VIGILANT TRAINEE GUIDE

FTP 124

ISSUE 1

Central Gliding School

Produced by the
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AMENDMENT RECORD SHEET

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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 kts 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 kts in level flight and the glide and 55 kts 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. The only places where parachutes are to be are: in the cockpit, on the parachute rack overnight (or being carried to and from), or in the airfield caravan. Parachutes 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).

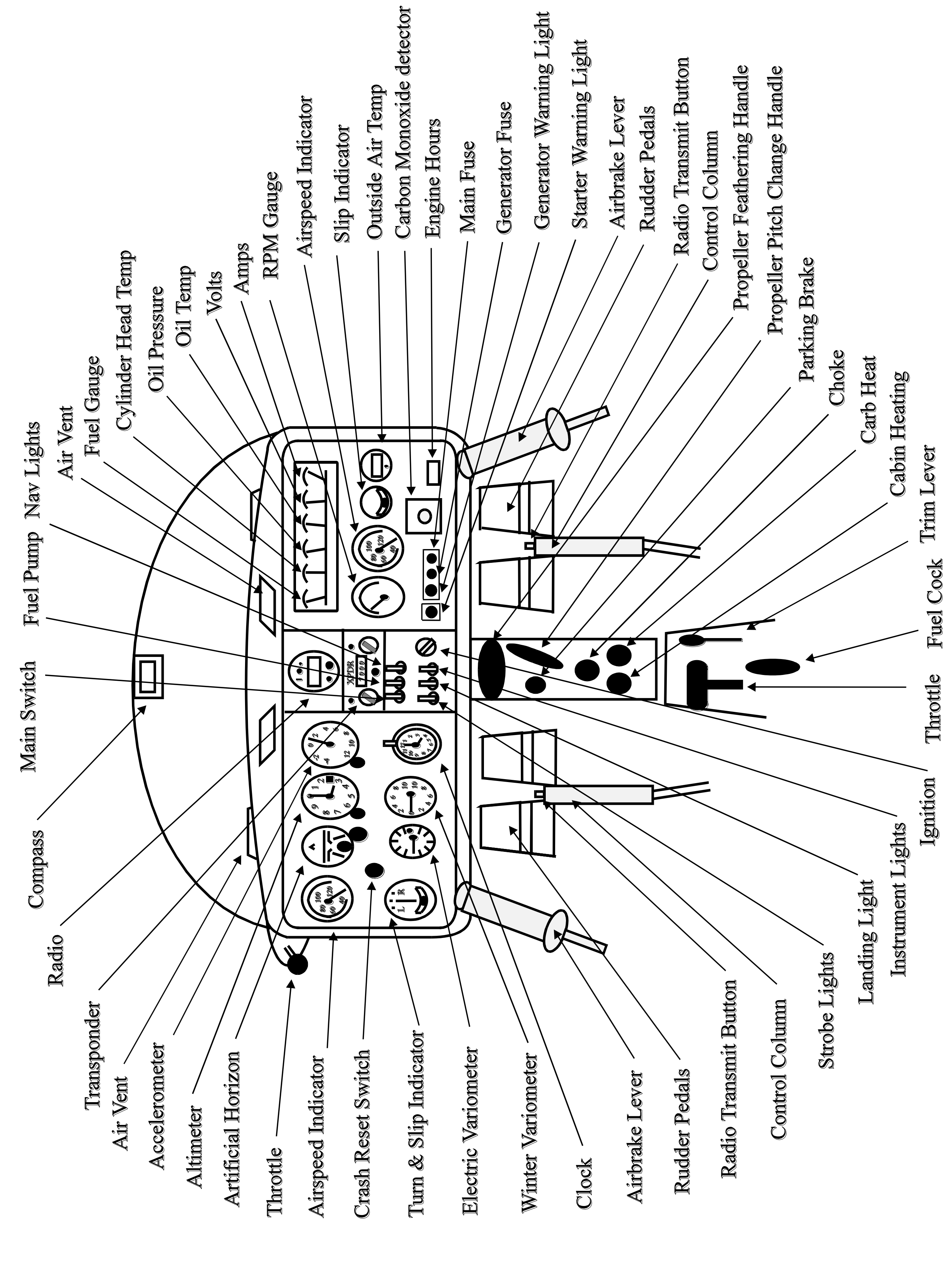


Fig 1. Cockpit Layout Vigilant T Mk 1

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 13 in this study guide. To be awarded GS silver wings you must also complete exercise 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. Trainees proceeding onto AGT 2 will also complete exercise 21.

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 at all unclear on 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.

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 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 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.

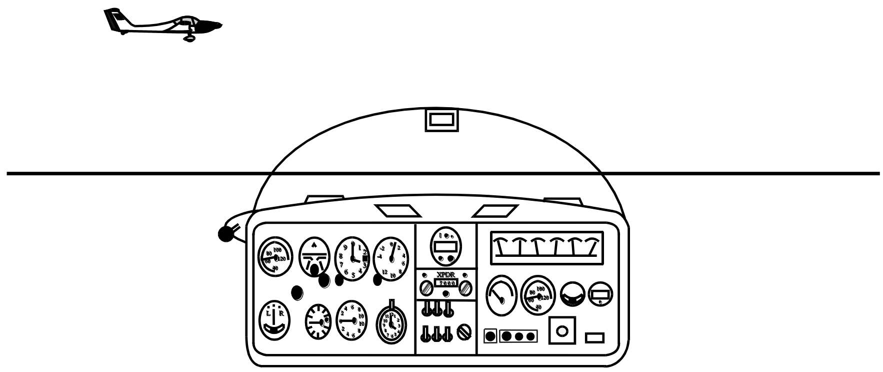


Fig 2. "Aircraft left 11 o'clock high".

3. **Follow through 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 kts, 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.

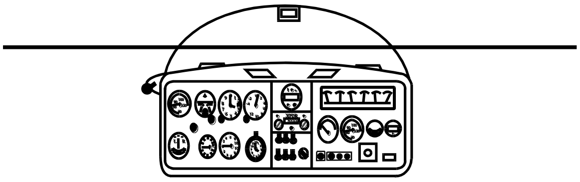


Fig 3a. Normal Level attitude.

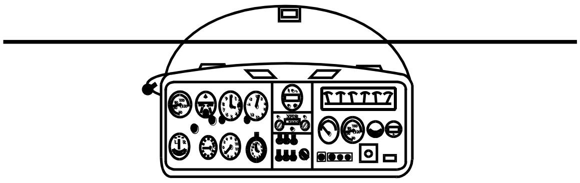


Fig 3b. Normal gliding attitude.

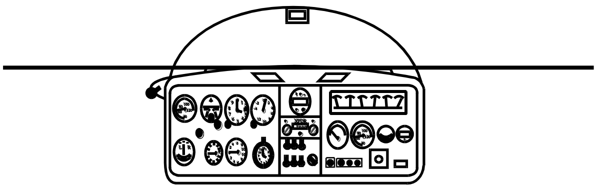


Fig 3c. Normal climbing attitude

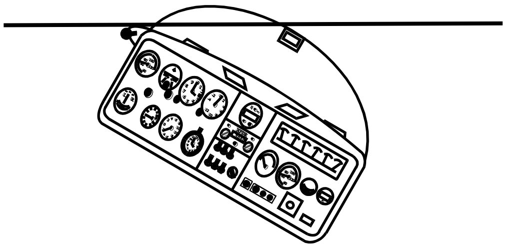


Fig 3d. Banked attitude to the right.

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

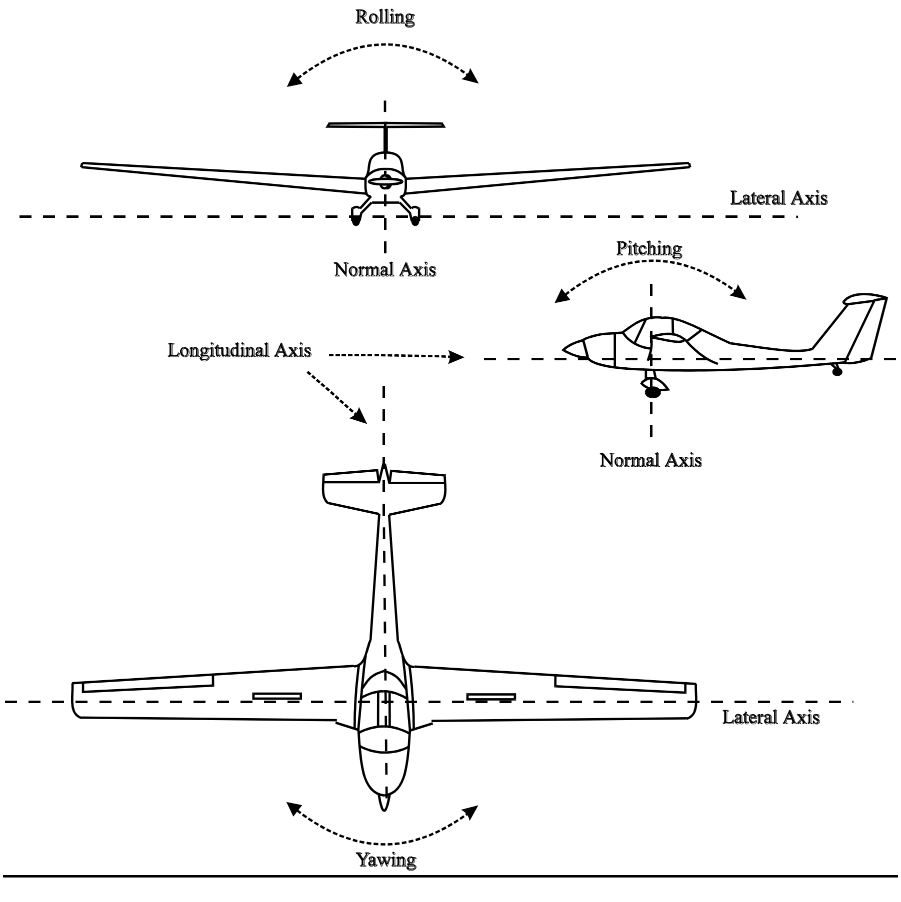


Fig 4. Movement about the three axes.

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. Returning the rudder to neutral restores balanced flight with the slip ball central.

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 kts. At lower airspeeds the response of the controls 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 kts and 70 kts.

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 5). 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. This co-ordination of aileron and rudder is necessary to ensure balanced flight.

