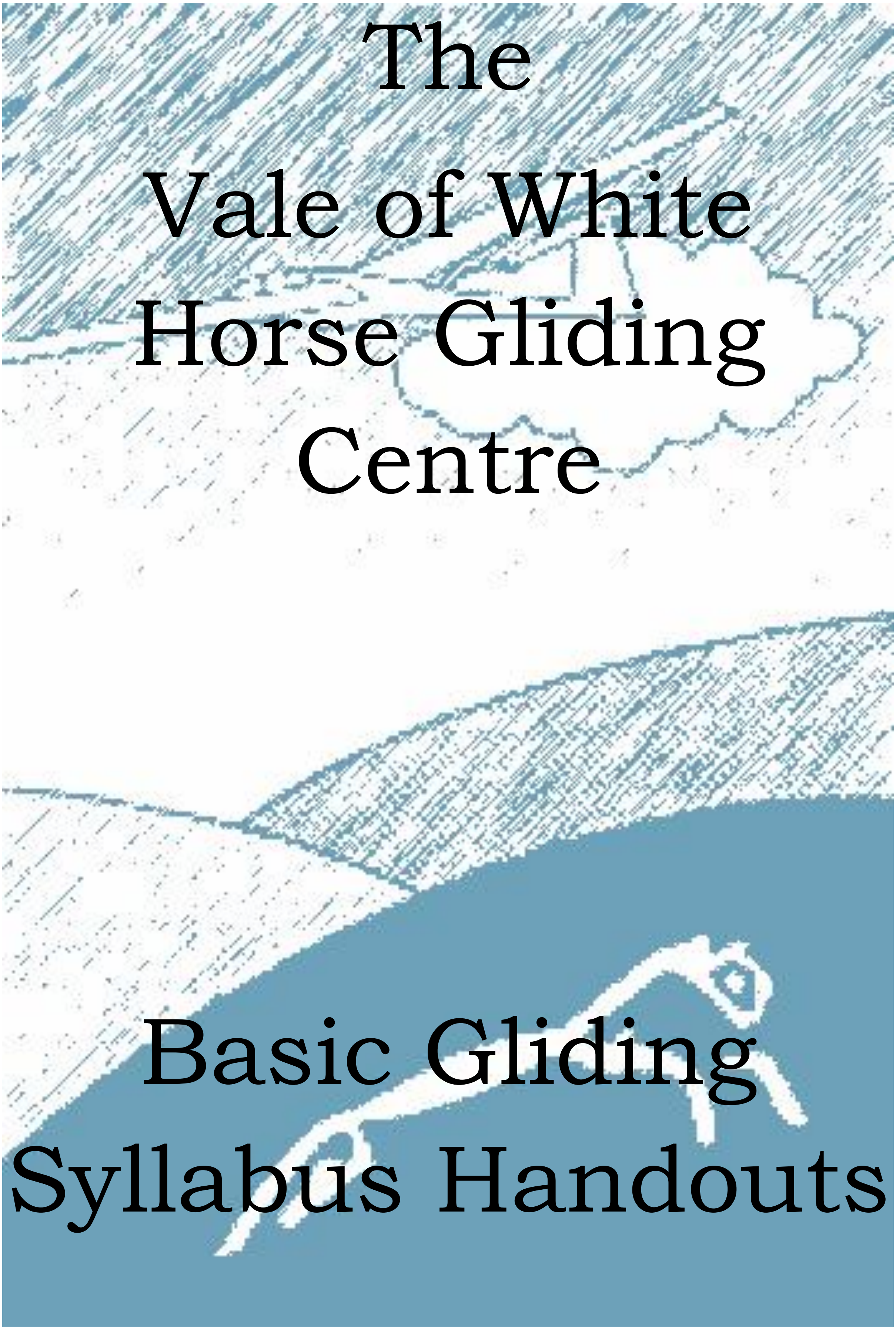
# The Vale of White Horse Gliding Centre



# Basic Gliding Syllabus Handouts

The Vale of the White Horse Gliding Centre
A Member Club of the British Gliding Association

**Contents**

The following basic exercises are covered within this book:



# Ground Handling

**Aims**

To understand the basic principles of the movement and handling of gliders on the ground.

**General**

Whilst gliders are designed sufficiently strong enough to withstand the loads placed upon them in flight they are very vulnerable to damage on the ground through careless or mishandling.

Safe ground handling requires teamwork with one person in charge who gives the orders.

**The Canopy**

The canopy is both fragile and very expensive. The following rules with regards to canopies are **MANDATORY** at Bannerdown:

- The canopy should never be left open unattended. When not in use it is to be locked in the closed position.
- Never reach through the DV window to release the tow rope. Always open the canopy.
- The right hand K21 rear canopy latch must never be operated by reaching through the DV window. Access is to be via reaching in from the front cockpit.

**Movement of Gliders by Hand**

When moving the glider a short distance such as in the launch queue it is normal to move the glider forwards. This will require one person on the wing tip to steer the glider and one to two people to pull the glider forward using the seat straps or strong structure. (Note the canopy is not is not designed to be used as a point for pulling the glider, neither is the arch between the two canopies on the K21).

For moving the glider anything other than a short distance it is normal to move the glider backwards. This has the following advantages:

- The canopy can be shut so there is less chance of breaking it.
- The inboard section of the wing leading edge is very strong and ideally suited to being used as a place to push the glider.

When moving the glider backwards it is normal to have one person on the wing who steers the glider and several people pushing on the wing leading edge. The wingman should be positioned on the wing that is into wind. It may be necessary to change wings during ground handling and the terminology **'Your wing'** should be used by the person handing over the wing who does not let go until the person on the other wing has acknowledged with **'my wing'**.

When steering the glider the tail will need to be off the ground unless the glider has the tail dolly fitted. The K13 and K18 have lifting handles on the rear fuselage for this purpose. The K21 tail may be raised by pushing down on the glider's nose. It is not acceptable to push down on the nose of any other glider – the tail dolly must be used.

The glider should never be lifted by the tailplane under any circumstances. The tailplane is not designed to support the weight of the glider on the ground and its mountings are easily damaged.

**Movement of Gliders by Car**

There are two methods of moving gliders with a vehicle:

1. Using a tow rope.
2. Using the single man towing out kit.

**Using a Tow Rope**

This will require a minimum of two people in addition to the car driver. One person on the inter wind wing who is responsible for steering the glider and one person stood by the nose of the glider who is responsible for preventing the glider rolling forwards into the towing vehicle and spotting obstruction and holes in the ground to prevent the glider getting damaged. Gliders such as the K13 and K18 will require an additional person stood by the tail to lift the glider's tail by the carrying handles when the glider goes around corners.

The glider should be moved at the walking pace of the slowest person using a rope no shorter than one wingspan.

Ideally the rope should be fitted with a weak link and steel rings; at the very least a piece of chain link should be fitted to the end of the rope which is placed in the glider's release hook.

The vehicle driver must have the window open and have the radio turned down so that they can hear a potential stop signal from the glider crew.

**Using the Single Man Towing Out Kit**

All the club gliders have a single man towing out kit. Before using the single man tow out kits the vehicle driver is responsible for ensuring that it is serviceable – paying particular attention to locking catches and welds in the metal work.

It is normal practice for the wing dolly to be fitted to the side of the glider that the vehicle driver is sitting as this is the lower wing which is more likely to strike an obstruction.

The single man tow out kit is designed to save manpower; it is not designed to allow the glider to be towed out faster than using people. The **MAXIMUM SAFE SPEED IS WALKING PACE**.

**Temporary Parking / Stacking**

There will be times when there are gliders at the launch point that are not in use. When the glider is parked out of use the tail dolly must be removed.

For single seat gliders it is normal to park them with the into wind wing down. For light gliders or gusty days it is normal to place a ballast weight such as a car tyre on the wing tip.

Heavy two seat gliders are normally parked with the down wind wing down as the glider is unlikely to blow over.

In all but light winds consideration should be given to strapping the glider's airbrakes open.

**Strong Winds and Squalls**

Extra ballast will be required to hold gliders down in strong winds and approaching squalls. Consideration should be given to the following:

- Have somebody strapped in the cockpit to provide extra weight and stop the control surfaces being bashed about.

- Carefully placing the sill of a car over a tyre over the glider's wing tip.

- Placing a tyre behind the rudder to prevent the rudder getting damaged.

- Locking the airbrakes open.

**IF THERE IS ANY DOUBT AS TO THE SAFETY OF THE GLIDER IT SHOULD BE RETURNED TO THE HANGAR AT THE EARLIEST OPPORTUNITY.**

# Pre-Take Off Checks

**Aims**

To know the check list and the actions required to complete it.

**General**

The pre-take off checks should be carried out before each and every flight you make. The checks should be carried out meticulously and if distracted for any reason start them again.

To help us remember the checks and the correct order for doing them we use the pneumonic:

- CB SIFT BEC

**Controls**

Move each individual control slowly and smoothly to the limit of its travel, while watching the movement of the related control surface. The check is for full and free movement in the correct sense. If you can not see all the control surfaces from the cockpit then either enlist the services of an outside observer, or check the correct functioning of the controls before you get in. To ensure that there is no interference between the straps, pilots & controls, Full & Free should only be done when both pilots are strapped in.

**Ballast**

This check is to make sure that the glider will be flown within the placarded weight limits. It should never be flown with the pilot(s) below the minimum placarded cockpit weight as the glider can become almost uncontrollable. If the weight of the pilot(s) is at or near the minimum cockpit weight, then ballast should be added until they are 30lbs or more over it. Ballast weights should always be secured with proper mountings. Before entering the cockpit, check if there are any ballast weights already installed, and if they are sufficient, or indeed necessary. The check should also include water ballast; is the glider carrying any, how much, is it in the wings or the tail, and is it within CG limits?

**Straps**

Start with the straps long, and fasten the lap straps first. Make sure they are close to the pelvis and as tight as possible. For gliders with a fifth 'crotch strap' connect it up and tighten it now. Connect the shoulder straps last and adjust them until they are comfortable. Whatever the system, once the straps are connected together, always tighten the lap straps first and don't over tighten the shoulder straps.

