Instructor Support Manual

for teaching airborne exercises

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Record of Revisions

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Revision 1.0	20 November 2022	Initial Issue as accepted by CAA on 19 October 2022
Revision 1.1	26 January 2023	Added hyperlinks to a number of existing references

Note: The numbering system in this document is deliberately aligned with the numbering used in GNZ Form OPS-08. To preserve this relationship the introductory material appears in the *Notes and References* section at the end.

List of Abbreviations

A-Cat	Category A Gliding Instructor
AGL	Above Ground Level (in reference to height)
AoA	Angle of Attack - of a wing relative to the oncoming airflow
B-Cat	Category B Gliding Instructor
BGA	British Gliding Association
C-Cat	Category C Gliding Instructor
CAA	Civil Aviation Authority of New Zealand
CAR	Civil Aviation Rule
CFI	Chief Flying Instructor
DI	Daily Inspection - of an aircraft before the first flight of the day
FAI	Fédération Aéronautique Internationale - world governing body for air sports
FM	Flight Manual - as issued by the aircraft manufacturer
GFA	Gliding Federation of Australia
GNZ	Gliding New Zealand Incorporated
IAS	Instructor Assessment Standards
ISM	Instructor Support Manual (this document)
IT	Instructor Trainer
ITP	Instructor Training Program (comprising IAS plus other supporting material)
MOAP	Gliding NZ Manual of Approved Procedures
PIT	Principal Instructor Trainer - responsible for the training of a particular instructor
PPL(G)	Private Pilot Licence (Glider) - aviation document issued by CAA upon application
PTP	Pilot Training Program - support material hosted at training.gliding.co.nz
PTR	Pilot Training Record of Progress - located in the PTP
SA	Situational Awareness
TAS	True Air Speed (will be faster than IAS at higher altitudes)
XCP	Cross Country Pilot (proficiency standard required to apply for PPL-G)

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1 Airfield Safety Briefing

1.1 Standard Operating Procedures for the Airfield

Airfields and aerodrome used for gliding have written safety rules and procedures which refer to glider operations. Every instructor must have read and understood these rules, be able to give a safety briefing to visitors, and be alert to any breach of rules or procedures. Some airfields can be very confusing to a visitor, and they may walk or drive in unexpected places, such as onto active runways or across winch cables, even when there is clear signage in place.

When training is conducted at an aerodrome shared by aircraft types other than gliders and towplanes, procedures specific to that aerodrome will also need to be taught. If the aerodrome has Air Traffic Control or a flight advisory service then ground movement procedures will need to be included in the briefing.

1.2 Towplane Hazards

These need to be pointed out clearly to visitors and new trainees. The principal hazards are the revolving propeller and the trailing tow rope. Tow pilots tend to follow predictable movement patterns, and visitors need to be made aware of these patterns - and that they can vary without warning.

1.3 Winch Hazards

The principal hazard to people on the ground are winch cables. Cables laid out prior to launch must be treated as "live" at all times and handled with care. Make sure an enthusiastic "helper" doesn't wrap a cable around their arm, for example. Point out the visual signal which indicates the winch transmission is engaged. A further hazard is cables falling to the ground after a launch failure, especially in a crosswind.

2 Glider Familiarisation + Daily Inspection

2.1 Parts of a Glider and Ground Handling

Follow the guidance in the PTP. Pay particular attention to briefing wing runners - they are required to "balance" the wings, and not apply any significant force. If in doubt, stop the launch.

2.2 Daily Inspection

An instructor needs to be able to teach and assess the trainee for a DI on the aircraft they will be flying. For more information refer to Gliding NZ AC 3-01 *Glider Daily Inspection*.

3 Effects of Controls

3.1 Primary Effects

A common fault is attempting to give too much detail and confuse the trainee pilot. Don't try and explain everything in one lesson, and (in accordance with *Learning Theory*) allow the opportunity for self-discovery and let the trainee figure some of it out for themselves. This makes the lesson more interesting, and the training is likely to be more effective.

Instructors are encouraged to introduce the concept of "Angle of Attack" very early in training, despite the extra complexity. This is because the simple statement "easing the stick back will raise the nose" will sink deeply into the trainee's consciousness (*Law of Primacy*) and could become a problem later when attempting to recover from a low-level stall or spin. It also prepares the way for understanding why applying opposite aileron after a wing-drop stall can aggravate the condition due to the down-going aileron increasing the AoA on the dropped wing, further decreasing lift and increasing drag.

3.2 Secondary Effects

These effects are more subtle, so allow some exploration of effects like adverse yaw and the secondary effect of rudder before leaping in with your explanation. Allow the pilot to develop some curiosity about how subtle the flight controls can be. This provides a good grounding for precision circling exercises later, useful when trying to climb in weak lift.

3.3 Confusing Terminology

Some controls have names that may confuse. For example, the "elevator" adjusts the "Angle of Attack" of the wing, which in turn regulates the air speed. It does NOT make the glider go up or down (except when exchanging speed for altitude - in which case it is still a speed control).

Likewise, the "airbrake" is mainly used to increase the rate of descent, akin to retarding the throttle in a power plane. Only at high speed does it have a secondary effect of slowing the glider down.

Furthermore, the "rudder" doesn't turn the glider in the air like a rudder turns a boat. The rudder is used mainly to counteract adverse yaw from the ailerons, but also to steer when rolling along the ground.

Demonstrate the secondary effect of aileron (adverse yaw) first by briskly moving the aileron and observing that the nose initially swings in the opposite direction. Demonstrate the secondary effect of rudder by applying full rudder and observing that the nose swings in the same direction, then after a short while the glider starts to roll slightly in the same direction. Secondary effects are more pronounced and easier to demonstrate when the airspeed is kept low.

