



GLIDING NEW ZEALAND INCORPORATED

ADVISORY CIRCULAR
AC 2-09

**MANUAL OF
GLIDER TOW PILOT TRAINING
AND
TOWING PROCEDURES**

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Foreword

Gliding New Zealand via the GNZ Operations Committee approves the rules, procedures and guidance contained in this manual.

Nothing contained in this Manual is to be construed as:

- (a) Preventing individual clubs from introducing more restrictive procedures, as may be required to suit local conditions, etc, or
- (b) Relieving the individual pilot or pilot instructor of that pilot's responsibility to take any action in non-normal circumstances that that pilot considers necessary to preserve the safety of the aircraft's occupants, the aircraft or any third party.

Bibliography

Aviation Medicine and other Human Factors for Pilots

by Dr Ross L. Ewing

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Definitions & Abbreviations

AC	Advisory Circular
AGL	Above Ground Level
AMSL	Above Mean Sea Level
ATC	Air Traffic Control
ATL	Aircraft Technical Log
AUW	All-up Weight
BFR	Biennial Flight Review
CAA	Civil Aviation Authority
CAR	Civil Aviation Rules
CET	Civil Evening Twilight
CHT	Cylinder Head Temperature
CMT	Civil Morning Twilight
Combination	Towplane and glider under tow
ft	Foot/Feet
hrs	Hours
km	Kilometre(s)
kt	Knot(s)
MAUW	Maximum All-up Weight
MOAP	Manual of Approved Procedures
MCTOW	Maximum Certified Take-off Weight
GNZ	Gliding New Zealand Incorporated
PIC	Pilot in Command
RPM	Revolutions per Minutes
TEM	Threat and Error Management

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Section 1 Pilot and Technical Rules

1.1 CAR Part 61 - Pilot Licences and Ratings Subpart M - Glider Tow Rating

61.601 Eligibility requirements

- (a) To be eligible for a glider tow rating a person shall-
- (1) have a minimum of 100 hours as pilot-in-command in an aeroplane; and
 - (2) have successfully completed a course in towing gliders conducted by a gliding organisation if the organisation's Part 149 certificate authorises the holder to conduct the course; and
 - (3) have successfully demonstrated competence in the towing of gliders to an appropriately authorised person within a gliding organisation if the organisation's Part 149 certificate authorises the holder to conduct the assessment.
- (b) The holder of a current glider tow rating issued by an ICAO Contracting State is deemed to have met the requirements of paragraph (a)(2).

61.603 Issue

- (a) If the authorised person who conducted the competency demonstration required by rule 61.601 is satisfied that the pilot complies with rule 61.601, the authorised person may issue the glider tow rating by entering the following statement in the pilot's logbook in accordance with rule 61.29:
- I certify that on [date of assessment] [name of pilot and client number] satisfied the requirements of Part 61 of the Civil Aviation Rules for the issue of a glider tow rating [enter the date, full name, signature, and licence number of the flight instructor issuing the rating].*
- (b) The holder of a glider tow rating issued under paragraph (a) may apply to the Director to have the rating endorsed on the holder's pilot licence.
- (c) On receipt of an application under paragraph (b) and payment of the applicable fee, the Director may endorse the pilot licence with the glider tow rating.
- (d) To avoid doubt, a statement of endorsement made in a pilot's logbook prior to 15 April 2016 is deemed to satisfy the requirements of paragraph (a) of rule 61.601.

61.605 Privileges and limitations

A current glider tow rating authorises the holder to act as pilot-in-command of an aircraft on glider tow operations subject to the privileges and limitations of their pilot licence.

61.607 Currency requirements

- (a) A holder of a glider tow rating must not exercise the privileges of the rating unless –
- (1) within the previous 12 months, the holder has performed at least 6 glider tows; or
 - (2) within the previous 12 months, the holder has demonstrated competency in accordance with the requirements of rule 61.601(a)(3); and

- (3) the authorised person who conducts the competency demonstration certifies the successful completion of the check in the holder's logbook in accordance with rule 61.29.
- (b) A pilot who completes the demonstration within 60 days before the date on which it is required, is deemed to have completed the demonstration on the required date.

1.2 CAR Part 91 – General Operating and Flight Rules

91.709 Towing Gliders

- (a) A person must not tow a glider in flight unless that person holds a glider tow rating issued under Part 61.
- (b) A person must not tow a glider in flight unless-
 - (1) the aircraft used for towing is operated at airspeeds below the maximum airspeed specified for aero-tow in the glider flight manual; and
 - (2) the towing load does not exceed the maximum load specified in the aircraft flight manual; and
 - (3) the person has checked the operation of the tow hook of the aircraft to be used prior to flight; and
 - (4) the person uses the take-off, glider release, airspeed, and emergency signals established by a gliding organisation for the pilots of tow aircraft and gliders; and
 - (5) the take-off distance to clear a 50 foot obstacle with the glider, in tow does not exceed 85% of the take-off run available; and
 - (6) the aircraft is capable of maintaining a rate of climb of at least 200 feet per minute at 1000 feet above the aerodrome with the glider in tow.
- (c) A person must not operate an aircraft to tow a glider in flight unless -
 - (1) the aircraft to be used is equipped with -
 - (i) a tow hook and attachment assembly; and
 - (ii) a pilot-activated quick-release capable of releasing the tow line from the tow hook with the glider in tow and while the aircraft is in flight; and
 - (2) the towline to be used meets the requirements of Appendix A.26[#]; and
 - (3) if more than one glider is being towed, the tow lines to be used are-
 - (i) one for each glider; and
 - (ii) of a length that provides a distance of not less than 50 m between any glider and towing aircraft; and
 - (iii) of a length that provides a trailing separation of not less than 30 m between each glider; and
 - (iv) attached by a single tow ring to the aircraft, and capable of separation on release from the aircraft.

- (d) Paragraphs (a), (b), and (c) do not apply to the towing of a hang glider in flight.

#Appendix A.26 to CAR Part 91 - Glider Tow Lines

Note that on 11 July 2016 the Director granted general exemption 16/EXE/34 from the requirements in Part 91.109 and 91.709(c) in relation to Appendix A.26. The exemption has the effect of requiring a minimum towline strength of 300 daN (300 kgf), and a maximum strength as limited by glider and towing aircraft Flight Manuals. Also, when one weak-link is used it must be installed at the towing aircraft end of the line. For more information, see GNZ AC 3-02 Aero Tow Ropes.

1.3 Tow Instructor Experience

- 1.3.1 GNZ issues approvals to pilots to act as tow instructors. The Civil Aviation Authority has delegated this authority to GNZ as the holder of a part 149 certificate. GNZ form OPS 13 must be used to document the issue of a Glider Tow Pilot Instructor Approval.
- 1.3.2 Tow pilot instructors shall hold either a category A or B glider instructor rating or a category A, B or D aeroplane instructor rating. In addition, the following experience will be taken into account:
- Towing experience
 - Total flying experience
 - Gliding experience
 - Currency with glider operations
 - Instructional experience
 - Soaring Pilot Certificate for aeroplane instructors without glider instructional experience.
- 1.3.3 An appropriate person assigned by the National Operations Officer will assess applicants.
- 1.3.4 Tow instructors must be familiar with this document, and remain abreast of training and regulatory changes.
- 1.3.5 All tow instructors will be required to train tow pilots in accordance with the training syllabus detailed in this document. This syllabus is broad and instructors are expected to provide additional, detailed training for the aircraft and environment applicable to each tow pilot.
- 1.3.6 Tow instructors should be actively serving on the tow roster of a gliding club, and will preferably be experienced glider pilots.

