Private Pilot Licence

Pre-Licence Ground Component

Privileges and Limitations

1. Operations – Definition of a private operation [CAR 2(7)(D)]
    - the personal transportation of the owner of the aircraft
    - aerial spotting where the pilot, or the owner of the aircraft, receives no remuneration by any person or organisation on whose behalf the spotting is conducted
    - agricultural operations on land owned and occupied by the owner of the aircraft
    - aerial photography where no remuneration is received by the pilot or the owner of the aircraft or by any person or organisation on whose behalf the photography is conducted
    - the carriage of persons or the carriage of goods without a charge for the carriage being made other than the carriage, for the purposes of trade, of goods being the property of the pilot, the owner or the hirer of the aircraft
    - the carriage of persons, but not in accordance with a fixed schedule between terminals, provided that:
        - public notice of the flight has not been given by any form of public advertisement or announcement
        - the number of persons on the flight, including the operating crew, does not exceed 6
        - no payment is made for the services of the operating crew
        - the persons on the flight, including the operating crew, share equally in the costs of the flight
        - no payment is required for a person on the flight other than the cost-sharing payment above
    - the carriage of goods otherwise than for the purpose of trade
    - flight training other than Part 141, Part 142 or balloon
    - any other activity of a kind substantially similar to any of those specified above
2. Flight Reviews [CASR, Volume 2, 61.L.5, 61.800]
    - flight review is required in order to exercise the privileges of the license
    - flight review is valid from 24 months after the month in which the flight test is passed (e.g. passed 20th July 2016, flight review due 31st July 2018)
    - can conduct flight review 3 months before due date if wishing to keep flight review the same date (e.g. flight review due 31st July 2018, can conduct from 1st May 2018 to 31st July 2018)
    - if assessed as not yet competent in flight review before due date then can still act on privileges of licence until expiry date
    - flight reviews can only be conducted by a Grade 1 or 2 flight instructor (CASR, Volume 2, 61.T.1, 61.1175 (6)
3. Recency for passenger flights [CASR 61.395]
    - in order to carry passengers by day or by night as PIC, 3 take offs and landings must have been carried out either as dual or solo in the previous 90 days; Or,
    - in the past 90 days, a relevant flight check/review/test for a licence or rating which included at least 1 take-off and landing, has been successfully completed and passed

4. Type of aircraft that can be flown (Class and Type Ratings) [CASR, Volume 2, 61.T.1, 61.1175(3)]
    - if wanting to fly a new aeroplane (without design features) meeting the licence limitations then a flight with a Flight Instructor (any grade) must be completed to meet the General Competency requirements mentioned in (CASR, Volume 2, 61.E.1, 61.385), which includes:
        - operating the aircraft's nav and operating system
        - conducting all normal, abnormal, and emergency flight procedures for the aircraft
        - applying operating limitations
        - weight and balance requirements
        - applying aircraft performance data, including take-off and landing performance data, for the aircraft
    - examples of ratings for PPL holders:
        - a class rating
        - an aerial application rating
        - an instructor rating (?)
        - an instrument rating
        - a low level rating
        - a night VFR rating
        - a night vision imaging system rating
        - a private instrument rating
        - a multi-engine rating
5. Ratings and endorsements (operations, flight activities and design features)
    - Design features available for aeroplanes are [CASR, Volume 2, 61.L.4, 61.755]
        - tailwheel undercarriage
        - retractable undercarriage
        - manual propeller pitch control (piston engine)
        - gas turbine engine
        - multi-engine centre-line thrust
        - pressurisation system
        - floatplane
        - floating hull
        - ski landing gear
    - Flight activities available for PPL holders+ [CASR, Volume 2, 61.S, 61.1145]
        - aerobatics (manoeuvres above 3000', 1500', 1000', 500', and any height)
        - formation flying (aeroplane)
        - formation aerobatics flying
        - spinning flight activity
    - Operations [CASR Volume 2, 61.H.1, 61.505]. The holder of a PPL is authorised to act as a PIC or co-pilot if:
        - private operation; or
        - the holder is receiving flight training
        - cost sharing <u>evenly</u> among all crew and passengers if total passengers/crew does not exceed 6. If exceeding 6, then PIC must pay for all cost.
6. Maintenance authorisations (Schedule 5 and 8)
    - [CAR 1988, SCHEDULE 5] for Daily Inspection (pre-flight check)
    - [CAR 1988, SCHEDULE 8] for Maintenance that can be carried out by pilot on a Class B aircraft
7. Drug and Alcohol Regulations [CAR 256]

- Alcohol
    - CASA requirements 0.02% BAC (BASAIR requirements 0.00% BAC)
    - 8 hours bottle to throttle
    - can't perform flight duties hung-over, even if BAC is 0.00%
    - body processes 2 standard drink in first hour then 1 standard drink every hour after that
- Drugs
    - care should be taken when taking over-the-counter medication
    - any drugs that state care should be taken when operating heavy machinery or incur drowsiness should (e.g. antihistamines) not be taken without consulting a DAME
    - drugs containing codeine (e.g. Nurofen Plus, Panadeine) can cause drowsiness and therefore must not be used
- Legal and illegal drugs
    - alcohol – depressant
    - cannabis – depressant/ hallucinogen
    - cocaine – stimulant
    - codeine – depressant
    - ecstasy – stimulant/ hallucinogen
    - methamphetamine – stimulant/ hallucinogen
    - opioids - depressant

8. Dangerous good awareness
    - Are items or substance that when transported by aircraft are a risk to health, safety, property or the environment, which include:
        - Explosives
        - Radioactive materials
        - Flammable liquids
        - Dangerous or volatile chemicals
        - Strong acids
        - Compressed gases
        - Poisons and aerosols
    - Permission must be sought and obtained from CASA before these goods may be consigned on, or carried by, an aircraft
9. Controlled airspace procedures
    - Summary of airspace requirements for VFR flights [AIP ENR 1.4 para 4]

	Class A	**Class C**	**Class D**	**Class E**	**Class G**
Airway clearance required?	VFR not permitted	YES	YES	NO	NO
Continuous 2-way VHF radio required?	VFR not permitted	YES	YES	YES	YES – if above 5000', or in a CTAF, or in reduced VMC
Controller provides separation?	VFR not permitted	YES, VFR from IFR	No separation for VFR flights unless 'special VFR'	No separation for VFR flights	No separation for any flights
Services provided by ATC?	VFR not permitted	Provides +ve separation from IFR flights.	ATC service provided. VFR flights get	Radar info service provided on request to VFR	Flight info service and Flight Watch available.

		Traffic info service provided for separation from other VFR flights (and traffic avoidance advice on request).	traffic info only on IFR and VFR flights.	flights.	

