

# Chapter 12: Aerotow

## Introduction

Glider pilots in the United States commonly launch using an aerotow. [Figure 12-1] An aerotow takes time but can offer flexibility regarding energy, location, and altitude. Chapter 7: Launch, Flight Maneuvers, Landings, and Recovery Procedures presents information from the glider pilot's perspective. This chapter provides much of the same information but from the perspective of the tow pilot.



**Figure 12-1.** *Gliders commonly use tow planes to launch and obtain altitude.*

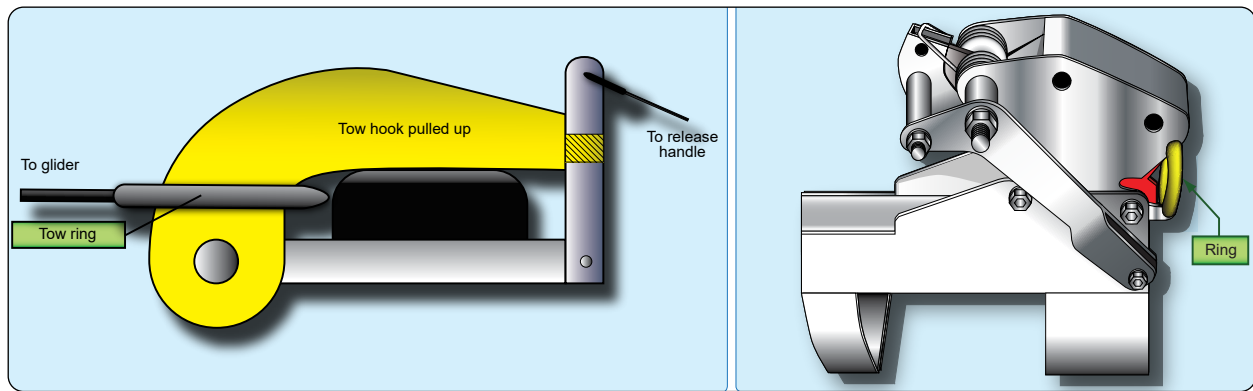
While all pilots follow Title 14 of the Code of Federal Regulations (14 CFR) part 61, Certification: Pilots, Flight Instructors, and Ground Instructors, and 14 CFR Part 91, General Operating and Flight Rules, the following sections sample some of the requirements of interest to tow pilots:

- 14 CFR part 61, section 61.23—Medical certificates: Requirement and duration.
- 14 CFR part 61, section 61.69—Gliders and Unpowered Ultralight Vehicle Towing: Experience and Training Requirements.
- 14 CFR part 91, section 91.15—Dropping Objects
- 14 CFR part 91, section 91.309—Towing: Gliders and Unpowered Ultralight Vehicles

## Equipment Inspections & Operational Checks

### Tow Hook

Tow plane equipment in the United States typically uses one of two types of tow hooks: Tost or Schweizer. [Figure 12-2] The tow pilot should inspect the tow hook for proper operation daily and prior to any tow activity.



**Figure 12-2.** Schweizer tow hook (left) and a Tost tow hook (right).

### ***Schweizer Tow Hook***

Prior to use, the tow pilot should visually inspect the tow hook and release arm for damage, cracks, deformation, and freedom of movement on the pivot bolt. The inspection should ensure that the hook properly engages the release arm. The pilot should also inspect the rubber spacer for general condition and check the condition of the release cable. Inside the airplane, the pilot should verify that the manual release lever does not rub against the aircraft seat or any other obstructions and check the security of the release handle assembly and the cable attachment. The pilot should also perform a functional inspection. If the visual or functional inspection reveals an issue, the pilot should restrict the tow plane from towing duties and repair the tow assembly.

The following functional checks should be performed:

- Attach the tow line to the tow hook and apply tension back on the line.
- With tension on the tow line, have another person pull the release control in the tow plane and check for proper release of the tow line.
- Reattach the tow line and apply a moderate rearward tug.
- Inspect the release assembly to ensure it remains completely closed.