1.4 GNZ Manual of Approved Procedures (MOAP) & AC 3-02

Section 2-10 (Launching) and Section 2-11 (Glider Tow Pilot Ratings) in the MOAP affect glider-towing operations. AC 3-02 Aero Tow Ropes provides guidance on making up and caring for aero tow rope assemblies, including weak-link requirements.

1.5 Chief Tow Pilot Responsibilities

The Chief Tow Pilot is responsible for the following:-

- Maintaining a roster of club tow pilots
- Monitoring operational procedures and flying standards
- Managing future tow pilot requirements
- Reporting to club CFI and Committee on matters relevant to towing
- Keeping records of tow pilot BFR and medical expiry dates
- Liaison between tow pilots and the club committee
- Disseminating operational information as required including organising a minimum of one tow pilot meeting per annum.

1.6 Pilot Responsibility

It is the responsibility of the individual tow pilot to adhere to the various regulations and procedures governing glider towing operations and the requirements of the pilot licence held, and remain abreast of amendments and updates.

Section 2 Tow Pilot Training – Basic

2.1 Club Requirements

- 2.1.1 When considering the training of a new tow pilot the club needs to consider its current and anticipated needs. Experience will dictate the optimum size of the tow pilot pool and from there it is a case of crystal ball gazing as to whether more will be needed. This needs to be given thought as the tow pilots will not be able to give good service if they are too few in number, and the incumbent pilots will be done a disservice if the roster is swamped with new entrants and towing slots become few and far between.
- 2.1.2 There is also a question of currency. A tow pilot is likely to give a better tow and have a greater empathy with the towplane if currency is maintained. This will result in better value for money to the glider pilot and less wear and tear on the towplane. As a general rule of thumb, each tow pilot should ideally get a minimum of one or two rostered slots per month.

2.2 What are Good Tow Pilots Made of?

- 2.2.1 In some cases the club towplane is the most valuable asset on the club's books. The towplane insurance bill is a big cost faced every year, rivalled only by its maintenance bills.
- 2.2.2 While the average club glider pilot rates "an efficient tow" as the number one requisite of a tow pilot; looking at the overall picture, "correct operation of the towplane" must be the prime consideration.
- 2.2.3 Is the candidate prepared to follow club procedures on the operation of the towplane? It is a topic to be discussed with the candidate. It is not acceptable to adopt an attitude of, "I'm the pilot - I'll fly how I like". This may be true to a certain extent, but not at the expense of safety and undue wear and tear on the aircraft.
- 2.2.4 Now is probably a good time to bring up the subject of "service".
- The tow pilot provides a crucial service to the club's glider pilots - but one funded by those glider pilots.***
- 2.2.5 The glider pilot is reliant on the tow pilot to provide the service of launching and the glider pilot should be appreciative of this. But looking at it from the perspective of the glider pilot, they are funding the tow pilot's flying, and this can represent quite a lot of money over the year. An inefficient tow pilot can cost the club glider pilots a lot of money over a season and this has nothing to do with operating the towplane incorrectly or unsafely. Conversely, an efficient tow pilot will optimise the tow flight to deliver the glider in the right place at the right height - or into lift as soon as possible - and return as quickly as possible *without compromising operating procedures.*
- 2.2.6 Is the candidate asking questions all the time? The best tow pilots are not necessarily experienced glider pilots, but good ones often ask lots of questions because they have a passion to improve their skills and learn how to better their performance. It is likely this will manifest itself from an early stage of the training.
- 2.2.7 Many tow pilots want to tow as a stepping stone or hour-builder to greater things. This is not necessarily bad so long as the individual is committed to providing a professional

towing service and wants to learn. Having said this, the experienced glider pilot who tows will invariably have the edge on putting the glider in the right place.

- 2.2.8 Experienced glider pilot or keen powered pilot? Regardless - the club's towplane must be operated to approved procedures for safety, consistency and economy. No point saving 1 minute per tow (maybe \$5 or \$10 saving per tow) if this is going to crack cylinders (\$\$\$\$\$\$ each!).

2.3 Club Responsibilities

In the previous paragraph the topic of the tow pilot's responsibilities to the club were discussed, but equally the club has responsibilities toward the tow pilot. These include:

- Ensuring that the pilot is properly and thoroughly trained
- The pilot is flying an airworthy aircraft devoid of annoying minor faults
- The pilot is made fully aware of how the tow aircraft is to be operated
- Correct equipment is provided for the task - big, heavy gliders need a powerful towplane.

2.4 The Training Aircraft

It is strongly recommended that the tow rating be conducted in a two-seat towplane. These notes are written with the assumption that such an aircraft is being used. It is also recommended that an additional mirror be fitted for the use of the tow instructor.

2.5 Candidate Assessment

- 2.5.1 After discussion with the candidate and after reviewing the candidate's logbook and flying history, an assessment flight may be considered. This would provide the tow instructor with the opportunity to rate the candidate and decide whether the candidate has the basic skills to become a tow pilot. Ensure the candidate is aware that this is to be an assessment flight so that if it is found that the candidate is not yet ready to begin training then this conclusion can be reached without further expense. Even a circuit could be enough.

What to Look For:

- 2.5.2 Overall, the candidate should take a thorough and professional approach to the task. This begins with the pre-flight and continues through to the end of the flight.
- 2.5.3 Keeping this in mind, a marking table like the one detailed as Appendix 1 may be helpful.
- 2.5.4 Each trainer will need to set their own scoring regime and minimum performance expectations; however it should be remembered that the pilot has over 100 hours P-I-C in a powered aircraft and really should be able to score well.

2.6 Tow Pilot Training Begins

- 2.6.1 Assuming the candidate has passed the assessment flight, the training process can begin. At all times ensure that the candidate is fully aware of what is expected.
- 2.6.2 Note: The following exercises are summarised in Appendix 2 "Tow Pilot Record of Training". The trainee pilot should have a copy of this form completed by the instructor(s) during training. Gliding Clubs are required to retain the completed Record for all tow pilots trained by that Club.

- 2.6.3 **Rules and Regulations.** The trainee tow pilot must have an understanding of the rules, regulations and procedures relevant to glider towing.
- 2.6.4 **Gliding Operations.** If not experienced in gliding operations, then the pilot should be left in the hands of gliding members to observe operations and learn the launching procedures and responsibilities of the wing runner:

- “Launch this glider next” signal
- Checking the towrope
- Attaching the towrope to the glider
- Launch signals - “Take up slack” - “All out” - “Hold”
- Wing running
- Bat waving
- Stopping a launch and situations when this is appropriate
- People in the maneuvering area
- Communications set-up
- Time keeping responsibilities.

The more experience on these procedures, the better. The more exposure to gliding operations, the better.

Glider Experience Flights:

- 2.6.5 It is crucial that tow pilots experience life on the back of the rope. The candidate should have as many glider flights as practicable, not only to get a first-hand look at what goes on, but also to gain an understanding on the limitations and capabilities of gliders. Hopefully the tow pilot will get hooked enough to take it up! Certainly, all tow pilots should refresh themselves with a glider flight on a regular basis.
- 2.6.6 All good tow pilots have an empathy with the glider pilot. A good tow pilot will see who is about to be launched and know that lower-hour pilots and those flying low-performance club gliders will generally need to be treated more carefully in the air. Then of course, there is the trainee. Most powered pilots will not instantly grasp the art of the aerotow, so it is good for the candidate to have a go during the glider flight, just to see what can happen.
- 2.6.7 Discuss the glider’s limitations while on tow. All gliders have a maximum permissible towing speed, an ideal towing speed and a minimum safe towing speed. It is worth a chat about the general speed ranges for different glider types including the needs of water-ballasted gliders. Make the point to the trainee tow pilot that if there is any doubt about the aerotow speed required for any particular glider - find out before take-off.
- 2.6.8 During the glider flights, ensure that the candidate is shown the flight envelope of the glider/towplane combination:
- Box the towplane to demonstrate how far out of position the glider can be, and still be safe and in control
 - Show the correct position behind the towplane
 - Demonstrate the loss of performance with the glider’s airbrakes extended

- Point out that while on tow, the glider pilot is focused on the towplane in order to maintain station and therefore, the responsibility for lookout is weighted upon the tow pilot.

