TM04

PARAGLIDING TOW MANUAL

Version 1.2 as of 29th March 2022

Last reviewed and approved by CAA CIVIL AVIATION AUTHORITY OF NEW ZEALAND : 21/5/2021

The NZHGPA has developed a suite of Technical Manuals. The number of Technical Manuals is growing.

These documents can be used as:

- Best practice guides
- Study material for students and other pilots
- Guidance on rules and compliance

Table of Contents

List of Amendments:

29/3/2022 - Version 1.2: updated inconsistency within section 3.4 to align with the recently reviewed HG Tow Manual

1. Introduction

1.1. General

This manual has been compiled to establish minimum standards for tow launched paragliding flight. It provides criteria for operators to establish adequate safety and training systems.

This manual is intended to be EQUIPMENT NON-SPECIFIC. Towing technology varies greatly, and each system enjoys its own philosophy. Equipment is to be fit-for-purpose.

Many pilots and organisations have contributed to the development of this manual. Contributions from the USHGA, SAFA and BHPA are acknowledged. Many NZ pilots have contributed to the wealth of knowledge which now exists, whether documented, or not.

Despite its complexities towing can be safe and rewarding. Great care must always be taken, and responsibility must not be taken lightly.

2. Personnel Requirements

2.1 Pilot and Crew Qualifications

The following qualifications relate specifically to tow launching paragliders:

- OPMF70: Tow Operator Pay-In Certificate (PTOI).
- OPMF71: Tow Operator Pay-Out Certificate (PTOO).
- OPMF76: Paraglider Tow Instructor Certificate (PTI).
- OPMF78: Paraglider Tow Pilot Certificate (PTP).

2.2 Pilot Currency

Currency requirements are prescribed in the NZHGPA OPM.

2.3 Authorisation of Tow Operations

Where all tow pilots hold a minimum of paraglider tow pilot certificate (PTP), a paraglider tow operator certified pilot (PTOI or PTOO) can authorise and supervise tow operations.

Where a tow pilot is under instruction (not PTP certified), a paraglider tow instructor (PTI) must authorise and supervise tow operations.

3. Sites

3.1 Launch and Landing Area Suitability

Landowner permission is always required (even if Council or public land).

Take-offs must be checked for snags that might catch the paraglider or its lines and these removed or mitigated. The use of AstroTurf or a tarp is beneficial in some situations. Other considerations include launch orientation with the wind, refuelling of the tow vehicle, windsock placement, cautionary signage, hazard register and access, including for emergency services.

3.1.1 Land Based Towing

Suitable sites include airstrips, fields and long private roads running parallel to the wind. The surface must be flat and easily driven upon, and there must be a suitably open area for take-off. A gently sloping take-off area is ideal.

Specific hazards include other traffic, powerlines, fences, stock, or wildlife and these must be taken into consideration.

Both vehicles and winches can become hot. Fire risk must be carefully considered in dry areas and areas of long grass. Some risk can be mitigated through the availability of a fire extinguisher.

3.1.2 Water Based Towing

Permission from the local Harbour Master is likely to be required in addition to the landowner's permission.

Consideration of other water traffic is a crucial element in determining the suitability of a location. Be aware a high percentage of boat drivers lack experience, professionalism, and the level of awareness necessary to integrate safely with a tow operation.

The lake size, surrounding terrain, wind strength and direction will be factors in determining the suitability of a location. A good take-off beach would be grass, gravel or sand. Cobbles or rocks, depending on size, increase the risk of catching lines. The laying of AstroTurf or a tarp can greatly improve the characteristics of a beach. A gently downwards sloping beach is ideal.

Coastal waters with tide, undertow and waves are additional risks in the event of a water landing. Waves or swell can contribute to the smoothness of a tow.

3.1.3 Landing Areas

Landing areas must be appropriately sized given consideration to pilot experience. All tow operators must incorporate nonstandard significant hazards into a daily pilot briefing. Risk to the public must be considered.

Ensuring separation between pilots landing and any pilots on tow is important.

3.1.4 Alternative Emergency Landing Areas

Pilots must be aware of alternative landing area locations. Pilots must be aware that beach landings are often cross wind.

3.2 Launch Site Authorisation

The NZHGPA OPM outlines processes for the authorisation of launch sites.

3.3 Flying Near Aerodromes

A controlled aerodrome is surrounded by controlled airspace. Controlled airspace limits how close we are permitted to fly, except where a clearance is obtained from the local controlling authority.

There is no minimum distance that hang gliders or paragliders must fly from an uncontrolled aerodrome. However, you must remain clear of the circuit traffic or comply with standard circuit procedures. Complying with circuit procedures is generally difficult on a hang glider or paraglider, therefore if possible contact must be made with the aerodrome operator.

To understand your ability to comply with the circuit procedures, you will first have to study the aerodrome traffic information in the AIP – if you don't know local traffic rules, or how to do this, stay well clear!

Perhaps, one of the more understated risks associate with aerodromes, whether controlled or uncontrolled, is skydiving.

Airband radio is to be used whenever operating from or within the vicinity of an aerodrome. Use of an airband radio includes maintaining a listening watch, and broadcasting activities at regular intervals. Refer to Section 4.6.2 for further discussion on airband radio use.

Notifying aerodrome (and nearby) operators of towing activity is encouraged. This can often be done collectively through airport user groups and increases the level of awareness if GA pilots fail to check for current NOTAMs (refer Section 3.4).

3.4 NOTAMs

A NOTAM is a written notification available to pilots before a flight, advising them of circumstances relating to the state of flying. They are a way to promulgate urgent information about potential hazards to flight which may have missed the publishing deadline for inclusion as an AIP supplement. Towing will usually fall into this category of hazard.

NOTAMs, along with weather information, can be obtained via the IFIS Mobile app. You can also obtain NOTAMS, or request a NOTAM be issued, by logging in to www.ifis.airways.co.nz.

It is recommended that a NOTAM be issued whenever towing above 500 ft AGL or when operating from an aerodrome. The NOTAM must include the maximum altitude of tow operations.

The only exception to the NOTAM recommendation (above) is when a towing operation is incorporated into the Visual Navigation Chart (VNC).

