Bob Wander's

GLIDING MENTOR

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USA, glider pilots may have been trained to expect a wave off signal from the towplane. It's a good idea, when serving pilots trained overseas, to make sure that the towpilot and the glider pilot have the same procedures and expectations in mind.

The glider pilot must always assure that glider airbrakes and closed and locked during takeoff and climb, and that the glider does not get too high on the tow, in relation to the towplane wake. The towpilot must maintain VFR minimums, deal with airspace considerations, scan for other aircraft, and yield right of way to gliders. Other engine driven aircraft must yield right of way to the aircraft towing the glider. (FAR 91.113)

Towplane Airworthiness

The Pilot In Command of the towplane is responsible for the airworthiness of the towplane (FAR 91.7). This includes the inspection of the required paperwork. The mnemonic word **AROW** is useful:

- **A**irworthiness Certificate
- **R**egistration (to current owner)
- **O**perating Handbook and Placards
- **W**eight & Balance Information

Aircraft, Engine and Propeller logbooks must indicate the following:

- Current Annual Inspection
- Compliance with Airworthiness Directives (AD Notes)
- Tow Hook and Mirror STC, or entry that indicates compliance with the aircraft manufacturer's certification data sheet, permitting installation of a towhook and mirror. A Form 337 is required.
- Weight & Balance: Make sure it is up to date with all modifications. Do not carry excess weight in the aircraft, such as oil containers, extra towropes, and passengers.

The towpilot should know when the next oil change, repetitive maintenance, inspections per Airworthiness Directives, propeller overhaul, ELT battery and the annual inspection are due. A listing of these items along with weight and balance information may be placed in a binder to be carried in the towplane for each tow pilot to inspect.

By recent interpretation of FAR 91.409, if no passengers are carried for hire nor any flight instruction is conducted for hire, the towplane does not require a 100 hour inspection.

Tow Release Handle: Check operation. Note the direction of movement for release. Handle must be clear of lap belts, shoulder harness, cushions, etc.

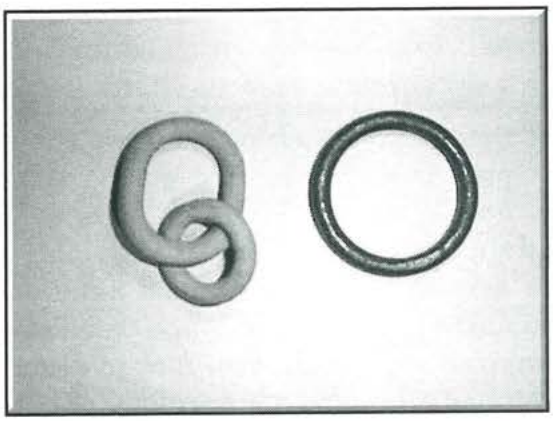
Mirror: Clean and adjust for clear view of the glider.

Windshield and Windows: Clean and in good condition. You need to see & avoid traffic.

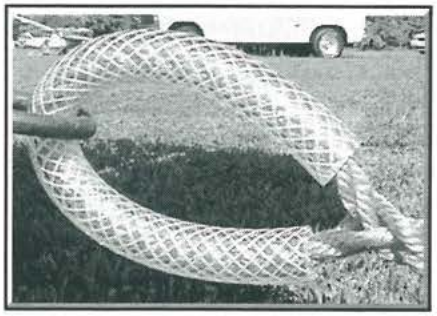
A short warm-up flight around the patch without the towrope or glider gives the towpilot a chance to check all systems, temperatures, and pressures before the first aerotow. On this flight the towpilot can also observe the height of the cloudbase, wind strength aloft, and any low-level turbulence in the vicinity of the airport.

During the flying day, dipstick the fuel often. If you take a break, or change towpilots, another preflight should be accomplished. At the end of the flying day, do a postflight inspection, so any items that need attention or repair may be addressed before the next flying day. This prevents the dreaded and disappointing "Oops - we can't fly - the towplane is broken" situation.

Tow Rings

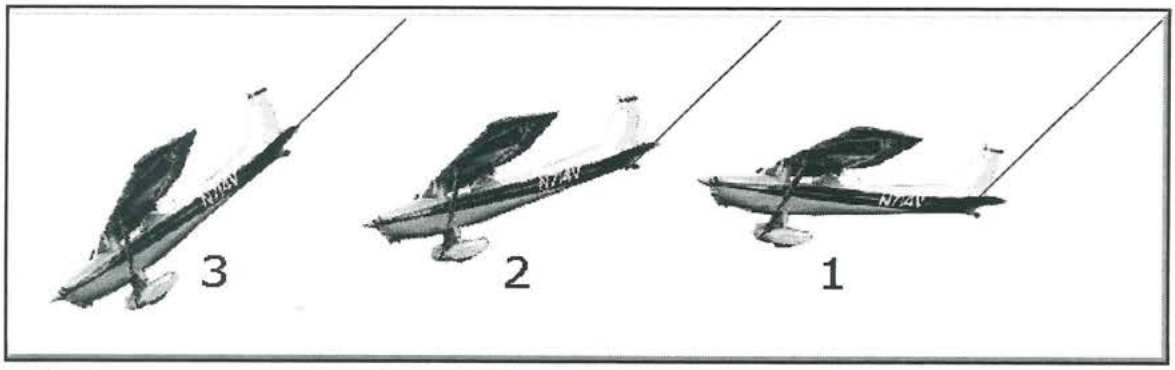


Steel alloy tow rings are available from glider parts dealers. Never use chain links from the hardware store! Rings for towing gliders must be a particular size and shape and properly welded. The diameter and shape of the steel ring is specific to the glider towhook used. The tow ring at the towplane end must be the appropriate type of towring for the towhook fitted to the towplane. An improper fit may cause the towrope to release prematurely, or perhaps to fail to release when the release handle in the cabin is pulled. American-built glider towhooks (such as found on the Schweizer series of single-seat and multi-seat gliders) usually require a large round Schweizer steel tow ring. European-built gliders commonly require a smaller, two-part ring, often identified as a Tost ring after the prominent German manufacturer of glider towhooks and towrings. Tow ring sources can be found in SOARING magazine every month.



Tow rings are attached to the rope by a braided eye in the rope, never by a knot. Consult your rope vendor or marine store for information on how to braid and make eyes in the particular type of rope you are using. Clear plastic tubing may be slipped around the eye where the tow ring will ride to reduce wear. Inspect the towrope and tow rings daily.

