What the Ops Team is Talking About
Memo to Club CFI's and other interested parties - Dec 2018 - *please forward to your instructors.*

A summary of the key items discussed at the Ops Team on-line meeting on 16 October 2018.
David Moody (North), David Hirst (Central), Graham Erikson (South) and Martyn Cook (NOO).

1. Form Filling: The Ops team is trying hard to process all forms in a timely manner, particularly those for new instructors and visiting pilots. This is made much easier when
- forms are filled in legibly - particularly names, mailing addresses and email addresses
- mailing addresses are in NZ (for quick card delivery) and are in a format recognised by NZ Post
- all forms are submitted in pdf format - allows electronic signing without printing and rescanning.

2. Training Program Development - Moodle: The question of "safe speed near the ground" is unresolved, with some resistance to applying a "formula" approach, plus a divergence of opinion on what such a formula should be. There's also a spread of opinion in NZ as to whether "approach speed" means "final approach with wings level, with enough energy to flare and an allowance for the use of air brakes" or whether the term can also be used for circuit speed.
One idea to be explored is to take the "stalling" exercise in different flight modes (wings level, turning, brakes, flaps, etc) and note that there is no single "stall speed" for a glider. It changes . . . depending on several factors . . . and link this exercise to a "safe margin" in each of these modes when flying close to ground.
The positive in all this is that new pilots should become attuned to the subtleness of stalls, particularly stalls in a turn. A pilot may even elect to "nudge the onset of the stall" on every flight (at a safe height, of course) just to confirm how close it is. It was observed that some newbie pilots have difficulty climbing a glider because they fly too fast (when not close to the ground).
A further alternative might be to have an early basic introduction, just enough to get going with circuits, and then when the pilot can handle the aircraft well enough to land and launch (but before solo) have a second shot at a more detailed treatment along the lines proposed.

3. Review of Incident Reports for Last Month:
- wheel rim buckled after heavy landing, glider bounced after airbrakes were closed too early
- glider required to release just after takeoff due to carb icing in tug + insufficient power
- wing tip damaged after hitting a rock during wing-down retrieve from a remote airstrip
- instructional flight, airbrakes opened during takeoff - not locked by student, or bumped open?
- stick grip came off on tow in turbulence, negative-G applied to recover, tricky landing
- winch cable tow car driving on runway on opposing track to tow plane taking off

Some of these incidents are being followed up to check whether existing SOP's cover the circumstances of the incident, and if so whether the SOP's were being followed. Regarding the recurring airbrake issues, consideration is being given to moving the "airbrakes closed and locked" check to before canopy closing, at least for new pilots being trained. This is not the full cause of these recent incidents, but could be helpful in having the brake check done along with flaps+trim, especially if the canopy is to left open (on a hot day) after all the other checks are done.

4. Instructor Development: The observation was made that of the 8 new instructor ratings or upgrades issued since 1 April 2018 only 3 had completed their Silver badge (according to the GNZ database). The Ops Team considered it "desirable" that a new instructor would have a Silver C and be setting a positive example in cross-country, badge and contest flying.
Another observation concerned the way the least-experienced instructors (C-Cat) are typically assigned to conduct the most critical flights in training, being the air experience and early training flights. And that pilots conducting their first passenger rides need to be very well briefed to ensure passengers are not startled by noises or movements they haven't been warned about.

5. Instructor Handbook: Consideration is being given to adopting the 2017 BGA Instructor Manual for NZ, similar to the way the Australian Manual was adopted by GNZ circa 2000. If not in its entirety then at least on a page-by-page basis, with edits as required where there are significant differences. Edits would allow for concise additions of things learned in NZ - eg mountain flying issues, microlight tugs, lateral tow upset, etc - without requiring a full rewrite.

6. Review of Trial Program: There was discussion around how the trial Training Program is being reviewed. The point was made that while there is no argument about the need for revision and updating, there needs to be a formal process for reviewing and approving it. In response it was stated that the program is being "tested" each flying day at the Wellington Gliding Club, and plenty of feedback is being received from this source. The program is also openly available at moodle.gliding.co.nz and anyone who wishes to can review the program and submit observations and suggestions.
A number of submissions to date have addressed the minutae of the pre-solo section. It would be good to receive some comment on the overall structure of the program, the balance of attention given to different topics, and the depth of treatment at each stage, bearing in mind that we are attempting to strike a sensible balance between *safe* and *efficient*. Also its likely effectiveness in guiding pilots smoothly through to task, badge, contest and alpine flying.