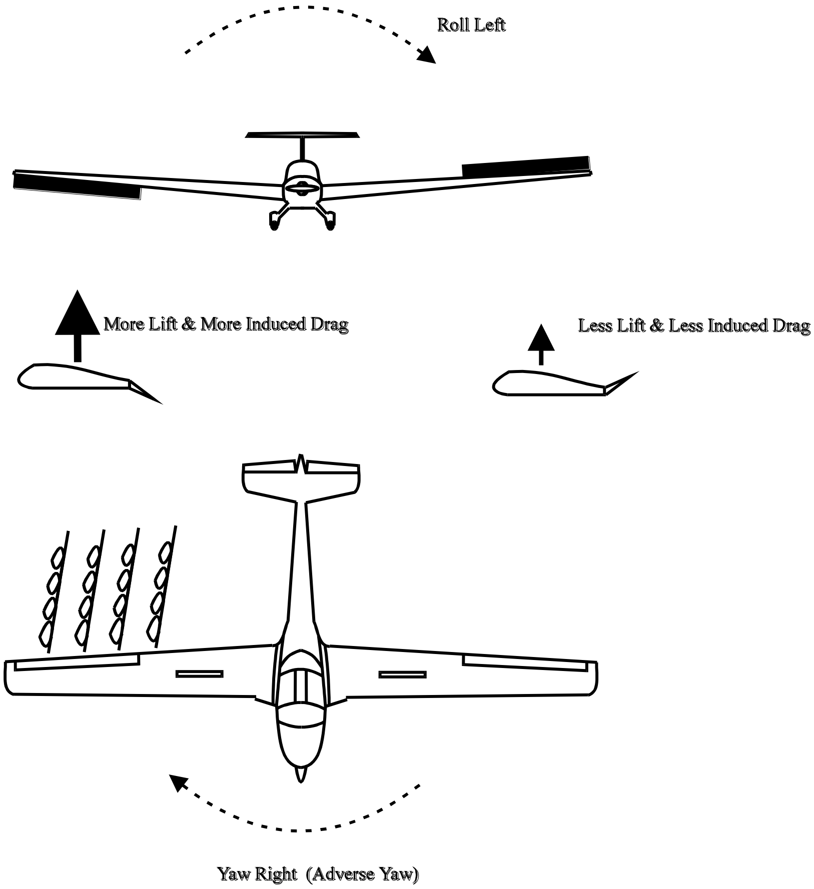


Fig 5a. Aileron drag inducing Adverse Yaw.

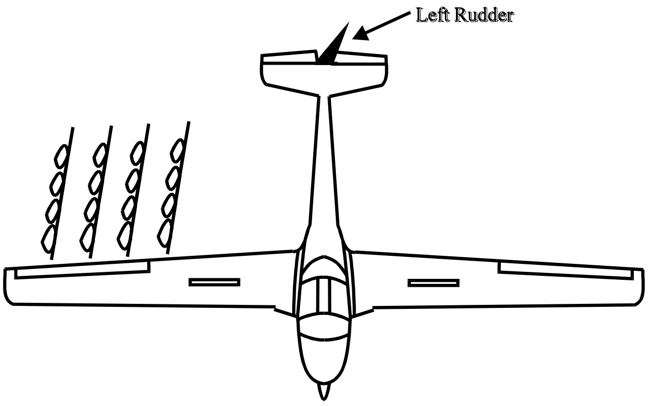


Fig 5b. Rudder overcoming Adverse Yaw

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.

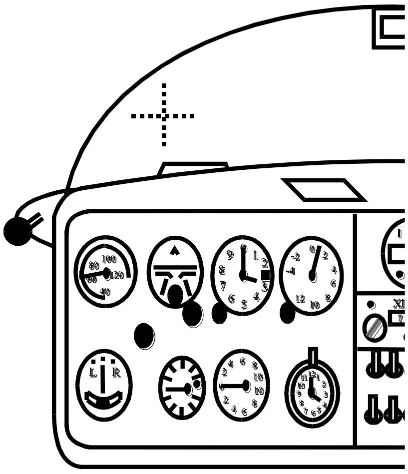


Fig 6. The view straight ahead from the left hand seat.

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 kts, 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, checking the balance on the slip ball.

EFFECTS OF CONTROLS – 2, ENGINE START AND TAXY

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

Engine Start and Taxy.

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 taxy. 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 taxying 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 taxy 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 taxy.

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 selected off 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 such as 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. **Taxy checks.** After starting the engine the aircraft is taxied clear of the dispersal and any obstructions. The taxy checks must then be carried out in accordance with the FRC's. However, because the aircraft will be in motion, these checks must be done from memory.

a. Wheel brakes. Check wheel brake operation by taxying 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.

5. **Taxying.** 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, and 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 taxying 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 and the control column must be held centrally back. When taxying 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 greater the number of inputs. Also, the speed is likely to increase so great care is required. During cross wind taxying 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 of the pedals. 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.

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.

Recover 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. Trim as required.

d. Check for accuracy, by relaxing on the control column.

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.

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. One recommended pattern is to lookout as far as possible in one direction along the horizon, then scan above and below the horizon as your eyes travel back to the front of the aircraft. Confirm the correct attitude is being maintained or 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. Finally look above the aircraft before re-checking attitude and instruments and then start the whole 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 ground ►Effects of Controls 1◄, paragraph 2.

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

a. Wings level.
b. Normal level attitude.
c. Airspeed 60 kts.
d. Aircraft neither climbing nor descending (approx 2,300 rpm set).
e. Aircraft in balance.
f. Flying on a constant heading towards a reference point on the nose.

You will then be taught how to achieve straight and level flight from a descending, banked attitude. This is accomplished by using co-ordinated controls to roll the wings level, selecting the correct pitch attitude, then ensuring that the aircraft is in balance, trimmed correctly and that the RPM is correct. 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.

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

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

(1) Select the attitude - use co-ordinated controls to roll wings level, then pitch to the correct attitude.

(2) Hold the attitude - check speed.

(3) Check trim - adjust as necessary.

(4) Check in balance and maintaining a constant heading.

(5) Check maintaining level flight - 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 kts), 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.

(8) 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).**

(1) **Gaining.** If tending to gain height (more than 100 ft), open airbrakes, maintaining 60 kts, use anticipation to close airbrakes just before regaining DH.

(2) **Losing.** If tending to lose height (more than 100 ft), increase engine RPM, maintaining 60 kts, use anticipation to reduce RPM to 2300 20 ft (1 notch on altimeter) below DH.

4. **Transitions.** Whenever a transition is made between glide, 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 glide) then the order of actions is Attitude, Power, Trim (**APT**). Where the change involves an increase in power (i.e. level to climb) the order is Power, Attitude, Trim (**PAT**). In practise these are not really separate actions, but are coordinated. In the case of APT the forward movement of the control column should slightly lead the closing of the throttle; 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 above, in front and behind.

(2) Carb-heat – In (Cold)

(3) Apply full power smoothly and select climb attitude (55 kts).

(4) Trim as required.

(5) Check engines instruments - all indications in green or amber arc.

(6) Resume normal scan (LAI).

b. **Transition from climb to straight and level (APT).**

(1) Look out - especially ahead and below.

(2) Select Carb Heat - Hot.

(3) Select attitude for level flight (60 kts). Once 60 kts is achieved reduce power to about 2300 RPM (actual RPM varies from aircraft to aircraft).

(4) Trim as required.

(5) Resume normal scan (LAI).

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

(1) Look out - especially below.

(2) Select glide attitude (65 kts) and close throttle completely. ◄

(3) Trim as required.

(4) Resume normal scan (LAI).

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

5. **Achieving and maintaining Datum Height (DH)**. The next part of the exercise will involve you practicing achieving straight and level flight at a given datum height and then maintaining this height using throttle and airbrakes. This exercise requires a little anticipation to prevent the datum height being overshot.

a. Select Carb-heat out (Hot) approximately 50-100 ft before reaching the datum height.

b. On reaching the datum height select level flight as normal; anticipate DH by approx 20 ft.

c. Start the lookout scan as normal.

d. ATTITUDE – maintain straight and level attitude and wait for airspeed to settle at correct speed.

e. POWER – sat 2300 RPM once 60 kts has stabilised.

f. TRIM.

g. Check for correct RPM if height is consistently lost or gained; an incorrect power setting is a frequent cause for error.

h. Use power or airbrakes to make corrections, as in para 3.d. above.

6 **Approach Attitude.** On the last part of this exercise, you will be taught how to set up and maintain the approach attitude at 65 or 70 kts. The exercise will be carried out in the upper air away from the circuit, and is in preparation for Ex 9 (Approach and Landing). The method is as follows:

a. LOOKOUT – especially below.

b. ATTITUDE – select the approach attitude for 65 or 70 kts (your instructor will define which) and wait for the aircraft to accelerate and stabilise.

c. POWER – set idle power once approach speed is achieved.

d. TRIM.

e. MAINTAIN – lookout, especially below.

f. ATTITUDE – to maintain approach speed.

g. INSTRUMENTS – check speed and balance.

You will be given the opportunity to practice this once your instructor teaches you.

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 that the final turn, approach and take-off run are completely clear.

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

(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 heels are on the floor (toes clear of brakes).

b. **Ground roll.**

(1) Smoothly open the throttle to full, taking 2 to 3 seconds. Check achieving at least 2550 RPM, oil pressure 3 bars minimum and ASI indicating a positive increase.

(2) 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.

c. **Lifting off.**

(1) 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) When the airspeed reaches 55 kts select the normal climb attitude.

d. **Normal climb.**

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

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

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 maintained but the lookout is biased towards the direction that you are turning. 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 stick will be necessary to maintain the correct pitch attitude whilst turning. We do not normally trim out this force except for prolonged turning.

a. **Maintaining the turn.**

(1) Lookout into the direction of the turn, particularly at horizon level.

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

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

b. **Entering the turn.**

(1) Before entering any turn you must lookout. Start in the direction of the intended turn but scan right around the horizon to look away from the turn as well. Check above and give a final look in the turn direction. If it is clear look ahead.

(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.

The work cycle is therefore Lookout, Attitude, Instruments **(LAI)**.

c. **Exiting the turn.**

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

(2) As soon as this attitude is achieved, look out to check the area which had been masked by the raised wing during the turn.

(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.

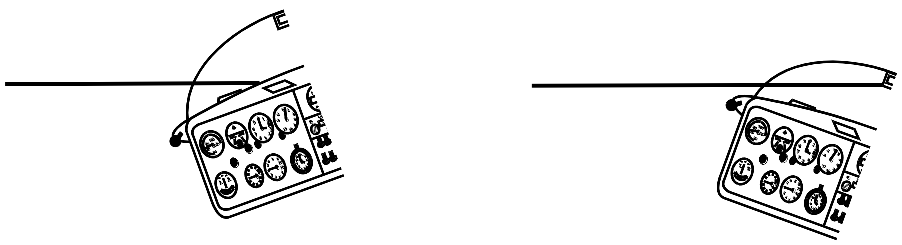


Fig 7. Turning attitudes - Left and Right.

5. **Rolling out onto a selected 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 learned in lesson 6.

d. Continue the normal scan.

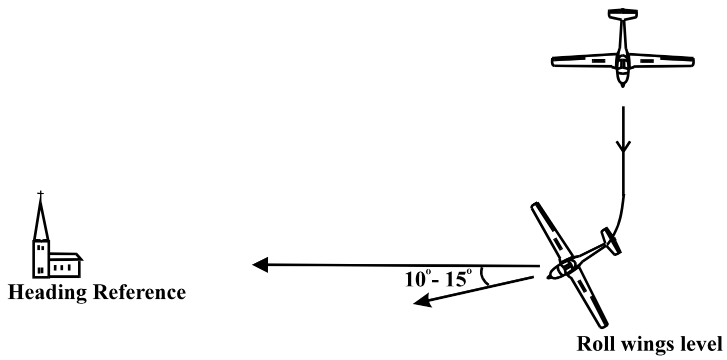


Fig 8. **Rolling out onto a selected feature.**

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. Otherwise the same technique is applied as for a level turn.