3.5 The Public

Everyone involved with towing needs to be mindful of the potential to endanger and upset the public. The consequence of dangerous or upsetting behaviour is not isolated to the pilot but worn by the entire community.

Tow operation must mitigate all danger to the public. Pilots and operators should conduct a risk assessment for each site that includes possible risk to the public. Consideration must be made for how risk to the public can be avoided.

A pilot shall not drop any object unless the pilot has taken reasonable precautions to ensure dropping the object does not endanger persons or property. The risk of dropping a tow line must be considered when selecting a tow location and making a flight plan.

4. Equipment

4.1 General Description

Tow systems consist of the paraglider (and harness) attached to a tow line via a bridle, release mechanism and weak link. The tow line exerts a towing force on to the glider allowing height to be gained. The tow line can be either pulled in by a stationary winch (pay-in winch) or gradually released by a moving winch (pay-out winch). Most systems use a drogue chute attached to the end of the tow line that deploys or inflates after the pilot has separated from the tow line.

This section is intended as a baseline guide to suitable equipment. It is not exhaustive or exclusive.

4.2 Paragliders

Paragliders must be checked to establish if the manufacturer endorses the use of the paraglider for towing. A paraglider must have a current warrant of fitness (WOF). Paragliders that exhibit tendencies to hang back or over fly may prove unsuitable for towing. This can be due to the glider's age, trim or design.

Check Paragliders used for towing regularly for increased wear resulting from higher wing loading (i.e. porosity, structural integrity, and line length/strength).

If a glider is fitted with trimmers, they must be checked before each tow that their setting is suitable for the tow launch. It is possible to over trim a glider to a slower speed than neutral on some models.

4.3 Harnesses

The suitability of a harness for towing depends mainly on the ease with which the towing bridle can be attached.

Some harnesses have dedicated tow bridal attachment points. It is important not to mistake a stirrup attachment point or another part of the harness for a tow bridal attachment point. Refer to the harness’s manual for clarity.

Check Harnesses used for towing for increased wear. A tow bridal can result in higher loads being placed on some parts of a harness.

4.4 Reserve Parachutes

It is important that the tow bridle does not interfere with a pilot’s reserve parachute. The tow bridal must be positioned safely away from the pilot’s reserve handle once they have released from the tow line. This minimises the risk of interference.

It is important to ensure that a lifejacket will not impede the pilot’s ability to deploy their reserve parachute. Front mounted reserves are more likely to be a problem, consider this when selecting equipment for tow operations.

4.5 Hook Knives

Pilots being towed must be equipped with an easily accessible hook knife.

4.6 Radios and Communication Equipment

4.6.1 Communication

Communication between the pilot and tow crew is extremely important. Satisfactory communication often occurs using radios, but there are times where radio use is difficult or unnecessary. Flights over water risk damage to expensive radio equipment.

Radios, cell phones, arm and leg signals, voice, and tow vehicle (or boat) positioning all contribute to ensuring reliable methods of communication.

The style and level of communication is likely to be linked to the experience of the pilot and tow crew, the physical environment, and the intended altitude of the tow.

Both the pilot and tow crew are to be briefed on communication methods. This includes preferred signals and/or terminology. Communication procedures are discussed in Section 5.3.

4.6.2 Airband Radio

An Airband radio is to be used whenever operating from or within the vicinity of an aerodrome. or a Mandatory Broadcast Zone (MBZ). Whilst not compulsory, it is good airmanship to use an Airband Radio in a Common Frequency Zone (CFZ). Remember when towing and especially above 500 ft pilots of other aircraft will not expect to look out for a tow line that is difficult to see. Use of an Airband radio includes maintaining a listening watch and broadcasting flight details at regular intervals. It is standard practice to broadcast prior to each launch on the appropriate area or aerodrome frequency.

NOTE: The person responsible for the Airband radio communications needs to be appropriately licensed.

4.7 Tow Bridal

A tow bridal forms a “V” with the pilot’s two carabiners and attaches the pilot to the tow line.

Tow bridals must be thoroughly tested to ensure compatibility and reliability. They are a critical component of the tow system and compromises must be avoided where possible. Some tow bridals are certified. Use of such bridals can provide a degree of confidence that they are fit-for-purpose, provided they are used correctly.

Check tow bridals regularly for wear or damage which could influence their integrity or performance.

The bridle is usually made of non-elastic webbing with minimal hard components. To avoid heavy components recoiling and hitting the pilot in the event of a line or weak link break.

A bridle used over water can be the same as that used over land. However check to verify that it releases reliably when wet.

It is important that once released from the tow that the tow bridle is positioned safely away from the pilot’s reserve handle and is unlikely to interfere with reserve deployment.

4.8 Weak Link

A weak link must be used for towing. The purpose of a weak link is to provide a maximum limit to the possible tow line tension that can be exerted on the glider. The weak link is usually placed between the bridal and tow line. Weak links must be made from material that consistently breaks at a predictable load. They must be infallible.

The strength of a weak link needs to be known. A professional tow operator is likely to have weak links suitable for pilots of different weights.

A weak link can be weakened by repeated use. Regular inspection and/or replacement is recommended to reduce the likelihood of an accidental break.

There are varied opinions on the use and recommended strength of weak links. A weak link with a strength that is less than the pilot's take-off weight is not recommended.

Weak link strength needs to be carefully considered by both the pilot and tow operator and be suitable for the type of towing being done. A weak link must be installed between the point of attachment of the towline to the glider with a breaking strength of:

A) Not less than 100 percent of the AUW of the pilot and his equipment
B) Must be the weakest link in the tow system e.g., not stronger than the tow line or equipment being used.

No matter what you use it must be tested to break consistently at a predictable load, its strength needs to be appropriate for the pilot, glider and the tow system being used.

NOTE: An accidental weak link break in the early stages of a tow can be dangerous.

4.9 Drogue Chute

A drogue chute is intended to control how the tow line falls once the pilot has released. It is usually brightly coloured to be obvious to other air traffic.

