Surface Towing Course Page

Welcome to the Surface Towing Course!

Towing a paraglider aloft is an excellent method for getting airborne when hills or mountains are unavailable, inconvenient, or not subject to an up-slope breeze. Paragliders can be towed aloft in any into-wind direction and simply require a strip of open land, road, or lake; a tow-rig, and a tow-operator to get airborne. This makes it an ideal and popular launch method for pilots who live in flat areas, or for maneuvers and SIV courses where they are towed over water.

Towing has an excellent safety record though it may feel strange to pilots who are accustomed to foot launching. It is important to relax, pay attention, and be situationally aware.

Please remember that we have done our best to provide a comprehensive and thorough presentation of the most important concepts for new pilots learning how to safely launch with a tow operation. Do your best to prepare for each day by studying material available from other sources including the USHPA web site and asking lots of questions.

Intro and Equipment:

Before you get started towing, it is important to recognize that Towing is a special skill that is not part of typical foot launch P2 training. There are many specific topics and concepts to be aware of when learning to tow – especially with regard to added risk. As with any sky sport, we have to evaluate and consider the risk when choosing to fly, and just because you are flying over water or in flat-land regions does not lessen the risk. The added requirement of tow-specific equipment complicates the process of launching, and as such requires additional preparation to get into the sky safely.

Below is a basic introduction to most of the extra equipment that is used. Also, this will serve as an introduction as to the use of the equipment. Some of the equipment is connected to the pilot, and some of it is specific to the the type of tow system and method that is being used.

Bridles:

Tow bridles are strategically constructed from high strength rope or webbing that connect your two main carabiners to the tow-line and allow you to disconnect when necessary. There are many different types of bridles used to tow paragliders aloft, but the two most common are 1-piece and 2-piece. 1-piece bridles are attached together at the release mechanism end and when released from the line, do not fall to each side of your harness. This reduces the risk of tangling with your reserve handle and requires no extra action after releasing from the tow-line. However, they do make it more difficult to get into and out of your harness so they are not recommended for flying over water or for pilots who use a front mount reserve. 2-piece bridles fall apart at the release

mechanism end after releasing from the tow-line. After releasing you will need to stow the two sides of the bridle to avoid interference, especially with your reserve handle.

Both bridle types, when connected to the line, form a “V” between the tow line, and your two carabiners. The release mechanism is located at the farthest end from you, and the release handle should be easily within reach. The other ends should always be connected to the top of your carabiners with webbing loops. NEVER attach the bridles in such a way that it applies force to the stitching of your harness or in which they could cross-load the carabiners during flight. There shouldn’t be any hard or heavy parts on the bridles. In the event of a weak link break or line failure, the bridles could snap back into the pilot and heavy objects could lead to injury. Face protection is highly recommended when towing for this reason. The weak link, which sits between the line and the bridles, should be reachable so that it can be cut with a hook knife in the event of a tow bridle malfunction.

Some bridles have “tow-assists” or “speed-assists” which connect to your speed system and speed the glider up during the launch and tow. They help to mediate the increased angle of attack during a tow and in all but a very few cases are considered much safer than towing without a speed assist. If the glider being towed has any tendency to hang back while ground handling, is old, or is lightly loaded, a speed assist tow bridle is a pilot’s best defense against deep stall/ parachutal malfunctions during takeoff. Heavily loaded gliders, or fast, performance gliders may not always need a tow-assist. When in doubt, it is better to use the tow assist than not.

The release mechanism, which will release the tow line from your bridles, should be simple, reliable, and work properly with no tow force, and also with extremely high tow forces. The most common mechanism is a rope 3-ring release system which has been adapted from skydiving cut away systems. They are light, reliable, and distribute the load throughout the release allowing it to work under very high forces. It is extremely important that you are familiar with the type of release on your bridles, and what mistakes you can make when connecting it. In the case of a rope 3-ring release system the longest loop should ALWAYS be the one passed through the weak link. The release trigger or handle should be reachable by either hand when the tow-line is pulled to 60o either side of straight- ahead ahead, 90o down and 180o down and back.