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, yet 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. Otherwise, the same technique is applied as for a level turn.

8. **Recovery from an overbanked turn.** If the angle of bank exceeds 45° and the airspeed begins to increase, trying to reduce speed using the elevator is ineffective and results in the ‘G’ loading on the aircraft increasing. (Effects in a banked attitude ground lesson 4). The correct recovery action is to :

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

b. Adopt correct pitch attitude using the elevator.

c. Regain datum attitude, and re-enter the turn if required.

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

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 finals.

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).

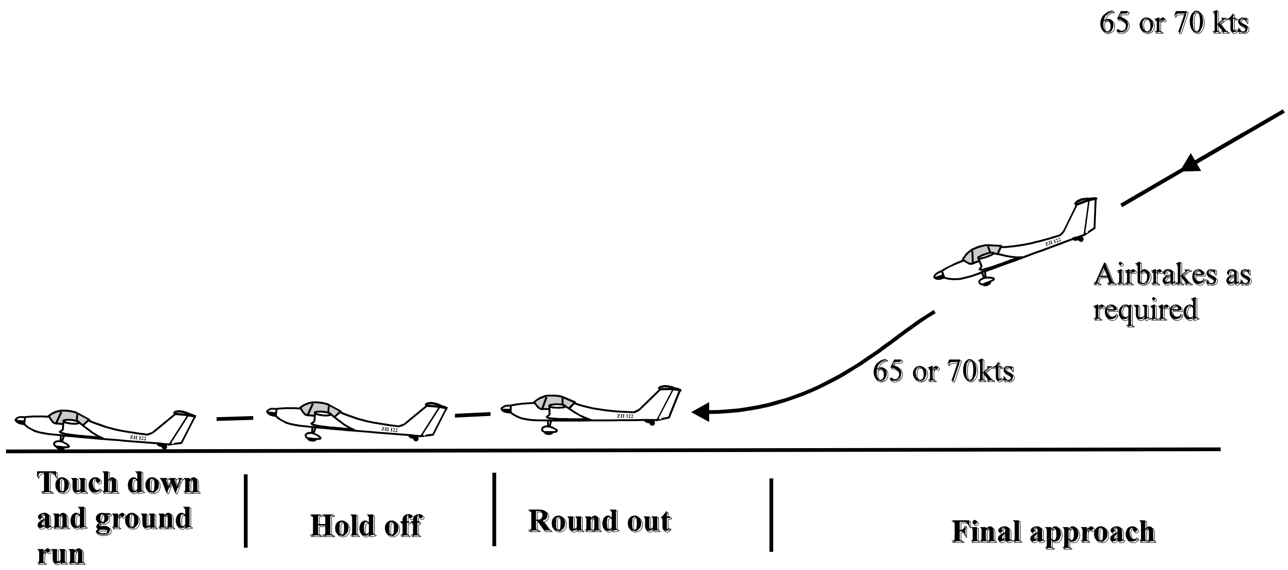


Fig 8. **Approach and Landing.**

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.

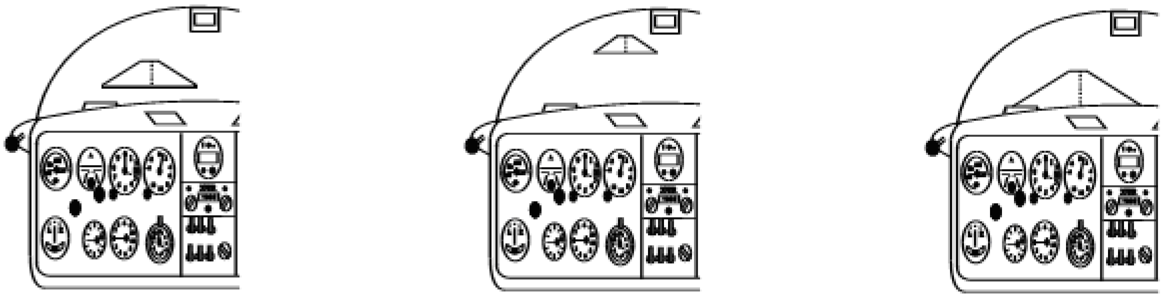
a. **Appearance of the normal approach.** As per fig 9a. Because we increase speed on the approach, we have a slightly lower nose attitude than the normal gliding attitude.

b. **Airspeed.** We check this is correct (65 - 70kts 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 9. **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 heating in (cold), 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 three 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 taxying. 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 flight is not over until this is achieved.

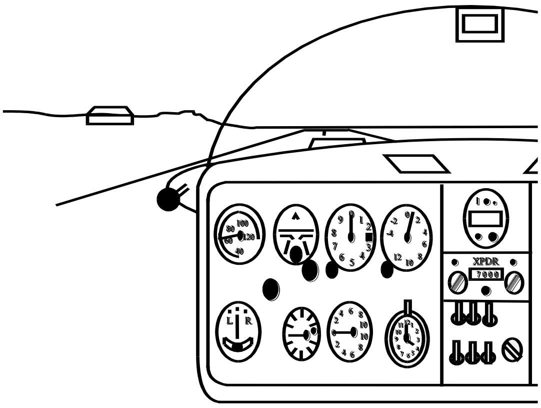


Fig 11. The Landing or Touch down attitude.

5. 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 the airbrake setting.

(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 taxy clear of the runway.

(8) Complete the after landing checks.

6. **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 airbrake setting.

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

d. Land as usual.

7. **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.

STALLING

AIM To monitor the speed and prevent the stall.

To recognise and recover from stalls with minimum height loss.

1. **Airmanship.** Before we deliberately stall the aircraft we always carry out the Pre-stalling checks from the FRCs. These are known as the HASELL checks from their mnemonic and provided that we cover them conscientiously we may be sure that it is safe to proceed. The checks are repeated in an abbreviated form (HELL) 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 a developing stall, so that you can prevent it from happening.

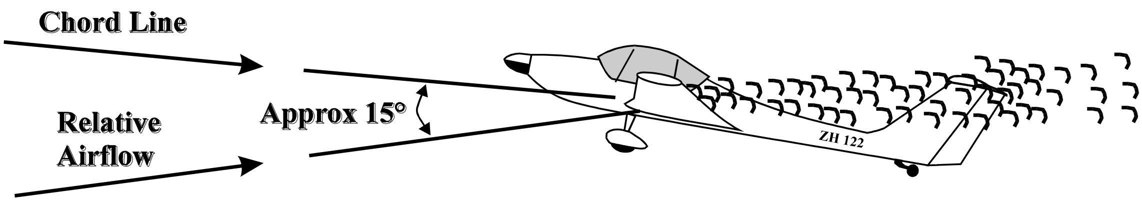


Fig 12. The approaching stall.

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

H **Height.** Sufficient to recover by 1200 ft MSD, within gliding range of the airfield.

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

S **Security.** Harnesses tight. 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.

4. **Reduced 'G'.** During the stall it is possible that you will experience a sensation of approaching weightlessness or reduced 'G'. You will have clearly demonstrated to you 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!!

5. **The full stall.** There are four symptoms of the full stall which may appear individually or in any combination.

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

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

c. Increased sink.

d. Wing drop.

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 kts).

c. Roll the wings level if necessary.

d. Return to the correct attitude confirming that the aircraft is in balanced flight.

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. Relatively nose high attitude.

b. Decreasing airspeed.

c. Decreasing airflow noise.

d. Decreasing control effectiveness accompanied by sloppy feel.

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. Recognise one or more signs of the approaching stall.

b. Select the correct attitude.

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 probably prove 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 noticed.

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

a. Recognise the first sign(s) of the approaching stall.

b. Close the airbrakes whilst simultaneously reselecting approach attitude.

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

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, 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.

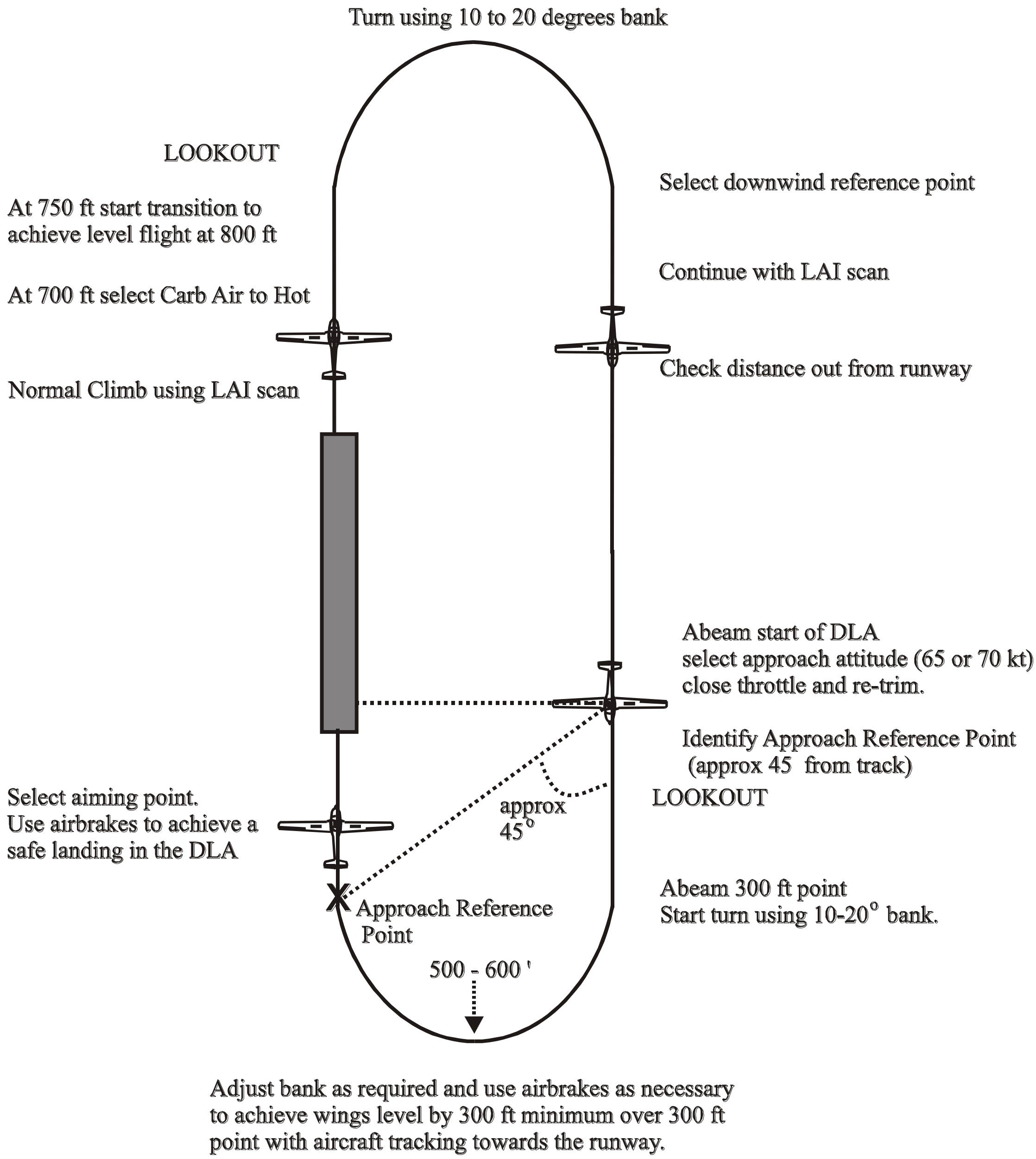


Fig 13. The Vigilant circuit.

