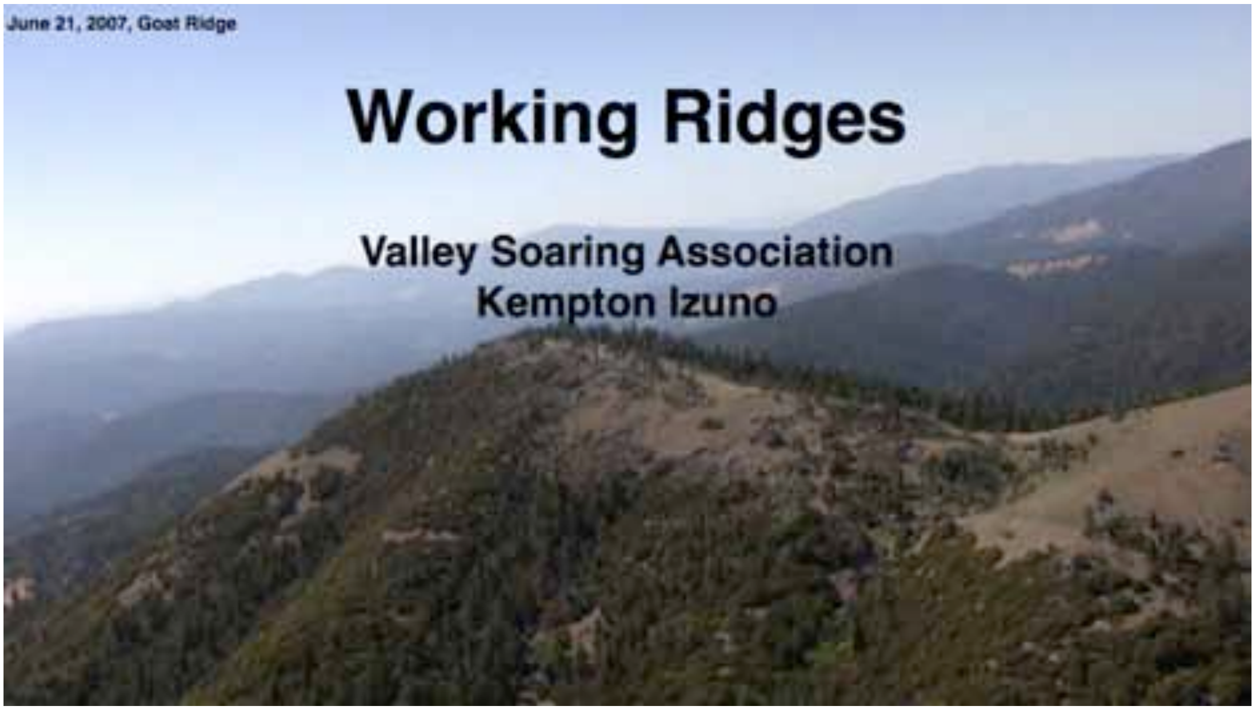
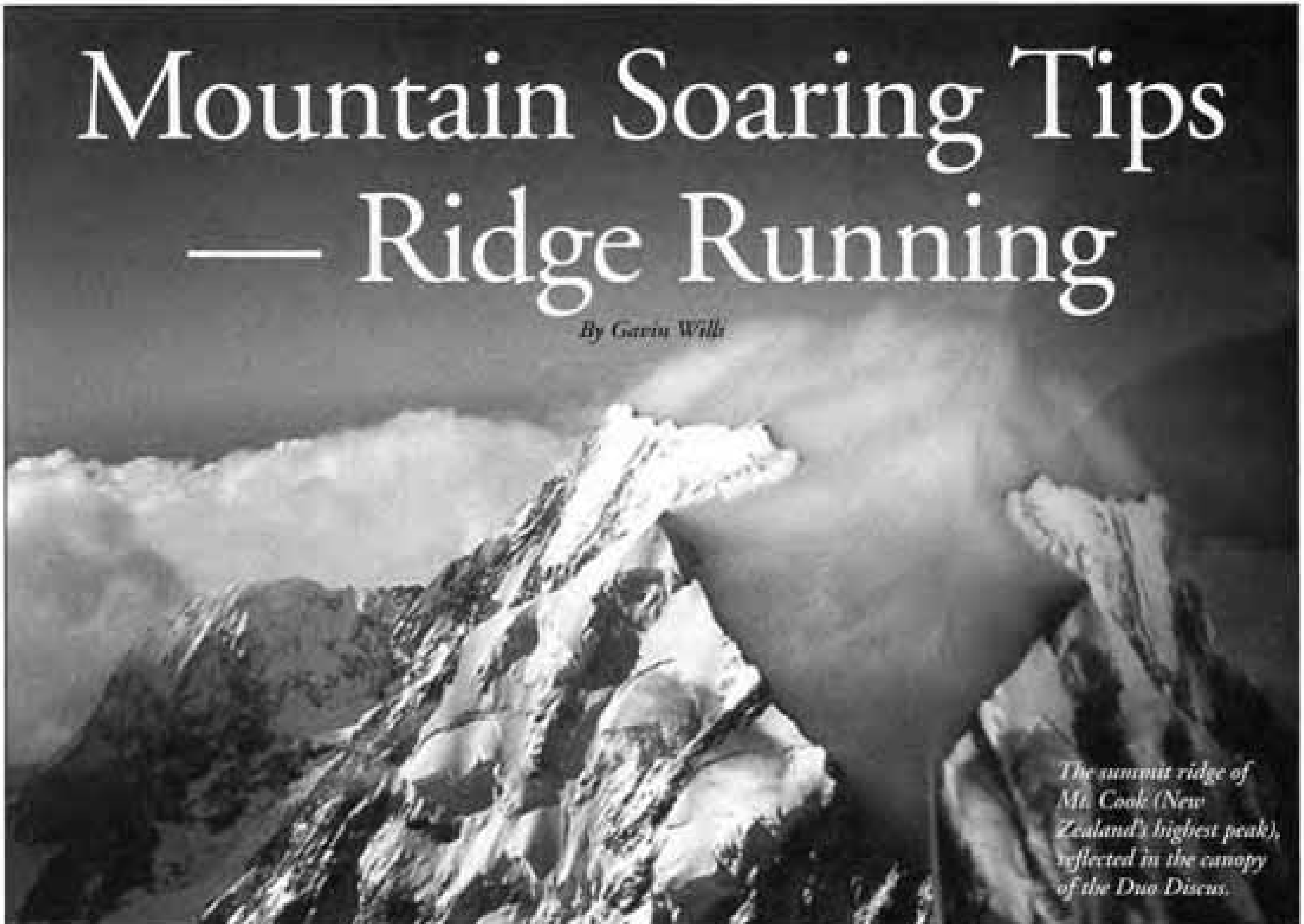


In support of the 2009-2010 Valley Soaring Association Winter Series seminars at Williams Soaring Center, Williams California, the following articles are compiled into this one PDF for review and study in conjunction with Kempton Izuno's Working Ridges presentation. These articles include:

Kempton Izuno
kizuno1@gmail.com

Mountain Soaring Tips — Ridge Running

By Gavin Wills



The summit ridge of Mt. Cook (New Zealand's highest peak), reflected in the canopy of the Duo Discus.

Gavin Wills is the director of a Mountain Soaring school in Omarama, on the South Island of New Zealand. This is the first in an occasional series of articles on his specialty.

The truth is that even before the canopy blew off, Jeff and I were not doing well. Struggling below the ridge crests we seemed unable to get "up on the step" to absorb the ridge's energy and to keep moving on. It was teaching us patience and determination: common lessons for pilots flying gliders in the mountains.

Jeff Campbell of Telluride, Colorado was planted in the back seat of "Hawkwing" (my Duo Discus), enjoying his first Omarama-based competition. Our first mountain pass crossing had set us up for a fast run south. But it was an advantage we squandered even before the Mayday calls went out.

We approached the unnamed pass from the lee side following a subsidiary ridge leading to the main range. Maintaining energy (80 knots and full ballast) but below glide slope, we plugged into wind and descending air, until we met the main range and turned toward the pass, a hundred feet above us and half a kilometer away. Then, beneath the rotor with rocks off our right wing and heavy sink to our left, we gently climbed the leeward slope. At the last minute, using our excess energy, we punched up through the rotor and rolled right, into a twenty-knot headwind. We had crossed the pass and climbed in powerful lift. It felt great!