The release handle should ideally be on the opposite side of your harness from your reserve handle for consistency. You will have to fly one handed (both brakes in one hand) during the release and you should be in the habit of using the same hand to release, and get into the harness if it is not fitted with a stirrup.

Weak Links:
Weak links or safety links are required on every tow and should be rated to a strength of no more than 150% of the total pilot weight. They are usually connected between the tow line and the bridles and stay connected to the pilots’ bridle when the pilot releases. By keeping the weak link on the bridles each pilot keeps the weak link that is properly sized for them, and it prevents abrasion wear on the tow bridles. When the force on the

pilot is too great the weak link is designed to break, preventing excessive forces on the canopy. They are NOT designed to prevent lockout (if not familiar with this vocabulary then please read on). Weak links that are too weak have the potential to break while the pilot is still close to the ground leading to a surge that can make a safe landing difficult. Weak links should be changed regularly to ensure that they are still rated for the proper strength and that they don't break prematurely.

Hook Knife & Extra Reserve:

If something goes wrong during the tow process, a hook knife can be a very useful tool. They are primarily used as an emergency release in case the pilot can't find the handle or if the handle somehow won't release. All pilots on tow MUST have a hook knife. It should be sharp and unused, but one that is made of steel and hasn't been used much or is in very good condition will do the trick. If the tow line fails to release from the bridles for any reason, a hook knife may help you free yourself. Be sure to attach the knife to your harness in such a way that you can easily release it from its case with one hand. Many people make the mistake of attaching it without considering this and find themselves unable to access the knife with one hand. The tow-tech who is operating the winch will also have at least one hook knife within easy reach or a guilotine system on the winch in case an emergency situation presents.

In addition to having a good hook knife, many SIV instructors are making a second reserve part of their mandatory gear for anyone on tow. As per USHPA regulations, every pilot must fly with a reserve (one flights when successful deployment is possible), but having a second reserve in a front mount container can add an additional measure of safety especially if the pilot is training in advanced maneuvers. There are a few videos that show situations in which the main glider and reserve become entangled and the second reserve proved its utility.

Life Jacket/PFD:
During any towing that involves training over water it is required for all pilots to wear a life jacket or personal flotation device (PFD). When training in advanced maneuvers, there are several ways for a pilot to suffer an inadvertent water landing. These include but aren't limited to: aborted launch, malfunction with reserve deployment, malfunction without reserve deployment and mis managed approach to landin. Due to this potential, it is best to wear a life jacke/PFD to ensure you will not end up entangled in your equipment and unable to stay above the water. There are several types that are used – some of which will inflate automatically when you land in the water. These should be used in combination with a life jacket that does not reply on a mechanism to inflate.

Tow Lines:
Various types of line or rope can be used for towing. The most popular types are Nylon and SpectraTM because of their durability and strength. Nylon line has a much greater stretch than SpectraTM and can dampen oscillations during a tow. Generally it results in a smoother tow but is not as strong. Spectra lines are generally thinner, have less drag and will result in being able to achieve higher altitude tows.

Tow Systems:
There are 3 different types of tow systems commonly in use for paragliders. The static line, stationary winch, and pay-out winch. Static line towing is not an endorsed method as it does not rely on a device to moderate tow force. All methods must be able to limit or reduce the tow force, zero the force (hook knife), and be able to gradually increase and decrease the tow force. Under no circumstances should the line be tied to the spool in such a way that if the line were pulled to the end, it wouldn't automatically separate from the spool. Pilots should remain curious about the tow device being used and how it is being managed.

A reversing pulley may be used in some circumstances and should be able to swivel without binding the tow line between the wheel and block. Typically, the tow-lines are Spectra/Dyneema which is light and does not stretch very much.

Static Line Systems:
These systems use a fixed length of line attached to a moving vehicle. This is not an endorsed method of towing.