The towpilot must never assume that the towrope is the allowable strength for the glider you are about to tow. A rope that is too weak puts the glider pilot at risk of rope break and premature release. A rope that is too strong may put the towpilot and the glider pilot at risk. The towpilot (more, perhaps, than the glider pilot) wants the towrope to break if the glider kites up high above the towplane during the early portion



of the aerotow, causing the towplane tail to be pulled up and the towplane to be pointed down toward the ground. **This kiting is obviously a very hazardous situation for the towpilot. It is to be avoided at all costs. In such a kiting situation, the towpilot of a towplane that has been upended may not be able to activate the tow release handle due to the excessive friction loads that result on some towplane towhooks. It may also be difficult, or even impossible, for the towpilot to reach the tow release handle if the towplane tail has been lifted vigorously enough for the towplane to undergo negative "G". In this situation, the towpilot is also undergoing negative "G" and may find that it is impossible to reach down far enough to activate the release handle if it is mounted on the cabin floor.**

There is no other FAA requirement beyond FAR 91.309 (towrope strength) for any paperwork, yellow tags, inspections, etc. for towropes or tow rings. Your local FAA inspector may question this during a ramp check.

Towrope Maintenance

The towpilot must inspect the towhooks, towrope and tow rings as part of the preflight inspection. Towropes and tow rings will suffer wear and decrease in strength with repeated use, especially during landing and taxiing. Ultraviolet light will also reduce the breaking strength of a rope exposed to the sun. Broken strands, especially around the tow rings, reduce the integrity of the towrope, and make the breaking strength of the towrope an unknown quantity. Oil, gasoline, and other solvents do nothing good for the towrope.

A knot in the rope will reduce the rope strength by about 50%. Knots are never the recommended method of managing your towrope breaking strength. Flightline crew members should watch for developing knots in the towrope as the towplane pulls out the slack before takeoff. Knots, at least loose knots, develop with surprising regularity during aerotow operations. Knots usually develop due to the quick forward snap of the towrope in the second or two just after the glider pilot pulls the release knob and the towrope springs forward as the towing load drops to zero. Knots are also created during the whipping of the towrope behind the towplane during descent. One way of reducing the likelihood of knots is to install a plastic funnel of about 4 inches diameter facing aft on the glider end of the towrope, about 16 inches from the tow ring. This funnel will minimize the whipping of the towrope into a knot just after release and during descent behind the towplane. A funnel will also lift the towrope a bit higher over obstacles during landing, and help the towpilot and ground crew locate the end of the towrope while taxiing. Naturally, the funnel must be adequately secured so that it can not slide down the towrope and interfere with the glider towhook.

Store the towrope on a plastic reel. Hardware stores sell reels designed for long electrical extension cords. These reels are inexpensive and work well for towrope retrieval and storage. Store your towropes in a dry place, out of direct or indirect sunlight. Mark the length of the towrope on the reel. It's an excellent idea to keep several towropes ready for use. Reel up the ropes after flying so the airport manager does not ask you to untangle them from his mowing equipment. Towropes left lying about may be caught up by an airplane propeller and landing gear. A discarded or extra towrope left laying along the runway may also be picked up by a glider wingtip while taking off and jam in the aileron gap. It has happened!

Towrope Length

There is no FAA regulation regarding the length of the towrope. In the USA, towropes are typically 175 to 225 feet. Towropes tend to grow shorter with time, a result of cutting and rebraiding towrope ends due to wear. If the glider pilots are having a hard time staying in proper position during the aerotow, you may need to check the towrope length. The width of your runway is usually a known distance and can be used as a ready yardstick to measure the length of your towrope.

A long towrope (200 - 225 feet) may be best for the student to learn the aerotow. Long towropes are preferred for cross-county aerotow retrieval flights, during which the glider and towplane are in level flight for a long period. This level-flight cruise phase of aerotowing presents some differences from the climbout portion of the aerotow. The airspeed is usually higher during cross-country retrieve cruise mode. During aerotow level-flight cruise, some glider pilots prefer to fly below the towplane wake in the low-tow position. This keeps the towplane in sight and reduces the tendency of high-performance gliders to over-run the towplane. Note, though, that low-tow position may not suited to gliders that use a belly hook, rather than a nose hook, for aerotow.

A short towrope requires a much higher degree of skill and attention on the part of the glider pilot. **A short towrope increases the risk of the glider quickly getting out of the proper tow position, and lifting the tail of the towplane. For this reason alone, extra vigilance is absolutely essential if a short towrope is employed.** A short towrope may be desired because of the short length of the runway or field used for takeoff. Short towropes trail higher behind the towplane during landing and are easier to manage while taxiing. **Nevertheless, the hazards of short towropes almost always outweigh any advantages the short towrope may offer.**

Towrope Strength

The towpilot must know that the towrope will break under excessive load, so that neither the towplane nor the glider structure will be damaged. New pilots are often surprised by the small diameter of towropes. This sense of surprise disappears as they discover that, in the towplane-towrope-glider equation, the towrope should be the breakable, frangible part. During the aerotow, when the glider is in normal position for climbout, the static load on the towrope is only about 50 pounds or so - sometimes even less. This relatively low static load on the towrope is the result of the low drag and aerodynamic efficiency of the glider being towed.

Towrope breaking strength is regulated by FAR 91.309, which requires that the towrope be no stronger than 200% of the maximum certified weight of the glider being towed, and no weaker than 80% of the maximum certified weight of that glider. Maximum certified weight is the *maximum gross weight* of the glider, not necessarily the *operating* weight of the glider on any particular flight. A towrope must comply with the 80%-200% rule for each glider before every tow.

FAR 91.309 describes the FAA's view on permitted towrope strengths. However, the FAA is not the only authority with an opinion on towrope breaking strength. The POH for the glider being towed should also be consulted. Many glider types (notably many German-designed gliders) have a maximum permissible towrope strength listed in the POH for the glider. This POH maximum permissible breaking strength is often less than 200% of the maximum gross weight of the glider. The reason for this limitation is the glider designer's intent to protect the glider towhook or towhook attach points from excess load. The prudent glider pilot will comply with these limitations.

A towrope must comply with the 80%-200% rule for each glider before every tow. For example, a Blanik L-23 has a maximum certified weight of 1124 pounds. (These gliders typically have an empty weight of 700 pounds. The operating weight of an L23 might be as little as 854 pounds when flown solo by a minimum allowable weight pilot in the front seat, but the towrope regulations reference the maximum gross weight of the glider, not the operating weight of the glider). Calculation of the minimum and maximum allowable towrope breaking strength for the Blanik L23 glider follows.
200% of 1124 pounds = 2248 pounds, the maximum allowable breaking strength of the towrope used to tow a Blanik L-23.
80% of 1124 pounds = 899 pounds, the minimum allowable breaking strength of the towrope for this particular glider.