If any cushions are needed make sure that those underneath the pilot are made of energy absorbing foam, and that any behind the pilot are either non-compressible, or very difficult to compress. Soft cushions are potentially dangerous for two reasons:

- If the cushion behind the pilot compresses during the initial take-off acceleration of a winch launch, the pilot will instinctively try to stop himself sliding backwards, or pull himself forwards by hanging onto the stick and inevitably hauling it to the back stop. The moment the glider becomes airborne it will pitch up rapidly and there is a very real danger of it stalling. Even if the stick is not fully back, the pilot may still slide far enough back to be unable to reach the rudder pedals. Such situations are usually irretrievable.

- In the event of a heavy landing, say, the interaction between a soft cushion, the glider, and the pilot, can result in the pilot sustaining crippling injuries.

**Instruments**

Where appropriate set the instruments to zero. Check they are reading correctly and that the glass faces are not cracked or broken. Most of the flight instruments are pressure operated, so broken or cracked glass will mean leaks and inaccurate readings. Check the correct operation of any electrically powered instruments.

Additionally, are all the instruments secure in the panel, and the panel itself is secure? Make a mental note of the panel position for the critical instruments like the ASI so that in an event of a launch failure we are not monitoring say, the variometer instead of the ASI.

**Flaps**

If they are fitted two separate actions are associated with checking the flaps:

- Check for full and free operation.

- Set for take off.

**Trim**

To be able to see the operation of a tab type trimmer, keep the stick back during the check. The movement of the tab is the opposite direction to the elevator. Moving the trim lever forward raises the trim tab; moving the trim lever back lowers the trim tab.

When setting the trim take into account the circumstances. For a winch launch, the trim lever would normally be set for the approach speed – usually a little forward of neutral. For an aerotow it would be set for no load at the anticipated aerotow speed i.e further forward still.

**Brakes**

The brakes should be checked both sides, above and below the wing. Make sure these close together. Locking is critical. If the over centre lock is particularly strong and the pilot isn't, he may not be able to lock the brakes shut, or may assume they are locked because the lever won't go any further.

**Eventualities**

This is designed to jog the memory in relation to the launch, and launch failures, with regard to heights, speeds and recovery options.
The check can also include noting where other gliders are in the circuit, whether there are any objects that are likely to become unwitting targets if the glider veers off line at the start of the launch.

**Canopy**

Canopy closed and locked can be confirmed in most cases by a visual inspection. Even so, a physical check with upward pressure applied on the canopy frame is a must. Gently close the DV panels before take off. When the front and rear seats have separate canopies, each pilot should verbally confirm that their canopy is closed and locked with the words 'closed and locked and not resisting to upwards pressure'.

# Lookout

**Aims**

To understand the scan cycle and recognise the dangers of not paying enough attention to lookout in flight.

**Using the Clock Method**

Clock terminology is a useful way of quickly identifying the location of a potential threat. Imagine the glider is fixed at the centre of a clock face with the nose pointing at 12 o'clock. Three o'clock is on the right wing, nine o'clock on the left wing and six o'clock is behind the glider.

Although a clock face is two dimensional the sky is not. Therefore high or low are added to the hours to describe contacts that are above or below the horizon.

**The Scan Cycle**

Theoretically, equal attention to all areas would be the most effective scan, but only when the risks are truly random; in other words, when you've no idea from which direction a threat will appear. In practice some area hold more risk than others. Sitting outside an ATZ, of the end of a nearby active runway, increases your risk from that direction, but don't automatically make it zero for everywhere else! Likewise using a cloud street increases the risk from ahead.

The basic pattern of the scan cycle is:

- Lookout.
- Attitude.
- Instruments.

**Where to Look – Basic Pattern**

In straight flight attention has to be directed forwards (twelve o'clock), but the whole area from seven o'clock through to four o'clock (or as far back as you can see each side) needs scanning, both above and below the horizon. Directly overhead also needs checking regularly.

Begin the scan by looking far ahead, over the nose. Focus on the most distant objects visible. Check the attitude, and look above and below the horizon. The total area to be scanned is large, so merely looking ahead is not sufficient. Glance briefly at the instruments (this could be included with the initial check on the attitude), then look to one side or the other about 45 degrees, re-focus on a distant object on the horizon, scan the appropriate segment. Neither the attitude nor the instruments should need checking at this point, so shift your gaze to 90 degrees, and scan that segment.

After looking as far back as you can, look directly overhead, then forwards to check the first segment again, and the attitude and the instruments.

Continue the scan at the 45 and 90 degree points on the opposite side, as far back as possible, then overhead once more – and so on.

In principle an uninterrupted scan with no attention paid to anything else would be the best, but you need to pay attention to other things every now and again. Whatever the scan pattern that is adopted it must have a number of 'stop and look' points.

Whilst the scan pattern does not need to be done continuously, **it must be done regularly and frequently.**

**Scanning Just Before and While Turning**

The view backwards from most gliders is non-existent, and the position of the wing often doesn't help. Before turning, say, to the right, look around and well back to the left. This is not the obvious place to look for a right turn, but you don't want to turn your back on an approaching aircraft which you may not be able to see again until you've turned through nearly 180 degrees.

Having looked left, briefly check the attitude and speed, then look right where you are going to go. Assuming its clear look ahead again and initiate the turn.

Once established in the turn, adopt the scan so that, in this case its centre is displaced to the right. Attitude checks are still 'straight ahead' in relation to the glider, but the centre of the scan is off to one side. What was previously the overhead part of the scan is now a look at the direction of the turn.

When turning, look along the horizon and treat that, rather than looking down along the wing – which in a descent turn will be way below the horizon as the centre of the segment of that scan.

If very steeply banked, say to the right, anything to the left may be underneath the glider and invisible. Before rolling out of a turn, check below the raised wing as well as ahead, or, alternatively, check ahead about 90 degrees before you intend to roll out.

**Areas of Risk**

Risk is everywhere and variable, but the degree posed by the aircraft you spot, as against those which you don't (easily the most dangerous) can be difficult to judge. There is an important element of 'thinking ahead' to lookout, so check the position of other aircraft regularly, even if they seem to be going away. They could change course and come back. Assess whether the risk is reducing, remains the same, or is increasing. If it stays constant or starts to increase, take appropriate action to reduce it.

As far as other gliders are concerned, flying/thermalling in gaggles, running a ridge or in the circuit, are all times when the risk is higher than normal, and a good lookout is very important. Furthermore, most collisions are not head on, but when one aircraft converges on another from the rear quarter. It is extremely important, therefore, that **every** pilot maintains a good lookout.

**The Aircraft that Will Kill You is Often the Hardest to See**

- If it is on or very near the horizon.
- If there is insufficient contrast between it and the background.
- If the relative angle between it and you remains constant, and the aircraft is approaching. This won't be at all obvious until it starts to increase in size.

**Lookout in the Circuit**

The important points to remember about the circuit are that traffic density is likely to be high, your altitude isn't, and most importantly, everyone is heading for more or less the same spot. One purpose of the circuit is to set up an orderly traffic flow and reduce the collision risk, but the close proximity of other aircraft will increase the pilot's workload.

If everybody flies circuits in the same direction, closing speeds are likely to be low, but aircraft in a pilot's peripheral area of vision will converge quite slowly, by stealth, as it were. Circuit collisions are most likely when a pilot's attention is 'eye trapped' by looking for too long at the landing area from, say, the low key point, or just before the final turn.

On the base leg, remember to look away from the airfield, along the approach line, for anyone creeping in on long finals. Look ahead also for gliders approaching on an opposite circuit. They can be very difficult to spot if they are just above the horizon and against a background of solid cloud. The direction of the sun can also be critical.

**Some Practical Precautions**

Allow for the blind spots of other aircraft. If they are ahead of you and moving in the same direction, they won't see you at all. It is your responsibility not to run them down. Likewise don't get too close, particularly if above and behind, just in case they suddenly pull up into lift.

Don't forget to look directly above you when entering a thermal.

When descending rapidly with airbrakes out, do so in a series of 'S' turns, or circling, either is usually safer than letting down in a straight line, dependent of course on the exact circumstances.

When thermalling, always try to position yourself so that you can see as many other gliders as possible, and they can see you.

If you wear a hat make sure the brim doesn't obstruct your view. Baseball caps are not acceptable in gliders.

- **Never assume that the other glider has seen you.**
- **Always be prepared to take avoiding action regardless of who has right of way.**

# Effects of Controls

**Aims**

To understand how the ailerons, elevator & rudder control the glider.

**The Controls**

The three main controls which are used to control the glider's flight path are the:

- Elevator
- Ailerons

- Rudder

**Elevator**

The Elevator is mounted at the rear of the glider and controls the glider in 'pitch' and controls the glider along its lateral axis.

The elevator is the most sensitive of the controls.
If we move the stick forward the elevator goes down raising the tail which in turn lowers the gliders nose.

If we move the stick back the elevator goes up forcing the tail down which in turn raises the gliders nose.

**Elevator – The Air Exercise**

With the wings level flying straight at the normal flying speed – notice the amount of ground in view or where the nose is in relation to the horizon. This is called the normal gliding attitude.

When we move the stick forward an inch or two:

- The nose of the glider will go down.
- More ground will come into view.
- The glider will be flying faster.

When we move the stick back an inch or two:

- The nose of the glider will go up.
- There will be less ground in view.
- The glider's airspeed will decrease.

**Ailerons**

The ailerons are mounted on the outboard section of each wing of the glider and control the glider in 'roll' along the glider's longitudinal axis.

When we move the stick to the left:

- The left aileron will go up – forcing the left wing down in flight.
- The right aileron will do down - forcing the right wing up in flight.

When we move the stick to the right:

- The right aileron will go up – forcing the right wing down in flight.
- The left aileron will do down - forcing the left wing up in flight.

**Ailerons – The Air Exercise**

- Before we roll or turn the glider we must have a thorough lookout.
- First look away from the proposed direction of roll/turn.
- Then as far around in the intended direction of roll/turn as possible.
- Having made sure it's clear we then look back over the nose.
- Move the stick to the left or right to achieve a positive angle of bank of about 30 degrees.

Unlike the elevator where the stick can up to a point be moved and held in position without the glider's attitude continuing to change, here the glider will continue to roll until the stick is centralised.

The stick is normally moved to slightly beyond the ailerons central position, at which point the glider stops rolling, adopts a new bank angle and then starts to turn.

To bring the wings level or roll out of a turn:

- Lookout from the current direction of roll towards the new track and then over the nose.
- Move the stick away from the direction of turn.
- When the wings come level move the stick back to the middle to centralise the ailerons.

