VIGILANT TRAINEE GUIDE

FTP 124

ISSUE 2

Central Gliding School

Produced by the
Central Gliding School
Groundschool Department

AMENDMENT RECORD SHEET

Change No	DATE OF ISSUE	DATE OF AMENDMENT	AMENDED BY	
			NAME	SIGNATURE
1	Jan 14	Change incorporated Jan 14		
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				

CONTENTS

Intentionally Blank

AIRFIELD AWARENESS AND DISCIPLINE

AIM. To familiarize you with basic ground handling procedures and safety awareness.

1. Before you carry out any associated ground duties connected with gliding operations, you will be briefed on the procedures to be used. Your briefing will cover some or all of the following topics:

   a. Aircraft ground handling.

   b. Propeller awareness.

   c. Aircraft parking.

   d. Aircraft handling and parking in strong / gusty wind conditions.

   e. Control of personnel / aircraft operating area hazards.

   f. Movement of personnel by MT vehicle.

   g. GRP awareness.

   h. Care and use of parachutes plus aircraft abandonment.

2. **Ground handling.** All ground handling is to be supervised by an instructor. The Vigilant may be moved backwards by a person pulling on each wing tip. At the same time other people may push on the leading edges of the wings ensuring that they remain outside of the propeller arc. The aircraft may be pulled forward by one person on each wing tip. One person per side may assist by pushing on the marked walkway near the wing roots. If the aircraft has its engine running it is still permissible to assist in moving the aircraft forward. In this case one person pulls on each wing tip but the operation must be directly supervised by the Duty Instructor (DI).

3. **Propeller awareness.** The propeller must always be treated as if the engine is about to start. Aircraft ignition systems are notoriously unpredictable and there have been many cases of aircraft engines starting with no one at the controls. An aircraft propeller can kill or inflict serious injury so you must keep well clear of any aircraft with its engine running. Even when it is not running, you must **NEVER** touch the propeller or enter the propeller arc. Always approach the aircraft from behind the wing to board.

4. **Parking.** Whenever the aircraft is left unattended it is parked facing into wind. The harness is to be used to secure the control column to prevent the controls thrashing about in the wind. The wheel brakes are to be applied, the main wheels are to be chocked, the pressure head is to be covered and the canopies are to be closed and secured. In winds above 25 kt the aircraft will only be left unattended if in the hangar.

5. **Canopy handling.** Your instructor will brief you on opening and closing the canopy and on how to lock it. You should not handle a canopy without specific instructions. A firm hold is required whilst the canopy is unsecured until fully open (held by the gas-strut) or locked firmly down. Do not hold on to or lean on any part of the open canopy whilst entering or leaving the cockpit. The area around the DV panel is particularly vulnerable to damage if ill treated.

6. **Main undercarriage.** Do not tread on the main wheel spats as they are not structural and will be damaged.

7. **General.** Do not stand or walk beside the cockpit/engine area whilst the aircraft is being moved forward as there is considerable risk of injury to the foot from the main wheel running into or over it.

8. **Airfield supervision.** On the airfield all personnel are under the direct supervision and control of the Duty Instructor (DI). He will arrange your training and supervision whilst on the airfield.

9. **Movement of personnel.** Cadets must not walk unescorted on the operating area of the airfield unless specifically authorized to do so by an instructor.

10. **Care of Aircraft.** Glass Reinforced Plastic (GRP) is a modern material well suited to aircraft construction. When handled correctly it is immensely strong, but it is susceptible to damage if treated carelessly, for example by banging with parachute harness buckles or standing or sitting on areas which have not been specifically strengthened. The perspex of the canopies can be easily scratched by rough handling or placing anything on top of the instrument panel. Any damage to the canopy creates a flight safety hazard due to impaired visibility.

INTRODUCTION TO THE AIRCRAFT

AIM. To familiarize you with the Vigilant.

1. **Introduction to the Vigilant.** The Vigilant is a 2 seat, side by side, self launching motor glider, powered by a 4 cylinder 95 HP air cooled engine. During training, GS trainees occupy the left seat. The engine is normally kept running throughout flight and is used in a similar manner to a conventional light aircraft. The Vigilant is of GRP construction throughout with a twin mainwheel undercarriage and steerable tail wheel. The empty weight is approximately 667 kg and the maximum all up weight is 908 kg. The minimum pilot weight for solo flying is 70 kg (although this is reduced to 55 kg when ballast weights are fitted) , the maximum crew weight for either seat is 110 Kg. Full details of these limitations are shown in the Vigilant Flight Reference Cards (FRC). The normal flying speed is 60 kt in level flight and the glide and 55 kt in the climb.

2. Before beginning your flying instruction, you will be shown around the aircraft to familiarize you with the following features:

a. The aircraft's construction and layout, the location of control surfaces, propeller and the permitted handling points.

b. Operation of canopies, including jettisoning in the event of an emergency.

c. Getting into the aircraft, operating the harness and adjusting the rudder pedals, seat position and seat cushions.

d. Weight and balance placard. Use of fixed ballast weights.

e. Operating the flying controls and throttle.

f. The cockpit layout, instruments, electrics and radios.

g. Aircraft performance and permitted speeds.

3. **Parachute.** Before beginning your flying you will be shown a video about wearing and using a parachute. The video will include the emergency abandonment drill. Parachutes are to be treated with care and are never to be placed on the ground or anywhere where they can get wet or contaminated.

4. **Cockpit layout.** The controls and instruments are shown in Fig 1 (overleaf). Some Vigilant cockpits are subtly different to the one shown in Fig 1. Please ask your instructor about any differences.

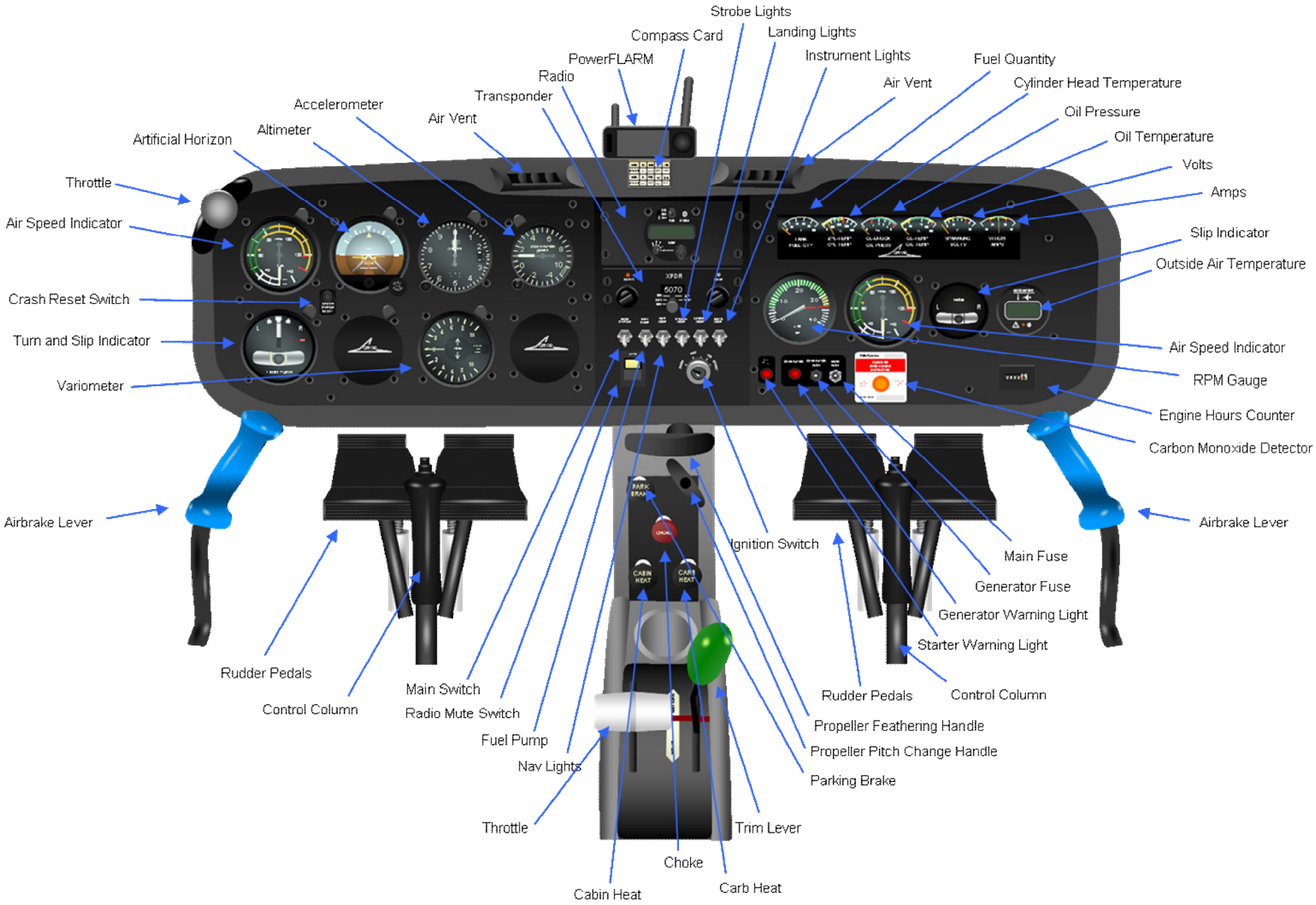


Fig 1. Cockpit Layout Vigilant T Mk 1

THE AIR CADET ORGANISATION GLIDING TRAINING SCHEME

1. **Aim.** To familiarize you with the gliding training available within the Air Cadet Organisation.

2. **Gliding Scholarship (GS).** To be awarded Gliding scholarship blue wings you must complete groundschool and flying exercises 1 to 11 in this study guide. To be awarded GS silver wings you must also complete exercises 13 and 14 and fly one solo circuit, safely culminating in a normal landing.

3. **Advanced Gliding Training (AGT).** To be awarded AGT gold wings you must complete exercises 15 and 16 and fly a further five solo circuits.

INSTRUCTION

4. **Ground instruction.** There will be a classroom presentation at the start of your course covering airfield safety and discipline, introduction to the aircraft, use of the parachute and aircraft abandonment drills. Further ground instruction, relating to the exercises to be flown, will be given prior to the relevant sortie. This study guide will back up that ground instruction and you should read it as necessary during your course. An essential knowledge examination is part of the course and you have to pass this before the award of your wings. This guide contains all the information you will need to pass the examination.

5. **Pre flight briefing.** Before each sortie you will be given a pre-flight briefing which will comprise:

a. **Aim.** This is what you will be expected to achieve during the sortie.

b. **Airmanship.** You will be taught what is meant by airmanship and the airmanship considerations relevant to the planned exercise.

c. **Exercise brief.** This will cover how the exercise is to be taught, highlighting the control inputs and visual cues used to achieve the manoeuvre in question.

d. **Flight brief.** This explains which aspects of the flight your instructor will perform and which will be your responsibility.

e. **Check of understanding.** You may be questioned to test your understanding of the exercise. If you are unsure of any aspect you will have the opportunity to ask questions about it.

6. **Air instruction.** Following the briefing, you will be given practical instruction appropriate to the exercise, by a qualified instructor. The pace of this instruction will be matched to your ability and you will only be expected to perform a new manoeuvre after you have been taught how to do it. A typical instructional sortie will follow the pattern:

a. **Demonstration.** This will show clearly what you will be expected to achieve by the end of the exercise and will explain any terms with which you are not familiar.

b. **Teaching.** When being taught you will follow through on the relevant controls and be clearly shown how to achieve the manoeuvre. You will then be given the opportunity to ask any questions you have about this exercise. Complicated exercises may be broken down and taught in small sections.

c. **Tasking.** You will now be told what you are expected to do to practice this exercise. If you are uncertain about your tasking you will have the opportunity to say so at this stage.

d. **Practice.** You will be given control to fly the aircraft through the exercise you have just been taught. Your instructor will monitor your performance and will not allow you to get into a difficult situation. He will be ready to take back control at any time if necessary. At the end of this practice your instructor will take back control and explain clearly how you have done. At this stage he will either give you further training or practice if required, or move on to the next part of the syllabus.

To repeat, if you are not sure what is expected of you, ask your instructor again until you are sure and confident.

Ex 4 - EFFECTS OF CONTROLS - 1

AIM. To select the datum attitude using co-ordinated controls.

1. You will need an understanding of the following topics:

   a. Airmanship - definition and explanation - use of the clock code.

   b. Hand over/take over of control and follow through/relax procedures.

   c. Axes of an aircraft.

   d. Stability.

   e. Definition of attitude.

   f. Primary effects of elevator - aileron - rudder.

   g. Effects in a banked attitude.

   h. Proportional control response.

   i. Effect of airspeed on control response.

   j. Aileron drag - adverse yaw - co-ordination - balance.

2. **Airmanship - clock code.** Airmanship is the airborne equivalent of road craft and is a skill which develops with experience. It includes awareness of other traffic, remaining within safe gliding range of a suitable landing area, considering the effect of approaching weather, and maintaining a high level of situational awareness. At the start of your training the instructor takes full responsibility for the airmanship but as your training progresses you will be expected to develop a good standard of airmanship for yourself before being allowed to fly solo. This will include judging how to remain within gliding range of the airfield and keeping a good look out for other aircraft. Even on your first flight you provide another useful pair of eyes to see other aircraft and you should report any that you see to your instructor. At some stage you will be taught the use of the clock code to report sightings. This code assumes you are at the centre of a clock and therefore 12 o'clock is directly ahead, 3 o'clock is directly to your right, 6 o'clock directly behind you, and 9 o'clock directly to your left. So to report an aircraft that appears above the horizon and slightly left of directly forward you should say "Aircraft left 11 o'clock high". See Fig 2. If you can estimate the distance that will also be useful.

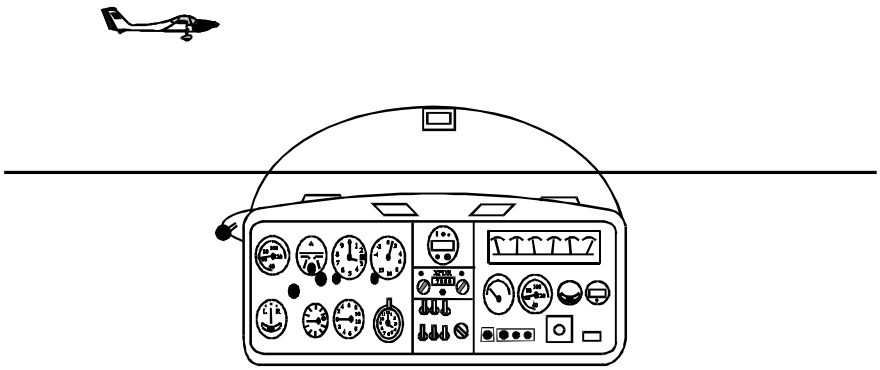


Fig 2. "Aircraft left 11 o'clock high".

3. **Follow through/relax and hand over/take over of control.** Invariably you will have the required manoeuvre demonstrated to you before you are taught how to achieve it. When being taught you will be required to 'follow through' on the relevant controls. When your instructor says **'Follow me through'** you must place your right hand lightly on the control column and feet lightly on the rudder pedals and then say **'Following through, sir'**. Once the teaching phase is completed your instructor will say **'Relax'**. You must release the controls and say **'Relaxed, sir'**. It is perfectly acceptable to leave your feet resting lightly on the rudder pedals when your instructor is flying the aircraft so long as you do not restrict their movement in any way. Once you have been taught a skill and your instructor wants you to practice he will say **'You have control'**. You are to put your hands and feet on the relevant controls and say **'I have control, sir'**. After this practice, or at any time the instructor sees the need, he will join you on the controls and say **'I have control'**. You are to immediately release the controls and reply **'You have control, sir'**. Again, it is perfectly acceptable to leave your feet resting lightly on the rudder pedals. On your first instructional sortie you will practice these procedures.