### ***Tost Tow Hook***

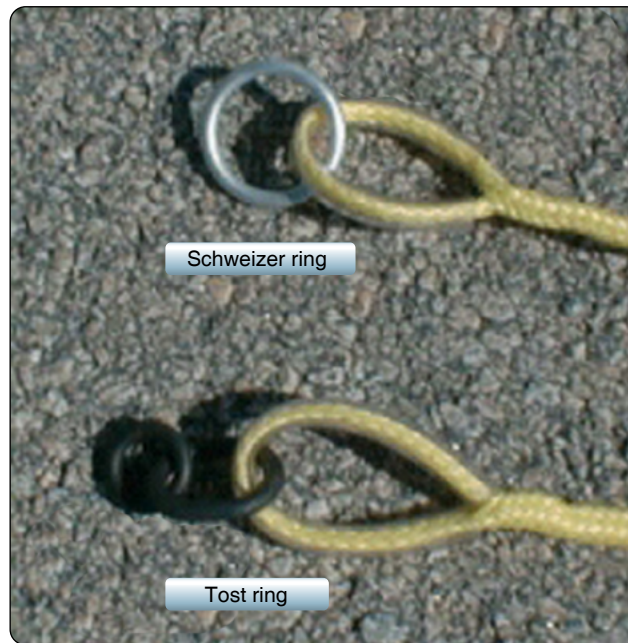
Before use, the tow pilot should ensure that the release hook opens completely when a helper pulls the release to its fullest extent from inside the airplane. The release hooks should touch the tow hook ring. Inside the airplane, the pilot should check to see that the manual release lever does not rub against the aircraft seat or any other obstructions. The pilot should check the security of the release handle assembly and the cable attachment. When not pulling the manual release lever, the tow hook should return to the fully closed position. The pilot should check the hook for dirt or corrosion and confirm that the airplane end of the tow rope has a Tost ring. If the release mechanism does not work correctly, factory repair should occur before any tow.

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- Inspect the release assembly to ensure it remains completely closed.

## Tow Ring Inspection

Tow ring inspection begins with a check for wear and tear. Tow pilots should take rings out of service if they have scratches or dents. The tow ring design corresponds to the type of tow hitch assembly: Schweizer or Tost. [Figure 12-3] The Schweizer tow ring uses a single two-inch diameter high-grade, one-quarter inch steel ring magnafluxed with good weld. The Tost tow ring consists of a pair of interconnected rings made from high-grade steel.



**Figure 12-3.** Schweizer tow ring and a Tost tow ring.

The tow pilot should only attach a compatible tow line ring to the tow hitch. While a Schweizer tow ring will not fit into a Tost tow hitch, the tow pilot could mistakenly attach a Tost tow ring to a Schweizer tow hitch. If that happens, the Tost ring might not release when the tow pilot actuates the release mechanism.

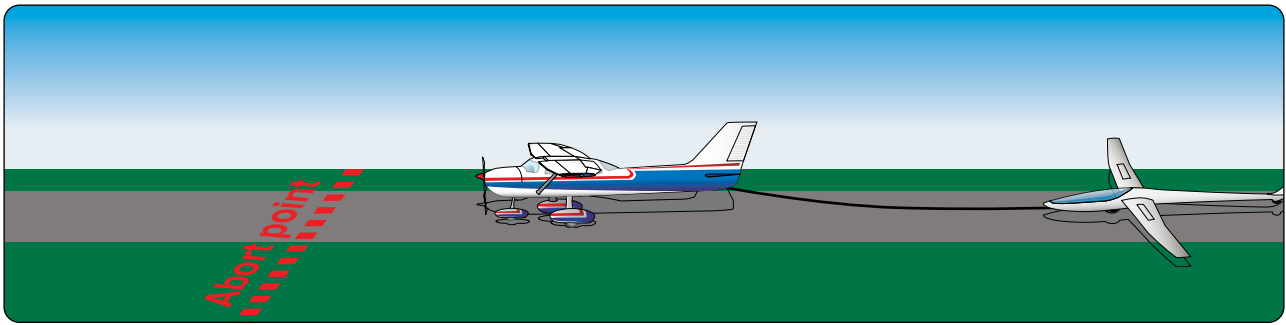
## Tow Rope Inspection

Although the pilot of the glider has primary responsibility for the selection and inspection of the proper tow line, the tow pilot should confirm the tow line and any required weak links meet the strength requirements of the Federal Aviation Administration (FAA) Regulations and are acceptable for use. See chapter 6, Preflight and Ground Operations, regarding tow line selection and inspection. Pilots should consider replacing the tow rope after a specific period of usage and exposure to the sun or to the elements.

Density altitude affects airplane performance. An increase in air temperature or humidity, or decrease in atmospheric pressure significantly decreases power output and propeller efficiency.

## Abort Briefing

Using the computed takeoff data or actual takeoff point for the given conditions, the tow pilot should choose a physical abort point on the runway [Figure 12-4] and brief the glider pilot on the abort point and abort procedures. If the tow plane is not off the ground by the chosen abort point, the glider should release, or be released, allowing the tow plane to accomplish a normal takeoff.



**Figure 12-4.** A physical abort point on the runway should be determined and briefed to the glider pilot before starting the towing procedures.

14 CFR part 91, section 91.309 (a)(5) states, “The pilot 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.” If any doubt exists about compliance with this rule through briefings or published and agreed upon standard operating procedures, the tow pilot and glider pilot should make certain to clarify all aspects of the upcoming tow.