- Reduce the back pressure on the stick to maintain the required gliding attitude.

**Rudder**

The rudder is mounted at the rear of the glider at the back of the horizontal fin and controls the glider in 'yaw' along its normal axis.

When we move our left foot forward:

- The rudder will move to the left– forcing the nose of the glider to yaw to the left in flight.

When we move our right foot forward:

- The rudder will move to the right– forcing the nose of the glider to yaw to the right in flight.

The rudder does not turn the glider in flight, however, it is used to steer the glider during the ground roll of the take off and landing. The simplest way to understand what the rudder does in flight is to talk through the air exercise.

**Rudder – The Air Exercise**

If we fly the glider into wind with the wings level along a line feature or towards an easily identifiable object and move our left foot forward whilst keeping the wings level with aileron:

- The nose of the glider will swing (yaw) to the left.
- The glider continues along its original track with the nose offset to the left – thus the glider is flying sideways and not travelling in the direction it is pointing
- Notice that the yaw string is pointing to the left and the ASI is under reading.
- When we centralise the rudder, the nose swings back to the original heading.
- The yaw string is now straight.

- The ASI is now reading normally.

The rudder yaws the glider but does not turn it.

All movement of the controls should be gentle but positive. Over controlling can be lessened by resting your forearm on your thighs. Stick movement can then be made with the wrist / fore arm.

# Trimmer

**Aims**

To understand the effect, correct operation and advantages of the trimmer.

**Trimmer**

The trimmer in a glider is designed to reduce stick loads in the elevator circuit. There are 2 types of trimmers found in gliders:

- Aerodynamic – as fitted to the ASK13.

- Spring trimmer – as fitted to the ASK21.

Irrespective of which side of the cockpit that the trim leaver is mounted on the right hand should remain on the control column and the left hand should be used to operate the trim lever.

**Why Have a Trimmer?**

The advantages of flying in trim are:

- Easier to control speed.

- More attention can be paid to other important activities such as airmanship.

- Easier to maintain attitude whilst thermalling, resulting in more accurate circles.

- Greater safety when speed is a critical factor, such as when low, or in the circuit.

**How to Use the Trimmer**

For re-trimming the glider the correct sequence of events is:

- Adjust the gliders attitude with the elevator and allow the speed to stabilise.
- Move the trim lever in the correct direction until the stick becomes light and you no longer have to apply a forward or aft pressure on it to maintain the attitude.
- Check that the trim is set correctly by releasing the pressure on the stick.
- Re-trim if necessary.

**Remember**

The glider should be flown in trim at all times during flight apart from during the winch launch and the initial stages of an aerotow where the trim is set for landing.

# Adverse Yaw

**Aims**

To recognise Adverse Yaw and take the appropriate actions to prevent it.

**Adverse Yaw**

We have previously seen the primary effects of controls and in particular the aileron which is roll.

However the ailerons also have a secondary control effect:

- Yaw

**Quite simply:**

If we move the stick to the left the left aileron goes up which forces the wing down and decreases the wing's angle of attack.

At the same time the aileron on the right wing goes down forcing the wing up and increasing the wings angle of attack.

**Basic theory of flight tells us:**

More lift = More drag

Therefore if we roll the glider with the stick to the left without using the rudder, the greater lift generated by the up going wing will initially yaw the glider away from the direction of roll / yaw.

This is known as Adverse Yaw.

# Basic Turning

**Aims**

To understand what makes a glider turn.

**General**

The glider is turned by rolling it so that some of the lift force created by the wings produces the required 'pull' (acceleration) in the direction of the desired turn.

Because this 'tilt' reduces the vertical component of lift supporting the gliders weight, an appropriate back pressure is needed on the stick to increase the Angle of Attack to make up the difference. This increases both the into-turn component and prevents the nose from dropping.

**Relevant Points**

Before entering a turn look out and check that the airspace you'll be entering is clear, and will remain so.

While entering the turn, look over the nose of the glider to check the attitude, the roll rate, the angle of bank, and any yaw.

The rate of roll is determined by the amount of aileron applied. The larger the stick deflection, the faster the roll rate and the more rudder is required.

**Rudder**

The rudder has 2 functions:

1. To overcome the adverse yaw (aileron drag) created by the ailerons when they are deflected.
2. To keep the nose of the glider pointing into the airflow as the glider changes direction.

The rudder is applied in the direction of the turn. The amount applied is: Proportional to the aileron input. Relatively large when rolling into or out of the turn and Smaller when the desired angle of bank has been reached and the ailerons 'centralised'
The greater the angle of bank, the faster the rate of turn.

**Elevator**

During a turn the natural tendency is for the glider's nose to go down. If no action is taken to prevent it, both the rate of descent and the airspeed will increase. It is normal to increase the aft pressure on the stick to maintain the nose at the normal gliding attitude as the glider becomes established in the turn. The steeper the angle of bank, the greater back pressure required on the stick.

**Ailerons**

The ailerons are used to stop the roll continuing once the desired angle of bank has been reached.

Once the roll into the turn is complete, look out again. Set up a regular pattern looking out for other traffic, then looking over the nose to check the attitude, the instruments, the angle of bank and the yaw string. The angle of bank will vary if the ailerons aren't properly coordinated with the rudder.

After any correction to maintain the angle of bank, the ailerons and rudder are returned to their original positions:

- Ailerons approximately central.

- The rudder deflection reduced to a small amount in the direction of turn.

Rolling out of the turn is the reverse of rolling in:

- Look out to ensure it is clear.

- Look back over the nose.

- Apply coordinated aileron and rudder.

As the wings come level:

- Centralise the ailerons and rudder.

Maintain the attitude by reducing the back pressure on the stick.

# Basic Turning - Flying

**Flying the Exercise**

**Going into the Turn:**

Before turning (in this case to the right), look out, first to the left and then around as far as possible in the direction of the intended turn, particularly behind the wing.

If it is clear then:

- Look ahead over the nose.

- Roll the glider using aileron and rudder together.

- As the bank increases, maintain the attitude with a slight backward pressure on the stick.

- When the desired angle of bank has been reached, use the ailerons to  stop it increasing any further and reduce the rudder deflection.

The glider is now established in the turn. Re-trim if the turn is going to continue.

- Now look out again!

**Staying in the Turn:**

Notice how the noses moves steadily around the horizon.Keep the bank constant, making any correction with coordinated aileron and rudder. Continue to maintain a good look out, particularly in the direction of the turn and along the horizon.

**Coming out of the Turn:**

First check that its clear to straighten up, especially ahead of and below the higher wing. Take off bank using coordinated aileron and rudder.
Relax the back pressure to maintain attitude.

When the wings are level, centralise the ailerons and rudder and re-trim if necessary.

**Common Mistakes:**

- Failing to look out before turning.

- Looking in the wrong place at the wrong time.

- Failing to maintain a constant angle of bank.

- Allowing the speed to increase excessively.

# Slip and Skid

**Aims**

To recognise Slip & Skid and take the appropriate recovery actions.

**Identifying Slip**

- The yaw string is deflected towards the outside of the turn.
- The slip ball is deflected into the turn.
- The nose is higher than normal.
- There is a feeling of sliding into the turn.

**Correcting Slip**

The glider is slipping towards the lower wing, and needs more in turn rudder.

- Apply sufficient rudder to straighten the yaw string and / or centre the slip ball.

The bank angle and, indirectly, the attitude, are almost certain to be affected so make the necessary adjustments to keep the bank angle constant.

The turn will now be balanced and there will no longer be a feeling of slipping into the turn.

**Identifying Skid**

- The yaw string is deflected towards the direction of the turn.
- The slip ball is deflected out of the turn.
- The nose is lower than normal.
- There is a feeling of skidding & sliding out of the turn.

**Correcting Skid**

The glider is skidding towards the raised wing, and needs less in turn rudder.

- Reduce the amount of rudder to straighten the yaw string and / or centre the slip ball.

Keep the bank and attitude constant using the ailerons and elevator respectively.

**Remember**

If the string is deflected to the right use left rudder and if the string is deflected to the left use right rudder – move your foot to the gap!

# The Straight Glide

**Aims**

To fly straight at a given speed whilst maintaining a good look out.

**The Straight Glide**

Straight and coordinated flight is very precise, and requires the wings to be level within a degree or two.

Turning could be regarded as anything else.

The glider can be considered in the Straight Glide when:

- The nose is at the correct attitude in relation to the horizon.
- The wings are level.
- When in balanced flight – the string directly down the gliders centre line.

The straight glide requires:

- Co-ordinated use of the ailerons, elevator and rudder.

Whilst…

- Maintaining a good look out.

To fly the straight glide you need to:

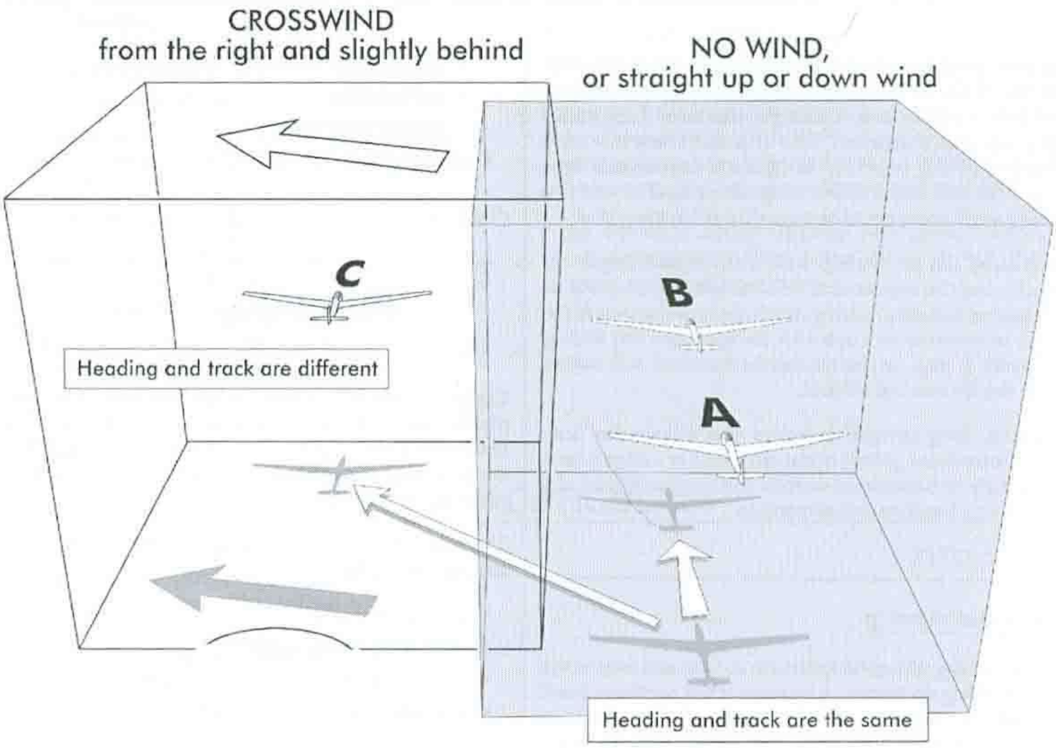
- Select the desired attitude and allow the speed to stabilise.
- Trim.
- Check that the wings are level and adjust as necessary.
- Maintain balanced flight by co-ordinated control inputs.

