PARAGLIDING TOW MANUAL

PREFACE

This manual has been compiled to establish minimum NZHGPA standards for tow launched paraglider flight.

It is intended to be EQUIPMENT NON-SPECIFIC as towing technology varies greatly and each system enjoys its own philosophy.

It provides criteria for operators to establish adequate safety and training systems.

It is based on USHGA, HGFA and BHPA manuals combined with experience gained by NZHGPA members.

Information in this manual has been compiled by Robert Darby in good faith; a disclaimer is claimed of any responsibility implied direct or indirect. His hard work is gratefully acknowledged.

Acknowledgements:

- USHGA Paraglider Towing Program
- HGFA Recommended Towing Procedures Manual
- BHPA Operations and Procedures Manual
- Ed Pitman (Inventor and Pilot)
- Pat Blackburn (Tow Guru)
- Peter Scriven (Tandem Tow Pilot)
- Various NZHGPA members

SECTION 1: INTRODUCTION

Towing has been around as long as hang gliding and paragliding itself and although it is a more complex method of launching, it can be safe and rewarding. Due to the extra complexity, great care must be taken at all times. Crew and pilot rely heavily on the integrity of the towing system. Responsibility must not be taken lightly.

NEVER TAKE A CHANCE WITH TOWING OF ANY FORM!

The CAA has stipulated minimum requirements for tow launching paragliders and hang gliders. They are as follows:

- VHF air band communication between pilot and tow crew,
- VHF air band broadcast prior to and after each launch on the local frequency,
- Operation to be in a designated area which must be promulgated on Aeronautical Charts and in the Aeronautical Information Publication (this is done through CAA),
- A method of advising local operators when the area is active is to be established,
- Maximum altitude is 2000 feet AGL.

There are situations allowing exemption to one or more of the above requirements, they are as follows:

- Towing up to a maximum altitude of 500 feet AGL is exempt of all requirements,
- Where there is significant risk of water damage to airborne radio equipment (for example during over water safety courses) the pilot need not carry radio equipment*
- When novice tow pilots are training and may require continual radio or visual communication, they need not carry Air Band radio equipment*,
- Radio equipment need not be carried when towing in an exclusive hang glider/paraglider area after all pilots have been informed,

Exemption or variation on one or all of the above requirements with the agreement of the CAA.
Note: Two ground based Air Band radio posts are required, preferably one with the winch and one on elevated ground, to provide adequate monitoring of the air space

SECTION 2: PRELIMINARY RECOMMENDATIONS

This section is intended to provide criteria for safe and efficient towing:

Constant Direction: The direction of the towing force must remain constant relative to the canopy throughout every phase of the towed flight. (i.e. Staying on line).

Constant Tension: The tension of the tow line must remain essentially constant throughout every phase of the towed flight.

Reliable Tensiometer: The system must have a reliable (electronic or hydraulic) load sensor to accurately determine line tension to.

Center-Mass Attachment: The towing forces applied through the tow line and bridle must be attached as closely as possible to the effective center 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 release devices and their methods 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 the limits for safe operation.

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 the safe environment and under conditions conductive to safe operations.

SECTION 3: CREW REQUIREMENTS

This section establishes certificate requirements for all towing crew.

The Tow Crew Certificates are:-

OPMF70 TOW OPERATOR PAYIN CERTIFICATE (PTOI)
OPMF71 TOW OPERATOR PAYOUT CERTIFICATE (PTOO)
OPMF76 TOW INSTRUCTOR CERTIFICATE (PTI)
OPMF78 TOW PILOT CERTIFICATE (PTP)

3.1 REQUIREMENTS

In order to qualify for the above certificates the pilot/crew must satisfy the flight/log requirements as described in the relevant rating form. Essential Background Reading is contained in OPMF74.

3.2 CURRENCY

Pilot-in-command/crew of a glider/winch shall not fly/operate a glider/winch unless within the previous 12 months they have demonstrated in flight/operation to a person approved by the Association that:

- They have maintained the ability to fly/operate to the standards of the certificate.

3.3 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 authorize and supervise tow operations.

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

3.4 AUTHORISATION OF COMMERCIAL TOW OPERATIONS

A commercial tow operation should have standard operating procedures which document the training required for winch operators and a record of training for personnel. Commercial tow operations may employ winch operators that are not NZHGPA qualified pilots and do not hold NZHGPA certificates, in this case the responsibility for authorising and supervising tow operations is as follows:

Tandem flights.

The paraglider tow pilot (PTP) is responsible for ensuring that the winch operator is trained to the standard required for the paraglider tow operator payin (PTOI) or paraglider tow operator payout (PTOO) ratings in respect of winch operation or to the standard operating procedures of the commercial tandem tow operation, whichever is the greater.

