Ten Vicious Traps in Ridge and Mountain Flying

Dedication

This document describes a number of traps that can catch a glider pilot out when flying on a ridge or in the mountains. Each trap has caused or contributed to the death of at least one glider pilot in New Zealand in recent years. This document is dedicated to the memory of those pilots.

Trap #1: Being in the Wrong Place for the Type of Lift

There is a difference between wind and thermal sources. If the lift is mainly caused by wind then the glider needs to be positioned where the vertical component of the wind vector is the strongest. If there is little or no wind then the glider needs to be positioned directly above the highest point on the ridge to pick up the thermal coming off the peak.

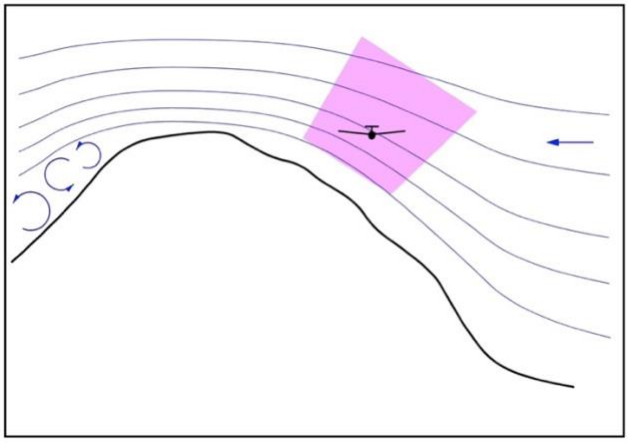

Fig 1: Ridge Lift in Moderate Wind

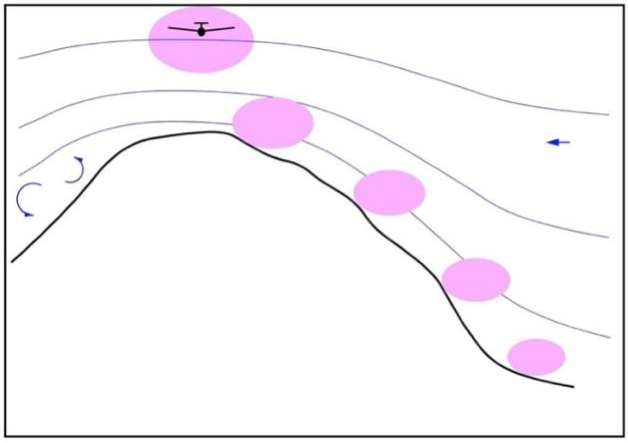

Fig 2: Thermal in Light Wind

Trap #2: Lack of an Escape Route to a Landable Area

Compare the drawings below. On the left the glider can easily leave the ridge and glide down into a wide valley where there are good landing options. On the right the glider is attempting to soar a ridge that is surrounded by ridges and gullies, and is so low there are no landing areas within gliding range. In addition the wind is turbulent due to the terrain upwind.

At some gliding sites there are certain areas over which experienced pilots would never fly - unless they had plenty of height to glide out to a landable area.