4. **Attitude.** Your instructor will demonstrate the datum attitude to you and will ask you to note the position of the horizon in relation to the aircraft's canopy. You should memorise what the datum attitude looks like as you will be expected to return the aircraft to this attitude throughout your training. The airspeed of the aircraft in this attitude is 60 kt, with the wings level. Your instructor will demonstrate how stable the aircraft is, showing that a firm but light grip on the controls is all that is necessary. This enhances your ability to feel how the aircraft responds and how it is affected by movements of the air. During your training you will learn to recognise and achieve various attitudes: gliding, level, climbing and banked. See Fig 3.

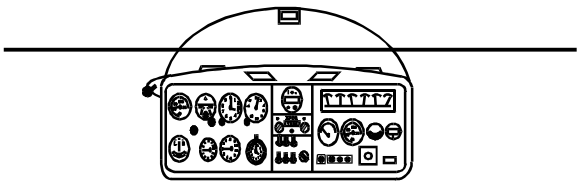


Fig 3a. Normal Level attitude.

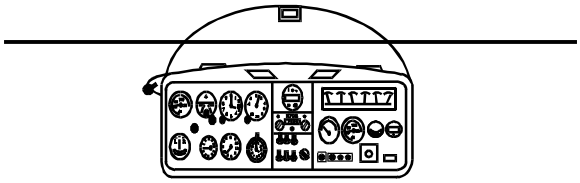


Fig 3b. Normal gliding attitude.

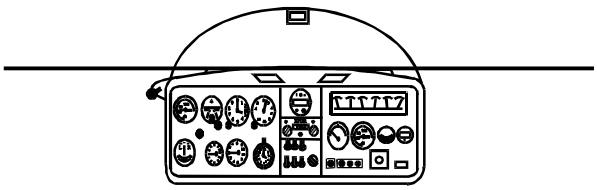


Fig 3c. Normal climbing attitude.

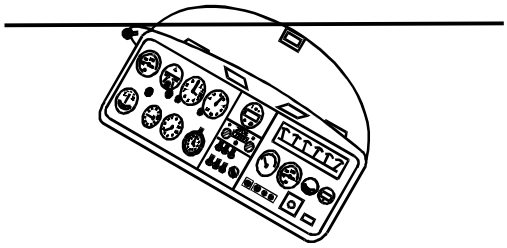


Fig 3d. Banked attitude to the right.

5. **Axes.** The aircraft can move about one or more of its 3 axes. These movements are summarised below and explained in detail in para 6.

MOVEMENT	CONTROL	MOTION	AXIS
Stick forward pitches nose down Stick back pitches nose up	Elevator	Pitching	Lateral
Stick right rolls right Stick left rolls left	Ailerons	Rolling	Longitudinal
Right pedal forward yaws nose to the right Left pedal forward yaws nose to the left	Rudder	Yawing	Normal

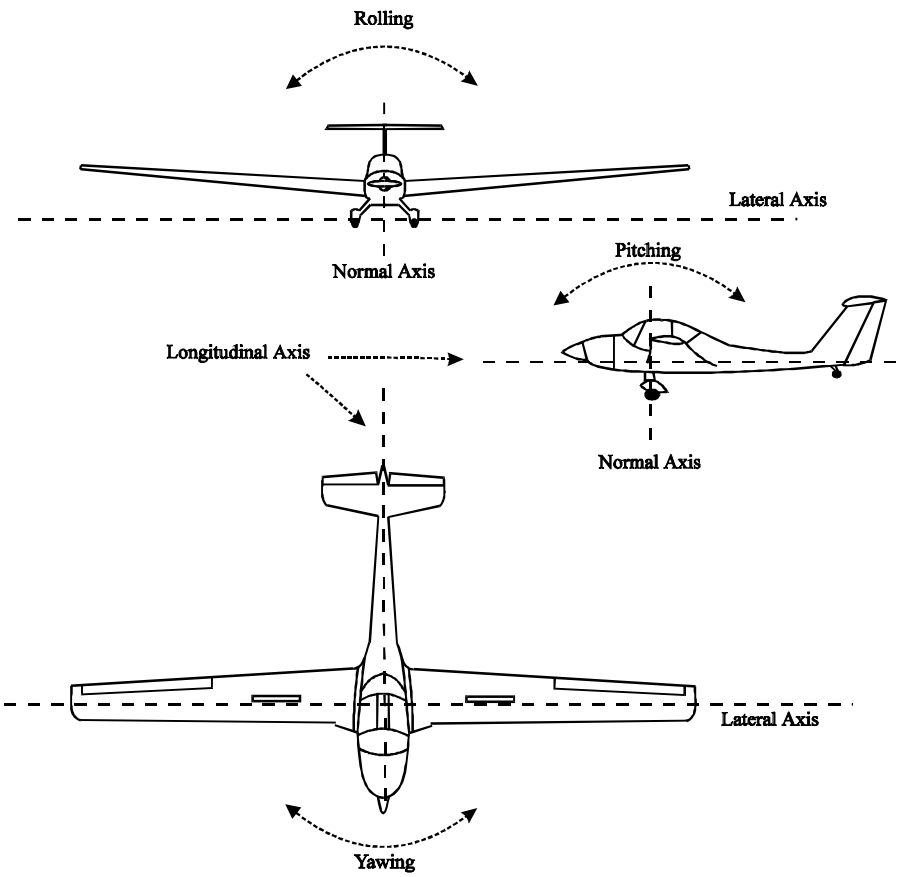


Fig 4. Movement about the three axes.

6. **Primary effects of controls.**

a. **Pitching.** Moving the control column forward pitches the nose of the aircraft down, and moving the control column aft pitches the nose up. The neutral point for the elevator is that position of the control column where no pitch change is taking place. A low nose attitude leads to an increase in airspeed and more airflow noise. A high nose attitude leads to a reduction of airspeed and airflow noise.

b. **Rolling.** Moving the control column to the right causes the aircraft to roll to the right. Moving the control column to the left causes roll to the left. In both cases the roll will continue until the control column is placed in a neutral position.

c. **Yawing.** The aircraft is flying in balance when the slip ball is in the middle. When the right rudder pedal is moved forward the aircraft's nose will yaw to the right, the slip ball will move to the left and the aircraft will be flying out of balance. If the left rudder pedal is moved forward the nose will yaw to the left and the slip ball will move to the right. The aircraft is once again flying out of balance. To return the aircraft to balanced flight in this case, the right pedal would have to be pressed to bring the ball back into the centre.

7. **Primary effects in a banked attitude.** The primary effects of all the controls are relative to the axes of the aircraft. For this demonstration, the aircraft will be placed in a banked attitude and each effect flown. You will then see that regardless of where the horizon appears, the aircraft still pitches, rolls and yaws relative to its own axes.

8. **Proportional response.** The response of the aircraft to all the controls is proportional to the amount of control input. This will be taught using the aileron response as an example. If the control column is moved a small amount, the aircraft will roll only slowly in that direction. If the control column is moved a larger amount, a faster rate of roll will be observed. So a larger, rather than faster, deflection of any of the primary controls produces a quicker response. It follows that all control inputs should be smooth and progressive.

9. **Effect of airspeed on control response.** The Vigilant is normally flown at 60 kt. At lower airspeeds controls feel light and the response is decidedly sluggish whereas at higher airspeeds the controls are more responsive and feel firmer. Your instructor will allow you to note these effects at speeds of 50 kt and 70 kt.

10. **Adverse yaw and co-ordination.** When the control column is moved to one side the down-going aileron produces more lift than the up going aileron and consequently also produces more induced drag. This is known as aileron drag and it causes adverse yaw (yaw in the opposite direction to the roll, see Fig 5a). This effect will be demonstrated to you. You will then be taught how to eliminate adverse yaw by co-ordinating the use of aileron with rudder (Fig 5b). This co-ordination of aileron and rudder is necessary to ensure balanced flight.

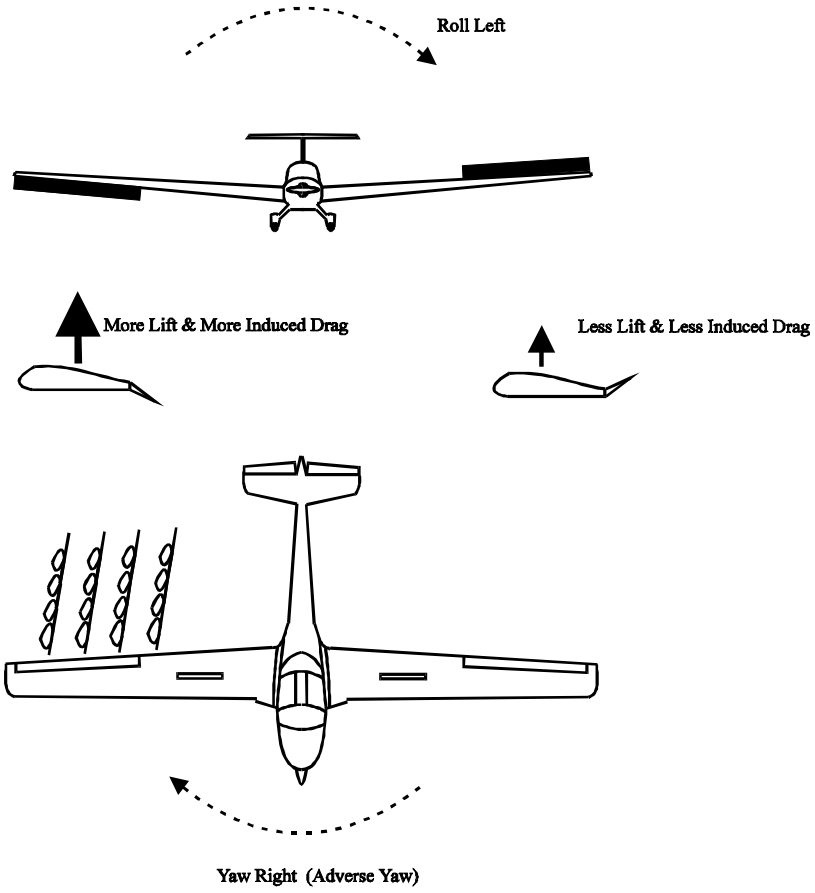


Fig 5a. Aileron drag inducing Adverse Yaw.

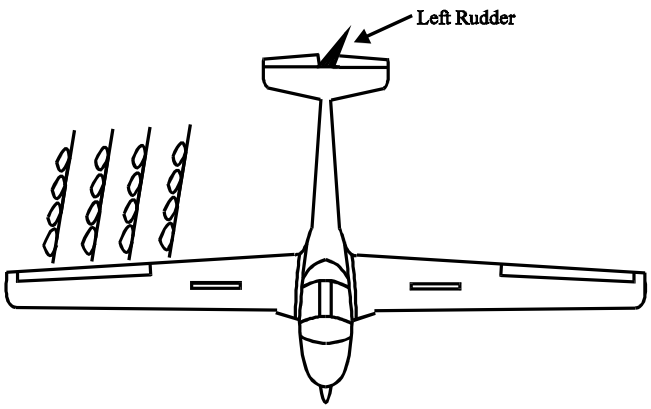


Fig 5b. Rudder overcoming Adverse Yaw

11. **Lookout and use of the visual horizon.** You should use visual judgment to assess changes in attitude and listen to the changes of airflow noise. Basic flying skills rely on the use of all of your senses. Do not depend on the instruments, but use them to confirm the visual cues you can see by looking at the horizon ahead and for making fine adjustments. Note that your view straight ahead is directly over the left hand edge of the loudspeaker grill. See Fig 6.

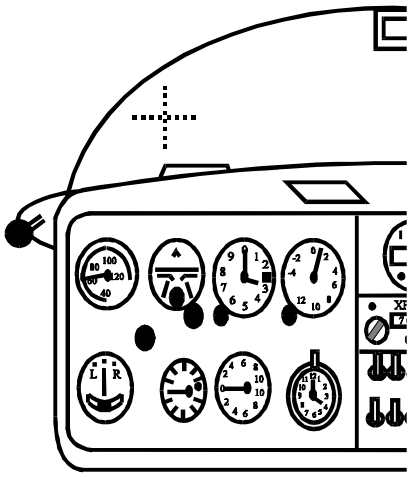


Fig 6. The view straight ahead from the left hand seat.

12. **Selection of the Datum Attitude.** Once you have mastered the co-ordinated use of aileron and rudder, your instructor will teach you how to re-select the datum attitude should the aircraft's attitude change. The datum attitude is normally defined as flying the Vigilant at 60 kt, in balance and with the wings level. Your instructor will demonstrate any minor changes to this as required. The technique is to firstly roll the wings level using co-ordinated aileron and rudder, then secondly, use the elevator to select the correct pitch attitude, finally checking the balance on the slip ball, correcting with rudder if required.

Ex 5 - EFFECTS OF CONTROLS – 2, ENGINE START AND TAXI

AIMs. To start the aircraft and taxi safely.
To select the datum attitude and fly in balance and in trim.
To operate the airbrakes correctly.

Engine Start and Taxi.

1. **Airmanship.** The commander of any aircraft is responsible for its safe operation. The Flight Reference Cards (FRC's) serve to ensure that all vital actions are completed to ensure the safety of the aircraft, its occupants, and any ground personnel. Particular emphasis should be placed on ensuring that personnel and objects are clear of the propeller during the start and taxi. Unlike a car the Vigilant is a very wide vehicle (17.4m wingspan) and a great deal of care and anticipation is required to safely manoeuvre on the ground. However, if in any doubt whilst taxiing it is always possible to stop and seek assistance.

2. **FRC checks.** The initial checks are started as you approach the aircraft and ensure that the aircraft will be safe to start and taxi from its current position. They are also used to confirm that it is safe to start the external checks. The external checks are a systematic walk around, outside of the aircraft, to confirm that it is serviceable. Once these checks are complete it is safe to enter the aircraft and strap in. The next set of checks are the cockpit checks which confirm the position / operation of every switch / control in the aircraft. These are then followed by the starting and after starting checks. Once these have been completed you will be ready to taxi.

3. **Starting and stopping in a straight line.** To set off from parked, it is first important to check that it is clear all around the aircraft. The throttle is then closed (pulled fully rearwards), the control column held fully back, toe brakes applied and the parking brake selected off. After looking ahead, the toe brakes are released and power applied as necessary to start the aircraft moving. More power will be required to achieve this when starting on grass than when starting on a hard surface. Once the aircraft is moving it is necessary to adjust the power to establish and maintain the required speed. To bring the aircraft to a controlled stop, first close the throttle. Then, with the control column fully back, apply the toe brakes to keep the aircraft travelling straight until stopped. Apply the parking brake, then re-select 1500-1700 RPM. Release the toe brakes and confirm that the aircraft does not creep forward.

4. **Taxi checks.** After starting the engine the aircraft is taxied clear of the dispersal and any obstructions. The taxi checks must then be carried out in accordance with the FRC. However, because the aircraft will be in motion, these checks must be done from memory.

   a. Wheel brakes. Check wheel brake operation by taxiing forward and braking to a stop.

   b. Rudder. When clear of dispersal and obstructions confirm that full rudder is available in both directions and that the aircraft steers satisfactorily.

c. During the rudder check also confirm that the turn indicator, compass and artificial horizon are serviceable.

d. Gently apply individual toe brakes to check satisfactory operation.