Instructional tow flights.

The paraglider tow instructor (PTI) is responsible for ensuring that the winch operator is trained to the standard required for the paraglider tow operator payin (PTOI) or paraglider tow operator payout (PTOO) ratings in respect of winch operation or to the standard operating procedures of the commercial tow operation, whichever is the greater.

SECTION 4: EQUIPMENT

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

4.1 GENERAL DESCRIPTION

Most tow systems consist of the canopy 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 payed in by a static winch or payed out by a moving winch. Most systems require a drogue chute attached to the end of the tow line that deploys after the pilot has separated from the tow line.

4.2 CANOPIES

Canopies should be well selected. Does the manufacturer endorse the use of the canopy for towing, if so, what is its maintenance schedule.

The primary characteristic required is ease of launch. If the canopy establishes easily ‘on line” then the risk of lockout is greatly reduced. Most modern paragliders are good towing canopies. Canopies that exhibit tendencies to hang back or over fly will probably prove unsuitable for towing.

Canopies used for towing should be regularly checked for increased wear as a result of higher wing loading, (i.e. porosity, construction and line length/strength).

4.3 HARNESSES

The suitability of a harness for towing depends mainly on the ease with which the towing bridle can be attached. Sky Systems have produced harnesses with towing attachments for years but most owners are not even aware that they are there.

Basic flotation is advisable for towing harnesses used over water. The flotation must allow the pilot to RIGHT without any input, it must then remain stable in an upright position. Flotation you do not want is also very important. Lots of closed cell foam under the pilot will cause a great deal of negative buoyancy. Open cell foam (like Sup Air’s Protector) will become sodden and heavy when saturated, a problem for recovery crews. Air bags (the Keller Bag) should be left at home.

Harnesses should also be fitted with a Hook Knife.

4.4 RELEASE MECHANISM AND BRIDLE

It has been found that for paragliding a webbing bridle forming a “V” with the two hang points and tow line assists the pilot to stay on line. The tendency to become off line is restricted by the bracing provided by the bridle.

A Tow Bridle used over water can be the same as that used over land. It must, however, be checked to verify that it meets release requirements when wet. Whether over water or land releases that require a heavy metal component on the end of the bridle should not be used. If the weak links breaks this component becomes a nasty projectile flying directly towards the pilot. The bridle should be made of non-elastic webbing with no hard components, in the event of a weak link failure the bridle offers no danger to the pilot (see figure 4.4).

When using a 2 or 3 loop release mechanism (this is a ‘soft’ version of the 3 ring circus release used in parachuting) it is optional to use a release loop (see figure 4.4). The release loop should be of a larger diameter than the loops in the release mechanism. This aids operation and reduces wear of the release mechanism.

