

Proposed revisions to:
HPAC Towing Procedure Manual
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Original text is in black.

Immediately following original text are recommended revisions and/or comments designated in colors blue and red.

Blue text addresses grammatical issues.
Red text addresses issues of more substance.

If a pilot does choose to follow different procedures than those described here in the interests of making his activities safer, the authors would appreciate being apprised of these procedures so that we may improve this manual. [If in the interests of making his activities safer a pilot chooses to follow procedures different from those described herein, the authors would appreciate being so apprised in order that they might improve this manual.](#)

Written by Bruce Williams & AJ Murray, AHGC
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* Peter Birren (President of Reel Hang Glider Pilots Association and inventor of the Linkknife Towing Release) Don Hewett (Criteria for Safe and Efficient Towing)
[* Peter Birren \(President of Reel Hang Glider Pilots Association and inventor of the Linkknife Towing Release\)](#)
[* Don\(nell\) Hewett \(Skyting Criteria for safe and efficient towing\)](#)

ASL = Above Sea Level
[MSL = Mean Sea Level](#)

..using rudders to control roll - such as the Fledge...
[\(Do they?\)](#)

All forms of towing are a more complex method of launching than foot launching from a mountain. If approached carefully with due regard for safe operational procedures, towing can be as safe as any form of glider launch. [I actually think they're WAY safer. This seems to be a no brainer with respect to dolly launched AT in any case.](#)

re-emergence
[reemergence](#)

both hang gliders and paragliders
[both hang and paragliders](#)

For the trainee tow pilot, a sound understanding of the systems and procedures to be used is imperative, prior to actual towing.
[Prior to actual towing, for the trainee tow pilot a sound understanding of the systems and procedures to be used is imperative.](#)

Towing may only be carried out by tow-endorsed pilots or pilots under the direct supervision of a Tow Instructor.
[Only pilots tow endorsed or under the direct supervision of a Tow Instructor may be towed.](#)

If at any time the pilot in command of the aircraft being towed is not happy with the progress of the tow, he should stop the tow immediately!! All pilots should be prepared to release from tow before an undesired situation becomes worse.
[Termination of the tow cannot be a default response to all problems encountered.](#)

Skyting Criteria
[Not all are geared to aerotowing and some could use tweaking.](#)

The pilot must also have a hook knife to use in case the release does fail, or if there are any entanglements.
[A hook knife should be virtually useless in aerotowing and should mostly be thought of as something for a person on the upwind/bottom end of the line for surface based towing.](#)

The system must include a weak link which is infallible and will automatically release the glider from the tow line whenever the tow line tension exceeds the limits of safe operation.
[A weak link is incapable of doing this because one may simultaneously be well below the maximum tension allowed by the weak link and well beyond the point of survivability.
Something needs to be said about LOWER limits of safe operation.](#)

The system must have a source of power adequate to maintain a safe mode of flight while under tow. The glider must be quickly brought up to a safe and adequate speed for launching.
[If you don't have an adequate weak link that adequate power isn't gonna do you any good.](#)

A locking steel carabiner, or a locking aluminum carabiner with backup. A single aluminum carabiner is not adequate.
[The locking option of a hang gliding carabiner is not only of no use but, in fact, actually makes things MORE dangerous. And if there's anything more dangerous than a locking carabiner it's a backup.
I say a PROPERLY CARED FOR aluminum carabiner is quite appropriate for hang gliding and that's what I have in the bag for any occasion when I don't care to be bolted in.](#)

Control bar mounted wheels are recommended.
[Basetube mounted wheels are recommended.](#)

The pilot must:
* be endorsed for the type of towing being performed by,

* or be under the direct supervision, control, and responsibility of, an appropriately endorsed HPAC Instructor.

The pilot must either be:

* endorsed for the type of towing in which he is engaging; or

* under the direct supervision, control, and responsibility of appropriately endorsed HPAC Instructor.

For ground-based towing operations, all operators must be:

* experienced at operating the equipment being used,

* or under the supervision and control of an experienced operator.

For ground-based towing operations, all operators must either be:

* experienced at operating the equipment being used; or

* under the supervision and control of an experienced operator.