5. **Taxiing.** The rudder pedals control steering on the ground, the throttle is used to control speed and the wheel brakes are used only sparingly, at low speed, to slow, stop and park the aircraft. The aircraft should be taxied no faster than a brisk walking pace. The differential toe brakes may be used for turning in confined spaces or to assist in steering in a crosswind. Extreme caution must be observed whenever the toe brakes are being used to assist steering, or the application of power against brake may cause the tail of the aircraft to lift with the attendant risk of a propeller strike.

6. **Steering.** Due to the system which connects the rudder pedals to the steerable tail wheel, there is a noticeable lag between pedal movement and the steering effect, so anticipation and observation are vital to successful steering on the ground. Where a taxiway is used, aim along the centre to give optimum wing tip clearance, look well ahead to detect any tendency to wander. When turning the aircraft onto a specific heading the pedals will need to be returned to a neutral position before the heading is achieved, experience will dictate how much anticipation to apply. When the tail wheel steering mechanism exceeds 45° it unlocks with a characteristic noise. This allows a smaller radius of turn, which can be varied with additional use of toe brakes. When using toe-brakes in this manner care must be taken not to lock a wheel as this causes damage to the tyres.

7. **Wind direction.** When taxiing directly into wind the aircraft is very stable due to its weathercock stability and very little corrective rudder pedal action is necessary, the tendency being for the pedals to be practically central. The control column must be held centrally back. When taxiing downwind the aircraft is much less directionally stable and consequently more anticipation is required and the number of pedal inputs to steer straight is generally high, the stronger the tail wind the less stable the aircraft is. Also, the speed is likely to increase so great care is required. During cross wind taxiing the aircraft will tend to weathercock into wind and so the pedals are likely to require biasing toward the down wind side (e.g. cross wind from the left will require some right pedal to keep straight) in a strong cross wind it will sometimes be necessary to use differential braking to assist the steering action. When turning from cross wind into wind the turn will tend to tighten so more anticipation is required to stop the turn, whereas a turn downwind will tend to widen so more space will be needed. There is also a tendency for the aircraft to increase its speed over the ground as it turns down wind.

Effects of controls - 2.

8. For the airborne part of this exercise you will need an understanding of the following topics:

a. Further effects of aileron and rudder.
b. Use of trimmer.
c. Use of airbrakes.

9. **Airmanship.** During this part of the exercise you will be expected to assist your instructor in looking out for other aircraft. You will also be shown that it is important to re-trim the aircraft every time you select a new attitude. This will reduce the likelihood of the attitude changing should you become distracted.

10. **Further effects of rudder and aileron.** The elevator has only one effect, its primary effect (Pitch). Both the rudder and aileron have a primary effect and further effects. These are:

a. **Rudder.** With the elevator and ailerons held neutral continued application of rudder will produce:

(1) Yaw (primary effect), then:

(2) Roll, in the same direction as the yaw (further effect). The roll is induced by the advancing wing producing more lift.

(3) Continued roll and yaw in the same direction leads to a spiral descent.

You will then be reminded how to recover to the datum attitude.

b. **Aileron.** With the rudder and elevator held neutral continued application of ailerons will produce:

(1) Roll, (primary effect), then:

(2) Yaw in the direction of the roll. The yaw is caused because, when the aircraft is rolled, it goes out of balance and begins to slip toward the lower wing. The airflow meets the side of the aircraft and causes it to "weathercock" in the same direction as roll.

(3) Continued roll and yaw in the same direction leads to a spiral descent.

You will then practice the recovery to the datum attitude.

11. **Use of the trimmer.** The Vigilant only has elevator trimming so the following relates only to this. If a forward or rearward pressure is required to maintain the desired attitude the aircraft is “out of trim”. The aircraft is said to be “in trim” when it maintains a selected attitude without the need to hold any fore or aft pressure on the control column. The trim control is the small green lever on the central console, forward of the fuel cock. It works in the same sense as the control column. If a forward pressure is required on the control column to maintain the required attitude, then the trim lever must be moved forward until this forward pressure is removed, and vice versa. The aircraft needs to be re-trimmed after every change of pitch attitude and you will be taught how to do this using the sequence:

a. Select the new attitude.

b. Hold the new attitude.

c. Move the trimmer until there is no force on the control column (coarse trimming).

d. Check for accuracy, by relaxing on the control column and watching the attitude. If it changes, reselect the correct attitude, hold it and re-trim (fine trimming).

12. **Use of airbrakes.** The blue lever on the left side of the cockpit is moved rearwards to open the airbrakes. When operated, the airbrakes reduce the total lift generated by the wing and increase the drag. An increased rate of descent can therefore be maintained without increasing the airspeed. When landing, this allows the approach to be adjusted to land the aircraft in a chosen area. You will be taught the following points:

a. Rearward pressure on the airbrake lever first overcomes the strong, over-centre lock. Further rearward movement opens the airbrakes.

b. At approach speed the airbrakes tend to be sucked open after being unlocked so a firm hold is required on the lever. At reduced airspeed, e.g. as the aircraft slows down before landing, the airbrakes tend to close under their own weight, so positive control is also needed at this stage.

c. As the airbrakes are opened there is a nose down pitch change and co-ordination with the elevator will be necessary to maintain the required attitude.

d. The further you open the airbrakes the greater the rate of descent, although the greatest rate of change in effectiveness is over the first half of the airbrake travel.

e. As the brake lever is moved forward again the rate of descent decreases, there is a nose up pitch tendency, which must be controlled with the elevator. To lock the airbrakes closed requires a firm push on the lever.

f. As the airbrakes are opened and the drag increases, a slightly lower nose attitude is needed to ensure that the correct airspeed is maintained. Similarly, as the airbrakes are closed and the drag from them is reduced, maintaining the correct airspeed will require a slightly higher nose attitude.

You will have the opportunity to practice all this, in stages, as your instructor demonstrates and then teaches the subject.

Ex 6 - STRAIGHT & LEVEL FLIGHT, CLIMBING & GLIDING

AIMS a. To achieve and maintain straight and level flight, in balance and in trim.
b. To fly the climb and the glide.
c. To transition between straight and level flight, the climb and the glide.

1. **Airmanship.** During this phase of your training you will be taught a systematic scan which allows you to fly the aircraft safely and accurately, whilst maintaining good situational awareness. The scan comprises **L**ookout - **A**ttitude - **I**nstruments (**LAI)**. The lookout scan must cover the whole field of view in a regular, organised way. The recommended pattern is to start the lookout scan from straight ahead. Scan in stages, moving the eyes around the horizon to one side in a series of steps, scanning above and below the horizon at each point. It is essential to briefly pause movement of the eyes in order to focus into the distance, this makes it easier to spot moving objects such as other aircraft. Scan at least as far around as the wingtip, then lookout over the top (moving the head to see around the canopy frame) and then back to the front. Confirm the correct attitude is being maintained, if not adjust it as necessary. Check that the airspeed is correct and the aircraft is in balanced flight at a safe height. Repeat the lookout to the opposite side, re-check attitude and instruments and then restart the work cycle again. The work cycle is therefore:

LOOKOUT - ATTITUDE - INSTRUMENTS

You should report any aircraft that you see to your instructor, using the clock code described in exercise 4, paragraph 2.

2. **Straight and level, balanced flight.** You will first be shown how to recognise straight and level, balanced flight. This is done by checking:

a. **Straight**
- Wings level.
- Constant heading.

b. **Level**
- Correct attitude.
- 60kt.
- Constant height.
- 2300rpm

c. **Balance**

You will then be taught how to achieve straight and level flight from a descending, banked attitude. This is accomplished by using SHT as taught in the previous lesson. Select the attitude using roll then pitch, select 2300rpm, hold the attitude before checking attitude, speed and rpm, finally trim the aircraft. Next you will be taught to maintain this condition and incorporate an organised scan using the **LAI** work cycle. This will ensure a good all round lookout, monitoring of the aircraft attitude and instruments and highlight any corrections necessary to continue in straight and level flight. After this you will be taught how to regain straight and level flight towards a specific heading reference. Finally you will be taught how to maintain a datum height.

3. **The Exercise.** The teaching points for this exercise are as follows:

a. **Achieving straight and level flight.**

(1) Select the straight and level attitude - using co-ordinated controls to roll wings level, then pitch to the correct attitude and rudder to achieve balanced flight.

(2) Set 2300RPM.

(3) Hold the attitude - check speed, adjust attitude if required.

(4) Trim as required.

(5) Adjust RPM as necessary.

b. **Maintaining straight and level flight.**

(1) Look out for other aircraft, scanning above and below the horizon to one side. Look behind the wing and then above the aircraft.

(2) Attitude. Confirm wings level, pitch attitude correct, heading constant. Correct as necessary.

(3) Instruments. Confirm airspeed correct (60 kt), rpm correct (approx 2,300) and aircraft in balanced flight. Correct as necessary.

(4) Carry out the same look out for other aircraft to opposite side.

(5) Check attitude and instruments as above.

(6) Repeat process.

This scan is a continuous work cycle and it will apply throughout all your flying. When correcting airspeed errors it is important to look ahead and make an appropriate correction to the attitude. Due to the aircraft's inertia there will be a small delay before the effect of the attitude change is registered on the ASI.

c. **Regaining a heading reference.** Once you have mastered the basic work cycle described above, you will be taught to use a reference point to ensure you can make the aircraft fly straight on a particular heading. If during the scan (**LAI**) you notice you are no longer heading toward your selected reference point the following procedure is used:

(1) Apply a small amount of bank towards your heading reference using co-ordinated controls.

(2) Roll the wings level when the heading reference is regained.

(3) Continue with the standard scan work cycle (**LAI**).

d. **Maintaining Datum Height (DH).** You will also be taught how to maintain a datum height.

(1) **Gaining.** If tending to gain height (more than 100 ft), check you have the correct attitude, speed and RPM set, open airbrakes, maintaining 60 kt, use anticipation to close airbrakes just before regaining DH.

(2) **Losing.** If tending to lose height (more than 100 ft), check you have the correct attitude, speed and RPM set, increase engine RPM, maintaining 60 kt, use anticipation to reduce RPM to 2300 20 ft (1 notch on altimeter) below DH.

4. **Transitions.** Whenever a transition is made between approach, level or climb there is a set order in which the actions must be taken. If a change is to be made where power is to be reduced (i.e. climb to level or level to approach) then the order of actions is **A**ttitude, **P**ower, **T**rim (**APT**). Where the change involves an increase in power (i.e. level to climb) the order is **P**ower, **A**ttitude, **T**rim (**PAT**). In practise these are not really separate actions, but are coordinated. In the **PAT** situation the application of more power should slightly lead the rearward movement of the control column.

a. **Transition from level to climb (PAT).**

(1) Look out – especially in front, above and behind.

(2) Carb-heat – In (Cold).

(3) **POWER** - Apply full power smoothly.

(4) **ATTITUDE** – Simultaneously select climb attitude (55 kt).

(5) **TRIM** as required.

(6) Resume normal scan (LAI) but bias the lookout above and behind and check the engine instruments to ensure they stay in limits.

b. **Transition from climb to straight and level at a datum height (APT).**

(1) Look out - especially ahead and below.

(2) Select Carb Heat – Hot 100ft before the datum height.

(3) **ATTITUDE** - Select attitude for level flight (60 kt).

(4) **POWER** - Once 60 kt is achieved reduce power to about 2300 RPM (actual RPM varies from aircraft to aircraft).

(5) **TRIM** as required.

(6) Commence normal scan (LAI).

c. **Transition from level to approach (APT).**

(1) Look out - especially below.

(2) **ATTITUDE** - Select approach attitude (65 or 70 kt).

(3) **POWER** – Set idle power once the approach speed is achieved.

(4) **TRIM** as required.

(5) Resume normal scan (LAI) but bias your lookout below.

Note: With increasing power there will be a slight tendency to yaw to the right. This can be corrected with left rudder.

Ex 7 - TAKE OFF AND CLIMB

AIM. To take off and enter the climb.

1. **Airmanship.** The take off checks are to be completed using the FRCs, the windsock checked to confirm wind speed and direction and the position of other aircraft in the circuit are to be noted before any attempt is made to line the aircraft up for take off.

2. The take off can then be broken down into the following parts:

a. **Lining up.**

(1) Check the windsock (No tailwind. Note any crosswind).

(2) Check that the final turn, approach and take-off run are completely clear.

(3) Taxi to line up on the centre line, select a heading reference at or beyond the upwind end of the runway. Continue to move forward to ensure the tail wheel is straight (2 - 3 m).

(4) Place the control column just aft of the neutral position, (in line with the canopy locking levers) and ensure that the rudder pedals are neutral.

(5) Check carb heat IN, heels are on the floor, toes clear of brakes.

b. **Ground roll.**

(1) Smoothly open the throttle to full, taking 2 to 3 seconds keeping straight with rudder.

(2) Check achieving at least 2550 RPM and oil pressure 3 bars minimum.

(3) Continue to steer straight with the rudder and keep the wings level with aileron. Coarse movements of the controls may be required initially, but as speed increases progressively smaller inputs will be needed.

(4) Confirm the ASI is indicating an increasing airspeed.

c. **Lifting off.** The aircraft will get airborne all three wheels together.

(1) Once clear of the ground slightly release the back pressure to select the initial climb attitude, with the far end of the runway in view, to allow the airspeed to increase. Use co-ordinated control movements.

(2) As the airspeed approaches 55 kt select the normal climb attitude.

d. **Normal climb.**

(1) Confirm the airspeed is 55 kt and trim as necessary.

(2) Select a heading reference to maintain the climb on the extended runway centre line. Commence the normal scan (LAI).

Intentionally Blank

Ex 8 - MEDIUM TURNS

AIM. To turn onto specific features using up to 30º of bank.

1. **Airmanship.** Before executing any turning manoeuvre it is vital to look out all around to ensure the area is clear. During a turn the LAI work cycle is used but the lookout is slightly different to ensure the area where you are turning is clear. When exiting a turn it is important to look out in the direction of the previously raised wing as this blocks your view in that direction when banked. Maintaining a situational awareness during turns uses the scan as described, both to avoid conflict with other aircraft and to maintain orientation with respect to the base airfield and known landmarks.

2. You will be shown a medium turn so that you can recognise the attitude required. In the early stages of this lesson you will be taught the entry, maintenance and exit of turns separately.

3. The aircraft has an increasing tendency to pitch nose-down as bank is increased so a slight rearward pressure on the control column will be necessary to maintain the correct pitch attitude whilst turning.

a. **Maintaining the turn.**

(1) Look as far into the turn as practical, then along the horizon to the front.

(2) Check the Attitude. Use co-ordinated aileron, rudder and elevator to maintain the correct angle of bank and pitch attitude for 60 kt.

(3) Scan the instruments. Make fine adjustments of attitude if the speed is incorrect or rudder if the aircraft is not in balance.

The work cycle is therefore **L**ookout, **A**ttitude, **I**nstruments **(LAI)**.

b. **Entering the turn.**

(1) Start the lookout scan from the wingtip in the direction of the intended turn, all the way along the horizon to the opposite wingtip, up over the top of the aircraft with a last look in the direction of the intended turn. Then look ahead at the visual attitude and start the roll in.

(2) Use co-ordinated controls to achieve the medium turn attitude (20º ideally, up to 30° angle of bank). A small amount of back pressure may be required on the control column to prevent the nose from pitching down.

c. **Exiting the turn.**

(1) Use co-ordinated controls to return to the straight and level attitude.

(2) Once you have selected the straight and level attitude, lookout in the direction of the downgoing wing.

(3) Resume the normal scan for straight and level flight.