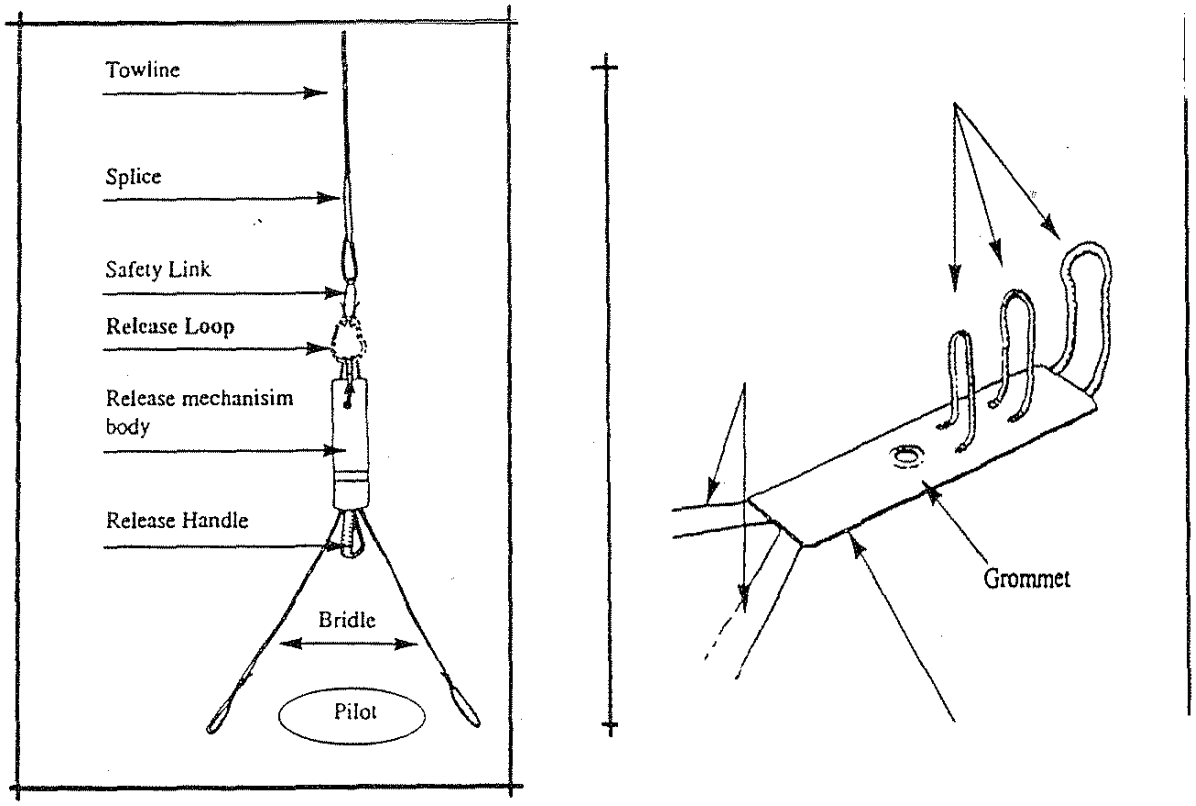

Fig 4.4 Typical Bridle. Typical 3 loop 'soft' release mechanism. Release pin and handle have been omitted for clarity.

4.5 SAFETY LINK (OR WEAK LINK)

The purpose of a safety or weak link is to provide a maximum limit to the possible tow line tension that can be exerted on the glider.

The recommended strength of the *safety* link for paragliding is between 0.75 Gs and 1.5 Gs. One "G" is the force due to gravity when you and your glider are in straight and level flight. For example, if you

- weigh 170 lb (77Kg) naked, and you glider, harness, helmet, reserve, ballast, clothes, boots etc total 30 lb (14 Kg) then your gross weight is 200 lb (91 Kg). Therefore, a 1 G load for you is 200 lb (91 Kg) and a 0.75 G safety link should be 150 lb (68 Kg). Values outside this range can and have been used, but a safety link within this range provides a reasonably safe baseline or starting point.

Safety links should be made from material that consistently breaks at a predictable load, they must be infallible.

If a safety link with a diameter larger than the cord in a particular three loop release mechanism is used, this then negates the reason for a release loop (as detailed in 4.4).

A common design of safety link is shown in figure 4.5.
It is important to note that knots reduce line strength and must be allowed for in calculations and testing of safety link material (i.e. test the finished item).

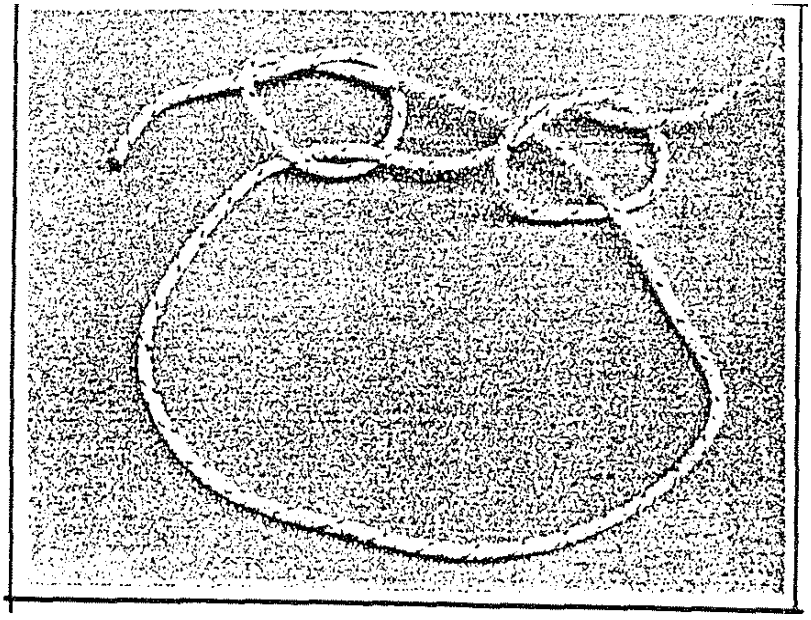

Fig 4.5

4.6 DROGUE CHUTE

Some operators use a ram air type drogue. It has a swivel placed between it and the Tow Line. It is brightly coloured to be obvious to other air traffic,

Packing of the drogue is crucial, but once learnt never forgotten. The lines pack into a separate compartment of the Deployment Bag.

Parachute type drogues offer faster rewind but may not be suitable for some operators.

4.7 TOW LINE

Tow lines may be made from Polyester, Nylon, steel, Spectra etc. Choice of tow line material is based on cost, stretch and good U.V. and abrasion resistance.