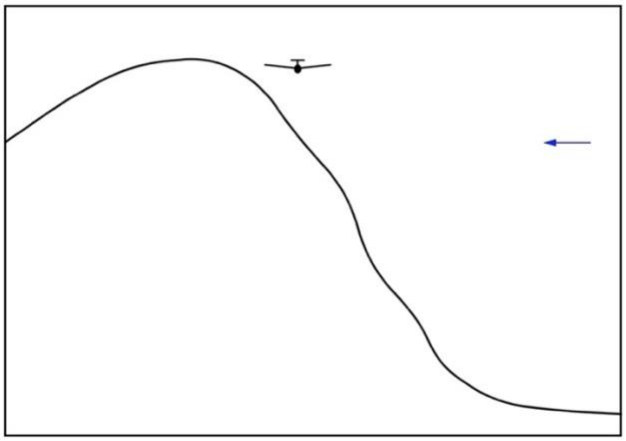

Fig 3: Escape Route Available

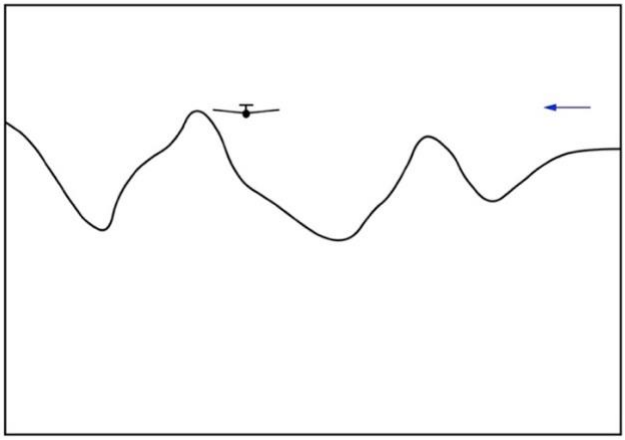

Fig 4: No Escape Route

Trap #3: Failure to Monitor Drift

When flying along the spine of a ridge the pilot has poor visibility straight down, and may not appreciate that the glider is being blown by the wind closer to the ridge, and possibly over onto the lee side. The glider must be pointed partly into wind to offset the drift. If the glider is slowed down then the angle into the wind needs to be increased to maintain position.

If the glider has been allowed to drift back close to the ridge then the pilot will need to dive into the headwind to regain position. Always keep the top of the ridge in view - through the side of the canopy, not directly ahead.

Trap #4: Sudden Loss of Energy

Always be prepared for a sudden loss of height or speed. Wind blowing against a ridge is not smooth - it would have been disturbed by travelling over uneven terrain upwind, plus being heated by ground at different temperatures. One exception is a coastal ridge, where the wind has travelled a long distance over the ocean, and turbulence has mostly died away. Inland ridges require greater caution, and ridges in the lee of other ridges or mountains demand the greatest caution of all.

The recommended safety margins are 200 feet above the terrain directly below you, combined with a minimum speed of 1.5 times the wings-level stall speed. In stronger conditions even greater margins are recommended.

Trap #5: Shallow Slope or Plateau

A shallow slope or plateau can appear "safer" than a steep slope, but this is not true. There is less lift obtainable from a shallow slope, and there is a danger of being unable to out-glide the terrain if the glider experiences a sudden loss of energy.