4. **Turning in the opposite direction.** In a side by side training aircraft such as the Vigilant, the view ahead is noticeably different when turning left compared to turning right, however in both instances the distance of the horizon above the speaker box will be similar. (See Fig 7). You will be taught to recognise and achieve a medium turn in both directions.

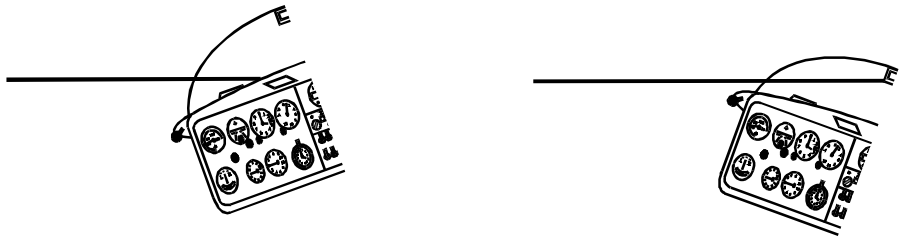


Fig 7. Turning attitudes - Left and Right.

5. **Rolling out onto a feature.** This exercise requires anticipation because the aircraft continues turning, although at a reducing rate, until the wings are level.

a. Approximately 10-15° before the selected heading is achieved look ahead. (See Fig 8).

b. Using co-ordinated controls achieve the appropriate straight flight attitude.

c. If a slight error exists, use the regaining a heading reference technique which you learnt in exercise 6.

d. Continue the normal scan.

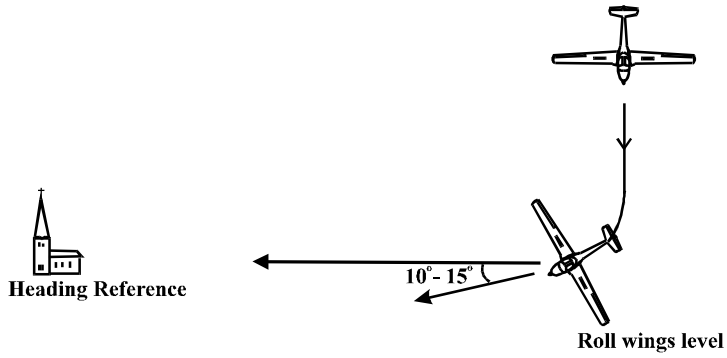


Fig 8. **Rolling out onto a feature.**

6. **Turning in the glide.** You will be taught to recognise and achieve the different attitude whilst turning in the glide. Due to the reduction in slipstream over the tail area, the aircraft is less directionally stable during the glide, and the rudder less effective. As a consequence of this you may notice the need for slightly more rudder to co-ordinate

whilst rolling into or out of a banked attitude. The lookout is biased below the aircraft. Otherwise the same technique is applied as for a level turn onto a feature.

7. **Turning in the climb.** You will be taught to recognise and achieve the different attitude whilst turning in the climb. Due to the increase in slipstream over the tail area, the aircraft is more directionally stable under full power. The rudder will feel heavier, but will be more effective. As a consequence of this you may notice the need for slightly less rudder to co-ordinate whilst rolling into or out of a banked attitude. Because increasing angles of bank reduce the rate of climb, you will be required to limit the angle of bank to 15° whilst turning in the climb. The lookout is biased above the aircraft. Otherwise, the same technique is applied as for a level turn onto a feature.

8. **Recovery from an overbanked turn.** If the angle of bank exceeds 45°, there is a tendency for the nose to drop and the airspeed therefore increases, trying to reduce speed using the elevator is ineffective and results in the 'G' loading on the aircraft increasing. The correct recovery action is to :

a. Reduce the bank using co-ordinated aileron and rudder.

b. Adopt the correct pitch attitude using the elevator.

c. Continue with the turn using LAI.

You will be given the opportunity to practice this recovery once your instructor has taught it.

9. **Demonstration stall.** At the end of the turning exercise your instructor will demonstrate a stall to you. This is to show you that the stall is in no way unpleasant and the aircraft recovers quickly.

Intentionally Blank

Ex 9 - APPROACH AND LANDING

AIM. To fly the approach and land the aircraft.

1. **Airmanship.** A good lookout is especially important in the circuit, where the concentration of traffic is bound to be highest. The approach and the landing area must be checked whilst on the downwind leg. Note the wind speed and direction from the windsock and mentally confirm the approach speed appropriate for the conditions. Remember that in the circuit, the lower aircraft has right of way but must not cut in front of another aircraft already established on the approach. So a glance downwind should be made, to confirm that there is no other aircraft on long final.

2. **The approach and landing.** The approach and landing can be split up into four manageable parts, the approach, the round out, the hold off and the ground run (as shown in Fig 8).

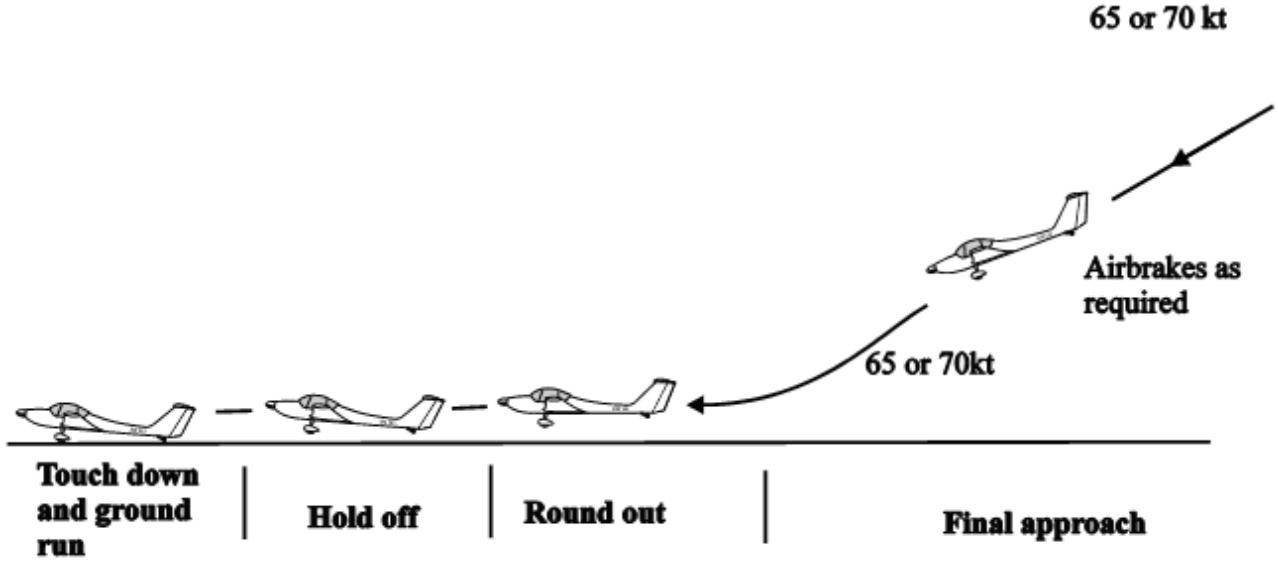


Fig 9. **Approach and Landing.**

3. **Final approach.** Glider approaches are always made with a reserve of height and the approach is steepened by means of the airbrakes. To allow for adjustment in each direction, approaches are always planned to use about half airbrake. The airbrakes also make the aircraft more controllable close to the ground in that there is less tendency for the aircraft to balloon upwards as the nose is pitched up before landing. They also reduce the length of the ground run after landing. To recognise the normal approach we use 5 **A**s.

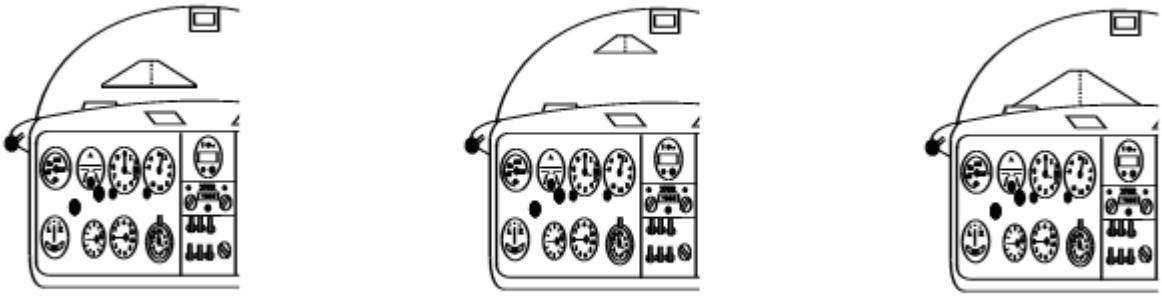
a. **Appearance of the normal approach.** As per Fig 9a. Because we increase speed on the approach, we will be flying in the approach attitude as you learnt in exercise 6.

b. **Airspeed.** We check this is correct (65 - 70kt depending on wind strength) and remaining constant.

c. **Aiming point.** Make sure it is in the correct position in the canopy (as per the start of the runway in Fig 9a) and remaining steady.

d. **Alignment.** Ensure the aircraft is tracking down the intended landing run.

e. **Airbrakes.** Adjust as necessary to maintain the aiming point in the correct position.



a	b	c
Good approach.	Correct airspeed, but undershooting	Correct airspeed but overshooting

Fig 10. **The Aiming point.**

4. **Aiming point.** You will be taught to recognise and use an aiming point (see Fig 9) to control your approach path. In Fig 9a the aiming point is correct, so providing the airspeed is correct, the approach is good. At 9b the aiming point has risen in the canopy showing that the aircraft is undershooting. This may be because you have too much airbrake, the aircraft could be in sinking air, or the nose may be pitched too far down. To recover, ensure the attitude and airspeed are correct, reduce the airbrake setting until the aiming point is in the correct position then use airbrake as required to maintain the correct approach path. In 9c the aiming point is lower than normal in the canopy so the aircraft is overshooting. This may be caused by too little airbrake, the aircraft could be in an area of rising air, or the nose may be pitched too high. To recover, ensure the attitude and airspeed are correct, increase the airbrake setting until the aiming point is in the correct position then use airbrake as required to maintain the correct approach path.

5. **The Approach Workcycle.** As we exit the final turn we have to put the carb heat in (cold) and check our feet are clear of the toe brakes. We then wait for an overshoot to develop, when this happens we open the airbrakes to about ½ and then maintain the approach using the workcycle; the four **A**s:

- **A**ttitude – control with pitch
- **A**irspeed – control with pitch attitude
- **A**iming Point – control with airbrake
- **A**lignment with landing area – control with aileron (bank)

6. **The landing.** Essentially, the landing can be broken down into four parts, the round out, hold off, the touch down and ground run. See Fig 8.

a. **Round out.** This is the change of attitude from the approach attitude to one of flying level just above the ground, your instructor will teach you how to recognise when to do this.

b. **Hold off.** This is a period where the aircraft is losing airspeed because it is gliding level just above the ground. If the attitude remained the same then the aircraft would sink toward the ground as the reduction in speed caused a reduction in lift. To prevent the aircraft touching down early we increase the angle of attack of the wings by applying a back pressure on the control column. This progressively pitches the nose of the aircraft up until the landing attitude is reached. Fig 11 shows a landing attitude although, depending on your sitting height, this will vary from one individual to another. The correct picture for the landing attitude is that which you see whilst taxiing. Remember that the airbrakes tend to close as airspeed reduces so it is vital to hold the airbrake lever firmly.

c. **Ground run.** The aircraft should be landed on all 3 wheels together. Once on the ground the smooth application of full airbrake is required. Next the control column must be brought smoothly and progressively back to its stop. Steer the aircraft straight with rudder, keeping the wings level with separate movement of the ailerons. Coarser movement of the ailerons and rudder will be necessary as the aircraft slows down on the ground. Wheel brakes may be used as necessary to bring the aircraft to a controlled stop. The landing is not over until this is achieved.

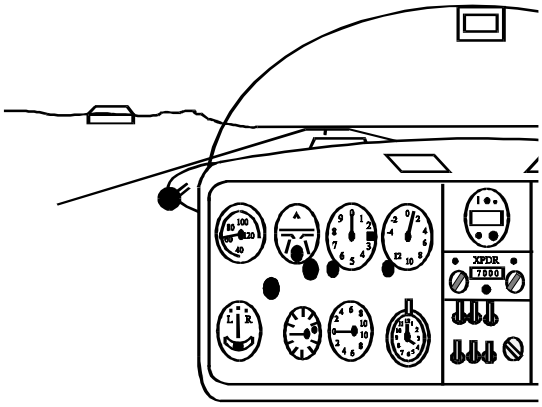


Fig 11. The Landing or Touch down attitude.

7. The elements which make up the landing are as follows:

a. **The round out.**

(1) Look well ahead towards the far end of the runway.

(2) Maintain at least half airbrake.

(3) From the approach attitude, smoothly pitch the nose up.

(4) Achieve the level attitude just above the ground.

b. **The hold off.**

(1) Maintain the airbrake setting.

(2) As the aircraft starts to sink, progressively raise the nose to maintain height.

(3) Adopt the landing attitude.

c. **The ground run.**

(1) The aircraft should be landed on all 3 wheels simultaneously.

(2) Smoothly apply full airbrake.

(3) Progressively move the control column back to its stop.

(4) Steer straight with the rudder.

(5) Keep the wings level with aileron.

(6) Use the wheel brakes as necessary to come to a controlled stop.

(7) Once the aircraft has stopped, close the airbrakes and taxi clear of the runway.

(8) Complete the after landing checks.

8. **Balloon landing.** When a glider climbs during the landing phase, we call it 'ballooning'. This can result from over-rotating during the round-out, a bounce or touching down too fast. If you approach too fast, the elevator is more sensitive than usual, and ballooning is more likely. Insufficient airbrakes or gusty wind conditions also increase the likelihood of ballooning. Your instructor will teach you how to recover from a balloon landing (or from rounding out too high) as follows:

a. Recognise the balloon (ground dropping away).

b. Adopt an attitude to prevent any further climb, maintain the airbrake setting.

c. As the aircraft descends, progressively reselect the landing attitude.

d. Land as normal.

9. **The Bounce.** (brief only, this will not be flown deliberately as a teach)

a. **Recognition** – The aircraft gets airborne again after touching down, probably due to the wrong landing attitude or touching down with flying speed being still present .

b. **Recovery** – use the balloon landing recovery as above.

10. **The Go-Around.** There are times when flying an approach where it becomes obvious to the pilot that a safe landing is in doubt. This may be due to a number of reasons, excessive lift or sink on the approach, poor approach technique or the landing area becoming blocked by a vehicle or another aircraft. In all cases a go-around must be flown as follows.

a. Select airbrakes closed, level the wings and smoothly pitch to the level flight attitude.

b. Smoothly apply full power, selecting the full climb attitude to reduce speed towards 55 kt.

c. Check carb heat in (COLD).

d. Climb away at 55 kt and re-join the circuit.

Intentionally Blank

Ex 10 - STALLING

AIM To recognise the stall and recover with minimum height loss.

To monitor the speed and prevent the stall.

1. **Airmanship.** Before we deliberately stall the aircraft we always carry out the FRC Pre-stalling checks. These are known as the HASELL checks from their mnemonic and provided that we cover them conscientiously we will be sure that it is safe to proceed. The checks are repeated in an abbreviated form (HELL) after every third stall. We must also confirm that we will remain within safe gliding range of the airfield allowing for the additional height loss inherent in stalling.