For aerotowing operations, the tug pilot must hold an appropriate pilot certificate, and:

* hold an HPAC Tugmaster Endorsement,

* or be under the direct supervision and instruction of an HPAC Instructor for the purpose of gaining a Tugmaster Endorsement.

For aerotowing operations, the tug pilot must hold an appropriate pilot certificate, and either:

* hold an HPAC Tugmaster Endorsement; or

* be under the direct supervision and instruction of an HPAC Instructor for the purpose of gaining a Tugmaster Endorsement.

Good eye sight

Good eyesight

Tow instructor or Launch Marshall

Tow Instructor or Launch Marshall

Must only operate tow systems of the type they are experienced on.

Must only operate tow systems of types with which he is experienced.

Thorough knowledge of all signals and commands including emergency procedures.

Thorough knowledge of all signals and commands, including emergency procedures.

In the club environment they are known as the "Tow Instructor" and are qualified in all aspects of towing.

In the club environment he is known as the "Tow Instructor" and is qualified in all aspects of towing.

Teach driver

Teaching Driver

Teach signaller

Teaching Signaller

Teach Pilots

Teaching Pilots

Responsible to the Launch Marshal

Move to "Duties", make spelling of Marshal/Marshall consistent.

well-understood

well understood

when operations are being conducted at an airport or airfield which may be used by general aviation aircraft, ensure that a gliding operations signal is in place and ensure that the appropriate VHF radio frequency is monitored; and any incoming aircraft notified of the towing operations.

when operations are being conducted at an airport or airfield which may be used by general aviation aircraft, ensure that a gliding operations signal is in place, the appropriate VHF radio frequency is monitored, and any incoming aircraft are notified of the towing operations.

The flight plan and landing patterns should not be complicated but it is important that all pilots and ground crews using the site or strip are thoroughly briefed as to what procedures are adopted. When circuiting with larger aircraft, hang gliders, paragliders and lightweight gliders should either circuit inside the established circuit pattern, or circuit on the opposite side of the runway to other aircraft (contra-rotating circuits), and should land on the upwind edge of the active runway, without crossing over the runway at low level.

The flight plan and landing patterns should not be complicated but it is important that all pilots and ground crews are thoroughly briefed as to what procedures have been adopted. When circuiting with larger aircraft, hang, para-, and lightweight gliders should either stay inside the established pattern or on opposite side of the active runway (contra-rotating circuits) and land on its upwind edge without crossing it at low level.

emergency landing zones (for use should a weak link break, engine failure or release failure occur).

emergency landing areas (for use in the event of a weak link, engine, or release failure).

Overall control of operations on towstrip on the day.

Controls all tow operations.

has the authority to refuse the use of tow equipment they consider unsafe

has the authority to refuse the use of tow equipment he considers unsafe

Use only approved bridles and releases as many accidents have resulted from the use of home built releases and unconventional bridle arrangements.

I'd hazard a guess that most the store bought is WAY more dangerous home built stuff. Most of the "approved" equipment NEVER should have been.

The pilot should never learn to tow on an unfamiliar glider or harness and should never attempt the prone position unless fully experienced in it prior to the towing course.

I would submit that you're gonna mangle a lot more upright than prone pilots regardless of prior experience. Put 'em on wheels and start, keep, and land 'em prone.

When any fluctuation in wind speed occurs due to wind shear, wind gusts, or thermal conditions...

When any fluctuation in airspeed occurs due to shear, gusting, or thermals...

The pilot launches from his feet, or from a dolly.

The pilot launches from his feet or a dolly.

One end of the rope should be held in the operators hand...

One end of the rope should be held in the operator's hand...

After the glider has released, the vehicle continues to the gliders' launch area...
After the glider has released, the vehicle continues to the glider's launch area...
After the glider has released, the vehicle continues to the launch area...

The hang glider is anchored to the vehicle ("platform") by a nose release until launch airspeed is achieved, and then pilot and glider lift off from the back of the moving vehicle.
The glider is anchored to the vehicle ("platform") by a nose release until launch airspeed is achieved.