Stationary Winches:
Pay-in winches or Scooter tow systems remain at one end of the field or road and spool the line onto a drum to generate tension. The Tow Tech is able to adjust the tension with a hydraulic pump or with the engine throttle during the tow and can pay-out line if necessary. The altitude attainable is less than a pay-out winch on a moving vehicle but requires less operating distance.

Pay-out Winches:
These are mounted on moving vehicles and release line from the drum as the tow progresses. The pressure is moderated by the speed of the vehicle and various methods of adjusting the friction on the spool of line. It's the most popular method for maneuvers courses where the winch is mounted on a boat that can travel in large circles around the lake, towing the pilot to altitudes sufficient for maneuvers.

Towing and Weather:
Like all forms of aviation, the biggest factor in the go/no go decision is the weather. Because of all the extra gear and moving parts involved in towing it is critical that the conditions are appropriate for the pilot being towed aloft. All SOP's listed for pilot rating should be followed with concern to wind speed, gust factor, amount of cross wind, etc. This is especially true for new pilots and for pilots being towed for the first time. Keep an eye on the weather as the towing day progresses, and always err on the side of safety with respect to the conditions.

Summary:
Obviously there is a lot of information to process when preparing to do some tow flying. As with any flying you will do, be prepared and do your homework. Completing this course is extremely helpful and will help in many ways to make your first tows more

successful, but nothing substitutes solid on-site training. We recommend visiting the USHPA web site where you can download, study guides and checklists that you can bring to your first towing lesson. Listen to your instructors carefully and make every effort to execute their commands. Just as when you are flying, you are the pilot in command – tow pilots are reminded to take personal responsibility for their own wellbeing. Tow pilot beware, not all tow systems and tow operations are equal. Experience, skill and overall level of diligence vary greatly.

Some gear can be purchased ahead of time, especially if you plan to do more towing in your flying future – a good tow bridle and hook knife are great first purchases that will save time and any confusion with gear at the tow site.

Communication, Preflight, and Launching

Communications:

It is extremely important to have a solid communication system for coordinating and executing a safe tow. When using radios, the commands should be distinctive and not easily confused with other commands. “GO” and “NO” can sound alike and should not be used. “LAUNCH” and “ABORT” would be more appropriate. All members of the tow team should agree on these commands before towing. There are some recommended radio commands:

Take up slack – “More..More..More..”
Stop the tow – “ABORT! ABORT! ABORT!”
Ready to launch – “LAUNCHING!”
Increase tow tension – “More..More..More”
Decrease tow tension – “Less Tension..Less Tension..Less Tension..”

Tow Director likes flight path – “Yes..Yes..Yes”
Pilot ready to release – “RELEASING!”
Tow-Op ready to end tow – “RELEASE..RELEASE..RELEASE”

The Launch Director or Tow Tech may issue additional commands like “LEFT” or “RIGHT” to direct the pilot to follow the tow line and avoid lockout. It may also be helpful to use a number scale during the tow. Before towing let the Tow Tech or Launch Director know what climb rate you would like. As you are climbing call out “1” for 100 ft/min, “2” for 200 ft/min, etc. Be careful when you get to “4”! It sounds like “more”. Use “4 hundred” instead. The number scale will help the Tow-Op provide a more comfortable and smoother tow.

Visual signals may be used if radios are unreliable or unavailable. There are some recommended visual signals:
Take up slack – Extend one leg out to the side and back to center.
Ready to launch – Bend forward at waist once.
Increase tension – Flap elbows or make a running motion with feet.

Decrease tension – Spread legs to the sides, back to center, repeat.
Pilot ready to release – Spread legs and hold them there.
Tow-Op ready to end tow – Significantly reduce towline tension.

