15B – RIDGE FLYING

SPL syllabus: Exercise 15B Ridge flying			
(i)	**Look-out procedures**	**(iv)**	**Speed control**
(ii)	**Practical application of ridge flying rules**	**(v)**	**Wind shear**
(iii)	**Optimisation of flight path**	**(vi)**	**Consideration for change of turn radius with the same indicated airspeed at different altitudes**

INTRODUCTION

Ridge flying can be exhilarating but it can have many traps for the unwary. There have been many accidents on hill sites and some of those have been caused by ignorance and/or inadequate briefing. This section aims to address those issues.

THEORY BRIEFING

Lookout Procedures – maintenance of a good lookout on a ridge is essential, so the trainee must have been briefed fully on the scan cycle. Whilst ridge flying, the trainee can get fixated on the following aspects, to the detriment of a wider lookout.

- fixation on the aircraft that is closest and obviously is no danger to the glider, instead of looking for other conflicting traffic and avoiding flying into an untenable situation with no escape path.
- watching the ASI or other instruments to the detriment of all else.

Spatial awareness is important when ridge flying to avoid conflict with other traffic. Flarm is helpful and the trainee should understand how to use it, but it will never be a substitute for good lookout.

Practical application of ridge flying rules –All pilots must be fully aware of the rules of the air as they apply to gliding including ridge soaring. These are found in UK SERA and the Rules of the Air 2015 which are helpfully summarised in the CAA publication CAP1535 Skyway Code under the section 'Essential Rules of the Air'. The provision that allows for gliders to undertake hill-soaring can be found in a CAA ORS4 exemption – the link is in the 'Skyway Code.'

Key points to remember:

a) The pilot nominated PIC is responsible for the safe operation of the flight, whether they are on the controls or not.

b) The aircraft shall not be flown in such a manner that would endanger either people or property.

c) Low flying – the CAA have made a relaxation of the 500ft rule to allow hill/ridge soaring provided b, above is complied with.

d) Do not intentionally fly close to other aircraft so as to cause a collision hazard.

e) If approaching another aircraft head on, such that there is a risk of collision, both aircraft shall turn right to avoid each other – effectively this means that the glider with the hill on its right has 'right of way' as it may not be possible for it to turn into the hill.

f) When overtaking, a sailplane may pass to the left or right of the aircraft being overtaken but the aircraft with right of way remains the same.

Local Rules

Generally these have been developed over many years and modified over time to ensure that pilots remain safe. Below are the types of rules to be expected, the details will vary from site to site.

- All turns to be made away from the ridge.
- Minimum height to circle in thermal over the top of the ridge.
- Minimum height to leave the ridge for a safe landing.
- Maximum number of aircraft on the ridge (weather dependent.)
- no-go areas (defined by previous accidents/incidents.)
- Action to be taken if ridge suddenly stops working (landing many aircraft safely.)

Optimisation of flight path

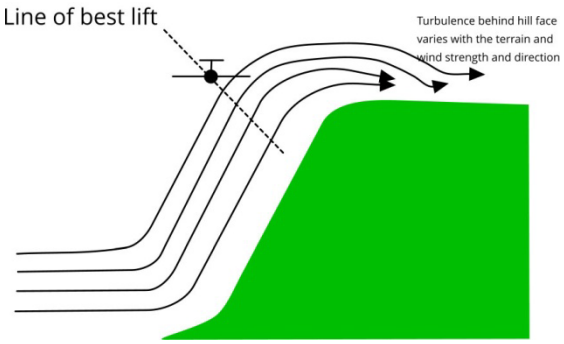
We need to consider the types of hill geography that may be encountered, because although the basic positioning on the ridge is similar for all ridge types, implementing the rules of the air may be different.

For any type of hill, positioning is important, the best lift being in front of the hill face. Trainees often have problems noticing position when busy with controlling the aircraft, lookout etc. Moving too far behind the hill can result in heavy sink unless adequate height is maintained and this can result in having to turn downwind and possibly land out.