- Procedures in civil and military controlled airspace

No aircraft may operate in controlled airspace without a clearance. **START CLEARANCE:** In some controlled aerodromes you must obtain a clearance to start up. This requirement will be found in the ERSA or may be included as part of the ATIS.	*AIP ENR 1.1 para 2.2.1* *ERSA*
TAXI CLEARANCE: In a primary control zone you must obtain a clearance to taxi from your parking position to the runway holding point. A separate clearance is required during the taxi to cross any runway.	*AIP ENR 1.1 para 2.3.3*
TAKE-OFF CLEARANCE: You must not commence a take-off unless you have received and acknowledged a specific clearance to do so.	*AIP ENR 1.1*
LANDING CLEARANCE: You must not land unless you have received and acknowledged a specific clearance to do so.	*AIP ENR 1.1*
AIRWAYS CLEARANCE: You must obtain an airways clearance before you depart or enter controlled airspace. On departure, an airways clearance is normally obtained before take-off. An airways clearance must always be obtained before you enter controlled airspace.	*AIP ENR 1.1 para 2.2.22*
CLEARANCE LIMIT: Sometimes the clearance issued for your entry or departure into controlled airspace may include the words 'clearance limit'. For VFR aircraft this limit will often be an easily recognised feature such as the crossing of a major road or river etc. In this case you may operate in controlled airspace along the track and at the height specified in your clearance but you must not continue beyond the clearance limit until you have received another clearance to proceed.	*AIP ENR 1.1 para 2.2.22.2 (b)*
VISUAL APPROACH: As you approach a controlled airport you will be following the track and height specified in your latest clearance. At some point the requirement to maintain the specified height will be lifted to allow you to manoeuvre to join the circuit for a landing. The controller will use the phrase 'make visual approach'. However when you are cleared for a visual approach you must maintain the last track specified in your clearance until you are within 5nm of the aerodrome. You may then leave that track as required (without further clearance) to manoeuvre for landing.	*AIP ENR 1.1 para 2.11.8.1 & 12.8.4*

Minimum Equipment/ Documents Required for Private Flight

1. Documents that must be carried in flight when operating wholly within Australia territory [CAR 1988, REG139]
    - licence and medical certificate of each crew member
    - aircraft's maintenance release (or an approved alternative)
    - aircraft's flight manual (or an approved alternative)
2. Day VFR equipment [CAO 20.18 Appendix 1]
    - ASI
    - Altimeter: accuracy +/- 100' or +/- 110' for AD above 3300' AMSL elevation (AIP, ENR 1.7)
    - Magnetic compass
    - Accurate timepiece: time in hours, minutes and seconds. May be carried on the pilot. Accuracy of the time must be +/- 30 seconds (AIP, ENR 1.1)
    - Turn and slip indicator: only a slip indicator is required for agricultural aircraft
    - OAT gauge: when operating from an aerodrome at which ambient air temperature is not available from ground based equipment
3. Flight manual minimum equipment list

    ?
4. Placarding unserviceabilities [CAO 20.18.10.1A]
    - Unserviceable instruments or equipments shall be prominently placarded '**Unserviceable**', or removed from the aircraft. Furthermore these should be endorsed in the MR.
    - Where an instrument or piece of equipment performs more than 1 function, it is permissible to placard as unserviceable only the function/s which is unserviceable.
    - The unserviceability is permitted under the provisions of a permissible unserviceability schedule.
5. SARTIME with ATS or responsible person [AIP GEN 3.6-2]
    - Pilot operating away from the departure airfield should nominate a SARTIME. This will alert the appropriate authorities if you fail to cancel your SARTIME on time due to some difficulty or emergency.
    - Three emergency phases triggered by failing to cancel SARTIME:
        - Uncertainty
        - Alert
        - Distress
6. Emergency equipment [CAO 20.11, CAR 252A]
    - Life jackets [CAO 20.11, 5.1 Life jackets]
        - (5.1.1) aircraft shall be equipped with 1 life jacket for each occupant when the aircraft is over water and at a distance from land:
            - In the case of a single engine aircraft – greater than that which would allow the aircraft to reach land with the engine inoperative
        - (5.1.3) a life jacket or individual flotation device shall be stowed at or immediately adjacent to each seat. In addition, sufficient additional life jackets or individual flotation devices shall be carried in easily accessible positions for use by infants or children for whom a life jacket or individual flotation device is not available at or adjacent to their seated position.
        - (5.1.6) lifejacket must:
            - Comply with a standard approved by CASA

        - Be of an inflatable type
        - Except for an infant life jacket – have a whistle fitted in a suitable stowage
    - (5.1.7) where life jackets are required to be carried in accordance with subparagraph 5.1.1 (a) each occupant shall wear a life jacket during flight over water. However occupants of aeroplanes need not wear life jackets during flight above 2000' above the water.
- Life rafts [CAO 20.11, 5.2 Life rafts]
    - (5.2.1) an aircraft that is flown over water at a distance from land greater than the permitted distance must carry, as part of its emergency and lifesaving equipment, sufficient life rafts to provide a place in a life raft for each person on board the aircraft.
    - (5.2.1.1) for the purposes of paragraph 5.2.1, the permitted distance is:
        - (b) in any other case – a distance equal to 30 minutes at normal cruising speed, or 100 miles, whichever is the less.
- ELTs [CAO 20.11, 6.1 Emergency signalling equipment]
    - (6.1) when life rafts are required to be carried, an approved ELT or approved portable ELT is required.
    - (6.2) a single engine aircraft must be fitted with, or carry, at least 1 approved ELT or 1 approved portable ELT if it is:
        - On a flight over water; and
        - Not required to carry a life raft under paragraph 5.2.1 or 5.2.2; and
        - Either:
            i) Not equipped with radio communication equipment; or
            ii) Not capable of continuous air-ground communication.
    - (CAR 1988, REG 252A) when proceeding more than a 50nm radius from the departure aerodrome.

7. GNSS equipment [CAO 20.91]
    - Day VFR - CASA does not prescribe any required equipment standards and both panel-mount and hand-held equipment may be used for day VFR operations. Non-TSO equipment can be used to supplement visual navigation under VFR.
8. Carriage of radios and transponder
    - Radios [AIP, Gen 1.5, 1.1]
        - Radio (VHF) is required for day VFR operation in Classes A, C, D and E, regardless of altitude.
        - In Class G, a radio (VHF) is required for day VFR operation above 5000' AMSL; and
        - (AIP, ENR 1.1) At aerodromes where radio carriage is required (all certified, registered, and military AD. Also at uncertified aerodromes where the operator or CASA specifies a radio is required.
        - In Class G, below 3000' AMSL/or 1000' AGL, when operating in reduced VMC (i.e. visibility less than 5 km, and clear of cloud).
    - Transponders [AIP, Gen 1.5, 6.1]
        - Transponders (Mode A, C, S, SSR) is required for all aircrafts operating within classes A, B, and C airspace, and any class of airspace at or above 10,000' AMSL.
        - Mode A – transmits transponder code (or squawk code)
        - Mode C – transmits transponder code (or squawk code), and altitude of the aircraft

- Mode S – transmits transponder code (or squawk code), altitude of the aircraft, and the aircraft's call sign ID

Requirements for landing areas

1. Guideline for aeroplane landing areas
    - CAAP 92.1
    - Considerations for a suitable aeroplane landing areas
        - Location
            - Does the location and orientation of the strip allow compliance with CAR 157 relating to flight over populous areas?
            - Is the permission of the owner of the property required?
            - What about the proximity of controlled or restricted airspace?
        - Physical properties
            - Is the proposed strip long enough?
            - Is it wide enough?
            - Are there any obstacles on the approach or take-off path which would present danger?
    - According to CAAP 92.1, in order for a field to be considered as suitable, it should be 60 metres wide including a 15 metre strip suitable for the actual ground run of the aeroplane. For aircraft with a maximum take-off weight below 2000kg, a 10 metre strip is considered adequate. The strip length should not be less than that obtained from the aircraft's performance charts.
    - For day operations, an approach and take-off area should extend for 900 metres beyond the strips end with a 5% horizontal splay from the strip edges. The approach and take-off area should be clear of obstacles above a 5% gradient (equiv. 1 in 20).
        - Every obstacle must be at least 20 times its own height away from the end of the strip.
    - Two options if an obstacle within the approach or take-off area has penetrated through the 1 in 20 gradient:
        - Reduce the height of the obstacle until it remains beneath the gradient; or
        - Reduce the runway length used in any take-off or landing performance chart for the purpose of establishing the maximum take-off or landing weight.
2. Checklist in ERSA
    - Pavement strength – known as Aircraft Classification Number/Pavement Classification Number
    - Pavement type – (i) rigid, and (ii) flexible
    - Subgrade strength category – high, medium, low, ultra low
    - Runway slope – difference between the max and the min elevation along the RCL divided by its length, and expressed as a percentage
    - Runway strip – the width from side to side which contains the runway, the graded and ungraded portions of the runway strip, in meters.
        - Graded portion of the RWS is defined by boundary markers and is graded to alleviate damage to an aircraft in the event that it runs off the runway.
        - Ungraded portion of the RWS is free of upstanding objects but may contain depressions, trenches etc.