Wind direction and wind changes have less influence by than with most other launch methods. Crosswind launching still requires extreme caution, and obstacles and landforms upwind or downwind of the road, such as embankments or ditches, can have a strong effect on the glider during taxiing, launch, and liftoff.
Platform towing launching better tolerates variations in wind direction and speed than do most other methods but crosswinds, obstacles, and terrain features such as embankments and ditches nevertheless mandate extreme caution.

It is recommended to have an observer or winch operator separate from the vehicle driver.
It is recommended to employ an observer or winch operator in addition to the vehicle driver.

A hook knife or other cut-away system must be readily accessible to the operator. There is often also a rope cut-away guillotine built into the system which can be operated from within the vehicle in an emergency situation. The operator must be able to quickly reduce tow pressure in case the glider oscillates excessively or goes too far off line, and to instantly dump the tow pressure to zero in case of lockout or the glider contacts the ground.
It is recommended that a driver operable guillotine be built into the system and required that the observer be equipped with a hook knife or cut-away device which he can employ at the winch. The system must be able to immediately eliminate line tension when appropriate in an emergency situation.

control bar
basetube

A topless hang glider's nose bridle should pull directly forwards and not downwards on its nose to avoid extra strain on the keel.
A topless hang glider's nose bridle should pull directly fore (and not down) to avoid extra strain on the keel.

A kingposted hang glider can have it's nose...
A kingposted hang glider can have its nose...

The boat must be able to quickly attain planing and then launch speed without raising it's bow...
The boat must be able to quickly attain planing and then launch speed without raising its bow...

...or Linseed oil.
...or linseed oil.

...floatation devices...
...flotation devices...

...drums of light weight rope...
...drums of lightweight rope...

turn-around
turnaround

The pilot launches from his feet, from a dolly, wheels, or skis.
The pilot launches from his feet, wheels, skis, or a dolly.

re-engages
reengages

Releases must function when flying downwind as well as upwind.
Releases must function when flying both up- and downwind.

More ropes, drums, and pulleys does increase the chances of rope problems...
The employment of more ropes, drums, and pulleys does increase the chances of problems...

up-wind
upwind

This allows the glider to be launched near to the winch for easy communication and allows the operator to be able to watch the take-off and early stages of the flight from nearer the glider.
This allows a launch near to the winch and thus the operator a better vantage point to observe the early stages of the flight.

A release at each end of the tow rope with weak links are mandatory. The release fitted to the tug must comply with the HPAC Standard for Towing Installations, and be quickly and easily accessible by the tug pilot in all situations. These releases must be tested to demonstrate compliance and functionality.
Releases and weak links at both ends of the tow line are mandatory. Prior to use in towing these releases must be tested for compliance with HPAC Standards and be instantly operable in any situation in a manner in which control is not compromised.

...the glider may have a strong nose-up tendency, which can be reduced by using a two-point bridle, where the second point is the carabiner, or on the keel at or forward of the hang point.
...the glider may have a strong nose-up tendency which can be mitigated through the use of a two point bridle in which a second (upper) attachment is anchored at the carabiner or on the keel at or forward of the hang point.

All releases must be infallible and must only release upon pilot activation, or possibly if the tow angle or alignment of the glider and the tow line exceeds acceptable limits.
I'm not a fan of doing this because I'm not sure that acceptable limits can be clearly and safely defined.

...the end of it should be tied to the harness where it can be easily found and reached...
There are situations in which "easily reached" is a total fiction.

The two- or three-string (or webbing) release is simple...
Barrel releases are so superior to multi-string releases that conventional versions of the latter have no place in aerotowing.

If the tow line tension is very high, a strong or even two-handed pull may be required.
Completely unacceptable.

These systems are the most suitable for releases mounted at the hang glider's keel.
There's better stuff out there.

The weak link is placed through the Linkknife...
It doesn't have to be the weak link. Any suitable line material will do.

For keel-mounted releasing with a string through the downtube...
This is the way to do it right.

There are several...
There are several...