4 Lookout, Scanning and Collision Avoidance

4.1 Scan Cycle

The Scan Cycle is: Lookout - Attitude - Instruments. The scan pattern should be adapted to reflect current risks e.g. circuit traffic and likely position, speed monitoring on approach, aircraft on the horizon. This habit needs to be established early and insisted upon by every instructor.

4.2 Making Observations

It is critical that the trainee pilot learns to report and can act on what is being observed - before being prompted by the instructor. Encourage observation of the many different aspects of flight, depending on the stage of training. For example, point out indicators of surface wind direction, cumulus cloud activity, soaring birds, airfield activity, radio messages, etc in order to maintain a broad situational awareness.

4.3 Multi-Tasking

Maintaining an active lookout is a demanding discipline in its own right. It can be difficult to maintain the scan cycle and practice another new skill at the same time, but pausing the scan cycle will convey to the trainee that it is not so important.

The preferred approach during training is for the instructor to persistently require active scanning, even when this slows down the other training exercise. This firmly establishes the vital importance of lookout, scanning and gathering information. For example, be thorough with the HASELL check when teaching stalls and spins. Also, insist on looking sideways in both directions before demonstrating or practising turns.

4.4 Collision Avoidance

The Give Way rules must be understood and tested using actual situations and verbal scenarios. Pilots must take timely and appropriate action to avoid conflict without relying on corrective action by the other aircraft.

5 Straight Flight, Use of Trimmer

5.1 Natural Stability

Demonstrate that the glider flies in a stable manner with hands off the controls. Encourage the trainee to feel the natural response period of the glider, and to harmonise with this rather than fight it. This results in minimal control movements and a more efficient flight due to less drag from deflected control surfaces.

5.2 Develop the Kinesthetic Sense

Encourage the pilot to "feel the air" through the glider (via the controls and seat of pants) and by listening to the glider. This will prepare for flight without use of instruments, and greatly improve soaring ability later. "Seat-of-the-pants" awareness is about noticing the small changes in g-load, both positive and negative, and being able to detect and correct for sideways forces in unbalanced turns.

5.3 Use of Trimmer

Show how the trimmer balances the stick load at different speeds. The glider should always be flown with the trim control adjusted to remove any stick load - especially when thermalling. Emphasise that the ASI responds too slowly to use as a primary speed reference, and that nose attitude is more immediate. But low to the ground the horizon can appear higher than usual, which can give rise to a dangerously low airspeed, so frequent reference to the ASI is still required.

5.4 Track, Heading and Offsetting for Drift

For ridge and wave flight it is necessary to "offset for drift" in a crosswind. It is surprising how many trainee pilots have difficulty with this concept, so be prepared to give a more detailed ground briefing if this is not understood while teaching the straight flight topic.

6 Turning Flight, Slip and Skid

6.1 Movement Around a Circular Path

An object will remain at rest, or keep moving at a constant speed in a straight line, unless a force acts upon it. This means that - for circling flight - a force needs to be applied to keep deflecting the glider from its "natural" straight path. At a constant speed this force will be in a direction towards the centre of the circle.

This force (called *centripetal*, or centre-seeking) is produced using the wings. The wings are banked over and this enables a portion of the lift force to be applied to make the turn. However, some extra lift is now required, and this is obtained by increasing the Angle of Attack while maintaining a steady speed. Hence the need to ease the stick back slightly. The pilot doesn't need to understand the mechanics to fly turns well, but an instructor should be very clear about the dynamics involved.

6.2 Slip and Skid

This can confuse some trainees, so be careful not to overload while still making sure the requirement is understood. Some pilots can remain in a balanced turn purely by feel, but trainees with a poorly-developed kinesthetic sense will need to manage using the yaw string (or slip ball if installed). Be prepared to adapt your lesson until you can identify how the trainee is best able to achieve a balanced turn.

6.3 Where to Look

Despite the need for a constant scan, especially when turning (and in preparation for gaggle flying later), the best place to look when entering, exiting or making small corrections to a turn is directly over the nose. This provides pitch, roll and yaw information all in the same place, plus reference can easily be made to the yaw string and the ASI. Gliders with curved instrument panels don't provide much of a reference for the roll attitude, so some sensitivity needs to be developed here.

7 Standard Circuit and Circuit Variations

7.1 Purpose of the Circuit

- to arrive at the final turn in the right place
- at a safe height and speed
- with safe alternatives always available

7.2 Standard Overhead Join

Refer to the PTP Pilot Manual for the required method to teach circuits in NZ. In particular, trainees need to learn the SOJ because it applies to all aerodromes in NZ. In practice some aerodromes and airfields used by gliders don't permit SOJ's, so at these locations gliders would join at the start of the downwind leg. Despite this, knowing how other aircraft are likely to manoeuvre is important.

7.3 Judging Distance and Height

Trainee pilots instinctively use landmarks on the ground to set up their track, and the altimeter to measure their height at these points. But a glider pilot must be trained to land even in a field never seen before, so judgement must be developed without the need for these cues.
Blanking off the altimeter will force the pilot to learn to judge height during the circuit by looking around. One method is to look at hilltops at about the same height and judge the height of those hills. Use a variety of landing areas and circuit directions to force the pilot to judge distance to the Aiming Point, rather than connect up a series of learned landmarks.