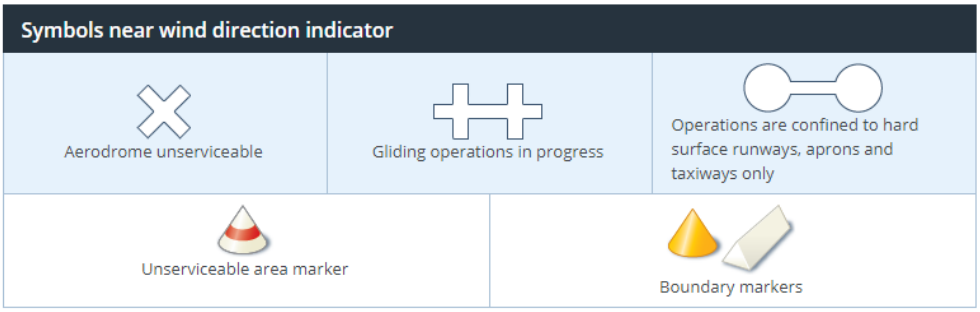
- TORA – length of the runway declared available and suitable for the ground run of an aircraft taking off (in most cases, it is the physical length of the runway pavement).
- TODA – the length of takeoff run available plus the length of any clearway available.
- ASDA – the length of takeoff run available, plus the length of the stopway, if provided.
- LDA – the length of runway declared available and suitable for the ground run of an aircraft landing (in most cases, it is the physical length of the runway pavement).

3. Aerodrome markings
   - Light signals for aircraft [AIP ENR 1.5]

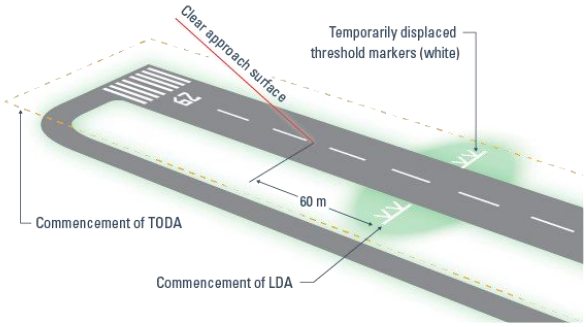
Light signal	Meaning in flight	Meaning on aerodrome
Steady green	Authorised to land if pilot satisfied no collision risk exists.	Authorised to take-off if pilot satisfied no collision risk exists.
Steady red	Give way to other aircraft and continue circling.	Stop.
Green flashes	Return for landing.	Authorised to taxi if pilot satisfied that no collision risk exists.
Red flashes	Aerodrome unsafe – do not land.	Taxi clear of landing area in use.
White flashes	No significance.	Return to starting point on aerodrome.

   - Ground signals to aircraft [AIP, ENR 1.5]

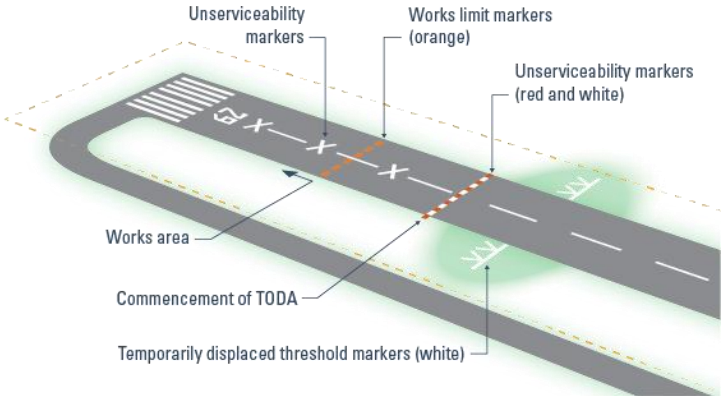
Description	Where displayed	Meaning
Horizontal white dumb-bell	Adjacent to wind direction indicator	Use only hard surface movement areas.
White cross	a) Adjacent to wind direction indicator b) On manoeuvring area	a) Aerodrome completely unserviceable b) An area marked by a cross or crosses with the limit delineated by markers is unfit for use by aircraft
White double cross	Adjacent to wind direction indicator	Glider operations in progress



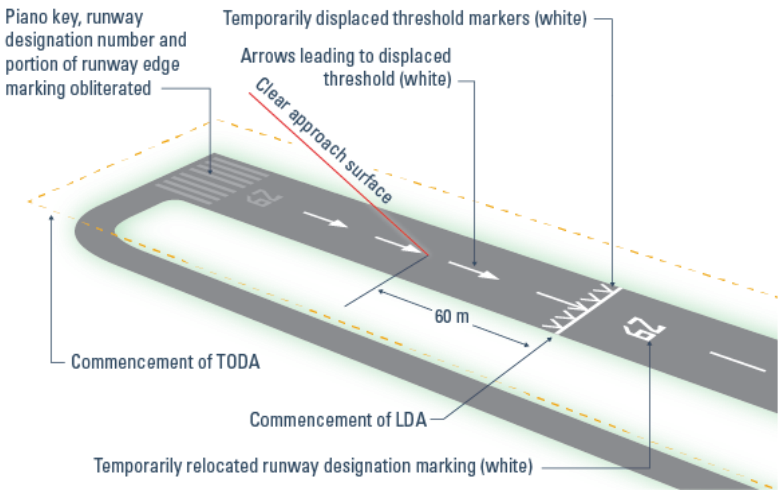
- Displaced threshold [AIP AD]
  - Markings for a temporarily displaced threshold due to **obstacle infringement of approach surface** for a period of **30 days or less**



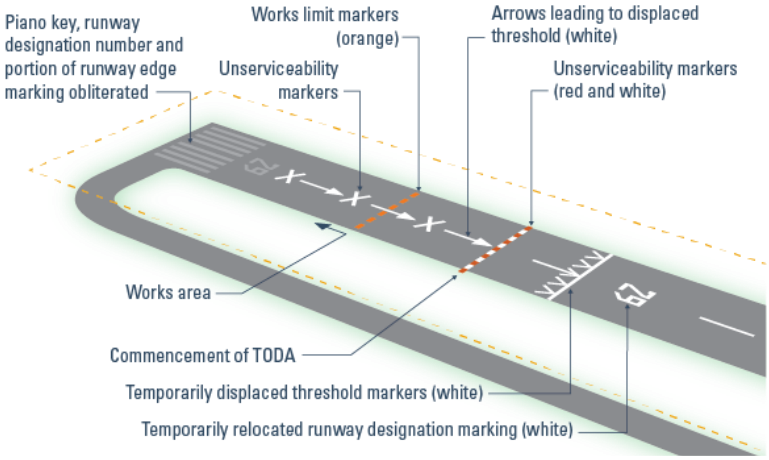
  - Markings for a temporarily displaced threshold due to **works on the runway** for a period of **30 days or less**