2. **Considerations.** When the angle of attack of an aerofoil exceeds a critical angle (about 15° for the Vigilant wing) the airflow over the aerofoil will progressively become turbulent and break away. See Fig 12. This dramatically reduces the amount of lift generated until it is no longer enough to support the aircraft and a large and rapid loss of height can occur. You will learn to recognise the symptoms of a stall and the correct recovery technique. Finally, you will learn to recognise the signs of an approaching stall, so that you can prevent it from happening.

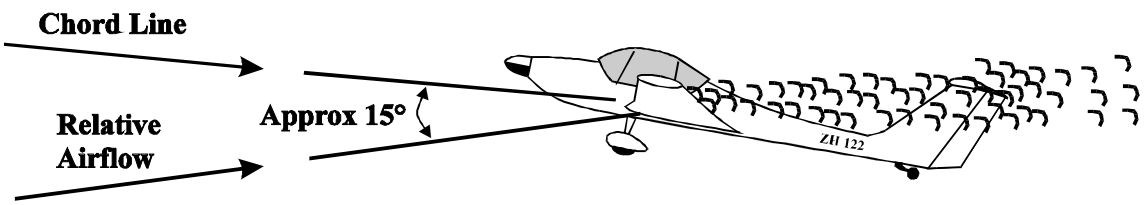


Fig 12. The stall.

3. **Reduced 'G'.** During the stall it is possible that you will experience a sensation of approaching weightlessness or reduced 'G'. You will have learnt that this sensation is not necessarily a symptom of the stall. Mistaking reduced 'G' for a stall could result in you adopting an unnecessarily steep nose-down attitude by further forward movement of the control column in a misguided attempt to recover. In this situation ignore the senses and select the recovery attitude - no lower!!

4. Before the exercise begins, your instructor will complete the HASELL checks.

H **Height.** Sufficient to recover by 1200 ft Minimum Seperation Distance.

A **Airframe.** Airbrakes set as required.

S **Security.** Harnesses secure and adjusted. No loose articles.

E **Engine.** Fuel pump on. Fuel contents sufficient. Engine instruments indications normal.

L **Location.** Clear of **A**ctive Airfields, **B**uilt up areas, **C**ontrolled airspace, **C**loud and **D**anger areas (**ABCCD**).

L **Look out.** Clear of other aircraft.

5. **The full stall.** There are four symptoms of the full stall which may appear individually or in any combination. It is important to note that not all of these symptoms have to be present to indicate that the aircraft has stalled.

a. Buffeting (shaking) of the airframe (noticeable through the control column).

b. Nose may pitch down despite the control column being held fully back.

c. Possible wing drop.

d. Increased sink.

6. **Standard stall recovery (SSR).** If one or more of the above symptoms is detected it is vital to take the standard stall recovery action immediately.

a. Move the control column centrally forward to adopt the recovery attitude. (Note that centrally in this context means without any aileron being applied).

b. Regain minimum safe flying speed (50 kt).

c. Roll the wings level if necessary.

d. Return to the correct attitude.

7. **Further stalling.** It is possible to stall the Vigilant from a shallow nose high attitude. In such a case the aircraft will not pitch down at the stall and it will be necessary to move the control column further forward to achieve the recovery attitude.

8. **Stalling in a turn.** It is also possible to stall the aircraft in a turn. There is a greater likelihood of a wing drop during this type of stall, but the standard stall recovery must still be applied as any attempt to raise the down going wing with aileron, before the wings are unstalled, can make the situation worse.

9. **Approach to the stall.** There are four signs of the approach to the stall which you will be taught to recognise:

a. The attitude is higher than it should be.

b. The speed is low because the attitude is incorrect.

c. The noise level is reduced because the speed is low.

d. The controls are less effective because the speed is low.

10. **Stall prevention.** Once you are proficient at recovering from the full stall, you will be taught to prevent the situation occurring. By recognising the signs of the approach to

the stall and taking preventative action before the full stall develops, a much smaller height loss is experienced and the recovery is conducted more safely and efficiently.

a. At the first sign of the approaching stall reselect the correct attitude.

b. The stall has been prevented.

The stall will have been prevented with minimum loss of height.

11. **Approaching stall in the turn.** Just as in any other phase of flight, recognising the signs of the approach to the stall and reacting before the stall occurs will minimise any height loss.

12. **Approaching stall on the final approach.** If, during an approach to land with airbrakes open, the aircraft entered an attitude where it was approaching the stall, it would be more difficult to detect than normal. This is because:

a. The nose attitude will not be particularly high.

b. The noise from the airbrakes will mask the reducing noise level.

c. During a stable approach control inputs are often very limited and therefore the reducing control effectiveness will not be apparent.

As such the only reliable sign of the approaching stall is a reduction in airspeed below the normal approach speed. Selecting the approach attitude alone would not be sufficient to recover in this situation because the extra drag created when the airbrakes are open would prevent the aircraft from accelerating to the correct speed quickly. The higher rate of descent due to a portion of the lift being destroyed by the airbrakes would also make it inadvisable to leave them open.

13. **Prevention.** If you recognise an approaching stall in this situation, the correct recovery action is:

a. Monitor the airspeed; if the speed falls below the approach speed:

b. Close the airbrakes whilst simultaneously reselecting approach attitude.

c. Check approach speed has been regained then re-select airbrake as necessary.

Intentionally Blank

Ex 11 - CIRCUITS

AIM To fly a normal circuit.

1. **Airmanship.** In the circuit you will be expected to apply all of the airmanship skills you have been taught so far. You will need a high standard of lookout and a situational awareness for the whole of the circuit area and an appreciation of the effects of the wind. To ensure that you remain within safe gliding range you will need to glance regularly at the Designated Landing Area (DLA). The workload during this exercise will be greater than you have experienced on previous exercises.

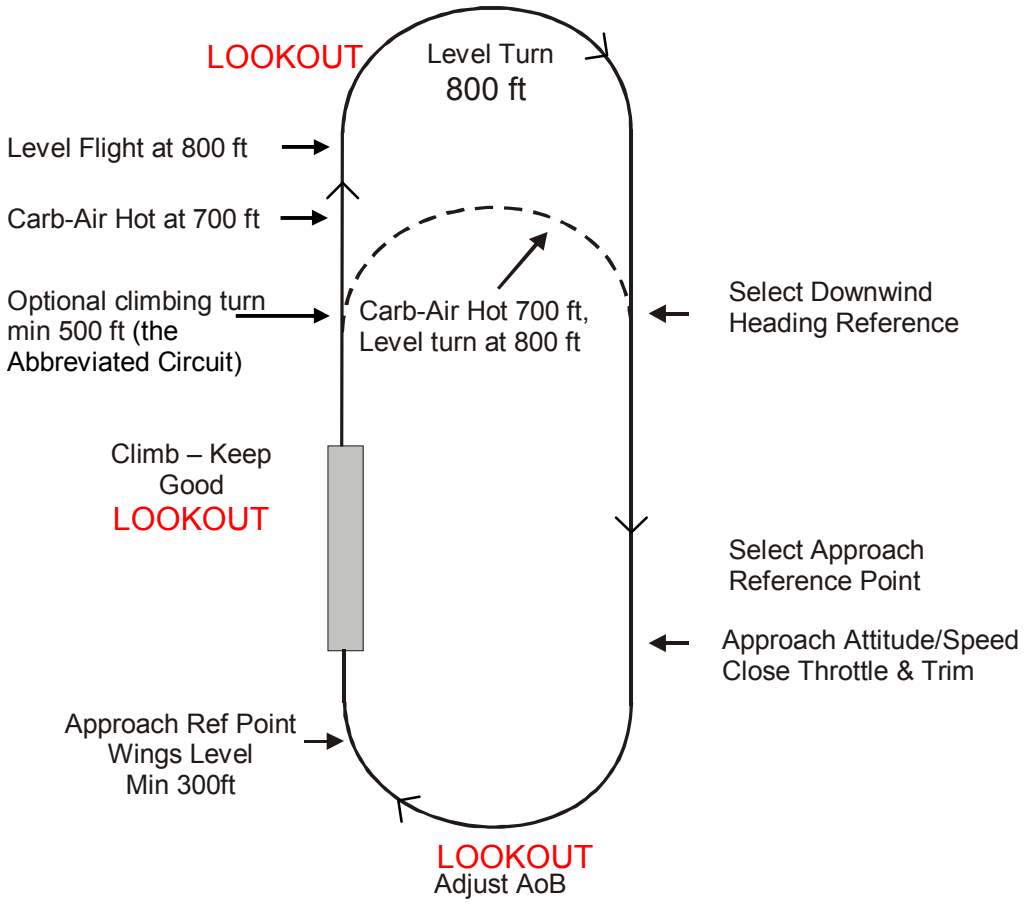


Fig 13. The Vigilant circuit.

2. a. **Take off.**

(1) FRC - Pre take-off checks.

(2) Line up and take off.

(3) At 55 kt enter the normal climb and trim.

(4) Confirm reference point and start the straight flight scan (LAI).

b. **Level.**

(1) At 700ft select Carb Air to Hot.

(2) At 780ft start transition (APT) to achieve level flight (60 kt) at 800ft (Approximately 2300 RPM).

(3) Look out, turn through 180° using approximately 15° angle of bank.

c. **Abbreviated circuit.** Sometimes it is necessary to shorten the circuit due to local procedures. This is known as the abbreviated circuit and requires you to do a climbing turn.

(1) Have a good lookout especially upwind.

(2) At a minimum of 500ft, enter a climbing turn (approximately 15° angle of bank).

(3) At 700ft select Carb Air to Hot.

(4) At 780ft start transition (APT) to achieve level medium turn attitude (60 kt) at 800ft (Approximately 2300 RPM).

(5) Exit the turn to track downwind.

d. **Downwind.**

(1) Establish straight and level flight, parallel to the runway at the correct distance out. For left hand circuits the runway should be at the end of your airbrake box. For right hand circuits it should appear midway through your instructor's DV panel. (See Fig 14). Select a suitable reference point to assist in maintaining the heading.

(2) Continue with LAI scan.

(3) Use full power or airbrake to maintain height within 100 ft of datum.

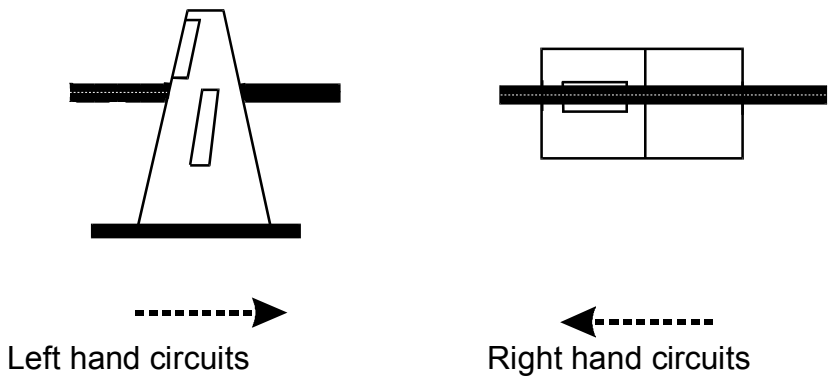


Fig 14. Checking distance out from runway.

e. **Final turn.**

(1) Identify the Approach Reference Point **(ARP)** on the final approach path (approx 45° from track).

(2) Abeam the start of the designated landing area select the approach attitude (65 or 70 kt), close the throttle and re-trim.

(3) Look out to ensure it is clear to commence your final turn.

(4) Abeam the ARP, enter the turn using 10-20° bank.

(5) Throughout the turn use LAI work cycle. Ensure correct speed, confirm that the approach and landing path is clear and there is no conflicting traffic. Adjust angle of bank as necessary to achieve wings level over the ARP (approx 3 – 500 ft, minimum height 300 ft). Use airbrake or power, if required, to exit the final turn at 300-500 ft over ARP.

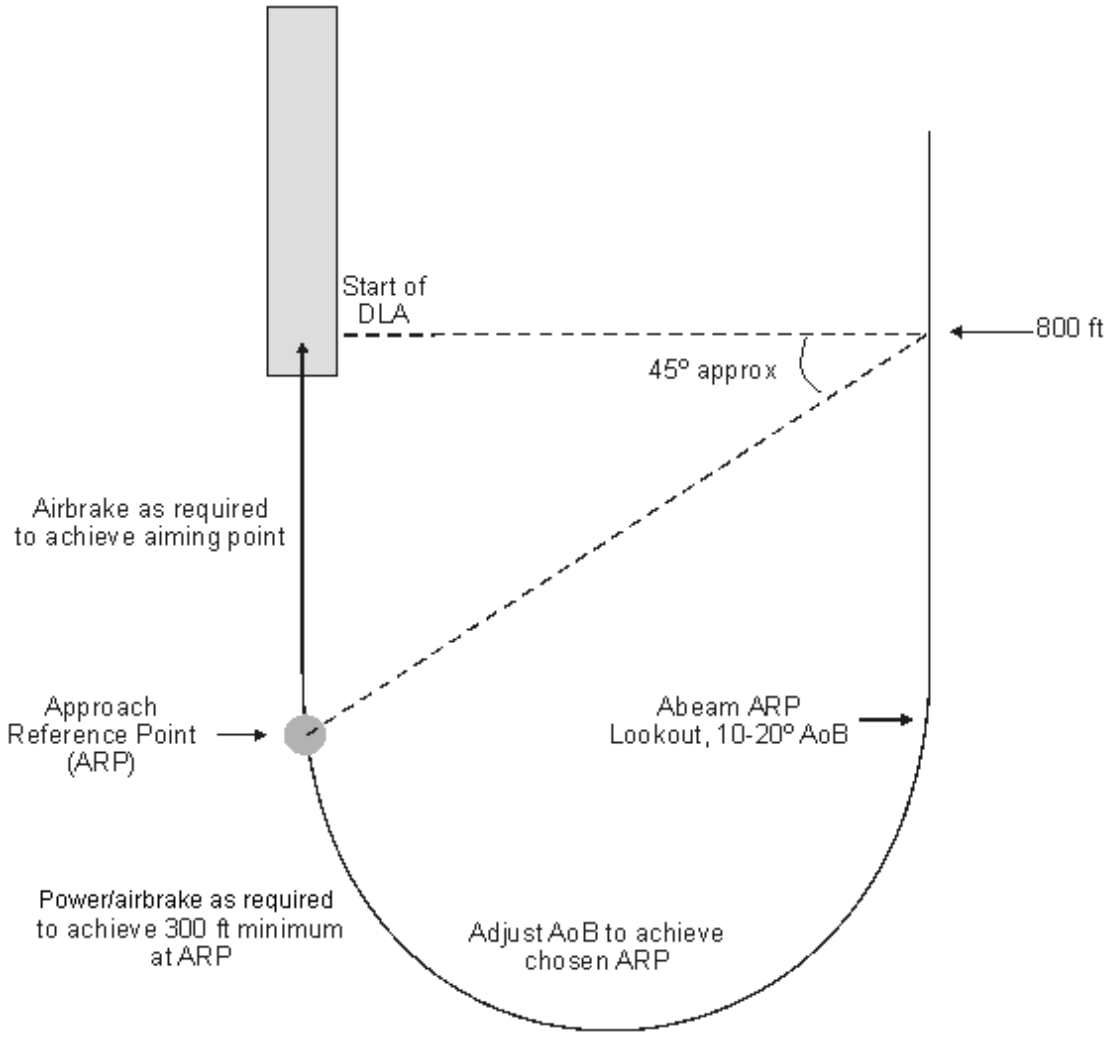


Fig 15. The Final Turn

f. **The final approach.** After you roll wings level in line with the runway you must start your final approach as covered in exercise 9. The first part of this process is repeated here for clarity.

(1) Select carb heat in (COLD).

(2) Check feet clear of the toe brakes.