Scraping over mountain passes against strong headwinds is a speciality of the experienced mountain pilot. There are many tricks but only one rule: Don't Hit the Hill.

Here are some of the tricks: Know the wind. Be aware of the sun and try to approach the pass up a subsidiary ridge or leading spur. Imagine the wind swirling around and over the pass towards you and along that leading ridge, creating little areas of convergence. Notice where the sun heats the ridge and where its shape may shelter and encourage thermal activity. Use these scraps of lift to maintain energy, keep an escape route clear and have a Plan B in case you don't make the pass. (See Figure 1).

I am often asked how close one should fly to the hill to gain the best lift. "Close enough to see the grasses blowing" is often my tongue-in-cheek reply. Because I love to fly in close, swooping around the rocks and basins and popping over ridges, I sometimes soar closer then one really needs to be! But if the winds are light and the grasses barely moving you have to be within a wingspan or two to read their motion and to take advantage of the weak lift. Further out there may well be nothing.

Flying in close is like driving a car onto a narrow bridge. One looks at the space ahead and never at the bridge sidings. Likewise in the air look ahead and plan your route to swoop the delicious mountain curves. Distances off the hill are not judged by the size of the sheep's eyes rolling but by one's subconscious use of parallax principles and the relative movement of the scenery ahead.

Practice flying closer to the mountain on a calm day. Contour fly the slope slowly but with 10 knots added for mother. Fit your glider into the spaces made by the mountains for your enjoyment, and revel in the scenery flashing past. Be careful if the hill is bubbling — your outside wing flying into a thermal can initiate an alarming tilt toward the rocks. Mother will thank you then for the control brought on by her extra bit of speed!

The fastest route along a windy mountain ridge is at the ridge's crest. Here the wind velocity may be several times greater than above or below the edge. If you are really in a hurry, use surges of lift to build speed rather than altitude. If a ridge is working from low down it is generally fastest to climb gently on track until the crest is reached and then accelerate to stay there.

How do we know if a ridge is working before we get to it? Know the wind All Ways! Understand how the terrain will interact with the wind at every level.

Unless the wind is so strong as to be blowing dust, snow or small trees off the ridge tops, cloud shadows may be the best indication of wind on a mountain ridge. Cloud shadows climbing a mountain face ahead always puts a tingle of anticipation up my spine. But cloud shadows are indicators of the wind at cloud base and may not always relate to breeze on the ridges below.

Billy Walker's Rule

Bill Walker is a leader and visionary within the New Zealand gliding movement. A passionate racing pilot, he has been soaring for over 30 years and has flown competitions in Australia, France, Italy, Spain, Turkey and the United States. He was the instigator and is the developer of the Omarama Soaring Centre. He was co-chairman of World Glide 1995 and a competitor in the very successful Omarama based World Championships.

The west face of the Remarkable Mountains rises over seven thousand feet above the lake behind Bill's home in Queenstown, NZ. One day with the west wind howling down the lake he flew onto this face expecting a good climb but instead encountered only sink. With landout options running out he headed upwind across the lake and to his astonishment found gentle lift that dragged him up from an inevitable watery landing. This and other experiences of sink on a hill led to the formulation Billy Walker's Rule.

Bill Walker of Queenstown, New Zealand

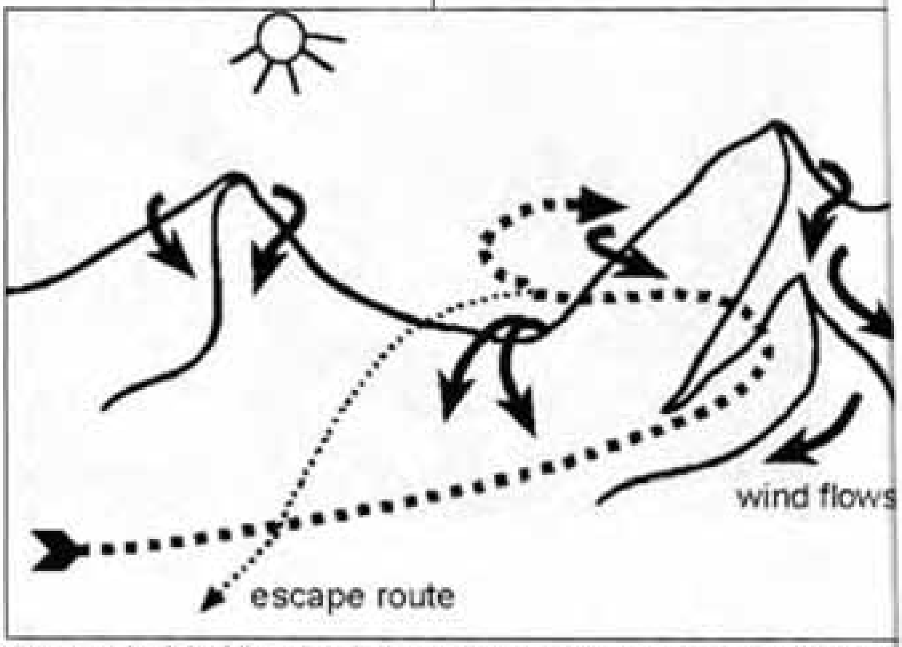


Figure 1: The glider follows the subsidiary ridge toward the pass, utilizing local heating a[nd] convergences to maintain energy.

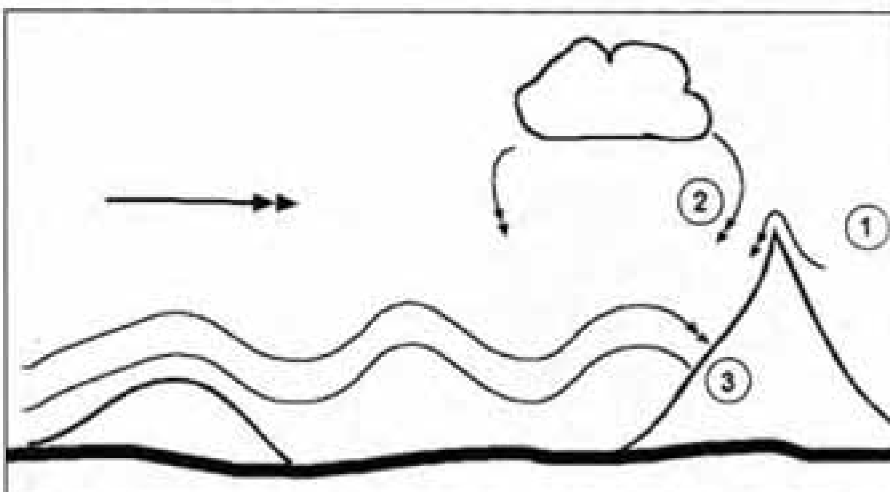


Figure 2: Three possible reasons why Billy Walker's rule is necessary:
1. There is a wind change on the hill (convergence in the valley).
2. A thermal is dumping on the hill (lift in the valley).
3. Wave triggered by an upwind obstruction is dumping on the hill (lift upwind).

The airfield at Omarama, New Zealand.

How low can one be to join a mountain ridge? That depends on a lot of things, including how desperate one is! Some daring pilots have climbed away from a couple of hundred feet when others landed out or, worse still, crashed.

The direction and strength of the wind on the valley floor will indicate if the lower mountain slopes are working. The indicators will be seen on water, from smoke, dust, trees, mother's washing or from a friendly windsock. For the hill to be working very low down, the wind has to be blowing onto it and not around it. Upwind, there should be no obstructing terrain, nor nearby thermals dumping.

Which brings me to Billy Walker's Rule: "If you fly onto a hill slope expecting lift but encounter sink then immediately fly away at a right angle." It sounds very reasonable but it is surprising how long one can scratch around on a slope that one thinks should be working when the only thing climbing is the valley floor. The reasons why Billy Walker's Rule is so often necessary are illustrated in Fig 2.

Things settled down for Jeff and me after the Maydays went out. We were able to retrieve the canopy and hold it half shut while we thermaled back up the mountain face and limped home to Omarama. Bottom placing on the first day was not an auspicious start to our National Competition.