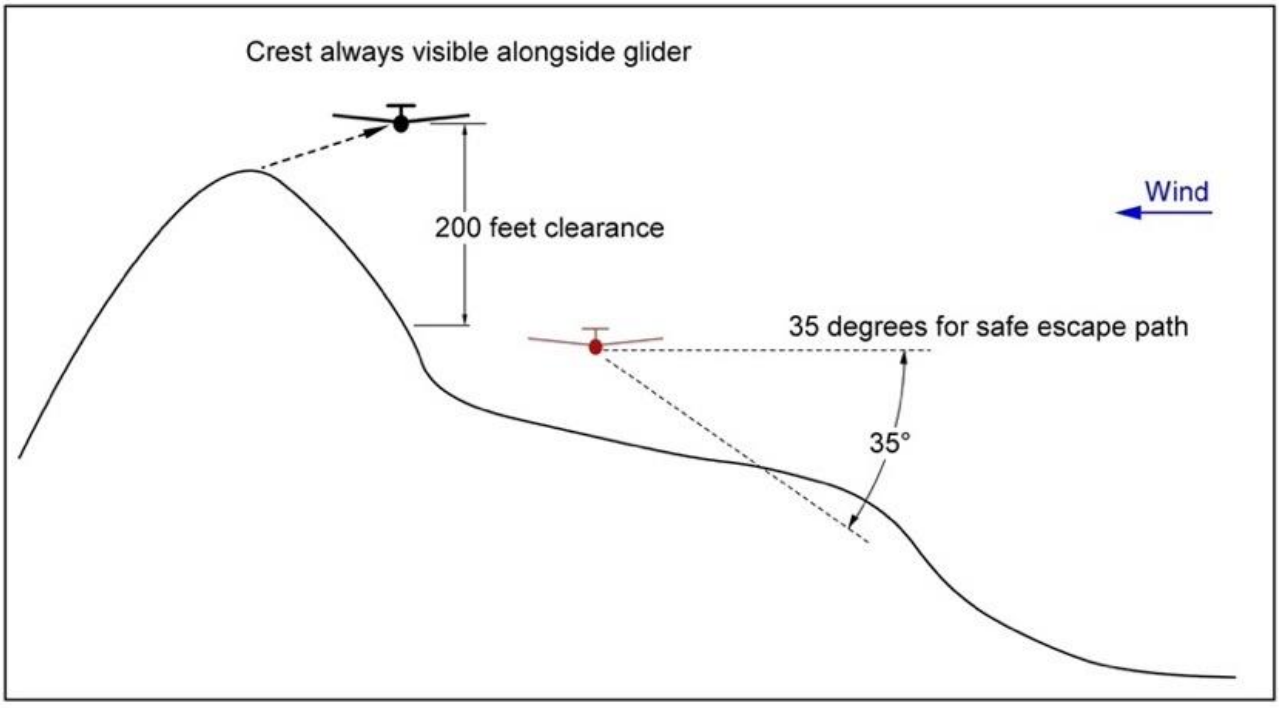

Fig 5: Safe Margins Flying Near a Plateau

Circling above a shallow slope can be particularly dangerous in the mountains. The photo below shows a fatal crash near the Siberia turn point.

Fig 6: Site of Fatal Crash Near Siberia

Trap #6: Rounded Hilltop or Ridge

A thermal lifts off cleanly and predictably from a sharp peak. Soaring over a rounded peak or uneven summit is hazardous, because any thermal over it can be difficult to locate. While hunting for it - with the inevitable surges and sudden energy losses - the pilot may find they are no longer able to glide clear of the hill, or the the glider could be overpowered by a gust under one wing.

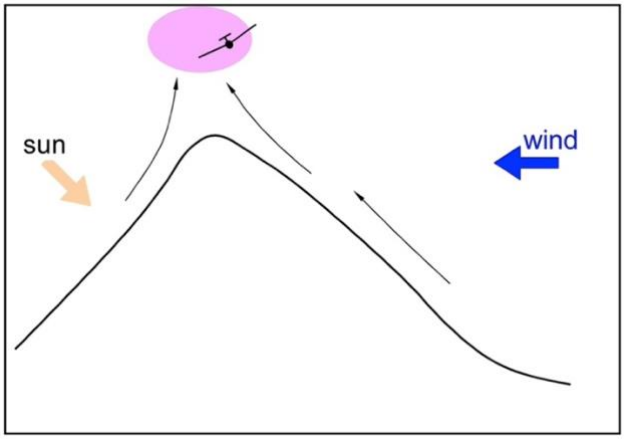

Fig 7: Thermal Above a Sharp Peak

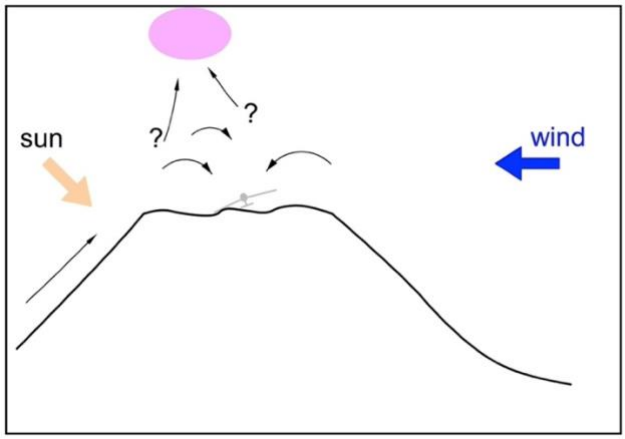

Fig 8: Thermal Above Uneven Summit

Trap #7: Ailerons Overpowered by Differential Lift Force

A difference in lift force can occur between each wing of a glider. This can force the glider into an uncommanded roll (or roll-over), and the ailerons may not be powerful enough to overcome this, especially at low airspeed. If you are between a thermal and the hillside then the differential lift force could roll you towards the hill.