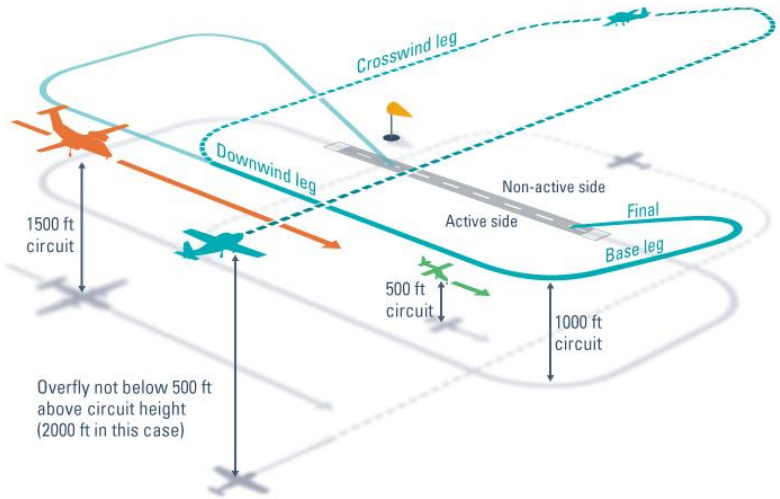
  - Markings for a temporarily displaced threshold due to **obstacle infringement of the approach path** for a period in **excess of 30 days**



- Markings for a temporarily displaced threshold due to **works on the runway** for a period in **excess of 30 days**

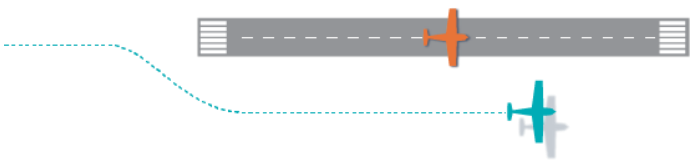


4. Arrival and departure procedures
    - Class G
        - Recommended circuit join



- Pilots departing and arriving at non-controlled aerodromes where the carriage of radio is mandatory are expected to monitor their radios and broadcast their intentions. Pilots should also make additional broadcasts when considered necessary to minimise any risk of collision.
- Where a pilot is unfamiliar with the aerodrome layout, or when its serviceability, wind direction, wind speed, or circuit direction cannot be ascertained prior to arrival, use the overfly procedure. Overfly or circle the aerodrome at least 500 ft above the circuit altitude, which may be 2000 ft or more above the aerodrome elevation (as in the case shown above).
- When you have determined the circuit direction position the aircraft to a point well clear (normally the non-active side of the circuit) before descending to a circuit altitude that equates to the aircraft's performance.
- Do not descend into the active side of the traffic circuit from above because of the difficulty of seeing – and being seen by – aircraft directly below the aircraft's flight path.
    - **Low performance aircraft** – For low-performance ultralight aircraft and rotorcraft with a maximum speed of approximately 55 kt, it is recommended that the aircraft overfly midfield at 500 ft above aerodrome elevation. This will minimise the risk of conflict with higher or faster traffic.
    - **Descent on the non-active side** – When arriving and intending to join the circuit from overhead, descend on the non-active side of the circuit so that the aircraft is established at its circuit altitude as it crosses the runway centreline on crosswind, between midfield and the departure end of the runway
    - **Arrival on the active side** – When arriving on the active side, the recommended method is to arrive at the circuit altitude entering midfield at approximately 45° to the downwind leg, while giving way to aircraft already established in the circuit.
    - **The downwind leg** – On downwind, maintain the applicable circuit altitude until commencement of the base leg turn. The base leg position is normally when the aircraft is approximately 45° from the reciprocal of the final approach path, measured from the runway threshold. Along the base leg, continue to look out and maintain traffic separation.
    - **The final leg** – When on the final leg, confirm that the runway is clear for your landing.
    - **Go around** – A pilot who elects to abort a landing should manoeuvre to keep other traffic in sight, maintain a safe distance from all aircraft and re-join the circuit when it is safe to do so. This may involve manoeuvring to the right, left or maintaining the runway centreline, depending on traffic, the circuit direction and terrain.

Suggested go around manoeuvre



- **Straight-in approaches** – Straight-in approaches are not a recommended standard procedure; however, CAR 166B allows pilots to make straight-in approaches providing they meet certain conditions:
    - pilots who choose to adopt a straight-in approach should only do so when it does not disrupt or conflict with the flow of circuit traffic
    - on a straight-in approach, the pilot must give way to any other aircraft established and flying in the circuit pattern at the aerodrome (pilots on the base leg and before entering the final leg should be vigilant that no traffic is on long final for landing)
    - before making a straight-in approach, pilots must determine the wind direction and speed and the runway in use at the aerodrome. There are several ways to do this:
        - automatic weather station (AWS), aerodrome weather information service (AWIS), automatic aerodrome information service (AAIS), CA/ GRS or UNICOM
        - radio contact with a ground-based radio communication service, company agent, approved observer [CAR 120], or aircraft currently operating at the aerodrome or
        - visual indications if the information cannot be determined by the above means.
    - pilots must assure themselves, by other means, of the aerodrome's serviceability and other hazards which are usually indicated by markings adjacent to the wind indicator
    - on a straight-in approach, the aircraft must be established on final at not less than 3 nm from the landing runway's threshold. Pilots should include their intention to conduct a straight-in approach with their inbound broadcast. Also make a further broadcast of intentions when not less than 3 nm from the runway threshold.
    - Pilots making a straight-in approach should observe the following:
        - do not commence a straight-in approach to a runway when the reciprocal runway is being used by aircraft already established in the circuit
        - only minor corrections to speed and flight path, to maintain a stable approach, should be required within 3 nm on final. The aircraft's transponder should be squawking (transmitting) Mode C or ALT. The aircraft's external lights should be illuminated and remain on until the aircraft has landed and is clear of all runways
        - an aircraft established on the base or final leg for any runway has priority over an aircraft carrying out a straight-in approach.

Managing Cargo and Passengers

1. Smoking on an aircraft
    - A person must not smoke:
        - In a part of an aircraft in which a permanent notice is displayed indicating that smoking is prohibited at all times
        - Anywhere in an aircraft during takeoff, landing or refuelling
2. Seat belts and safety harnesses
    - Each crew member and passenger shall occupy a seat of an approved type:
        - During takeoff and landing
        - During an instrument approach
        - When an aircraft is flying at a height less than 1000 feet AGL
        - In turbulent conditions
    - At least 1 pilot crew member shall wear a seat belt or harness at all times during flight
3. Carriage of passengers in a control seat
    - Passengers may occupy a control seat at which fully or partially functioning dual controls are fitted if the pilot gives adequate instruction to the person to ensure that the controls are not interfered with in-flight, and there is satisfactory communication available at all times between the pilot and that person.
4. Carriage of children and infants
    - The number of passengers carried in an aircraft for which an emergency evacuation demonstration is not required may exceed the number of approved passenger seats fitted in the aircraft only if the excess number of passengers:
        - has been approved by CASA; or
        - does not exceed the number specified in column 2 of the following table opposite the number of passenger seats specified in column 1;
        - and the excess passengers are infants or children:

Column 1 **No. of passenger seats**	**Column 2** **No. of excess passengers**
2-6	1
7-13	2
14-20	3
21-26	4
27-39	5
40-44	6

    - Infant = age < 3 years old
    - Child = age <13 years old
    - Where the combined weight does not exceed 77 kg, 2 children may occupy 1 seat if:
        - Seated side by side; and
        - Restrained by a lap strap only; and
        - The seat belt is adjusted to secure both children at all times when a seat belt is required to be worn