Preflight:
As with any launch you should always have a pre-flight checklist. Remember that the pre-flight is always the pilot's responsibility! The standard checklist can be modified for flights originating with a tow.
R1234–Big-Huge-STARVE.
Reserve Parachute – Check the handle and pins. Make sure everything is secure.
1 Helmet Strap – Check to make sure it is securely fastened. You should never attach yourself to a glider without your helmet on.
2 Carabiners – Check to make sure that the gates are closed and locked.
3 Harness Buckles – Give them a tug to make sure they are securely buckled.
4 Corners – From the two A risers and two D risers follow the lines up to the canopy to make sure they are clear and there no snags, knots, etc.
Bridles – Check that they are connected to your carabiners properly, attached to the weak-link correctly and will release cleanly.
Hook Knife – Make sure you have a hook knife within reach and easily ex- tractable from its case. You should be able to reach the weak-link with it! They are mandatory on

ALL tow flights:
Stirrup & Speed System – Check to see that your speed system is properly attached, routed, and clear of your reserve parachute handle and tow bridles. If you have a foot stirrup check to see that it is clear of your speed system and will be easily accessible after launch. This usually means putting one leg through/behind the stirrup bar.
Top & Turn – Make sure the correct riser is on top for the direction you will be turning after a reverse launch.
Airspace – Check the surrounding airspace to avoid collisions during launch.
Radio – Check for the correct frequency and that you can transmit and receive.
V-shape – Check for V's between brake lines and rear risers to avoid brake line twists.
Even pressure – Ensure that tension on A-lines are even when doing a forward inflation.
The Launch Director can assist you when preparing for launch, especially when it comes to testing the release mechanism.

Launching:
Your first tows will probably be forward launches as it is the easier to see the tow line and there are fewer chances for stepping on it. This will also depend on the wind conditions. The same rules apply to a forward on a tow line as a forward off a hill. The glider should be thoroughly checked for line tangles and laid out in a clean, curved shape so that the center cells inflate first. As the Tow Tech increases the tow force you should run and follow the tow line. Remember that you will still have to center yourself under the glider while being pulled by the tow line. This may require stepping to the side and steering the glider with the brakes.

In stronger winds, a reverse inflation is used. When performing a reverse inflation on

tow, set up to turn away from your reserve handle. In other words, the tow line must be routed to the opposite side of your reserve to avoid tangles or accidental deployments. Tow Techs should never build tension on the line while pilots are performing a reverse launch. This is to make sure that pilots aren't lifted off the ground while inflating and turning to face forward. An additional risk during a reverse launch is stepping on or over the line before takeoff. When the Tow Tech does apply tension, the pilot won't be able to turn forward if the line is on the wrong side.

Towing Procedures and Physics

Towing Procedures
Launch:
Once you have performed your pre-flight, connected to the tow line, and the Launch Director has given you the OK, you are ready to launch. When performing a forward launch the Launch Director (when utilized) will direct the Tow Tech to gently add tension to the line (taking up slack) or the Pilot will signal Tow Tech to "Take up slack". You should brace yourself against the pull of the line to avoid disturbing the canopy until you are ready to launch. When you are ready to inflate, signal Tow Tech with a "Bow", begin running forward, bring the canopy up overhead. Once you have the glider overhead and stable, in the forward position, the Tow Tech can be directed to add tension on the line and pull you aloft. Once aloft, the Tow Tech gradually begins developing tension until normal tow tension is reached and you climb at an appropriate rate. Remember to keep your feet down for at least the first 50' feet of altitude. If the tow pressure suddenly decreases or the weak link breaks you should be prepared to land on your feet.

Settling into The Harness:
Once you are at an appropriate altitude and following the tow line properly you may get comfortable in your harness. The same rules apply as when foot launching. Getting comfortable is a low priority, maintaining directional control is a high priority! Using a foot stirrup is always the most effective and preferable but is not available on all harnesses. The both brakes in one hand method can be used but pilots are to avoid inadvertently steering the glider off course. Use the hand opposite the reserve handle and bridle release to slide yourself into the harness while lifting your knees to your chest. If you are drifting left, push your control hand left. If you are drifting right, push your control hand right to correct your course and vice versa. Never let go of your brakes and/or grab the risers to help you get into the harness. Once you are comfortable, cross your legs at the ankles or put your feet together.