Some drogues use a small ram air wing to slow the fall of the line, where others behave like simple parachutes. There are advantages and disadvantages with each. The effectiveness of the drogue can be linked to the winch, speed of rewind, wind, and weight of the line.

Some drogues use a deployment bag. Extra caution must be exercised to ensure it does not impede the pilot releasing safely from the tow line.

The presence of a drogue chute can assist in keeping a pilot focused on the tow line's direction of pull.

4.10 Tow Line

Tow lines are usually made from polyester, nylon, Dyneema or spectra. The following considerations must be made when choosing a tow line: strength, stretch, weight, U.V. and abrasion resistance as well as floating or non-floating.

NOTE: Wire lines must not be used as a main tow line.

Nylon line has a lot of stretch and can lead to tugging and rough feeling for the pilot under tow.

The line can be marked in a way to inform the tow operator that they are at the end of the tow line. For example, the last 200m of line could be a different colour.

A towline must only be tied off to a pay-out winch is via a weak link, otherwise it must not be attached.

Any join in a tow line must be done by splicing rather than knotting the line. Knots can create an increased risk of the tow line getting caught as it is released or rewound. They also weaken the line.

4.11 Guillotine

All towing operations are required to have an infallible method of cutting the tow line where the line leaves the winch. This means a mechanical guillotine forming part of the winch.

The system used must be immediately accessible to the winch operator and within arm's reach. The winch operator must be able to cut the line without the need to stop the boat or vehicle as this delay can prove too significant.

The system must work reliably irrespective of whether the line is under tension.

4.12 Winch

Pay-out winches are usually mounted on a vehicle or boat. The pilot begins close to the winch during launch. The line is payed-out as the vehicle or boat moves forward and the paraglider climbs.

Having the pilot close to the winch is beneficial as the winch operator can observe the pilot during launch. The winch operator remains close so can help in the event of an aborted launch.

Pay-in winches are used where the winch itself is stationary. The line is pulled in as the paraglider climbs. The pilot and winch operator may be a long way apart (1,000m or more) at the crucial take off phase. However, with good communications and a suitable site, pay-in winches are perfectly serviceable.

NOTE: The towing of paragliders using a towline of fixed length is not permitted.

The regulation of the tow force occurs by varying the speed of the vehicle or boat. The control of the tow force is not sufficiently precise. This restriction is not intended to limit hand towing, where a short rope is pulled by hand, to achieve ground skimming flight.

It is important that a winch has a high-speed rewind. The presence of other aircraft is not uncommon (i.e. planes, helicopters or other paragliders or hang gliders) and they may not be aware of the tow line. The tow must be terminated and the line rewound if another aircraft gets too close. In some cases, the rewind speed needs to be high to ensure the line is retrieved before it touches down.

All winches must have a reliable tensiometer to accurately determine line tension.

Never rely solely on a tensiometer. Tension must also be judged by the glider's reactions and the tow angle whilst referencing the tensiometer.

4.13 Streamers or Windsocks

Streamers or windsocks must be placed appropriately to provide the pilot and tow crew with a clear understanding of the wind strength and direction. This is most important during the launch phase to minimise the impact of cross wind.

4.14 Life Jackets

Life jackets must be used in all over-water tow operations. Due to the the risk that once in the water, harness back protection can float a pilot in a head down position.

Maritime Nz sets the NZ standards for lifejackets, lifejackets must meet these standards.

There are advantages and disadvantages to both inflatable and traditional life jackets.

Experienced SIV instructors must be familiar with life jacket suitability.

Considerations to be made when selecting a lifejacket:

- Compatibility with the pilot's helmet making sure it does not impede their breathing.
- Will it keep the head of an unconscious pilot above water?
- Ease of running for launch, seeing clearly, and accessing the tow bridal.
- It must not impede a pilot's ability to release from the tow line.
- A life jacket must not impede a pilot's ability to deploy their reserve parachute. This is especially relevant in the case of front mounted reserves.

5. Towing Procedures, Principals and Requirements

5.1 Principles for Safe Towing

Constant Direction	Direction of the tow force must remain constant relative to the glider throughout every phase of the towed flight (i.e. staying on-line).
Constant Tension	The tension of the tow line must remain essentially constant once the pilot is clear of the launch phase, on-line and towing comfortably. Any change in tension will ideally be gradual and intended to facilitate a safe, smooth, and efficient tow. Changes in tension can be linked to the tow phase, such as launch, the end of the tow, during directional changes or when step towing (refer Section 5.5.5).
Reliable Tensiometer	Winch must have a reliable sensor to accurately determine line tension.
Centre-Mass Attachment	The towing forces applied through the tow line and bridle must be attached as closely as possible to the effective centre of mass of the system i.e. harness to PG risers.
Gradual Transitions	The graduation to, and from the tow, as well as any variations while on tow, must be of a gradual nature.
Reliable Releases	The tow bridal (releases) must be sturdy, rapid, and reliable.
Weak Link	The system must include a weak link, which will infallibly and automatically release the paraglider from tow, whenever the tow line tension exceeds safe operating limits.
Safe Learning Method	The system must include a safe method for learning and gradually advance the student from one level of experience to the next.
Adequate Power	The system must have a source of power adequate to maintain a safe mode of flight whilst under tow.
Capable Crew	The system must be operated by a crew which is adequate in number and competent in ability to see that the system functions properly.
Reliable Communication	The system must provide a means of reliable communication between the winch operator and pilot, using signals and or radios.
Suitable Environment	The system must be operated only within an appropriate environment and under conditions conducive to safe operations.

5.2 Minimum Pre-flight Checklist

Tow launching is a team activity. All crew members must be familiar with their own and other crew members responsibilities, as defined by the tow supervisor.

- Flight plan briefing.
- Safety equipment.
- Paraglider layout good and lines cleared.
- Crew briefing (tension, flight plan).

- Weak link check.
- Release mechanism correctly assembled.
- Tow bridle symmetrically connected to risers.
- Tow line drogue chute attached.
- Radio check.
- Boat/vehicle positioned for take-off.
- Check water way/field for traffic.
- Airband radio call.
- Wind speed and direction acceptable to pilot.
- Pilot signals to tow vehicle “commence tow”.

