), kilometres (km)
b. Define knot (KT)
c. Define wind velocity (MV)
d. Express time as a 4, 6 and 8 figure group
e. Covert mentally local time (EST, CST or WST) to UTC and vice versa
f. State the unit for vertical measurement and differentiate between:
   (1) Height
   (2) Altitude
   (3) Elevation
g. State the following methods of expressing direction:
   (1) As a three figure group
   (2) As a two figure group for runways
   (3) In the clock code

Distance

7002. The distance used in navigation is a NAUTICAL MILE (NM). In modern terms it is equal to 1852 metres.

7003. When expressing visibility or runway length, metric units are used. Runways (shorter distance) are expressed in metres, eg. 1500 metres, while visibility (longer distance) is expressed as kilometres, eg. 8 kilometres).

Knot

7004. A knot is the unit for velocity (speed). One knot being one nautical mile per hour.

Wind Velocity

7005. Wind velocity is the direction from which the wind is blowing and its speed in knots eg. 015/40 indicates that the wind is from a direction of 015 degrees and its speed is 40 knots.

Time

7006. Time is based on Greenwich Mean Time and expressed as a four figure group. (number) That number relates to the 24hr UTC (Universal Time Co-ordinate) clock.

An example is:

a. 7.15am in Greenwich = 0715UTC

7007. The date can be added to complete either a six or eight digit number.

Examples are: 15 November 1994 at 0815UTC

a. a six figure 150815 (day only)

b. eight figure 11150815 (month & day)

7008. Know how to convert the actual time in Australia by adding the following:

a. Eastern Standard Time (EST) by adding 10hrs to UTC.

b. Central Standard Time (CST) by adding 9hrs 30mins to UTC.

c. Western Standard Time (WST) by adding 8 hrs to UTC

Note: deduct if going from UTC to actual time eg 1015hrs in Adelaide is 0045UTC. Remember to allow for daylight saving in those respective States.

Vertical Measurement

Height

7009. Vertical measurement is by 'foot'. It is equivalent to 1/3rd of a metre. It has been retained for altimetry purpose, as it is easier to express the metrics. Aircraft separations are made at 500' and 1000'.

7010. Height is also expressed in 'feet' and is the vertical distance above a given datum eg. a control tower may have an elevation of 35' above the ground (datum) it is built on.

Altitude

7011. Altitude can be expressed in three ways and are always measured in feet.

They are:

a. ALTITUDE: the vertical distance above sea level,

b. PRESSURE ALTITUDE: the altimeter reads the height above whatever Pressure Level is set on the Subscale, and

c. HEIGHT ABOVE QFE LEVEL: QFE stands for *Aerodrome Surface Pressure*, and can be used for circuit operations above a specific aerodrome.

Elevation

7012. Elevation is the vertical distance of and aerodrome above mean sea level, and is measured in feet.

Direction

7013. Three figure group - starts with North as 000 of 360 and proceeds clockwise through East as 090, South as 180 and West as 270.

7014. Runways are expressed as a two figure group eg runway 21, which indicates 210 degrees magnetic. If a runway was in a direction of 055 degrees magnetic, it would be rounded off to runway 06. Be aware the reciprocal would be runway 24.

7015. When a pilot is sitting in the cockpit, the direction in referred to using a clock code. Straight ahead is twelve o'clock while the other directions follow the clock in a clockwise direction eg. if an aircraft was approaching off the right hand wing, it would be at three o'clock.

AVIATION BASIC STAGE
AVB 6 – AIRPORT VISIT.
PERIODS: As Required

6001. Visit a local airport with the view to consolidating AVB, particularly AVB 3, 4, 5 and 6.