The "Tubular Webbing" release is made from either a length of webbing with two stiffeners sewn inside, or webbing with a parachute release pin sewn into it's end. The webbing or pin is folded over the tow line ring, then a short piece of tubing is slid over it. To release, the tubing is pulled back and the webbing unfolds. This is a compact and simple release, and makes an excellent backup.

Don't do this. Don't make one of these "Tubular Webbing" releases which directly engage the tow ring. Use STRAIGHT PIN barrel releases on BOTH ENDS of a SHORT one point / secondary bridle.

...with a parachute release pin sewn into it's end.
...with a parachute release pin sewn into its end.

Winch, vehicle and tug releases are recommended and should be releasable at any tension.
Winch, vehicle and tug releases are recommended and MUST be releasable at any tension.

The benefits of this system are currently under debate.
Good idea. Keep doing that.

This release and bridle set-up enables the pilot to keep the hands on the controls while releasing.
This is how EVERYTHING oughta be approached.

Secondary releases are recommended if the main release is out of reach of the pilot.
These are REALLY BAD ideas. It is TOTALLY UNACCEPTABLE to configure a primary release such that its actuator EVER becomes inaccessible and/or to treat a SECONDARY release as a primary (that's why it's called a SECONDARY release).

If the bridle is of the type where the released end must thread itself through a ring, there is a chance of it becoming entangled and causing all the tow force to be applied to the other attachment point, which must be the harness to allow the pilot continued control over the glider.
EXACTLY.

They should be sewn to the structural webbing of the harness, likely to the same webbing that the leg loops attach to.
They should be sewn to the structural webbing of the harness, likely the same webbing to which the leg loops are attached.

For two-point bridles, the upper end should be tied to the keel of the glider at, or several inches forward of, the hang point. Beginning tow pilots should attach the tow bridle to the keel about 12-14" forward of the hang point, to help keep the nose down on launch and keep it more out of the way of the control bar at the top of the tow. As experience is gained the keel attachment point can be gradually moved closer to, but always in front of, the hang point.
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...may be a shorter bridle which is connected to the pilots harness...
...may be a shorter bridle which is connected to the pilot's harness...

The weak link should break before the tow force becomes uncomfortable or unmanageable.
Not possible.

A weak link should break quickly in the event the glider impacts the ground to prevent further injury by being dragged by the tow vehicle.

This is a job for a release - not a weak link.
AND

On a grass strip you are WAY better off if your weak link holds and you are dragged than you are if your weak link breaks and your glider comes to a sudden stop.

Each pilot should have his own weak link of appropriate strength.
Thank gawd somebody understands this.

If the weak link...
If the weak link...

Testing weak links tied from "#8" builders string or Mason line has shown that the type of knot used does not greatly affect the breaking strain of the weak link.
There are weak link options much better than loops of knotted string.

Aerotowing operations should use weak links which will break at a tow force of 80% to 100% of the total towed weight...
Nope. These numbers are based upon invalid assumptions. An ideal AT weak link should be 1.4 Gs regardless of pilot experience (consistent with sailplaning).

Since two-point bridles are usually used, if the weak link is at one end of the bridle rather than at the end of the tow rope, the weak link itself must break at less than half of the maximum allowable tow force.

A weak link at the end of a two point bridle is subjected to about 15 percent above half the tow tension and this must be factored into the calculations.

AND
You MUST have weak links above AND BELOW the tow ring if there's nothing on your end of the tow line.

Tandem operations should use weak links...80% or less for aerotowing.
They should be using a hundred percent or, if the rest of the system can handle it, more.

Knots used in tying weak links...
Knots used in tying weak links...

The best rope to use with most towing systems is one with very little stretch (though some "give" is required)...

I think there's enough "give" in the air itself such that we don't need to add any more using the line.

Long tow lines should be used for less experienced aerotow pilots, and shorter ropes give advanced pilots more maneuverability and ability to find thermals.

Short and long lines both have pros and cons and I don't believe they can be related to pilot experience very well.

Rings at rope ends should be used to prevent woven material (tow line, webbing, rope) from wearing on or digging into another piece of woven material. In the case of two-point bridles, the tow rope is allowed to slide on the bridle to self-equalize the forces on the upper and lower sections, so it is important to use a ring there to reduce abrasion. For these reasons you also need a sailmaker's thimble on the bottom end of your two point AT bridle.