5.3 Communication Procedures

The pilot, winch operator, and all assistants need be familiar with the radio communication and/or signals to be used.

5.3.1 Radio Procedures

Common communications used are:

- Go, Go, Go, or All Out, All Out, All Out.
- Stop, Stop, Stop.
- Weak link break.
- Release failure.
- End of tow.

Accuracy, brevity, and speed. Speak clearly. Do not ever use the word “NO”. It can easily be misconstrued as ‘Go’.

Be careful to avoid transmitting over the top of a tow in progress. Do not chat unnecessarily on the radio. A blocked frequency could mean that towing operations need to cease.

Ensure a different frequency is used (to avoid confusion) if you are about to start a tow and a near-by team is also towing.

Radio output power can affect communications during a tow. The most powerful radios should be used by senior members of the tow crew, operating in the most critical roles. This increases the likelihood of critical messages being able to be transmitted over other (less important) radio transmissions.

5.3.2 Visual Signals

Visual signals depend greatly on the tow system used (i.e. pay-in/pay-out). Each operation must establish signals that all concerned are familiar with.

Visual signals are not defined in this manual, Due to different signals being required for different operations also differing signals used internationally from country to country.

This means it is especially important for all tow operations to ensure signals are well understood by all involved. Any signals must be incorporated into pilot and tow crew

briefings, signals must be kept clear and simple. Visual signals are to be briefed in case of radio failure.

5.4 Wind Conditions

Pilots must only consider tow launching in conditions they are comfortable with and proficient at ground handling in. This applies to both light wind and strong wind conditions.

The most crucial phase of towing is the first 100 ft Above Take Off (ATO). Always launch into wind, as much as possible, to minimise lockout risk. Wind direction becomes less critical once 100 ft ATO has been achieved. The stronger the wind, the more into wind the take-off can be. Guidelines to be followed are:

- 45 degrees off wind, wind strength up to 8 km/h (4 knots).
- 30 degrees off wind, wind strength up to 15 km/h (8 knots).
- 15 degrees off wind, wind strength above to 15 km/h (8 knots).

5.5 Pay-out Winching

5.5.1 General

A streamer can be installed above the highest point of the vehicle boat to indicate the relative wind direction.

The winch must be securely fitted. Manufacturer's recommendations must be followed, where applicable.

5.5.2 Boat Towing

The boat must be capable of pulling up a paraglider. It must be fast, stable and with good directional control. The speed required to launch a paraglider (15-20 knots in no wind) must be achievable by the tow boat. Higher speeds are likely to be needed when “step-towing”.

Boat speed is important if the boat crew is expected to assist in the event of a water landing. A capable crew is useless if the boat is not where it is needed.

NOTE: Maritime rules state you must have a minimum of two crew for towing activities – Driver and Observer

In addition to the full complement of maritime safety equipment, the boat must be equipped with:

- Boat to shore communication.
- First aid kit.
- Spare dry jacket, blanket and or clothing.
- Drinking water.
- Hook knife.
- Throw rope.

The boat must be easy for the crew to communicate and operate in.

The boat must be equipped and prepared to assist in removing people from the water. This is made easier by the presence of a water line platform or an overhanging hoist. A horn can be useful in gaining necessary attention.

Consider the risks associated with a pilot unintentionally landing in the water. If a problem with the boat is the cause of the water landing, the ability to rescue the pilot could be compromised.

Lifejackets must be used in all over water tow operations. The benefits associated with a separate and dedicated rescue boat should be carefully considered.

A hook knife can be used in the event of an entanglement following a water landing.

5.5.3 Vehicle Towing

A land-based vehicle must be capable of driving at speeds required to launch a paraglider at least 30kph across the surface being used for towing.

Safety equipment that must be in the tow vehicle:

- Hook knife
- First aid kit
- Operator to observer communication

The tow crew must be able to communicate with each other. They must have secure seating such that they cannot be thrown from their controls.

5.5.4 Leader Length

The length of line payed out prior to beginning a tow is an important consideration. The greater the distance between a pilot and the winch, the slower the glider will deviate off-line if the pilot manages their heading poorly. Decide on an appropriate length depending on cross wind and pilot experience.

5.5.5 Step Towing

Step towing is where both the pilot and tow vehicle (or boat) stop towing, turn around, and then resume the tow is a different (often opposite) direction. There are many important considerations:

- Good communication is vital. End of tow must not be confused with a step. There is no room for confusion and a step must not be carried out if it was not included in the flight plan.
- Tension must be removed from the line throughout the turn. Tension must only resume once the pilot is on-line in the new direction.
- The winch tensiometer will not show a correct tension until the line between the winch and pilot is taught and the winch has resumed paying out.
- Avoid step towing in strong wind conditions. It can be possible that the vehicle or boat is unable to achieve sufficient speed to remain ahead of the paraglider.
- Slack in the low line must be carefully managed. Slack should not accumulate on the ground or in the water.
- The winch must be capable of paying out line in all directions without a risk of entanglement if the paraglider were to overfly the vehicle or boat.

- When a tow line is not pulling in the forward direction, and hangs to the side of the pilot, the tow line is at risk of interfering with the pilot's reserve. The pilot must consciously consider the location of their reserve, and how the tow line hangs throughout any step.
- Some tow bridals are designed to release automatically under cross loads. Use of these bridals can mitigate some risks associated with step towing, but their use can also come with disadvantages. A responsible and experienced tow operator will have considered the likely advantages and disadvantages when selecting or recommending a tow bridal.

5.5.6 Rewind

It is essential to have a smooth rewind and slack must not be allowed at any time. Slack can cause knots, line jams (and weak link failures) and or a rough tow experience.

5.6 Pay-in Winching

5.6.1 Use of Pulleys

A pulley can be used when pay-in towing. The use of a pulley allows the tow operator to be placed in closer proximity to the pilot. This enables closer observation during the critical launching phase.

The pulley needs to be adequately secured to the ground to withstand force in a variety of directions in case the pilot deviates off-line. The pulley must function reliably and minimise friction.

Give caution to tensiometer readings given the friction associated with the pulley and the line running over the ground. Increasing the distance between the winch and the pulley will increase the friction present.