- An infant may be carried in the arms or on the lap of an adult passenger, in a bassinet or in an infant seat in accordance with paragraphs 13.3, 13.4, 13.5 and 13.6 providing the bassinet or infant seat is restrained so as to prevent it from moving under the maximum accelerations to be expected in flight and in an emergency alighting, and precautions are taken to ensure that, at the times seat belts are required to be worn, the infant will not be thrown from the bassinet or infant seat under these accelerations.
- When an infant is carried in the arms or on the lap of a passenger in accordance with subparagraph 13.2 (1) the seat belt, when required to be worn, shall be fastened around the passengers carrying or nursing the infant, but not around the infant.
- When an infant is carried in the arms or on the lap of a passenger in accordance with subparagraph 13.2 (1) on an aircraft engaged in charter or regular public transport operations, the name of the infant shall be bracketed on the passenger list with the name of the person carrying or nursing the infant.
- An infant must not be carried in an exit seat during take-off or landing unless the pilot in command is satisfied that the infant's presence in the seat will not obstruct or hinder the escape of other persons from the aircraft.
- In subparagraph (4), exit seat means a seat that is in a row of seats adjoining an exit

5. Briefing of passengers
    - The operator of an aircraft shall ensure that all passengers are orally briefed before each take-off on:
        - smoking, including the prohibition of smoking in toilets; and
        - the use and adjustment of seat belts; and
        - the location of emergency exits; and
        - the use of oxygen where applicable; and
        - the use of flotation devices where applicable; and
        - stowage of hand luggage; and
        - the presence on board of special survival equipment where applicable
    - Overwater operations
        - Where an aircraft proceeds directly overwater after take-off, the briefing required by paragraph 14.2.1 shall be done before take-off.
        - Where the aircraft does not proceed directly overwater after take-off, no part of the briefing required by paragraph 14.2.1 need be given before take-off, but the complete briefing must be given before the aircraft reaches the overwater part of the flight
6. Cargo on a passenger seat
    - Cargo may be carried on an unoccupied passenger seat. The weight of such cargo shall be evenly distributed over the squab, and shall not exceed 77 kg, except where a seat loading scheme permitting a greater weight is specifically approved by CASA.
    - Cargo carried on a passenger seat shall be restrained in accordance with the requirements of paragraph 3.
7. Cargo in pilot compartment

- Carriage of cargo in pilot compartments is prohibited except that in aircraft having a maximum take-off weight not more than 5 700 kg, cargo may be carried on an unoccupied control seat.
- Cargo carried on a control seat shall not exceed 77 kg in weight unless a seat loading scheme which would permit a greater weight is specifically approved by CASA.
- Cargo shall not be carried on a control seat if the cargo or means of restraint would interfere with the operation of the aircraft.
- When cargo is carried on a control seat, the flight controls relevant to that seat shall be removed where they have been designed for easy removal and the remaining fittings protected so as to prevent interference by the cargo to the operation of the aircraft.

8. Cargo obstructing an emergency exit
    - Cargo shall not be carried in any place where it may damage, obstruct or cause failure of controls, electrical wiring, pipe lines and items of aircraft equipment, essential to the safe operation of the aircraft, unless such items are adequately protected during loading and handling of cargo and during the operation of the aircraft.
    - Cargo may obstruct an emergency exit where sufficient other emergency exits are available for the number of occupants carried in accordance with the tables in Part 105 and any cargo aft of these exits is restrained in accordance with paragraph 3.1.
    - Whenever an emergency exit is obstructed, the emergency exit sign for that exit shall be covered or otherwise made ineffective.

Loading and Unloading Fuel

1. Fuel grades
    - Different types of fuel:
        - 80/90 – mogas (red)
        - 100LL – avgas (blue)
        - 100/130 – avgas (green)
        - 115/145 – military avgas (purple)
        - AVTUR/JETA-1 – jet fuel (straw/yellow/clear)
    - Numbers 100/130 relate to the octane rating of the fuel; with 100 being the lean mixture and 130 being the rich mixture. The numbers relate to the antiknock (detonation resistance) properties of the fuel. Higher the number; the less chance of detonation occurring.
2. Fuelling with passengers on board
    - The operator of an aircraft must ensure that avgas is not loaded onto an aircraft while passengers are on board, or entering or leaving, the aircraft.
3. Safety precautions during fuelling operations
    - Where the fuelling equipment is not mobile, the aircraft shall be so placed that it can be rapidly moved to a place of safety, and a means of ensuring that this can be done shall be readily available.
    - All engines in the aircraft, including any auxiliary power units, must be shut down, except where CASA is satisfied that the operation of such an engine or auxiliary power unit will not present a hazard and where a statement to that effect, together with any special conditions for operation, is included in the operator's operations manual if such a manual is required.

- For fuelling an aircraft, the following requirements apply:
    - before a fuel tank cap is removed, the aircraft and all fuelling equipment must be bonded;
    - if bonding is lost, fuel transfer must be stopped immediately and not resumed until the bond is restored.
        - ***bonded*** means the aircraft and the fuelling equipment have the same electrical potential.
        - ***fuelling*** includes refuelling and defuelling.
        - ***fuelling equipment*** includes mobile fuel tankers, in-ground refuel ports, fuel bowsers, hand pumps, drums, funnels and other loose items of equipment if these are used in the fuelling operation.
    - All footwear worn by aircraft servicing personnel and persons operating fuelling equipment shall be of a non-sparking type and such persons shall not carry any matches, cigarette lighters or other objects which could represent an ignition hazard.
    - Except where automatic shut-off devices limit the capacity of an aircraft fuel tank, the operator and the pilot in command shall ensure that sufficient airspace remains in each fuel tank to allow for anticipated fuel expansion.
    - When a fuelling operation on an aircraft has been completed, the pilot in command and the operator of the aircraft shall ensure that all fuel and oil tank caps are securely refitted.
- The area in which fuelling operations are carried out shall be clearly placarded as a 'No Smoking' area and the limits of this area shall be a sealed building or at least 15 metres (50 ft) from the aircraft or ground fuelling equipment.
- Where mobile fuelling equipment is used, the equipment shall be so placed that it can be rapidly moved in the event of fire.
- A person shall not, and the pilot in command and the operator shall take reasonable steps to ensure that a person does not, during fuelling operations:
    - smoke or use a naked flame within 15 metres (50 ft) of the aircraft and ground fuelling equipment; or
    - except in the case of aircraft, operate an internal combustion engine or any electrical switch, battery, generator, motor or other electrical apparatus within 15 metres (50 ft) of the aircraft's fuel tank filling points or vent outlets, and ground fuelling equipment unless the engine, switch, generator, motor or apparatus complies with the provisions of Appendix I to this Order and has been inspected.
- At least 2 fire extinguishers of approved type and capacity must be positioned:
    - within 15 metres, but not less than 6 metres, from the aircraft and the fuelling equipment; or
    - carried on the fuelling equipment.
- If the fire extinguishers are carried on the fuelling equipment, they must:
    - be fitted with quick release brackets; and
    - be readily available from either side of the equipment; and
    - be located as far as practicable from the vehicle fuel tanks and fuelling points.

- A fuelling operation shall be suspended and the Airport Fire Service notified when any fuel of a quantity likely to create a fire hazard is spilled on or within 15 metres (50 feet) of the aircraft or ground fuelling equipment, including the bilge of a fuelling barge, and the operation shall not recommence until the fire hazard is removed.
- A fuelling operation shall be stopped as soon as it becomes apparent that an infringement exists of any of the relevant requirements of this Order.