Subsequent investigation showed that the canopy latch pins lacked an over-center lock or spring device. While we were preoccupied with the race, the sustained turbulence of our ridge running caused the pins to slowly work undone. Luckily the canopy flew open at about 65 knots in level flight and failed to break way.

Later the Schempp-Hirth factory voiced surprise that the canopy had not torn from its hinges as it was supposed to. We, on the other hand, were surprised that the latch could have worked open in flight. Now we use rubber bands to keep the latch shut and we recommend other Duo Discus pilots do the same, at least until the factory completes a fix!

Happy ridge running!

About the author: Gavin has lived many lives including that of Geologist, Mountain and River Guide, Avalanche Forecaster, Film Director and Bush Pilot. But coming from a family of glider pilots he has been flying gliders since he was ten years old and now has over 7,000 hours in the air. In 1996 he collaborated with his daughter Lucy and cousin Justin Wills to produce the award-winning, gliding film, "Windborn, a Journey into Flight." He now operates a Mountain Soaring School at Omarama, New Zealand where he introduces visiting pilots to the mountains he loves and knows so well. Details may be found at www.GlideOmarama.com

MOUNTAIN THERMALS PART 1

Cloud Huggers & Rock Hoppers

by Gavin Wills

"I think I just got my money's worth!" exclaimed Harman from the back seat. With a turbulent shot of sweet air Hawkwing (my Duo Discus) surged off the razorback ridge and wrapped into a steep spiral climb. Jagged spires of rock dropped away as Harman exclaimed again, "I would never have looked in here for lift!"

Still low and locked between walls of rock above sapphire-blue waters, the glider lifted clear of the razorback and pointed up the ridge to the black peak a thousand feet above. "Shouldn't we circle to climb some more?" But even as Harman spoke Hawkwing swept up the precipitous ridge until the black peak scraped below the nose and the glaciated mountains of New Zealand's Mount Aspiring National Park sprang into view.

For my money, soaring amongst the mountains is the most exhilarating and challenging way to fly gliders. Rocks, cliffs and trees flash past the canopy as one sweeps skyward in powerful narrow-gutted thermals. Mountain thermals are my favorite soaring engine.

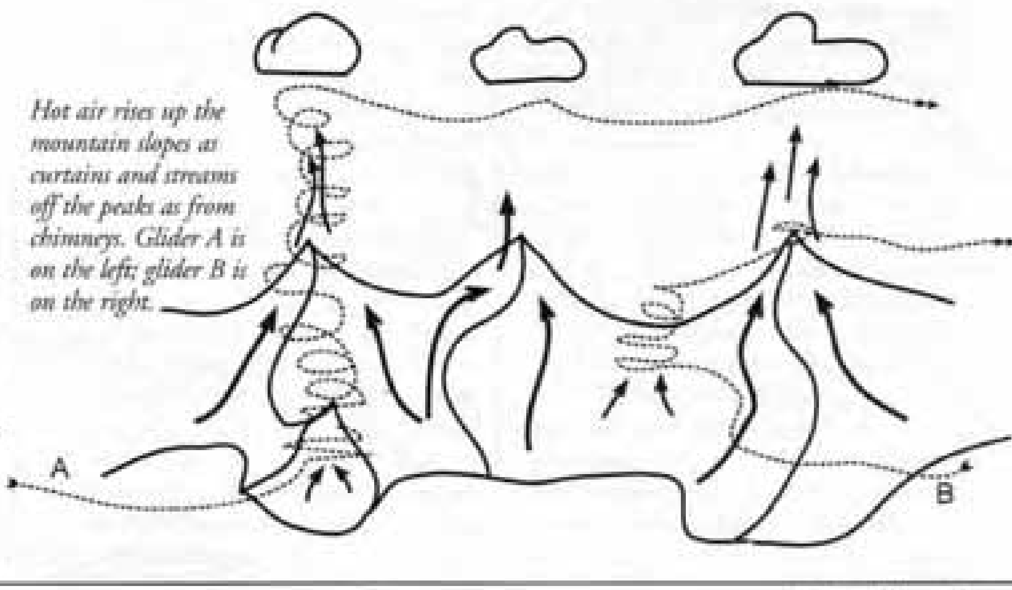
On a good day, when the winds are light, mountain thermals originate from hot spots in the valley floors. They rise up the sun-baked mountain flanks to crest the ridge as narrow curtains of hot air. Mountain peaks act as chimneys drawing these multiple source curtains together into single thermals of exceptional strength. The strongest mountain thermals are usually found above the highest peaks (see the diagram).

Mountain thermal soaring requires a certain minimum experience. The mountain pilot must be able to handle his glider accurately without conscious input, land anywhere, and have confidence in his atmospheric model of how, why and where the mountain thermals work. A steely nerve and a sense of wonder also help, as gorgeous panoramas, soaring eagles and spectacular views unfold and distract. A good memory for terrain and landout options is desirable so the map stays neatly folded when the GPS points at a nearby landout which happens to be located on the other side of an insurmountable mountain ridge!

"Never turn towards the hill or thermal below the ridge crest" Roger my early instructor told me. I often think of him and his words when, locked in a canyon of red rock, I turn towards the mountain wall fighting a rough, narrow thermal. What he really meant was "*Don't hit the hill, buddy!*" So I add a few knots for mother and try to maintain a medium angle of bank that if steepened can steer me out of trouble.

If trouble does loom and the hill gets too close for comfort on the inside of a turn, I maintain the same angle of bank as the mountainside and drop the nose a little to exit along my escape route. Remember the fuselage can be a few feet off the hill if the wings are parallel to the slope. It's not a nice place to be but, along with your escape route, it's worth remembering!

Surprise, surprise! On mountain thermal days puffy cumulus form up in lines. No, they are not cloud streets. They mark the best thermals and follow the lines of the



Hot air rises up the mountain slopes as curtains and streams off the peaks as from chimneys. Glider A is on the left; glider B is on the right.

main ranges. As you climb to cloud base and thank your thermal source (an important mountain flying technique!) you will notice the cloud is often over a beautifully shaped mountain. Dolphin happily along your "cloud street" and notice which peaks are producing clouds and wonder why. The "why" may help when the clouds disappear and/or you change from a cloud hugger into a rock hopper.

When cloud base is lowish — within a few thousand feet of the ridge tops — then rock hopping along the ridge crest is often faster then cloud hugging. At ridge crest you track along nearly continuous curtains of rising air and accelerate in the strong surges over the mountain peaks. However, when cloud base is 10,000 feet above ridge top, as in Colorado's Rocky Mountains, cloud hugging is a comfortable way to go!

Horror of horrors, sooner or later you will find yourself below ridge top and scrabbling to climb back up. Firstly, relax! — the valley floor is probably far below you. Secondly, if it is a good mountain thermal day the thermals are likely to originate from the valley floor and will help you back up. But you have to quickly change down a gear or two to cope with the much weaker conditions below the ridges and their thermal-focusing effects.

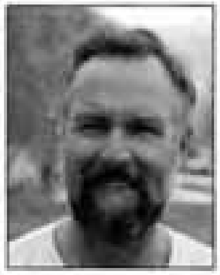
As soon as possible, identify the stepping stones that will lift you back to the main ridge crest. Then, in the absence of obvious, well-defined thermals rising from the valley floor, work "curtains" and "chimneys" to get your wing over almost any low ridge.

In the diagram, Glider A slowly and carefully figure eights up the sunny face of the very low peak until he can "point his wing" at the peak and fly around it. Then with his wing pointed steeply down at the peak he thermals upwards and notices that his drift is leading him up the ridge towards the high peak. Drifting onto the high peak, he gets too close to thermal. So he climbs the last few hundred feet by again circling the peak. Then, steepening his bank to point his wing at the summit, he climbs rapidly and happily towards cloud base. He has been lifted by the strong thermal gusting from the mountain's "chimney".

Glider B is a little higher and elects to try and get a wing over the main ridge. He flies to the lowest point, a sunny saddle, and begins to figure eight. By ensuring each 180-degree turn is in a bubble of lift he gently climbs to the saddle, gets a wing over the ridge and begins to circle. A few hundred feet above the ridge he points at the nearest mountain "chimney" and riding the curtain of air rising off the ridge he is lifted upwards to the peak. Here he decides to rock hop rather than take the climb, so he accelerates in the strong lift and barrels on down the ridge.