It is possible for the paraglider to lock out by flying beyond the pulley. Procedures should be in place to minimise this risk, which the pilot and winch operator need to be aware of.

NOTE: The complexities associated with pulleys must not be combined with step towing.

5.6.2 Strong Wind Launching

Caution must always be exercised when launching in strong wind conditions.

Greater caution must be exercised whenever a pilot is attached to a tow line where the line will not be released at minimal tension.

It is important a pilot can move towards their paraglider when inflating in strong wind conditions.

The danger of being dragged is exacerbated when attached to a line which could be under tension.

5.7 Information for Pilots

5.7.1 Launching

Having completed all pre-flight checks, the instruction to commence towing should be given.

It is common for a pilot to resist the tension before inflating the glider when forward launching, especially in no wind. A skilled winch operator will be able to provide guidance on how much to resist. This will be linked to the specific winch and the wind conditions. This can be more of a factor during boat towing operations. Resisting tension too much can result in the pilot being pulled off their feet before the glider has fully inflated, Insufficient resistance can lead to a long take off run if tension is slow to increase.

As the tension and speed increase, the pilot commits to take-off, keeping the glider centred overhead. The pilot is accelerated by the tow line tension and leaves the ground. The pilot needs to maintain an awareness of the glider's position, actively keeping it on-line.

Be cautious not to apply too much brake after take-off, however, use what brake is needed to keep the glider on-line. More brake than usual may be needed to bring the glider back on-line.

5.7.2 During Tow

To control direction, use weight shift to minimise brake input. Be prepared that applying weight shift whilst on tow can feel awkward. Ensure that any attempt to weight shift has the desired result, and your glider is not deviating off-line. Ensure that any difficulty in weight shifting does not provide a distraction from steering the glider using the brakes.

It helps for the pilot to remain relaxed during the tow, sitting centralised in their harness and avoiding unnecessary weight shift. Try to avoid the position of having your head forward between the risers. This is a common result of nervousness.

Some wings respond well to delicate rear riser pressure as an alternative to brake input. However, avoid the use of rear risers through the launch and in the early stages of a tow. Seek guidance from advanced pilots with experience on your model of wing before experimenting with rear riser input.

Staying on-line means the paraglider is flying in the direction the nearest 20 meters of tow line is pulling. This is not necessarily directly towards the tow vehicle. In a laid-back relaxed position, continually checking that the wing is at right angles to the nearest 20 meters of tow line. It can be hard to feel if your online as the pilot.

5.7.3 Release

Generally, the pilot will release after tension has been reduced. There are, however, several other scenarios requiring the pilot to release (see Sections 6 and 7).

The pilot must anticipate their glider pitching forward whenever releasing under tension.

NOTE: The pilot must always check the line has separated from the bridal and it has not snagged on the bridal, pilot, or harness. An inflated drogue chute usually confirms this.

5.8 Information for Tow Crews

5.8.1 Launch

Increases in tension must be made smoothly.

The tension used must be based on the pilot's all up flight weight (AUW) and you should never tow with a loading more than their all-up flight weight (whether tandem or solo).

The strength of the weak link must be considered when determining the intended tow tension.

It is desirable for a tow to start with the winch at a low tension, however there needs to be sufficient tension to stop the winch spooling (3-4kg). The tow vehicle should begin moving before tension is increased to launch, typically increasing tension to approximately 50% of the pilot's flight weight. This is a critical time in the tow and if the pilot is going off-line with the tow or appears to have any problems tension must be reduced.

NOTE: The tow crew must be familiar with non-standard Scenarios (Section 6) and emergencies (Section 7), and the appropriate courses of action.

5.8.2 During Tow

Following a successful launch, the tow crew must monitor the wing's reaction to tension, pilot input, for possible deviation off-line, and for lock out risk (see Sections 6.7 and 0).

Once above 100ft AGL and the pilot is on-line and looking comfortable, the tow tension can be gradually increased. The tension can be increased above 50% of the pilot's flight weight, providing the following consideration are made:

- Pilot experience and currency.
- Being on-line.
- The paraglider's reaction to tow force.
- Weak link strength.
- Turbulence.
- Accuracy of the tensiometer.
- Winch operator's experience with the winch being used.

5.8.3 End of Tow

The tow crew reduce the tension. Communicating "end of tow" over the radio can be helpful. However other signals can be enough such as:

- The pilot feels the tension reduce he/she operates the release. The line falls away and the drogue chute is deployed or inflates.
- The tow vehicle or boat can slow and turn 90 degrees to the tow. This visually signals the end of tow to the pilot.

6. Non-Standard Scenarios

This section is intended to show that 'situations', if managed correctly, need not become emergencies.

6.1 Weak Link, Release Mechanism or Tow line Failure

The period between a pilot leaving the ground and reaching 100 ft AGL is arguably the most critical phase of towed flight. Any tow line or tension failure will cause the paraglider to surge forward. The pilot will then pendulum through, possibly hitting the ground. Pitch control is essential in managing this risk.

Gentle increases in tension are especially important. Applying maximum tension only once the pilot is at least 100 ft AGL.

6.2 Paraglider Does Not Inflate Correctly or Risk of Lock Out

It is essential for the tow crew to pay close attention to the pilot's launch.

Tow line tension will usually be dumped, and the launch aborted, following concern over how the glider inflates. The pilot must treat this as per any normal aborted take-off.

A knot in a pilot's lines presents a significant risk and often (but not always) leads to an uneven inflation. Correction of an uneven inflation does not necessarily mean the underlying cause has been resolved.

Any pilot can shout STOP STOP STOP if they identify a problem. Once the pilot's feet leave the ground the problem is compounded.

A smooth reduction in tension is preferable to dumping tension in some situations, where the concerning aspect is likely to be recoverable. This is often the case where the pilot is already airborne, and the issue is recognised early.

A reduced tension usually allows relatively normal control to be regained. It will become easier for the pilot to bring their wing on-line once the tension has been reduced. Only increase tension when their wing is back on-line.

Be very mindful of deterioration in the pilot's heading, and the need to dump tension prior to lock out (refer Section 0).