It may be necessary to paint the tow line in bars so that it is readably visible to other air traffic. It can be painted solid at each end so that the crew know they are either all ‘payed in’ or all ‘payed out’, (i.e. the first 50Mand the last 150M respectively). The first 50M could also be of a harder wearing material.

4.8 WINCH SYSTEM

Payout winching is the preferred method for a vehicle/boat mounted tow operation. Payout winching also has the advantage of placing the pilot in close proximity to the boat/vehicle during launching. This is very important when launching students or low-airtime pilots. It allows the winch operator to observe the student/pilot closely during launch and keeps the boat/ vehicle in close proximity so assistance can be rendered in the event of an aborted launch.

Payin winches are used where the winch itself is static. The pilot and winch operator are relatively remote (up to l000m) at the crucial take off phase. However, with good communications and a suitable site payin winches are perfectly serviceable.

Static towing (i.e. a fixed length of line) is not recommended for paragliding because it requires the boat/vehicle driver to regulate tow forces. This cannot be considered reliable.

It is important that the winch have high speed rewind capability. When towing paragliders it is not uncommon to

have air born spectators (i.e. ultralight or helicopter pilots) who may not be aware of the tow line. In the event that they get too close, the tow should be terminated and the tow line rewound. With a high speed winch this will take only a matter of seconds. In some cases the rewind speed also needs to be high to retrieve all of the line before it touches down.

4.9 BOAT OR TOWING VEHICLE

A boat that is suitable for a water tow operation must be capable of pulling up a paraglider and it must be fast with good directional control (stable). The speed required to launch a Paraglider (15-20 knots in no wind) may not be sufficient. This speed capability is important so that the boat crew can assist the pilot in the event of a blown landing. On small lakes, speed may not be an issue, however, when flying over a large body of water speed becomes a factor. Speeds up to 45-50 knots may be required when towing a pilot flying downwind. A capable crew is useless if the boat is not where it is needed.

- A streamer should be installed above the highest point of the boat to indicate the relative wind direction. In addition to the full compliment of coast guard required equipment, the boat should be equipped with a hook knife, some form of ship to shore communication, a first aid kit, ample supplemental flotation, foul weather gear, spare dry clothing, drinking water, optional horn and a means with which to remove people from the water, (i.e. a water line platform at rear or a overhanging hoist).
- It should be comfortable and easy for the crew to communicate and operate in.

A land based vehicle must have the same safety features, (less the life jackets etc). The crew must be able to communicate with each other, an open Land Rover is ideal (as long as its capable of speeds in excess of 50 knots).

The Winch must be securely fitted to the vehicle, as per manufactures recommendations.

The crew must have secure seating preferably with some form of restraint (that can be easily removed in an emergency) such that they cannot be thrown from their controls.

SECTION 5: TOWING

5.1 PROCEDURES

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

5.2 GENERAL DESCRIPTION

Most towing procedures start with the pilot and canopy ready in a forward launch position, tow tension is then exerted. Given that the launch is successful, the pilot gains altitude, when the desired altitude is reached the pilot separates from the tow line. The tow crew then rewinds the tow line.

5.3 CAA MINIMUM REQUIREMENTS

The CAA has stipulated minimum requirements for tow launching paragliders and hang gliders. They are as follows:-

- VHF Air Band communication between pilot and tow crew,
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Exemption or variation on one or all of the above requirements may only occur with the agreement of CAA.

* Note: Two ground based Air Band radio posts are required, preferably one with the winch and one on elevated ground, to provide adequate monitoring of the air space.

5.4 LAUNCH AND LANDING AREA SUITABILITY

The land owners permission is required (even if council or common land).

An important consideration is the suitability of air space above.

In general, all take-offs should be clear of snags that might catch lines or canopy. The use of AstroTurf or Geo-Textile is recommended. It would be good practice to observe conditions and note their effect on towing over a period of time before operating with novice pilots.

Other considerations might include; refuelling of the tow vehicle, placing of windsocks, placing of advertising signage, placing of cautionary signs, access for clients and most importantly access for Emergency Services.

5.4.1 Land Based Towing

Suitable sites may include fields and long deserted roads with one dimension at least 1000 m preferably parallel to the prevailing wind. The surface can be tarmac, grass or desert, however it must be flat and easily driven upon.

A sloping area for take-offs would be ideal (see Low Level Separation, Emergencies Section).

Other land based traffic or wild life must be taken into consideration. There may be an established towing operation locally, they should be consulted as to their rules and operation methods.

5.4.2 Water Based Towing

Coastal waters with tide, undertow and waves etc are not suitable in the event of water landings.

Permission from the local Harbour Master will most likely be required in addition to the land owners.

Other water traffic is a crucial element to the suitability of waters, there is a high percentage of poor boat drivers. There may be an established Boat Towing Operation, they must be consulted.