On the good days mountain thermal flying is the soaring pilot's delight but on the difficult days it can become a rock-scraping, gorge-following nightmare. Part two of Mountain Thermals will discus recognition of the tricky situations and how to deal with them.

In the meantime enjoy a mountain thermal or two. Or, if you are not in such a lucky place as I am, then, at the least, dream about them!



About the author: Gavin Wills co-produced and directed the award-winning soaring films "Windborn, a Journey into Flight", and "Champions of the Wave." He operates a Mountain Soaring School at Omarama, New Zealand from October through March and from Telluride, Colorado during the Northern Summer. Details may be found at www.GlideOmarama.com

MOUNTAIN THERMALS PART 2

Outsmarting the Sirens

by Gavin Wills

Understanding the terrain and the wind may get you home when nothing else will.

Approaching the summit of a mountain ridge. There is little clearance between ridge top and cloudbase here.

The remote salt pans glisten in the late afternoon sun. In the High Mountain deserts of Nevada they are desperate outposts for soaring adventurers that beckon weary fliers down to land, then drown them in heat, loneliness and wind-blown salt.

With nearly two hundred kilometers to run across half a dozen salt pans and four mountain ranges, we knew we would have to pay careful attention to what was left of this mountain thermal day. One mistake could become a night in the desert siren's arms followed by a multi-day retrieve over uncharted dirt roads. Crew costs alone could amount to a ton of ghastly Budweiser!

So pay attention, reader! One day you could be faced with a similar soaring challenge! One in which your skill, your experiences and your good understanding of mountain thermals might get you home against the odds.

Still airborne, but now alone and confronted with a potential mountain of Budweiser, this is exactly what Uniform Two and I had to do. And this is how we did it. First we took stock and updated the day's "atmospheric model." Then we identified lift sources and energy lines, planned a route, crossed our fingers and set off without looking down.

We started our stock take with the obvious, and kept it simple, remembering we had to fly and think clearly at the same time. (Something that soaring men are not famous for!)

1. Air stability.
Broken thermals rising 4,000 to 5,000' above the desert floor have been our soaring engines all day. They will weaken and die with the setting sun. The sun is 30 degrees above the horizon. Maybe two hours of heating is all that is left of the day at this latitude. With two hundred kilometres remaining at an average speed of 100 kph there is no time to recover from mistakes. Good decisions and efficient flying will be essential.

2. Moisture content.
The air is dry and the thermals blue. There will be no clouds to follow. To find thermals we will have to recognize their sources. But at least overdeveloped cumuli will not obscure the sun! (Look on the bright side!)

3. Terrain.
Four north-south mountain ranges lie directly across our track (see Fig 1.) The highest, called Mount Wheeler, rears 7,000' above the desert. Silhouetted 140

kms to the west we notice that its southern end is close to our direct track home.

The remaining ranges, broken by occasional low passes, rise only 1,500 to 3,000' above the sand. The late sun will heat their western flanks while their eastern slopes cool in deepening shadow. We notice that most of these low ranges have even lower hills scattered a few kilometers to their east.

4. Wind.

In the mountains, wind is everything. We need to know the wind All Ways at Every Level and All the Time. Today we reckon the upper wind at thermal top height is southwest at about 25 knots — that's why the thermals have been so broken and sheared all day. The morning forecast suggested that this wind would continue into the night without abatement. Wind, therefore, will be an important factor for the journey home.

What about the wind on the valley floor? Our buddy Jeff landed a couple of valleys east and reported southerly winds on the ground gusting to 30 knots. It is likely that, encouraged by the upper flow and drawn in by the day's heating, strong southerly winds will continue up all the valleys at least until sunset. Thermals therefore will originate only in areas sheltered by the hills and mountains.

Will the wind at ridge top height run along or across the ranges? A sixty-four thousand-dollar question! For the low ranges we assume the worse case — that the valleys' southerly winds will also blow along the ridges. However on the high slopes of Mount Wheeler we hope the upper level southwest winds will blow obliquely across the ridge. We count on that for the final glide home.

5. Thermal Triggers.

Thermal heating will occur only amongst the mountain ranges. Therefore thermal triggers will probably be three-fold; mountain peaks chimney-ing thermals from sheltered valleys, mountain ridges focusing curtains of rising air and the cool wind itself, chiselling off bubbles of ground heated air as it swirls into sheltered corners

So what has all this brain work done except sink us inexorably towards the salt pan sirens? Hopefully this combination of observations, assumptions and deductions will have helped us create a useful current model of the atmosphere. Hopefully this model will point us to those essential stepping-stones and energy lines that will enable us to soar over the seductive sirens and get us home in time for whisky and bed.

So now the plan (Fig 1 again). We will try to dolphin-soar southwards, into wind along the first mountain range. We will cross the next two valleys at their narrow points and be well upwind of Mount Wheeler — just like in sailing, being upwind is money in the bank. Then we will backtrack north along the third range, floating downwind until we can reach the southwestern flanks of Mt. Wheeler. There the slopes have sheltered aspects, and sun and wind should work from low down to help us climb to Mount Wheeler's summit ridge. From there, high above the sodding sirens, we will (hopefully) start the final glide home.

We will search for climbs in only two kinds of places; southwest-facing bowls where heated air may be swept skywards, and around sunny hills that are sheltered from the prevailing valley wind. Once beyond the upwind plug, and if the climbs become weak or broken, we will dump our water ballast to maximize climbs from the dying thermals. Anything to avoid the salt pan sirens!

Each of these considerations – air stability, water content (clouds), terrain aspect, thermal triggers and the wind – are important. The most important are terrain aspect and the wind because they control the air's heating by the sun. When the sun and the wind work together the soaring is much easier than when the sun works against the wind.

The source and strength of the valley wind is important. For example, valley winds that blow off bodies of water or are simply very strong can shut down thermal activity in exposed places. The smart pilot can almost always find those secret spots that are sheltered from unkind valley winds.

Did the little LS-3 called U2 make it home across the desert that night? Of course!

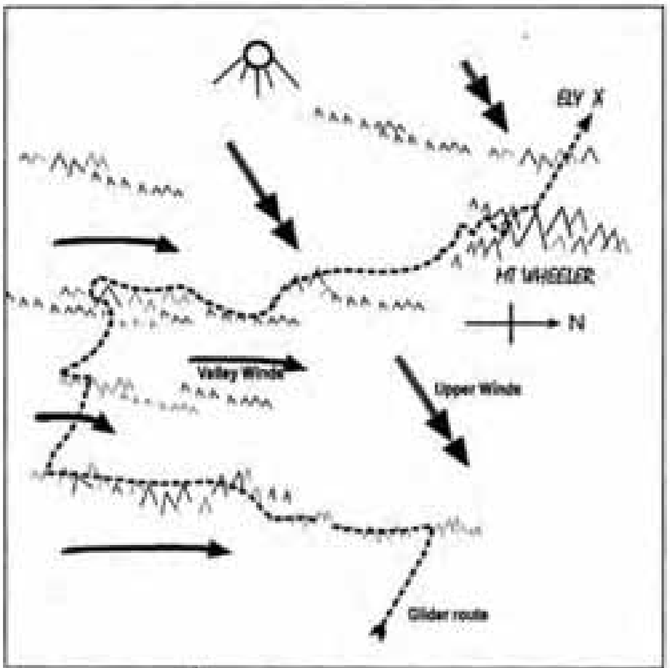
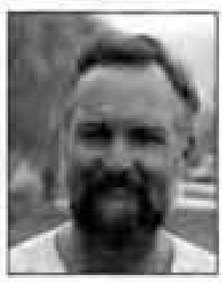


Figure 1. Picking the right route home! Consider the terrain, sun angles, the valley winds and the upper winds.

We followed the plan to the letter; dolphin-soared the ridges, dumped our water, climbed gently over mountain chimneys and floated onto the base of Mount Wheeler. Here a dying thermal and the prevailing southwest wind swept us aloft for a long fast final glide into the setting desert sun.