TYPES OF RIDGES

Flat top ridge:

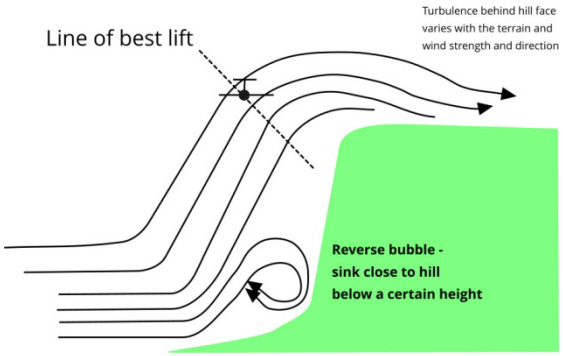
Hill with flat top and reasonable slope



Often hilltop sites are located here. Wind strength and direction play an important part here, since the amount of, and position of, turbulence will vary from day to day. Returning low to the ridge will have the same problems as flying from the bottom of the hill (see later), with the added risk of being unable to climb high enough to land at the top, especially if the wind is dropping in strength.

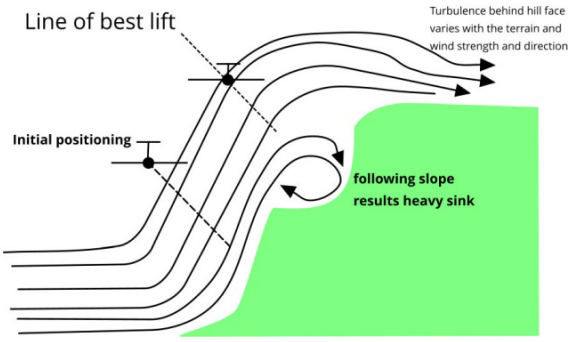
Steep ridge:

Hill with flat top and steep slope



In this situation entering from a bottom of hill site or returning low to the hill, the bottom of the hill may not produce any lift as a reverse bubble can form so the main airflow can then take up a shallower profile. Flying further away from the hill may produce some lift but it may be weak and possibly turbulent.

Hill with flat top and stepped slope

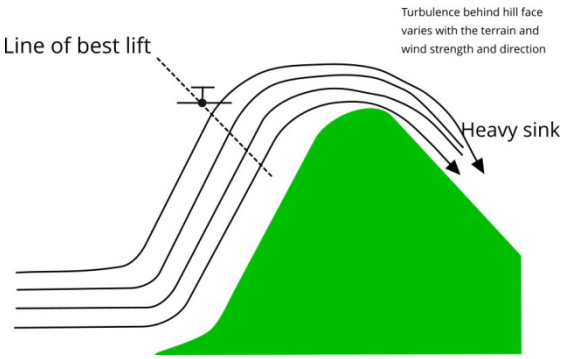


When there is a discontinuity or 'step' in the slope of the ridge there is likely to be an area of sink or turbulence similar to the reverse bubble on the bottom of a steep ridge. It is therefore necessary to carry on climbing in front of the lower part of the ridge, if possible, until high enough to drop back onto the higher part of the ridge, again local knowledge is important, if it is not a local ridge take great care.

Peaked ridge:

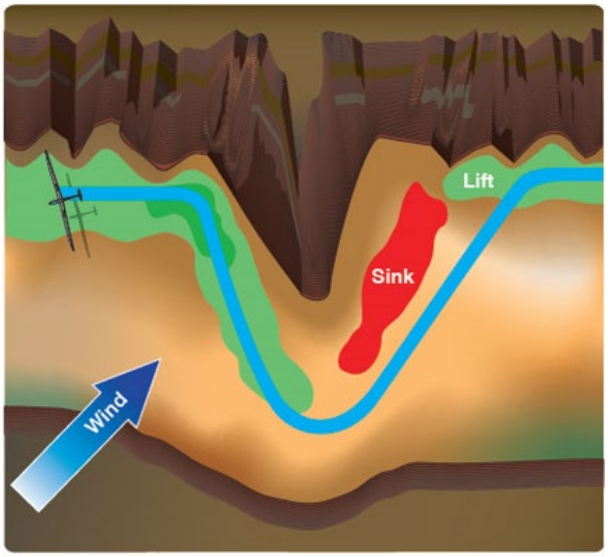
Positioning on ridges of every type to maximise lift are similar. The main variations are dependent on whether the ridge is local to the gliding site (where local rules apply) or encountered during cross country flight.