Lake/water shape is important, roundish lakes in excess of 1500m diameter would be ideal. A good take-off beach may be grass, gravel or sand. Cobbles, depending on size, are not such a good surface. The laying of Astro-Turf can greatly improve a beaches characteristics. A sloping beach would be ideal (see Low Level Separation, Emergencies Section). The boat should be able to

5.4.3 Landing Areas

Landing areas should conform to any applicable NZHGPA guidelines.

5.4.4 Alternative Emergency Landing Areas

These should be used for good reason only. All pilots should be fully briefed on their location and use. For land based towing alternative landing areas should conform to any applicable NZHGPA guidelines. The same applies foe water based towing, however the alternative site may often be a beach of sorts. When landing on a beach pilots must be aware that generally it will be a cross wind landing.

5.5 MINIMUM PRE FLIGHT CHECK LIST

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

- Flight plan briefing
- Safety equipment
- Canopy layout good and lines cleared
- Crew interactive briefing (tension, type of tow)
- Safety link check
- Release mechanism correctly assembled
- Tow bridle symmetrically connected to risers
- Tow line drogue chute attached and packed correctly
- Radio check
- Boat/vehicle positioned for take off
- Check water way/field for traffic
- Airband radio call if applicable
- Wind speed and direction acceptable to pilot
- Pilot signals to tow vehicle “commence tow”

5.6 ON TOW PROCEDURES

5.6.1 Wind Conditions

The most crucial phase of towing is the first 100 ft above take off (ATO). To avoid lockout at launch, launching should be made into wind as much as possible. Once 100 ft ATO has been achieved wind direction is not so critical. The stronger the wind the more into wind the takeoff should be. Guidelines to be followed are;

- Into wind take off, wind strength up to 25 km/h (13 knots)
- 30 degrees off wind, wind strength up to 15 km/h (8 knots)
- 45 degrees off wind, wind strength up to 8 km/h (4 knots)

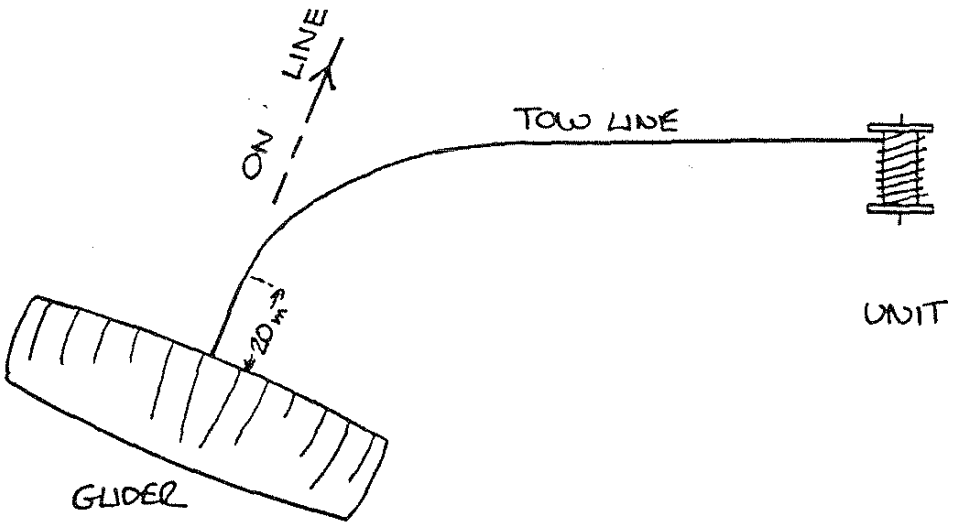


Figure 5.5.2

5.6.2 From Pilots Aspect

Launching:
Having completed all pre-flight checks and commence towing has been signalled, the pilot should expect the tension to increase. He/ she must hold the tension until they feel overpowered. They now commit themselves to take-off and take several steps forward. They will feel accelerated by the tow tension and after only a few steps their feet will leave the ground. After take-off only use 20-25% brake (best L/D position). Only use more brake if the canopy diverges from on-line. More brake than usual will have to be used to bring the canopy back on-line. Weight shift is also a useful tool and should be used before the controls. Incorrect weight shift is usually the cause of diverging from on-line. During towing the pilot should lean back in the harness and relax, the harness is designed to centralise weight shift in this position. Do not be tempted to 'Tortoise' (i.e. head out between the risers), a common mistake with novice pilots. The definition of staying on-line is that the paraglider is flying in the direction the last 20 meters of tow line, not directly towards the tow vehicle. In a laid back relaxed position the pilot should still check regularly that the wing is at right angles to the last 20 meters of tow line (see Fig 5.5.2). Remember use fingertip flying, lean back and relax.

