Chapter 8: Abnormal & Emergency Procedures

Introduction

Glider pilots train for abnormal and emergency procedures in case of control problems, instrument failures, or equipment malfunctions. In addition, since forced landings may occur due to inadequate lift on a cross-country flight, glider pilots should understand how to use emergency equipment and survival gear as a practical necessity.

Aerotow Abnormal & Emergency Procedures

Environmental factors, pilot error, and mechanical equipment failure can cause an abnormality during aerotow. The tow and glider pilots should avoid situations that would place the other pilot at risk. Should a situation arise where the glider position threatens the safety of the tow plane, the glider pilot may have no other choice but to release the tow rope.

Environmental Factors

Environmental factors for terminating the tow include encountering clouds, mountain rotors (area of turbulence created by wind and mountainous terrain), or restricted visibility. Any of these factors may require the glider pilot to release.

Pilot Error

Examples of tow-pilot errors include starting the takeoff before the glider pilot gives the ready signal, using steep banks during the aerotow without prior consent of the glider pilot, or frivolous use of aerotow signals, such as “release immediately!” For the glider pilot, examples of pilot error include allowing the glider to get out of position during the tow, losing sight of the towplane, or leaving air brakes open during takeoff and climb.

Kiting

A hazardous situation may occur during takeoff if the glider pilot flies high above and loses sight of the towplane. If the tension on the tow line pulls the towplane tail up, the tow pilot may run out of up-elevator authority. In addition to a the towplane experiencing a nose down pitching moment, it is also loosing airspeed. The kiting glider creates a huge amount of drag which slows the towplane. It can take 1,500 feet or more for the towplane to recover once the rope breaks or the glider pilot releases.

Unintended Spoiler Deployment

Spoiler-related emergencies often result from a pilot’s failure to lock the spoilers in the closed position prior to takeoff. As the glider accelerates down the runway, or soon after it becomes airborne, the airflow deploys the spoilers, greatly increasing the glider’s drag. The pilot may not notice the spoilers open, but the increased drag can make it impossible for the tow pilot to climb and clear obstacles. A release by the tow pilot leaves the glider low to the ground and in a high drag configuration. If the glider pilot does not recognize the situation, and close the spoilers, an unsafe landing becomes likely. If conditions permit a continued climb the towpilot can waggle the rudder to indicate something is wrong with the glider. The glider pilot should differentiate between the towpilot rocking the wings indicating release immediately, and the towpilot fanning the rudder indicating something is wrong with the glider, avoiding an unnecessary release.

If time allows, the tow pilot can use the radio and warn the glider pilot to close the spoilers. Without using radio, the tow pilot can use the “Rudder Waggle” signal for the glider pilot to check the glider. The glider pilot should not confuse this signal with the “Wing Rock” signal for the glider pilot to release the tow rope. This mistake would leave the glider pilot at low altitude with the spoilers open and make a safe landing very difficult.

Mechanical Failures

Mechanical equipment failures include tow hook failures, towplane mechanical or airframe failures, and glider airframe failures. The tow pilot rocks the wings of the towplane to request an immediate release by the glider pilot. [*Figure 8-1* right panel] The glider pilot may deliberately terminate the tow or launch anytime it seems safer than continuing. For example, if the glider pilot discovers control binding once air pressure builds on the surfaces, releasing the tow line seems less risky than continuing. If a mechanical failure occurs, the glider pilot should assess the situation and determine the best course of action. Options include remaining on the aerotow, planning to release at a point in the future, or releasing immediately.

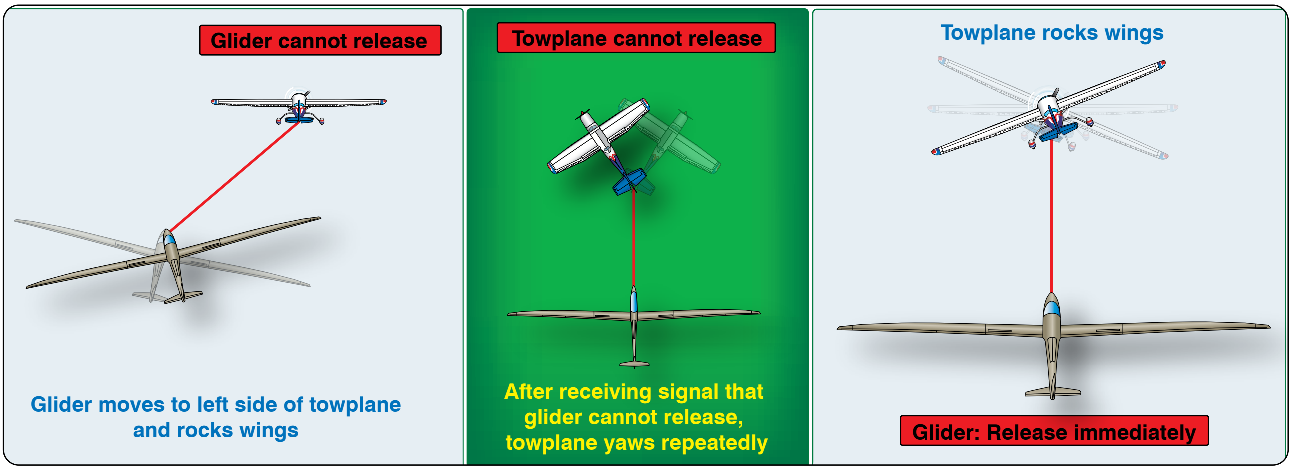

Figure 8-1. *Towplane and glider signals due to release mechanism failure (left and center panels) and towplane signal commanding glider release (right panel).*