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Appendix: Attached is a short summary of all the issues which have been raised and discussed under the subject of **"Safe Speed Near the Ground.**

A Discussion around "Safe Speed Near the Ground"

The objective of this discussion is to specify a safe circuit speed that can be used by pilots learning to fly a circuit. From the law of primacy ("first learned = first remembered") we can also expect that under duress a more experienced pilot may revert to earlier learnings, so we need to take care.

This document and the ideas it proposes arose from recent OSTIV discussions about the safe speed to fly a circuit, as opposed to the safe speed to fly a final (non-turning) approach. It is suggested herein that a higher circuit speed (a "safe speed for turning near terrain" for lack of a better description) is adopted. The present formula for calculating a "safe speed near the ground" is adequate for the final approach and is not in contention.

Too Fast vs Too Slow ?

A circuit speed that is *too fast* has the disadvantage that the passage around the circuit proceeds rapidly, and the unrushed feeling that characterises a well-executed circuit is eroded. The pilot might then fly further away, and risk running out of height in the circuit. A further disadvantage is that the pilot might still arrive "over the fence" too fast and gobble up more landing distance than necessary. This is not serious when the pilot is learning the circuit for the first time, but could be a problem later in training.

A circuit speed that is *too slow* has a more serious risk - the glider could enter a spin, or at least an uncommanded roll-over and nose drop that characterises an incipient spin. This is often fatal when close to the ground, so this hard "lower limit" needs to be well respected. The question then transforms into having a modest but adequate margin above the stall speed while in the circuit.

Circuit Speed vs Approach Speed

Gliders certificated to CS-22 are required to have a yellow triangle displayed on the airspeed indicator, denoting the "approach speed". Older gliders may not have the triangle but will have an approach speed in the FM. However, it is ambiguous whether this refers to the recommended circuit speed - which includes turns - or only to what we call *final approach* - where the glider is flying straight with wings level and air brakes optionally deployed. Generally the *approach speed* is set at about 10 knots above the stall speed in both older and newer gliders.

For example, an early training glider like a Ka-13 at maximum weight has a stall speed of 33 knots and the recommended approach speed is 43 - 48 knots. Assuming the lower figure would apply in calm conditions, the margin above the stall is 10 knots, or about 1.3 times the stall speed. Compare this to a more modern training glider like a DG-1000. Here the stall speed at maximum weight of 750 kg is 44 knots, and the "recommended approach speed" is 54 knots - also a 10-knot margin but only a 23% margin above stall.

What does the Approach Speed Allow For?

The long-standing "formula" for approach speed in NZ is to take the wings-level+brakes-closed stall speed at maximum weight (without water ballast), then add 10 knots, plus 1/2 the wind speed. The air near the ground can vary in both speed and direction, and change as the glider descends (wind gradient and wind shear). A thermal leaving the ground can generate a momentary gust in any direction, including a sudden tail wind. So the wind speed figure is at best a rough estimate.

Opening the air brakes can increase the stall speed because the lift over part of the wing surface is destroyed, and the rest of the wing has to carry the same weight. Note that quite small increases in speed significantly increase the energy of the glider, and lengthen the flare and landing roll. But in general the *10 knots plus half wind speed* seems to work quite well as a guide for final approach, with perhaps a speed reduction coming over the boundary fence.

Circuit Speed May be Different from Approach Speed

The speed in the circuit need not be the same as the approach speed, although some instructors consider it simpler to teach it this way. The key difference is that the circuit includes two turns of about 90°, typically done at a modest bank angle of 30°. This circuit pattern enables the pilot to maintain visual contact with the intended landing area and keep options open when lift or sink is encountered.

By comparison, most small powered aircraft are established on final approach by 500 feet, and there are no more turns. For gliders this would make our circuit too large, so we normally complete our final turn by about 300 feet. It so happens that 300 feet is a typical height required for spin recovery, so our final turn needs to be made with absolutely no risk of spinning.

Turning vs Straight and Level

A pilot learning to fly the circuit can find the turns quite challenging, and maintaining an accurate speed may not happen because of all the distractions. Many instructors address this by setting a hard lower limit (eg. "your speed must not drop below 55 knots"), and tolerate slight increases in speed until greater proficiency has been gained.

As the stick is eased back in a turn the stall speed increases, modestly at first then more sharply as bank is increased. At 30° bank the increase is about 3 knots, or 30% of the speed margin. At 45° of bank the increase is about 7.5 knots, or 75% of the 10 knot margin. These figures do assume the turn is flown accurately, with minimal slip or skid. If the airbrakes are opened in a turn then the stall speed can increase by a further 2-3 knots, depending on aircraft type. The DG-1000 increase is 2.8 knots at 600 kg, for example.

This means that a turn at 45° bank with airbrakes out could use up all the 10-knot margin above the stall. While this is not a normal circuit turn it could plausibly happen if the pilot was starting to overshoot the runway centreline, and was also too high or too close.