2. a. **Take off.**

(1) FRC - Pre take-off checks.

(2) Line up and take off.

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

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

b. **Level.**

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

(2) At 750 feet start transition to achieve level flight (60 kts) at 800 ft (Approximately 2300 RPM).

(3) Look out, turn through 180° using 10-20° angle of bank.

c. **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.

(4) Abeam the touchdown point select the approach attitude (65 or 70 kts), close the throttle and re-trim. Identify the

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

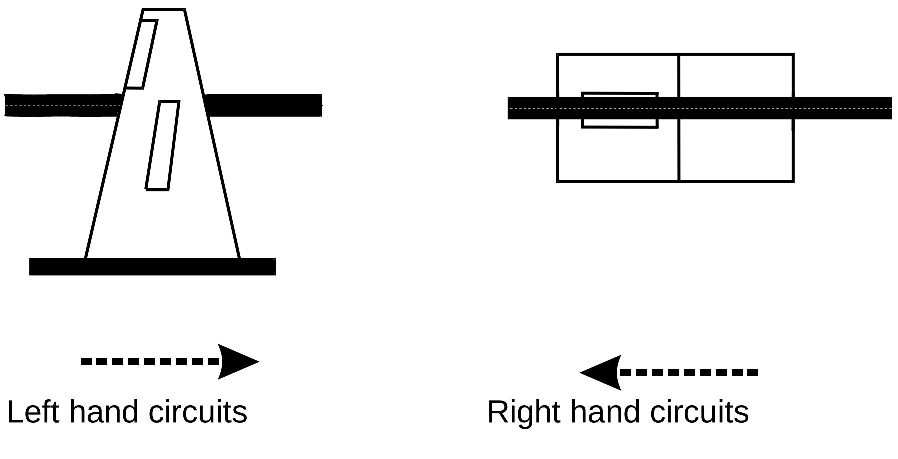


Fig 14. Checking distance out from runway.

d. **Final turn.**

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

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

(3) 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 – 400 ft, minimum height 300 ft). Use airbrakes as necessary to achieve a minimum of 300 ft at ARP.

(4) By half way round the turn, place your left hand on the airbrake lever and ensure that your heels are on the floor with your toes clear of the wheel brakes.

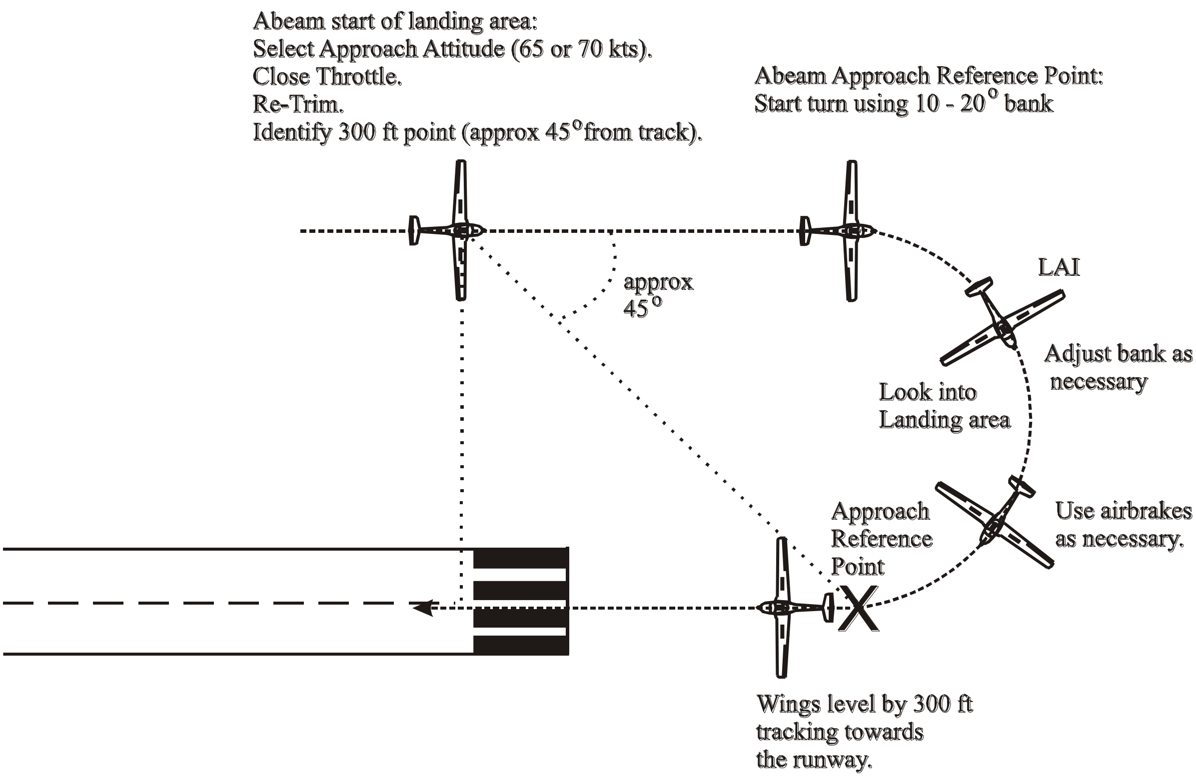


Fig 15. The Final Turn

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.

CIRCUITS – (800 ft or 1000 ft Rectangular)

AIM To fly a rectangular circuit.

1. **Airmanship.** On a few VGSs, it is not possible to fly the oval-ended circuit as described in Ch 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.

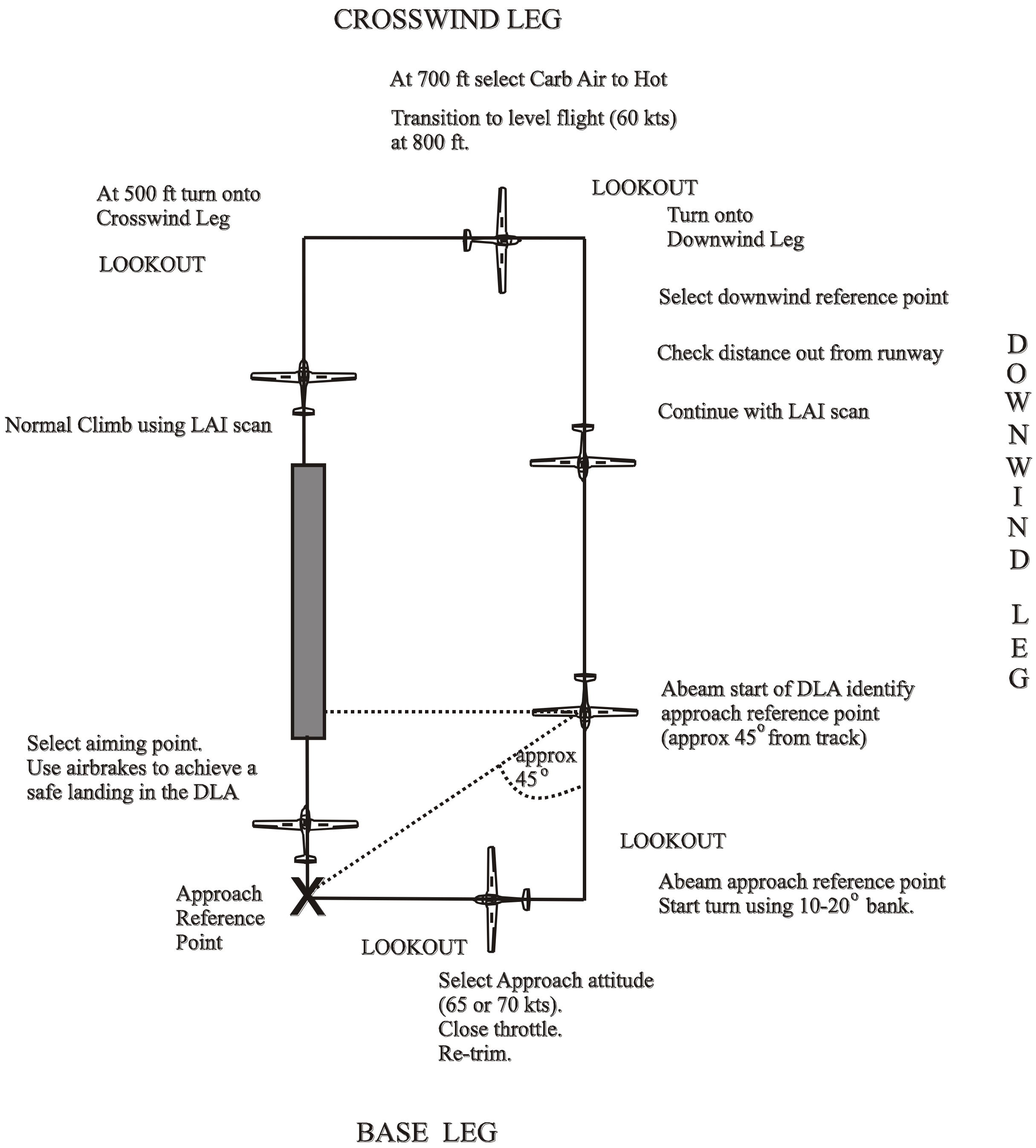


Fig 13. The Vigilant 800 ft rectangular circuit.