Last home, but safely back at Ely, Nevada our relieved crew rewarded us with nearly a ton of Budweiser! We toasted our thermal sources — for once again we had outsmarted the desert sirens!



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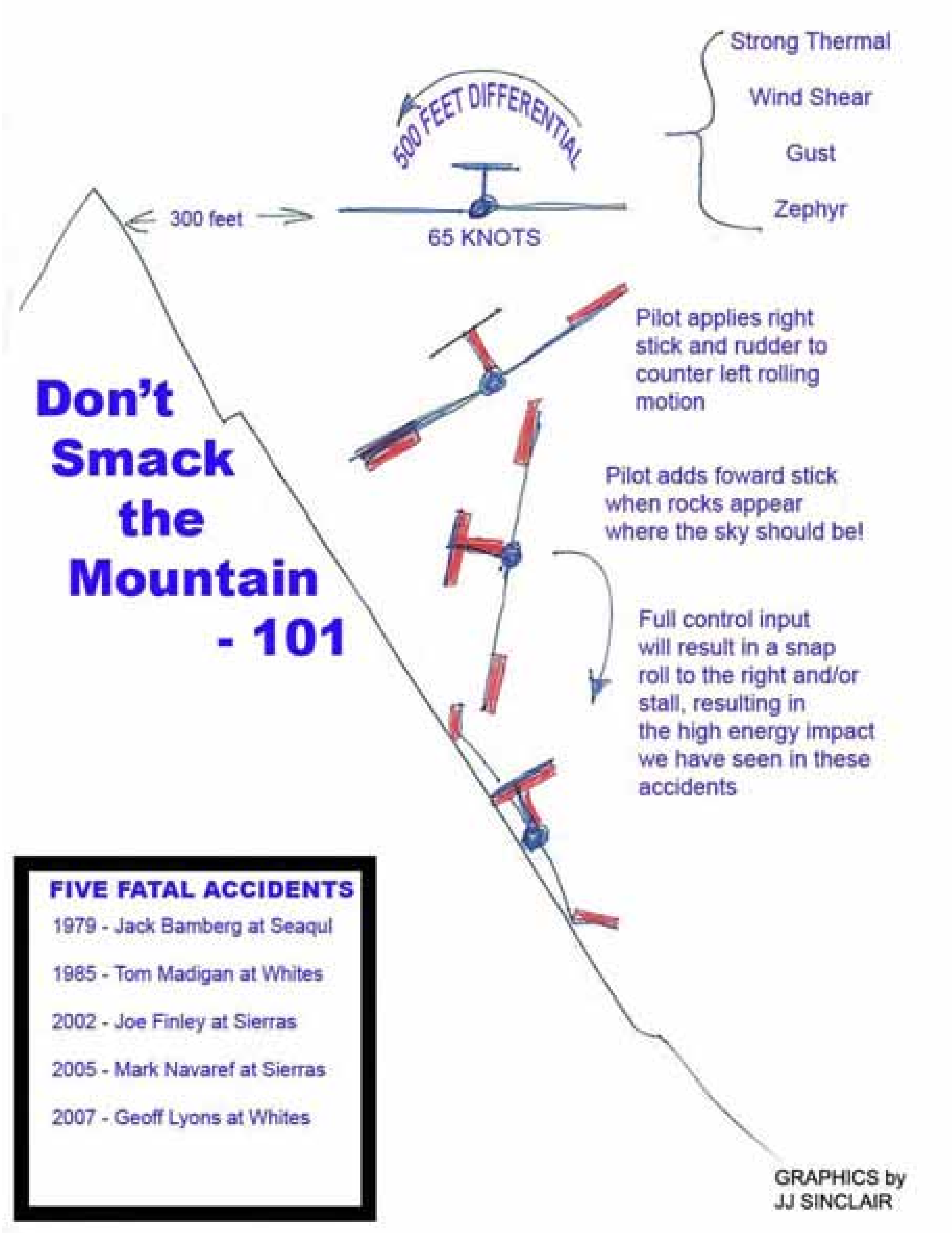
SAFETY FEATURE

Don't Smack the Mountain – 101

by JJ Sinclair 2007



Good morning, class. Today we will be discussing an alarming statistic. In the past 30 years our soaring area has witnessed 5 fatal accidents in the mountains and 3 of these accidents have occurred within the last 5 years! Would one of you work up a trend analysis on those statistics? Thank you Mr. Kelly.

All these accidents involved experienced pilots flying modern sailplanes and most of them impacted with high energy, indicating a stall situation. Why would an experienced aviator inadvertently stall his aircraft, especially near the rocks? Everybody now look at the graphic, the top sailplane represents us flying into the page as we approach a mountain on our initial pass. We stay 300 feet away from the rocks and keep our speed up (minimum 65 knots). Is that safe enough? Maybe not! Lets just suppose there's trouble lurking out there in the form of a gigantic gust, a really strong thermal, a violent wind shear. For the purposes of our discussion we'll just call it a **zephyr** and its going to apply a differential rolling moment to our theoretical sailplane. What's a differential rolling moment? Good question, Mr. Green, it happens when our right wing flies into lift that is much stronger than what our left wing is experiencing. We are constantly looking for this, aren't we? We call it "light wing" and turn into the wing that's coming up as soon as possible, because there's probably a thermal on the light wing side. Ever try to turn into the light wing and have the machine refuse to turn? Sure, happens all the time and we say something like, Turn, you big beast, turn! What's happening? Why won't the ship turn into the rising wing? Because, the thermal is stronger than the authority available in our ailerons. Another way to state this is; The thermal is trying to roll us left and we are trying to make the ship roll right. The result is a Mexican stand off and we fly straight with full right stick and rudder applied.

Now class, look at the second sailplane in the graphic. That's us, still flying into the page, but the zephyr's got us and its rolling us left into the mountain. We have applied full right stick & rudder, but the zephyr's stronger than the controls and we're still rolling left and **there's rocks over there**! Why is this happening? It is estimated that our ailerons can only counteract a differential moment of 500 fpm. Let's say there's 1200 fpm under our right wing and only 300 fpm under our left wing. Reasonable figures? Sure, we see 1200 fpm all the time on the Whites and in the Sierras, only near this damned mountain it's mostly under our right wing!

Now, look at the third ship. We're in real trouble, aren't we? There are rocks and trees up there on our canopy where the sky is supposed to be! We're experienced aviators and we don't panic, we continue to hold full right stick & rudder and apply forward stick to make the rocks stay away from our canopy.

STOP ACTION

Class, remember what we learned in Aviation –101? We can stall a ship in any attitude and at almost any airspeed, can't we? I believe it was in chapter 6 that we learned how to do a snap roll. All you had to do was slam in full rudder and full back stick and the airplane would do a snap roll in the direction of applied rudder. Can we stall a ship while inverted? Yes we can! OK, resume action. We're flying 65 knots, holding full right rudder and the stick's now in the right forward corner. What's the ship likely to do? It might try to snap roll to the right, but the zephyr probably won't allow that, so I'm betting it will just stall & fall and we have another mysterious high energy impact on the side of a mountain, don't we?

Does it have to be this way? Are those of us who choose to fly close to the mountains, destined to become a high-energy impact, some day?   NO

I see Mr. Seamons has his hand up. OK, sir what's you question? How do we prevent smacking the mountain? Good question, I was just getting to that. First of all, there are days where I won't get within 1000 feet of the rocks. If I'm approaching a mountain and the turbulence is so bad that things are flying around the cockpit. **I don't get within 1000 foot of the rocks**

Let say I'm approaching the Whites, I'm holding 65 knots and things seem fairly smooth. My computer tells me the westerly wind should make the canyon up ahead, work. But, what if there's a zephyr in the canyon? What if it tries to roll me into the mountain? As I get within 300 feet of the rocks, I roll the ship into a 30 degree right bank and hold it there with a bit of top rudder. Why? Because, I'm already banked away from the mountain, so if a zephyr tries to get me, I'm ready to apply all three control inputs to fight it with right stick, right rudder and back stick to make it turn away from the rocks.