6.3 Glider Drops Back or Stalls on Launch

Tension must be dumped in the event the paraglider stalls or starts to drop back on inflation or during the take-off run. Dragging a pilot and/or wing along the ground can easily damage equipment and or injure the pilot.

A gradual reduction in tension would suffice if the glider's behaviour is recognised early, however, it is vital the wing is not forced into the air with tension unless it is flying satisfactorily.

The vehicle or boat should stop in the event tension is dumped. Spooling of the winch can result in a line jam. If this occurs and the vehicle continues to move the pilot could be dragged.

6.4 Strong Wind Forward Launches

Stronger winds of 8-13 knots (15 -25 km per hour), or more, must be approached with caution. More skill is required to establish a paraglider correctly and to keep it on-line if it is inflated cross wind. Alternatively, a reverse launch can be used.

6.5 Reverse Launches

If the wind strength is sufficient to allow a reverse launch. The pilot inflates the paraglider as per a normal. Tension will usually be kept to a minimum throughout the turn. Tension is increased once the pilot is facing forward, if the glider is well established, and is on-line. The tow continues as normal.

Pilots must be proficient at reverse launches.

Always check the tow line is on the correct side of the pilot to work with their turn direction.

6.6 Cross Wind Launches

Cross Wind Launches are to be approached with caution and not recommended in strong winds. The main problem with cross wind launches is the paraglider's natural tendency to inflate asymmetrically. The risk of lock out is significantly increased when towing in strong cross winds.

The tow tension pulling the pilot forward at launch has greater effect than the wind direction on in light wind conditions. This is equivalent to running hard when hill launching. Light cross winds are therefore less problematic than strong cross winds, you must still minimise where possible.

The likelihood of the pilot inflating and launching off-line increases as the cross wind becomes more significant in strength or direction. The pilot must correct their direction to avoid a lock out.

An experienced tow pilot or winch operator will be able to provide guidance on what to expect when launching in cross wind conditions.

6.7 Off-Line Towing

Being off-line is inefficient with reduced height gain. It is usually apparent to the winch operator that the pilot is not fully on-line, but this becomes increasingly difficult to determine when the pilot is at high altitude or a long way away.

Being off-line is the first stage in the development of increased lock out risk (refer Section 0).

It need go no further than being off-line, however, the winch operator must reduce the tension on the pilot if the pilot fails to make corrective action. If able the tow crew will signal to the pilot which way to turn.

By reducing tension, it makes it easier for the pilot to come on-line. Normal tension and or vehicle boat speed can resume once the pilot is back on-line.

6.8 Wind

Be observant of changes in wind strength and direction as a pilot gains altitude. The low-level winds can be different to the upper level wind, particularly in coastal areas (sea breezes) or near lakes. If near an aerodrome it may be possible to get up to date upper wind information from the local Aerodrome Terminal Information Service (ATIS) using your Airband Radio.

A change in wind can lead to difficulties remaining perfectly online and inefficient tows. The vehicle / boat would need to increase or decrease its speed when pay-out towing. There would be an observed change in the rewind rate when pay-in towing.

7. Emergencies

This section describes towing situations that require immediate attention. The list is not exhaustive or exclusive.

7.1 Weak Link, Release Mechanism or Tow Line Failure

7.1.1 Low Level

A weak link break, the release mechanism releasing unintentionally, or tow line break will result in the paraglider pitching forward. The timely application of brake will minimise or eliminate the glider's attempt to pitch forward.

Brake applications to manage forward pitch will need to be significant, however overreaction can be equally dangerous.

The lower the altitude, the more critical the pilot's inputs. It will be necessary to 'flare' aggressively. The pilot must be alert and ready to PLF or resume running.

7.1.2 High Level

The consequence reduces with altitude; however, the pilot must still expect a surge.

Pilots must be aware of the dangers of landing with a broken tow line hanging below them. The dangers of snagging the trailing line are significant. Always release a suspended line where and when possible, to do so safely.

There are some instances where releasing a snapped line could endanger the tow crew or bystanders.

Depending on how much line is suspended, it can be possible to pull up the hanging line. If doing so never wrap the line around your hand or body in case it was to snag on the ground, you need a way to release the line again.

The line could be released but held on to until a suitable location is reached for dropping the line. A pilot must never wrap the line around their hand.

Pilots must be familiar with their release mechanism. Some releases do not work effectively when the line is not under tension. Some require the use of both hands to be effective.

There is usually no reason for the pilot to activate their tow bridal release following a weak link break. Some tow operators use a metal ring between the weak link and the tow bridal. Activating the bridal release mechanism could result in the metal ring being dropped. This can be a hazard to people or property below.