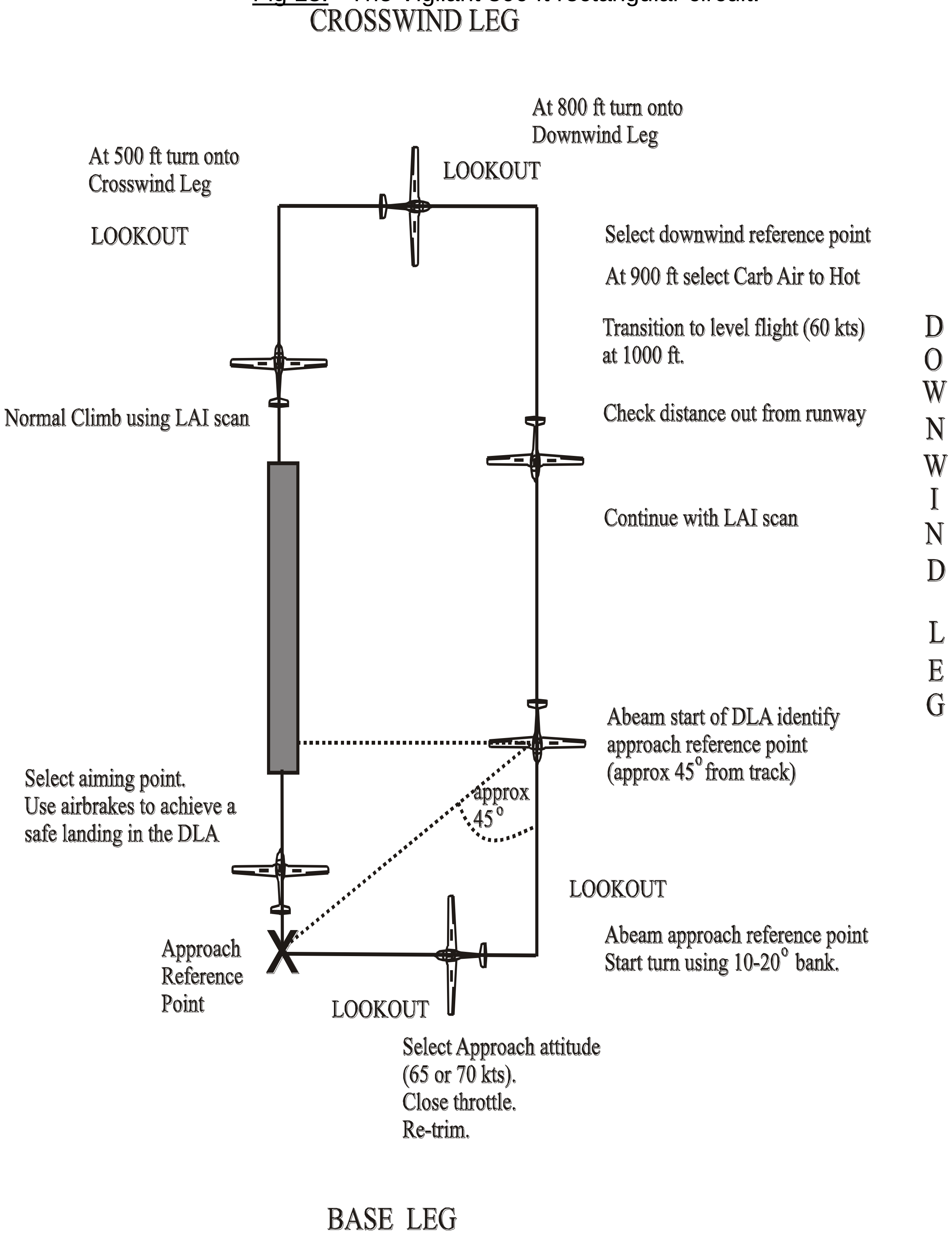


Fig 13. The Vigilant 1000 ft rectangular circuit.

2. a. **Take off.**

(1) FRC - Pre take-off checks.

(2) Line up and take off.

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

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

(5) Approaching 500 ft start a pre-turn look out.

(6) On reaching 500 ft turn onto the crosswind leg using 10-20º angle of bank.

b. **Crosswind.**

(1) Identify new reference point and continue climb using LAI work cycle.

(2) **800 ft circuit only:** At 700 ft select Carb Air to Hot.

(3) **800 ft circuit only:** Approaching 800 ft start transition to level flight (60 kts)

(4) Lookout and turn downwind.

(5) **1000 ft circuit only:** Approaching 800 ft start a pre-turn look out.

c. **Downwind.**

(1) **800 ft circuit only:** Identify new reference point and continue level flight, using LAI work cycle.

(2) **1000 ft circuit only:** On reaching 800 ft turn onto the downwind leg using 10-20º angle of bank.

(3) **1000 ft circuit only:** Identify new reference point and continue climb using LAI work cycle.

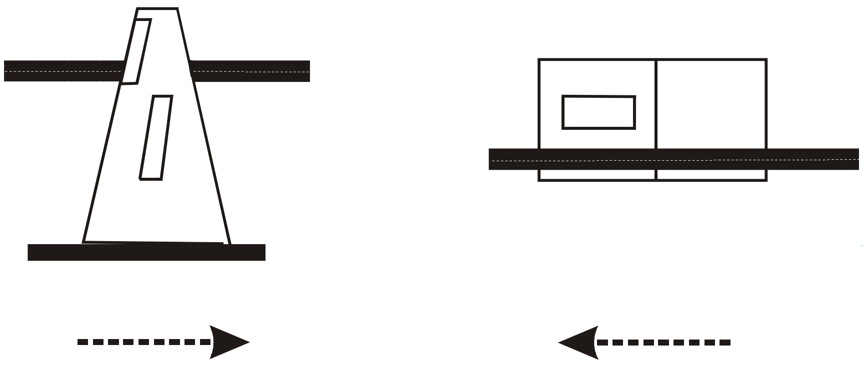
(4) **1000 ft circuit only:** At 900 ft select Carb Air to Hot.

(5) **1000 ft circuit only:** Approaching 1000 ft start transition to level flight (60 kts).

(6) **Both circuits:** Confirm distance out. On a right hand circuit the runway should appear close to the bottom of your instructor's DV panel. On a left hand circuit it should appear just beyond the airbrake on the wing (See Fig 14).

(7) Abeam the touchdown point identify the Approach Reference Point on the final approach (approximately at 45º from track).

(8) Continue downwind until abeam the approach reference point.



Left hand circuits Right hand circuits

Fig 14. Checking distance out from runway.

c. **Base Leg.**

(1) Passing abeam the Approach Reference Point (ARP)perform a pre-turn lookout and then turn onto base leg using 10-20º angle of bank.

(2) On exiting the turn select the approach attitude (65 or 70 kts), close the throttle and re-trim.

(3) Lookout to check that the approach and landing area is clear.

d. **Final turn.**

(1) Anticipate the final turn such that you pass over the ARP tracking towards the runway.

(2) Place your left hand on the airbrake lever and ensure that your heels are on the floor with your toes clear of the wheel brakes.

(3) Continue with the approach and landing as in chapter 9.

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 offset the heading on both the crosswind and base legs and also move the approach reference point 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 during the initial climb and downwind legs.

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.

POWER LOSS AFTER TAKE OFF (PLATO)

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

1. **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.

2. 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.

3. **Partial power loss above 400ft or able to climb to 400ft.** If a reduction in RPM occurs it may be possible to maintain height. This will usually require a minimum of 2300 RPM.

   a. Lower the nose to an attitude to achieve 60 kt (approach attitude if below 400ft).

   b. Check height and RPM.

   c. When time permits check for the cause of the partial power using the following checks.

T	Throttle …………	Select fully open
C	Carb Heat ……..	In (COLD). Out (HOT) if carb icing suspected.
C	Choke …………..	IN
F	Fuel …………….	Cock ON, Pump ON

   d. Confirm you are above 300ft, if so turn downwind, maintaining 60kts. If not continue climbing until 300ft has been achieved and then turn downwind using a maximum of 30° of bank, turn back towards the airfield.

*Note – c and d above may be carried out in either order depending on the severity of the engine failure and local weather conditions. The priority must always be to ***fly the aircraft.***

   e. Fly downwind monitoring height, airspeed and RPM.

   f. Give a radio call if time permits.

   g. If aircraft descends to 400 ft or before the final turn select the approach attitude.

   h. Intercept the normal approach if possible; if not start the final turn by 300ft.

i.   Level wings by 100 ft and accept landing area ahead.

j.   Close throttle when confident of making landing area.   Ensure approach speed is maintained.

4.   **Partial power loss below 400ft and unable to climb.** If a reduction in RPM occurs it may not be possible to maintain 400ft. This will usually occur if the maximum RPM available is less than 2300RPM. If the aircraft is below 400ft and is unlikely to continue climbing to 400ft whilst safely maintaining 60 kts then land ahead.

a.   If it is possible to land on the remaining runway, close the throttle and treat as a total power loss. If at less than 100ft carry out the recovery as in para 7.

b.   Lower the nose to achieve the approach speed.

c.   Check height and RPM (in this case a mini circuit is not possible).

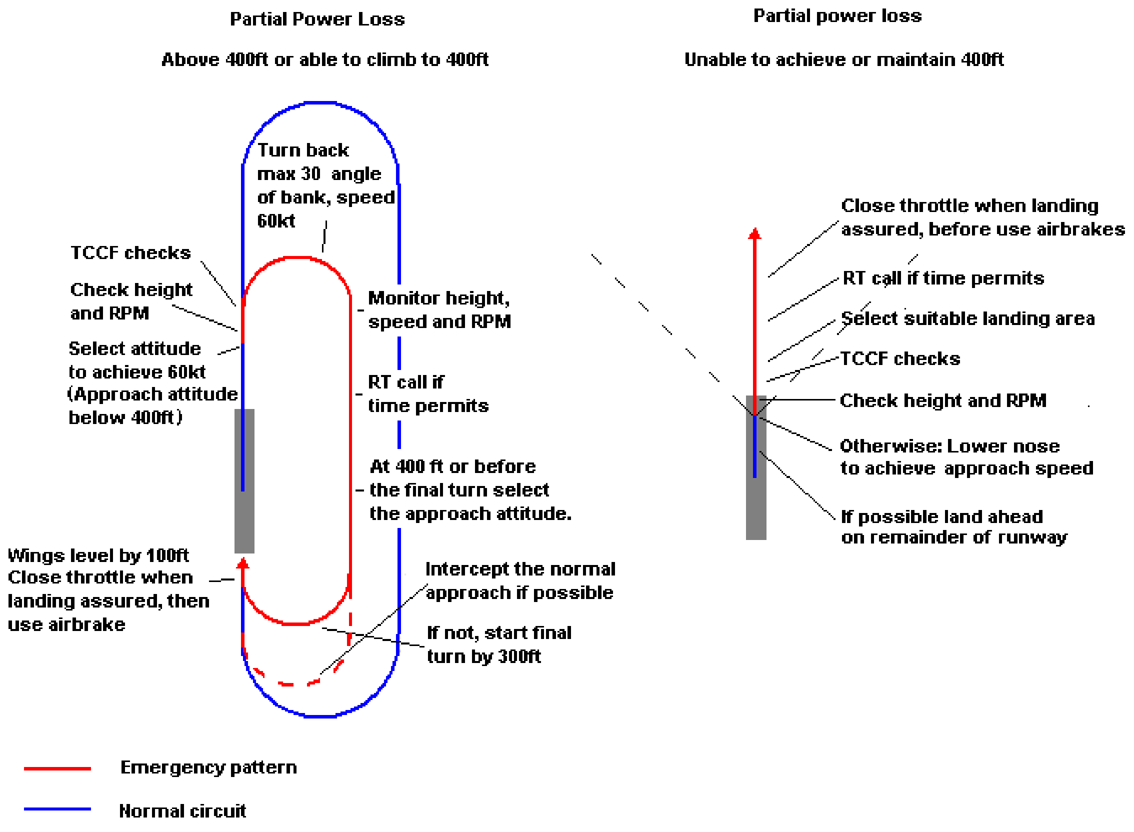
d.   If time permits check for cause of power loss (TCCF).

e.   Select suitable landing area, into wind if possible,(max 45° from runway heading).

f.   Radio call if time permits.

g.   When confident of making landing area - Close throttle before using airbrakes.