I also follow all the normal rules about never turn directly into the mountain, always S turn an area for a beat or two before attempting to circle. If I fly by an area that shows 300-fpm lift for 20 seconds, I turn away from the mountain and come back through the lift area to verify it really is workable lift. If it is, I turn 90 degrees away from the rocks, roll wings level for a count of 3 (you know 1000-one, 1000-two, 1000-three) then I turn back into the mountain. My 3-second burst flying away from the rocks gives me plenty of room to finishing a turn into the mountain, but I'm still not committed. As I face the rocks again, I ask myself; Am I 100% sure I can finish this turn? Only if the answer is an unequivocal YES, do I continue. If I'm not completely sure, I roll the other way and continue S turning the area. If I do continue the turn, I may shallow out the turn as I come parallel to the rocks and let the ship drift in close, if that's where the best lift is. I do this while holding a 30 degree bank angle AWAY from the rocks.

OK, that's enough for today, class dismissed!

Oh, one more thing, **always keep an escape route open**! You may see some of this material on the quarterly exam. Mr. Kelly, you may give your accident trend analysis, first thing Monday morning, please hold it down to 2 minutes, maximum.

Norm's Last Flight

by Gavin Wills

An American glider pilot died in a crash near Omarama, on the south island of New Zealand; this preliminary report examines the circumstances and possible causes. The observations and opinions are the author's and are not intended to pre-empt or prejudge official reports.

Norm Gray was from Telluride, Colorado. He died at about 3:30 pm on January 22, 2002, when his Omarama-based ASW-20 crashed at 4,500' on the slopes of the Ohau Range, 10 km north of Ribbonwood Station. There have been two other fatal gliding accidents in the Omarama area: in 1973 and in 1984.

Norm and two friends were attending a two-week-long private mountain soaring course with GlideOmarama. The course was directed by Gavin Wills. Gavin had known Norm for several years and had flown with him and his buddies in Telluride and at both Minden and Ely in Nevada.

Norm owned an ASW-20 in Colorado and had about 450 hours soaring experience over a five-year period. He was methodical and careful in everything he did and was a particularly competent pilot who had made successful flights of over 750 km. He had already completed eight soaring flights from Omarama, including a thermal and ridge flight from Mount Aspiring to Mount Cook.

The group of four gliders launched at Omarama on January 22 into a 15- to 20-knot easterly and quickly became established on the Buscot Ridge of Little Ben where they climbed to about 3,500'. At Clearburn they entered convergence thermals and soared to 5,500' before cruising west to the Ohau Range, just south of the Ohau Lodge. Here quite by chance a helicopter cruised beneath the gaggle. Recognizing the aircraft, Gavin established radio contact and chatted with the pilot.

Five minutes later the group was circling left, close to the scree-covered mountain in weak thermal/ridge lift. The wind at this altitude was a light east-north-easterly blowing at 10 knots or less straight onto the slopes. The four gliders were separated by about 500 feet vertically and were approaching 5,000', climbing slowly at one or two knots in smooth lift. Cloudbase was 5,500' with total cloud cover above but with unlimited horizontal visibility.

One of Norm's buddies observed him making a left turn towards the hill when the nose appeared to pitch down and the glider pivoted around its left wing. He thought that Norm had got too close to the hill and was steepening his turn and speeding up in an avoidance manuever. He was both surprised and horrified when the glider struck the mountain instead of zooming away.

Gavin immediately called the helicopter, which arrived in about 5 minutes; the other pilots returned to Omarama. Gavin remained soaring above the site while the helicopter hovered and dropped someone nearby the crash who confirmed in coded language that Norm was dead.

During the subsequent recovery of the body and later of the glider it was observed that the ASW-20 had struck the 30-degree scree slope at between 40 and 60 degrees to the horizontal. It had impacted on its nose and stopped in about a meter with its wings level. The tail was broken off and both wings were delaminated with broken main spars. We believe that Norm was making a left turn close to the hill when the glider stalled with insufficient height to make a recovery.

Assuming that the official investigation confirms that this indeed was the cause, we can only surmise how a careful pilot with Norm's mountain flying expereince could allow such a stall to develop. There may be some contributing factors:

- The stalling characteristics of a turning ASW-20 include very clear warning signs and a pronounced pre-stall buffet followed by a sudden pronounced nose drop and rotation around the inside wing. Norm was experienced on type but in spite of this failed to recognize the onset of the stall in time to recover. Perhaps he was distracted by something.
- The scree slopes of the Ohau Range are steep, smooth and somewhat featureless and Norm was flying midway up a grey slope on a grey day. It is possible that he was closer to the featureless slope than he realized.
- There were other gliders above him, close to the hill and circling in the same lift. These may have distracted him at a critical moment of his turn towards the hill.
- He was an avid picture-taker and may have become distracted using or stowing his camera.

We will never know exactly what happened that day, but we do know that Norm would want us to share our thoughts and any lessons. Circling close to a hill is a dangerous maneuver but nevertheless one that is a valid, often-necessary mountain soaring technique. Norm would have been the first to suggest the following:

- When flying near the ground add 5 to 10 knots airspeed.
- If circling close to the hill use a medium angle of bank and maintain a constant airspeed.
- Avoid speeding up while turning away from the hill or slowing down while turning towards the hill.
- Allow for wind drift, wind shear or wind gusts.
- Plan the circle well ahead, pay close attention and avoid distractions.
- When centering below other gliders circling close to the hill, be aware of the slope at your level. It may not be possible to center under them if the slope at your level gets in the way!

About the author: Gavin has been flying gliders since he was 10 and now has over 7,000 hours in the air. In 1996 he collaborated with his daughter Lucy and cousin Justin Wills to produce the award-winning gliding film, "Windborn, a Journey into Flight." He now operates a mountain soaring school in New Zealand.

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by HENRY COMBS

THAT BEAUTIFUL MOUNTAIN AND HER SINISTER TRAP

A Possible Explanation For Some Unexplained Ridge-Soaring Crashes

That Saturday morning, May 26, 1984 was especially pleasant in the Antelope Valley north of Los Angeles, California. The preparations for our upcoming flight were like many others over the years. We were all enthused, and pleased over the prospects—Robert Nethercutt, Chet Lyman and I had no idea of what was in store for us on this particular Fateful Day.

Chet was anxious to go first and explore for lift early in the day. We often referred to him as our "sniffer" for lift. In his beautiful *Phoebus* A he could work weak lift with amazing success. His wife, Violet, was his crew and we both helped him get ready for the takeoff. I pulled his seat belt and shoulder harness up nice and tight. He started tow at 10:36 a.m. from Crystalaire airport near Pearblossom, and released at the normal departure point along the San Gabriel Mountains. At 10:46 he called me, as I awaited tow, and said that he had 200 fpm lift on the north face of the mountain. I started my takeoff at 10:57 a.m. and was towed to the same departure point, where I released at 10:57. I did not see Chet's *Phoebus* anywhere.

A few minutes later Chet's ground crew called him and received no response. I could not see him, and I thought he ought to have been visible. Then I called him, with no response. This was not like Chet at all.

Then some overpowering Guidance caused me to return to the field. On the way in I called on the radio and outlined the problem. They had George Thomas in a towplane ready to search by the time I landed. We took a portable radio, took off and made one left turn toward the mountain. As though an unseen power was guiding us, we flew an almost straight course to the crash site at the 6700-foot level on the north face of the mountain. There lay the twisted and torn wreckage of what used to be a very beautiful *Phoebus* A. The terrain was exceedingly steep and it was difficult to make out the details amongst the pines as George and I passed over it repeatedly . . . and then, on one pass over we saw an arm wave to us! You can imagine our emotions!

The only possibility of rescue would be by helicopter, which we already had called for upon spotting the wreckage. The Los Angeles County Sheriff's Rescue Unit went into action. Paramedics were dropped in from smaller helicopters, then the primary rescue helicopter—a Sikorsky s-58 flown by Roger Peterson—made the expert and daring recovery of Chet Lyman. He was on board approximately two hours from the time he crashed, and was flown directly to the Antelope Valley Medical Center in Lancaster where he lingered close to death for four weeks in the intensive care unit. His progress is a tribute to his excellent physical condition before the accident and his very determined spirit, together with the excellent medical care he has received. Of course, his loving wife and crew, Violet Lyman, is ever present at his side.