Recovery from a Turn

It is not necessary for the whole wing of the glider to stall to generate an uncommanded roll-over. Any increase in drag on the lower wing tip could be sufficient. When a glider is in a turn at low airspeed, attempting to return to wings-level flight using aileron control will lower the aileron on the inside wingtip. This action could partly stall this tip, or at least put it into a mushing state, which results in a decrease in lift and an increase in drag. If the glider doesn't start to roll towards level and the pilot instinctively applies more aileron then the stall at the tip can deepen. This can be clearly seen frame-by-frame in videos of stall-spin crashes.

The visible presence of the ground - even several hundred feet below - can trigger a primal impulse to pull back further on the stick. A pilot needs to be aware of this and be ready to over-ride it.

Another impulse can be to try and turn the glider mostly with rudder, like a boat or a car. Humans are not natural aviators, and the "elevator" control will not elevate the nose if one wingtip is stalled!

The correct remedy is to ease the stick forward and keep the inboard wing unstalled even with the down-going aileron while recovering from the turn. In other words, more speed.

Other Countries

In Australia the safe speed near the ground is taught as 1.5 * stall speed in calm air, plus half the wind speed. For a glider with a stall at 40 knots this would mean a 60 knot speed near the ground. This exceeds most Flight Manual recommendations for a wings-level speed on final approach, but certainly preserves safety margins when turning or manoeuvring, as described above.

In France the CNVV recommends not going below 1.45Vs when flying in mountains, and notes that this is close to the best glide angle.

From Canada here is a comment from Dan Cook:

> *With respect to what will be in the updated Canadian manual, the instruction will be to follow the manufacturer's recommendations in the FM. However, if there is no recommendation in the manual, the recommended approach speed is 1.5 Vstall + 1/2 Vwind+ Vgust factor (this is fairly close to numbers in AFM for K21, DG1000 etc). If older gliders are flown, the recommendation is 1.3 Vstall+ Vwind+ Vgust factor. This is to recognise that modern gliders have more effective air brakes, are more aerodynamic (less drag), and have a more critical airfoil (laminar flow). The stall can be more abrupt!*

The Soaring Safety Foundation (SSF) is the Training and Safety arm of the Soaring Society of America (SSA). Ron Ridenour, an SSF Trustee, recently made a review of some of the US soaring accidents over the past 2 years, and states:

> *The bottom line is that it revealed many accidents by glider pilots flying an approach that resulted in landing short or stalling and spinning in. These scenarios are a result of flying at too slow an airspeed during the approach. I also noted that there are only a very few accidents caused by overflying the entire length of the runway - the vast majority are crashing short of the runway.*
>
> *Don't be confused by the difference between approach speed and touchdown speed. The approach speed should be greater that the touchdown speed. Touchdown speed is a speed the pilot slows to over the fence once the field is made so that the landing roll is minimized.*

The SSF recommended approach speed formula is 1.5 Vso + 1/2 the steady state wind speed + all of the gust factor.

The FAA Glider Flying Handbook says to *maintain the recommended approach airspeed established by the manufacturer. If no approach speed is recommended by the manufacturer, use 1.5 Vso* plus an unspecified "adjustment for wind and gusts".

In the UK the BGA Instructor's Manual deftly avoids any specific formula, but does discuss the factors that influence the choice of circuit speed. There's also an awareness of the effect of turning:

> *Because recovery from an inadvertent spin within 500' of the ground is very unlikely, set the approach speed before the glider reaches 500' on downwind . . . certainly no later than just before turning from the downwind leg onto the base leg.*

Jonathan Cross from Auckland Gliding Club provides a further commentary:

> *It is interesting that the BGA instructors' manual does not offer a formula; rather it advises several speeds for different conditions and perhaps more importantly a discussion of the factors involved in choosing a speed. I struggled to understand the different formulas but eventually settled with a statement in one manual that the speed was that required to maintain good control response.*
> *The principle of adequate speed for turns and then approach . . . with not too much for the eventual landing is how I see it. The last part is more relevant for pilots later in training when short out landings become more relevant.*

Ian Oldaker, chair of the Training and Safety Panel at OSTIV, comments further:

> *I recall my discussion, maybe 30 years ago, with Derek Piggott when he was CFI at Lasham, and he advocated what amounted to increasing speed to 1.5 Vs with no wind and increasing the approach speed by half the estimated wind speed, although he did not put numbers to the increase, such as to add 1/2 wind speed.*

Wind and Gust Factors

Some European formulae separate out wind and gust factors, such as "20 knots with 5 knot gusts". For example, to the calm air approach speed the French add "50% wind + 100% gust". In NZ we would be more likely to describe such a condition as "20 gusting 25" and just use the larger number for our wind speed.