7.4 Standard Shape and Size

It is helpful if all instructors demonstrate a consistent circuit size. Experience has shown that placing the downwind leg approximately 1,000 metres across from the landing vector works well in light conditions. The base leg should be about 1,000 metres downwind from the threshold - which means the final leg should take about 30 seconds at 60 knots.
The circuit shape taught in NZ is rectangular, as per the diagrams in the PTP. Cutting the corner between downwind and base is not taught as a standard circuit. The final turn must be completed by 300 feet AGL.

7.5 Speed in the Circuit

Refer to the PTP for the recommended speed. In the early stages it is acceptable for the instructor to nominate a speed appropriate to the aircraft and the weather conditions on the day.
It's important to teach pilots to judge the wind speed and degree of turbulence without reference to windsocks or information obtained by radio from the ground.

7.6 Variations

It is common for pilots to not appreciate the difference between a high final turn well back, and one close in and low. If the final approach seems rushed then the most likely cause is turning too early onto base. Pilots need to be trained to master the basic circuit pattern, and then be prepared to deviate from it as necessary to achieve a well-positioned final turn. To teach this you might require every circuit to vary slightly in some way from the standard pattern.

8 Final Approach and Landing

8.1 Approach Control

There are two aspects to managing the final approach:

- whether the glider is over-shooting or under-shooting
- whether the glide slope is too steep or too shallow

The Aiming Point technique is used to adjust for over-shoot or under-shoot. The Aiming Point is the point on the ground which does not "appear" to move up or down the canopy when on steady final approach. Make sure the pilot can identify this point and notice the relative motion against the canopy - some pilots find the concept hard to grasp.

8.2 Half to Two-Thirds Airbrake on Final Approach

The Aiming Point technique requires that the airbrakes are partly deployed during the last part of the approach, so they can be extended or retracted to make the Aiming Point appear stationary, while the airspeed remains steady. This enables the glider to make a controlled landing on a given spot.

The recommended target for optimal airbrake setting is half to two-thirds, in terms of effectiveness (rather than lever position or amount of panel showing above the wing). This allows for slightly more correction for an undershoot situation. The airbrakes should not be deployed "automatically" after the turn onto final - wait until the final glide-slope has been intersected before deploying them. Refer to the PTP for advice on how to fly such an approach. The airbrake can also be used to reduce height anywhere in the circuit.

8.3 Landing

As the glider reaches the round-out point (sometimes called the flare) the pilot should concentrate on looking ahead towards the far end of the airfield, and move the stick gently but progressively back until the glider is flying just above the ground.

As the speed decays the glider will inevitably sink and the stick will need to be brought further and further back to prevent this. Eventually the glider will land itself. There is no need to actively land the glider, but don't extend the float by reducing the airbrake setting.

In some gliders a fully held-off landing will cause the tail to strike the ground while the main wheel is quite high off the ground. This can lead to a heavy landing. Try to land with main wheel and tail touching together, or the tail very slightly before the main wheel, as this reduces the chance of a balloon or bounce. Some FM's recommend touching down tail first (e.g. Discus).

9 Wings Level Stall, Wing Drop Stall

9.1 Principles of Flight - Fixed Wing

The most basic principle of flight is that a wing moving through the air generates a lift force sufficient to support the weight of a glider and its occupants. The lift force increases with both the Angle of Attack and the airspeed. As airspeed increases in straight gliding flight the angle of attack will reduce, and vice-versa.

9.2 Basic Stall

In wings-level flight, as the airspeed is reduced the Angle of Attack must be increased to maintain a lift force equal to the weight of the aircraft. There is a point (called the critical angle of attack) beyond which this relationship no longer holds true - and the wing starts to behave very differently! At this point the lift force severely decreases at the same time as the drag rapidly increases. This is called a stall.

The Angle of Attack must be reduced to return to normal flight. This can be achieved by the pilot reducing the back pressure on the stick, because the elevator regulates the Angle of Attack of the wing.

Many "symptoms" of a stall (such as reduced wind noise, soft controls, nose attitude higher than normal) are not *reliable* indicators, because they are not always present. A glider can stall in ANY attitude and at ANY speed, if the AoA reaches the critical angle. Inability of the elevator to raise the nose (or prevent it going down) is the most important indicator of a stall, and this needs to be emphasised.

9.3 Stall Recognition

The one symptom present in every stall is the elevator's ineffectiveness at raising the nose of the glider. The most likely place for an inadvertent stall is close to the ground. For example, a pilot might under-estimate the wind gradient, unconsciously attempt to stretch the glide or try to climb away in weak lift.

9.4 Stall in a Turn

In a banked turn the wing needs to provide additional lift to sustain the turn while still supporting the weight of the aircraft. This extra lift is obtained by increasing the Angle of Attack of the banked-over wing (assuming airspeed is kept constant), using the elevator control to achieve this (by easing the stick aft).

When lift is produced then drag is also produced in (roughly) the same proportion. The drag force is normally a small fraction of the lift force (about 1/40), but increases sharply when approaching the stall. This means the stall speed in a balanced turn is higher than the wings-level stall speed.

9.5 Wing Drop Stall

The instinctive response to an uncommanded wing drop is to apply opposite aileron in an attempt to restore a wings-level attitude. Unfortunately, such action can have the opposite effect, and is a common cause or contributor to fatal crashes. This is because the down-going aileron on the dropped wing increases the Angle of Attack of the outer section, causing a further increase in drag and reduction in lift.

Have the trainee notice the "uncommanded wing drop" - typically from a flat, skidding turn. Secondly, notice the pronounced yaw in the direction of the dropped wing due to the high drag of the stalled outer portion. If left uncorrected this yaw could lead to a full spin.