- 2.6.9 Free flight is a good time to discuss the glider's capabilities and demonstrate its performance. In terms of developing an empathy with the glider pilot, it is important that the tow pilot develops an impression of what is a sufficient altitude compared to the distance away from the airfield. The glider should be positioned so as to allow the glider to return to the airfield if it fails to climb away, but at the same time gives the glider the best opportunity to climb away. This is especially important when lift is some distance from the airfield.
- 2.6.10 The most likely place for conflict between glider and towplane is the circuit. The towplane will often enter the circuit area at 120 knots while the glider could be flying the circuit as slowly as 40 knots. Demonstrate a typical glider circuit, which will usually be much closer to the airfield. Discuss where a glider can be expected if it is returning low.
- 2.6.11 Hopefully by now the tow pilot will better appreciate what gliders can get up to so that the eyes will never stop searching for other traffic - especially in the circuit.

2.7 The Towplane

- 2.7.1 Walk around the tow aircraft and discuss the equipment for towing and the pre-flight inspection thereof. These notes assume that the pilot is rated on type and refers to aspects that are specific to towing.

Ensure the following points are covered:

- 2.7.2 Tow Release Features

- Release hook and mechanism – check free play and lubrication
- Release cable – check there is no fraying or excessive friction, and that the hook mechanism locks over-centre easily
- Rear-view mirrors – check adjustment
- Rope release-handle – check operating function in terms of position, direction and throw.

Fuel management:

- 2.7.3 The towplane will consume fuel at a higher rate than it would during non-towing operations. Discuss the aircraft's:

- Total fuel capacity
- Fuel type
- Total useable fuel capacity
- Rate of consumption during towing operations.

- 2.7.4 For example, the Piper PA18-150 has a fuel capacity of 30 imperial gallons (135 litres) which would allow for a safe 3.5 hours flying at 2200 rpm in non-towing conditions. The rate of fuel consumption is around 8.5 gallons (38 litres) per hour. Under towing conditions the same aircraft could be expected to burn 2 gallons (9 litres) per 2000 foot tow which allows for around 10-12 tows. Assuming a 2000-foot tow takes 9 minutes, the safe flying time is reduced to as little as 1.5 hours flying time.

- 2.7.5 Fuel management is important because consumption is broken down into units of one tow. The tow pilot needs to make a decision on the available useable fuel before the start of each launch. The length of the tow to be conducted must be taken into account. Be careful - more than one tow pilot has made the mistake of trying to squeeze one more tow out of the tanks, and failed. What if this is the last tow of the day? The pressure can certainly be brought to bear; however the tow pilot must take the responsibility.
- 2.7.6 Set levels on the tank sight tubes that must not be compromised. If the fuel level is below this line before take-off then the tow must not proceed under any circumstances. This helps the tow pilot to make the correct decision, and takes off some possible pressure because he is no longer making a subjective decision - he is following club policy.
- 2.7.7 Some towplanes, like the PA18 and some PA25 models, have a tank in both wings, which must be managed. Although not critical in the PA18, it is important in the PA25 that the tanks are kept reasonably level. It is good airmanship, regardless. Discuss this issue and give some guidance on how regularly the tanks should be changed over, and the procedure for doing so. It is recommended that tank changeovers be made at a safe altitude during climb-out or during the power-on descent. In any case it would be best to change tanks within gliding range of the airfield in case a problem arises. It is not desirable to change tanks while the engine is idling. This is in case there is just enough fuel in the lines or header tank to commence take-off and fuel starvation occurs at low-level during climb-out.
- 2.7.8 At the home field most pumps use a swipe card system but it is worth confirming how the pumps operate (this will depend a lot on the pilot's experience at the home field). Explain where the grounding line is usually attached, and procedures for recording the amount of fuel drawn. If the home field has more than one pump then the pilot will need to know which one to use.
- 2.7.9 At this stage it is timely to discuss operations away from the field. In some cases it may be necessary to draw fuel from drums. The risk of contamination is higher in this situation and adequate measures must be in place to ensure the fuel is correctly filtered. Any club that is affected should have procedures in place (i.e. written down) for the tow pilot to follow.
- 2.7.10 Remember that the fuel should be checked for water contamination after any refuelling operation, especially when pumping from drums
- 2.7.11 Use the refuelling stop to give the windscreen a clean as well.
- 2.7.12 Plan the refuelling stops wherever possible. It may be prudent to take a quiet moment to top up the tanks so that there is no need to stop when things get busy again.

Oil Management:

- 2.7.13 A towplane engine works hard. It is important that the correct oil is used in the engine and kept above minimum levels, to minimise the risk of damage to the engine.
- 2.7.14 The tow pilot will need to know which type of oil to use and when (like a running-in oil for use after maintenance). Where does the club store the oil? Does it get decanted into bottles from a drum? If so, what bottles are used and how does the pump operate to draw oil from the drum if necessary?
- 2.7.15 It is good airmanship to always check the oil level when refuelling. This slows the operation down slightly but the health of the engine is infinitely more important.

2.8 Pre-Flight

2.8.1 The pilot should conduct a standard pre-flight inspection as per the Flight Manual. In addition to the normal parts of the aircraft, the pilot should also thoroughly check the security of rear view mirrors, and the hook system. The windscreen should be thoroughly clean.

Tow Rope, Rings and Weak-Link:

2.8.2 It is the tow pilot's responsibility to ensure that the rope, rings and weak-link are serviceable. The rope should be malleable and look and feel fresh. It would be helpful if the pilot could be shown an old piece of rope that is no longer acceptable so it can be compared with a serviceable rope. Likewise, a set of rings that are cracked make an excellent training aid. Tost weak-links should be carefully inspected for cleanliness and any sign of necking across the weakest part of the link element. Check that the correct link is being used (Tost are colour coded).

2.8.3 Show the pilot how to inspect the rope by running it through the hands. The splices should not be frayed.

2.8.4 All rings should be symmetrical and free of distortion. Rotate the rings from behind the splice to check for cracks, distortion and damage.

2.8.5 If only one weak-link is being used in the rope, it must be attached at the towplane end using the small ring to the tow hook. The pilot should activate the hook while sitting in the cockpit using the release lever. Do not attach the rope by pulling on the release cable or hook mechanism at the rear of the towplane. Once attached, pull the towrope with a reasonable force and allow the pilot to activate the release. The release mechanism must be checked in this manner before the first tow each day. Assuming the release operated correctly, reattach the rope.

2.8.6 The rope should be left laid out behind the towplane in such a way that the risk of a vehicle driving over the rope is minimised. This also reduces the risk of the rope becoming tangled.

2.9 Demonstration Tows

2.9.1 Where possible, conduct these demonstration tows using experienced pilots in single seat gliders to aid climb performance.