Hill with Peaked top and reasonable slope



Most hill bottom sites are located within reach of the hill. As you can see from the previous diagrams there may be a no-go height at the bottom of the hill caused by a reverse flow bubble of air and sink as the air tries to streamline itself over the ridge by creating a vortex parallel to the ridge. All approaches to the hill below hilltop height should be made with adequate speed because the air close to the surface will be slower due to friction (similar to wind gradient when landing). Entry must be above the minimum height (set by the gliding club). This is set as a minimum height to carry out a safe landing back at the site if no lift is encountered. This applies to both top and bottom of hill sites.

Long ridges with alignment variations:



This covers ridges which change direction and those that have re-entrant areas or bowls. The main difficulties here are: -

- Changes in lift/sink along the ridge
- Turbulence at sharp direction changes
- And finding a safe route to drop back on to secondary ridges
- Turbulence at direction changes

Speed control - In weak conditions there is a balance between flying slow enough to climb and maintaining enough speed to have adequate control. Lack of co-ordination at slow speed is a recipe for a stall or spin.

Speed control is very important flying below hilltop as horizon information will be taken (sub-consciously) from the hill profile, which can vary and flying along below a rising hill profile can result in inadvertent loss of speed. Co-ordinated flight and speed monitoring must be observed at all times especially when flying below hilltop height (e.g. string in the middle or ball centred.)

Turn radius changes with height Mountain flying has its own challenges and one important one is turning close to the slope. Remember that at higher altitudes, indicated airspeed can be very different to true airspeed. The rate of turn is governed by bank angle and true airspeed, which means that turning near a slope, may result in a greater radius of turn at the indicated airspeed than usual. If a tighter turn is essential for e.g. collision avoidance a steeper bank angle required for the radius of turn needed. This in turn will require more airspeed so care is needed not to stall and spin the glider.

Weather considerations The overall airmass conditions, coupled with local micro-climatic effects, will change the expectations for ridge lift.

Upper air directional wind shear can also cap ridge lift and create turbulence.

Thermals moving across the hill will affect the strength of hill lift, either augmenting or reducing it. Therefore, in light winds with thermals low down, it is important to maintain a position which will allow a safe exit from the hill. Constant manoeuvring in such conditions requires skill and care. Sufficient height to be gained to allow transition from hill soaring to thermal flying.

Hills facing into sun often trigger thermals but beware climbing in a thermal that drifts behind the hill such that there is not sufficient height to push back through the curl-over in the lee of the hill.

Windy days, can also be good wave days. Beware: if the wave is 'out of sync' with the hill, it can completely cancel out the ridge lift, even at low levels. Additionally, it can create additional turbulence on the hill. The conditions on the ridge can change very suddenly if the wave system shifts.

Quite subtle changes in the strength or direction of the wind can significantly alter the nature and position of the lift. Local pilots will often be able to advise what the wind strength is required to make the local ridge work, noting that stronger wind is needed if the wind is not blowing directly onto the hill

Orographic cloud can give a false impression of position on the ridge due to cloud formation and apparent flow rate obscuring true ground speed, especially when flying above the cloud. When flying from hilltop sites care and foresight with respect to orographic cloud formation is necessary for a safe landing on top. It can form very suddenly especially on winter days. Do not be tempted to continue flying in poor visibility, or very close to cloud based on a ridge.

Avoiding Conflict with Other traffic.

It is impossible to itemise all the situations that may be encountered whilst hill flying, but these are a few important things to be considered.