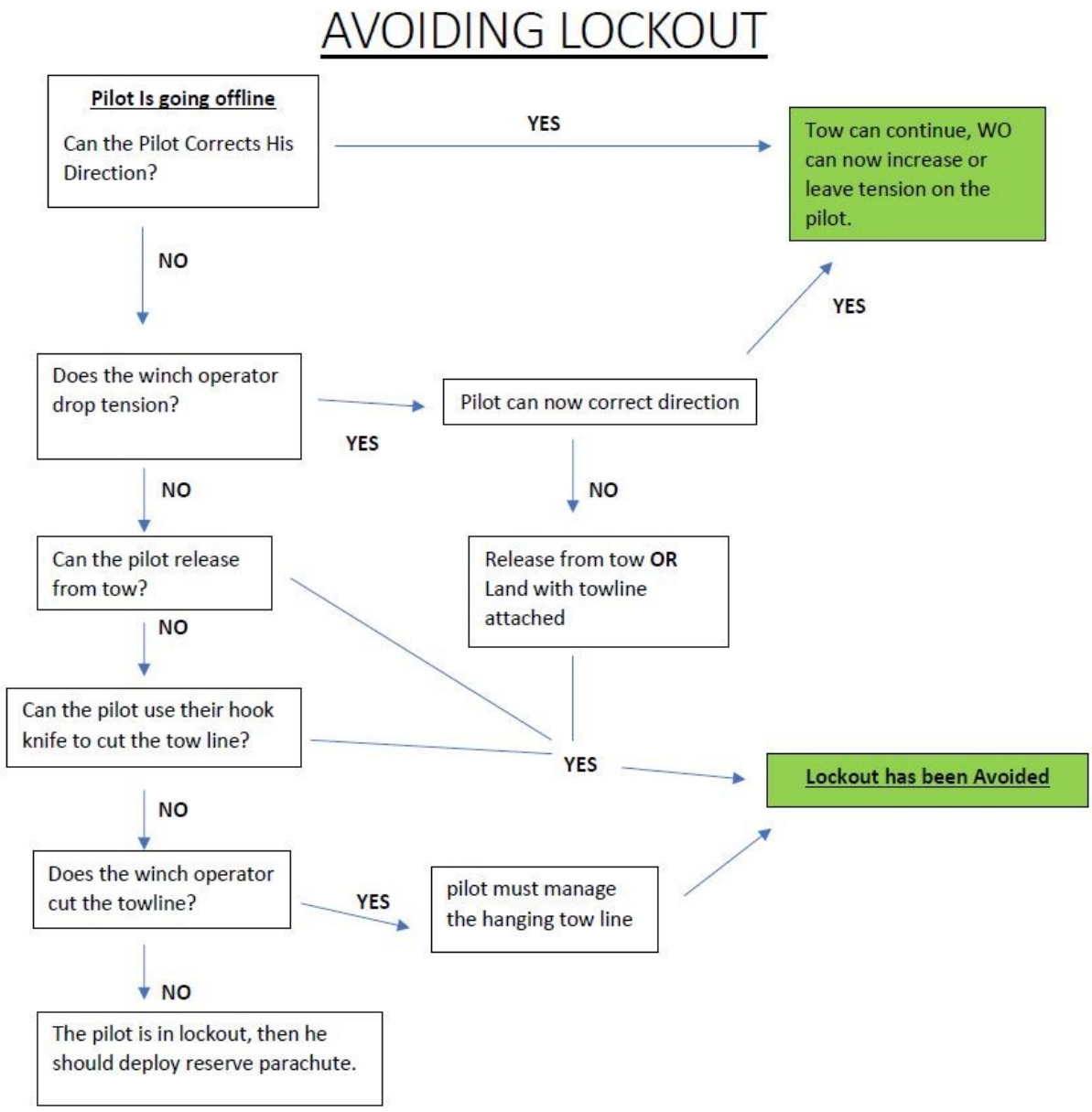
7.2 Lockout

A pilot is in a lockout if they find themselves with their wing in a diving turn, diverging away from the direction of the tow line by greater than 45 degrees. Their brakes are likely to be (or become) ineffective in controlling their direction.

The pilot must control their direction to keep the glider on-line to avoid a lockout developing. A **weak link will not protect a pilot from lockout**.

The tow operator **must dump tension**. If this fails to achieve the desired result, or where there is insufficient time to wait, the **guillotine** must be used. The pilot must be ready to regain control of their glider!

The pilot **must release**. A tow bridle release must work reliably, but the pilot must be prepared to use their **hook knife** in case of a failure. Pilots must be aware that they may not have sufficient altitude for a successful reserve deployment, but it remains available as last resort. A pilot **must not hesitate** to deploy their **reserve parachute** if needed.



A lockout could easily be caused by not correcting a cross wind induced turn just after take-off, coupled with too much tension, too early, compounded by lack of awareness by the winch operator. The speed at which a lock out develops is partially linked to the length of line between the pilot and the winch. Be careful to have adequate separation when launching using a pay-out winch.

A pilot can find themselves in the situation of landing with (part of) a tow line hanging from them following the tow line breaking or being cut. The hanging line could result in sufficient tension to cause a lockout. This is most likely if the line were to snag on something on the ground, or if is dragged over the ground or through water. This risk increases when longer lengths of line hanging.

7.3 Paraglider Collapses

The extra wing loading produced by towing means that a paraglider is less likely to collapse. It can still happen, including on take-off. Corrective action must be applied immediately by the pilot (i.e. course and correction) and the winch operator must be prepared to dump tension. Due to a higher loading the glider could react more aggressively in a collapse.

Factors contributing to collapses can include but are not limited to:

- Excessive thermal or wind shear conditions.
- Poor pitch control following inflation.
- Sudden and significant changes in tow line tension.
- A poorly maintained paraglider.
- A paraglider not suitable for towing.

7.4 Paraglider Stalls

Tow line tension, combined with a low tow angle, is likely to be a contributing factor to a stall on tow. The risk of stalling is increased by low porosity, poorly trimmed gliders, and rapid increases in tow tension.

Excessive use of brake will contribute to an increased risk of stalling. Remaining on-line is usually a pilot's highest priority, but in achieving this, a pilot must remember that flying their glider fast reduces the stall risk.

The early signs of a glider entering a parachutal stall can be easily missed. Unexpectedly poor climb rates or long take off runs could suggest a stalled wing, prior to it becoming more obvious.

In the event of a stall, the winch operator needs to consider glider's behaviour and its likely reaction in determining how to reduce tension.

Dumping tension will likely lead to the glider recovering, however, the glider's surge is likely to be significant. The surge is enhanced by the backwards momentum of the pilot following the drop in tension. Dumping tension is increasingly likely to become the preferred option as the pilot climbs above 100 ft AGL. The situation can develop in a manner where the pilot must deploy their reserve parachute.

The risk associated with a glider's surge is significantly greater at low altitude. Caution needs to be exercised when dumping tension at low altitude. The winch operator should reduce tension progressively when the pilot is at low altitude. Sufficient tension must be maintained to minimise the likelihood of a significant surge.

In any case, a pilot must remain alert and acknowledge the unpredictable nature of stalling on tow. They must be prepared for a hard landing and to carry out a PLF. The pilot must be prepared to manage the glider's surge whilst allowing it to develop airspeed. An experienced SIV instructor will be able to provide guidance on piloting options, decisions and actions when recovering from stalls.

7.5 Serious Structural Failure of Paraglider

In the event of serious structural failure (of the paraglider) whilst under tow, the pilot is most likely to need to deploy their reserve parachute. The winch operator must dump tension. The pilot (and passenger) should remain alert and be prepared for a hard landing.