## On the Airport

The tow pilot should maintain an awareness of the direction of the tow plane’s prop blast. Blasting launch personnel and glider canopies with wind and debris creates an annoyance and danger. Whenever possible, the tow pilot should angle prop blast away from any ground operations. Prior to taking the active runway for tow line hook-up and takeoff, if applicable, the tow pilot can monitor and announce intentions on the Common Traffic Advisory Frequency (CTAF).

## Ground Signals

In most cases, tow pilots use the Standard American Soaring Signals to communicate between the launch crew and tow plane. In some cases, however, specific local procedures take precedence. The tow pilot should receive a briefing on any specific local signals or procedures. The tow pilot might need to observe these signals through the mirror or through an additional signal relay person positioned safely on the side of the runway adjacent to the tow plane. Chapter 7 of this handbook, Launch, Flight Maneuvers, Landing, and Recovery Procedures has figures for the ground signals.

## Takeoff & Climb

When ready for takeoff and if applicable, the tow pilot should broadcast the commencement of a glider launch. For example, “Tallahassee traffic, N12345 taking off Runway 33, glider in tow, Tallahassee.” 14 CFR part 91, section 91.309(a) (4) states, “Before conducting any towing operation within the lateral boundaries of the surface areas of Class B, Class C, Class D, or Class E airspace designated for an airport, or before making each towing flight within such controlled airspace if required by ATC, the pilot in command notifies the control tower. If a control tower does not exist or is not in operation, the pilot in command must notify the FAA flight service station serving that controlled airspace before conducting any towing operations in that airspace;”

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On takeoff, the tow pilot advances the throttle smoothly and quickly in one motion. [Figure 12-5] If the tow plane accelerates and then slows down, the glider could overrun the tow line and snag the line in the landing gear. The glider pilot might not have release capability if that occurs.



**Figure 12-5.** The tow pilot advances the throttle smoothly and quickly in one motion so that the glider does not overrun the tow line.

The tow pilot accelerates to liftoff speed keeping in mind that what will occur during the transition out of ground effect. The tow plane leaving ground effect will:

- Require an increase in the angle of attack (AOA) to maintain the same lift coefficient,
- Experience an increase in induced drag and thrust required,
- Experience a decrease in stability and a nose-up change in moment, and
- Experience a reduction in static source pressure and increase in indicated airspeed.

These general effects point out the hazards associated with attempting takeoff prior to achieving the recommended lift-off speed. Due to the reduced drag in ground effect, the tow plane may seem capable of takeoff well below the recommended speed; however, lifting out of ground effect with a lower-than-normal lift off speed may result in poor initial climb performance.

The glider will normally lift off first. The tow pilot should expect the glider pilot to correct for crosswind until the tow plane becomes airborne. At this point, the tow pilot should remain alert to a glider climbing too high and lifting the tow plane tail. Should this happen, the application of full-up elevator on the tow plane may not be sufficient to prevent an accident, and the tow pilot should pull the release handle, release the glider, and regain control. As a rule of thumb, a glider climbing 20 feet or more above a tow plane when using a 200-foot rope presents the danger of an upset.

After liftoff, the tow pilot should pitch up to establish a constant airspeed climb and expect the glider pilot to establish a position directly behind the tow plane. Upon reaching a safe altitude, the tow pilot can initiate a turn to maintain the desired departure path using bank angles limited to 15°–20°.

The tow pilot climbs at full throttle unless otherwise required by the POH. The fuel/air mixture should be leaned in accordance with the POH for maximum power. Each specific model of glider has a published maximum aerotow speed, and the tow pilot should know this speed, which may be very close to the minimum safe speed of the tow plane. [Figure 12-6]

Maximum Aero Tow Speed	MPH	Knots
Blanik L-23	93 mph	81 knots
Blanik L-13	87 mph	76 knots
SGS 2-33	98 mph	85 knots
SGS 1-26	95 mph	83 knots
ASK 21	108 mph	94 knots

**Figure 12-6.** Sample glider maximum aerotow speeds.

The towing speed results from consideration of several variables. The tow pilot determines the minimum towing speed after considering minimum speed for proper engine cooling and stall speed of the tow plane, flies at a speed slower than the maximum glider aerotow speed, and conducts the aerotow at the slowest safe speed sufficient for the glider to remain under control. When towing a model of glider for the first time, the tow pilot should obtain a briefing from the glider pilot to ensure compliance with minimum, maximum, and optimal towing speeds. An experienced tow pilot can determine if the speed is sufficient for the glider by observing the glider wing profile in the tow plane mirrors. A tow pilot viewing a larger than normal portion of the underside of the glider wing for a given tow position may indicate a high glider angle of attack and the need for a slight increase in towing speed.

Because of the potential for low altitude emergencies, the initial climb should remain within gliding distance of the airport. The tow should not climb in a direction that would prevent the glider from returning to the traffic pattern with the existing headwind component. If the tow pilot allows the departure path to drift with a crosswind, it reduces the radius of a turn back to the runway in the event of a low altitude emergency.