Correct Recovery:

- immediate stick forward sufficient to unstall the wing
- enough opposite rudder to halt any yaw
- aileron control can be used ONLY after wing is no longer stalled

Incorrect Recovery:

- applying aileron immediately to lift the dropped wing is a FAIL - this can aggravate the stall
- pulling the stick back to lift the nose up is a FAIL - need to unstall the glider first!

Another useful exercise is to invite the pilot to attempt an incipient spin first from a skidding turn, then from a slipping turn! The difference is very noticeable.

10 Full Spin and Recovery, Spiral Dive

10.1 Objectives of Spin Training

- recognise when spins can occur (see *Five Scenarios* in the PTP under *Spin Consolidation*)
- recognise the characteristics of a spin
- learn and apply the correct recovery action - with minimum loss of height
- avoid inadvertent spins by developing safe flying habits (e.g. aim for a slight slip in turns)
- recognise the difference between the spin and spiral dive, apply correct recovery action

10.2 Demonstration of Spins and Spiral Dives

For the first few demonstrations the trainee should NOT have their hands and feet on the controls. This lessens the chances of a panicky trainee - who may never have experienced a spin before - attempting to over-ride the instructor on the controls. This may not sound particularly dangerous, but when people are scared they can become incredibly strong.

Trainees should only be allowed to follow through on the controls when they are judged to be reasonably familiar with the sensations, and have no adverse reactions.

Instructors teaching spinning must be cleared for teaching and current for this exercise. The aircraft used must be capable of full auto-rotation, not just wing-drop stalls, in order to demonstrate fully developed spins. This is important because when pilots graduate to single seat gliders most will spin fully and many fatal accidents have occurred because of this.

10.3 Distinguishing Between a Spin and a Spiral Dive

In both cases the aircraft is pointing steeply at the ground and turning around rapidly. A pilot must be able to distinguish between a spin and a spiral dive in order to choose the correct recovery action - because the other recovery method does not work.

Spin	**Spiral Dive**
Glider stalled	Not stalled
Normal G	Increasing G
Light control loads	Firm control loads
Unresponsive controls	Effective controls
Low or fluctuating ASI	Airspeed increasing

10.4 Correct Recovery

Spin	**Spiral Dive**
Full opposite rudder	Unload "G" with pitch
Stick centrally forward - and hold	Roll wings to level
When rotation stops, centre rudder	Ease out of dive
Ease out of dive	Adopt gliding attitude
Adopt gliding attitude	

Caution: opening the airbrakes under the combination of high-G load and a rolling manoeuvre can overstress the glider. A smooth but firm pull-out is preferred.

11 Aerotow Launch

11.1 When to Introduce

Do not attempt to teach aerotow until the trainee pilot can confidently land the glider. The trainee's first attempts at aerotow shouldn't begin until the tow reaches a height and position from which landing back on the airfield would pose no problem. Do not allow the trainee to become exhausted from the effort, or the rest of the instructional flight will be wasted.

11.2 Common Issues

Demonstrate common issues such as:

- dropping a wing on early ground run - consider releasing
- not keeping straight on ground roll
- too much drag during the ground roll - must fly smoothly - especially with a microlight tug
- getting too high or too low - tug should be level with horizon in high-tow position
- glider will drift from side to side if glider wing is not parallel to tug wing
- cutting the corner when towplane is in a turn - rope goes slack
- rope going slack - demonstrate careful use of airbrake
- over-correcting when out of position
- holding position when towing in severe turbulence - when to abandon the launch

11.3 Avoiding Upsets

- refer to *Eventualities* checklist for aerotow
- never allow the glider to be higher than the tug
- avoid being out to the side further than the wingtip of the tug
- keep an even tension on the rope as much as possible
- never move upwards or sideways to remove a bow in the rope - use airbrake carefully
- release if you cannot remain in position - or if the rope is about to jerk tight severely

11.4 Aerotow Launch Signals

When the tug waggles its rudder this is 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, but if the glider has a braking/tail parachute, that could have deployed.

When the tug rocks its wings the glider must release immediately. The glider pilot may not know why they have been waved off, so immediately after releasing check that the airbrakes aren't open.

Point out the difference between the tug pilot deliberately rocking the wings, and the tug bouncing around randomly in rough air. When a signal is being given the tug will bank further, one way and then the other, with the appropriate aileron being applied *before* the roll occurs. In turbulence, the tug pilot responds to what's already happened, so the ailerons move *after* the wings.

If the glider is unable to release and you are in a two seater, try the other release first. If you are in radio contact, talk to the tug. Otherwise, fly a little out to the left (no further than the left wingtip of the tug) and rock your wings positively from side to side. Rock left first and furthest, or you'll end up swinging back towards the centre. While out to the left you may need a small amount of airbrake to keep the rope tight. The tug pilot will tow the glider back to the airfield and then release their end of the rope.

11.5 Aerotow Failure Procedures

During the early stage of an aerotow, safe landing options are limited. There can be a period when it is not possible to land back within the airfield boundary. Because there is almost no time to consider options or to search for places to go, it's important to identify suitable off-field emergency landing areas during every tow, until height and position are such that a safe return can be made to the field.

Until the glider is at a safe height to turn back, the safest option is to land straight ahead, or deviate just a few degrees to either side. At some sites there may be a short period during which the only available landing option is likely to result in a controlled crash. The primary aim then is to avoid personal injury. The recommended "Eventualities" check list in the PTP includes this item.

Practice rope breaks in gliders are almost always performed from a position where a landing can be made back on the airfield. This can reinforce the tendency of the trainee (and some instructors) to feel obliged to turn back to the airfield. Counteract this reaction with something more reflective, so that the pilot gains the confidence to land directly ahead, even off the airfield, if necessary. A motor glider can be useful here.