7.6 Mechanical Failure of Vehicle or Boat

If the tow vehicle stops moving the rewind procedure must be followed. The pilot will have to release and, in some circumstances, need to land at an alternative site. If is likely to be helpful to communicate "end of tow" via radio to the pilot to expedite their release.

7.7 Mechanical Failure of Winch

A winch must be well constructed and maintained to reduce the risk of mechanical failure. Although uncommon, it is a reason a form of weak link must always be used.

All towing operations are required to have an infallible method of cutting the tow line where the line leaves the winch.

NOTE: The winch operator must also have a hook knife as a back up to the guillotine.

This backup system ensures that the pilot can be separated from the winch in the event of a problem. The potential to need immediate separation of the pilot must not be underestimated (refer Section 4.11).

7.8 Water Landing and Recovery

It is inevitable that a water based towing operation will experience a water landing at some time. A water landing is considered an emergency. An experienced operator will have rehearsed and practised this as a safe alternative for landing. Life jackets must be worn by all pilots (and passengers) when towing over water. Life jackets are discussed in Section 4.14.

7.9 Risk of Mid-air Collision on Tow

All members of the crew, and the pilot, must be aware of other potential airspace users.

Sections 3.3, 3.4 and 4.6.2 must be reviewed with respect to Airband radio use and NOTAMs.

If another aircraft fails to provide comfortable separation, then the tow must be terminated before any possible conflict can occur. The avoidance of a collision must never be solely dependent on the other aircraft taking appropriate action.

7.10 Reserve Parachute Deployment

The value of a reserve parachute can easily be overlooked in a towing environment. Successful deployment of a reserve parachute is a viable course of action in avoiding many dangerous situations. Deployment of a reserve must be considered in the event of a lock out.

8. Programme for Novice Tow Pilots and Novice Crew

This section provides criteria for operators to establish adequate training systems. The suggested programme consists of four phases:

- Ground School (towing theory).
- Equipment familiarisation and skill demonstration.
- Practical training for pilot and operator.
- Theory examination.

NOTE: For training/towing any pilot without a tow pilot rating an observer with communication to the winch operator must be used at the launch. The only exception is if using a system such as a pay-in reflex system where the operator is proximate to the pilot launching.

8.1 Ground School

8.1.1 System Differences

- Fixed length line towing, pay-in winches, pay-out winches.
- Tow vehicles and boats.

8.1.2 Tow Rigging Components and Configuration

- Tow line, leader lengths, advantages, and disadvantages.
- Release mechanism differences, safety advantages of soft releases.
- Connection of tow bridle to risers or harness.
- Weak links; desired strength, material variability, weakening from knotting and tying.
- Recovery drogue chutes, differences.
- Line splicing.

8.1.3 Glider Effect Of

- G loading: definition and increase from towing and banking.
- Risk of paraglider line stretch from towing tension.
- Air speed increase due to tow line thrust and loading.
- Thrust as low tow angles.
- Wind direction and strength, including cross wind.
- Control effects due to thrust, loading and airspeed.
- Lockout; description, cause, prevention, recognition, and recovery.
- Flight attitude; glider lags pilot at high angle of attitude.
- Paraglider surging following tow line separation due to glider attitude and sudden loss of thrust.
- Low altitude separation and risk of penduluming into the ground either backward or forward.

- Two stage increase in towing tension (i.e. above or below 100ft ATO).

8.1.4 Pilot Responsibilities

- Adjustments for difference between hill and tow launching.
- Directing launch, depending on system (except during instruction).
- Inflation and steering during lift off.
- Steering for heading relative to tow line (i.e. staying on-line).
- Minimising use of brakes.
- Release criteria: vehicle stops or confusion or discomfort or lock out.
- Tow line separation, timing, and glider surging.
- Lock out prevention, recognition, and recovery.
- Use of pre-launch checklists.
- Ensuring pilot to operator communication and signals.
- Pre-flight checks, including a check of tow bridal connection, weak link and paraglider layout.

8.1.5 Tow Operator Responsibilities

- Use of pre-launch checklists.
- Pre-launch check of tow system, tow rigging and connections.
- Ensuring operator to pilot communications and signals.
- Tow line: leader length, start tension and slack removal.
- Lift off/abort criteria; glider inflation, glider orientation and attitude, pilot control exhibited and pilot ATO altitude.
- Adjusting tow line tension and vehicle speed for glider tow angle and climb rate.
- Cause, prevention, and alleviation of pay-out reel surging.
- Lock out recognition and recovery.

8.1.6 Take Off Crew Responsibilities

- Pre-launch checklists.
- Pre-launch check of tow rigging, connections, and layout.
- Ensuring pilot to operator communication and signals.
- Lift off/abort criteria.

8.1.7 Emergency Procedures

- Low altitude tow line separation.
- Lock out avoidance and recovery.
- Premature recovery drogue deployment.
- Recovery drogue entanglement.

- Managing a broken tow line.

8.2 Equipment Familiarisation and Skill Demonstration

- Set up pre-launch tow system.
- Set up pre-launch tow rigging including weak link, release, bridle connection, and recovery drogue chute.
- Placement and use of wind indicators.
- Pilot to operator communication and signals and pre-launch checklists.
- A no wind launch, a windy launch, and a crosswind launch.
- Launch aborted prior to lift off by operator and/or pilot.
- Adjusting vehicle speed and tow line tension for inclination angle and climb rate.
- Glider heading with respect to tow heading (staying online) in no wind and with cross winds.
- Tow line separation with low tow line tension (no surging).
- Tow line separation with high tow line tension (with surging and potential bridle whiplash).
- Rewinding tow line with and without use of drogue.

8.3 Practical Training for Pilot and Operator

- OPMF70: Tow Operator Pay-In Certificate (PTOI).
- OPMF71: Tow Operator Pay-Out Certificate (PTOO).
- OPMF78: Tow Pilot Certificate (PTP).

8.4 Theory Examination

- The tow pilot rating requires successfully passing a theory exam.

Note: - The existing exam is being updated. Winch operator theory exams will be introduced.