Release:
Generally the pilot will release after tension has been reduced. There are, however, several other scenarios requiring the pilot to release (see Non Standard Procedures Section)

5.6.3 From the Tow Crews Aspect

Launch:
The tension is smoothly increased.
For solo canopies tension is increased to 120 lbs.
For tandems it is increased to 150 lbs.
The winch operator must observe the pilot and canopy at all times during the take-off in case of an abortive take-off.
The pilot holds until he or she feels overpowered at which time the pilot commits to the take-off and allows to be pulled forward (the pilot must stay on his or her feet and in command of the canopy).

Under-Tow:
The launch goes well, the tow crew monitor the canopy, once at least 100 ft ATO has been achieved and the pilot is on-line and looking comfortable, the tow tension is increased further.
Solo canopies to 150 lbs.
Tandem canopies to 200 lbs.

Once this stage is reached the tow crew must still observe the canopy for possible lock-out or just not being on-line (See Non Standard Procedures Section).

At End of Tow:
The tow crew reduce the tension

- The pilot feels the tension reduce he/she operates the release and the drogue chute is deployed

Rewind is as important as payout.

For payout winches it is essential to have a smooth rewind, slack must not be allowed at any time. Slack at worst, will cause knots during the next pay-out (and weak link failures) and at best, cause un-smooth pay-out.

5.7 RADIO PROCEDURES AND VISUAL SIGNS

5.7.1 Radio Procedures

Be careful not to transmit over the top of a tow in progress, and do not chat unnecessarily on the radio....
Accuracy, Brevity and Speed.
It is important that you identify crew members by code name or call sign prior to each command when towing in

the vicinity of other tow groups.
If you are about to start a tow and a near-by team is also towing, ensure that different frequencies are used to avoid confusion.
Be sure to unclip your mike after the tow and be wary of mikes being clipped on accidentally during set-up/pre-flight/ground handling. If you cannot raise anyone on the radio then there is a good chance that you are on 'constant'.

A blocked frequency means that towing operations must cease.

It is important that the most senior tow supervisor has the most powerful radio unit if possible. Thus it is possible for the tow supervisor to transmit over deranged pilots.

Speak clearly. The word 'No' should never be used. It can easily be misconstrued as 'Go'.

Common communications used are:

1. Go, Go, Go.
2. Stop, Stop, Stop.
3. Weak link break.
4. Release failure
5. End of tow

5.7.2 Visual Signals

Visual signs depend greatly on the tow system used (i.e. payin/ payout). Each operation must establish signals that all concerned are familiar with.

SECTION 6: NON STANDARD SCENARIOS

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

6.1 LAUNCHING (FIRST 100 FT ATO)

6.1.1 Weak Link, Release Mechanism & Tow line Failures:

Once the pilot's feet are off the ground and before he/she reaches 100 ft ATO, is arguably the most critical phase of towing. Any towing tension failure will cause the canopy to surge forward followed by the pilot penduluming forward underneath, possibly into the ground.

This is why we increase to maximum tension over 100 ft ATO

6.1.2 Canopy Does Not Inflate Correctly/Lock Out At Take Off:

- It is essential that the tow crew observe take off. If there is any doubt - dump
- Once the pilot's feet leave the ground the problem is compounded. If the pilot is dumped whilst still on the ground he/she should treat this as any normal aborted take off.
- If a canopy in a lock out situation is allowed to launch its pilot, then smooth reduction in tension is preferable to immediate dump (as above). This situation is recoverable if managed correctly. Once tension is reduced the pilot should be able to bring his or her canopy on line, tension can then be increased and the tow continues. At a reduced tension (30 - 50 Ibs) it is possible to kite a canopy and maintains its height, while the pilot 'settles'. At this tension it is impossible to lock out unless the pilot intentionally turns away from the winch, in this situation - dump.

6.1.3 Strong Wind Launches

Strong winds can be considered as 8-13 knots (15 -25 km per hour) and for experienced pilots only.

If the canopy is launched cross wind, more skill is required to establish it correctly and to keep it on line. Alternatively, a reverse take off can be used.

6.1.4 Reverse Take Offs

If the wind strength allows canopies to be kited up then the pilot can reverse launch.

The pilot inflates the canopy as per a normal foot launch. As the pilot starts to turn forward tension is set at minimum.
The winch operator increases tension if the canopy looks well established and on line. The tow continues as normal.
Pilots must be proficient at crossed control reverse take offs, turning the wrong way to face forward is unacceptable.