The towrope vendor can usually supply the breaking strength of the rope. Marine supply stores sell rope by quantity and have the printed data in their catalog for the rope strengths. Make a photocopy of the rope data for your curious FAA inspector and put a copy in the towplane.

Typical rope strengths by the diameter are provided in the SSA *Soaring Flight Manual*, Chapter 12. Towropes of known strength are available from vendors listed in SOARING magazine. Note: Do not use nylon fiber ropes because they stretch excessively. Most towropes are polypropylene or dacron, and 1/4 inch outside diameter, which gives a typical breaking strength of about 1200 pounds.

Weak Links

A typical weak link (sometimes called a safety link) is a smaller diameter rope of about 24 to 48 inches in length, attached to the glider end of the towrope. It has its own tow ring for attaching to the glider, and a braided eye loop for attaching to the tow ring of the towrope. This short safety link has a known breaking strength, less than the towrope breaking strength, and is used for lighter gliders. The weak link must meet the 80%-200% breaking strength requirement relative to the maximum certificated operating weight of the glider being towed. To satisfy the requirements of FAR 91.309, a weak link must be installed on each end of the towrope as described below.

Making a tow with a glider that is very lightweight, such as the American built single place Schweizer SGS 1-26, will shift the allowable towrope breaking strength limits to lower values. In this event, a pair of weak links may be installed. The weaker of the two weak links must be installed on the glider end of the towrope, and must meet the 80%-200% rule relative to the maximum gross weight of the glider being towed. The weak link on the towplane end of the towrope must also meet the 80%-200% rule relative to the maximum gross weight of the glider being towed, but must also be stronger than, but no more than 25% stronger than, the weak link at the glider end of the towrope (FAR 91.309). The preferred result of a towrope or weak link breaking is that the towrope not fall back onto the glider in flight, but remains with the towplane. When employing weak links, make certain that the tow ring on the glider weak link is suitable for the glider being towed, and that the towring on the towplane weak link is suitable for the towhook installed in the towplane.

Towrope Management

After release, never fly close to other aircraft (glider, airplane, hot air balloon) with the towrope attached. Air-to-air photo flights should never be attempted with a towrope trailing the towplane. When flying the approach to landing, always assume that the towrope is still attached, even if you released the rope on a previous pass. Only when you have received reliable verbal or visual confirmation from a knowledgeable individual that the towrope is no longer attached to the towplane can you safely fly the approach without risk of the towrope snagging something or someone on the ground during your approach to landing. After landing, if the towrope is still attached to the towplane, taxi slowly. The towrope tends to snag tiedown rings, clumps of grass, runway border markers and light stanchions, and other airport objects (including other aircraft and other people!). Best preventative is to taxi slowly.

Dropping The Towrope

At 200 feet over the drop zone, make sure the rope will not fall near people or aircraft on the ground. When released, the towplane end of the rope will fall almost vertically to the ground. The towplane then goes around to land while the ground crew retrieves the rope from the runway.

FAR 91.309 states that "no pilot of a civil aircraft may intentionally release a towline, after release of a glider, in a manner that endangers the life or property of another." An FAA Inspector observing your rope drop may offer an opinion as to your compliance with this regulation.

Flight Operations

Aerotow Signals

Towpilots must know all the standard aerotow signals. This is true whether or not radio communications are used during aerotow operations. Two-way aviation radio communication, while highly desirable, is a luxury at many sites. Nevertheless, it would be a mistake to rely exclusively on radio use for aerotow communications. Radios can fail due to electrical problems, component failure, radio interference from other aircraft radios, and operator error (such as selecting the wrong frequency or misplacing the microphone). The standard tow signals will prevail in an emergency. Know the signals. The signals are attached to this manual, and a copy should be kept in the towplane. They are also illustrated in the SSA *Soaring Flight Manual*, Chapter 12.

Propeller

Do not let anyone approach the aircraft near the propeller, whether it is turning or not. Props are always considered "hot", even when the magneto switch is turned to OFF.

Fuel

Operating the towplane with less than full tanks for weight and density altitude considerations is common practice. The towpilot must positively know the minimum amount of fuel required for a tow, plus at least 30 minutes of flight per FAR 91.151. Always dipstick the fuel tank. Never rely on the fuel gauges.

Towpilot Aeromedical Considerations

The repetitive nature of flying the towplane can lead to complacency. The only way to manage the risk in aviation is to think through all the possible scenarios, review your options as they change from second to second, recognize a potentially dangerous situation before it develops further and react with the correct action.

Lack of attention, especially to the airbrakes of the glider or the position of the glider on high tow, will cause a serious accident. Be alert. Stay focused.

The towpilot **IMSAFE** checklist:

Illness: Do I have any symptoms?
Medication: Have I had prescription or over-the-counter drugs?
Stress: Am I under pressure to rush the tow? Personal concerns?
Alcohol: Have I been drinking within 8 hours? 24 hours?
Fatigue: Am I tired, yet willing to fly "one more tow"?
Eating: Am I hungry and thirsty?

The towpilot works hard so that others may enjoy the sport of soaring. The towpilot makes the go/no-go decision and should never feel pressure to hurry the towplane preflight inspection, the towhook and towrope inspection, or the tow itself. Consider taking a break after five tows. Know your personal limits regarding fatigue, concentration, hypoxia, hunger and thirst. Do not underestimate the problems associated with dehydration in any climate.

The towpilot must manage more risk than any other pilot on the airport. Know your towplane, the aerotow signals, the emergency scenarios and all your options. You may have to rely upon your knowledge and preparation to save yourself one day!

The Towpilot-Glider Pilot Briefing

Regulatory Considerations

FAR 91.309 states that no person may operate a civil aircraft towing a glider unless "The pilots of the towing aircraft and the glider have agreed upon a general course of action, including takeoff and release signals, airspeeds, and emergency procedures for each pilot."

As a minimum, the FAA has interpreted this regulation to mean that the towpilot and glider pilot have had the training in the recognized procedures, the aerotow signals, and a written or verbal orientation to the airport operations. On the other hand, the

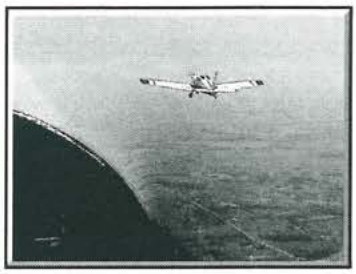
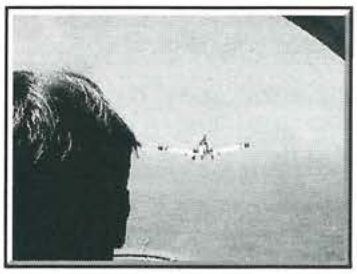
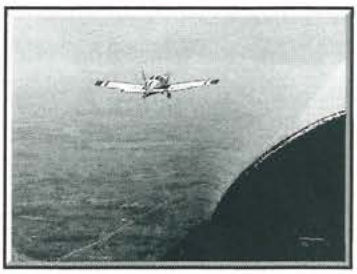
FAA has also been known to revert to the strict reading of the regulation, and inquire as to the exact nature of the briefing if an incident occurs.