Now start the scan cycle:

- Scan ahead, on the horizon and above and below it.
- Scan 45 right (or left).
- Scan 90 right (or left) and as far back as possible.
- Look directly ahead.
- Look ahead. Check the attitude and ASI.
- Check wings level. Adjust as necessary.
- Scan the 45 and 90 segments on the opposite side.

**Flying Straight with Drift**

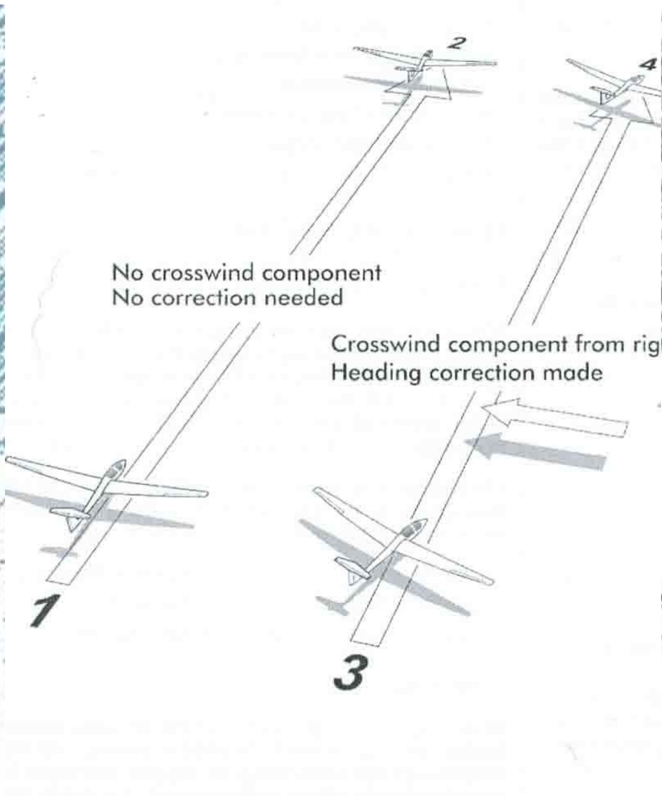
Regardless of what the air mass is doing, a glider must maintain a certain minimum airspeed through it in order to be able to fly. Where there is no wind, the air mass, as represented by the right hand cube in the next slide is stationary in relation to the ground. The glider's track over the ground and its heading through the air mass remain identical, regardless of the direction in which the glider is actually flying.




Where there is any kind of wind the air mass moves over the ground, carrying the glider (and its flight path) with it. If the glider in the previous slide maintains the same heading as it did when there was no wind, then any cross wind component in relation to that will carry the glider 'sideways' over the ground, and the track and heading will differ.

Drift is greatest when the wind is at 90 degrees to the heading.
Aside from any wind gradient, air mass movement affects only the glider's speed and direction over the ground.
It has no effect on airspeed.

From the illustration below we can see that when there is no crosswind component the glider moves from 1 to 2 pointing directly at 2 with no correction needed for drift. When there is a crosswind component the glider moves from 3 to 4 with its nose offset to the right to compensate for the crosswind from the right.




So:

Unless flying directly up or down wind, the glider's nose must point upwind of the track to the ground feature. Straightening onto and maintaining a crosswind requires additional anticipation.

Therefore:

Make a first approximation of the drift correction and further adjustments as required. The effects of drift and the anticipation needed become far more obvious during cross wind circuits.

# Aero Tow Launch – Tug Upset Accidents

**Aims**

To recognise the dangers of getting too high during the initial stages of the aero tow.

**General**

Tug upset accidents are serious and have caused the deaths of a number of tug pilots.

If the glider is allowed to climb rapidly behind the tug, it can very quickly become impossible to prevent it accelerating upwards in a sling shot action (similar to a winch launch), and tipping the tug over into a vertical dive.

Once the tug is in a vertical dive only height can save the tug pilot from disaster. Downward displacement of the glider to a place below the slipstream is quite acceptable, but upward displacements are much more critical.

**The glider pilot must release immediately if:**

- The glider is going high and the tendency cannot be controlled, or
- The pilot loses sight of the tug.

**Factors which can combine to create a tug upset accident are:**

- A light pilot flying close to the minimum cockpit weight.
- An inexperienced pilot – particularly wire launch pilots with little recent aero tow experience.
- A glider fitted with a belly or C of G hook.
- An all flying tailplane, or a glider with very light elevator forces.
- Short tow rope.
- Turbulent conditions.

# Aero Tow Launch

**Aims**

To understand the basics to aerotow launching.

**Ground Operations**

The glider and tug should begin by pointing in the same direction and in line. Depending on the wind direction, surface and glider type, there is a good chance that if the combination isn't lined up properly to start with, that the glider will either ground-loop shortly after it starts moving, or run straight and uncontrollably in the direction it happens to be pointing.

The pilot must not allow the rope to be attached until he is completely ready to launch. In accepting the rope, the glider pilot gives responsibility to the wingtip man or launch martial to issue the instructions to commence the launch.

The glider pilot should keep his left hand on the cable release knob, so that if the wing drops, or for any other reason, the launch can be aborted immediately.

Aerotow acceleration is much slower than that experienced during a winch launch.

**Glider at rest – Nose down.**

Raise the nose as soon as possible to get the glider balanced on the main wheel. The ground run should be commenced with the stick well back unless the wind is very strong.

**Glider at rest – Tail down.**

The technique used for gliders that sit on their tail will depend on the glider type – particularly in cross winds. The wing's angle of incidence affects the Angle of Attack, and is critical here. On some gliders raising the tail can forcibly hold them on the ground even when they have reached flying speed.

- For these gliders, pilot induced oscillations are a risk if the glider hits a bump and suddenly takes off. With these gliders it is better to keep the tail wheel on the ground by starting the ground run with some back pressure on the stick, relaxing it gradually as the glider accelerates, and then allowing it to take off in the two point attitude. Holding the stick back during the early stages of the ground run can also keep the glider running straight.

The above is more important during crosswind take-offs because:

- The glider is likely to weathercock into wind.

- The rudder won't keep the glider straight during the first few seconds. A wingtip holder on the down wind wing can help the pilot keep straight until the rudder takes effect.

For other tail down gliders, the best technique is to begin the ground roll with the stick forward, to lift the tail as soon as possible. The wings AoA will reduce as the tail comes up and the ailerons will become more effective, reducing the risk of a ground loop. Raising the tail early has the further benefit of preventing the glider becoming airborne at too high an AoA, and then wallowing and/or trying to out climb the tug.

**Effects of Prop-wash**

On calm days, especially when using short ropes, the wash from the tug's propeller will tend to force down one wing of the glider, requiring prompt action with the ailerons. The down going propeller blade will be on the same side of the glider as the potentially down going wing.

**Take off and Initial Climb**

If the glider does not lift off by itself when it has reached a knot or two above the unaccellerated stalling speed, lift it off cleanly with gentle back pressure on the stick.

Fly about 6 – 10 feet above the ground. This is just high enough to prevent flying on again yet not high enough to hinder the tug's take off.

If there is a cross wind, either yaw or gently bank the glider to make an appropriate heading correction to prevent it drifting off line behind the tug. The glider should be kept wings level with the string in the middle, after the correction.

Except for heavy and water ballasted gliders, during the first and slowest part of the acceleration phase the glider will take off before the tug.

The combination will accelerate more rapidly once the glider is airborne.

Depending on the initial trim setting, positive forward movement of the stick may be required to prevent the glider climbing during the acceleration phase.

Once the tug is airborne it will accelerate, either staying level until climbing speed is achieved, or climb and simultaneously accelerate. Keep the glider in roughly the same position relative to the tug as it was shortly after take off.

There will be an increase in airspeed if the combination climbs through a wind gradient. The effect will be even more marked if the tug is 'held down'.

**Vertical Positioning Behind the Tug**

As the tug travels through the air the propeller and airframe create a turbulent slipstream. During the climb this slip stream trails well below the tug.

If the glider is below the slipstream it is said to be in the low tow position and if above the slipstream, in the normal tow position.

In the normal tow position the glider is positioned just far enough above the slipstream to keep the glider clear; making allowance for rough air, and the fact that the pilot will rarely maintain exactly the same position behind the tug.

**Lateral Positioning Behind the Tug**

Where two forces pull out of line at opposite ends of a piece of string, the string will end up straight and the forces in line. The thrust of the tug's propeller at one end of the aero tow rope and the glider's drag at the other, create a natural tendency for the glider to line up directly behind the tug.

The force required to keep the glider 'out of position' laterally can only be there if the tug and glider's angle of bank differ, so to maintain the correct lateral position, simply keep the gliders wings at the same angle of bank as the tug's.

The higher flying speeds on aero tow made rudder aileron coordination more difficult because:

- Rudder forces tend to be heavier.
- When the rope is taut and the glider is even slightly out of position laterally, it will yaw towards the tug, creating a strong rolling moment. When the ailerons are used to counteract this, the adverse yaw gets worse. Correct coordination here requires more rudder than usual.

Given the above effect on a glider equipped with a nose hook will tend to automatically bank the glider towards the central position. However, if the glider does 'auto-roll' and is then left to its own devices, it will overshoot the central position and begin a series of increasingly violent and divergent figure of eight manoeuvres culminating in a broken rope.