The type of 'chute used depends on the type of winch and it's rewind speed.

The type of 'chute used depends on the type of winch and its rewind speed.

...above spectators and snagable objects...

...above spectators and snagable objects...

While towing, protective eye-wear should be worn by the pilot, and by the student during tandem flights. This is to prevent injury in the event of a rope or weak link break, or impaired vision from flying debris or insects. For payout systems, any crew not in an enclosed cab should wear eye protection, and helmets for payout systems mounted on trailers. Protective eye-wear MUST be worn by any participant at the end of a line unless enclosed in a cab or cockpit.

A suitable hook knife (similar to those used in parachuting operations) must be with the glider pilot at all times when towing.

Any AT pilot whose equipment is so pathetic that he could conceivably need a hook knife to get off tow deserves to go down with his ship.

Care must be taken with these systems, the added drag and weight...

Care must be taken with these systems as the added drag and weight...

...especially for beginner tow pilots so that they may receive instruction and procedural reminders from their instructor, who should observe their progress during the entire tow.

...especially for a beginner tow pilot so that he may receive instruction and procedural reminders from the instructor, who should observe his progress during the entire tow.

Advanced pilots may choose to use radios to send instructions to the tow crew in order to maximize their tow.

An advanced pilots may choose to use a radio to send instructions to the tow crew in order to maximize his tow.

Pilots should use a finger-mounted push-to-talk button so that their hands are always on the control bar and in position to activate the release.

A finger-mounted push-to-talk button should be used in order that both hands are always on the basetube and available for release actuation.

3.7.7 - Control Bar Wheels

3.7.7 - Wheels

Wheels mounted on extensions to the control bar...

Wheels mounted on basetube extensions...

...with the control bar acting as the wheel's axle...

...with the basetube serving as the axle...

3.8 - Launch Dollies

3.8 - Launch Dollies

The wheels should be mounted as far apart (5-6') as possible, for stability.

To maximize stability the wheels should be mounted as far apart as possible (5-6').

The dolly must be adjustable for different control bar widths and wheel positions, and must be able to provide the glider with a high angle of attack, at least 15-20 degrees above horizontal so that the glider does not "lock into" the dolly during launch, either by adjusting the keel cradle height or the control bar cradle height. The angle of attack setting can be checked by...

Basetube cradles must be adjustable to accommodate different control frame widths and wheel positions.

The dolly must allow for the setting of an appropriate pitch attitude, at least 15 to 20 degrees positive, to prevent the glider from locking into the dolly during launch. This may be accomplished through vertically adjustable keel support or basetube cradles. The appropriate setting can be determined by...

...or with the control bar level with the pilot's forehead.

...or with the basetube even with the pilot's forehead.

...dependant on pilot weight.

...dependent on pilot weight.

Immediately upon liftoff, hang glider pilots should level off at about 10-20' above the ground, to avoid interfering with the launch of the tug, and to avoid propeller wash.

Immediately upon liftoff the glider should level off at about 10-20' to avoid propeller wash and interference with the launch of the tug.

Because of the horizontal forces on the harness and pilot while aerotowing, the position of the pilot relative to the control frame is different than when in free flight.

Because of the horizontal forces on the pilot while aerotowing, his position relative to the control frame is fore of that experienced in free flight.

...easier in turbulent conditions, or with a heavy tandem passenger.

...easier in turbulent conditions and/or with a heavy tandem passenger.

If the glider is too high the glider pilot should increase speed; conversely speed is reduced to move to a higher position behind the tug.

If the glider is too high or low it should increase or, if at a safe altitude, decrease speed respectively.

...faster when positioned outside the track of the tug and slower when positioned inside the track.

...faster and slower when positioned out- and inside of the track of the tug respectively.

The glider will be more resistant to stalling when on tow so full push-out position can be used and held if required. The glider will be more resistant to stalling when on tow so at safe altitude full push-out position can be used and held if required.

The glider must still remain square to the tow line:
The glider must still remain square to the tow line.