4. Refuelling from a drum
    - Fuel should be less than 12 months old from the fuel date on the drum.
    - Ensure fuel is free of contaminants.
    - The drum should be stored on its side to stop water collecting at top of the drum and sinking in. Secure the drum with chalks, by keeping it on a timber rail. The metal bars of the drum should be at the 3 and 9 o'clock positions.
    - Use a trolley to move drums around.
    - Tilt the drum with a stick so a sample of the fuel can be collected from the bottom of the drum where the contaminants settled.
    - Ensure both the fuel and the drum is okay.
        - Drum needs to be in good condition
        - Check the fuel label to ensure the fuel is not too old
        - Check the drum seals to ensure it is sealed and has not been tempered with
        - Take a sample from the low area with a tube, and put the sample into a glass jar
    - Bond aircraft and all fuelling equipments to ensure they have the same electrical potential.
        - Bond drum to earth, then;
        - Bond drum to the aircraft.
    - Pump should be fitted with a filter, check to ensure filter is free of contaminants.
    - Bond nozzle to the aircraft, then remove the fuel cap. Once refuelling is complete, secure the fuel cap and remove the bonding lead.
    - In the event of a fuel spillage, follow:
        - Control – stop the spill
        - Contain – to prevent the spill from contaminating the environment
        - Clean up – use rag or absorbent paper to mop up the spillage
5. Location of aircraft
    - During fuelling operations, the aircraft and ground fuelling equipment shall be so located that no fuel tank filling points or vent outlets lie:
        - within 5 metres (17 ft) of any sealed building; and
        - within 6 metres (20 ft) of other stationary aircraft; and
        - within 15 metres (50 ft) of any exposed public area; and
        - within 9 metres (30 ft) of any unsealed building in the case of aircraft with a maximum take-off weight not exceeding 5 700 kg (12 566 lb).
    - For the purpose of this Order, a sealed building is one which all the external part within 15 metres (50 ft) of an aircraft's fuel tank filling points or vent outlets or ground fuelling equipment is of non-flammable materials and has no openings or all openings are closed.
    - An aircraft engine shall not be started or operated:
        - within 5 metres (17 ft) of any sealed building; or

- within 8 metres (25 ft) of other aircraft; or
- within 15 metres (50 ft) of any exposed public area; or
- within 8 metres (25 ft) of any unsealed building in the case of an aircraft with a maximum take-off weight not exceeding 5 700 kg (12 566 lb)

Planning Requirements

1. Fuel calculation/requirements
    - Fixed fuel reserve – the amount of fuel, expressed as a period of time, for a helicopter conducting an IFR flight, an aeroplane or an airship, required to fly at holding speed at 1,500 feet above aerodrome elevation at ISA conditions, or for a helicopter conducting a VFR flight, required to fly at best-range speed, calculated with the estimated weight on arrival at the destination alternate aerodrome, or the destination aerodrome when no destination alternate aerodrome is required, that would be useable fuel remaining in the fuel tanks until completion of the final landing.
    - Variable fuel reserve – The amount of fuel required to compensate for unforeseen factors. It shall be the highest of the percentage of the planned trip fuel specified in column 4 of Table 1 for the applicable category and class of aircraft or, in the event of in-flight re-planning, the percentage specified in column 4 of Table 1 for the trip fuel from the point of in-flight re-planning, or the fuel required to fly for 5 minutes at holding speed at 1,500 ft above the destination aerodrome elevation in ISA conditions (as applicable). *Variable fuel reserve does not apply to alternate fuel.*
    - Holding fuel – The quantity of fuel that will allow an aircraft to fly for a specified period of time calculated at the holding fuel consumption rate established for the aircraft for the anticipated operational conditions, environmental conditions or ISA.
    - Fuel burn rates:
        - Warrior II & III = 36L
        - Archer II = 39L
    - Fixed reserve [CAAP 234-1] Table next page.
        - small piston day VFR private operations = 30 minutes
        - small piston IFR or NVFR private operations = 45 minutes
    - Variable reserve [CAAP 234-1] Table next page.
        - small piston day VFR private operations = N/A
        - small piston IFR or NVFR private operations = N/A
    - Taxi:
        - Warrior II & III = 5L
        - Archer II = 8L
    - Safe endurance (minutes) = [(useable fuel – taxi – fixed reserve)/fuel burn rate] * 60

4.1.1 The quantities of fixed fuel reserve and variable fuel reserve required for a flight are prescribed in *Civil Aviation (Fuel Requirements) Instrument 2018* and reproduced in Table 1.

Item	Column 1	Column 2	Column 3	Column 4
	Aircraft	Flight Rules	Fixed Fuel Reserve	Variable Fuel Reserve
Other than RPT and charter (e.g. Private, aerial work and flying training)				
1	Small aeroplane (piston or turboprop)	Day VFR	30 minutes	N/A
2	Small aeroplane (piston or turboprop)	IFR or Night VFR	45 minutes	N/A
3	Turbojet & Large Aeroplane (turboprop)	IFR or VFR	30 minutes	5%
4	Large Aeroplane (piston)	IFR or VFR	45 minutes	5%
5	Helicopter	VFR	20 minutes	N/A
6	Helicopter	IFR	30 minutes	N/A
7	Airship	IFR or VFR	30 minutes	N/A
RPT and charter				
8	Piston aeroplane	IFR or VFR	45 minutes	10% (not less than 5 minutes)
9	Turbojet or turboprop aeroplane	IFR or VFR	30 minutes	5% (not less than 5 minutes)
10	Helicopter	VFR	20 minutes	10%
11	Helicopter	IFR	30 minutes	10%
12	Airship	IFR or VFR	30 minutes	N/A

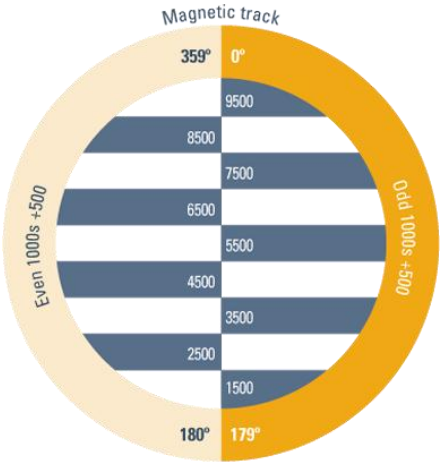
Table 1: Fixed fuel reserve and variable fuel reserve requirements

Note: Variable fuel reserve for RPT and charter operations in aeroplanes is the higher of either:

a) the specified percentage (%) of trip fuel (as time), or

b) an amount of fuel to fly for 5 minutes at holding speed at 1,500 ft above the destination aerodrome elevation in ISA conditions.

2. VFR cruising levels
    - VFR flights must be flown at a cruising level appropriate to its magnetic track according to the diagram below:
        - when cruising level is 5000 ft or higher; or
        - when practicable when cruising level is below 5000 ft (CAR 173).



3. En-route requirements (tracking tolerances, planning tolerances)
    - Navigation of aircraft on VFR flight
        - The pilot in command must navigate the aircraft by visual reference to the ground or water, or by using any of the methods specified in AIP ENR 1.1, except that when operating at or below 2000 ft above the ground or water,