I can count several friends and acquaintances who have been either killed or severely injured on sailplane flights which ended on a mountain. All of them were good sailplane pilots. Why did it happen to them? Did they finally make that one mistake? Or can it be that the mountain *sets a trap which will put any sailplane out of control?* I believe in the trap theory. Coincidence may keep the pilot out of it for a long time, even years. But years of success flying in the mountains, up close to the rugged terrain, breeds false confidence that all is well, until that one time when you coincidentally fly into the mountain's trap.

This trap the mountain sets is invisible and transient. In order to visualize the phenomenon, let's start with a study of a vigorous thermal where it originates near the surface over flat terrain as shown in **Figure 1**.

A sailplane approaching the thermal often will encounter strong sink just before flying into the thermal. All of us pilots are familiar with this phenomenon, and many of us have experienced a turbulence that has raised one wing to a near-vertical position, with the tail high. This has happened in spite of full corrective control, and has meant recovery with a pull-up.

Note that the lower the flight path is, the greater will be the difference between the lift on the left wing and the sink on the right wing, should we encounter the edge of the thermal. This can be a deadly situation, and has led some of the best pilots to recommend that dust-devil thermals *not be used* without at least 400 feet of ground

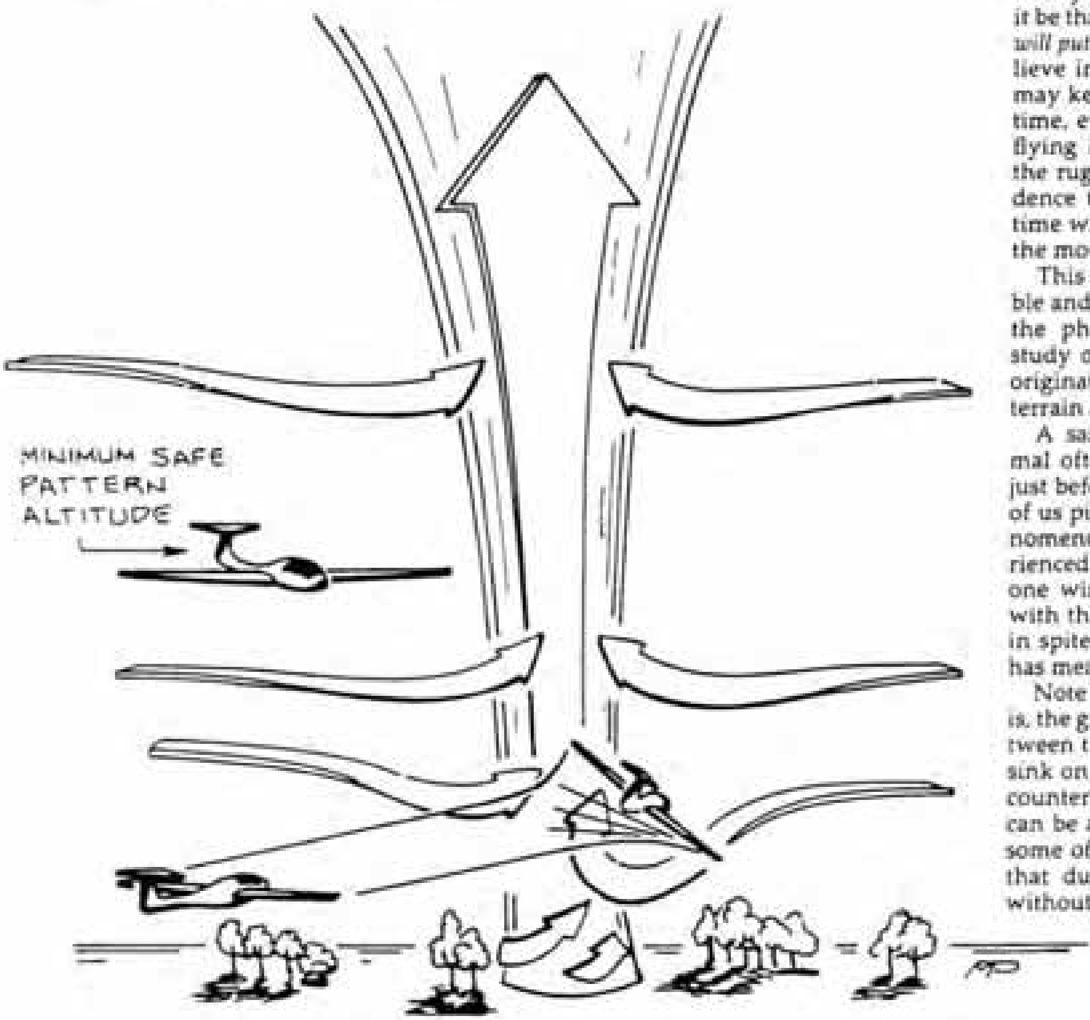

Figure 1.

Illustrations by Mike Pohlig

clearance and a speed high enough to take care of horizontal shear effects on indicated airspeed.

We have all been schooled as to the dangers of shopping for a thermal at very low altitudes. This training, and our desire to save pattern altitude for adequate landing preparations, has kept most of us from exposing ourselves to this invisible trap close to the ground over flat terrain.

But how about flying along a mountain slope when there is potential for thermals? There is all that ground clearance just 100 or 200 feet over to one side, even though our opposite wing may be cruising along close to the trees or rocks. After all, we can merely roll and peel away from the slope any time we need to, can we not? Right, most of the time. In fact, it works so well for years and years that we come to believe this kind of flying to be a safe practice. We've done it over and over, and we haven't been killed yet.

For those of you who still fly this way, best take heed. You have not yet encountered that beautiful mountain's sinister trap, where the hidden turbulence will roll the sailplane *toward* the mountain and pitch the nose down, overpowering all the control authority available on our modern sailplanes. This means that we can't carry out our good intention of peeling away from the slope, and we are trapped. Only enough ground clearance to permit recovery will save us from either a high-speed ground impact or a stalling, spin-in condition.

In order to better appreciate this sinister trap of the mountain's, we can redo and extend the analogy of thermals originating on flat ground, and compare them to those spontaneously erupting from a steep mountain slope, as illustrated in **Figure 2**.

The hazardous situation we saw in Figure 1, over level ground, becomes very much accentuated in the region where the air feeding into the base of the thermal rushes *down* the mountain and then very abruptly is sucked into the vertically rising core of the thermal. The condition which was serious on level ground becomes deadly on a steep mountain slope uphill from the base of the thermal.