(3) Select half airbrake when an overshoot of the aiming point starts to develop.

(4) Adopt the final approach workcycle.

3. **Wind velocity.** Your instructor will give you advice to help you cope with variations in wind strength and direction. Increasing wind strength will mean it is necessary to move the ARP closer to the airfield (perhaps 60° instead of 45° from track), any cross wind will affect the headings required to achieve the required track over the ground in the various phases of the circuit. Cross wind will affect your choice of angle of bank during the turn to downwind and onto final approach. A cross wind which tends to blow you toward the airfield (closing cross wind) will need a shallow angle of bank for the turn downwind and a steeper angle of bank for the final turn. With an opening cross wind (tending to blow you away from the airfield) you will need a steeper angle of bank for the turn to downwind and a corresponding shallower angle of bank for the final turn.

Ex 11a – RECTANGULAR CIRCUIT

AIM To fly a rectangular circuit.

1. **Airmanship.** On a few VGS's it is not possible to fly the oval-ended circuit as described in Ex 11 due to other conflicting traffic. In those cases, the VGS needs to conform by flying 800 ft or 1000 ft rectangular circuits, which are described below. In the circuit you will be expected to apply all of the airmanship skills you have been taught so far. You will need a high standard of lookout, a situational awareness for the whole of the circuit area and an appreciation of the effects of the wind. To ensure that you remain within safe gliding range you will need to glance regularly at the Designated Landing Area (DLA). The workload during this exercise will be greater than that which you have experienced on previous exercises.

2. **The 800ft rectangular circuit.** (Fig 16).

a. **Take off.**

(1) FRC - Pre take-off checks.

(2) Line up and take off.

(3) At 55 kt enter the normal climb and trim.

(4) Confirm reference point and start the straight flight scan (LAI).

b. **Climbing turn.**

(1) Approaching 500 ft lookout – especially above and behind.

(2) At 500 ft enter climbing turn (15° of bank).

(3) Exit turn to track at 90° to runway.

c. **Level off.**

(1) At 700 ft, select carb heat out (HOT).

(2) At 780ft start transition (APT) to achieve level flight attitude (60 kt) at 800ft (approximately 2300 RPM).

d. **Downwind turn.**

(1) Start the turn as soon as the aircraft is levelled off or at a nominated ground feature.

(2) Lookout – check upwind for joining traffic.

(3) Medium turn to track downwind.

e. **Downwind leg.**

(1) Use downwind reference to adjust distance out downwind; select heading feature to aid tracking.

(2) Maintain LOOKOUT – ATTITUDE – INSTRUMENTS workcycle.

(3) Use full power or airbrake to maintain height within 100 ft of datum.

f. **Turn onto base leg.**

(1) Abeam start of DLA nominate approach reference point.

(2) Continue downwind to start turn abeam approach reference point.

(3) Lookout – check for aircraft joining on base leg.

(4) Medium turn to track at 90° to runway.

g. **Base leg.**

(1) At the selected descent point select the approach attitude (65 or 70 kt), close the throttle and re-trim.

(2) Start final turn to exit on extended runway centreline at the ARP.

h. **Final turn.**

(1) Lookout – especially along the extended approach path.

(2) Gliding turn onto final approach.

(3) Adjust bank to roll out tracking down extended runway centreline.

i. **The final approach.** After you roll wings level in line with the runway you must start your final approach as covered in exercise 9. The first part of this process is repeated here for clarity.

(1) Select carb heat in (COLD).

(2) Check feet clear of the toe brakes.

(3) Select half airbrake when an overshoot of the aiming point starts to develop.

(4) Adopt the final approach workcycle.

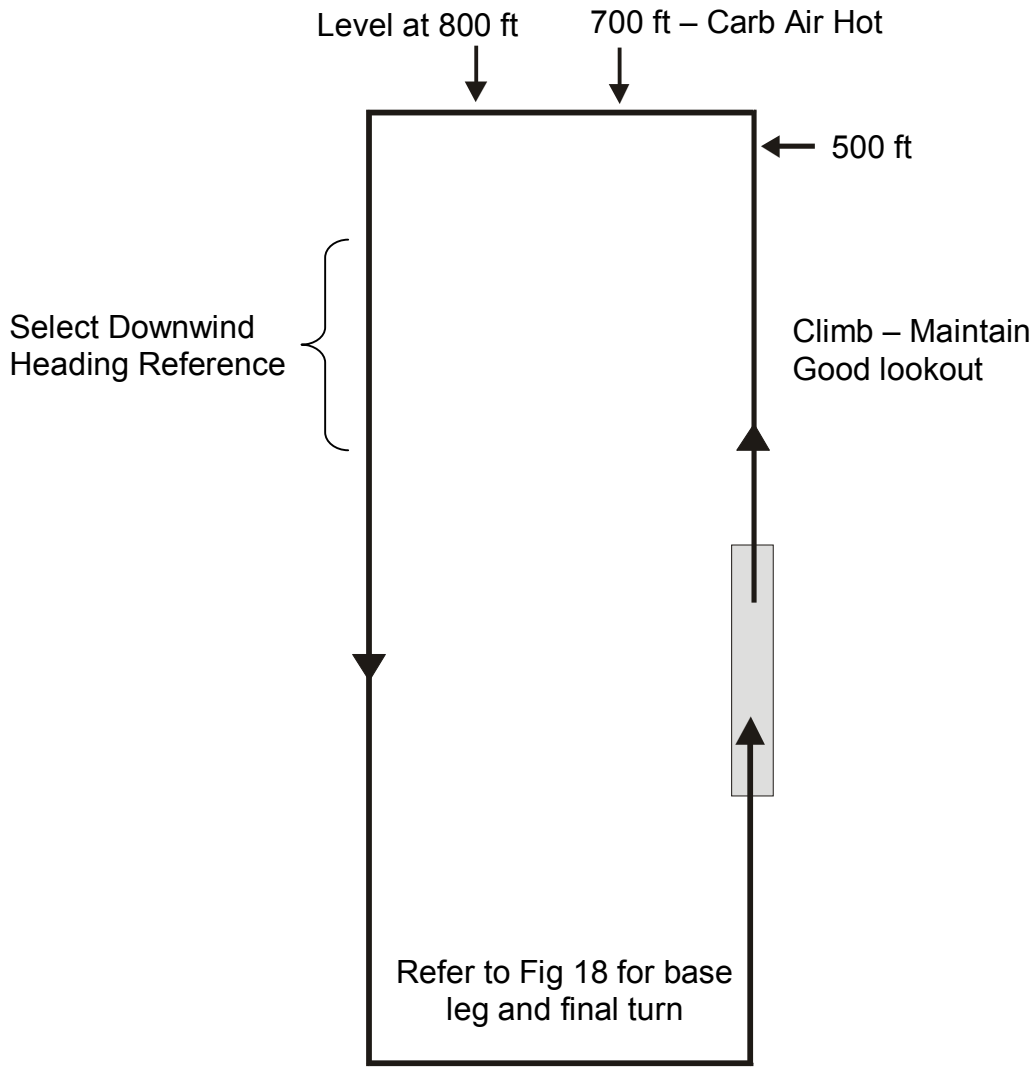


Fig 16 The 800ft rectangular circuit

3. **The 1000ft rectangular circuit.** (Fig 17).

a. **Take off.**

(1) FRC - Pre take-off checks.

(2) Line up and take off.

(3) At 55 kt enter the normal climb and trim.

(4) Confirm reference point and start the straight flight scan (LAI).

b. **Climbing turn.**

(1) Approaching 500 ft lookout – especially above and behind.

(2) At 500 ft enter climbing turn (15° of bank).

(3) Exit turn to track at 90° to runway.

c. **Climbing downwind turn.**

(1) Approaching 800 ft, lookout – check upwind for joining traffic.

(2) At 800 ft, enter a climbing turn using 15° angle of bank.

(3) Exit turn to track downwind.

d. **Level off.**

(1) At 900 ft, select carb heat out (HOT).

(2) At 980ft start transition (APT) to achieve level flight attitude (60 kt) at 1000ft (Approximately 2300 RPM).

e. **Downwind leg.**

(1) Use downwind reference to adjust distance out downwind; select heading feature to aid tracking.

(2) Maintain LOOKOUT – ATTITUDE – INSTRUMENTS workcycle.

(3) Use full power or airbrake to maintain height within 100 ft of datum.

f. **Turn onto base leg.**

(1) Abeam start of DLA, nominate approach reference point.

(2) Continue downwind to start turn abeam approach reference point.

(3) Lookout – check for aircraft joining on base leg.

(4) Medium turn to track at 90° to runway.

g. **Base leg.**

(1) At the selected descent point select the approach attitude (65 or 70 kt), close the throttle and re-trim.

(2) Start final turn to exit on extended runway centreline at the ARP.

h. **Final turn.**

(1) Lookout – especially along the extended approach path.

(2) Gliding turn onto final approach.

(3) Adjust bank to roll out tracking down extended runway centreline.

i. **The final approach.** After you roll wings level in line with the runway you must start your final approach as covered in exercise 9. The first part of this process is repeated here for clarity.

(1) Select carb heat in (COLD).

(2) Check feet clear of the toe brakes.

(3) Select half airbrake when an overshoot of the aiming point starts to develop.

(4) Adopt the final approach workcycle.

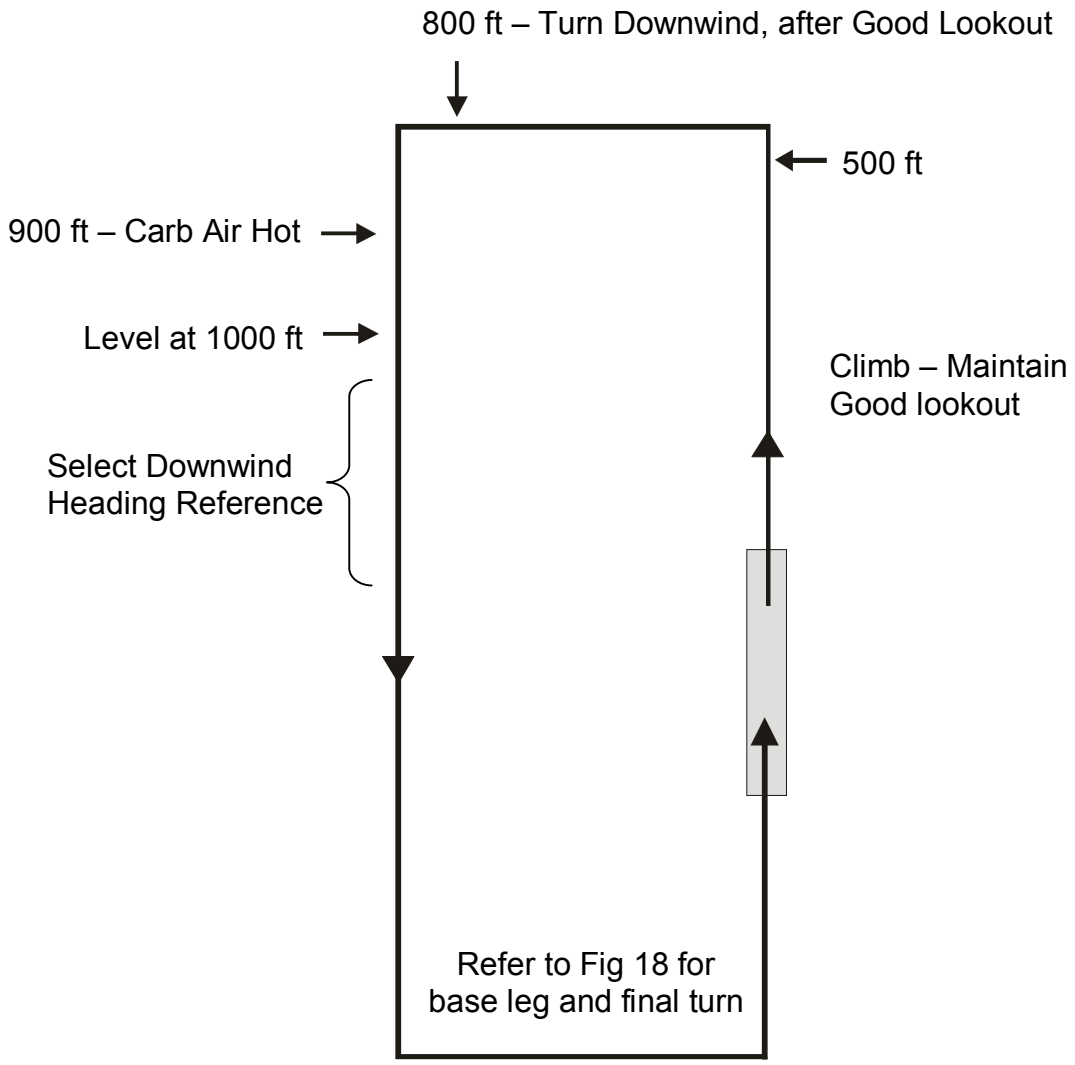


Fig 17 The 1000ft rectangular circuit

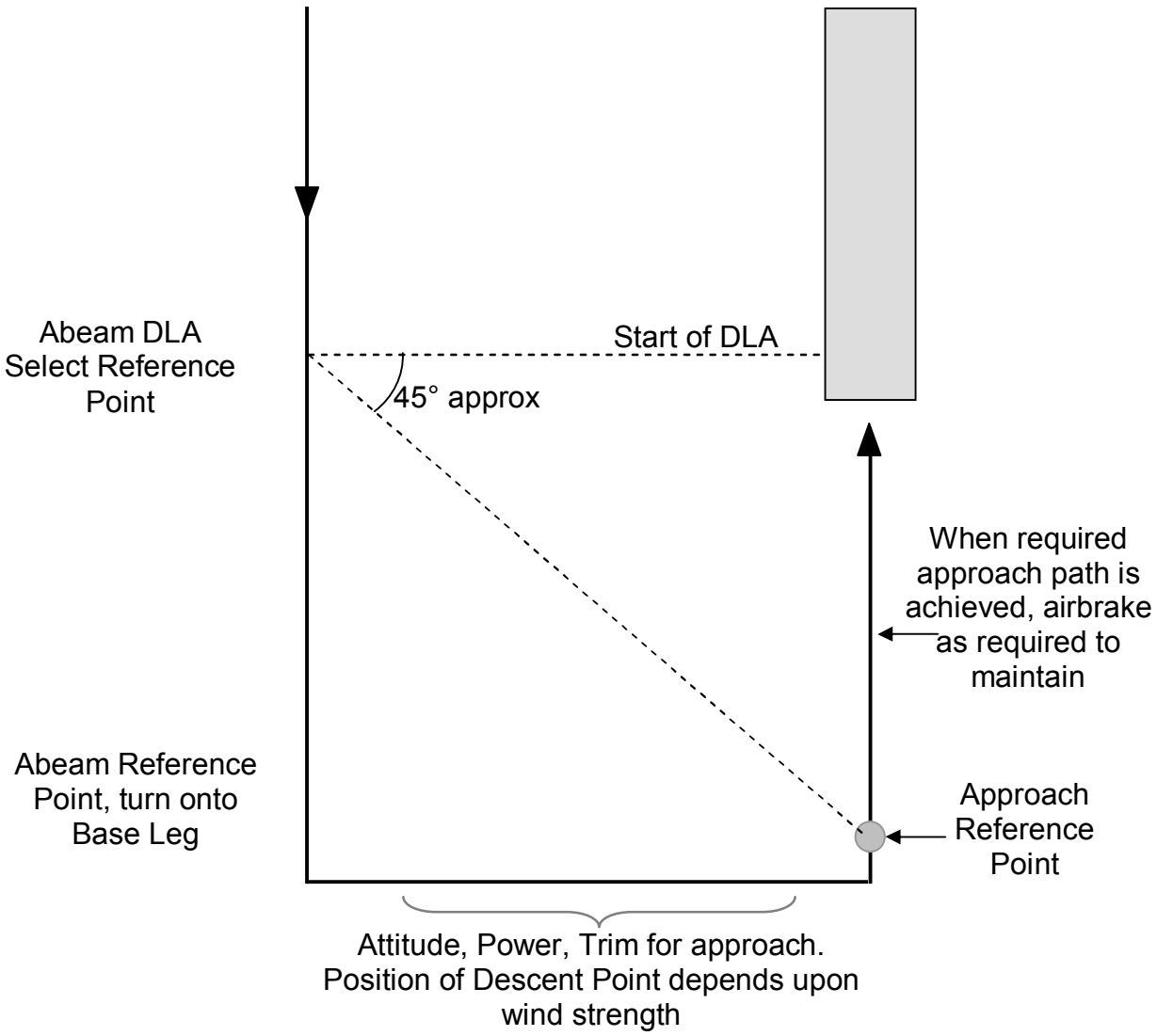


Fig 18 The base leg and final turn

4. Descent point. For both circuits the point to select the approach attitude depends on the wind velocity.

a. In light winds, the descent point is close to the beginning of the base leg.

b. In strong winds the descent point will be further along the base leg or even on the final approach.

c. If you have been forced to fly your base leg further back than normal due to other traffic it may be necessary to delay selecting the approach attitude until you are established on the final approach.