Early pilots find estimating wind speed to be difficult, and in any case the wind is typically variable and different in different places! We can't train pilots to rely on ATC reports if they are landing in a field. Mark Wilson, CFI at Wellington, adopts the view that pilots struggle to gauge a windspeed more accurately than to the nearest 10 knots, and uses the categories: calm, mild, bumpy and rough. He advocates the following increases in circuit speed under these conditions:

+ 0 kts for Calm Wind

+ 5 kts for Mild conditions - the windsock is not yet half way , from the air, trees, grass etc appear stationary. There is no real perceptible drift in a turn and the glider is flying smoothly most of the time. May be some thermals around.

+ 10 kts for 'Bumpy' /Moderate wind conditions - the windsock is over half way, you can see cloud shadows moving if you look close and maybe movement of trees & long grass Glider drift is becoming noticeable in turns. Some turbulence is felt. Thermals are booming and lots of vertical cloud development. Getting knocked around a bit.

+15 kts for 'Rough' conditions - the windsock is flat out, you can see cloud shadows moving and most trees and grass are moving around. Long crops and water show moving streaks. Glider drift is very obvious in turns. The air is quite obviously turbulent and the glider needs continual and significant control input.

Experienced Pilots and Instructors

I stumbled into this issue a while back when a trainee pilot performed what I felt was a "slowish" circuit in gusty conditions, despite the air speed being in accordance with the NZ formula. I found myself saying "keep your speed up until you have made the two turns". What I realised was that the turns had to be snappy under the conditions of the day, which meant more speed was needed, and the speed could be safely reduced slightly as soon as wings were level again on final (notwithstanding allowing for the wind gradient).

Other experienced racing pilots have also told me they tend to keep their circuit speed up, especially around the turns, and slow down gradually during the final approach. If that's really what experienced pilots eventually do, then why shouldn't we teach this right from the beginning?

Tentative Conclusions

1. *Safe Speed Near the Ground* is a complex estimation, and most experienced pilots eventually develop their own sense around this, instinctively speeding up to maintain control effectiveness. Nonetheless, it is still desirable to provide straightforward guidance when teaching new pilots who are just starting to learn to fly the circuit. The speed selected should be accurate and not over-simplify any inherent complexity.

2. There is a significant difference between wings-level flight and turning flight in terms of a safe margin above the wings-level stall speed. Any turning flight requires a greater speed margin. One way to describe this would be to educate pilots about a "safe speed when turning AND close to the ground". This means, for example, that a pilot could safely slow down to a safe speed (allowing for gusts) when running a ridge with wings level, and speed up a little before making any turns.

3. NZ does not need to slavishly follow overseas trends, but we do need to monitor these and where possible remain within the boundaries of the international gliding community. Overseas it looks like circuit speed is moving to a higher value than the one currently in use in NZ, which is Vs + 10 + 1/2 wind.

4. There is some ambiguity between circuit speed and approach speed - some manuals imply they are the same, but others address them separately. We may choose to teach different speeds for circuit turns vs final approach. Most are already clear that touchdown speed is somewhat less than final approach speed.

5. A speed that is too fast is not hazardous until the need arises to land short. But a speed that is too slow does have a hard lower limit, and stall-spin accidents still occur in gliding. It makes sense to initially teach a speed that is on the high side, both to stay safe and to address the principle of primacy.

6. Wind speed is difficult for new pilots to assess, and glider pilots should be trained to land out without relying on reported wind from a ground station, whether it is ATC or the club base. A kinesthetic approach would be to combine what is visible outside with how the glider feels - bumpiness in the air, wind drift on base leg, responsiveness of the controls.

7. We may choose to specify and fly different minimum speeds for circuit, final approach and touch-down. In this case a *Safe Speed* could be defined by the speed at which the glider stalls for the configuration it is being flown in at the time (AUW, flap setting, dive brakes, wet or iced wings) etc to which a safety margin is applied.

8. Depending on analysis of glider types used for training and early solo in NZ, it's likely that a base formula of either 1.4*Vs or Vs+15 knots could be appropriate for the circuit speed. In each case add 1/2 the wind speed.

9. The formula would not apply to the speed during a winch launch, which - because of the vertical acceleration provided by the wings - would need 1.5*Vs as a minimum speed prior to rotation.

10. Another possibility is to describe the minimum safe speed for approach as the calculated minimum safe speed + ½ wind (including the gust factor) . . . and then . . .
when near the ground (thermalling or mountain flying) add a further amount of speed for the angle of bank . . . especially if greater than 30° AoB.

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