- Overtaking – whilst legally gliders can overtake on either side how practical is it? Obviously overtaking on the hill side of a glider when below hill height is dangerous. **Above hill height,** it may only be possible if the hill profile allows it. The glider being overtaken should only ever turn away from the hill, so you should either pass on the inside or give a very wide berth on the outside.
- Overtaking on the outside has its own dangers; you must give enough room for the other glider to turn and enable you to take avoiding action. In weak conditions this may mean loss of height which it may not be possible to regain. If the other glider is having to deal with head on traffic and you are too close, the result does not bear thinking about.
- Head on traffic – manoeuvring early to indicate intent early, can avoid the confliction. Alternatively, turn back along the ridge to reposition and avoid the situation.
- Being 'in the right' is no solution if the other pilot has not seen you. It is no good being 'dead right'!
- Flying over the top of other gliders with minimum clearance is not good airmanship: if they hit a strong patch of lift, heights can change very quickly.
- When sharing a ridge with paragliders or hang-gliders spatial awareness gets even more critical. These aircraft have much slower speeds, especially into wind, but they can turn tightly. Always give them a wide berth. For preference, pass in front/up wind of them. Do not fly close over the top of paragliders as the turbulence of the gliders air flow can cause a collapse of their canopy

Use of electronic collision avoidance systems. - (e.g. FLARM). When flying with paragliders on a ridge, multiple indications can be really confusing since they change direction very quickly. There can be a big difference between heading and track so locating conflicting traffic. Multiple aircraft in the same direction can be confusing so maintaining a good visual lookout is vital. In poor visibility these devices are useful but cannot be totally relied on.

It is necessary to carry out detailed training in the use of these devices, but as always, they can be an extra distraction from flying the aircraft and physical lookout raises the workload of the trainee.

Remember:

AVIATE NAVIGATE COMMUNICATE

The latest innovation of 'LED flashers' may be a helpful safety addition especially when ridge flying.

AIR EXERCISE BRIEFINGS

A lecture room briefing for the site, whether for local trainees or visitors should cover:

- the geography of the local ridge (where lift may be contacted depending on wind direction and any other pertinent information) and where curl over/heavy sink may be encountered.)
- local ridge rules (including max number of gliders if appropriate.)
- minimum height to leave the ridge for a safe landing.
- landing procedures (+ possibly recommended minimum approach speed.)
- possible weather changes that may affect the outcome of the flight. These may include expected lift strength in light winds, turbulence etc Possibility of lowering cloud base and poor visibility should be considered, including low sun and misting canopy, together with the possibility of orographic cloud.

Emphasise the need for a good lookout all the time, a collision on a ridge is, often, fatal.

For early ridge flying, trainees will be learning to fly the glider in a co-ordinated manner, trying to trim properly, and carry out turning manoeuvres. They should know the 'local ridge rules' before their first attempts at flying on the ridge.

TEM

Threats:	**Mitigation:**
Collision	Maintain thorough Lookout and avoid confliction by taking action early
Errors:	
Running out of height, leaving ridge too late, or heavy sink in circuit.	Monitor height & position
Staying too long on the ridge in marginal weather conditions	Call off the flight early as a training point

MANOEUVRE DEMONSTRATION & LESSON

If the trainee is at an early stage in training, first get established on the ridge and properly trim the aircraft. Then demonstrate how to keep position on the ridge, (a good time to demonstrate the difference between heading and track over the ground, and how important lookout is). Then if conditions allow, hand over control to the trainee and monitor progress.

When appropriate, demonstrate the avoidance of conflict with other traffic and how the rules of the air are applied on the ridge.

Let the student fly, with prompts as needed in the early stages. Monitor progress and if the trainee is finding things difficult take over control and leave the ridge. Always maintain a good lookout yourself as well as encouraging your student to look out– you have overall responsibility for the flight and the potential collision risk remains high on a ridge.

DE-BRIEFING

Ridge flying is an excellent opportunity for 'stick time' - practicing co-ordination in the turns etc, but the workload may be high so emphasise the good points and be constructive with a maximum of two or three points to improve at most. Getting used to flying in rough conditions, pays dividends when the air calms down.

COMMON DIFFICULTIES

Poor position on the ridge, pre-occupied with flying the aircraft.

Poor lookout .