6.1.5 Cross Wind Launches

- The main problem with cross wind launches is the canopy's natural reaction to establish asymmetrically. Cross winds should therefore be avoided by towing into wind.
- In light conditions the tow tension pulling the pilot forward at launch has greater effect than the wind direction on the canopy. This is equivalent to running hard when foot launching. Light cross winds are therefore not such a problem but should still be avoided.
- In medium to strong conditions a cross wind becomes more problematic and tow direction should be adjusted. Alternatively, reverse launching can be used (as detailed above) because the pilot has more control over establishment of the canopy.

6.2 UNDER TOW (100 FT ATO AND ABOVE)

6.2.1 Off Line Towing

- It is usually apparent from the winch that the pilot is not fully 'on line'.
- It would also be an inefficient tow with reduced height gain. The tow crew can signal to the pilot which way to turn (ie. if a flag is extended out on the right hand side the pilot must correct to the right). Alternatively radio commands can be given.
- Being off line is the first stage of a progression of nasties leading to lock out. (see Lock Out in Emergencies Section). It need go no further than being off line.
- If the pilot fails to make corrective action, the winch operator can reduce the tension, say to 100 lbs.
- The boat/vehicle can also reduce speed (remember, slack must be avoided).
- By reducing tension it makes it easier for the pilot to come on line, once back on line the tow unit can increase to operational speed and or tension can be adjusted.

SECTION 7: EMERGENCIES

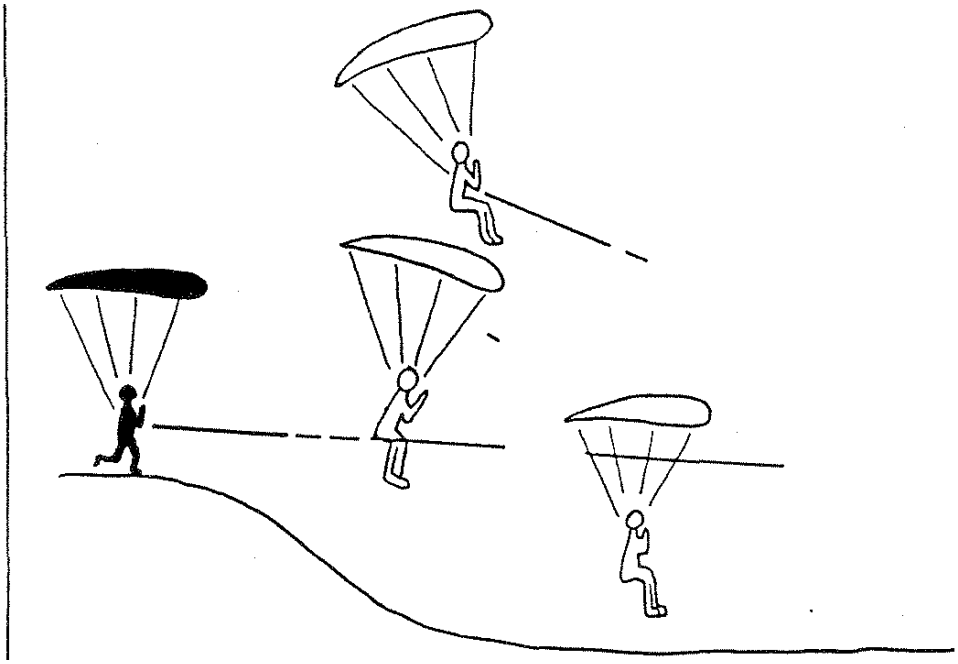
This section describes towing situations that require immediate attention. The list is not exhaustive or exclusive.

7.1 LOW LEVEL WEAK LINK RELEASE MECHANISM AND TOW LINE FAILURE OR ACTIVATION

If the pilot has enough altitude he/she should not overreact but dampen the surge (with approximately half control depending on glider) and concentrate on an alternate landing site.
The closer to the ground the more critical the pilot's inputs. Under 30 ft ATO the pilot's inputs will have to be increasingly more aggressive to stop the canopy surging in front of the pilot (see fig 7.1).

If the canopy's surge is stopped before it gets ahead of the pilot then no resulting penduluming forward of the pilot can result

Under 8 ft ATO it may be necessary to 'flare' aggressively.
All Pilots (and passengers) should be ready to PLF.
At low level, dealing with a broken tow line or un-deployed drogue chute is secondary.



7.2 HIGH LEVEL (ABOVE 100 FT ATO) TOW LINE WEAK LINK AND RELEASE MECHANISM FAILURE

As previously discussed it is not as critical as at low level. However, the pilot must expect surge. In the case of a line failure the pilot must release before attempting to land as towing line behind a paraglider is extremely dangerous.