Before any aerotow, and especially on a glider rating practical test with an FAA Examiner, the glider pilot and tow pilot would be well advised to meet face-to-face and discuss the items listed in FAR 91.309.

As a matter of procedure at many glider clubs and commercial operations, a daily briefing is held that includes the line crew, towpilots and glider pilots to discuss the takeoff direction, departure pattern, release point, landing pattern and taxi routes. Runway length, density altitude, emergency procedures and options for the wind direction and runway to be used, along with a review of signals, is part of this briefing. It is essential to hold another briefing when conditions at the airport change.

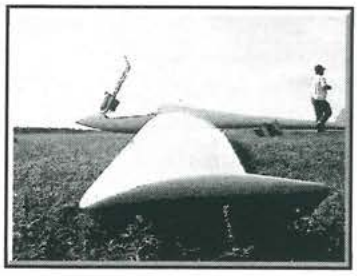
Training Flight Briefing

Training flights with students may require premature termination of tow practice, a wake box, a slack rope demonstration, or the demonstration of emergency signals such as the rudder waggle from the towplane. It's definitely best for the Glider Flight Instructor to alert the towpilot to any unusual towing demands. Prior knowledge of towing maneuvers required for the training flight protects all parties concerned. The towpilot has the option to signal the glider to release if things get out of hand.


Typical Soaring Flight Briefing

Soaring flights require an aerotow that takes the glider to the best lift conditions in the area, considering airspace restrictions and wind conditions. It is usually preferable to tow upwind of the airport. If requested by the glider pilot, a tow to a release point downwind of the airport means the glider pilot must locate rising air immediately or risk a land-out.



Introductory Glider Ride Briefing

Introductory glider ride flights are routinely offered to introduce the general public to soaring. Depending on the fee charged, the aerotow may go up to one mile high (5300 feet AGL). Hold a briefing to discuss release altitude, airspace considerations, wind direction and engine temperature limits. Always dipstick the fuel tanks before a long aerotow. Give the standard release signal if you must terminate the tow.

Towing Heavy Gliders

Aerotow Airspeed Selection

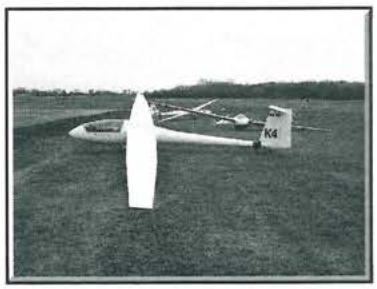
Different gliders require different aerotow airspeeds. This is a result of the wide range of glider weights and glider wingloadings that we encounter in gliding. Lightweight gliders possessing a large wing area may have a wing loading of as little as 3.5 pounds per square foot of wing area. On the other end of the spectrum, heavily ballasted racing gliders may feature a wingloading of 12 or more pounds per square foot of wing area.

Lightweight, large wing-area gliders, such as the SGS 1-26, SGS 2-33, and many antique gliders, can easily handle aerotow airspeeds as low as 55 knots - slower than most towplanes can tow efficiently. These gliders feature large flight control surfaces and low stall airspeeds. While light wing-loading gliders have their advantages, such as short takeoff roll and low stall airspeed, they also tend to get rocked around quite a bit on turbulent days primarily because they are so light. Pilots of these gliders must be extra vigilant on turbulent days to maintain the desired tow position.

Intermediate gliders such as the Blanik L13 and L23 and the Schleicher K6 and K8 tow well at an airspeed of 60-65 knots or so.

Ballasted racing gliders tend to require the highest aerotow airspeeds. Some of these gliders can carry 500 (or more) pounds of water ballast. This additional weight causes





a substantial increase in the glider's wingloading, stall airspeed, and minimum controllable airspeed. Heavily ballasted gliders also require substantially higher airspeed to achieve liftoff. Towing heavy gliders requires careful consideration. The take-off roll will be longer. The rate of climb may be slower. The required towing airspeed may be higher due to the relatively high stall speed of a heavy glider. The target airspeed for aerotowing these gliders may be 75 knots, 80 knots, or more. Be sure to consult with the glider pilot regarding the preferred tow airspeed for any racing glider before the launch begins.

When towing heavily ballasted racing gliders, the towplane must stay in ground effect until the towplane-glider combination has accelerated to the agreed-upon airspeed for climbing out. Only after this airspeed has been reached should the climb out of ground effect begin. When aerotowing these gliders, it is often possible for the towplane to lift off before the glider pilot can lift off. This is particularly true of lightweight, low wing loading, high-power towplanes such as the 235 horsepower and 260 horsepower Piper Pawnee. After the towplane lifts off, if the towplane begins to climb out of ground effect prematurely, the glider may be unable to leave the ground because the wings of the glider have not yet provided enough lift for the glider to rise off the runway. As a result, it's possible that the towplane could climb to an altitude of 20 feet, 40 feet, or more while the glider is still rolling along on the ground, struggling to achieve liftoff airspeed. In this situation, the downward pull of the towrope on the tail of the towplane degrades pitch control in the towplane. Likewise, the upward pull on the nose of the glider may cause great difficulty for the glider pilot. This hazardous, low-altitude situation must be avoided, prior to launch, by mutual agreement between towpilot and glider pilot regarding critical airspeeds for towing the glider.

Before Takeoff

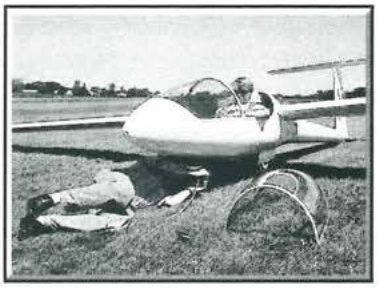
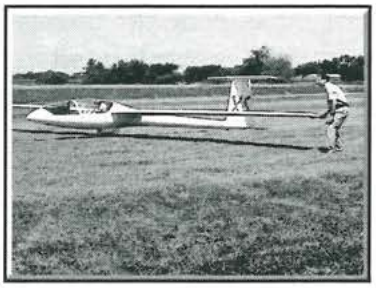
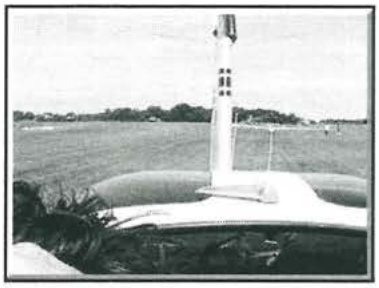
After the preflight and runup in accordance with the towplane POH, position the towplane in accordance with your glider operation procedures. The towplane should be well clear of the runway, as should the trailing towrope. Start the engine only after clearing the area visually and verbally. Shout "Clear!" and look around for people and aircraft behind you. Never let anyone approach the towplane with the engine running. On windy days people will chase their hat, lucky flying towel, or candy wrapper directly towards a turning propeller.