Upsetting the tug (by causing its tail to be lifted by the tow rope) has 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 slingshot action (rather like a winch launch), and tipping the tug right over into a vertical dive. Once that has happened only height can save the tug pilot from disaster.

Upsets can also occur in a sideways direction if the glider gets out of position, the rope goes slack, and then suddenly comes tight again. The sideways jerk on the rope can cause the tug to spin. It happens!

12 Winch Launch

12.1 Minimum Skill Level

Before a trainee is taught winch launching they should be reasonably confident with the circuit and landing. Introducing winch launching too early in the training, before the trainee is ready for it, is at best, a waste of time. At worst it can produce a variety of handling and confidence problems which can be hard to pin down, and even harder to put right. In the early stages of training it is more productive if the instructor flies the launches.

12.2 Equipment Limitations

Winch launching uses a wide variety of equipment, and the piloting technique required can depend on several factors. Amongst them are:

- the power of the launch equipment
- the method of power transfer from engine to winch
- the type of wire being used (stranded or solid wire), or the properties of the rope (e.g. Dyneema)
- the type and breaking strain of the weak link being used
- the rate at which the glider can be accelerated from rest to a safe launch speed
- the glider's maximum permitted winch launch speed
- the position of the winch tow hook on the glider
- the restrictions of the specific site
- minimum safe launch speed for the glider

What is taught at one site won't necessarily be appropriate at another.

12.3 Safe Winch Launching

Refer to the Pilot Training Program and associated references (GFA and BGA) for detailed information about winch launching. For the instructor, the glider pilot must never put themselves in a position where they cannot recover and land the aircraft after a cable break, weak link break or power failure from the winch. This means a gradual climb after lift-off until the optimum launch speed is achieved, followed by a steady (not sudden) transition to the full climb.

For the glider to climb at all during a winch-launch, the wings must do extra work to oppose the pull of the cable and to provide the vertical acceleration during rotation into the climb. In the climb the extra lift force required - an increase in the wing loading, of which the pilot is largely unaware - can increase the glider's stalling speed by up to 40% of its normal unaccelerated value. To calculate the value of the minimum safe speed which allows for that increase, take the unaccelerated stalling speed (Vs) and add 50%.

The maximum winch speed is there to protect the glider from structural overload during the latter part of the launch, as is the weak link. However, the weak link won't break if any additional loads, however high they are, don't act along its length. Torsional loads in the wings would be an example. Neither pilots nor 'G' meters are 'aware' of such loads, nor of the cable tension, because no acceleration is involved. For these reasons the maximum speed must never be exceeded in the second half of the launch.

12.4 Winch Launch Signals

For safety reasons there is no signal to the winch for 'too slow'. If the launch speed starts to tail-off, reduce the angle of climb. Monitor the airspeed trend, and don't continue in the full climb if the speed is dropping down towards the minimum safe speed.

The technique for dealing with excessive speed on the launch varies, depending on the launch phase. In the early part of the launch there is little risk of an overspeed of 5-10 knots over-stressing the glider. If the glider isn't climbing steeply at the time the stresses are not much worse than those during an aerotow.

However, during the initial stages of the climb, the risk associated with abandoning the launch may be quite high.

At the top of the launch the likelihood of overstressing the glider is increased. If the speed approaches the placarded maximum winch speed (Vw), it may be better to relax the back pressure on the stick and signal *too fast*. Relaxing the back pressure reduces:

- the stresses on the glider
- the likelihood of a cable break or back-release
- the possibility of a high speed stall and flick roll

If there is reliable radio communication between the winch and the launching glider then the acceptable phrases are "more power, more power " and "slow down, slow down". Otherwise, lower the nose to signal for more power (and to keep the airspeed up), or yaw the glider from side to side to signal "slow down".

12.5 Winch Launch Failure Procedures

When the cable (or weak link) breaks the loss of power is instant. A power fade from the winch may be more gradual. The immediate response in either case must be to lower the nose - ideally to about the same angle downward as it was previously pointing upward. Then wait until the speed reaches normal approach speed - without opening the airbrakes or attempting to turn. Pull the release twice to make sure there is no cable remnant still attached. Waiting for the speed to build up can feel like a long time, but insist on getting that speed back up to at least approach speed first, or risk a stall/spin.

Simulated cable breaks should be done at a medium height (where there is room to land straight ahead) and at about 500 feet (where there is enough height for an abbreviated circuit). Always turn downwind after a cable break - which implies an awareness of the crosswind component prior to takeoff. The *Eventualities* checklist in the PTP includes this item.

Low-level manoeuvring, particularly under stress and/or at low speeds, is a MAJOR source of all flying accidents. Plans-of-action following a launch failure or an abandoned launch should stress the need to land straight ahead if possible, which might mean an out-landing.

Do NOT simulate a launch failure to test a trainee at a height below which any delay, over-controlling or airbrake deployment would tax your ability to recover. All launch failures must be pre-briefed and demonstrated before the trainee makes any attempt at the exercise. The exception to this is the ultra-low level (below 50 feet) launch failure which is by demonstration only. The pre-brief must contain specific advice about not over-controlling the elevator.

The original 'let the trainee have a go' exercise produced far more accidents than the real thing, certainly far too many to justify trainees attempting the exercise. The exercise must only be done as a winch power failure. A low break initiated from the glider has the potential problem of the glider flying into the parachute, as has happened on a number of occasions.

For very low level failure demos at 5 feet to 10 feet, don't lower the nose at all. A number of accidents have been caused by lowering the nose into the ground.