the pilot in command must be able to navigate by visual reference to the ground or water.
    - When navigating by visual reference to the ground or water, the pilot in command must positively fix the aircraft's position by visual reference to features shown on topographical charts at intervals not exceeding 30 minutes. When flying over the sea, visual reference features may include rocks and reefs and fixed man-made objects which are marked on suitable charts and are readily identifiable from the air.
    - When navigating by visual reference in controlled airspace the pilot must notify ATC if the aircraft's track diverges by more than one (1) nautical mile from the track approved by ATC, or, if navigating by reference to radio navigation aids, by more than the tolerances given in AIP ENR 1.1
- VFR flight on top of more than SCT cloud is available provided that:
    - VMC can be maintained during the entire flight, including climb, cruise and descent;
    - For VFR flight on top of more than SCT cloud the pilot must meet, the visual position fixing-requirements or the other navigational requirements of AIP ENR 1.1; and
    - Before flying VFR on top of more than SCT cloud, the pilot in command must ensure that current forecasts and observations (including available in-flight observations) indicate that conditions in the area of, and during the period of, the planned descent below the cloud layer will permit the descent to be conducted in VMC.
- The position at which descent below cloud is planned to occur must be such as to enable continuation of the flight to the destination and, if required, an alternate aerodrome in VMC (see notes).
    - When navigating by reference to radio navigation systems, the pilot in command must obtain positive radio fixes at the intervals and by the methods prescribed in AIP ENR 1.1.
    - The pilot in command of a VFR flight wishing to navigate by means of radio navigation systems or any other means must indicate in the flight notification only those radio navigation aids with which the aircraft is equipped and the pilot is qualified to use under CASR 61.385 (see note 2 below).
- During flight pilots must maintain a time reference accurate to within +/- 30 seconds.
- Pilots must immediately notify ATC for any of the deviations described below when operating in controlled airspace [AIP ENR 1.1, 4.2.4]:
    - Where route or track guidance is provided by a localiser or VOR – half scale deflection or more of the Course Deviation Indicator (CDI);
    - Where route or track guidance is provided by NDB - +/- 5 degrees or more from the specified bearing;
    - Where route or track guidance is provided by DME - +/- 2nm or more from the required arc;
    - When navigating by visual reference to the ground or water – more than 1nm from the cleared track

4. Weight and balance (effect of moving centre of gravity, flight category etc)
    - CG well forward
        - Horizontal stabiliser has a long moment arm, and the aircraft will be very stable longitudinally

- Aircraft will resist any pitching moment
- Forward CG is limited to ensure that the elevator has sufficient pitching moment to overcome the nose-heaviness and greater longitudinal stability, so the aircraft can be rotated for take-off, and be flared for landing at relatively low airspeed.

- CG well aft
  - Tail-heavy and less stable longitudinally
    - Difficult to control
    - Will tend to stall and/or spin more easily (from which it may be more difficult, or even impossible to recover)
  - Aft CG is limited to ensure the aircraft remains sufficiently stable to hold a reasonable steady nose position without excessive and frequent control movements by the pilot
- Aeroplanes may be certificated for aerobatics in either the acrobatic category or the utility category. The main difference between the two categories is the structural strength of the aircraft expressed in terms of the load factors, or 'G loadings', the structure is designed to withstand. The table below shows the minimum structural requirements for each category.

	Normal	**Utility**	**Aerobatic**
Positive	+3.8 G	+4.4 G	+6.0 G
Negative	-1.9 G	-2.2 G	-3.0 G

- Normal VS utility category
  - Normal – all aerobatic manoeuvres including spins prohibited
  - Utility – no aft passengers and baggage allowed
    - Approved for manoeuvres with bank angles over 60 degrees
    - Aerobatic manoeuvres are limited to (@ max manoeuvring speed = 111 kts in P28A):
      - Steep turns
      - Lazy eights
      - Chandelles
    - *Spins prohibited*

5. Performance and landing charts
   - Winds [CAO 20.7.0] – if ambient wind is obtained (from a ATIS/AWIS), it may only be used in P charts if departure occurs within *15 minutes* of receiving the wind.
   - Slope [CAO 20.7.4] – slope should be done for level or worse case scenario (i.e. upslope during takeoff or down slope during landing). If the worse case scenario slope is between 0.1% and 1.0% then it can be taken as level, anything in excess of 1% it must be worst-case scenario.
   - Factoring [CAO 20.7.4] – unless the chart mentions ‘factored by 1.15’, then 15% must be added onto whatever distance is calculated on the P charts.
   - Safety distance factors
     - Take-off: subject to paragraph 6.3, the take-off distance required is the distance to accelerate from a standing start with all engines operating and to achieve take-off safety speed at a height of 50 feet above the take-off surface, multiplied by the following factors:

(a) 1.15 for aeroplanes with maximum take-off weights of 2 000 kg or less;
(b) 1.25 for aeroplanes with maximum take-off weights of 3 500 kg or greater; or
(c) for aeroplanes with maximum take-off weights between 2 000 kg and 3 500 kg, a factor derived by linear interpolation between 1.15 and 1.25 according to the maximum take-off weight of the aeroplane.

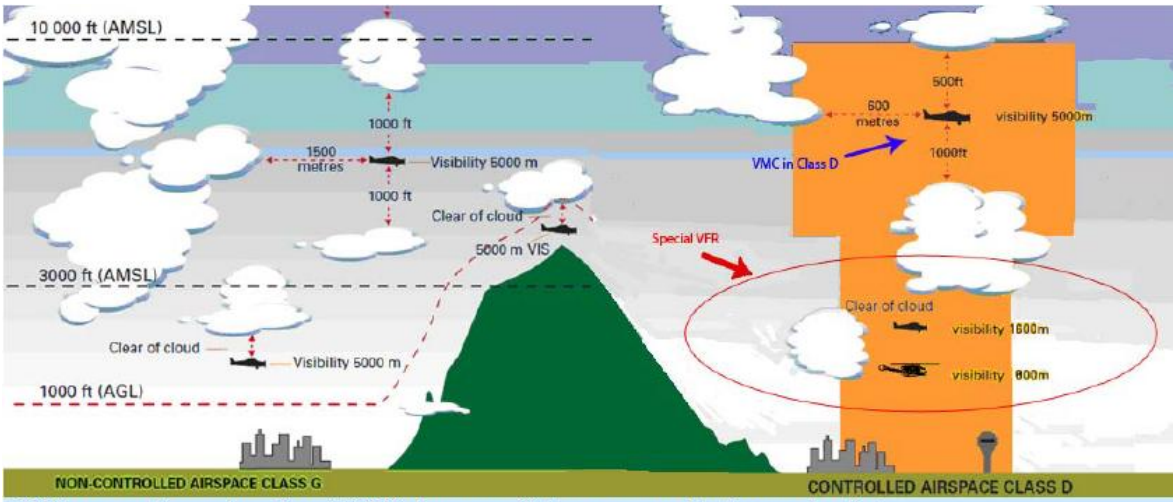
- Landing: subject to paragraphs 10.3 and 10.4, an aeroplane must not land unless the landing distance available is equal to or greater than the distance required to bring the aeroplane to a complete stop or, in the case of aeroplanes operated on water, to a speed of 3 knots, following an approach to land at a speed not less than 1.3VS maintained to within 50 feet of the landing surface. This distance is to be measured from the point where the aeroplane first reaches a height of 50 feet above the landing surface and must be multiplied by the following factors:
  (a) 1.15 for aeroplanes with maximum take-off weights of 2 000 kg or less;
  (b) 1.43 for aeroplanes with maximum take-off weights of 4 500 kg or greater;
  (c) for aeroplanes with maximum take-off weights between 2 000 kg and 4500 kg, a factor derived by linear interpolation between 1.15 and 1.43 according to the maximum take-off weight of the aeroplane.

- Climb gradients
  - In the take-off configuration with landing gear extended, an aeroplane must have the ability to achieve a climb gradient of 6% at take-off safety speed, without ground effect, and with all engines operating at take-off power. [P28A = 365'/min]
  - En-route – Single-engined aeroplanes must have the ability to climb at a gradient of 4.5% at an airspeed *not less than* 1.2VS at all heights up to 5 000 feet in standard atmospheric conditions with the engine operating at maximum continuous power, undercarriage (if retractable) and flaps retracted. [P28A = 273.42'/min]
  - In the landing configuration with all engines operating at take-off power an aeroplane must have the ability to climb at a gradient of 3.2% in standard atmospheric conditions at a speed *not exceeding* 1.3VS. [P28A = 210'/min]

6. Declared density charts (ambient, forecast, declared conditions)
   - Ambient conditions
     - Definition: atmospheric temperature, pressure and wind conditions prevailing at a particular aerodrome during the period of 15 minutes preceding the take-off of the aeroplane.
     - Ambient conditions are normally used for establishing take-off performance data since the pilot is actually present at the aerodrome and can assess the conditions by actual observation.
   - Forecast conditions

    - Definition: atmospheric temperature and pressure conditions forecast for the aerodrome of destination, and its alternate if applicable, by an authorised meteorological officer.
    - Forecast conditions are used to establish landing weight performance data since any landing limitations must be known before take-off.
- Declared conditions
    - Definition: atmospheric temperature, pressure, or density altitude conditions declared by the Director General as acceptable for a particular aerodrome for the purpose of determining weight limitations for take-off or for landing.
    - If no forecast is available, the performance data may be obtained using the declared density altitude for the aerodrome.