Explain the routine for a standard tow, making the following points:

- Wait for glider to get fairly ready before starting. If the engine is warm, start-up could wait until the glider's canopy is being closed. If cold, start-up earlier. Start even earlier if this is the first flight of the day and a run-up is required. Some clubs require the towplane to have a check circuit without the glider, to warm engine and oil, before towing begins.
- Ensure prop is clear and start-up in the approved manner. Turn on and adjust radio as required
- Idle at usual rev rate (normally 1000 rpm) until engine is warm (usually 100 deg C)
- Make any necessary radio call, and carefully taxi out. Conduct an engine run-up in a clear area if required

- Wait with the tail of the towplane pointing to the **outside wingtip**. This minimises the risk of prop-wash blowing a canopy closed or picking up a glider wing that has not been picketed. Adjust for crosswind and use common sense
- Once instruction has been received on where the glider wants to go, line up and taxi forward slightly, then wait for the rope to be attached to the glider
- Conduct pre take-off checks
- The tow pilot should do a quick take off safety brief on release lever position and actions in event of a partial or complete engine failure after take off
- Check for the “take up slack” signal from the wing-runner and taxi forward at walking pace, slowing as the rope comes tight to avoid jerking the glider forward. Checking the loop of rope on the ground through the mirror as you take up slack assists with this. Note that once the glider has been hooked on, control of the launch is passed to the wing-runner - except that the tow pilot makes the final decision to take-off
- Check that the glider’s canopy is definitely closed and the airbrakes are retracted
- While taxiing also check wind direction and strength. Also check quickly for any incoming weather
- Once the rope is fully extended and the wing-runner is signaling the “all out”, make any necessary radio call and positively apply full power (around 2 to 3 seconds to full power to provide good initial acceleration for glider control)
- For tail-draggers, begin the ground roll with the stick back
- Check temps and pressures and check for full revs
- Note the reduced rate of acceleration with the glider attached
- As the combination is approaching flying speed (the glider will probably be flying) quickly check the mirror to ensure the glider’s airbrakes are still retracted
- Once airborne, allow the combination to accelerate to the desired climb speed
- Transition to normal climb-out, which will be a lower attitude with the glider, and also note the reduced rate of climb
- Plan the climb-out path for safety and noise abatement
- When turning, generally use 10 to 15 degrees of bank
- Position the glider at the required point and wait for release
- *Confirm release in the mirror (do **not** rely on just a radio call to signify release) and transition to approved descent configuration. If possible, also conduct a turn to the left to improve separation of the combination*
- Conduct a normal circuit, including downwind checks and radio calls. No turns should be below 500ft AGL and any obstacles to be cleared by at least 150ft to allow for the trailing rope
- After landing, taxi to parking area or to next glider on the grid and shut down or get set up for the next launch.

- 2.9.2 The tow instructor should explain what is going on during each step of the flight. The flight profile needs to be planned to deliver the glider at the right place at the desired altitude. Noise abatement procedures are part of this planning.
- 2.9.3 Take this opportunity to point out options in the case of a power failure on take-off and any hazards applicable to the field. Remember that the trainee may well be used to better performance from the aircraft than what will be available during towing.
- 2.9.4 Conduct a minimum of 3 standard tows with the trainee observing from the second seat. After these flights it would be appropriate for both pilots to debrief so any questions can be answered and aspects of the flights can be explained in detail without the engine noise.
- Sensations when glider is out of station and need to stay flying in balance.
 - Deceleration when glider takes up a bow in the rope on tow.

2.10 Non-normal Events

2.10.1 Stability and Control

***Remember!* If at any time near the ground, the tow pilot reaches full control deflection, of any control, the tow pilot should immediately release the glider.**

Wing-down Takeoff:

- 2.10.2 It is occasionally necessary for the tow pilot to launch a glider when no wing-runner is available. In the case of an outlanding retrieve, it may be better to conduct a wing-down takeoff rather than risk an error by a local farmer or other untrained wing-runner.
- 2.10.3 The biggest concern is the risk of the glider ground-looping, which will be more likely in a downwind or crosswind takeoff. If a crosswind is present then place the upwind wing on the ground for the take-off. This will minimise the risk of the glider pilot losing control before sufficient aileron command has been achieved to maintain level wings during the take-off roll.
- 2.10.4 Before starting it will be necessary for the rope to be attached to both aircraft. Be aware that the rope is attached and do not start moving until a clear signal has been received from the glider pilot. The glider's canopy will be closed and the airbrakes flush (closed) before any such signal will be given.
- 2.10.5 If possible, communication should be over the radio, with the glider giving the "take up slack" and "all-out" commands. The tow pilot should positively acknowledge each call by repeating the command back to the glider pilot.
- 2.10.6 If radio communication is not possible, the tow pilot should wait until the glider's airbrakes and canopy have been closed (signaling that the glider pilot has completed pre-takeoff checks) and gently taxi forward until the rope is taut. Once the slack has been taken out of the rope, apply full take-off power prior to brake release for maximum acceleration.
- 2.10.7 The glider pilot will pull the release if it is necessary to abort the launch at any point. Please note, off field retrieves are generally riskier than normal club operations.

Glider Loss of Control on the Ground:

- 2.10.8 It has been known for a glider to ground-loop on take-off. This could happen for a number of reasons, such as a poor wing-run.

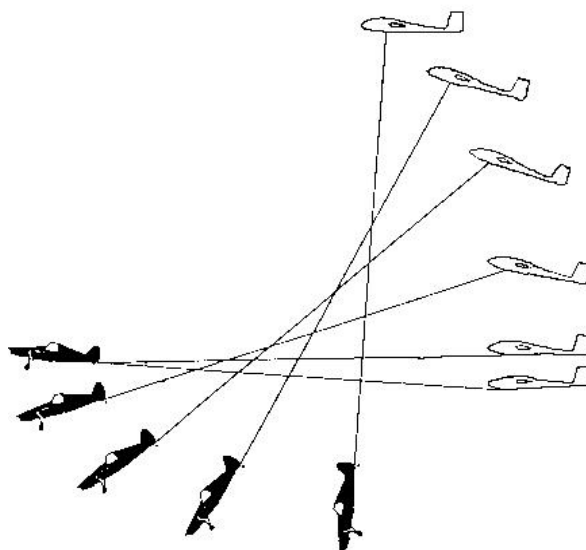
- 2.10.9 In most cases the glider pilot will realise that a ground-loop is inevitable and pull the release with no detrimental effect on the towplane. Occasionally the ground-loop happens too quickly and the rope releases through its back-release mechanism. Again, this will not normally have any effect on the towplane.
- 2.10.10 If the glider recovers at an acute angle to the towplane, the tow pilot will have to counter the lateral force with rudder, which may have to be applied quickly. With a typical wing span of 15m it can take some sideways distance to gather up a reluctant wing and then steer a glider back on path. Tow pilots should be ready for this eventuality so that the reaction is rapid.
- 2.10.11 It may be possible for the tow pilot to maintain course with some rudder input and allow the glider to ease back into position. If the towplane was to reduce power or abort, the glider would almost certainly ground-loop. The towplane provides a restoring force for stability. If take-off performance or control is in doubt, release the glider.

Glider Release or Rope Break at Low Level:

- 2.10.12 If the glider releases during the ground roll then there should be enough runway to close the throttle and roll to a stop. Gently steer the towplane to the left of the runway before stopping to ensure that the glider does not run into the back of the towplane.
- 2.10.13 If a glider releases after the towplane has become airborne, the towplane should continue on and fly a normal circuit. The glider will want every option available to complete a safe landing.
- 2.10.14 Engine Failure at Low Level. *Release the glider immediately*** - the glider has a greater range, and therefore more options, than the towplane. Take the best alternative for the forced landing.