In a turn the glider is not directly behind the tug. Since the tug and glider are in effect flying round the surface of a cone, if the glider maintains the same angle of bank as the tug, the glider's nose will be pointing towards the tug's outer wing tip. The exact position will depend upon how steep the turn is. The glider will then follow the path of the tug.

Even in straight flight the tug's tail may not always point directly at the glider. If the tug pilot uses too little rudder to counter the effects of the propellers slipstream, the tug ends up flying sideways. The result is a slight reduction in climb, and the glider having to fly sideways, apparently, in order to keep straight!

**Slack in the Rope**

Small bows and horizontal displacements can be ignored. Bows in the cable will gradually pull out if nothing is done to worsen the situation, and any displacement will automatically correct itself.

If you have to release with a big bow in the in the rope, wait until just before the rope goes tight again. Releasing without getting rid of the bow first can lead to the rings flying back and hitting the glider. In the worst case they may become entangled with it.

**Releasing from Tow**

Throughout the tow it is important to remain aware of the glider's position in relation to the airfield. Prior to releasing the cable it is wise to have a good lookout for other traffic particularly in the direction which it is intended to turn the glider.

If the rope is released under tension a ripple will travel along it. This is a useful visual cue that it has released.

Having checked that it's clear and that the rope has released make a climbing turn to the left to provide separation from the tug and rings.

**Emergency Signals**

**The tug waggles its rudder –** A signal to indicate that there is a problem at the glider's end of the rope. The usual problem is that the glider's airbrakes are open.

**The tug rocks its wings** – The glider MUST RELEASE. You may not know why you have been waved off, so immediately after release check that the airbrakes are not open.

**If the glider is unable to release** – If in a two seater try the other release knob first. If you are in radio contact talk to the tug.

Otherwise, fly well out to the left of the tug (to a position that the tug pilot can see you) and rock your wings positively from side to side. Rock left first and the furthest, or you will end up swinging back to the middle. While out to the left you may need a small amount of airbrake to keep the rope tight. The tug pilot should tow the glider back to the airfield and then release his end of the rope.

# Flying the Aero Tow

**Aims**

To understand the basics to flying a safe aero tow launch.

**Take off**

Complete the pre-take off checks. When you are ready accept the rope.

Ensure the glider is pointing in the direction of take off and that the tug is directly in front.

If possible, establish radio contact with the tug.

Decide on the initial stick position according to the type of glider (for gliders that sit on their nose such as the K13 start with the stick well back, for those which sit on their tail such as the K18 start off with the stick in the central position).

Keep your hand on the cable release, ready to release if a wing drops or the glider over runs the cable.

Before the rope tightens, check that it is still clear ahead and that there is no conflicting traffic. If there is release immediately. Otherwise:

- As the glider moves, steer with the rudder to keep directly behind the tug. Keep the wings level with the ailerons and balance the glider on its main wheel with the elevator. This gives the best acceleration and shortest ground run.

- Once the glider is airborne, move the stick progressively forward to remain about 6 to 10 feet above the ground until the tug takes off, and keep the wings level with coordinated ailerons and rudder.

- Be ready for the tug to climb, and climb with it.

- Identify the changing options in the event of a rope break which are to:

    1. Land straight ahead or slightly to either side, on the airfield.
    2. Make an arrival in that field.

- Continue reviewing the options until returning to the airfield again is a safe option.

**Vertical positioning behind the Tug**

Use the tug's vertical position in the gliders canopy as an attitude datum.

Confirm this is the correct position by locating the tug's slipstream. Note the vertical position of the tug in relation to the glider's canopy.

At the same time the aileron on the right wing goes down forcing the wing up and increasing the wings angle of attack.

If the tug's position on the glider's canopy rises, the glider is descending relative to the tug.

If the tug moves down the glider's canopy, the glider is ascending in relation to the tug.

Use the elevator as necessary to keep the glider in the correct vertical position behind the tug.

**Lateral positioning behind the Tug**

Use the tug's wings as a datum for the angle of bank.

In straight flight the glider is directly behind the tug.

If the glider's wings are not at the same angle of bank as the tug's then the glider will move off-line in the direction of its lower wing.

Correct this by simply bringing the wings parallel with the tug's. Do not allow the inside wing to go down. Allow the rope to pull the glider back into position.

When the tug turns, use the same angle of bank as the tug. Even though the tug pilot is suppose to be in charge of the combination, you should look out at least briefly in the direction of turn. The likelihood is that you will be able to see far more than the tug pilot in that direction anyway, particularly if the tug has a high wing.

In the turn, the side of the tug is visible. The glider's nose points to the outside of the turn rather than the back of the tug.

Higher than usual force is required on the rudder pedals to coordinate with ailerons and eliminate adverse yaw.

**Releasing from Tow**

Approaching release height:

- Check the position of the glider in relation to the airfield.
- Look out in preparation for turning but keep half an eye on the tug.
- Pull the release.
- Check that the rope has actually separated from the glider.
- For maximum separation promptly raise the nose and then turn to the right.
- Once clear:
  1. Return to the normal flying speed and trim as appropriate.
  2. Confirm your position relative to the airfield.

If you can't see the airfield, watch where the tug goes!

# Aero Tow Launch Failures

**Aims**

To recognise an aero tow launch failure and understand both, the dangers and the actions required of the pilot in the event of a failed launch.

**Early Stages of the Launch**

During the initial stages of an aerotow, the options available to carry out a safe landing may be limited. Unlike the winch launch there may be a period when it isn't possible to land safely within the airfield boundaries. In the event of a low level launch failure there isn't a lot of time to think about options or search for places to go, so it's important to identify suitable off airfield emergency landing areas during the tow until the height and position are such that a safe return can be made to the airfield.

It is vitally important during the initial stages of the aero tow to concentrate on the emergency options and not to be distracted by fiddling with the instruments, DV panel etc.

Until the glider is at a safe height to turn back the only options are to land ahead or a few degrees to either side.

There may be a short period where the only option is a more or less controlled crash. The primary aim is to avoid injury. Fly the glider onto the ground in a clear space and ground loop at the slowest possible speed.

**Aero Tow Launch Failure Accidents**

Most serious aerotow launch failure accidents are caused by pilots attempting to turn back and land at the site whilst having insufficient height and speed to do so.

Given that the climb rate of the combination usually exceeds the gliders normal sink rate by a factor of at least two, then theoretically the glider could immediately do a smart 180 turn and arrive back at the launch point at something more than half the height of release.

This scenario fails to work because:

- If the airbrakes have been open for all or part of the tow. Unless the tug is exceptionally powerful, or the glider's airbrakes rather ineffective, the combination will have travelled a significant distance before gaining final turn height.
- If the combination climbed unusually slowly. Perhaps the tug's engine was not operating at full power.
- The take off was downwind.
- The wind was strong. The combination's climb angle in relation to the ground will be steep, so a 180 turn could be inside or very close to the airfield boundary. In this case a downwind landing would almost certainly end up in disaster. There might nevertheless, be enough height for a short, tight circuit.

**Rope Break**

A rope break will leave the rings and possibly some rope attached to the glider. Depending upon the amount of rope left attached and the gliders speed, the rope will usually stream down sufficiently far below the glider to avoid fowling the tailplane or elevator

Unlike wire launching most of the tow rope won't be over the 'sterile area' of an airfield. Dropping the broken rope and rings 'out in the country' after a rope break could cause damage or injury to persons or property.

Unless there are control difficulties, it isn't usual for the glider to release a broken aero tow rope.

However care needs to be taken to ensure that during landing, the dangling rope doesn't snag on a hedge or fence.

# Pre-Landing Checks

**Aims**

To understand the checks required PRIOR to landing.

**Pre-Landing Checks**

The pre-landing check should be carried out when:

- The decision to land has been made.
- And prior to joining the circuit.

This allows the pilot to pay full concentration to flying the glider accurately whilst maintaining a very good lookout during the circuit phase of the flight.

**The Pre-Landing Check**

**W**ater – Dumped.

**U**ndercarriage – Down and locked.

**L**oose articles – Stowed and secure. Pilots straps tight and secure.

**F**laps – If fitted, set appropriately. They may need adjusting later in the circuit. Avoid adjusting the settings while turning onto the final approach.

# Circuit Planning

**Aims**

To safely understand the principles behind flying a suitable circuit for the prevailing conditions.

**Purpose**

The purpose of the circuit is:

- To arrive at the final turn in the right place

- At a safe height and speed

- With safe alternatives always available.

At an airfield it has the secondary purpose of setting up an orderly flow of traffic.
Though GOOD LOOKOUT is important during every phase of flight it is vital in the circuit where traffic density is likely to be high and everybody is heading for the same place.

**Reference Point (RP) Selection**

The Reference Point is the point where the glider hits the ground if we don't bother to round out. The exact point where the round out begins, depends on the wind strength and or the steepness of the approach.

Starting from the place where we want the glider to stop, we need to work backwards towards the round-out point allowing for:

- The length of the ground roll and float after round-out; depending on surface condition, glider type, wind and approach speed.

Starting from the place where we want the glider to stop, we need to work backwards towards the round-out point allowing for:

- Approach obstructions or curl over, or anything that may preclude an ideal Reference Point.

**Approach Path**

The final approach is straight.
Either use an imaginary line through the landing area from a distant object ahead, or a line parallel to the appropriate edge of the area.

A successful and easy landing needs a straight approach from a final turn that is no lower than 300ft.

Turns below 300 ft can be dangerous due to:

- The different effects of any wind gradient on the raised and lowered wings.

- High Workload.
- Reduced time on approach.

Adjust the approach line as soon as possible after the final turn, if necessary, but always ensure a safe speed.

Remember that :

- A long, braked approach is wasteful of height.
- A long un-braked approach has very few (if any) alternatives.
- A two thirds airbrake approach allows for adjustments and a good safety margin against undershooting.

**Approach Speed Selection**

Choose an approach speed that gives a safe margin over the stall and spin. The choice should allow for any possible speed loss due to wind shear or gradient, give adequate handling in turbulence, and ensure sufficient speed for the round out.

Stronger winds usually produce stronger wind gradients or shears. Thermal activity or showers can cause large short term local shears, even on light wind days.