Takeoff With Glider In Tow

Taxi into the hold short position at 90 degrees to runway, about 100 feet ahead of the glider to be towed. Stop the engine. Attach the towrope to the towplane.

Observe the glider closely. When wings are level, this means glider pilot has finished the checklist, the canopies and airbrakes are closed and locked, the tail dolly has been removed from the glider, the towrope is hooked to the glider, the airport traffic pattern is clear, the runway is clear, and the glider is ready for immediate takeoff. If the glider wing is lowered back down to the ground, STOP.

Confirm that the propeller, pattern and runway are clear, start the engine, check the engine instruments, and taxi onto the runway. Take up slack as the appropriate

signals are given by ground crew, or by radio advisory from the glider. When the towrope is taut, wait for the takeoff signal from the ground crew, or by rudder waggle of the glider, or by radio advisory. The radio advisory from the glider pilot should say: "Glider canopies and airbrakes closed and locked, ready for takeoff".

Gliders equipped with radio share the 123.3 / 123.5 MHZ radio frequencies with other glider operations and flight schools (in accordance with FCC frequency allocation), so the source of radio transmissions must be positively identified. If in doubt, do not start

the aerotow. Gliders have been towed aloft with no pilot in the cockpit, or just the student without the instructor. Be positive that the glider is ready before you begin the takeoff roll.

When conducting towing operations in controlled airspace, ATC must be notified per FAR 91.309. When operating at a non-towered airport, consideration should be given to using the CTAF (Common Traffic Advisory Frequency), at least by the towplane if radio-equipped.

Begin the tow only when you are positive that the pattern is clear in every direction, the runway ahead is clear, the glider is ready and spectators are standing well away. If you have a doubt, re-confirm.

When everything is good to go, advance the throttle briskly, and check engine oil pressure and engine RPM. If your towplane is equipped with a manifold pressure gauge, check it also. Look into the mirror to confirm the glider airbrakes are closed. If the airbrakes are open, the rudder waggle signal is intended to alert the glider pilot that the airbrakes are open, and should be closed immediately. Make certain that towpilots and glider pilots are up to date on aerotow signals. Your life, and the lives of your soaring friends, may one day depend upon it.

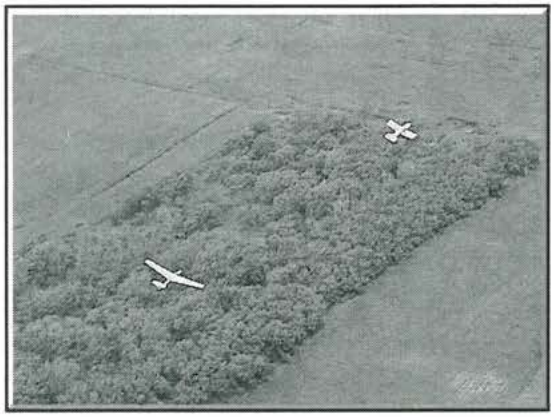
If glider gets high and out of position, you may rock the towplane wings to signal the glider pilot to release the towrope. If you are losing elevator authority in the towplane due to a kiting glider on aerotow behind you, pull the release handle. If you have a partial power loss and are unable to hold altitude, you must take the same action. Know the aerotow signals. Know your limits, and the limits of your towplane.

Departure Procedure

Climb at full power, or per the recommendations of your aircraft flight manual, at an airspeed which will give an adequate rate of climb for the towplane-glider combination, while assuring sufficient control response for both the towplane and the glider. Do not exceed the maximum permitted aerotow airspeed of the glider you are towing. The maximum permitted aerotow airspeed is usually placarded in the cockpit of the glider,

and can be found in the glider's Pilot Operating Handbook.

Climb upwind of the airport. Turn at no more than 20 degrees of bank and stay within gliding distance of the airport. Do not make continuous turns, because it decreases rate of climb and because it is harder for student pilots to follow a towplane that is always turning. Tow upwind of the airport. Seek thermals under cumulus clouds to assist the climb, but keep a careful lookout for other aircraft. Remain cloud clearance as required by the FARs, but DO NOT LEVEL OFF. If you level off without the glider moving to the low tow position, the glider may overrun the towplane. Finally, always continue to climb until you are sure the glider has released. It is dangerous and frightening to begin an aggressive descent, only to discover that the glider has not yet released from aerotow. And if you think it is unpleasant from the towplane point of view, you should see it from the glider pilot point of view! So, make certain, absolutely certain, that the glider has released from aerotow before you begin your descent to the airport for the next tow.



Release And Descent Procedures

In accordance with long-established practice in the USA, the towplane will always turn left and descend after glider release. The glider turns right, away from the towrope and towplane. Watch for traffic below, especially other gliders.

Make sure the glider has released before you begin to descend. If in doubt, and within gliding distance of the airport, rock the towplane wings.

During descent, you must keep the engine developing power to avoid shock cooling, which can crack the engine cylinders. Check the temp gauge(s). Reduce power in steps. Consult the aircraft/engine manual. If you use flaps during the descent, keep the airspeed well below maximum flap-extended airspeed. If you use the no-flap fast descent, be extra vigilant in your scan for other aircraft. Be careful making steep turns which limit your scan and may damage the engine mount by imposing higher "G" forces. Decelerate to pattern airspeed before entering the traffic pattern and fly a wide pattern in order to not overtake a glider flying at 50 knots.

Descend well away from the airport, preferably over unpopulated areas, so as not to confuse any local or transient airplane traffic in the pattern. This is also useful for noise abatement. To avoid gliders that may be congregating in thermals, do not descend under cumulus clouds. Instead, descend in the sink areas between the cumulus clouds to facilitate your descent and to reduce risk of traffic conflict with gliders in the area. Fly a wide pattern around the airport, outside the glider traffic pattern.

Landing The Towplane With The Towrope Attached

Landing pattern with the rope, or when making a pass to drop the rope, should be with the prevailing traffic pattern. Always land into the wind. Do not attempt downwind landings with the towrope.

On final approach with the towrope, cross the runway threshold or last obstacle (fence, trees, people, or aircraft) at exactly 200 feet AGL. One method to ensure clearance is to descend to 300 feet AGL on final, then slow the descent rate by adding power, to cross the threshold at 200 feet AGL.