Tow Upsets:

- 2.10.15 A number of towplane accidents and incidents have occurred by the glider climbing out of position (sometimes called “kiting”) and the tow pilot running out of elevator command. As the glider kites above the normal tow position, the tow pilot applies aft elevator to maintain attitude. If the glider continues to kite, the tow pilot continues to apply aft elevator until full control is reached. If the kiting continues, the towplane is



pitched nose down. This is likely to be fatal if it occurs lower than 500ft above ground.

- 2.10.16 This situation can develop extremely quickly and the decision to release the glider must be made quickly. Releasing the glider should be automatic if full control deflection has been reached, or full control deflection is being reached rapidly and reaching it is inevitable.
- 2.10.17 A Lateral upset can be just as dangerous. This is the result of the glider going out to one side too quickly, or with the rope slack so that when the rope tightens the towplane is abruptly yawed in the opposite direction. This sudden yaw can cause the towplane to roll so that the glider and towplane start to quickly and progressively diverge. This may be beyond the ability of the tow pilot to counter with full rudder and aileron control. The need to release immediately is obvious because if the glider remains attached, the vertical upset scenario will develop, but with the glider and towplane on diverging headings as well.
- 2.10.18 Note that a deliberate steady-state (non-diverging) lateral out-of-position by say 10 m (half a glider span) is not a problem - we do it for training, boxing the slipstream, etc. But arriving at such a position dynamically on a slack rope as a result of turbulence, a miss-corrected and overshoot manoeuvre, or inattention, and perhaps on a diverging heading, can induce an abrupt large yaw of the towplane when the rope comes tight. The towplane pilot won't have applied rudder to correct the yaw before it happens, and once the yaw/roll couple turns the towplane onto a further diverging flight path the upset is under way.
- 2.10.19 The ways in which an upset can start are many: the towplane peeling off abruptly with the glider still on tow; the glider pilot losing sight of the towplane when being towed into a low sun and climbing; the glider pilot trying to steer the towplane by flying out to one side too abruptly; the glider getting out of position and the pilot trying to get back too quickly and overshooting; turbulence, etc.
- 2.10.20 Rope or weak link failure when the tow pilot has significant control input, is a risk. In a vertical upset, it is possible that the tow pilot may not release the back-stick pressure quickly enough to stop the towplane pitching up violently. A high-speed stall, and spin as a result of engine torque, may result.
- 2.10.21 A dynamic upset could result if either aircraft is turning, as well as pitching, with the tow rope still connected to both. This situation could occur if the glider completes a climbing turn, which is normal at the end of the tow, without successfully releasing first. Tow pilots should take note of any glider that kites off tow (also referred to as a "slingshot") as the glider pilot cannot see whether the towrope has successfully released and may no longer be in a position to avoid a tow upset even if the situation has been recognised. Any glider pilot who kites or slingshots should be spoken to.

Non-Urgent Situation at Altitude:

- 2.10.22 If for any reason the tow pilot wants the glider to release, but the problem does not require the tow pilot to release the glider, the tow pilot should roll the towplane from side to side. Ensure that the signal is given clearly so that the glider pilot does not confuse it with turbulence. The glider pilot is trained to act on this signal without delay.
- 2.10.23 Tow pilot instructors should discuss situations where this need may arise. Some examples are:
- Unusual engine vibration

- Higher than expected cylinder head temperature
- Concern over fuel reserves.

Glider Airbrakes Deployed:

- 2.10.24 If the tow pilot notices that the glider's airbrakes are extended during any part of the flight, then the tow pilot signals the glider by oscillating the rudder from side to side. This oscillation needs to be quick enough to draw the glider pilot's attention and also not induce any yaw on the towplane. So long as the combination is in no risk of a problem caused by the reduced rate of climb, there should be no reason to release the glider.
- 2.10.25 If the glider pilot does not comply, try calling on the radio. It has happened that the glider pilot has finished the tow and released and still not noticed that the brakes were deployed. This has resulted in an accident as the glider failed to reach the airfield. If radio is fitted, use it to confirm that the glider pilot is aware of the problem.
- 2.10.26 Another consideration is that the glider cannot retract the airbrakes. If radio communication cannot be established, continue climbing if possible and return the glider to overhead the airfield or to a position in the circuit and wait for the glider to release of its own accord.

Glider Unable to Release:

- 2.10.27 This situation has been known to occur when distorted rings have jammed in the glider's release system or the release mechanism has jammed due to mechanical failure. The situation will not be detected until the glider reaches its desired release point.
- 2.10.28 Where possible the glider will call the towplane on the radio. If communication cannot be established, the glider will fly out to the left of the towplane and rock its wings. This signal means the glider cannot release. This should be obvious to the tow pilot, because:
- The glider did not release at the expected altitude
 - The tow pilot will feel the glider fly out of position
 - Upon looking out to the left, the tow pilot will see the signal.
- 2.10.29 If no radio communication can be established, the tow pilot should wave to the glider to indicate that the signal is understood, while it is out to the left of the towplane. The glider will fly then back into position.
- 2.10.30 The glider pilot may make further attempts to release by creating some slack in the rope or by flying out to either side of the towplane. These manoeuvres will change the angle of the tow rings in the glider's release mechanism and may cause the rope to detach. It is recommended that the glider pilot advise the tow-pilot of these manoeuvres first, but the tow-pilot should be aware that these attempts may be made without any such advice (which is only going to be possible if in radio contact). The tow pilot should maintain a straight flightpath during these manoeuvres.
- 2.10.31 The towplane should fly overhead the airfield or nearby clear area, and release the glider. Common sense should prevail on where the release should occur, given the local situation, weather conditions and the possibility that the rope may back release from the glider once it is released from the towplane.
- 2.10.32 If the rope does back release, or for any reason becomes disengaged from towplane and glider, it will cause a danger to anyone or anything it hits when it falls to the ground. For this reason, avoid built-up areas when sorting out the hang-up problem. If the rope does

disengage, try to get an idea of where it has fallen and advise the local Police of the incident upon landing.

Glider and Towplane Unable to Release:

2.10.33 While always possible, this is an extremely unusual situation. In the event of this occurring, the combination could land while still attached. It is not recommended to try and break the rope, although checking for release on a slack rope is worthwhile.

2.10.34 Descend on tow, as discussed later in these notes. The towplane will provide the thrust and the glider will use its airbrakes to decelerate the combination.

In above situations, the standard signals should always be used as primary means of communication. Radio can be used simultaneously but is secondary.

2.11 Standard Tows

2.11.1 Have the trainee settle into the pilot's seat and adjust seat, cushions, rudder pedals and mirrors, as required.

2.11.2 With the instructor in the second seat, it is recommended that the trainee undertake at least 3 standard tows. Tows to 1500ft AGL or higher would be preferred to leave enough time for both pilots to discuss each step of the tow as they go.

2.11.3 It is important that the trainee adopts all safety practices from the first tow and it is the responsibility of the instructor to ensure these are followed.