13 Crosswind and Strong Wind Launch + Landing

13.1 Two Crosswind Techniques

There are two methods for cross-wind landings: crabbing and wing-down. Each has its particular merits for certain situations. A combination of the two will often be used by a more experienced pilot.

In the *crabbing method* the glider is turned onto the final approach so that the nose is pointing slightly to the upwind side to offset the effect of the crosswind. The approach is made with the wings level, with no slip or skid and with the glider tracking directly along the intended landing path.

When the glider is just about to touch down at the end of the hold-off or float, use the rudder to swing the nose into line with the direction from which the ground appears to be coming. This avoids sideways load on the wheel or skid at touchdown. This method has the advantage that it can be used successfully in very strong crosswinds. Care and practice are required to swing the glider with the rudder at exactly the right moment before touchdown.

In the *wing down 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 the 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. On flat ground the wing down method has the limitation that only a small amount of bank can be safely used, particularly if the sideslipping characteristics of the glider are poor.

When landing in a cross-wind avoid approaching near obstructions or other gliders. If the drift is not fully corrected there could be a risk of drifting too close to them, or swinging towards them after landing. Watch for the weather-cock effect after landing - apply full airbrake and plenty of wheel brake and come to a prompt stop.

13.2 Landing in Strong Winds

Strong wind brings increased turbulence, so extra speed is needed for good control and to maintain a safe margin above the stall. Take care when approaching low over trees or other large obstacles - there can be wind shear and a wind gradient near the ground which needs to be anticipated.

In the circuit the downwind leg is travelled much faster and in less time. This can be compensated for by starting further upwind. A slowly-executed turn onto base can put the glider well downwind, so this turn needs to be crisp, and started earlier than in calm air. It will also need to be more that 90° to offset the crosswind while on base leg. In general the final leg will be shorter in distance but of similar duration to a circuit in calm conditions, and the approach angle will be steeper.

Strong winds near the surface with wave aloft can generate very severe sink in the circuit - so much so that the glider may not even reach the intended landing area. The wise pilot will keep their options open, such as flying the circuit over other landable areas just in case, and starting the circuit with extra height.

Flying across the wind direction on base leg close to the ground can introduce a visual illusion of skidding sideways. Always believe the yaw string and keep the aircraft flying in balance. Limit the amount of flap, and don't use landing flap in strong winds as it creates too much drag.

Keep flying the glider even after landing, and don't be in a hurry to open the canopy or get out. Gliders have been lifted up and blown over after the pilot has got out. Call for assistance if the wind is very strong, and consider remaining in the cockpit with airbrakes open and canopy firmly held down until towed to a sheltered place. Don't leave the glider unattended unless absolutely necessary, and only when picketed.

14 Thermal Techniques and Etiquette

14.1 Circling Tightly

The *Soaring Pilot* milestone cannot be achieved without being able to circle tightly in a thermal. This in turn requires the ability to turn accurately with 45° angle of bank, at a steady speed just above the stall, and with just a slight amount of slip - while being buffeted around by the thermal.

The standard of precision required of glider pilots expecting to climb in a thermal is much higher than for power pilots operating in a circuit pattern. Beginning glider pilots typically fly too fast, with insufficient angle of bank, so their circles are too large and the sink rate of the glider is higher than it needs to be.

Finding the core of the thermal after randomly encountering lift is something of an art. The instructor can describe and demonstrate some simple methods of centring. There are several methods described in the PTP. Try and have the trainee develop their own methodical approach. A lot of practice is required to become proficient, and practising by staying airborne in weak lift is of more value than hanging around near cloud base on a strong thermal day.

14.2 Sharing a Thermal

Sharing a thermal brings a high risk of collision. Good lookout is essential - head out of the cockpit. Refer to the 11 Rules in the PTP under *Cross country Pilot > Safe Gaggle Etiquette*. Use questioning techniques to check that the trainee knows all these rules and can apply them in practice.

15 Ridge Techniques

Ridge flying typically involves flying close to terrain. The generation of ridge lift requires a brisk wind of 15 knots or more, hence turbulence is often present. Manoeuvring the glider correctly and maintaining a safe speed are vital. A pilot needs to offset the heading of the glider in order to track parallel to the ridge.

In moderate-to-strong winds the *zone of best lift* is on the windward side of the ridge, not on the top. However, in light winds the anabatic flow up the side of the ridge, possibly assisted by thermals, will often produce a zone of lift directly above the spine. Pilots need to avoid the lee side of the hill, particularly when close to terrain, because of the associated sink and turbulence.

Always turn away from the ridge, never towards it. Turning towards the ridge introduces a tailwind component, plus the total energy of the glider will be reduced. This can bring the glider very close to the ridge much more quickly than expected, and with less airspeed than intended.

Review the material on *Cloud Hazard* to reinforce the need to remain clear of orographic cloud at all times, and be aware that the upwind edge of the cloud is continuously forming and can "jump" further upwind with just a slight change in moisture level. Don't fixate on a cloud feature or you may drift back with it.

Ridges produce quite narrow lines of energy, so there is a heightened risk of collision between gliders on opposing tracks. This gets worse if gliders are flying up against a cloud ceiling or an airspace boundary, as the aircraft will be at similar heights. Regularly calling your position, altitude and direction by radio can be helpful to other pilots in the area. Keep a good lookout and make good use of Flarm when it's available.