**Final Turn**

- The final turn should be:
- Positive and accurate, and with about 30 degrees of bank.
- Flown at the approach speed.
- Completed at a safe height; normally about 300 ft.
- Positioned to allow for a two thirds airbrake approach to the RP, and adjustments to the approach angle.

**Final Turn**

The exact position will vary according to:

- The performance of the particular glider.
- The effectiveness of its airbrakes.
- The strength of the wind.
- In stronger winds the final turn will be much closer to the RP.

**Base Leg**

Position the base leg to avoid long approaches, and to allow time to judge progress and make adjustments to the flight path. Always have safe alternative approach paths available. If there is any likely hood of 'running out of height', position it so that a safe final turn can be made to an alternative approach. It is easier to confirm the wind strength and direction when the base leg is at right angles to the approach.

**Diagonal Leg**

The glider arrives on the base leg after a turn of approximately 45 degrees from the diagonal leg. The turn onto the diagonal leg is made soon after passing the low key area, and before the view of the landing area is obscured by either the wing of the glider or the cockpit edge.

This leg allows the pilot to keep the landing area clearly in view, and ensures that at no stage in the circuit is the glider being flown directly away from it. Remember to look in all directions and not just at the landing area.

The diagonal leg:

- Cuts the corner and joins the downwind leg to the base leg.
- Ensures the landing area remains continually in view.
- Reduces the risk of turning on to the base leg too late.
- Ensures that the angle down to (or up from) the landing area remains roughly constant throughout the latter stages of the circuit.

**Downwind Leg**

We normally arrive on the diagonal leg by flying a downwind leg parallel to the direction of landing, but in the opposite direction.

The downwind leg allows us time to judge our progress and make any adjustments, whilst always retaining safe alternative approach paths.
It begins in the high key area (abeam the winch!) at 8 – 900 ft – sometimes higher for busy circuits. Where the down wind leg passes opposite the landing area is called the low key area.

**Alternative Approach Paths**

Alternative approach paths are necessary because:

- We are all fallible and can make mistakes.
- We may fly into unexpected lift or sink.
- Circuit traffic may get in the way.
- The landing area may become blocked.

Always plan and fly the circuit with alternative approach paths to other landing areas in mind.

In general:

Obstructions along one side of the landing area reduce the alternatives if the circuit is to that side. In cross winds a circuit on the downwind side of the landing area gives a better view of it, a lower ground speed on base leg, and easier alternatives.

**Effects of Wind**

The exact position of the high key area, the turn onto base leg and the final turn will vary with glider performance and the strength and direction of the wind. Because the glider's penetration and glide angle on approach are reduced by the use of airbrakes, the base leg will usually be moved towards the landing area as the headwind on approach increases.

In stronger winds the time on the downwind leg is reduced, so the high key area is usually moved into wind to maintain it. The whole downwind leg is moved towards any crosswind component to maintain the time on base leg and retain safe alternative approach paths.

Each leg of the circuit requires a glider heading which allows for drift due to crosswind.

In strong winds the final turn height and whole circuit will be higher to complete all manoeuvring above the stronger wind gradient and surface induced turbulence.

**Remember:**

A poor circuit is generally fundamental to a poor landing.

# Flying the Circuit

**Aims**

To fly a safe circuit which in turn leads to a safe landing.

**Before going to the High Key area**

Throughout every flight we have to consider when to start heading for the high key area. We need to:

Choose a suitable landing area. The position of the high key area cannot be decided until one has been chosen.

Assess the wind strength and direction (check the windsock if at an airfield).

Choose the circuit direction and location for the high key area, upwind and to one side of the landing area. A stronger wind may need a high key area further upwind.

The effect of crosswinds on the circuit. A crosswind away from the airfield might mean a high key closer in and a shorter base leg, whereas a crosswind towards the field would suggest a high key further out and a longer base leg.

Check the landing area. There is no point starting a circuit to one that is unsuitable or blocked.

Select an approach speed but do not set it yet.

Make a positive decision to join the circuit to land, and plan to arrive at the high key area between 8 – 900 ft.

Complete the pre-landing checks.

Continue to fly the glider at the normal speed, but speeding up appropriately in any sink.

**At the High Key area**

Keep a good lookout, both inside and outside the circuit.

Assess the height, and judge the angle and distances from the landing area. Check again that it is clear of obstructions.

If far too high to begin the circuit, practice turns or fly away, aiming to arrive back at the correct height.

Begin the downwind leg between 8 – 900 ft, when the ‘picture’ of the landing area looks right. From this point onwards in the circuit the altimeter should not be used except as a rough guide at the high key area. Confirm the reading by your own judgement of the height.

Set any drift correction needed.

If low, fly a closer downwind leg, or choose an alternative landing area and re-plan the circuit.

If slightly too high, fly the downwind leg further out or return to the high key area and start again when you are down to the appropriate height.

**Downwind Leg**

Adjustments to the downwind leg consist of angling the leg in or out in order to shorten or lengthen the diagonal and base legs. Even with a very short base leg it may not be possible to reach the correct point for a safe final turn and approach to the normal landing area. In such cases, an alternative landing area (usually further into wind), perhaps even an alternative landing direction should be selected. The position you are then in should be regarded as the starting point for the new landing area, and the normal circuit flown from there.

Having begun the downwind leg and made any necessary adjustments to it and the choice of landing area, continue to keep a good look out, flying the glider at normal speed, but speeding up appropriately in sink. It is important to monitor the variometer, as a situation that was normal at the high key area may become something else if lift or sink are encountered.

Regularly assess height, angle and position.

Take some not of what the variometer says as a predictor of likely height loss or gain.

Check the landing area is still clear of obstructions, look out for other aircraft ahead in the circuit and consider them as possible obstructions.

Consider other aircraft which are anywhere nearby (behind, inside or outside the circuit or ahead). Avoid obstructing them. Consider where they are likely to be in the near future. This might mean having to change your landing area or make other decisions.

Keep checking that your intended landing area is clear of gliders and other obstructions – cars may drive across it towing gliders, people may wander out in a leisurely fashion to the launch point etc. Take into account any circuit traffic ahead of you that may clutter the landing area just before you arrive. Always have a contingency plan in case your first choice of landing area becomes obstructed. If its obstructed it is usually best to make the first part of the approach with the airbrakes closed. Rather than landing in or through a very narrow gap, or attempting to stop before an obstruction when room available is marginal, land past it.

Good airmanship would also dictate that you position your landing to avoid making life difficult for following aircraft.

**Low Key Area**
Again assess height, position, angle and make any necessary alterations to the circuit. The altimeter should not be used. Instrument errors can be bad enough to render the instrument completely useless, if not dangerous.

At this stage, possible adjustments to the circuit are:

- Shortening or lengthening of the base leg, turning directly towards the position of the final turn or widening the circuit.

- Shortening the downwind leg by turning early onto the diagonal leg, usually combined with displacing the landing area into wind.

- Choosing a new landing area and or direction, or using the airbrakes to get rid of any excess height. If the height is excessive don't use the airbrakes to let down in a straight line as there could be another glider underneath. A 360 degree turn is a better alternative – this is very height dependent – or the downwind leg could be extended.

Choose a Reference Point, and consider how far back from it the base leg and final turn should be, given the prevailing conditions.

**Diagonal Leg**

The turn onto the diagonal leg should be taken very soon after passing the low key area. In any event this must be before your view of the landing area is obscured. The turn should be normally banked. Having started your diagonal leg, continue to assess your height position and angle to the landing area.

Increase to the approach speed.

Identify and take hold of the airbrake lever. This should not normally be released until after the glider has come to rest.

Continually monitor height, angle and distance and make adjustments if necessary.

The possible adjustments are:

- If too low or too far away, turn finals towards a new landing area/direction.
- If you are a little low turn onto base leg.
- If you are too close but sufficiently high, move the RP into wind – further up the field or angle the diagonal leg further away from the landing area.
- If on the high side but at the correct distance, use the airbrakes.

**Base Leg**

The turn onto base leg from the diagonal leg should be back from the landing area at a distance appropriate to the wind strength, or sooner, if the glider is getting low. If it's necessary to angle the glider into wind, the turn will need to be through a greater angle to compensate for drift. Drift on the

base leg will always be away from the landing area if the landing is into wind. Correct for drift if necessary.

Continue to check the ASI regularly. Check the landing area is still free from obstructions. Look for other traffic ahead on the circuit, joining from downwind, on long finals or on base leg from a circuit in the opposite direction.

Continue monitoring the height (not from the altimeter but the apparent size of buildings, trees etc), and the angle and distance.

The only adjustments on base leg are:

- If you are too low or far away make an early final turn. This may require the choice of an alternative landing area/direction.
- If you are a little too far away but sufficiently high, angle in.
- If a little too close but sufficiently high, angle out a bit.
- If high but the correct distance, use the airbrakes but with care.

**Approaching the Final Turn**

Before the final turn the lookout should be careful outside the turn (for other aircraft on long final approaches) as inside. Again check for anyone on an opposing circuit.

Decide when to turn, allowing for any head or tailwind component. Don't turn early as this can lead to under-banking, a lower turn completion and less time straight on the approach.

Check speed again and monitor it every 2 or 3 seconds.

The final turn should be a normal (30 degree) banked turn, similar to the one onto base leg. Then, with wings level, line the glider up into the landing area and make an approach. Use the airbrakes as necessary to control the rate/angle of descent. Because of the importance of speed control in the final turn it isn't usually a good idea to increase brake settings. If the glider is excessively high – and with the proviso that the speed is monitored

carefully – open the brakes before the final turn and keep them open during it.

It isn't good practice to open the brakes during the final turn. Be aware that judging height loss in turns is more difficult, so it's easy to inadvertently loose too much height, and as a result end up a bit low.

**Final Approach**

Line up with a clear landing run and make due allowance for any drift.

Check the speed!

Judge whether airbrakes are needed or not using a combination of apparent Reference Point movement and angle / distance required for a half / two thirds airbrake approach.

Check the speed, look left and right.

Control the descent path with the airbrakes, and the speed with the elevator. Be prepared to close the brakes and land long to clear obstructions.

Check the speed!

**Remember:**

A poor circuit is generally fundamental to a poor landing.

# HASSLL Checks

**Aims**

To know the check list and the actions required to complete them.

**The HASSLL Checks**

The HASSLL checks should be carried out before each and every aerobatic manoeuvre, including stalling and spinning. The checks should be carried out meticulously and if distracted for any reason start them again.