A thoughtful glider pilot communicates the intention to perform any maneuvers behind the tow plane. However, the tow pilot should remain alert for any unannounced maneuvering. Glider pilots often practice maneuvers such as “Boxing the Wake,” explained and illustrated in Chapter 7 of this handbook, Launch, Flight Maneuvers, Landing, and Recovery Procedures. Once detecting this maneuver, which normally begins with the glider descending vertically from high tow position to low tow position, the tow pilot should maintain a constant heading and a wings level attitude. After the “Boxing the Wake” maneuver ends and the glider returns to a stabilized high-tow position, the tow pilot can maneuver as needed.

During tow, a glider instructor may demonstrate and teach slack rope recovery procedures. This maneuver normally involves a climb to one side of the tow plane followed by a small dive to create slack in the tow line. The instructor will then ask the student to take the controls and remove the slack out of the tow line without breaking the rope. The tow pilot should not confuse this maneuver with a release. Chapter 8 of this handbook, Abnormal and Emergency Procedures, contains more information regarding slack line procedures.

## Tow Positions, Turns, & Release

### Glider Tow Positions

Glider tow operations normally use the high tow position. However, the glider pilot could use a low-tow position in some instances such as a cross-country tow. Either position places the glider outside the wake of the tow plane. [Figure 12-7]

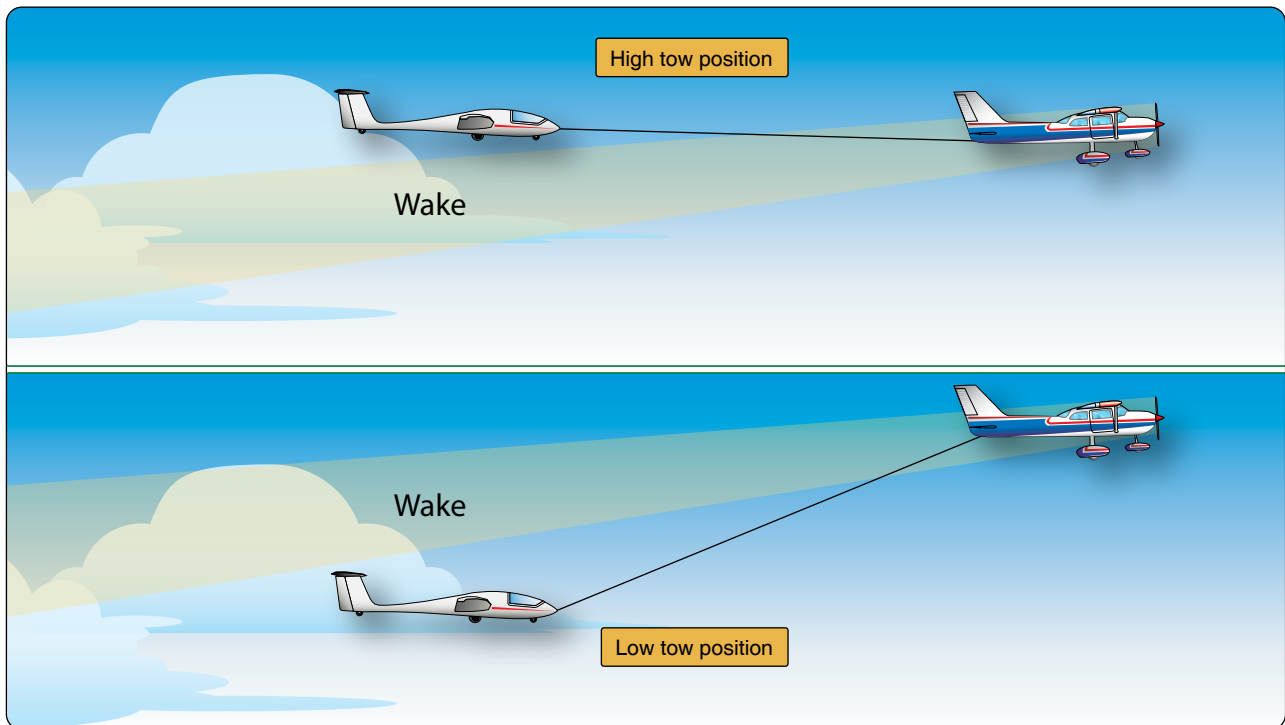


Figure 12-7. Aerotow climb-out.

## Turns on Tow

The tow pilot can initiate turns upon reaching a safe altitude. The pilot should consider clearance, terrain, and wind gradient. Turbulence and differential wing speed of the glider during turns are potential hazards. Tow pilots should make all turns gently and gradually. The tow pilot expects the glider pilot will attempt to match the flightpath of the tow plane. Due to the length of the wingspan, the glider typically rolls more slowly than the tow plane. Since the bank angles of the tow plane and glider must match to fly the same path, the tow pilot normally uses a maximum of 15–20° of bank.