7.3 THE LOCKOUT SCENARIO

Some pilots think that the safety link will, by breaking, protect them from lockout. This is not a reliable plan. Lockout is an accelerating descent, significantly diverging in heading from the direction of the tow line, which is not correctable by steering. The glider is in an accelerated stall, that is, stalled at an airspeed higher than normal because of increased loading. This increased loading is due to the download component of the tow line and also due to the bank angle. If you ever find yourself on tow with a glider in a diving turn, diverging in heading by greater than 45 degrees from the direction of the tow-line, and your toggle controls are ineffective, you are in a lockout. You should not wait for he safety link to fail. Instead you should release or he dumped immediately and regain control of your glider!

The worst scenario concerning a lock out would be the pilot diving into the ground behind his canopy from as low as 50 ft. This could have been caused by not correcting a cross wind induced yaw turn just after take off, coupled with too high an angle of attack (too much tension, too early),compounded by lack of awareness by the winch operator who fails to reduce tension or dump the pilot. The main contributing force in the lock out scenario is line tension.

7.4 CANOPY COLLAPSES

The extra wing loading produced by towing means that the paraglider is less likely to collapse, and if it were to, it would recover faster. This is not to say that it will never happen. Corrective action should be applied immediately by the pilot (i.e. course and correction) and the winch operator should be prepared to dump. Factors contributing to collapses may include:

- Excessive thermal or wind sheer conditions.
- A poorly maintained canopy etc.
- A canopy not suitable for towing (see Equipment Section).

7.5 SERIOUS MECHANICAL FAILURE OF PARAGLIDER OR HARNESSES

In the event of serious mechanical failure whilst under tow, the pilot must deploy the reserve immediately. The winch operator should dump the pilot. The pilot and passenger should make ready for a land or water landing.

7.6 SERIOUS MECHANICAL FAILURE OF TOW BOAT OR VEHICLE

If the tow vehicle has to stop moving the rewind procedure must be followed. The pilot will have to release and land at an alternative site.

7.7 SERIOUS MECHANICAL FAILURE OF WINCH SYSTEM

Relevant information should be found in the manufacturer’s operations manual.

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, it should however, be a well rehearsed and practised method for safe alternative landing.

7.9 AVOIDANCE OF POSSIBLE MIDAIR COLLISION WHILE ON TOW

All members of crew should be aware of other air space users. If another aircraft fails to respect air space then the tow should be terminated before any possible conflict can occur.

SECTION 8: PROGRAMME FOR NOVICE TOWING PILOTS AND CREW

This section provides criteria for operators to establish adequate training systems.
The clinic will consist of four phases:

- Ground School (towing theory)
- Equipment familiarisation and skill demonstration
- Practical training for pilot and operator as applicable
- Written examination

8.1 GROUND SCHOOL

Description, Explanation And Discussion Of Towing Theory Factors and Influences Including:

System Differences:

Static line, payout/payin winch, hydraulic winch, moving launch platform and boat/land tow vehicles.

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
- Safety links; desired strength, material variability, weakening from knotting and tying
- Recovery drogue chutes, differences, packing and placement

Glider Effect Of:

- G loading; definition and increase from towing and banking
- Risk of canopy line stretch from over-towing
- Air speed increase due to tow line thrust and loading
- Control effects due to thrust, loading and airspeed
- Lockout; description, cause, prevention, recognition and recovery
- Flight attitude; glider lags behind Pilot at high angle of attack
- Canopy 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)

Pilot Responsibilities:

- Adjustments for difference between foot 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)
- Minimal use of brakes rationing
- Release criteria; vehicle stops or confusion or discomfort or lock-out
- Tow line separation, timing and canopy surging
- Lock out prevention, recognition and recovery
- Use of pre-launch checklist
- Ensuring pilot to operator communication and signals
- Pre-launch check of tow rigging connections and canopy layout

Tow Operator Responsibilities:

- Use of pre-launch checklist
- 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; canopy 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 payout reel surging
- Lock out recognition and recovery

Take Off Crew Responsibilities:

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

Emergency Procedures:

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

8.2 EQUIPMENT FAMILIARISATION AND SKILL DEMONSTRATION

- Set up pre-launch tow system
- Set up pre-launch tow rigging including; safety link, release, bridle connection, and recovery drogue chute
- Placement and use of wind socks
- Pilot to operator communication and signals and pre-launch check list
- 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 on line) 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 bridle whiplash)
- Rewinding tow line with and without use of drogue

8.3 TOWING CERTIFICATES

OPMF70 TOW OPERATOR PAYIN CERTIFICATE
OPMF71 TOW OPERATOR PAYOUT CERTIFICATE
OPMF76 TOW INSTRUCTOR CERTIFICATE
OPMF78 TOW PILOT CERTIFICATE

8.4 WRITTEN EXAMINATIONS

OPMF73 PG Towing written exam

8.5 BACKGROUND READING

OPMF74 PG Towing background reading