Actively Flying During the Tow Process:
When airborne you must concentrate on following the line to climb effectively and avoid lockout. If the tow runway is directly into the wind, following the line will be fairly easy as the tow line will remain fairly straight. However, if there is a crosswind or you strayed off course early in the flight there may be a large "bow" in the line. You must steer your glider gently toward the bow regardless of where the tow rig or runway is. The line should be perpendicular to your glider. With your feet together and in front of you the

line should lay loosely between your feet. Think of it as a gun sight. If it is pulling to either side of straight ahead or pushing on one foot more than the other, you should correct your course appropriately with as much weight-shift as possible and only as much brake as you need. Control inputs on tow will be delayed but have a greater effect when the glider does react. When you are perfectly aligned with the line you will feel the “neutral point” where your glider needs no input to fly straight. Maintaining at least a light pressure on the brakes will help you find and feel the neutral point. Remember to be gentle and progressive with your control inputs. Constantly monitor the angle of your leading edge to the tow line in order to avoid over correcting. If the Tow Tech sees that you are approaching lockout, they will immediately decrease the tension on the tow line to help you then reapply tension when you are following the line.

While the Tow Tech controls most of the tension on the line, you may fine tune the tension and your climb rate by adjusting your brake pressure. Adding VERY SLIGHT brake pressure slowly will increase your climb rate in some cases. Decreasing your brake pressure toward the end of the tow can increase the angle of the line relative to the vehicle and result in higher tows in some cases. Listen to the Tow Tech for instruction about how to maximize altitude gains. If the Tow Tech increases tension dramatically, or if you hit a thermal, your glider may be behind you and you should decrease brake pressure until the glider is back above head. While deflations are not common on tow, pilots are refined to always modulate the brakes to defend against deflations.

Releasing from the Tow Line:
There are a number of reasons to release from the tow line; when maximum height has been reached, if there is significant slack in the line, if you find a thermal that you would like to turn in, if you receive a release command from the Tow Tech, or if anything looks wrong and you feel so inclined, you should release. If you are still under full tow force on a normal tow, it is customary but not required for you to alert the tow operator that you are about to release. Releasing under significant tow pressure can result in a surge which you might need to manage. Place both brakes in the hand opposite from your release handle and stick your hand to the center of your forehead (to avoid causing a turn). With the other hand, reach forward and pull the release handle. If there is still tension on the line, the glider may surge slightly. The bridle and tow line should separate and you should confirm that this takes place. Do not alter direction of flight until confirmation of tow line fully released. If the release mechanism fails to release the line due to lack of tension you may have to grip the line between your feet and push it away from you while pulling the release handle or use whatever means necessary to release. If there is any other sort of malfunction it may be necessary to use a hook knife to cut the weak link or release both brakes and fix the malfunction. It is very uncommon for releases to malfunction. It is important that during the release procedure you not fly beyond the tow rig, beyond the turnaround pulley or drift off course.

If the Tow Line Breaks:
During the tow there is a significant amount of force on the tow line and weak link. Old or worn tow lines may spontaneously break and cause a surge. You should be prepared

to deal with a sudden and strong surge at any time but especially during the first third of the tow when you are low altitude. If the line breaks you may be dragging a significant length of it behind you. It is important that you release the line from your bridle to avoid the risk that the line can snag on an object. A line break can feel like a weak link break which can make it so that you won't realize that you are dragging the tow line. Always check to make sure that you have separated from the tow line after suffering a tow line break.

If the line has become snagged on a ground object you must release immediately, use a hook knife, or fly circles (or figure-8's) over one spot to avoid putting tension on the line. Flying circles will stack the line over the snagged object, allowing you to descend without tensioning the line.

Step-Towing:
Step-towing is a technique used to gain altitude beyond what the tow rig would otherwise be able to tow a pilot to in a given area. It can be performed when doing stationary or a payout tow. The general idea is that once the pilot reaches the normal release point, the pilot continues and pulls additional line off of the spool. At some point the pilot turns back toward the line and is towed aloft to a higher altitude. There are some added risks associated with this method and it should not be used by inexperienced pilots or Tow Techs. Among these risks, if the tow line snags on the ground or a turnaround pulley, if the spool of line somehow locks up, or the Tow Tech doesn't coordinate the turn, the results can be catastrophic.