## Approaching a Thermal

When approaching a thermal and planning a release, both pilots should look for other gliders and expect inbound gliders from different directions. Since the first glider in the thermal establishes the direction of turn, any glider joining the thermal should circle in the same direction as the first glider, and the tow pilot should position the flight in a manner that allows the glider proper and safe entry to the thermal. The presence of several gliders in a thermal presents significant risk and the tow pilot should remain clear of any crowded thermal activity.

## Release

The winds aloft should be continuously evaluated to help determine the glider release area, and the tow pilot should always attempt to release the glider within gliding distance of the airport considering the winds. The tow pilot should discuss the planned release point with the glider pilot. Use of a consistent tow pattern allows the glider pilot to plan a release point.

Standard glider release procedures include [Figure 12-8]:

1. Some tension on the tow line prior to release allows the tow pilot to feel the release of the glider. A tow pilot looking in the mirror may see a wrinkle in the tow rope after the glider releases.
2. The tow pilot expects the glider to turn right after release but should remain alert for non-standard maneuvering by the glider.

- Once confirming that the glider has released and cleared, the tow pilot should clear the airspace to the left and start a medium bank, descending left turn.

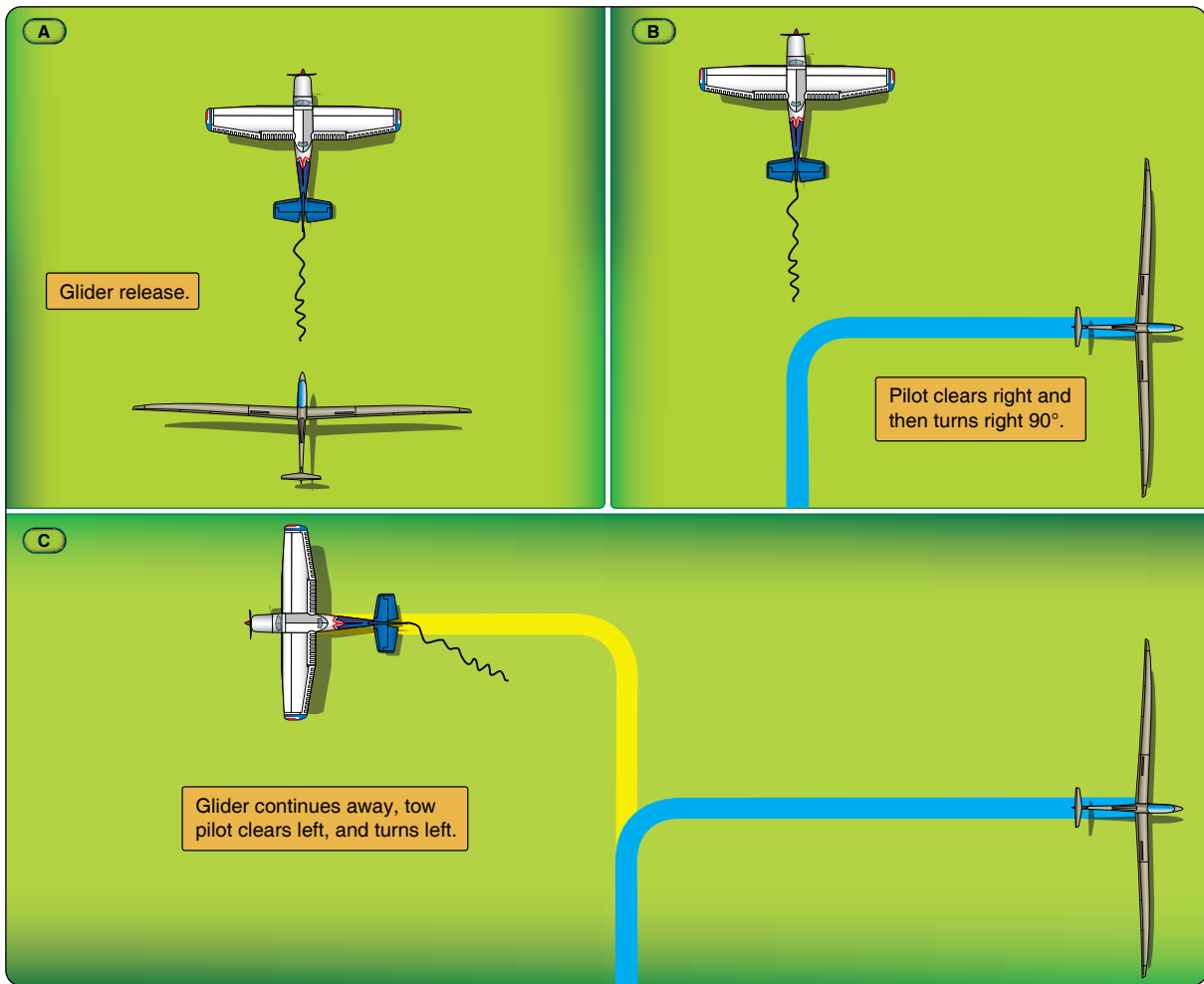


Figure 12-8. Aerotow release.