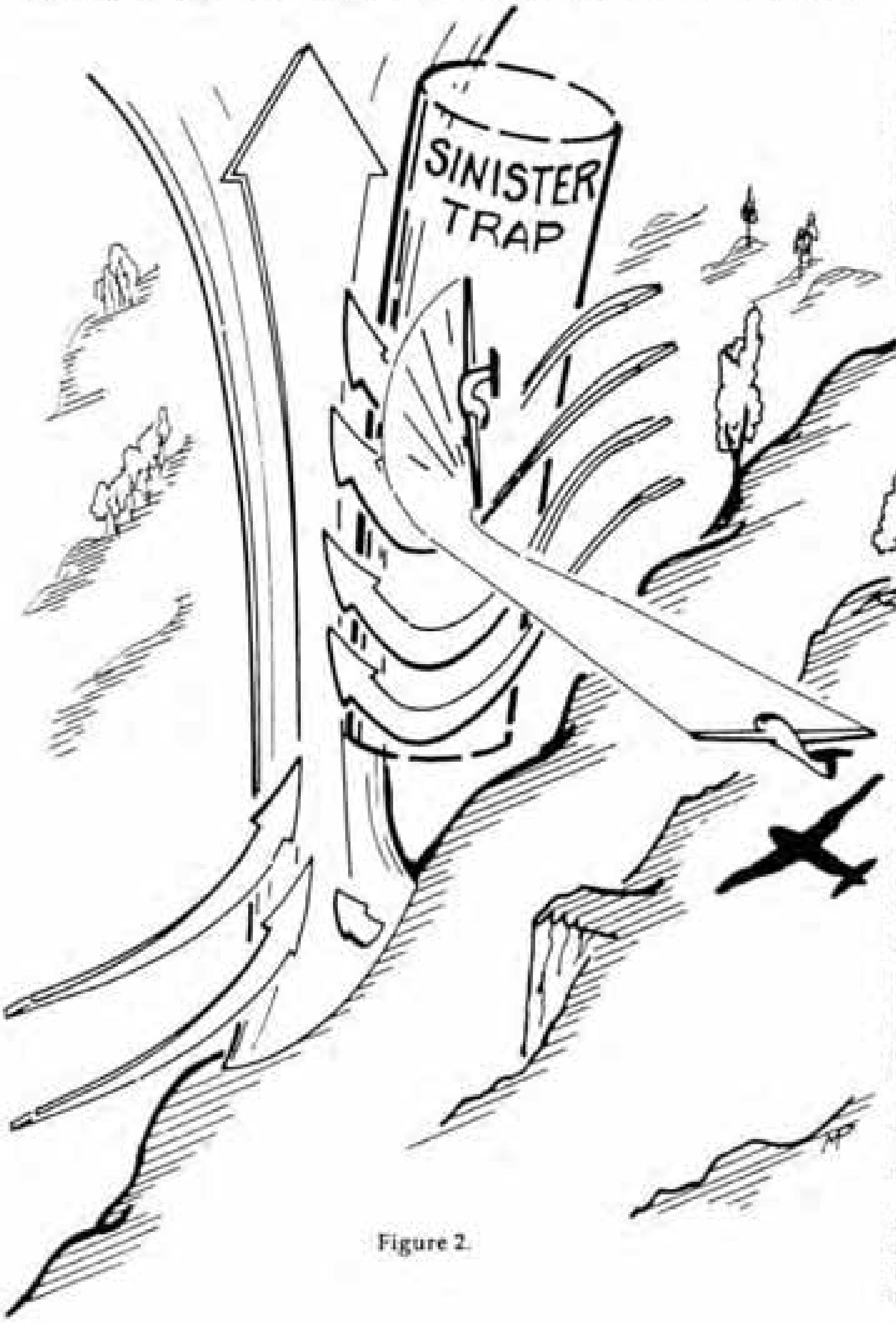

Figure 2.

A few numbers on the theoretical roll capability of any of the sailplanes we fly today will show that a thermal of 500 fpm (or perhaps even less) under one wing is more than we can handle with ailerons, even without possible downdrafts on the opposite wing. A hazardous attitude is bound to occur: we will be tail-high and banked vertically toward the mountain, and only enough ground clearance and expert airmanship will save the day!

Consider our chances for encountering the mountain's sinister trap:

1. There must be a young, vigorous thermal in progress.

2. We must fly into the very local region on the uphill side of the thermal, where the downrush of air feeding the base is very close to the air moving vertically upward inside the

thermal. Chances are that flying one wingspan to the left or right would be enough to avoid the upset.

3. The thermal is invisible and if we encounter it outside the very local trap region we will probably pat ourselves on the back for having so expertly found lift. But if we do hit the trap squarely, the mountain may win.

The chances of encountering the trap really are quite small for any one occasion. This fact builds false confidence that I suspect is at least partially responsible for a great portion of the so-called "unexplained" sailplane crashes in mountains.

Recommendations

1. If the atmospheric conditions suggest that thermals may be generated along the slopes, *stay far enough out* to permit recovery from a sudden and uncontrollable upset toward the mountain with wings vertical and tail high.

2. Evaluate, plan and *train* for the technique that you will use should the mountain spring her sinister trap on you. I recommend a maneuver as follows to escape with minimum ground clearance loss (see **Figure 3**):

First, dump the stick forward as an immediate reaction, so as to reduce the stalling speed and simultaneously go away from the slope. This will be a reduced-g or even slightly negative-g maneuver. Then, while your load factor and therefore your stalling speed are reduced by the zero or slightly negative angle of attack, roll the top wing down with the ailerons. Use coordinated rudder during the rollout. Complete the rollout headed *away* from the mountain.

3. *Remember* that the thermal lift will be more workable at higher ground clearances aboe the origin. In other words, select a thermal that has "popped off" lower down the mountain slope. If none exists, go home and fly again another day.

4. Even on days when there are no thermals and the only lift is ridge lift, it is noted that the slowing effect of ground friction on the air mass flowing up the mountain means that the best lift is out far enough from the slope to be free of this surface shear effect.

5. MORAL: when flying, give that mountain her distance, and enjoy her beauty forever.

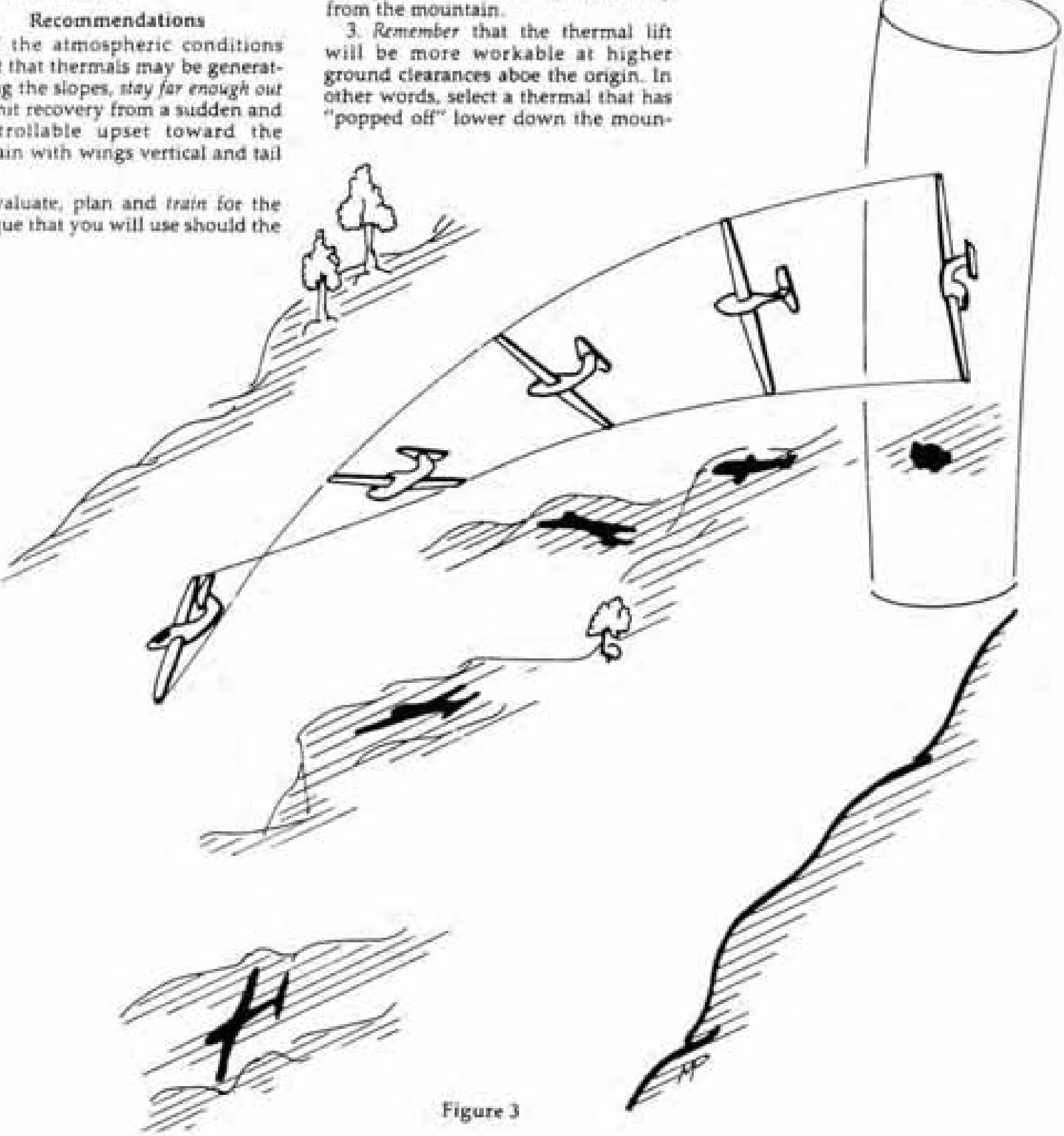

Figure 3