Another possibility is when the airspeed over each wing is very different and you are making a steep turn. This could happen after flying downwind onto a ridge and arriving at ridge-top height. The wind 100 feet above the ridge-top will be moving much faster than wind closer to the ground. The different wind speeds over each wing will cause a differential in lift, especially at high angle-of-attack, which could be so strong that full aileron deflection may not be enough to counteract it.

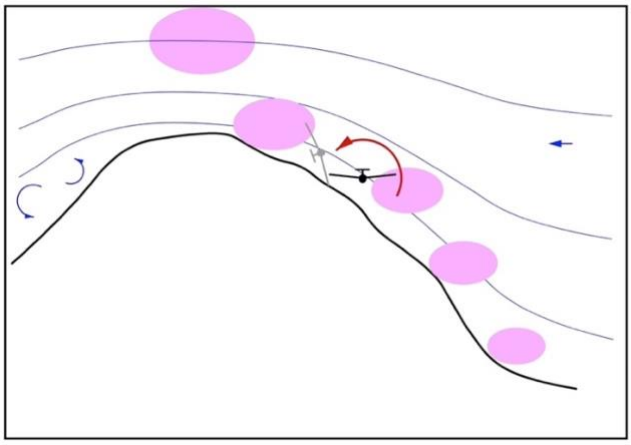

Fig 9: Thermal Gust Can Roll a Glider

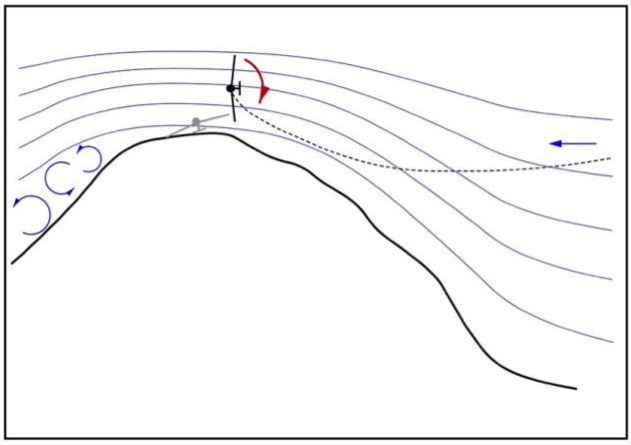

Fig 10: Strong Wind Gradient at Ridge Top

There's a deeper and even more vicious trap hidden inside the uncommanded roll or wing drop. If full opposite aileron is applied to recover then it's possible that the outer part of the lower wing (the part affected by the aileron) will stall because the down-going aileron increases the angle-of-attack of that part of the wing.

The result - which always puzzles the pilot - is that the low wing doesn't come up at all. Instead, it drops even further, while the increased drag from the stalled condition causes the glider to yaw towards the low wing. This trap aggravates the uncommanded turn into the slope.

Refer to *Wing Drop Stall and Recovery* in the Pilot Training Program for more information on the correct recovery, including a video of a glider crash due to exactly this cause. This is why speed and height margins are so necessary when ridge flying.

Trap #8: Reduced Visibility or Poor Depth Perception

The usual culprit is cloud or mist, which can obscure or reduce visibility. Orographic cloud can quickly form upwind of any slope with just a slight change in wind speed, direction or humidity. An existing cloud can "jump forward" and quickly envelop an unsuspecting pilot.