The **partial power loss** actions are summarised below:



5. **Total power loss below 500 ft.** In the event of a total engine failure below 500 ft the aircraft will normally be landed ahead, within 45° of the runway heading (this will always be the case for engine failures below 300 ft). The actions to be taken are detailed below.

a. Lower nose to approach attitude.

b. Close throttle.

c. Check height (if above 300ft and ►◄ the landing area ahead is unsuitable continue as per para 6; if below 300ft or the landing area ahead is suitable, select a landing area within a 45° of the nose, into wind if possible.)

d. FIP checks if time permits.

(1) **F**….... Fuel cock – Off
Fuel pump – Off

(2) **I**…….. Ignition – Off

(3) **P**……..Propeller – Feather

e. RT call if time permits.

f. Use airbrakes as required.

6. **Total power loss above 500 ft.** In the event of an engine failure above 500 ft a turn back manoeuvre is flown culminating in a mini-circuit or, where this is not possible, a downwind or crosswind landing. In either case, approach speed should be achieved by 400ft or before turning final.

a. Select attitude to achieve 60 kt.

b. Close throttle.

c. Check height and confirm above 500ft. Continue with turn back towards the airfield using a maximum of 30° angle of bank.

d. Carry out FIP checks (as para 5d)

e. RT call if time permits.

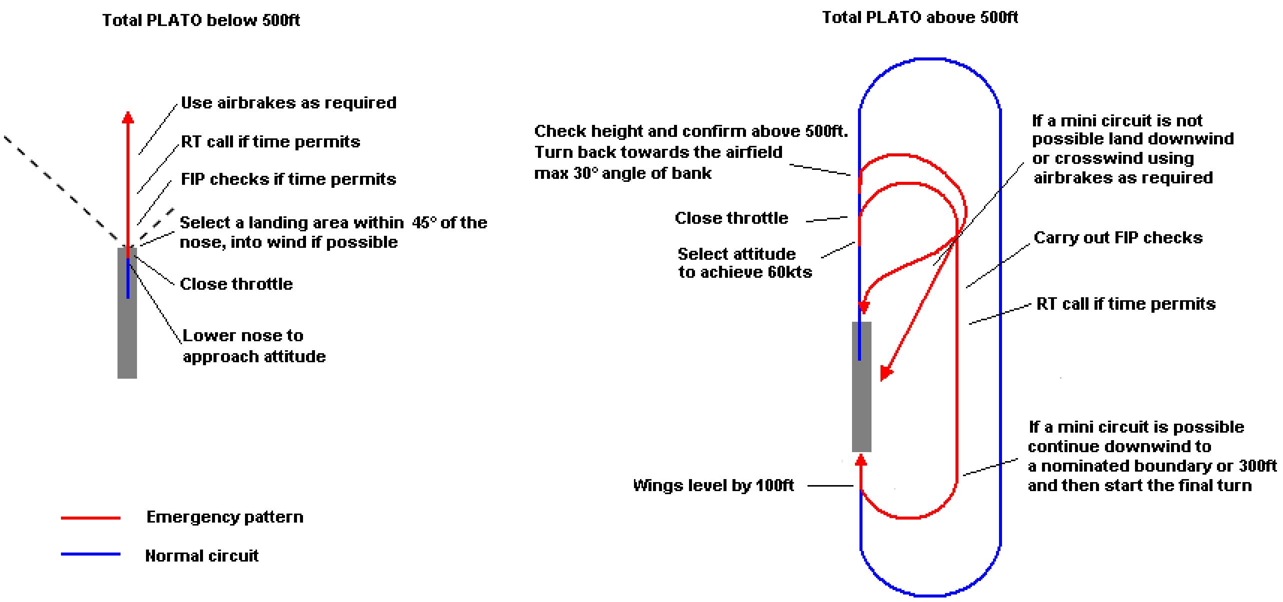
f. If a mini circuit is not possible land downwind or crosswind using airbrakes as required.

g. Ensure approach speed is achieved by 400ft.

h. If a mini circuit is possible continue downwind to a nominated boundary or 300ft ►(whichever comes first)◄ and then start the final turn.

i. Wings level by 100ft. A safe landing anywhere on the DLA is acceptable.

The **Total Power Loss** actions are summarised below.



7. **Power Loss below 100 ft.** When a PLATO or partial power loss occurs below 100 ft the aircraft is to be landed ahead, on the airfield if possible.

a. If possible select the approach attitude. However if very low this may not be possible in which case select the lowest attitude possible.

b. Close the throttle.

c. Attempt to achieve approach speed.

d. If approach speed is achieved open airbrakes gently.

e. If approach speed is not achieved do not use the airbrakes until the hold off attitude has been achieved. During the hold off, use airbrakes with caution if necessary.

8. **Engine fire in the air.** An engine fire in the air will generally become obvious, with smoke in the cockpit and/or a strong smell of burning. The situation should immediately be treated as a PLATO with the FIP checks (see para 5d above) being a higher priority to remove likely causes of the fire. A landing should be made as soon as possible. Once on the ground and having brought the aircraft to rest, leave the brakes off, open the canopy fully, vacate the cockpit and move upwind.

9. **Engine fire on the ground.** The symptoms will be as in para 8. Stop the aircraft, carry out the following checks; leaving the brakes off, vacate the aircraft upwind.

a. F……..Fuel Cock – Off, Fuel Pump – Off

b. I……...Ignition – Off

c. R……..Radio – Emergency call (if time permits)

d. M…….Main switch - Off

10. **Power Loss considerations.**

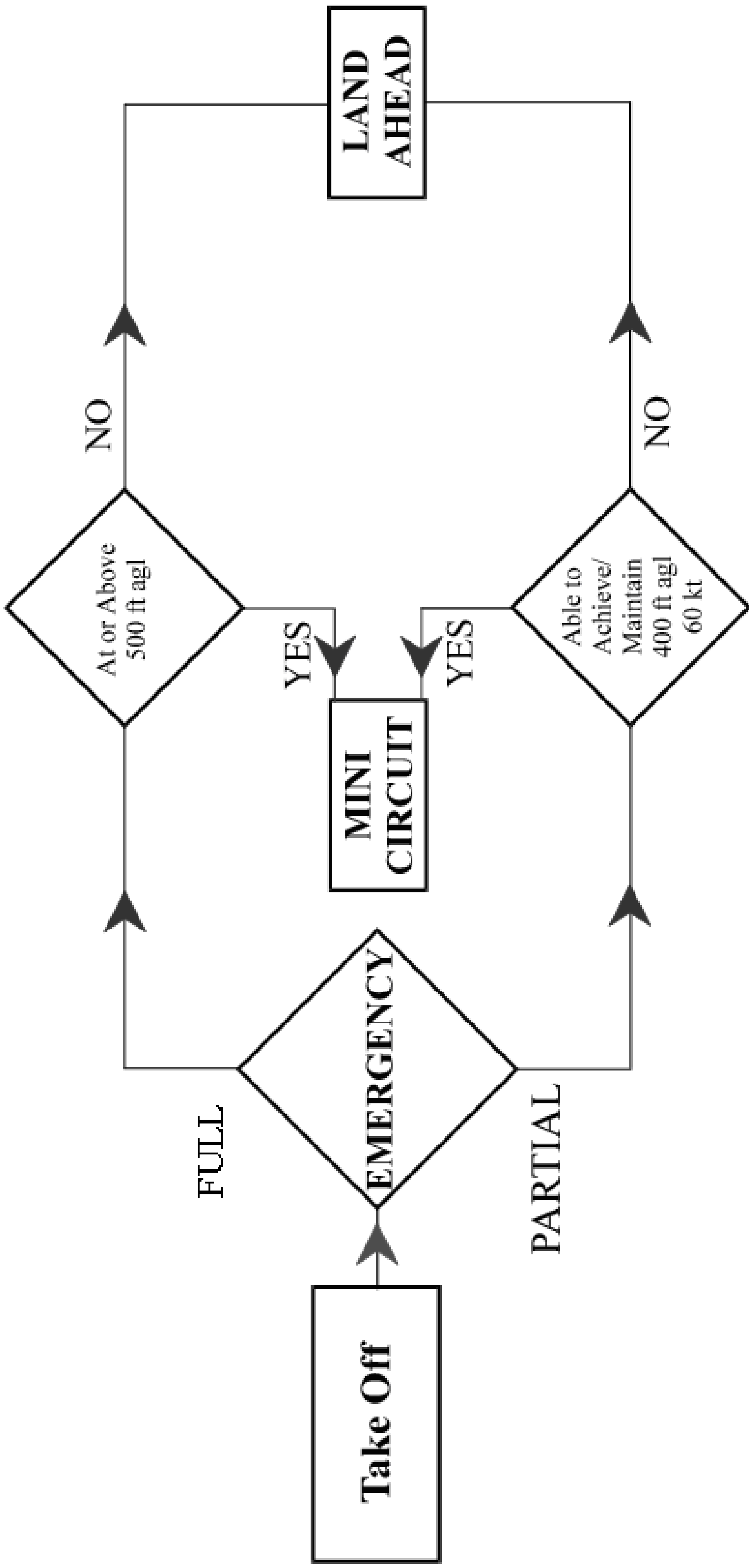


Fig 19. Power Loss Considerations – a flow chart.

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 one simulated partial power loss or full 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 800 ft point 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 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 manoeuvrability 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.

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 and higher rate of descent, more attention must be paid to maintaining orientation and remaining within gliding range of the airfield.

2. You will initially practice the medium turns 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 for the straight glide.

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 kts. 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. A slight increase in power will be required to maintain the correct speed.

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.

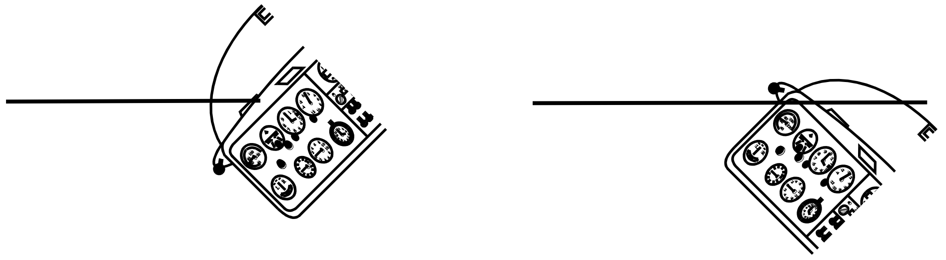


Fig 20.   Turning attitude Left and Right at 45° angle of bank.

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 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 kts max, Crosswind component 5 kts max) you will be taught to fly dual sorties in stronger wind conditions (25 kts max and 11 kts 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 kts 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.