When landing with towrope attached, land long. Throttle back over the threshold, and slip if needed. The towrope will touch the ground before the towplane lands.

Dropping The Towrope

At 200 feet over the drop zone, make sure the rope will not fall near people or aircraft on the ground. When released, the towplane end of the rope will fall almost vertically to the ground. The towplane then goes around. The ground crew retrieves the rope from the runway. The towplane lands only after ground crew members are well clear of the runway.

Crosswind Operations

Landing in a crosswind, the end of the towrope will swing considerably far out to the downwind side of the runway. Make your approach on the upwind side in any amount of crosswind. Ensure that you have adequate clearance for both the towplane and the trailing towrope.

Go Arounds

Yield right of way to gliders in the pattern. Go around if it appears you may run out of runway ahead of you, or if you see a runway incursion by another aircraft or vehicle.

Practice go-arounds occasionally to maintain proficiency. You must manage the throttle, the pitch attitude, the flaps, the trim, the variable pitch prop if so equipped, traffic in the airport area, and the rope behind you. A go around may require dropping the rope to clear obstacles ahead at the upwind end of the runway. Towpilots have a lot of things to manage in a go around. Make sure that you acquire, and then maintain, proficiency at going around in your towplane.

After Landing

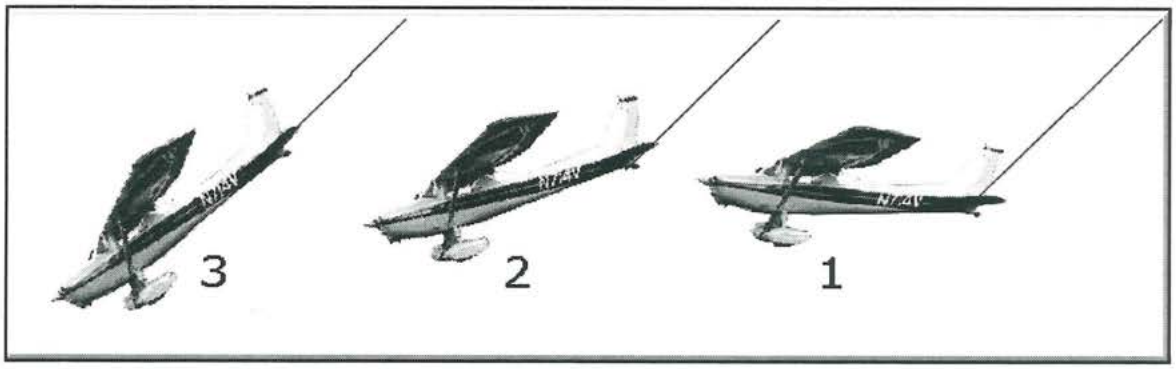
Clear the runway quickly for aircraft landing behind you. Taxi back to tiedown spot, or into the hold short position if another glider is ready for takeoff. Yield to other aircraft.

They may not be aware that you have a 200 foot long towrope behind you. The towrope you are trailing can whip around and injure people or damage other aircraft. Shut down the engine with the mixture control or as recommended in the Pilot Operating Handbook. Do not allow people near the prop, even when stopped. Pull the towrope off runway so that other aircraft, taxiing by, do not roll over it or snag it.

Aerotow Emergency Scenarios

Towplane Upset

Most glider instructors teach that the normal tow position for the glider is just above the towplane wake. If the position of the glider is excessively high, the rate of climb

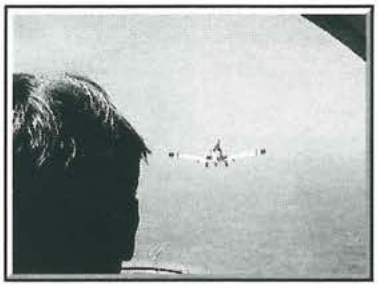
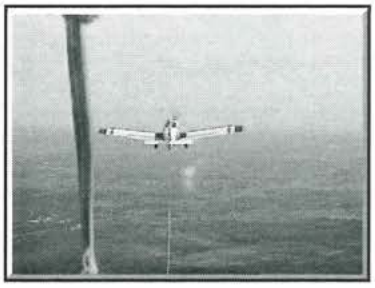


for the towplane-glider combination deteriorates. This occurs, in part, because the upward pull of the towrope on the towplane tail must be counteracted by towplane elevator pressure, causing excess drag. This excess drag reduces airspeed, reduces the rate of climb, or both. If the upward pull from the towrope is strong enough, it may even stall the horizontal stabilizer/elevator of the towplane, causing the towplane nose to pitch downward very rapidly despite counteracting elevator input from the towpilot. This is, in other words, a complete loss of pitch control in the towplane. This can be extremely hazardous. If it happens at very low altitude, the towplane will likely plow into the ground at high speed and with full power. If this occurs, serious injury or death is a very real possibility.

Towplane upset can happen quickly. The glider pilot should be constantly looking at the towplane during aerotow. If the glider kites up so high that sight of the towplane is lost, the glider pilot should pull the release handle to terminate the aerotow. It is worth noting that the momentum of a rising glider can be difficult for the glider pilot to reverse in time to prevent a towplane upset. It is also worth noting that a glider pilot may lack the courage to pull the release handle in a kiting situation, or may even fail to notice that kiting is occurring at all, due to distractions in the sailplane. These distractions can include sailplane flight control irregularity or flight control failure, an unsecured canopy flopping open during the aerotow, physical incapacitation of the glider pilot, and so on. A glider pilot dealing with a serious crisis on the glider end of the towrope may lack the ability or the will to act decisively in order to protect the towpilot and the towplane. Therefore, it is prudent for each towpilot to take

responsibility for the safety of the towplane and its occupant(s) on every aerotow. Each towpilot must be thoroughly familiar with the pitch-attitude response characteristics of the towplane being flown. Each towpilot must remain alert for signs that the glider is excessively high on aerotow, causing deterioration of towplane pitch control. If the towplane is running out of elevator authority while towing a glider, the towpilot has every right to release the glider in order to avoid a towplane upset. This is in fact critical to towpilot safety when the aerotow is still at a low altitude above the terrain.

One way to reduce the likelihood of towplane upset is to assure that glider pilots receive good training regarding the towplane sight picture as seen from the glider

during the aerotow. Many of today's powerful towplanes require that the glider pilot position the glider such that the towplane's wheels are superimposed just above the horizon. If the horizon is obscured, or if the aerotow is being conducted in hilly or mountainous terrain, the glider pilot can easily find the turbulence at the top of the towplane wake/slipstream, then ease the glider up a few feet to the proper aerotow position just above the wake.