2.11.4 The relevant safety points were mentioned under "Demonstration Tows", but are repeated below:

- Wait with the tail of the towplane pointing to the outside wingtip of the glider
- Check that the glider's canopy is closed and airbrakes retracted when taxiing forward
- Ensure wing-runner is signaling "all out" before applying full power – at any time the wing-runner holds the bat stationary above the head - STOP
- Check temps and pressures and ensure the engine is pulling full revs once the throttle has been fully opened. In tail-draggers, keep the stick back until the combination is well into the ground roll
- As the combination approaches flying speed, check in the mirror to ensure the glider's airbrakes are still retracted
- When turning, generally use 10 to 15 degrees of bank. If the towplane has a turn indicator, Rate 1 is a good guide. Up to 20 degrees of bank may be acceptable for a short time if it is necessary to avoid traffic. Bank angles greater than 20 degrees should never be used as, not only does climb performance significantly deteriorate, the glider may have difficulty in remaining in the correct position, potentially courting an upset.
- If attempting to place the glider in lift, plan to reach the release point abeam the lift to avoid congestion. The glider pilot can then glide the short distance and join the lift. Do not attempt to fly the combination into a thermal if there are other gliders circling at a similar altitude – the speed differential and lack of maneuverability make this too dangerous. It also makes it more difficult for the glider pilot to get established

- *Confirm that the glider has released - visually. Never assume the glider has gone by “feel”, or rely on a radio call from the pilot*
- Plan the descent to maximise noise abatement and avoid spirals if at all possible. Do not fly through any gaggles of gliders which may be thermalling – fly around instead
- When returning to the airfield, always clear obstacles by at least 150ft to avoid the risk of hitting anything with the trailing rope.

2.11.5 Remember that while the glider is on tow, the combination may turn below 500ft. Once the glider has released, the towplane should complete all turns by 500ft AGL.

2.12 Signals

2.12.1 Once the trainee has become comfortable with the standard tows, it is time to introduce more advanced exercises. Exercises involving the simulation of non-normal situations must be thoroughly planned and briefed with experienced glider pilots doing the glider flights. The standard signals should always be used as primary means of communication. Radio transmissions may be used in conjunction with the visual signals but are secondary.

Airbrakes Open Signal:

2.12.2 The tow instructor should brief an experienced glider pilot to extend the airbrakes at different stages of the launch. Ensure that the towplane is powerful enough to maintain a safe rate of climb if the airbrakes are deployed at critical altitude.

2.12.3 Remember that rudder oscillations (“brakes out” signal) need to be large enough to attract the glider pilot’s attention, but quick enough to avoid yawing the aircraft.

2.12.4 A good start is to have the glider pilot leave the airbrakes open for the start of the launch. The wing runner will also need to be briefed. Highlight the possible difficulty in seeing the extended brakes in the mirror, particularly if there is mirror vibration at low RPM.

2.12.5 If safe, have the airbrakes opened during the take-off roll. Note the loss of acceleration, possibly critical to go/no-go decision making.

2.12.6 Open the airbrakes again at altitude. Note the loss in rate of climb.

- Mix it up - open the airbrakes at different points on the same flight
- When at altitude, have the glider extend its airbrakes quickly at first, then on another occasion, slowly and progressively (to see if the tow pilot can detect the gradual drop in performance - and to see if the tow pilot is keeping a regular check on the glider in the mirror). Note that it can be difficult to detect this situation and highlight its insidious nature. A regular check of the glider in the mirror should become a part of the pilot’s scan.

Release Immediately Signal:

2.12.7 At the altitude requested by the glider, have the tow pilot give the “release immediately” signal by rocking the wings of the towplane. The signal should involve large aileron deflection but the roll should not be more than 30 degrees either way.

2.12.8 The trainee will note that it is important to roll the towplane in a balanced manner, as it will not be possible to keep the glider in the mirrors continuously. While in balance, it should be possible for the tow pilot to feel the glider release, then the mirrors can be

checked to confirm that the glider has released. There is no point continuing to signal after the glider has already released! (Stranger things have happened).

2.12.9 Remember to brief the glider pilot to expect the signal.

Cannot Release Signal:

2.12.10 At a pre-planned altitude, have the glider fly out to the left of the towplane and roll its wings to signal that it is unable to release. (In briefing for this exercise, the glider instructor should be reminded not to allow the trainee to go so far out to the left that it risks a dynamic situation and potential lateral upset – see paragraph 2.10.18 above.)

2.12.11 The tow pilot should wave (with a hand) back to the glider then wait for the glider to return to its normal station.

2.12.12 If the two aircraft are not in radio contact, ensure that the glider pilot is aware that only the first signal will be treated as the exercise. If the glider pulls alongside again to issue the signal, it could well be that Murphy has stepped in, and the glider really can't release!

2.12.13 There is no point following through with the release of the glider but it is worth discussing the subsequent actions expected of the tow pilot.

- Position overhead the airfield or a clear area nearby
- Release the glider.

2.12.14 It is worth asking the pilots of PA-18, PA-25 and similar towplanes, why the glider only moves to the left to make the signal. The original reason was to avoid the risk of the tow pilot misinterpreting that the glider had released, as it would be expected to be to the right of the towplane after release. In turbulent conditions it is possible to miss the feel of the glider releasing. Also, the pilot sits on the left side of some towplanes and would have difficulty seeing a glider on the right.

2.13 Towing a Simulated Trainee Glider Pilot

2.13.1 This exercise is to provide experience in the sensation of towing someone grappling with the art of aerotow.

2.13.2 Ensure that an experienced glider pilot is used to provide this simulation and that the conduct of the exercise is thoroughly briefed.

- Have the glider fly out of position to the side, and hold. The tow pilot will have to get the feet working to keep the towplane flying straight
- The glider can simulate the classic pendulum of a trainee glider pilot trying to “fly” the glider back into station. This should really get the rudder pedals working
- Next get the glider to form a slight bow in the rope and then allow the towplane to take up the slack. Let's not get carried away and break the weak-link! The tow pilot will feel the rather unpleasant sensation of deceleration as the slack gets taken up.

2.13.3 The aim is for the trainee tow pilot to maintain balanced flight at all times. Best attempts should be made to minimise airspeed variations. Stress the need to maintain attitude and balance and to not chase airspeed fluctuations. Turns should be kept to 10 to 15 degrees of bank; never more than 20 degrees.

Straight and Level / Descending on Tow:

- 2.13.4 On cross-country tows or to avoid climbing into cloud, it may be necessary to level out. The tow pilot should never climb into cloud simply because the glider has not released. Instead, plan to level out by gradually reducing the rate of climb well before the cloud base is reached.
- 2.13.5 It may also be necessary to descend on tow on a cross-country tow.
- 2.13.6 Again, ensure the glider pilot is experienced and the exercise is briefed with all pilots beforehand.
- 2.13.7 At the elected altitude, the trainee should gently reduce power and level out to the desired altitude with no variation in airspeed. It is now the responsibility of the glider pilot to maintain separation and not over-fly the rope. The glider pilot may use airbrake to facilitate this, although a small amount of yaw or extra drag by extending the glider undercarriage will often be sufficient.
- 2.13.8 To descend on tow, the tow pilot will need to close the throttle even more. The glider will have to use significant airbrake.
- 2.13.9 The aim is to remain very smooth and transition from climb to straight and level to descent to climb with no variation in airspeed and in a smooth, progressive manner.
- 2.13.10 Have the tow pilot descend at 50 fpm to start, then 100 fpm. If the glider has strong airbrakes (discuss this with the glider pilot) try a higher rate of descent.
- 2.13.11 Again, the greater the empathy the tow pilot has with gliding, the more successful this operation will be. If the tow pilot ever needs to make an urgent descent, the decision will have to be made on whether the glider will be able to follow or whether the tow pilot should release the glider to avoid a potential upset.