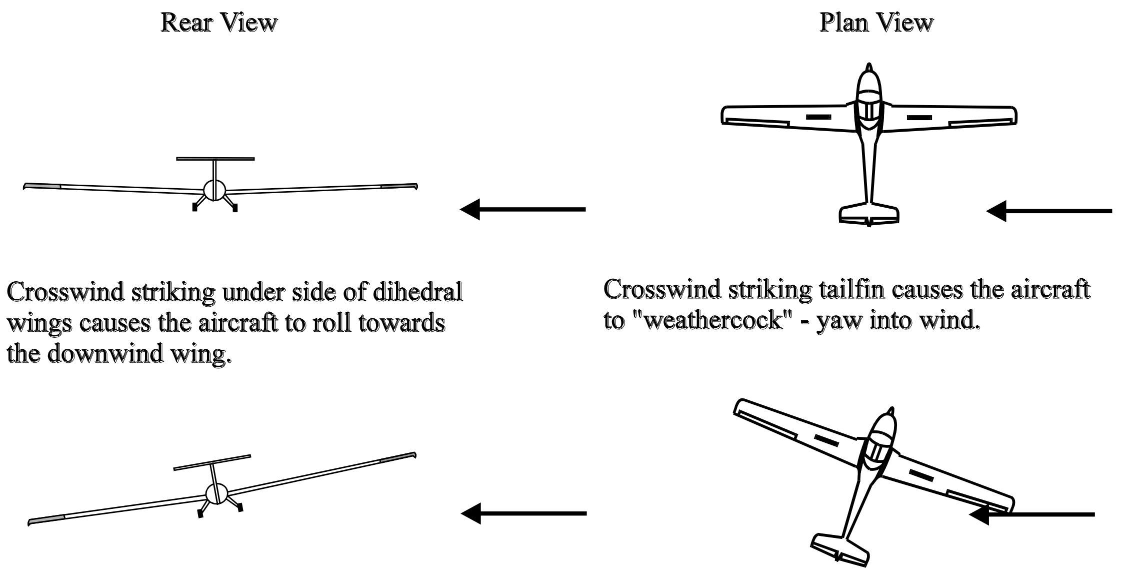
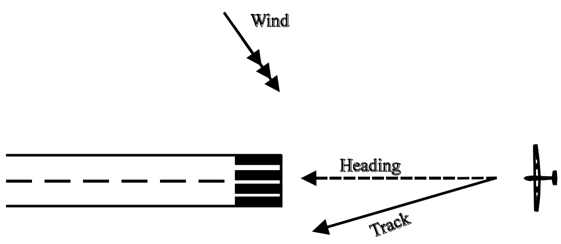


Fig 21. Effect of crosswind on ground run.

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.



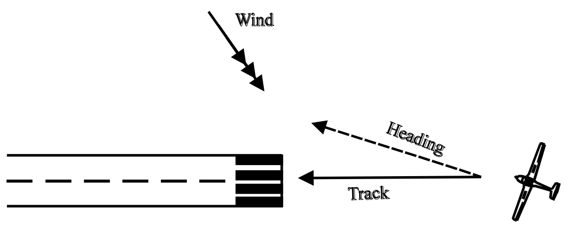


Fig 22a. Effect of Crosswind.

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.

PILOT NAVIGATION

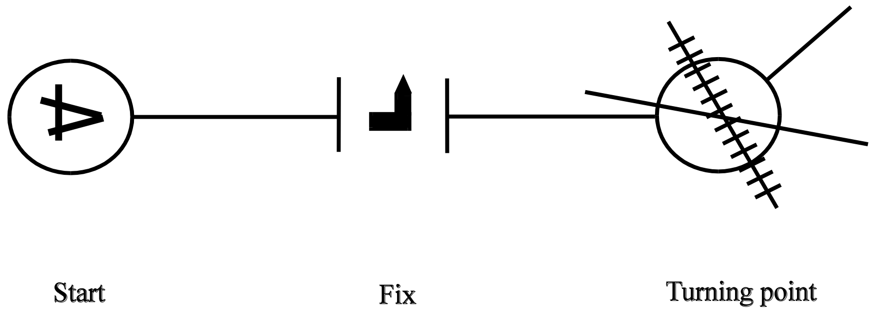
AIM To navigate the Vigilant safely on a pre-planned route using pilot navigation techniques.

1. **Airmanship.** When operating in the lower airspace a good lookout is essential since there will be many other aircraft operating at similar levels. The pilots of these aircraft may be working hard on their own navigation and may be "heads-in" looking at maps or a GPS receiver, additionally the visibility from the typical light aircraft is significantly poorer than that from the Vigilant. It is therefore essential that we "see and avoid" these aircraft. By keeping a good lookout we will also be able to keep an eye on the weather. Should the weather deteriorate we will be able to make an early decision to return to our home airfield or to divert as appropriate. To assist us in maintaining a good lookout we will study the route and the sequence of events before departure, this will allow us to concentrate on the lookout and limit our "heads-in" time to quick confimatory checks of the next event.

Map Preparation

2. **Map Selection.** Your instructor will select the appropriate map for the exercise. This will usually be a 1:250,000 Low Level Helicopter Chart. The problem with this map is that it only shows controlled airspace below 3000 ft. The first step is therefore to mark on the airspace above 3000 ft using an appropriate source (often a 1:500,000 chart).

3. The next step will be to mark the start and turning points on the map. These will already have been chosen by your instructor and will be features that are easily identifiable from the air. On the map they are marked by a circle. The next stage is to select one or more fix points along each leg. Ideally they should be at approximately half or one third and two thirds distance but the ease of identification of the fix is the most important factor in its selection. The fixes are marked by lines at right angles to the track either side of the fix. The track can now be drawn on. The track line doesn't extend through fixes or into start point or turning point circles.



<u>Fig 23.</u> Turning Points and Fixes.

4. The next step is to draw a wind arrow in the centre of the route to represent the 2000 ft wind. This will assist in calculating the headings and groundspeeds later.

<u>Fig 24.</u> Wind Arrow.

5. Next the heading boxes should be drawn on to the map, alongside the track, but positioned in such a way as not to obscure any important detail or information. The heading box has three sections:

a. Top - Magnetic Heading.
b. Middle - Magnetic Track.
c. Bottom - Leg Altitude.

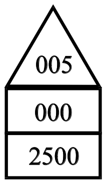


Fig 25. Heading Box.

The bottom two boxes can be filled in straight away, the top box is filled in once the Mental Dead Reckoning (MDR) has been completed.

6. Next we add fuel circles at appropriate positions around the route. The fuel circle contains two figures:

a. Top - Expected fuel remaining at this point in the flight.

b. Bottom - Fuel required to complete the route and to fly on to the nearest diversion airfield and land with 20 ltrs remaining.

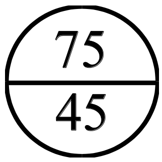


Fig 26. Fuel Circle.

The fuel calculations are all based on average figures of 15 ltrs/hr when airborne and 5 ltrs for engine start, taxy and climb to operating height.

7. The next step is to highlight any controlled airspace near to the route. This is best done using either a highlighter or red pen. Additionally the radio frequencies of airfields near to the route should be added.

8. Now clock marks can be placed on each of the turning points. These marks indicate that the stopwatch needs to be reset at this point

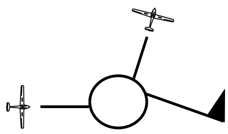


Fig 27. Clock Mark.

9. The final step is to add the legs times for each fix and turning point. These are calculated using MDR and are explained in para 17 & 18.

10. Once all the information has been placed on the map it may begin to look a little bit cluttered and confusing, however the more information you have on the map the less you will need to commit to memory, and the easier the flight will be. At this stage your instructor will run through the route study with you. Route study involves using the map to talk your way around the route, discussing all of the major events and features in the sequence that they will occur. It will include advice on how to identify the start point, turn points and fixes and their associated lead out features.

11. In summary, the map is prepared by:

a. Transfer controlled airspace above 3000 ft from a 1:500,000 map.
b. Draw in start and turn points.

c. Draw on 2000 ft wind.
d. Select and mark fix points.
e. Draw in track lines.
f. Draw in heading boxes.
g. Decide leg height - enter in heading box.
h. Measure track, add variation - enter in heading box.
i. Draw in fuel circles.
j. Highlight controlled airspace.
k. Add local airfield radio frequencies.
l. Add clock marks.
m. Obtain forecast, perform MDR.
n. Use MDR figures to complete:
   (1) Headings - fill in heading boxes.
   (2) Fix/turn point times - annotate on map.
   (3) Fuel plan - fill in fuel circles.

Mental Dead Reckoning.

13. Mental Dead Reckoning (MDR) is a simple technique for calculating headings and groundspeeds. Using the groundspeed we can proceed to calculate leg times and fuel plans.

14. **Max Drift.** The first step in calculating the aircraft's drift is to work out the drift that the aircraft would experience if the wind was at 90° to the track. For an aircraft flying at 90 kts this will be $^{2}/_{3}$ of the windspeed. This is called the Maximum Drift (Max Drift).

Max Drift = $^{2}/_{3}$ of wind speed.

15. **Actual Drift.** If the wind was at 90° to the track, the aircraft drift would be the max drift value, however if the wind was in line with the track there would be no drift. To calculate the drift between these two extremes we use the MDR clock.

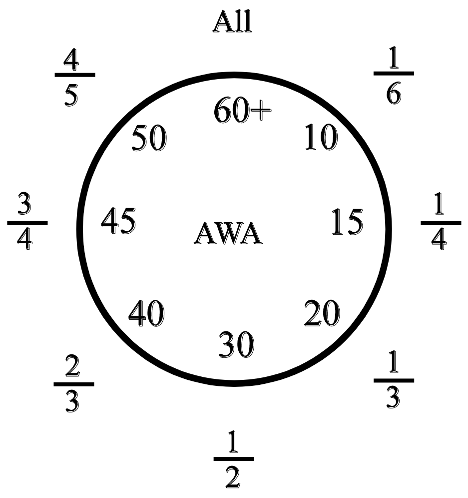


Fig 28. MDR Clock.

To use the MDR clock:

a. Calculate the acute angle (angle less than 90°) between the wind and your track. This is the acute wind angle (AWA).

b. Find your AWA on the inside of the circle (for angles greater than 60° use 60°).

c. Use the adjacent figure outside of the circle to decide what fraction of the max drift to use.

(eg 45° AWA gives $^{3}/_{4}$ of max drift).

16. **Heading.** To calculate the heading required look at your map and see if the wind you have drawn on will blow you left or right of track.

If the wind is blowing you to the left then: Heading = Track + Drift.
If the wind is blowing you to the right then: Heading = Track - Drift.

Once you have calculated the heading enter it in the top of the heading box.

17. **Groundspeed.** The aircraft groundspeed will be affected by the wind direction. If the wind is directly from the front then Groundspeed = True Air Speed (TAS) - windspeed, if it is directly from the rear then Groundspeed = TAS + windspeed, whilst if it is at 90° to the track then Groundspeed = TAS. To work out the groundspeed for directions between these extremes the MDR clock is used.