EXERCISE 12

There is now no Exercise 12; the original content (Recovery from High and Low positions on the downwind leg) has been covered in Exs 6 and 11.

Intentionally Blank

Ex 13 - POWER LOSS AFTER TAKE-OFF (PLATO)

AIM To land safely following a power loss after take-off.

Note – Where possible have a copy of the Vigilant FRC available when reading this chapter, a copy of these should be available from your instructor.

1. ►**Practice emergencies.** During the flying element of this exercise you will be taught the subsequent actions of the power loss procedures. When practising a PLATO your instructor will expect you to conduct touch drills if time permits.
Touch drills are performed by pointing at the appropriate switch or control and stating what you would do if the emergency was real.

NEVER actually move a switch or control during touch drills.

2. ◄**Airmanship..** You should be prepared for a PLATO on every take-off. The final action on the pre-take-off FRC check is to consider the actions in the event of an emergency. The overriding priority is to fly the aircraft safely, performing the emergency drills is a secondary consideration. Being aware of the position of other aircraft within the circuit and of obstructions on the ground will help you make decisions on landing areas more quickly.

3. A total engine failure will be obvious whilst a partial engine failure will appear as a loss of RPM, often accompanied by rough or erratic running, or misfiring. In either case the priority is to land the aircraft safely in any suitable area. You will be taught the PLATO procedures from various heights in wind conditions relevant to any solo flying you may do.

4. **Power Loss after Take-Off.** The flow chart in Fig 19 is a logical step by step guide to recovering from power losses, please view it in conjunction with the following power loss scenarios. In the event of a power loss after take-off, your first action is to select an attitude to achieve and maintain 60 kt. Next, you should assess if it is possible to land ahead on the remaining airfield, doing so if this is a safe option. If you cannot land ahead on the airfield, you should assess the remaining aircraft performance in order to distinguish between a total power loss and a partial power loss. Use the engine RPM indication for this diagnosis; RPM indication will only provide a meaningful measure of performance with the aircraft maintaining a steady airspeed of 60 kt:

a. **RPM 2300 or More.** The engine has suffered a partial power loss, so carry out the partial power loss after take-off procedure.

b. **RPM Less than 2300.** The engine has failed such that it is producing insufficient power to maintain level flight, so treat the failure as a total power loss and carry out the appropriate procedure.

5. **Partial Power Loss.** If the engine has suffered a partial power loss, your actions depend on the remaining performance of the aircraft, specifically the ability to maintain 300 ft, or climb to 300 ft. It is essential to achieve an accurate assessment of aircraft performance in order to choose the best course of action:

a. **Below 300 ft and Unable to Climb.** Treat the emergency as a total power loss but, instead of shutting down the engine or closing the throttle immediately, use the remaining power to accelerate to approach speed and reach the best available landing area. If time permits, carry out the TCCF checks and make a radio call.

Close the throttle when the landing is assured and before using airbrake.

b. **Above 300 ft or Able to Climb to 300 ft.** Below 300 ft, continue to climb straight ahead to 300 ft. When at or above 300 ft, turn back towards the airfield. Your aim is to fly a mini-circuit at 60 kt. If performance is marginal, a landing downwind or crosswind may be the only option. If time permits, carry out the TCCF checks and make a radio call. Use the remaining power to achieve the ideal solution (for example, climb to intercept the normal approach). Select approach speed before the final turn. Close the throttle when the landing is assured and before using airbrake.

6. **Total Power Loss.** If you diagnose a total power loss, check the height and proceed as follows:

a. **Below 500 ft.** Select the approach attitude and land ahead into wind. Ideally, an into-wind landing area will be selected within 45° of the nose. Airmanship might dictate that, to achieve the most suitable landing area, the aircraft is turned through a larger angle. If time permits, carry out FIP checks and make a radio call. If there is insufficient time to complete FIP checks, ensure that the throttle is closed.

b. **Above 500 ft.** Turn back towards the airfield. Depending on whether this is a first take-off or a touch-and-go, the headwind and the size of the airfield, you now have 2 options:

(1) **Mini-Circuit.** The safer option is to fly a mini-circuit and land into wind. If time permits, carry out FIP checks and make a radio call. If there is insufficient time to complete FIP checks, ensure that the throttle is closed. Select the approach attitude before descending through 400 ft. Start the final turn into wind by 300 ft or by a nominated downwind boundary (whichever occurs earlier). The downwind boundary consists of a nominated ground feature downwind of the DLA, chosen to ensure a low final turn remains within an appropriate distance from the start of the DLA. The position of the downwind boundary will necessarily vary depending on wind conditions. With a stronger headwind component, the downwind boundary will be closer to the DLA than it will be in light wind conditions. Achieve wings level before 100 ft and land.

(2) **Land Downwind or Crosswind.** If you have insufficient height to fly a mini-circuit, a landing downwind or crosswind is the only option. If time permits, carry out FIP checks and make a radio call. If there is insufficient time to complete FIP checks, ensure that the throttle is closed. Select approach speed before descending through 400 ft. Achieve wings level before 100 ft and land. See para 6a for the potential hazards of a downwind landing.

7. **The Turnback.** Consider the option of a turnback carefully:

a. In marginal conditions, ie a combination of low power, low height and following a touch-and-go that places you further away from the airfield than usual, a turnback will commit you to landing downwind or crosswind (consider crosswind limits) if you are unable to fly a mini-circuit. In strong winds, a landing downwind is likely to be hazardous as the aircraft will float a long way and there is a significant risk of 'nosing over' if you brake harshly after landing. Depending on the terrain upwind of the runway, the strength of the wind, size of the airfield and presence of any obstructions on the airfield, an into-wind landing beyond the airfield may be safer than a downwind landing on it.

b. Fly the turn using a maximum of 30° of bank. Do not start a turnback below 300 ft. Remember that an unfeathered, windmilling propeller will markedly reduce gliding performance.

c. Whilst flying a mini-circuit, consider the effect of any crosswind to achieve an appropriate downwind spacing. If it is not possible to intercept a normal approach, select an appropriate downwind boundary for the wind conditions.

8. **Power loss below 100ft.** If a power loss was to occur below 100ft, the procedure to land ahead is as follows:

a. Select an appropriate attitude. In all cases below 100ft the approach attitude is likely to be too steep. In general, the lower the failure occurs, the higher the appropriate attitude. At very low levels it may be necessary to use a level attitude, similar to the balloon landing.

b. Close the throttle.

c. Unless approach speed is achieved, do not use airbrakes until after the roundout.

d. During the hold off, use the airbrakes with caution if necessary.

9. **Subsequent actions.** The FRC procedures include checks that are to be carried out *when* time permits in the case of a partial power loss and *if* time permits in the case of a total power loss. These checks *must not* be carried out if the safe flying of the aircraft will be compromised.

a. **Partial power loss.** The following procedure should be carried out following a partial power loss. The partial power loss could have occurred for a number of reasons; it may be that you have accidentally knocked the throttle when trimming, the engine could be suffering from carburetor icing, the choke could have been inadvertently opened, likewise the fuel cock and/or pump could have been accidentally turned off. As such the procedure to carry out *when* time permits is:

Throttle	-	Select fully open
Carb Heat	-	In (COLD). Out (HOT) if carb icing suspected
Choke	-	In
Fuel	-	Cock ON, Pump ON

When convenient:

Radio	-	Emergency call

When a landing is assured in the selected landing area:

Throttle	-	Closed

b. **Total power loss.** The following procedure should be carried out following a total power loss. These checks *must not* be carried out if the safe flying of the aircraft is compromised. It may be that it is impossible to carry out these checks if the engine failure occurs at a low height, as such your primary concern should be to *fly the aircraft.* The procedure to carry out if time permits is:

Fuel	-	Cock OFF, Pump OFF
Ignition	-	OFF
Propeller	-	Feather (if practicable)

When convenient:

Radio	-	Emergency call

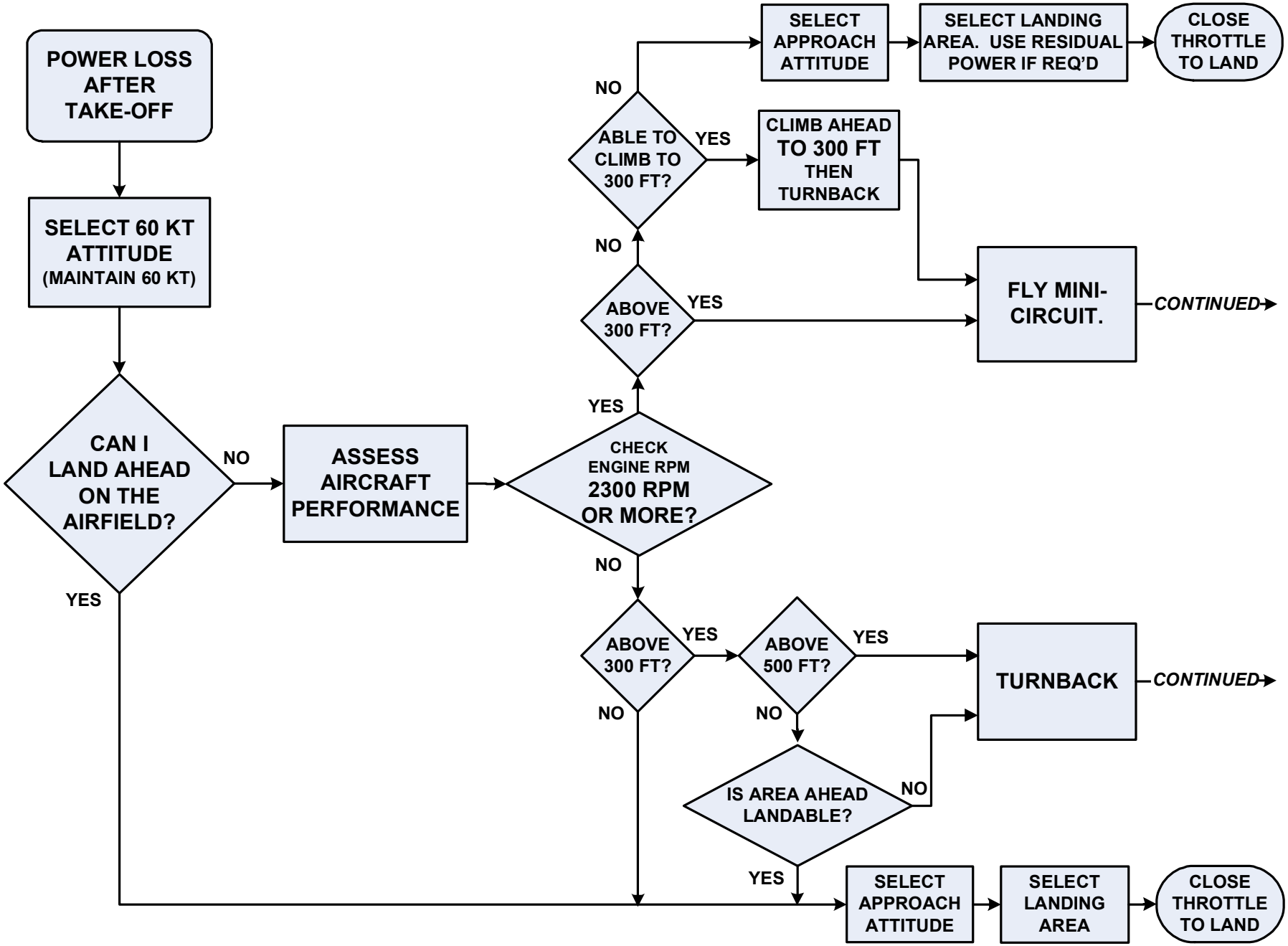

POWER LOSS AFTER TAKE-OFF
SELECT 60 KT ATTITUDE (MAINTAIN 60 KT)
CAN I LAND AHEAD ON THE AIRFIELD?
NO
YES
ASSESS AIRCRAFT PERFORMANCE
CHECK ENGINE RPM 2300 RPM OR MORE?
YES
NO
ABOVE 300 FT?
YES
NO
ABLE TO CLIMB TO 300 FT?
NO
YES
SELECT APPROACH ATTITUDE
SELECT LANDING AREA. USE RESIDUAL POWER IF REQ'D
CLOSE THROTTLE TO LAND
CLIMB AHEAD TO 300 FT THEN TURNBACK
FLY MINI-CIRCUIT.
CONTINUED
ABOVE 300 FT?
YES
NO
ABOVE 500 FT?
YES
NO
TURNBACK
CONTINUED
IS AREA AHEAD LANDABLE?
NO
YES
SELECT APPROACH ATTITUDE
SELECT LANDING AREA
CLOSE THROTTLE TO LAND