2.14 Debriefing

- 2.14.1 It is preferable for each tow to be debriefed before the next is started. For the first "standard" tows, a chat while taxiing back may be sufficient. If any fundamental problem arises, stop and talk about it with the engine shut down.
- 2.14.2 To keep the gliding operation going, it is advisable to have a standby tow pilot available to take over during the debriefing.
- 2.14.3 It will be particularly important to debrief the advanced exercises on a flight by flight basis.
- 2.14.4 Once this training has been completed to the satisfaction of the tow instructor, it would be wise to take a break - lunch or a cuppa. If possible, the glider pilot who has been flying the advanced exercises should also be involved in this session. Go away from the flight line and run through all that has been learned and discussed. Revise the safety aspects - ask questions of the trainee: "What would you do if...".

2.15 Solo Tows

- 2.15.1 After a break, return to the towplane and complete at least one more standard tow with instructor and trainee onboard.

2.15.2 If satisfied, the tow instructor should now authorise the trainee to complete some solo tows. Ensure weather conditions are ideal, or at least no worse than experienced during training.

2.15.3 The instructor will now need to observe the tows. The instructor should listen in on instructions to the tow pilot and intervene if advice is necessary.

2.16 Flight Test

2.16.1 With an experienced glider pilot, it may be appropriate to put the trainee to the test in a safe way. These tests can continue at various times during the tow pilot's normal duties and each Chief Tow Pilot is encouraged to use these exercises to gauge the alertness of tow pilots, regardless of their experience.

2.16.2 Some ideas for checking awareness are:

- Have the wing-runner hold the launch for no apparent reason
- Have an experienced glider pilot extend airbrakes at a safe point in the launch - like before take-off.

2.17 Administration

2.17.1 The tow instructor must complete an entry in the pilot's logbook using the Rule Part 61.603(a) statement referred to on page 5.

The GNZ Executive Officer holds supplies of a suitable logbook sticker to facilitate this. These will be supplied free of charge to tow instructors on request.

2.17.2 Complete a GNZ form OPS 14, which the instructor should then forward to the relevant GNZ Regional Operations Officer (ROO) for noting.

2.17.3 Discuss with the trainee the daily routine for tow pilots:

- Rostering
- Times the tow pilot is expected for each session
- Finishing times
- Aircraft log book / time keeping
- Towplane maintenance and cleaning
- Who has responsibilities for the towplane within the club
- Refueling
- Hangaring.

Joining the Flight Line

2.17.4 New tow pilots will normally start on the tow roster under some guidance. It is suggested that the new tow pilot be "buddied" with a senior tow pilot for at least the first roster so that any new points can be discussed as they arise and the senior pilot can continue to offer positive criticism.

2.17.5 It is worthwhile to consider limitations on weather for the new tow pilot to help development of decision-making skills. The tow pilot could be given a maximum wind which can be towed in, and a maximum crosswind component (if less than the aircraft's maximum crosswind rating).

- 2.17.6 Ensure the new tow pilot is aware that further training will be required before being cleared for cross-country tows, competition towing, outlanding retrieves and multi-glider towing.
- 2.17.7 The sum of previous aero towing experience of the tow pilot and glider pilot must total at least ten aero tows as pilot-in-command (reference MOAP Section 2-10, paragraph 4.2).

Section 3 Human Factors

3.1 "I'M SAFE

3.1.1 Pilots must be self-analytical as to their standard of health for flying. Hopefully pilots will avoid excessive alcohol consumption and ensure adequate rest when they know they will be flying the next day. Towing operations are intense and require constant concentration because the flights are short and sharp, and have to be flown efficiently from first flight to last. There is often no time during a towing stint to take a break so it is imperative that tow pilots do not handicap themselves, and risk flight safety, by over-indulgence the night before.

3.1.2 The following is a guide to pilots, which should be applied to them to take stock of their physical well-being before stepping into the towplane.

3.1.3 I'M SAFE!

- I **Illness.** We must be free of illness. Most illnesses affect our primary senses and have the potential to cause visual problems and/or balance problems and therefore orientation problems. Ears and sinuses must be clear of congestion to cope with the pressure changes that occur with all flight. Our limbs and muscular system must be fully functional to allow normal control. Don't be tempted to fly too soon after any illness and ensure you don't fly if still in bandages that may restrict your full control of the towplane!
- M **Medication.** Most over the counter medications are not designed with pilots in mind. They work perfectly well on the ground but may have hazardous side effects for pilots. The most common undesirable effects are drowsiness and suppression of primary senses. Check with an Aviation Qualified doctor that any medication you are taking is safe for use as a flying pilot...not just a passenger.
- S **Stress.** There is an optimum amount of stress for humans. Too much and we suffer undesirable side effects like forgetfulness and irrational decision making...not good in an aeroplane! Don't think going flying is an escape from the stress in your life, especially glider towing; it is supposed to be relaxing but you must start free of stress so you can handle any that pops up during your flying. When flying, remember that the environment we operate in can be very stressful in terms of heat and cold, so dress appropriately.
- A **Alcohol** or Drugs. Similar to driving, make sure you are not vulnerable to the side effects of alcohol or drugs. They are particularly bad news for our balance system and erode our judgement and decision making performance. Don't fly with a hangover - and remember, 10 hours bottle to throttle, even after a light drinking session.
- F **Fatigue.** Most of us will be well aware of our degraded personal performance when tired. Towing is a demanding exercise both physically and mentally so we must be well rested, as sleeping on the job can be disastrous!
- E **Eating** and fluid intake. We are what we eat...eat well and we fly well, eat crap and we fly like crap. Ensure you have eaten well and take some food along to eat during the day. Take sufficient fluids to avoid dehydration and remember the symptoms of dehydration like a dry mouth and lips, and a dull headache. In hot flying conditions fluid replacement may need to be up to 600mls of water per hour! This situation is made worse by intense concentration and continual aircraft handling.

3.2 Vision

3.2.2 Maintaining an efficient lookout is essential for a tow pilot for a number of reasons:

- The airspace around a gliding site is often very congested. Gliders will be seeking an initial climb near the airfield before starting out on a cross-country soaring flight, so they can land back for another launch if unsuccessful on the first attempt. Training gliders will stay close to the airfield to maximise their altitude for training exercises.
- With a glider on tow, the combination is not very maneuverable. Lookout is the best defense against having to take last minute avoidance action.
- Gliders do not follow much rhyme or reason when attempting to find lift. Unlike a powered circuit, gliders can be expected to appear from anywhere at any altitude.
- Gliders do not present a very big frontal profile. Unless they are turning, they can be extremely difficult to spot.

3.2.3 It takes approximately 1.5 seconds from the detection of the movement of a near-by object, to focus the eyes on the object, and recognise what it is, its heading, distance away and speed. Once this process has occurred, the pilot can then make a decision as to whether or not some action will be required to avoid it.

3.2.4 The eye's retina has light receptors placed around it, called "cones" and "rods". Rods are good at operating in low light levels, like at night, and are also good at detecting movement. When we talk about "peripheral vision" we are really talking about the rods detecting an object.

3.2.5 Once our rods have detected that there is something to investigate, the cones come into use. The cones, unlike the rods, are able to detect colour and will provide a sharp resolution of the object. For the cones to provide this information, they must be directed to it - the pilot must turn the eyes and/or head toward it.

3.2.6 The cones operate at an angle of 10° either side of central, hence the 20° rule. Try it for yourself - next time you are parked at a red light, take a look at a nearby billboard. Look directly at the middle of sign and without moving the eyes; try to detect what is written out to the sides. You know there is something there (the rods) but will need to turn the eyes to read it (the cones).

3.2.7 The 2-second rule is applied because of the time it takes (1.5 seconds) for the process of detecting, seeing and recognising to occur. This time can be longer if the eyes have to adjust for the effects of glare and contrast, so the time is rounded up to 2 seconds.