**Height**

Make allowance for the height used during the manoeuvre and allow sufficient to return afterwards to the airfield. Many manoeuvres end with a climb to convert speed to height, so the total height required can be considerably more than the difference between their start and finish.

Set a minimum height for the entry to any manoeuvre and don't be tempted to make it any lower. Some account should be taken of the height of the terrain below as it may be higher or lower than the point of launch.

**Airframe**

Check that the glider is certified for the intended manoeuvres. Maximum airframe 'G' loading should be noted, and the accelerometer reset.

**Straps**

Make sure that all straps are fitted into the buckle, and still tight. Before flight check the strap attachments to the airframe are also secure, and that the straps are in good condition. Make sure that all straps are fitted into the buckle, and still tight. Before flight check the strap attachments to the airframe are also secure, and that the straps are in good condition.

**Security**

Check the cockpit to ensure that no loose articles can fly around and damage either the glider or the pilots. Lumps of mud and small stones can

be a real hazard if thrown against the canopy. This check is best done before take off so that they can be removed from the glider.

**Location**

Make a visual check outside the glider to ensure that you are not over towns or active airfields, nor in controlled airspace.

**Lookout**

Execute two well banked 180 degree clearing turns, one in each direction, to check that the airspace you'll be using is clear of other traffic and will remain so long enough for the manoeuvre(s) to be completed. The 'S' turn will also signal to other gliders that you are **NOT** thermalling and that they should steer well clear as you are about to do something unusual!

**Lookout**

Remember to look beyond the immediate area in anticipation for potential traffic flying into 'your' manoeuvring zone. Look above and below. Repeat the lookout if you are in any doubt as to whether it is clear or not, and for safety, repeat it at intervals during any extended series of manoeuvres.

# Stalling

**Aims**

To recognise the symptoms of an approaching stall and take timely recovery action.

**General**

Even though stalling itself is a benign flight condition, it is still a major contributory factor in gliding accidents. This is not because the pilots involved did not know the correct recovery action, but simply because they did not realise what had happened.

**AoA and the Stall**

In normal flight a glider's wings must produce a lifting force equal to the glider's flying weight. The amount of lift generated depends on:

- the aerofoil's camber.
- Wing area.
- Angle at which the airflow meets the wing.

The angle at which the airflow meets the wing is called the Angle of Attack (AoA). The AoA is measured between the aerofoil *chord line* and the *relative airflow.*

If the glider is in steady and fast straight flight, the AoA will be small, but become progressively larger as the glider slows down or the 'G' increases. There is a critical angle for the AoA – aerofoil specific but typically about 15 degrees where the lift (lift coefficient CL) reaches a maximum value. If the AoA is increased further, lift will reduce, sometimes quite sharply but the drag level will continue to rise. Technically, the stall is defined as occurring when the 'CL' has reached its highest possible value, regardless of anything the glider is doing at the time.

The glider's flight path is the direction in which it is travelling opposed to the pitch attitude, which is the direction in which it happens to be pointing

relative to the horizon. There may be no direct relationship between these two. The important point is that *the glider will stall at ANY attitude and any speed, if the AoA reaches the critical angle.* Or to put it another way, the glider will stall if the discrepancy between the attitude and the flight path is large enough.

**Stalling Speed**

The actual value of the stalling speed depends on the following factors:

- Airspeed.
- Wing loading.
- AUW.
- Accelerations ('G').
- Contamination.
- Use of Airbrakes.

Wing Loading – If the wing loading increases, so too does the stalling speed. The wing loading depends on:

- AUW
- 'G' – any vertical accelerations in relation to the glider which alter its effective weight. This includes changes in direction (turning pulling out from a dive) as well as cable tension during the winch launch.

Contamination. In un-accelerated flight at a given flying weight and with a clean airframe, the stalling speed (VS) will have a specific value, say 35 kts. If the glider enters rain or the leading edge becomes splattered with bugs, for example, the stalling speed can increase from anything between 1 to 10 kts. The change in stalling speed due to contamination is aerofoil dependent, some gliders are more badly affected than others.

**Further Points**

Flying the glider partially, if not completely stalled, is inefficient, and – excluding the float just before touch down – dangerous if close to the ground.

The wings of most gliders are designed to stall in a smooth and progressive manner, either through using a different aerofoil section near the tip or building in washout, or both. Airflow breakdown then begins at the upper surface trailing edge, near the wing root and spreads forwards and outwards as the AoA increases. At the same time the drag level rises markedly and the rate of descent increases.

Washout enables many gliders to maintain some aileron control, however minimal, at, and sometimes just beyond the stall. In general though, as more of the wing stalls, the ailerons become increasingly sluggish and ineffective.

A problem that can result from the aileron being effective close to the stall is that the aileron can cause a very rapid roll in the opposite direction to the one intended. This is caused by downward deflected aileron stalling the tip that was suppose to go up.

Secondary effects of rudder inputs at, or just prior to the stall can have much the same effect, except that the glider can roll strongly in the direction of the rudder input.

Depending on the glider's elevator authority and/or the rate at which the stall is approached, the elevator may fail to raise the nose in response to the backward movement of the stick, or the nose may drop regardless. **Inability of the elevator to raise the nose or prevent it going down is the most important sign of the stall.**

As the glider slows down there may be a perceptible change in the airflow noise. While usually quieter, it can also be louder or different in character, and may sound completely different if there is any significant yaw present.

Separated airflow can produce airframe buffet and turbulent flow across the static ports can cause the ASI readings to flicker.

**Summary of Symptoms of the Stall**

Not all of the following may be present, or all that obvious:

- The nose attitude higher than normal.

- The airspeed slow or reducing.

- Changes in airflow noise.
- Flickering ASI.
- Airframe Buffet
- Changed effectiveness of the controls.
- Unusual control positions for the particular phase of flight. For example lots
- of out turn aileron.
- Higher rate of descent.

**Stall and Recovery**

If the pilot either fails to notice or ignores the symptoms, the glider will STALL and:

- Begin to descend at a very high rate.
- The nose may drop.
- A wing may drop.

To recover the AoA MUST be reduced:

- Ease the stick forward (the aimed for attitude needs to be steeper than the normal gliding attitude).
- Regain flying speed.
- Return to the required gliding attitude (for that phase of flight).

The degree of stick movement and the time and height taken to unstall the glider depends on the circumstances of the stall.

For example:

- A stall without nose drop – a mushing stall – normally requires more forward stick movement for recovery than if the nose is already dropping.

- Recovery action whilst descending through a wind gradient requires a very much lower nose attitude if the speed is to be regained.

A secondary stall may occur during or after recovery from the first stall if the recovery is hurries, and if:

- The glider hasn't been allowed to regain sufficient speed for the next manoeuvre, causing it to stall again, or:

- The stick is pulled back to harshly during the return to the required attitude, creating unnecessary 'G'. The accelerated stall that results may be vicious.

When a wing drops at the stall it is essential to un-stall the glider before attempting to level the wings. Once the glider is un-stalled, level the wings with coordinated ailerons and rudder.

# Spinning & Spiral Dives

**Aims**

To recognise the characteristics of the spin and apply the correct recovery action with the minimum loss of height.

**The Spin**

If the glider stall asymmetrically due to yaw, air turbulence, non-symmetrical wing profiles or (more commonly) misuse of the ailerons, one wing will stall before the other and drop.This increases its AoA and its drag, which in turn increase the yaw rate, stalling the wing further. At the same time the up-going wing AoA decreases, making it less likely to stall and reducing its drag.

Unless the glider is un-stalled, it will start to rotate automatically; rolling, yawing and pitching simultaneously and describing a steeply descending helical path.A stall with wing drop can result in a spin if the glider remains stalled, or a spiral dive if it un-stalls.

The characteristic symptoms of the spin (i.e. those which are obvious without input from the pilot) are:

- A usually nose down and rapid rotation of the glider.
- Low or flickering indicated airspeed (IAS).
- Very high rate of descent.
- No increase in 'G.'

**Spin Recovery Action**

- **Full Opposite Rudder** – to reduce the amount of yaw, and indirectly (as a result of roll coupling) to help pitch the nose down.
- **Centralise the Ailerons** – to reduce the down going wing's AoA.
- **Move the Stick Progressively Forward Until the Rotation Stops**– to unstall the glider, even though the nose is already pointing steeply downwards. In powered aircraft it is usual to pause between applying opposite rudder and moving the stick forward. In gliders this isn't necessary.
- **Centralise the Rudder When the Rotation Stops** to prevent a spin in the other direction, and also to prevent high sideways loading on the fin as the speed increases.
- **Recover From the Ensuing Dive**.

**Under-Banked Over-Ruddered Turn**

The glider is very prone to spinning from under banked, over ruddered turns, particularly when low down such as the final turn.
When starting to turn an inadvertent spin is usually masked by the turn and may go unrecognised. If any doubt exists move the stick forward.

**Under-Banked Over-Ruddered  Final Turn**

You have got a little low in the circuit/or too far away and unintentionally fly slower trying to stretch the glide. The nose is not high, perhaps only just above the normal gliding attitude. Reaching the final turn, the ground looks close so you only bank a little. The glider does not turn quickly enough so you try to bring the nose round faster with the rudder.

This appears to work because the glider looks as if it is turning more quickly. The nose starts to go down. You try to stop it with the elevator, but even with the stick fully back the nose won't come up. The glider is now spinning.

- The ASI is now reading low and the needle flickering.
- The glider is rotating rapidly.
- The 'G' feels normal.
- The stick is fully back but not raising the nose.

You now take the standard spin recovery action. However, by the time you start to take the standard spin recovery action you are too low and the glider crashes!!!!.

**The Spiral Dive**

In a spiral dive:

- The speed increases rapidly.
- 'G' increases if the stick is held back or moved back.
- The rate of rotation is markedly slower than most spins.
- The controls feel heavy, but are effective.

**Spiral Dive Recovery**

The standard spiral dive recovery is:

- Roll the wings level using co-ordinated ailerons and rudder.

- Smoothly recover from the dive.

**After the Spin / Spiral Dive Recovery**

Excessive speed can build up after spin recovery if the pull out from the ensuing dive is either late or too gentle. Likewise, if the pilot fails to recognise a spiral dive for what it is and/or doesn't roll level before pulling out, the speed can become very high.