Other causes of reduced visibility, which make it harder or impossible to see the ridge, include flying directly towards the sun (sun-strike), smoke (such as from Australian bush fires), snow and rain. Depth perception can be distorted by snow-covered slopes because of the lack of features. A heavy overcast sky can mean a lack of shadows on the ground, which can have a similar effect. Pilots can fly too close, too low or too slowly under such conditions.

Fig 11: Orographic Cloud with Passing Showers

Trap #9: Late Decision to Stop Circling

In this fatal crash the pilot was circling to the right without gaining any height, but was drifting towards the mountain. After five circles he started to roll the glider from a right turn to a left turn. There was a sudden loss of energy due to leaving the thermal (even though it was weak), plus the glider now had a tail wind component which had the same effect as a gust from behind. The turn away from the ridge was started too late, and took longer than expected. The sudden loss of energy meant that the pilot was unable to complete the turn before the glider impacted the ridge. If the pilot had kept turning to the right it was estimated that he would not have hit the mountain.

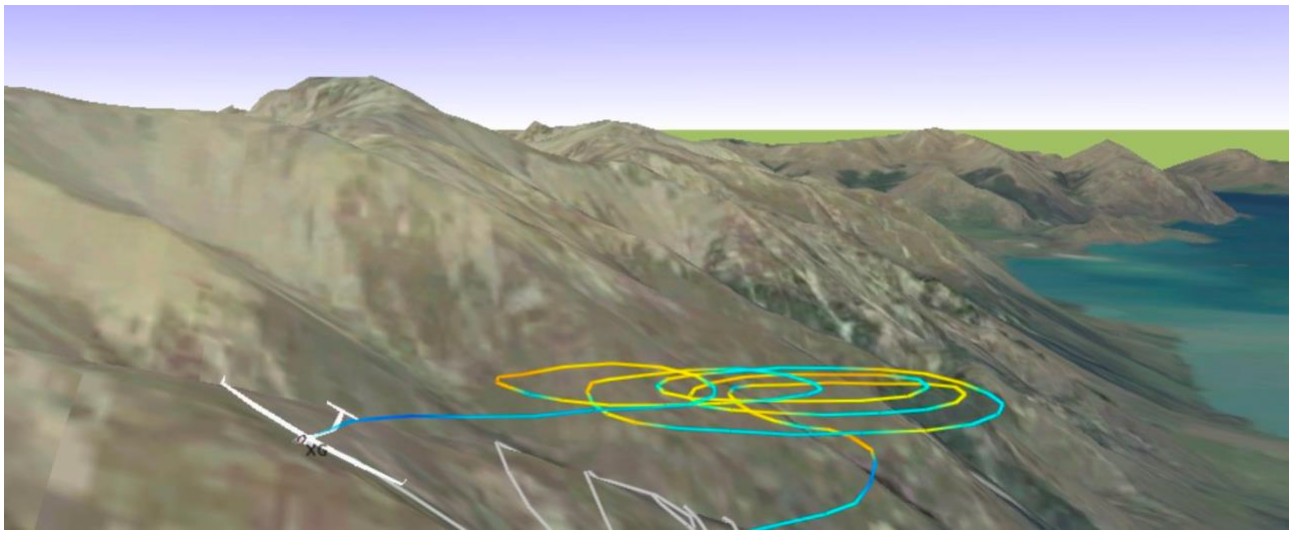

Fig 12: Late Decision to Stop Circling

Trap #10: People Watching on the Ground

It's not unusual to encounter trampers or people on the ground when flying near a ridge. Despite the fact that you don't know these people, and they don't know you, there can be an impulse to "show off" or make a low pass over them. This amounts to an impromptu display, and pilots untrained in display flying can easily become distracted and make other mistakes or exercise poor judgement. Don't be tempted to show off.

Further Reading

Safety in Mountain Flying, CNVV, France. (English version)

Mountain and Ridge Soaring Safety Principles, Gliding NZ Advisory Circular AC 2-13.