Blind Spots:

3.2.8 Rods and cones transmit their information to the brain via small nerves that are connected to a central nerve, called the optic nerve. The optic nerve departs the eye at the back of the retina, and at this point there is nowhere for rods or cones. Because of this, the eye has a "blind spot".

3.2.9 The aircraft also creates blind spots. Windscreen post-blind spots combine with the eye's blind spots to increase the area that is not seen by the eye. These blind spots can only be overcome by a good scanning technique.

Sunglasses:

3.2.10 Pilots should always use a good quality pair of sunglasses. There is no need to spend a fortune on them as the expensive models don't actually make much of a difference,

however cheap, plastic models have poor optics and should be avoided. The sunglasses are protection from the sun's glare, which can overload the eye and cause a moment of blindness, not to mention discomfort.

3.2.11 It is important that the sunglass frames do not contribute to blind spots. Use sunglasses that cover the field of vision of the eyes.

3.2.12 **Windscreens:** Keep the windscreen clean at all times. Dirty or scratched windscreens further restrict the pilot's ability to see and recognise other aircraft. Always clean the windscreen using vertical strokes, not horizontal and place a cover across the windscreen when the aircraft is stored, if it is not hangared, as sunlight damages Perspex over time.

Corrective Lenses:

3.2.13 It is very common for people to require corrective lenses to overcome long or short sightedness. Long-sighted pilots may have trouble focusing on aircraft instruments and other close up things. Long sightedness can become prevalent later in life with people who have always had good sight previously. Short-sighted pilots will find it more difficult to detect and recognise other aircraft and objects at a distance and should always wear corrective lenses to overcome this potentially serious problem.

3.3 Risk Management

Threat and Error management, TEM:

Threat and error management is of greater importance to glider towing than probably most other operations the trainee pilot has been involved in before. Some examples below are:-

- People on the runway in close proximity to a rotating propeller retrieving the tow line
- Lower climb performance of combination, more susceptible to downdrafts
- Decreased maneuverability of whole combination
- You are PIC for whole combination while on tow resulting in higher workload that, can divert attention away from good lookout and airspeed monitoring
- Distractions, be vigilant, disciplined. Carb heat, fuel management and flaps.

Know where to reach for the tow release blindfolded!!

3.4 Pilot Fitness

Dehydration:

3.4.1 The towplane cockpit can be a hot workplace. At the height of a summer's soaring day the tow pilot is working relentlessly in high temperatures. The tow pilot can get some relief during the high speed descent, but this is short-lived and the temperatures build again during the turn around on the ground and the grinding climb back out.

3.4.2 Say the air temperature at ground level is 25°, and the average tow is only to 2000', there is no discernible drop in air temperature at the top of the climb - it will still be about 21° outside. Added to this, the tow pilot is sitting behind an engine that is working very hard all day and is pumping out heat that cannot be totally diffused.

3.4.3 The tow pilot is constantly working, both mentally and physically, in this situation and as a result will be losing body fluids at a high rate. It is essential that fluids be replaced during the day to ensure pilot comfort, low stress and good decision making. As previously mentioned (see "I'M SAFE") it may be necessary to replace fluids at a rate of up to 600mls per hour!

3.4.4 Wear a hat to protect the head from long periods of sunlight. Some towplanes have a clear panel over the cockpit that can catch a pilot out.

Rest:

3.4.5 It is advisable to take breaks during the day. This will vary from pilot to pilot, however tow pilots are often put under pressure by the gliding operation to keep flying when they would far rather take a break. Tow Masters are encouraged to anticipate this problem and ensure enough pilots are rostered so that no one pilot is forced to fly longer than would be considered sensible.

3.4.6 Take advantage of refuelling time to refuel the body as well. Take a drink, eat something and take a comfort stop if required.

Carrying an Illness:

3.4.7 Most ailments such as coughs and sore throats do not present a major risk and can be treated by eliminating irritants such as smoking, and allowed to cure by themselves. If you see a doctor and medication is prescribed, ensure the doctor is aware that you are a pilot and discuss any ramifications the medication may have on your ability to fly.

3.4.8 Colds and sinus infections can be a problem for pilots because they are usually associated with blocking of the Eustachian tubes, which will make it difficult or impossible for pressures in the eardrum to be equalised. This can lead to a burst eardrum when the air cannot enter the Eustachian tubes during descent.

3.4.9 Many common ailments have a side effect of making the pilot feel drowsy and "not on their game". These feelings can be compounded by the use of typical medications, which are designed to alleviate the symptoms. Reaction times slow and more time is required for decision making than when the pilot is fully fit.

3.4.10 It is recommended that the pilot stand down from flying duties until the illness passes and the pilot is absolutely confident that there are no residual effects. The pilot should not start flying again until it is assured that the Eustachian tubes can be cleared - the pilot can "pop" the ears. Use the 'Valsalva' technique to test this. With a small pressure differential present, pinch the nose and force air through the throat until the ears clear.

APPENDIX 1

TOW PILOT CANDIDATE ASSESSMENT SHEET

PILOT NAME _____

DATE _____

INSTRUCTOR NAME _____

EXERCISE	RATING	COMMENT
Pre-flight		
Start up		
Radio work		
Taxiing - speed / control position		
Run up		
Pre take-off checks		
Speed and directional accuracy on		
After take-off checks (include T's & P's)		
Level out - smoothness and accuracy		
Trim		
Lookout		
Balance in turns		
Downwind checks		
Speed control in turns		
Speed control on finals		
Flare		
Landing		
After landing checks		
Taxi to parking point		
Shut down and security (chocks, etc)		

GENERAL COMMENTS:

APPENDIX 2

TOW PILOT RECORD OF TRAINING

BASIC TOW RATING

PILOT NAME _____

INSTRUCTOR NAME _____

GLIDING ORGANISATION _____

EXERCISE	BRIEFING (DATE)	PROFICIENT (DATE)
Understanding of CAR Part 61		
Understanding of CAR Part 91		
Understanding of exemption 16/EXE/34		
Understanding of the MOAP (Towing sections)		
Gliding Ground Operations		
Gliding Experience		
Towplane Release Features		
Fuel Management		
Oil Management		
Towplane Pre-flight		
Tow Rope, Rings and Weak-Link		
Line Up on Glider		
Wing-runner Signals (Up Slack/All Out/Hold)		
Take-off Ground Roll		
Turns on Tow – Normal & Maximum		
Airbrakes Open Signal		
Release Immediately Signal		
Noise Abatement During Climb		
Trainee Glider Pilot - Attitude/Stability Control		
Glider Boxing Wake		
Position Glider for Release - Thermal/Wave/Ridge		
Clearance After Glider Release		
Initiating Descent including Engine Management		

EXERCISE	BRIEFING (DATE)	PROFICIENT (DATE)
Stabilising in Optimum Descent Profile		
Circuit/Landing with Tow Rope Clearance		
Actions After Landing/Ground Roll		
Wing Down Take-off		
Glider Release or Rope Break at Low Level		
Engine Failure at Low Level		
Tow Upsets		
Non-urgent Situation at Altitude		
Glider Airbrakes Deployed		
Glider Unable to Release		
Glider and Towplane Unable to Release		
Straight & Level/Descent on Tow		
Towing Speeds for Light/Heavy Gliders		
Daily Routine (Before/After Flying Day)		
Weather Minima		
Human Factors		
Tow Pilot Responsibilities to Safety of any Tow		
Administration - Log Book Sign Out		

GENERAL COMMENTS:

INSTRUCTOR SIGNATURE _____

DATE _____