If the glider pilot releases with slack in the tow line, the tow pilot might not detect the release. The tow pilot should only begin a left turn and initiate a descent after observing and confirming the release of the tow line. If there any doubt exists regarding release status, the tow pilot should continue the tow and confirm the release via radio or visually.

## Descent, Approach, & Landing

### Descent

During the descent, a tow pilot should exercise proper engine management. Good engine conservation practices include both a gradual power reduction and conservative descent airspeeds. Studies indicate that high airspeed may affect the engine more than power reduction. The pilot can use a steep spiral, full flaps, or slipping turns to obtain a suitable rate of descent while reducing power in increments and without a large increase in airspeed. Closing cowl flaps, if equipped, further slows the rate of engine cooling. Each airplane model requires slightly different techniques to keep the engine from cooling too quickly while descending.

Descent and descending flight attitudes increase the potential of a mid-air collision. The tow pilot should consider developing and using specific descent corridors that avoid other glider and powered traffic.



## Approach & Landing

A 200-foot tow line hangs down behind the tow plane at a 30- to 40-degree angle. The tow pilot should adjust the altitude of the tow plane to ensure the tow line does not strike obstructions close to the ground.

The tow pilot should know or receive a briefing regarding the location of obstructions around the airport, especially obstructions on the approach end of the runway planned for use. Briefings should include a minimum above ground level (AGL) obstruction crossing height and any factors that may influence altitude judgment, such as visual illusions or other airport distractions.

Regulation does not prohibit landing with the tow line attached; however, the tow pilot should consider the following:

1. Clearing obstructions by more than the tow line length as indicated on the altimeter accounts for instrument lag.
2. Landing with the tow line attached should not occur unless using a field at least 2,500 feet in length with clear approaches.
3. Dragging the tow line on a turf field usually does not cause excessive abrasion. Abrasion from hard ground or paved runways invites early tow line failure.

If releasing the tow line before landing, the pilot normally drops the tow line near the glider launch area during a short approach to the runway. The tow line drop area should have defined dimensions. Ground personnel should receive a drop area briefing before the operation takes place and stay clear of the drop area during towing operations. If seeing an individual in the drop area, the tow pilot should go-around without dropping the tow line.

## Cross-Country Aerotow

A safe and successful cross-country tow requires planning. The tow pilot should plan for the maximum fuel consumption for the tow plane used. The pilot should study the route of flight on sectional charts, plan for any potential diversion, and comply with any airspace requirements.



**Figure 12-9.** *Cross-country tow.*

Since a tow line break can occur without notice, the tow pilot should plan the route over terrain suitable for a glider landing. The tow pilot should consider the physical and mental readiness of both pilots to take the flight. On a particularly long flight, the pilots can plan for rest stops along the way. Both pilots should remain hydrated and have a relief system, if needed. Appropriate use of aircraft trim helps keep the flight within the maximum tow speed of the glider and helps reduce pilot fatigue.

Two-way radio provides for essential communication between the glider and the tow plane during cross-country tows. The pilots should ensure portable radios (if used) or glider batteries have a sufficient charge prior to the flight and conduct a radio check as part of pre-flight activities. [Figure 12-9]



**Figure 12-9.** *On a cross-country tow, the tow pilot and glider pilot should have two-way communication using either panel mounted or portable radios.*

## Emergencies

### Takeoff Emergencies

Development of an emergency plan ensures successful emergency management. Before the tow and as stated previously, the pilots should select an emergency release point somewhere along the takeoff runway. This release point should leave sufficient room for the glider to land straight ahead, using normal stopping techniques, in the event conditions prevent a safe takeoff with the glider in tow.

During the takeoff and initial climb out, the pilots should remember that position and altitude determine their actions in any low-altitude emergency.

#### ***Tow Plane Power Failure on the Runway during Takeoff Roll***

The following plan applies in the event the tow plane has a power failure on the runway during the takeoff roll:

- Either pilot should release, and the glider should maneuver to the right side of the runway, if possible.
- The tow plane should maneuver to the left of the runway if space permits. An individual airfield layout and obstacles might dictate an alternate procedure, and the pilots should plan to follow any alternate plan in effect.
- The tow pilot should survey the abort area carefully and know if and where the airplane can roll off the runway (grass or taxiway) without creating a hazard.
- The glider usually lifts off before the tow plane, and the tow pilot should give the glider as much space as possible to land and brake to a stop on the remaining runway.