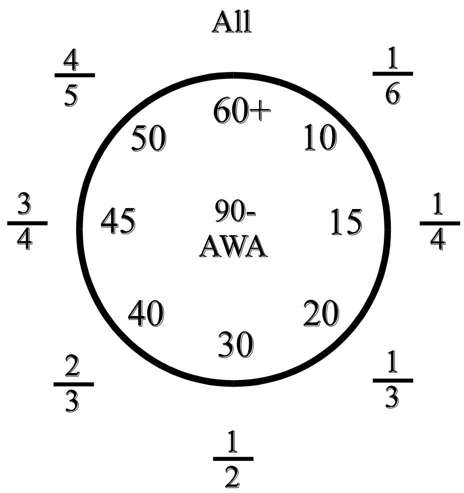


Fig 29. MDR Clock.

To use the MDR clock:

a. Use the acute wind angle as before.

b. Subtract the AWA from 90. Find the result on the inside of the circle.

c. Use the adjacent figure outside of the circle to decide what fraction of the wind speed to use.

(eg 30° AWA gives 90-30 = 60, 60 = All of wind).

The Vigilant is flown at 90 kts during navigation sorties. By looking at your map you will see if the wind you have drawn is coming from the front or rear. A wind from the rear speeds you up, a wind from the front slows you down. You can therefore calculate your groundspeed.

Groundspeed = TAS ± MDR windspeed correction.

18. **Leg Times.** Once you have the groundspeed you can calculate the leg times. This is derived using the formula Speed = Distance ÷ Time. Modifying this a little we achieve a formula to give time in minutes:

$$\text{Time (mins)} = \frac{\text{Distance (nm)}}{\text{groundspeed (kts)}} \times 60$$

19. **Fuel Planning.** Once the leg times for the route are known the fuel usage can be calculated. For these calculations we allow 5 ltrs for engine start, taxy, take-off and climb. We then allow 15 ltrs/hr for flying at 90 kts. We must also remember that the aircraft has a minimum landing fuel of 20 ltrs.

20. **MDR Worked example**. A Vigilant is to take-off from RAF Syerston and fly to RAF Coningsby a distance of 28 nm on a track of 072° (T). There is a check point at 15 nm. Variation is 5° W. The 2000 ft wind is 290/20.

The map would look something like:

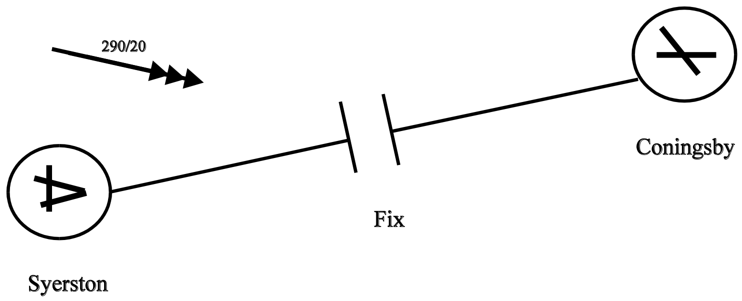


Fig 30. Worked MDR Example.

a. Max Drift = $^2/_3$ of wind speed. = $^2/_3$ of 20 = approx 14°.

b. AWA between 290° and 072° = 38°.
38° (approx 40) on MDR clock is $^2/_3$ of max drift. $^2/_3$ of 14 = approx 10°.

c. From map it can be seen that aircraft will drift right.
Therefore heading = track - drift. = 072 -10 = 062° (T).

d. To convert to a magnetic heading add the variation. 062 + 5 = 067° (M).

e. Groundspeed: 90-AWA = 90 - 38 = 52. From MDR clock 52 = $^4/_5$
$^4/_5$ of windspeed = 16.

f. From map it can be seen that wind is from rear.
Therefore groundspeed = TAS + MDR wind correction. = 90 + 16 = 106 kts.

g. Fix is at 15 nm. Time = (Distance ÷ speed) x 60. = (15 ÷ 106) x 60
= 8.49 mins or approx 8 mins 30 secs.

h. Coningsby is at 28 nm = (28 ÷ 106) x 60 = 15.85 = approx 15 mins 50 secs.

i. Fuel = 5 ltrs for climb + $^1/_4$ hr at 15 ltrs/ hr for transit + 20 ltrs landing fuel.
= 5 + 4 + 20 = 29 ltrs.

Airborne Techniques

21. Once the planning and route study are complete your instructor will make a final check of the weather, Royal Flights and Notams. If all are clear it will be time to fly the route. The initial take-off and climb to the operating altitude will be the same as on previous sorties. Once at altitude you will be shown how to set the aircraft into coarse pitch at 90 kts. This is achieved by:

a. Select an attitude to give 65 kts and select 2,300 rpm.
b. Pull the pitch change toggle fully out and hold.
c. When the engine noise changes release the toggle.
d. Apply full power.
e. Maintaining a nose low attitude, allow the speed to increase to 90 kts.
f. Reduce power slightly (approx 2,500 rpm) until the aircraft maintains level flight at 90 kts.

22. **Start.** Your instructor will help you to identify the start point. This is best achieved by working from large features to small features.

Eg. Look for the large river adjacent to the airfield, by the bend in the river is a large town with a railway running through it, in the centre of the town is the railway station we are looking for.

Once the start point is identified you will be shown how to line the aircraft up on the required heading as you run in towards it. You will be shown a lead out feature to aim at as you approach the start point and will perform your pre-start HAT checks.

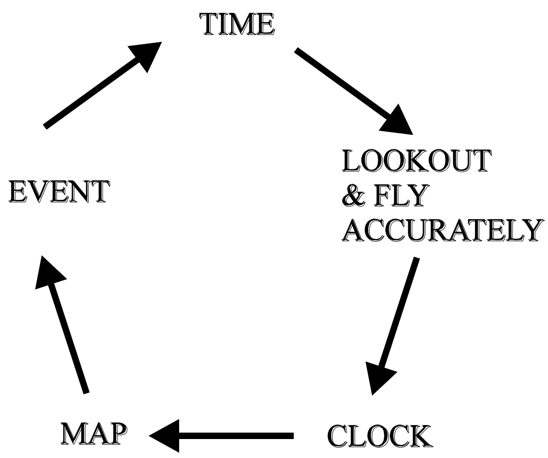
H - Heading	- Read heading from map, ensure heading correct on compass.
A - Altitude & Airspeed	- Confirm both are correct.
T - Time	- Start watch as you pass over start point.

Once you have passed over the start point the confirmatory HAT checks are required.

H - Heading	- Read heading on compass, ensure it is that required on map.
A - Airspeed & Altitude	- Still correct.
T - Time	- Watch is running. Note time of next event.

The map is then put away until the next event is due.

23. **Work Cycle.** The route is broken down into a number of "events" (fixes, turn points, fuel checks, RT calls etc). The time of each event is recorded on the map. The following workcycle is then used:



1. Note the time of the next event on the map.

2. Put the map away, lookout and fly accurately.

3. Include the clock in your LAI scan. Two minutes before the event is due retrieve the map.

4. Use the map to confirm details of the event.

5. Action the event.

6. Restart the cycle at step 1.

<u>Fig 31.</u> Airborne Workcycle.

Whilst the map is away the aircraft is flown as normal, however the following points must be remembered:

a. It is not possible to fly the Vigilant on an accurate heading by reference solely to the compass due to limitations in the compass design. The technique to be used is to:

(1) Estimate the required heading.

(2) Select a reference point on the required heading and turn towards it.

(3) Allow the compass to settle and then check compass reading.

(4) Make small adjustments by selecting new reference points the appropriate distance left or right (Left turns reduce the compass reading, right turns increase it).

(5) Again let the compass settle before checking the heading and refining further.

(6) Once the heading on the compass is correct look ahead and select a reference point in the distance. Concentrate on flying towards this point occasionally cross checking the compass reading.

b. The LAI work cycle needs to include a check of the heading reference when checking the attitude, and a check of both compass and watch when checking instruments.

24. **Fix points.** Ideally the fix point should appear three miles directly ahead of the aircraft when you retrieve your map with two minutes to go. However, due to inaccuracies in the forecast wind or in your flying it may not appear in this ideal position. The first step is to identify the fix, again working from large to small features. Once the fix has been identified the following steps should be taken.

a. If fix is directly ahead.

(1) Continue on heading.
(2) Note time as you pass over the fix.
(3) Update your ETA for the turn point.
(eg if 30 secs early at half way point then ETA will be 1 min early).

b. If fix is ahead but to one side.

(1) Turn towards fix.
(2) Note time as you pass over fix.
(3) Resume original heading.
(4) Update ETA for turn point.
(5) Update heading using the method in para 26 if appropriate.

c. If fix is directly abeam.

(1) A large change of heading to fly towards the fix is not sensible.
(2) Note the time as you pass abeam the fix.
(3) Update ETA for turn point.
(4) Using your map identify a ground feature further along the track and turn towards it.
(5) Once over the feature resume original heading.
(6) Update heading using the method in para 26 if appropriate.

25. **Updating Headings.** If you fail to arrive directly over a fix then either you have not flown an accurate heading or the forecast wind is not correct. If the former is the case then continue on the original heading and fly more accurately! If the latter is the case then update your heading using the following rule.

26. **Heading corrections.** Firstly estimate how far off track you are, then roughly work out how far you have flown since the last fix. You now need to apply these pieces of information to the formula below:-

Heading change required = (60 ÷ nm flown since last fix) x nm off track

e.g. If you are 1nm off track after flying 12nm, then $60 \div 12 = 5$
$5 \times 1 = 5°$

27. **Turn points.** The sequence of events for a turn are similar to those previously described.

a. Two mins before the turn retrieve map and identify turn point.
b. If required alter heading towards turn point.
c. Identify the lead out feature for the next leg.
d. Confirm heading for next leg from map.
e. As you approach turn point note the time and re-set stop watch.
f. On passing over-head turn point turn onto new heading and complete confirmatory HAT checks.
g. Continue on next leg.

Where large turns need to be made at turning points your instructor may teach you to fly a dumb-bell pattern in which the turning point is overflown on heading, a large slow turn is made away from the new leg and continued to allow you to run back over the turn point on the new heading.

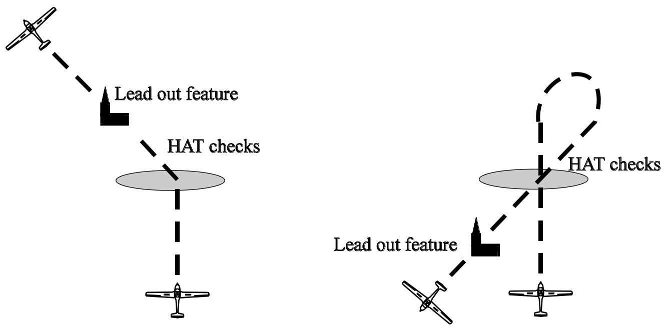


Fig 32. Turning Point Techniques.