It is the pilot's prerogative...
It is the pilot's prerogative...

not to release the tow rope where or when it's fall...
not to release the tow rope where or when its fall...

Brakes must be quickly applied to slow the pitch-over action.
Brakes must be quickly applied to slow the action.

Always watch the rope fall away from the glider to ensure that release has been successful and to check that the rope has not become snagged on the glider or harness.
Always watch the rope fall away to ensure that release has been successful and check for snags on the glider or harness.

...with other aircraft or the tug, and release, and turn right.
...with other aircraft or the tug, release, and turn right.

It is possible that the bridle and release could whip back and hit the pilot on release...
I'm not seeing or hearing about this with the low stretch materials we're using.

When landing with the rope attached the tug pilot should be careful not to overfly trees, fences, spectators or any other hazard on which the rope may snag or cause damage. The tug pilot must ensure that he does not fly low over people or gliders on the ground while landing with a rope attached.
When low the tug must ensure the tow line and ring poses a threat neither to himself nor persons and property on the ground through snagging or striking.

Due to the high angle of attack during surface-based towing, a line break will cause a hang glider to pitch up quickly, or a paraglider to pitch-over, due to the rapid loss in tow tension.
A glider neither has a high angle of attack during towing nor pitches up when it abruptly loses the line. It DOES have a high PITCH ATTITUDE under tow and its ANGLE OF ATTACK goes off the chart when the weak link pops but at that point it immediately starts pitching down and decreasing its angle of attack.

5.8.2 - Release Failure

Do not fly with releases (or sidewires) capable of failure.

A lockout occurs when the glider being towed moves off the direction of the tow for the pilot to safely and successfully correct, and is coupled with rapidly increasing tow tension, and increasing bank and nose angle.

Mostly wrong.

A lockout occurs when the glider towed diverges from the direction of the tow to the point at which it can no longer be brought back under control. The tow tension under which this occurs can be very low and may not increase significantly during initial stages in speed controlled towing and will not increase at all in tension controlled towing.

If directional control down the line of the tow can not be maintained, and depending on the severity and type of problem, the pilot must be prepared to release.
(The pilot must ALWAYS be prepared to release.)

All tow pilots must be prepared to release at any time.
Right.

Boots with lacing hooks can also cause problems
Boots with lacing hooks can also cause problems.

If the release being used is actuated by pulling on a line...
This already has been covered.

(f) The release control shall be so located that it can be operated by the pilot without having to release any of the primary controls.

Yeah. We need to be doing this on the BACK end of the tow line too.

1. Why do we use a weak link on the tow line?

Good one. I'd say about 99.5 percent of the hang gliding population will flunk that one.

2. What is the recommended breaking load of a weak link?

Don't forget minimums.

4. What are the two most common causes of emergencies while towing?

Weak link breaks and weak link breaks.

5. What are line breakages most commonly caused by?

Weak link breaks. (Hey! This test is pretty easy.)

8. What would you do if you suffered a line break at 50 feet?

Replace my downtube and shoot the bastard who sent me up with a 0.5 G weak link.

9. What would you do if you suffered a line break at 300 feet?

See above.

14. Some bridle systems incorporate a weak link which activates the release on breaking.

14. Some weak link systems function by actuating the release when a predetermined tension is reached.

15. Why are string weak links preferred over shear pin weak links?

Why are string weak links preferred over better stuff like Tost?

16. What are the last pre-flight checks before launching prior to a tow?

Lifting the glider until it stops if foot launching.

21. Is it true that during a lock out situation with a pull-in winch or pay-out winch that to free wheel the winch will stop the lock out from increasing?

21. Is it true that during a lockout situation with a pull-in or pay-out winch that to free wheel the winch will stop the lockout from progressing?

22. What is the maximum line tension that should be applied while towing?

1.4 Gs for aero.

24. On reaching the top of your tow, your release fails to operate. What is your most appropriate course of action? Ask yourself why you launched with a release capable of failing to operate.

27. While under aerotow the tugmaster signals by holding out a stationary arm up at an angle, what would this signal mean?

If your AGL is low it means pull in and release.

30. What is the recommended launch procedure when foot launching while aerotowing?

Don't.