- The tow pilot should know the stopping characteristics of the glider. Some models have very effective brakes and others do not.

### ***Glider Releases during Takeoff with Tow Plane Operation Normal***

The pilot of the tow plane should continue the takeoff to eliminate risk of collision with the glider.

### ***Tow Plane Power Failure while below 200 Feet AGL***

Because of airport obstructions near the airport, limited options may exist for a tow plane land out. The pilot of either or both aircraft will normally release to provide landing options for both aircraft. The tow pilot could make slight turns or land straight ahead. Since the tow plane requires considerably more altitude to return to the field in the event of a power failure, the tow pilot should have a specific plan in mind that includes pre-selected landing areas for each runway. Tow pilots should discuss these options during pilot briefings or safety meetings.

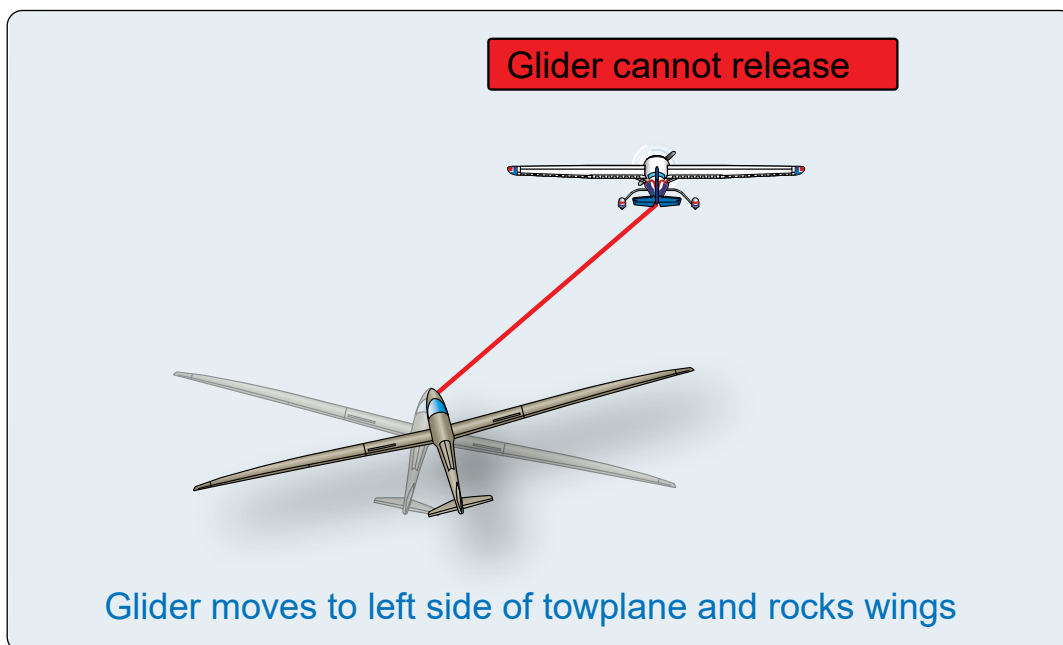
### ***Glider Climbs Excessively High during Takeoff***

A glider climbing excessively high during takeoff will lift the tail of the tow plane. Should this happen, the application of full-up elevator on the tow plane may not prevent an accident. The tow pilot should pull the release handle immediately to regain control of the tow plane. Any time the glider pulls the nose of the tow plane to a dangerously high or low pitch attitude, the tow pilot should pull the release. An excessively high glider position could jam a Schweizer tow hitch release mechanism.

## **Airborne Emergencies**

### ***Glider Release Failure***

If the pilot of the glider cannot release, the glider pilot should inform the tow pilot by means of the aircraft radio or with the following airborne signal. The glider will move out to the left side of the tow plane and rock its wings. [Figure 12-10] The tow pilot should wait a few seconds to ensure the wing rocking signals a release failure. Once the tow pilot determines the glider cannot release, the tow plane should return to the airfield and release the glider at a safe altitude over the field.



**Figure 12-10.** *Glider release failure.*

### ***Neither the Tow Plane or Glider Can Release***

The pilot of the tow plane informs the pilot of the glider by aircraft radio or airborne signal of this rare occurrence. The tow pilot signals by yawing the tail of the tow plane.

The tow pilot expects the glider to move to the low tow position. Then the tow plane should begin a slow descent toward an airfield of suitable length. The tow pilot flies a wide pattern with a long final approach and sets up a stabilized and gradual 200 to 300 foot per minute descent. The tow pilot should plan on landing long to allow sufficient altitude for the glider to avoid obstacles on short final.