Strong wind gradients can occur right along the spine, and particularly at low saddles, as the airstream is accelerated as it is forced to cross the ridge. In this case the highest wind speed is right at ground level. Turning steeply at the top of a ridge can drop the lower wing into stronger wind than the upper wing is experiencing. The overturning moment can be strong enough that the ailerons cannot counteract it. This explains why gliders sometimes get rolled upside down when turning steeply over the top of a ridge.
In extreme conditions aggressive use of rudder (away from the ridge) can help correct any unwanted roll.

There is a safe way to cross a saddle - never fly directly towards it in case you sink below the saddle and have no room left to turn away. Instead, approach the saddle by following the line of the ridge until you draw alongside. A slight dip of one wing will then see you safely across. If you are not quite high enough to cross with a safe margin then a gentle turn away will enable you to stay clear of terrain. This applies when approaching the saddle from either the windward or leeward side.

When working a zone of lift below or level with the ridge line it is much safer to fly a figure-of-eight pattern - where all turns are away from the ridge. Full circles should not be attempted until reaching a safe height above the top of the ridge, including clearance from masts, towers or power lines.

Refer to the GNZ publication *10 Traps in Ridge Flying* to review a list of known fatal traps in this environment.

16 Wave Techniques

Wave flying opens up the possibility of flying long distances in New Zealand, often at high altitudes, at high speed and in very smooth air. However, wave also lifts the glider pilot into a far less benign environment, and things can go badly wrong very quickly. In particular:

- With high altitude - comes freezing temperatures, the risk of hypoxia and a reduced indicated airspeed (IAS) limit
- With high wind speed - common with ridge and wave flights - comes issues of severe turbulence, insufficient penetration and rough landings
- With high terrain - there are strict disciplines to follow to avoid colliding with the mountain

General safety principles are described in the Gliding NZ Advisory Circular AC 2-13 *Mountain and Ridge Soaring Safety Principles.* Another excellent publication is Safety in Mountain Flying published in English by the French National Gliding Centre (CNVV). The NZ CAA also publishes a booklet in the "Good Aviation Practice" series called Mountain Flying.

The requirements for the carriage and use of oxygen are laid out in the Gliding NZ AC 3-07 *Carriage and Use of Oxygen.*

It is critical that pilots understand the reduction in IAS with altitude, to avoid exceeding the design flight envelope of the glider. It is very easy to overspeed a glider at 18,000 feet, especially when racing in the very smooth air that is characteristic of wave. Some instruments can display TAS based on the altitude and the IAS, and even sound an alarm when the maximum TAS is approached. However, these instruments need to be programmed correctly, so a printed placard is required in any oxygen-equipped glider.

The ability to recognise the signs of wave and use them to best effect is covered in books listed in the *Alpine Pilot* section of the PTP. There are certain characteristic cloud formations which help a pilot to enter, climb into and ride along a wave system. The rest is practice.

17 Field Landing and Cross Country Clearance

17.1 Field Landing

The objective of this module is to have the trainee land in a field, as opposed to an airfield or a long airstrip. The available length should be similar to other landing fields in the area - say 400 metres assuming no obstacles on approach.

Ideally, the exercise would be done in a single-seat glider that the trainee has some experience in flying. To keep it simple, select a field nearby and inspect it on foot with the trainee. Then have the trainee launch, glide to the field and land there, ideally with you watching from the ground and in radio contact.

There will be no familiar landmarks on which to base the circuit, so it is a good idea for the trainee to practice landing in a few different places - at a different airfield or different part of the airfield. Apart from that, try not to have too much else that is "different" to avoid overloading the trainee.

The trainee should supervise the de-rig into the trailer and subsequent rig back and DI back at the airfield.

17.2 Cross Country Clearance

This clearance takes the form of a log-book entry signed by a B-Cat or A-Cat instructor. This will happen only after all other items in the XCP list (including the XCP Study Course and Exams) have been checked off, and the pilot has demonstrated over a number of flights their general proficiency and preparedness to fly beyond gliding range.

Prerequisites for this rating include:

- demonstrating the ability to select a suitable landing field from the air
- an actual landing into a medium-sized paddock (usually in a single-seater) - see above
- taking charge of de-rigging the glider, towing it back to the airfield, re-rigging and DI
- knowledge of local airspace within 50 km of the airfield

18 Flight in Controlled Airspace

For most glider pilots the desire to access controlled airspace comes with cross-country flying, particularly in wave. Pilots need to become familiar with airspace types and boundaries, and be trained to access it responsibly. The training program requires a dual flight into controlled airspace, firstly to demonstrate the correct procedures, then to assess the trainee's ability to follow these procedures.

Key criteria include:

- remain clear of controlled airspace unless you have a clearance
- know how to operate your transponder in all modes
- seek clearance into controlled airspace well before your intended entry
- wait before transmitting and don't talk over other transmissions
- have a clear plan in mind for your clearance, even if you need to change it later
- read back correctly all details of the clearance
- remain on the control frequency and don't use it to chat to other glider pilots
- if you cannot comply with a clearance due cloud, terrain, lack of lift, etc then speak up
- after vacating advise that you are "clear and will remain clear" (or seek a new clearance)
- have a plan to follow if your batteries fail while in controlled airspace

The trainee needs to do all the radio work correctly to pass. It is helpful for the trainee to have had a dual flight in controlled airspace (purely as a passenger) before attempting to pass this topic.

19 Flight Test for Passenger Rating

The trainee pilot needs to pass a Flight Test in order to pass the training item "Passenger Rating".

The privileges of the Passenger Rating can be exercised after the trainee has been awarded their XCP certificate. There is a provision for exercising the passenger rating prior to XCP, but a number of conditions have to be met. These conditions are spelled out in the PTP at the end of the "*To XCP*" section. This is a concession to those who do not wish to make a 50 km cross-country flight, but is not to be encouraged.