Towing Physics:
In order to safely perform a tow launch you should understand some risks, physics, and basic forces that will be exerted during the tow process. The tow system is designed to apply a relatively specific and narrow range of pressures to the glider. Too little pressure and the glider descends. Too much pressure can be uncomfortable or lockout can occur.

When the system is working properly the savvy tow operator is able to adjust the tow forces such that the glider gains altitude, without over-towing. Typical pressure for a pilot new to towing is 60-75% of their flying weight. However, there are some situations, depending on the type of tow system used, that can change the tow forces unexpectedly. It is also difficult to measure tow force in most cases. Talking with the tow operator about your preferences before and after the flight can help avoid misunderstandings and yield the best tow experience.

Line dig is the most common and occurs when the line on a pay-out winch has become stuck either between other lines or on part of the tow rig and suddenly stops paying out. The tow system instantly becomes a static tow and tow forces can escalate quickly depending on the speed of the tow vehicle. Use of a properly sized weak link will prevent anything more dangerous than a weak link break from occurring.

As line is spooled onto the drum during a pay-in tow the spool diameter increases and,

at a constant RPM, the tow force exerted on the glider will decrease. During a pay-out tow, where the spool diameter decreases, the line force will increase. The tow operator should be aware of these trends and should adjust for either scenario.

Some stationary winches utilize a roller bearing or similar to guide the line. In some crosswind situations, there can be more friction on the line than when the tow device is oriented straight with the wind. Most winches will use a castering guide so that this is not a factor.

During any tow the force exerted by the tow line will pull the pilot ahead of the glider. This results in an increased angle of attack, and an increased wing loading especially at higher line angles. Most paragliders do not turn well at high angles of attack which may prompt the pilot to use more brake input to perform a turn. Because the glider is already at a high angle of attack, more brake may stall the glider. The increased wing loading has also increased your stall speed. Increased stall speed + increased angle of attack + brake is a dangerous combination. For this reason, speed assists and light brake inputs are encouraged. Having said this, it can also be important to make a decisive input to correct a glider which has been allowed to diverge to either side. Pilots should give sufficient input to arrest the drift but not over-do-it.

Lockout:
By definition, lockout occurs when the flight path of the paraglider diverges from the towline force by 45 degrees or more or if the glider rolls past 45 degrees from level flight. Lockout can occur if the pilot allows the glider to turn too far off to the side and can be compounded if the Tow Tech applies too much force on the tow line. In extreme cases, a glider will begin to rapidly diverge from the tow line direction and can point leading edge down, toward the ground. Lock out can be easily avoided if the pilot commits to quickly looking back and forth from tow vehicle to the leading edge of the glider, meanwhile steering to keep the glider pointed at the vehicle as the top priority. Once lockout has developed the glider will be difficult or impossible to steer and if allowed to continue, will result in injury. To prevent lockout or fix it once it has happened, the Tow Tech should reduce the tension on the line, or the pilot should release from the tow line. When the Tow-Op reduces the tow force the pilot will be allowed to swing back underneath the glider and steer back toward the tow line. It is possible to correct from this and continue the tow. If the Tow Tech fails to reduce the tow force the pilot MUST release immediately. Because of the high tow forces needed to maintain a lockout you should be prepared to manage the surges after release. If both the above methods fail, deploying the reserve will slow the descent and avoid injury.

Over-Towing:
By definition, over-towing occurs when too much tow force or control input has been applied to the glider. It can manifest as excessive climb rates with the glider excessively far behind the pilot's head. It may also be exacerbated by thermal activity during the tow. In extreme cases and most typically during take-off, over towing can manifest as a deep stall (aka parachutal stall) induced by an excessive angle of attack. When over

towing is combined with excessive brake close to the ground, pilots can be left without sufficient altitude to recover.