The glider in the low tow position should land first and the glider pilot should not apply brakes until after the tow plane touches down. The tow pilot should apply brakes gently or not at all to leave room for the glider to stop.

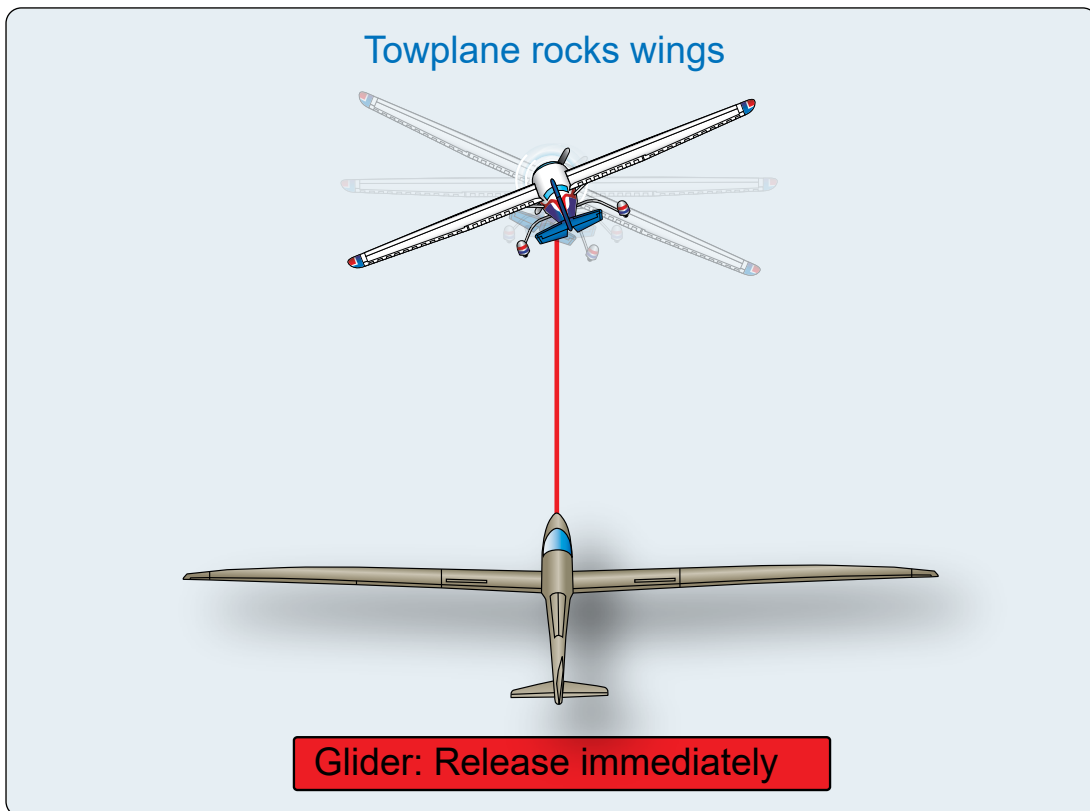
While not well defined in soaring literature as discussed in Chapter 8, Abnormal & Emergency Procedures, some glider pilots may attempt to break the tow rope rather than land behind the tow plane. If the glider does attempt to break the rope, the tow pilot maintains the tow plane in a straight and level attitude to reduce the total forces acting on the tow plane.

### ***Glider Problem***

The tow pilot might notice the glider has a problem not yet known to the glider pilot. The most common example involves unintended deployment of the glider spoilers as the glider accelerates on takeoff. The tow pilot can inform the glider pilot via radio or visual signal. The tow pilot waggles or fans the rudder when reaching a safe altitude as the visual signal for “Glider Problem.”

### ***Immediate Release***

The tow pilot rocks the tow plane wings to indicate the glider pilot should release immediately. This might occur during a critical tow plane emergency such as engine-failure or fire. [Figure 12-11]



**Figure 12-11.** *The towplane indicates the glider pilot should release immediately.*

## Chapter Summary

The duties and perspectives of a tow pilot differ from those of a glider pilot. However, both pilots have a regulatory responsibility for the safe execution of an agreed to aerotow operation, and both pilots should communicate and cooperate to ensure the safety of both aircraft during an aerotow. Having two-way radio makes communication easier, but no legal requirement exists for it, and pilots may use appropriate visual signals. The tow pilot should maneuver the tow plane accounting for glider characteristics and any glider speed limitations. An aerotow should not preclude the glider from returning to the airport due to wind conditions at release and not put either aircraft in conflict with other aircraft. Each pilot should know the standard procedures for potential emergencies. The tow pilot should manage post-release return to the airport to prevent shock cooling of the tow plane engine. For any long-distance tow such as might occur after a recovery from an airport after a cross-country, both pilots should have the mental and physical readiness to conduct the flight safely.