The flight test needs to include a demonstration of competency in the following items, and a report completed on the day of the flight using GNZ Form OPS-12 *Flight Test for XCP Passenger Rating*.

- an up-to-date and correctly-filled logbook
- satisfactory preparation of self and aircraft, including weight and balance calculation
- knowledge of the Flight Manual and other required aircraft documents
- briefing of passenger (assume the passenger has no experience in small aircraft)
- attending to comfort and security of passenger and cockpit (including cameras, cell phones, etc)
- preparation for flight, cockpit checks, hook on procedures
- winch launch - satisfactory climb profile, within minimum and maximum speed limits
- aerotow - tracks straight on ground, holds position accurately, recovery from out-of-position
- well-harmonised and gentle use of flying controls to provide a comfortable flight for passenger
- consistent lookout at all times, good situational awareness (e.g. where is the airfield from here?)
- engage in conversation with passenger in flight, explain simply what is happening
- demonstrate a wing-drop stall with prompt recovery (after the uncommanded wing drop)
- smooth turns at 45° angle of bank and a few knots above the stall, in a thermal where possible
- gives prior warning of events that might startle the passenger (cable release, opening airbrakes)
- a well-planned circuit in respect to height and track and a steady speed nominated in advance
- last part of final at 1/2 - 2/3 airbrake and airspeed suited to the aircraft and conditions
- smooth flare and touchdown
- stick right back after landing, maintains control of the aircraft on ground roll until stationary
- verbal review of launch emergency signals
- recent experience of a simulated launch failure with correct recovery (e.g. a winch cable break)

The logbook endorsement needs to follow the wording prescribed in the PTP in the *Endorsements* section, and include the type of aircraft, launch method, whether P1 is front or back seat, and any restriction on distance that can be flown from the airfield.

The instructor making the assessment may make use of observations from other instructors. If there is any doubt about the ability to manage launch emergencies or circuit variations these will need to be assessed on subsequent flights prior to issuing the rating.

19.1 Fit and Proper Person

The XCP may be recognised as the equivalent to a Private Pilot Licence for Gliders (PPL-G). Any candidate for the XCP Certificate (or any pilot wishing to exercise a passenger rating before meeting all the requirements of the XCP) needs to satisfy the criteria for a "Fit and Proper Person". This can be done by way of a signed declaration on GNZ Form OPS-03 *Application for XCP Certificate* (or Form OPS-17 *Fit and Proper Person Declaration*) which must then be ratified by a person with delegated authority from CAA.

The declaration is based on the conditions in Sections 9 and 10 of the Civil Aviation Act 1990. If there is any doubt about a person's fitness in this regard then raise the matter with your CFI or other senior person.

20 Conducting a Competency Review

20.1 Biennial Flight Review

Guidance for the conduct of a BFR is provided in Gliding NZ Advisory Circular AC 2-05 *Biennial Flight Review* and the review can be recorded on the GNZ Form OPS-11. *Biennial Flight Review.*

20.2 Instructor Competency Review

Guidance for the conduct of a ICR is provided in Gliding NZ AC 2-04 *Instructor Privileges and Currency* and the review can be recorded on the GNZ Operations Form OPS-09 *Instructor Competency Review.*

21 Introduction and References

21.1 Purpose of This Document

This document provides support material and further references for NZ instructors as they are trained and assessed to teach the airborne exercises.

The Pilot Training Program (PTP) is the definitive reference for the trainee glider pilot. The PTP is intended to be referred to by both trainee and Instructor during pilot training, and by the Instructor during instructor training.

21.2 Support Material From British Gliding Association

Refer to the BGA Instructor Manual, available here. At the end of each chapter there is detailed advice for instructors on each of the training topics - which you may find useful.

21.3 Where NZ May Be Different from British Practice

There are a few practices that we may do differently in NZ. If in doubt the primary reference is the PTP:

- NZ circuits are rectangular in shape - the diagonal leg is not taught as part of a standard circuit
- the circuit starting height in NZ is 1,000 feet at the start of downwind, or 1,500 ft overhead
- landmarks should not be referred to or used as references during circuit training
- low energy approaches are neither taught nor tolerated - use 1/2 - 2/3 airbrake by end of final
- the term *wing drop stall* is used in NZ, not *incipient spin*
- the term *aiming point* is used in NZ, not *reference point*
- after release from aerotow launch the glider always turns to the right, and the tug to the left
- the radio phrases used by a pilot on a winch launch are "more power" or "slow down"
- parachutes are required in NZ for all glider occupants on wave, contest and aerobatic flights
- oxygen must be used above 13,000 feet, or if above 10,000 feet for more than 30 minutes

21.4 Record Keeping and Form OPS-08

Gliding NZ Form OPS-08 should be used to record the *exercises approved to teach*. Each topic will be signed off after an acceptable airborne technique has been demonstrated to an A-Category Instructor or Instructor Trainer.

21.5 Logbook Endorsements

An endorsement is an entry in a pilot's logbook certifying approval for a specific skill or activity. The endorsement must include the name, signature and date of the certifying instructor to be valid. In addition, some endorsements require specific wording, and this wording can be found in the *Ratings and Endorsements* section of the PTP.

As an instructor you must have that particular endorsement in your own logbook (e.g. Launch by Winch, Double Aerotow) before you can issue it to another pilot. The exceptions are aerobatic flight ratings, which can only be issued by an aerobatics instructor with the appropriate rating, and the tow pilot rating which can only be issued by a tow pilot instructor. For more information refer to GNZ AC 2-06 *Aerobatic Flight in Gliders*.