Towpilot Recognition And Reaction To Kiting

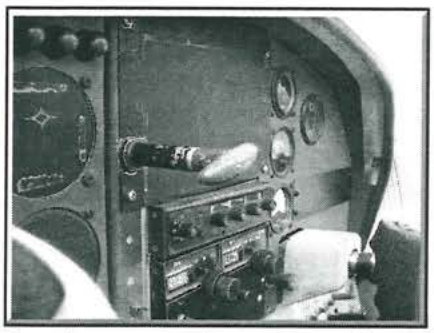
Towpilots must recognize when a glider pilot is beginning to fly too high on tow. This is most likely to happen soon after liftoff, or during the first turn. If the glider is kiting high above the towplane, the towplane stick or yoke will require more back pressure to keep the towplane at the proper pitch attitude. If the stick or yoke approaches the aft travel limit, the towpilot must quickly solve the problem by:

1. Signaling for an immediate release of the glider by rocking the towplane wings. The glider pilot may fail to see this signal because the glider is too high above the wake and the towplane is difficult or impossible to see over the nose of the glider. If the glider pilot fails to release, then

2. Release the towrope. Once you have made the decision to release, it may be harder to do than you think. Releasing the towrope might be difficult, or even impossible, for several reasons. One reason is the friction characteristics of the

Schweizer-type towhook installation that is found on many American towplanes. In this installation, the towhook is mounted so that the tip of the towhook flies upward when the towhook release arm actuates. If the glider kites up above the towplane and the towrope is under strong tension, a strong upward force is exerted on the towplane towhook. This strong upward force increases friction between the towhook and the towhook release arm. **If this friction is great enough, it may be very difficult, or even impossible, to get sufficient leverage on the tow release handle in the towplane cabin to actuate the towhook release arm and jettison the towrope.** [Note: It is now possible to mount the Schweizer towhook inverted, so that the towhook tip flies downward when released. This eliminates the excess friction problem caused by a glider kiting above the towplane. Consult your aviation maintenance professional for details]. Another reason that it may be difficult or even impossible to release is loss of control of the towplane. If the tailplane of the towplane has stalled, and the pitch-over of the towplane has begun, the towplane will be in a negative "G" maneuver. This causes the towpilot to float (or jerk) upward from the seat, restrained only by the lap belt and the shoulder harness. If these belts are not sufficiently tight, the towpilot may be unable to reach downward far enough to grasp, or even to touch, the tow release handle. This is particularly true of towplane release handles that are installed on the towplane cabin floor, rather than in the center of the instrument panel. This is a terrible scenario: the towpilot is fully aware of what is going on, but is powerless to pull the release handle and jettison the towrope. Needless to say, this scenario must be avoided at all costs. Keep your lap belts and shoulder harnesses very snug for each takeoff, and monitor the glider behind you very carefully, particularly when at low altitude.

Because life and limb are at quite literally at risk, the towpilot should recognize the symptoms of an excessively high aerotow position before the problem gets out of hand. If the glider kites vigorously above the towplane, every second is critical. Being quick to release a glider is a judgment call. You don't want to be trigger-happy, but you must also recognize that the glider pilot cannot be allowed to place your towplane into an uncommanded, uncontrollable dive. Know your personal limits and the limits of your towplane. If you encounter or observe a glider pilot who consistently flies a bit too high on tow, you should consult a glider instructor and request a briefing for that glider pilot regarding proper aerotow position.



Panel-mounted tow release handle in a Soccata Rallye.

Unanticipated Termination Of The Aerotow

Glider Flight Instructor Tom Knauff likes to ask: "What are the chances of a premature aerotow termination on your next aerotow? One in a million? No! The answer is 50/50. It will either happen or not!"

Unanticipated termination of an aerotow requires precise actions from the glider pilot and the towpilot. An unanticipated termination of an aerotow is any reason, whether intentional or accidental, that causes the towpilot or glider pilot to abort the tow. Pilots and instructors sometimes called these situations rope-break training, but there are many other causes that can force the termination of an aerotow. Causes that may force the termination of an aerotow include, but are not limited to, the following items.

Glider Factors:

- ✦ Airbrakes opening during the takeoff roll.
- ✦ Canopies opening during the takeoff roll.
- ✦ Loss of directional control during the takeoff roll.
- ✦ Lap belt or shoulder harnesses incorrect or unfastened.
- ✦ Disconnected flight control.
- ✦ Runway incursion ahead by aircraft, people, equipment.
- ✦ Rope break.
- ✦ Inadvertent activation of the tow release handle.
- ✦ Glider towhook failure
- ✦ Bee in the cockpit.
- ✦ Acceleration is not normal.
- ✦ This just doesn't feel right.

Towplane Factors:

- ✦ Loss of engine RPM.
- ✦ Loss of engine oil pressure.
- ✦ Incorrect magneto setting or mixture control setting.
- ✦ Incorrect carburetor heat control setting.
- ✦ Throttle control cable irregularity.
- ✦ Partial or full power loss for any reason.
- ✦ Fuel contamination or fuel exhaustion.
- ✦ Incorrect airspeed indication due to clogged pitot tube.
- ✦ Oil spraying on the windshield, due to oil cap left off.
- ✦ Cowling access door opens.
- ✦ Propeller governor surging.
- ✦ Bee in the cockpit.
- ✦ Pilot seat sliding aft.
- ✦ Lap belts or shoulder harness incorrect or unfastened.
- ✦ Towplane towhook failure.
- ✦ A sense that the towplane is not accelerating as fast as expected.
- ✦ Unexpected or unexplained sound or sounds in the towplane.
- ✦ Runway incursion by people, another aircraft, tractor, golf cart.
- ✦ Wind shift - realizing you are attempting a downwind takeoff.
- ✦ Seeing the airbrakes open on the glider in your mirror.

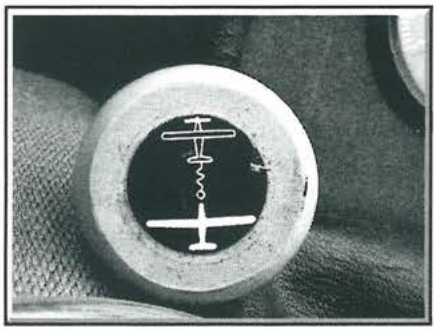
There are many more causes for unscheduled termination of an aerotow. Some are universal. Some may be unique to your towplane or airport. Many can be judgment calls. Some causes of unscheduled termination of the aerotow are obvious and unmistakable (such as a genuine rope break). Others are much more subtle (such as partial loss of power in the towplane). It is important for each towpilot and each glider pilot to recognize that aerotow failures do occur, and that each pilot on each pilot must be prepared for a failure of any type. Have a plan of action that will keep you safe for every conceivable tow failure.