Fig 19 Part 1

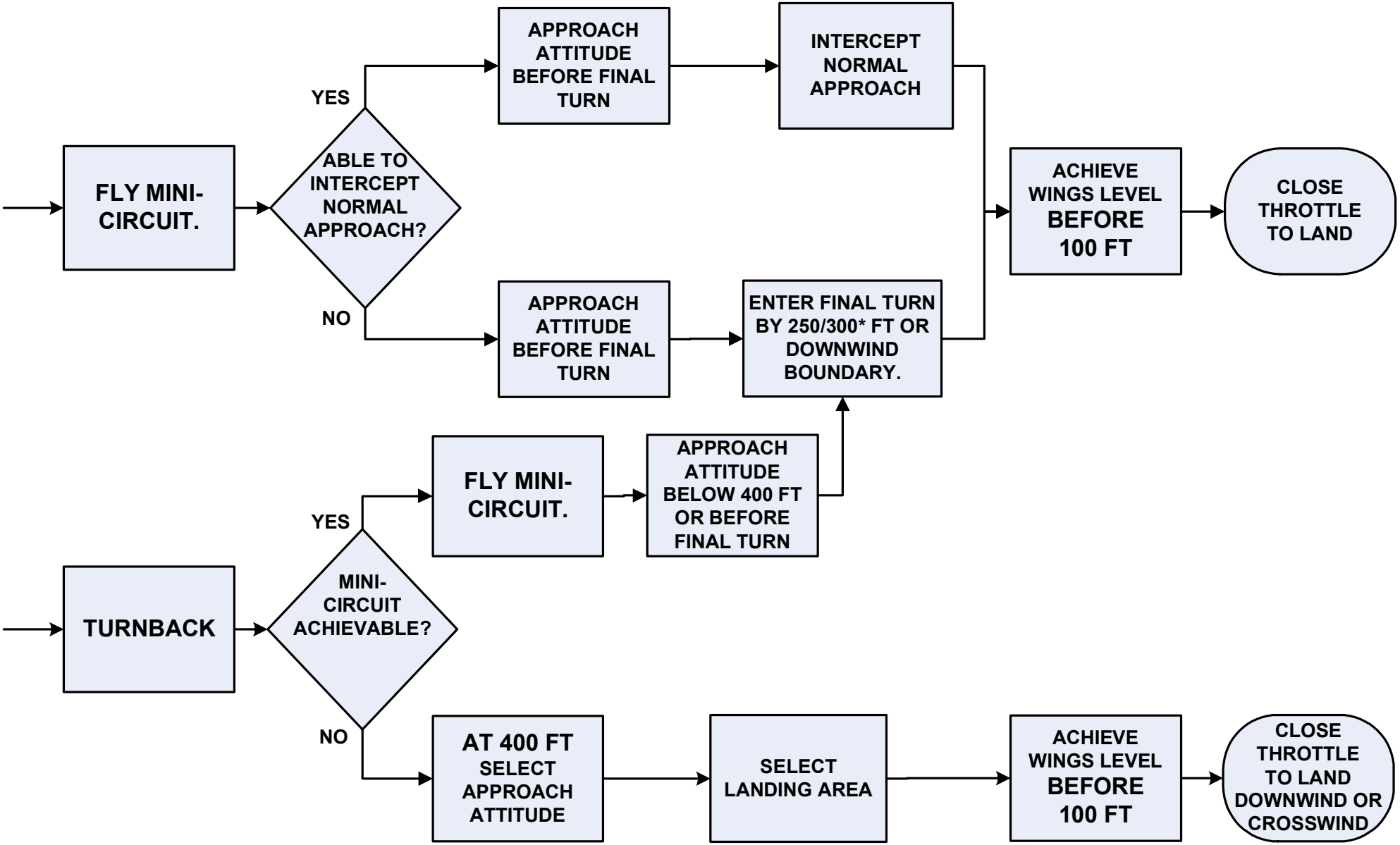

FLY MINI-CIRCUIT.
ABLE TO INTERCEPT NORMAL APPROACH?
YES
NO
APPROACH ATTITUDE BEFORE FINAL TURN
INTERCEPT NORMAL APPROACH
APPROACH ATTITUDE BEFORE FINAL TURN
ENTER FINAL TURN BY 250/300* FT OR DOWNWIND BOUNDARY.
ACHIEVE WINGS LEVEL BEFORE 100 FT
CLOSE THROTTLE TO LAND
TURNBACK
MINI-CIRCUIT ACHIEVABLE?
YES
NO
FLY MINI-CIRCUIT.
APPROACH ATTITUDE BELOW 400 FT OR BEFORE FINAL TURN
AT 400 FT SELECT APPROACH ATTITUDE
SELECT LANDING AREA
ACHIEVE WINGS LEVEL BEFORE 100 FT
CLOSE THROTTLE TO LAND DOWNWIND OR CROSSWIND

Fig 19 Part 2

Ex 14 - PRE SOLO CHECK & FIRST SOLO

AIM To fly a normal circuit and landing.

1. **Airmanship.** Your first solo will not come as a surprise to you. For several circuits you will have been handling the aircraft for the complete flight without help from your instructor. You will have been making all of the airmanship checks and decisions for yourself. The solo check will consist of a minimum of 3 circuits with an A category instructor and will include at least two simulated power losses, one full and one partial PLATO. Following a satisfactory check flight you will be briefed to fly one solo circuit.

2. There are several minor differences affecting your solo flight caused by the reduction in all up mass of the aircraft.

a. During the take-off the ground run will be slightly shorter.

b. The aircraft will exhibit a tendency to pitch up slightly more just after take-off.

c. The level flight point in the circuit will be achieved slightly earlier.

d. The trim lever position for the circuit speeds will be slightly further forward.

e. The elevator response will be a little more effective and it will feel lighter.

f. The aircraft will 'float' longer during the hold off.

3. Before flying solo it is vital that you are thoroughly familiar with the rules of the air. You will be expected to pass a simple test of these rules before your first solo.

4. **Collision avoidance.** The following general **Rules of the Air** (paras 4 – 9 below) apply to all aircraft including gliders and motor gliders:

a. Even when under Air Traffic Control, the commander of an aircraft has the over riding duty to take all possible measures to ensure that his aircraft does not collide with another.

b. Aircraft are not to be flown in such close proximity to other aircraft as to create a hazard.

c. Formation flying is only to be carried out when all the commanders concerned agree.

d. An aircraft which is obliged to give way to another aircraft shall avoid passing over, under or ahead of the other aircraft unless well clear.

e. An aircraft which has the right of way shall maintain its course and speed unless by doing so there is a risk of collision.

f. A tug and glider combination is considered to be a single aircraft under the command of the tug pilot.

5. **Converging.** Some aircraft have priority over others because of their limited maneuverability and for other reasons. The order of priority is as follows:

a. Flying machines give way to airships, gliders and balloons.

b. Airships give way to gliders and balloons.

c. Gliders give way to balloons.

6. Subject to the above order of priority, when two aircraft of the same category are converging and there appears to be a danger of collision the aircraft which has the other on its right must give way, provided that mechanically driven aircraft shall always give way to aircraft which are towing other aircraft or objects. An easy way to remember this is 'on the right is in the right'.

7. **Approaching head on.** Each aircraft must alter its heading to the right.

8. **Overtaking.** The aircraft being overtaken has the right of way. The overtaking aircraft must pass to the right of the other aircraft and keep out of the way until well clear. However, a glider overtaking another glider in the UK may pass either to the left or right of the glider being overtaken.

9. **Priority when landing.** Landing aircraft have the right of way over all other aircraft in flight or on the ground. When two or more aircraft are landing, the lower aircraft has the right of way unless:

a. Air Traffic Control has given priority to a higher aircraft.

b. The lower aircraft has cut in front of another aircraft.

c. The lower aircraft becomes aware that a higher aircraft is making an emergency landing.

Ex 15 - ADVANCED TURNING

AIM. To turn onto specific features using 45° angle of bank.

1. **Airmanship.** The airmanship considerations from the GS medium turns (Ex 8) all apply to this exercise. Additionally, due to the faster rate of turn more attention must be paid to maintaining orientation.

2. You will initially practice the medium turns and overbanked turn recoveries you learnt in your GS training. Your instructor will want to ensure that you:

   a. Complete a pre turn lookout.
   b. Maintain an accurate turn using the LAI work cycle.
   c. Exit the turn onto a given heading.
   d. Check the blind side after exiting the turn.
   e. Resume the LAI work cycle after exiting a turn.

You will then be shown the 45° turning attitude and taught how to achieve and maintain it.

3. **Entry.** Before attempting a steeper turn it is necessary to ensure that you are flying accurately at 60 kt. Once the lookout has been completed the entry is initially the same as a medium turn, but the bank is progressively increased to 45°. In this steeper attitude there is a more marked tendency for the nose to pitch down so a larger back pressure will be required to maintain the attitude and speed. A slight increase in power to 2600rpm will be required as you roll through 30° of bank to maintain the correct height.

4. **Maintenance.** Because of the increased back pressure on the control column there will be a slightly increased 'g' loading during the turn. This is not unpleasant and is nothing to worry about. Continue with the LAI work cycle as normal.

5. **Exit.** The steeper angle of bank causes a greater rate of turn. Additionally it will take longer to return the aircraft to wings level. Because of this, greater anticipation is required to roll out onto a given heading. You will also need to remember that there is more back pressure applied to the control column during the turn and therefore more pressure to release as you exit the turn. As the aircraft approaches wings level it will be necessary to reset the original power setting.

6. Once you have been taught the 45° turn you will be given the opportunity to practice it in both directions. It is important to remember that the attitude will look different for each direction but that the position of the horizon in relation to the speaker box will be the same. See Fig 20.

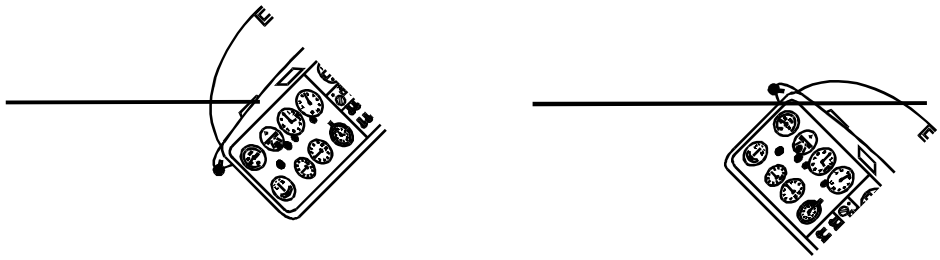


Fig 20. Turning attitude Left and Right at 45° angle of bank.

Ex 16 - ADVANCED LANDING

AIM To fly the approach and land the aircraft in a crosswind.

1. **Airmanship.** The airmanship considerations from the GS approach and landing exercise (exercise 9) all apply to this exercise. Additionally it is important to note the crosswind component before take-off and then re-assess it during the downwind leg of the circuit. It is also necessary to select a landing area well clear of obstructions, especially just up wind of the ground run area.

2. **Wind limits.** On your GS solo you will have flown in reasonably light winds with little or no crosswind component. Although the same limits still apply for your AGT solo (wind strength 20 kt max, crosswind component 5 kt max) you will be taught to fly dual sorties in stronger wind conditions (25 kt max and 11 kt max respectively).

3. **Estimating Crosswinds.** You will need to be able to estimate the crosswind before take-off and when airborne. This is best done by estimating the angle between the runway and the wind and then using the following table.

Angle	Crosswind
0°	Nil
15°	Quarter of wind strength.
30°	Half of wind strength.
45°	Three quarters of wind strength.
60° +	All of wind strength.

e.g. 20 kt wind, 30° to the runway
= half of wind
= 10 kt crosswind.

4. **Take-off.** On the ground run of the take-off it is important to keep the wings level and maintain a straight track. The crosswind will try to lift the into wind wing and also weathercock the aircraft. See Fig 21.

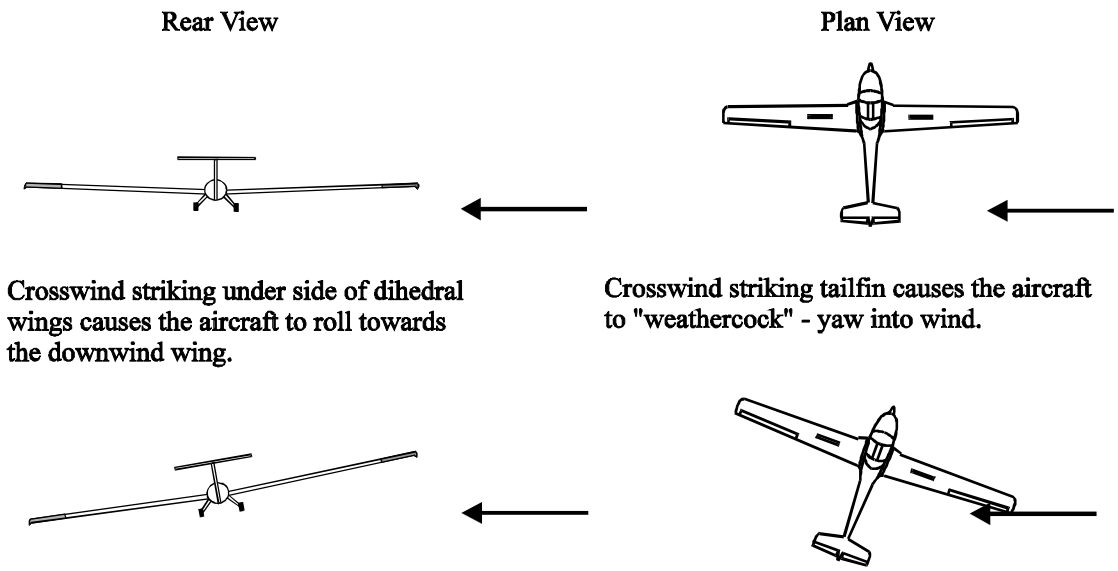


Fig 21. Effect of crosswind on ground run.

5. **Circuit.** Once airborne it is important to allow for the crosswind and adjust your heading to ensure that the aircraft's track over the ground is correct. Your instructor may refer to opening and closing crosswinds. An opening crosswind is one that drifts your circuit away from the airfield and requires extra consideration to prevent the aircraft from being pushed out of gliding range of the airfield. A closing crosswind drifts your circuit towards the airfield and requires extra consideration to prevent the aircraft from being drifted over the top of the landing area whilst heading downwind.

6. **Approach.** If the aircraft is pointed directly down the runway the crosswind will cause it to drift away from the desired track. To prevent this from occurring an into wind heading must be selected (Fig 22). This offset heading is selected using co-ordinated controls to turn the aircraft into the crosswind. The amount of heading offset used will depend on the strength of the crosswind and will typically reduce slightly as the ground is neared and the windspeed reduces. The heading should therefore be adjusted during the approach using small co-ordinated turns. Throughout the approach the normal approach workcycle (Attitude – Airspeed – Aiming Point – Alignment) is used.

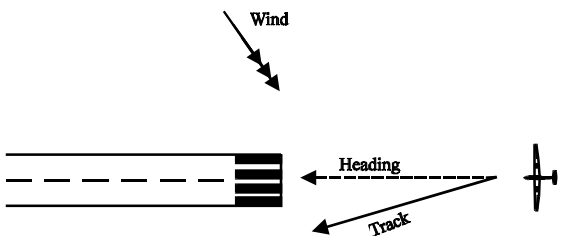


Fig 22a. Effect of Crosswind.

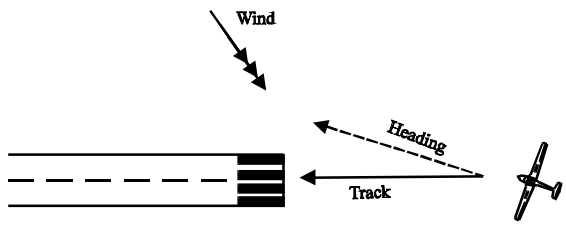


Fig 22b. Use of Offset Heading.

7. **Roundout and Landing.** During the roundout it is initially necessary to maintain the offset heading to prevent the aircraft from drifting, however if the aircraft is landed with this offset heading still applied significant damage may occur. Therefore as the aircraft is placed into the landing attitude the rudder is used to yaw the aircraft straight (such that its track and heading coincide). Whilst the aircraft is being yawed straight it will be necessary to hold the wings level using opposite aileron to overcome the further effect of the rudder (roll in the same direction as the yaw). If the yaw is timed well the aircraft will touch down without any drift and a crosswind landing will have been successfully achieved. Once on the ground the same considerations apply as to the take-off ground roll (Fig 21). These effects will become more noticeable and require larger control inputs to correct as the aircraft's speed reduces and the controls become less effective. It is very important not to lock the wheel brakes on during the ground roll as the aircraft will skid whilst yawing into wind resulting in a rapid loss of control.

8. Once you have practised the crosswind landing technique you will practise using the aiming point technique (chapter 9) to ensure that you can land accurately, towards the beginning of the DLA, in a crosswind.