7. Requirements for and decoding meteorological reports/forecasts
8. Synoptic charts
9. Alternate/holding requirements
    - Requirements for an alternate are
        - *Except* when operating an aircraft under VFR by day within 50 nm of the point of departure, the pilot in command must provide for a suitable alternate aerodrome when arrival at the destination will be during the currency of, or up to 30 minutes prior to the forecast commencement of, the following weather conditions:
            - Cloud: more than SCT below 1500' AGL
            - Visibility: less than 8 km
            - Wind: crosswind greater than the demonstrated for the aeroplane. Wind gusts must be accounted for. P28A = 17kts
            - PROB 30/40: of anything reducing visibility below alternate minima (e.g. fog, mist, haze etc), or thunderstorms
            - Thunderstorms: any mention of CB or TCU in the TAF will require an alternate
            - No forecast/provisional (PROV) TAF
    - Due to the continuous weather watch provided by TTF, the 30-minute buffers required by the above conditions do not apply. Flights which will be completed within the time of validity of the TTF may be planned wholly with reference to the destination TTF (AIP ENR 1.1).
    - INTER – lasting for periods less than 30 minutes
    - TEMPO – lasting between 30 to 60 minutes
10. VMC requirements



11. Decode a NOTAM
    - NOTAMs provide information that is of direct operational significance and which may immediately affect aircraft operations. It contains information concerning the establishment, condition or chance in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to personnel concerned with flight operations (AIP GEN 2.2).
    - In Australia, three types of NOTAMs are available to pilots (AIP GEN 3.3):
        - Location NOTAMs, accessed by individual location identifier, for example **YBWW** for Brisbane West Wellcamp/li>
        - FIR NOTAMs, which consists of NOTAMs applicable to individual FIRs – Brisbane (YBBB) or Melbourne (YMMM) and
        - Head Office NOTAMs, accessed by the identifier YSHO and shown in the briefing results as Australia Gen (YBBB/YMMM).
    - A NOTAM is issued in a format with the following fields:
        - Location identification
        - Time of commencement of information or time of publication where prior notification is required. This date/time will then reflect the actual commencement time of the NOTAM information
        - Time of cessation of information
        - Times of periods of activity
        - Plain language text
        - Lower limit and
        - Upper limit.
    - In the domestic environment, NOTAM numbering is preceded by the letter **C** followed by the number and year, for example: **C0689/14**.
        - For each location, a separate series of numbers is issued; thus the NOTAM is identified by the location identifier and the number, not by the number alone.
    - In the international environment, Australia issues NOTAMs against a series of registers. These registers are by individual FIRs, multiple FIRs, or Australia General. The individual FIRs and multiple FIRs registers are further subdivided by NOTAM category.

12. Beginning and end of daylight charts
    - Local time

Local time in Australia falls into three separate zones:

EST	UTC + 10 hours	New South Wales (except the Broken Hill area), Queensland, Victoria, Tasmania and the Australian Capital Territory
CST	UTC + 9.5 hours	South Australia, the Northern Territory and the Broken Hill area
WST	UTC + 8 hours	Western Australia

    - Example:

Time of last light AIP GEN 2.7

Worked example

Find the time of last light for a location at (3609005 1444600E) on 20 November.

Solution

Use the **Time of last light April to September** chart (see page 2.27 top) and **Arc to time conversion** table:

1. Using the **Time of last light** chart, enter at 20 November and follow downward until reaching latitude 36° (by interpolation) then straight across to read off **Local Mean Time** (LMT) = 1919.
2. To convert to UTC, using the **Arc to time conversion** table, find longitude 144° = 9h 36m.
3. Add the increment corresponding to 46′ in the right hand column = 3′ 04″ + 0936 = 0939.
4. Subtract the arc to time from the LMT to give the time of last light in UTC: 1919-0939 = 0940 UTC

Location	Echuca
Date	20 November
Lat/Long	S36 09.0 E144 46.0

Systems and Aircraft Limitations

1. Information contained in the flight manual
    - Sections of flight manual
        - General (definitions of V speeds, engine type, aircraft dimensions etc)
        - Limitations (operating limitations, speeds, red line limits on gauge etc)
        - Emergency procedures
        - Normal procedures (checklists, expanded information of checklist at rear of section)
        - Performance (charts for T/O, climb, cruise, descent, landing in order sequenced in flight)
        - Weight and balance (loading charts for aircraft, also contains the equipment list of each item with a weight and arm)
        - Aeroplane and systems description – explains in more detail how the different systems in the aircraft operate and possibly some limitations on the system.
        - Handling, service and maintenance – provides information relative to the pilot for conducting basic maintenance and instruction on what is acceptable or not.
        - Supplements – contains information of various optional equipment not provided with the standard aircraft

2. V speeds
    - Definitions

V speed	Definition	Speed (P28A)
V_{no}	Maximum structural cruising speed for normal operating conditions which may only be exceeded in smooth air and when justified by operational requirements. (green arc changes to the yellow arc)	126 kts
$V_{max\ x/w}$	Maximum demonstrated crosswind component	17 kts
V_a	Design manoeuvre speed. The highest speed at which a full control deflection and therefore increased load factor will not overstress the aircraft. At or below Va the aircraft will stall before the load factor can increase sufficiently to cause permanent damage to the aircraft. Can varies with weight.	111 kts
V_x	Best angle of climb	63 kts
V_y	Best rate of climb	79 kts
V_b	Turbulence penetration speed. Slow enough to avoid overstressing but fast enough to prevent a gust causing a low speed stall.	111 kts
V_s	Stall speed at clean flap configuration	50 kts
V_{FE}	Flaps extended maximum speed, to prevent overstressing the flap structure. (higher end of the white arc)	103 kts
V_{NE}	Never exceed speed. Maximum speed under any circumstances. (red line on ASI)	160 kts

    - V_s/V_{s0} – in aircraft manual are worked out with MTOW, CG forward, straight and level, idle power
3. Engine specifications
    - I = fuel injected
    - O = horizontally opposed cylinders
    - E.g. IO-560-L2C [means fuel injected, horizontally opposed cylinders, cylinder volume of 560 cubic inches]
    - Warrior II: Lycoming, O-320-D2A (or D3G). Four cylinders, 160HP at 2700 rpm, with supercharged engine.
4. Engine operations (normal and abnormal)
5. Flight instruments (power source, operations and failure)
6. Engine instruments (EGT, CHT, oil temp and pressure, ammeter)
7. Electrical system (normal and abnormal operations)
8. Ignition system (magnetos, impulse coupling)
9. Mixture leaning procedures
    a. At altitude, set cruise power.
    b. Lean by reducing the mixture gradually until the engine runs a little rough. You may see a slight increase in rpm before the engine starts to roughen.
    c. Slowly enrich the mixture until the engine smooths out. This is what's known as a "best economy" setting.

d. If you need to climb, enrich the mixture before adding power if at or above 75-percent power, then lean again at your new altitude.