You must review all the scenarios in your mind, and have options to use immediately. On the takeoff roll, the glider (being lighter) is often flying in ground effect by the time the towplane has accelerated to 45 knots or so. The glider is about 200 feet behind you - at that airspeed, that's about three seconds of separation between the towplane and the glider. The towplane is still accelerating on the runway. If you have a tow failure of any type at your airport, what will you do? Do you have a plan of action?

On an aborted takeoff caused by mechanical failure in the towplane (such as poor engine power or lack of oil pressure), the towpilot will attempt to stop the towplane on the remaining runway. On an aborted takeoff caused by something on the glider end of the towrope, such as a glider towhook failure, the towplane pilot may elect to continue the takeoff run and fly up and away from the decelerating glider, leaving the runway clear for the glider pilot to use as necessary to stop the glider. In any release, the towplane must turn (or bear) left, and the glider must turn (or bear) right. If the towplane and the glider both remain on the runway, this may mean giving just enough clearance for the glider - already airborne - to fly past the towplane on the right. How long are those glider wings...?

Glider Towhook Release Failure

What if, when the time arrives to release the towrope, the glider pilot attempts to release the towrope, but the towrope does not release? After repeated attempts to release, if the towrope is still attached to the glider, then the glider pilot should follow the recommended procedure and signal the towplane by moving out to the left side of the towplane and rocking the glider wings. The towpilot recognizes this signal and continues to climb back over a suitable landing area, preferably with no obstacles like trees or power lines at the approach end. When the glider is in normal high tow position, the towpilot releases the towrope. The glider pilot makes an approach to land assuming the 200 foot towrope is still attached to the glider.



Glider And Towplane Release Failures

The double-release-failure scenario has both the glider towhook and the towplane towhook failing to release the towrope. In such a situation, the towplane and the glider are attached by an unjettisonable towrope in formation flight. The towpilot gives the recommended aerotow signal for "towplane cannot release" by fishtailing the towplane slowly left and right, a slow-motion version of the rudder waggle. The next problem will be to assure that there is sufficient fuel aboard the towplane to buy some time to resolve the situation.

Should I Try To Break The Towrope?

Some pilots advocate trying to break the towrope in the event of a double release failure. This is risky business. If the pilots slack the towrope, then tauten it rapidly to

attempt to break the towrope, violent upset of towplane or glider can occur - in fact, is likely to occur. And there is no guarantee that the towrope will break on the first attempt. If the towrope fails to break, each pilot involved is faced with recovering from an unusual attitude while still attached to, and in close proximity to, the other aircraft. This kind of excitement, most pilots don't need. And regardless of whether or not the towrope actually breaks, the towhook mounting in the glider may be subjected to loads far in excess of the loads it was designed to endure, and the two aircraft will still find themselves in unusual attitudes while in very close proximity to each other. Finally, the broken towrope with its hardware of towrings is likely to be flailing around unpredictably, posing a hazard to both aircraft but particularly to the glider pilot, who may encounter towrings flying right through the canopy of the glider or towrope fragments trailing from any external part of the glider.

Approach And Landing On Tow

One solution is to attempt to land the towplane with the glider attached. The glider pilot moves to low tow position and prepares for the towplane to level off and descend. During the descent, the towpilot must not allow the airspeed to increase, and use a gradual reduction of power to set up a very low rate of descent to a landing area with the longest available runway. Turns must be shallow and a long, 2 mile final approach to landing will be accomplished. To avoid over-running the towplane during the descent, the glider pilot remains in low tow position. It may be necessary for the glider pilot to open the airbrakes a bit to prevent slack in the towrope during the descent. On arrival at the aiming point of the intended runway, the towpilot continues a slow rate of descent. The glider will touch down first. Do not force the glider down onto the runway. The towplane will land with some power on. The towpilot must not apply wheelbrakes because doing so may result in the glider overtaking the towplane. The towplane should ease to the left side of the runway, while the glider moves slightly right to avoid a ground collision. Note that these directions - towplane left, glider right - are the same directions employed after a normal release from aerotow. Smooth, precise flying will guarantee a happy outcome to this scenario. Better still, pre-flight your towhooks thoroughly. Periodic maintenance and daily inspection of the tow releases will help avoid tow release failures of any type, and will make the odds against a double release failure incalculably high.

The best prevention is to maintain your equipment properly and to keep your emergency procedures polished and in a state of readiness. Think through as many emergency scenarios as you can *before* you give the takeoff signal. Have your constantly evolving emergency plan of action in mind on every takeoff.

Cross-Country Aerotow

Cross-country aerotow to another airport requires an agreement between the towpilot and the glider pilot regarding the level-off altitude, route of flight, radio communications, airspace, alternate airports and the expected release point.

At some point the towpilot will make a gradual transition from climb to level flight. The towplane airspeed must be kept constant and well below the maximum towing speed of the glider. The glider pilot may prefer to move to the low tow position just under the towplane wake before the transition to level flight begins. In the low tow position, the glider pilot can see most of the towrope and has the towplane in view.

The goal is simultaneously to level off but not increase airspeed, so the towpilot must reduce power slowly. Changes in airspeed will cause surges in the towrope resulting in slack line problems for the glider pilot. The glider pilot may open airbrakes slightly to maintain a tight towrope. This causes additional drag but may be the only option. A common mistake of the glider pilot is to fly too low on cross-country tow. Maintaining a position just under the wake will minimize the occurrence of slack rope.

Review all the aerotow signals. If you plan to rely on radio communications between the towplane and glider, consider that the towplane may have to change frequencies to talk with ATC near controlled airspace. The glider pilot may wish for a third hand to fly, hold airbrake and key the radio microphone. A push-to-talk switch and a clip-on or boom microphone may solve the problem, but requiring the glider pilot to change radio frequencies may distract the glider pilot and de-stabilize the aerotow.

Cross-Country Aerotow Transition-To-Cruise Checklist

- ✦ Agree on a cruise altitude and course before takeoff.
- ✦ Glider pilot moves to low tow position, if desired, before transition to cruise.
- ✦ Towpilot reduces power slowly to maintain a constant airspeed.
- ✦ Glider pilot keeps a hand on the airbrake, and an eye on the towplane.

Descending to a landing while towing a glider can create problems. The glider pilot must be in low tow position, and airbrakes slightly extended. The glider pilot must create drag to prevent slack rope and overrunning the towplane. Reasons for descending while on tow could be a request from ATC to cruise at a lower altitude, encountering a lower en route ceiling or cloud layer, or descending in preparation for formation landing in the event of a double tow release failure.