In both cases there is a strong temptation to use the airbrakes to limit speed, usually when it is well past Maximum Rough Air (Vb).
Doing so can create additional problems is the change in load distribution, which reduces the airframe load limit from 5.3'G' (airbrakes closed) to 3.5 'G' (Airbrakes open).

If you do use the airbrakes be careful. The best way to slow down from excessively high speeds may be simply to accept a high 'G' loading and not to open the airbrakes.

Times when airbrakes ought to be opened regardless of the speed are:

- Just after (preferably before) losing control in cloud.

- Any situation where the speed is increasing rapidly and the position of 'up' is in doubt.

# Airbrakes

**Aims**

To understand the effect the airbrakes have upon the performance of the glider.

The airbrakes on most modern gliders such as the ASK21 extend from only the top surface of the wing where as on slightly older gliders such as the ASK13 they extend from both the top and bottom surface of the wing when operated by the pilot.

The airbrake's primary effect is to create variable amounts of extra drag, which comprises of profile drag and induced drag in proportions dependent on the glider's speed.

The extra drag increases the vertical rate of descent and worsens the glide ratio. The more airbrakes are extended, the greater the rate of descent and the steeper the glide.

A K13 for example has a glide ratio of about 25:1 at 50kts with the airbrakes closed. If the same speed is maintained with full airbrake the glide ratio reduces to about 6:1.

The airbrakes of most modern gliders are only speed limiting if the dive angle is 45 degrees or less, but for some the angle can be only 30 degrees. Very few gliders, have airbrakes which can limit airspeed in a vertical dive to the never exceed speed(Vne) or lower.

Airbrakes can cause the glider's speed to decay very rapidly, an effect which is particularly marked when approaching through a wind gradient. Airbrake / elevator coordination, with good speed monitoring and control are crucial when the glider is approaching to land.

To maintain a given speed when using the airbrakes, the attitude will need adjusting; nose down when the airbrakes are opened, and nose up when the airbrakes are closed.

Airbrakes can also cause pitch changes, nose up or nose down, usually small, but again type dependent.

Depending on whether you are either opening or closing the airbrakes, the operating forces may increase significantly with speed. At higher speeds they may suck out once unlocked, and on some gliders they can deploy fully and violently. The airbrakes may also be much harder to close at higher speeds.

The small loss of lift airbrakes cause when deployed can increase the stalling speed by an amount that is type dependent. Relevant when considering landing or ballooning.

Opening the airbrakes re-distributes the lift loads on the wing by, in effect, dividing the wing into three sections:

1. Inboard section.
2. Airbrake section.
3. Outboard section.

The lift contribution from the airbrake section of the wing is reduced, and results in an increase in the bending loads on the outboard sections, their 'pivot point' now being the outboard edge of the brake boxes. These changes typically reduce the glider's normal positive G limitations from +5.3 to +3.5, which is about 30%.

On many types of glider the glider's wheel brake is connected to the airbrake system and comes on at or near the full airbrake position. Care should be taken to ensure that the glider does not touch down with full airbrake selected.

# Approach Control

**Aims**

To safely fly the approach and recognise the  symptoms of an undershoot and overshoot.

**General**

This exercise requires:
- Judgement.
- Good aileron, elevator and rudder co-ordination.
- Good speed control.
- Good directional control – Straight lines.

There are two parts to approach control:

1. Judging whether the glider is overshooting or undershooting by observing the apparent movement of the Reference Point (RP) in relation to the canopy and making any corrections necessary.

2. Judging the steepness or shallowness of the approach, and deciding how (or if) to correct it to the optimum airbrake approach.

Approaching towards a relatively featureless surface such as grass or tarmac can be awkward. To make things easier a Reference Point can be chosen from the low key area, in relation to some definite object on or near the landing area such as a car or parked glider.

Once on approach don't be drawn to fly directly towards the object.
In practice when the Reference Point is chosen from the Low Key area it is more of a reference area – the level of ground detail is usually insufficient for it to be anything else!

It becomes a reference 'point' on approach.

The movement of the Reference Point up or down the canopy shows how the glider is moving in relation to a path targeted on the reference point. It doesn't indicate whether the glider has started the approach high or low. The descent path is controlled by the airbrakes.

The approach speed is controlled by the elevator, with reference to the attitude and the ASI. It may be necessary to change the amount of airbrake, e.g. Reducing it through a wind gradient.

**Overshooting:**

If the Reference Point appears to move down in relation to the canopy then the glider is overshooting. But this is only true if the attitude and speed are constant.

**Undershooting:**

If the Reference Point appears to move up in relation to the canopy then the glider is undershooting. But this is only true if the attitude and speed are constant.

**Correct Approach Path:**

If the Reference Point appears to be stationary in relation to the canopy and the attitude and speed are constant, then the glider is approaching the Reference Point correctly.

Ideally the correct approach path is flown with half airbrake. Keep checking the speed remains safe. Any unwanted loss of speed near the ground requires either a reduction in the amount of airbrake or their closure.

Small amounts of airbrake often lead to PIO's during the float when the speed doesn't decay soon enough, or as expected. Landings are easier when made with 2/3 airbrake. During the round out and float the speed's rate of decay is comparable with a comfortable rate of elevator movement.

# Landing

**Aims**

To understand how to fly a safe landing.

**Landing**

The landing can be broken down into 3 stages:

- The approach (covered in a previous lesson).
- The round out and hold off (float).
- The touchdown and ground run.

**Round Out.**

At about 75 feet hold the airbrake setting constant (unless the speed is reducing rapidly and you are about to stall), this allows a constant rate of descent.

As the glider continues to sink look up from the reference point and look well ahead.

As the ground approaches gently start and move the control column aft to arrest the rate of descent.

**Round Out – Too High.**

Is usually because you are unaware of the gliders height.

- If the speed is safe with a level attitude and moderate brake setting it is normal to hold all the controls still and allow the glider to sink.
- If the speed is safe with a level attitude and large brake setting ease the brakes in to reduce the rate of descent.
- If the speed is too slow and/or the glider is in a nose up attitude with the brakes open then close the air-brakes and gently lower the nose.

**Round Out – Too Late.**

Rounding out too late is usually due to not looking far enough ahead, or ‘target fixating’ on the Reference Point.

**Float or Hold Off.**

In a fully held off landing the gliders tail wheel touches the ground fractionally before the main wheel. The stick will be fully back and the glider is effectively stalled.

A fully held off landing gives the slowest possible touch-down speed.
If the glider hits a bump it won’t take off again, and any impact with embedded stones, holes in the ground etc, will be lessened.

**After Touch Down.**

Once the glider has touched down, open the airbrakes fully (watch out for the wheel brake coming on) and bring the stick progressively back to the stop if it is not there already.
This will:

- Prevent the glider taking off again.
- Prevent damage to the nose skid.
- Initially, slow the glider more quickly.
- Help a glider with a tail wheel to keep running straight.

- For some gliders (largely Schleicher where the ailerons go up when the stick is held back) the aileron response at low speed may be enhanced.

Throughout the ground run the wings must be kept level with the ailerons and the glider kept straight with the rudder. As the speed decays, larger and larger control movements will be required to keep the wings level and/or steer the glider.

Like the take off run, the ground run after touching down is another occasion where independent use of the ailerons and rudder may be necessary.

**Use of the Wheel Brake.**

The wheel brake should be used sparingly to bring the glider to rest and not as a means of slowing the glider down rapidly (unless about to hit something). If the landing surface is wet, be exceedingly wary of using to much as it probably won't slow the glider and if a ground loop starts heavy application of the wheel brake will make it worse.

**Remember:**

No landing is complete until the glider comes to rest.

# Cross Wind Landings

**Aims**

To safely understand how to fly a safe landing in a cross wind.

**Methods**

There are 2 methods for cross wind landings:

- Crabbing.
- Wing Down.

Each has its particular merits for certain situations.

**Crabbing Method**

The glider is turned onto the final approach so that it heads sufficiently into wind to track along the required approach line. The approach is made with the wings level, without skid or slip and with the glider's drift directly along track.

At the end of the hold off just as the glider is about to touch down the rudder is used to swing the nose into line with the direction that the glider is travelling across the ground. This avoids sideways load on the wheel or skid at touchdown.

After touch down the glider is kept as straight as possible by keeping the into wind wing very low. When the glider has stopped the ailerons are used to put the in to wind wing down to stop the glider blowing over before the ground crew arrive.

Care and practice are required to yaw the glider with the rudder at exactly the right moment.

The rudder's effectiveness varies between glider types, but whatever the response time, if the rudder is applied too early, the glider will still be airborne and will begin to drift downwind again.

A further application of rudder will be required to avoid landing with drift. The crabbing method has the advantage that it can be used successfully in very strong cross-winds, however, the crab angle may need to be reduced if approaching through a wind gradient.

- After touch down the glider is kept as straight as possible by keeping the into wind wing very low.
- When the glider has stopped the ailerons are used to put the in to wind wing down to stop the glider blowing over before the ground crew arrive.

**Wing Down Method**

In this method the glider is turned directly into line with the landing path and side slipped by applying bank and opposite rudder in such a way that track is made good.

A normal landing is made except that the angle of bank is reduced at the last moment to prevent the wing tip touching the ground.

The landing is then made with the inter wind wing slightly low.
It should be kept in this position after landing, while the glider is held straight with the rudder.

If the cross wind is very slight, the wing down method is the easiest as it is only a matter of making a normal landing with a little bank applied.

**Other Considerations**

When landing out of wind, avoid approaching near to obstructions or other gliders so that even if the drift is not fully corrected, there is no danger of drifting too close, or swinging towards them after landing. There is also the question of turbulence across the intended approach/landing area from buildings.

When the rudder is applied to yaw the glider straight there is a natural tendency for it to bank as well. Prevent this by using the ailerons to keep the wings level.

If the glider banks out of wind it will begin to turn and start to drift badly. A firm correction on the rudder will be needed to yaw the nose farther out of wind to eliminate the drift.

Gliders with their C of G well behind the wheel have a much stronger tendency to weather cock into wind. If a swing does develop it will worsen, sometimes very quickly, and the rudder may be incapable of stopping it. Unless the rudder is applied immediately the glider will start to swing and almost certainly ground loop.

**Remember:**

No landing is complete until the glider comes to rest.