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Tow release failure can occur in either the towplane or the glider tow hook system. If the glider release mechanism fails, the glider pilot should notify the tow pilot either by radio or tow signal as depicted in the left panel of *Figure 8-1* above, and the glider should maintain the high tow position. The tow pilot should tow the glider over the gliderport or airport and release the glider from the towplane. The towline should fall back and below the glider. The design of some tow hook mechanisms allows the line to pull free from the glider by its own weight. After release by the towplane and since some glider hooks do not back release, the glider pilot should pull the release to increase the likelihood of a towline release from the glider. In the rare event the tow pilot also cannot release, the tow pilot will yaw the tow plane repeatedly as shown in the enter panel of *Figure 8-1* above.

tow planes often use a variant of the Schweizer or Tost glider tow hitch. [*Figure 8-2*] and [*Figure 8-3*] The hitch connects to the tow plane fuselage below the rudder. The specific rings that attach tow lines to these hitch types can be seen in *Figure 8-4*. The wing runner should know the correct method of attachment. If the tow plane has the Schweizer tow hitch, the tow ring may rotate forward and trap the sleeve that locks the tow hitch in place if the glider flies too far above the tow plane during the tow. This may prevent the tow pilot from releasing the tow line. [*Figure 8-5*]

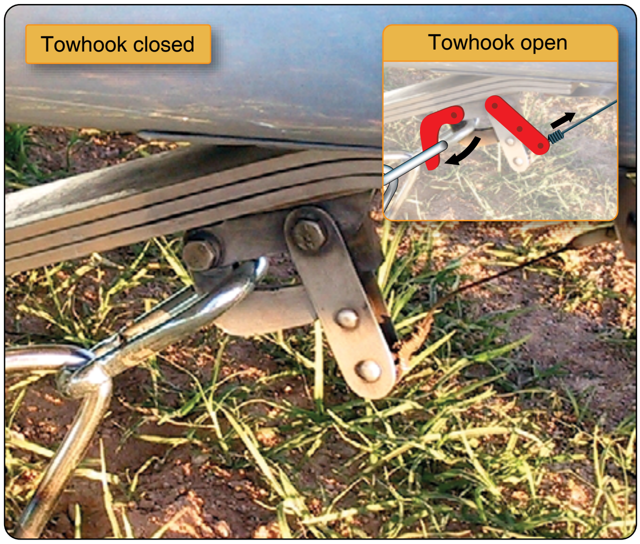

Figure 8-2. *A Schweizer tow hitch.*

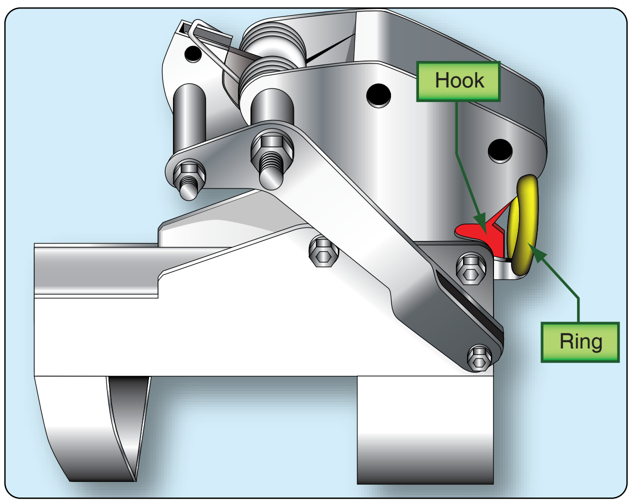

Figure 8-3. *A Tost tow hitch.*

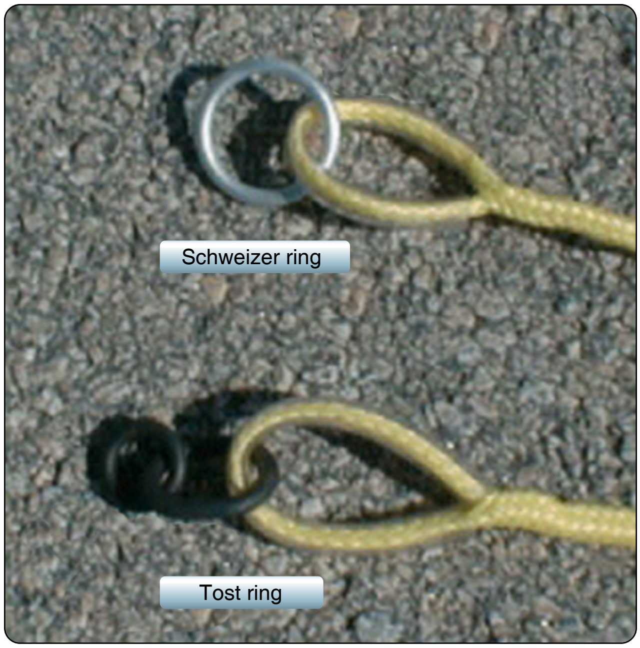

Figure 8-4. *Examples of Schweizer and Tost tow rings.*

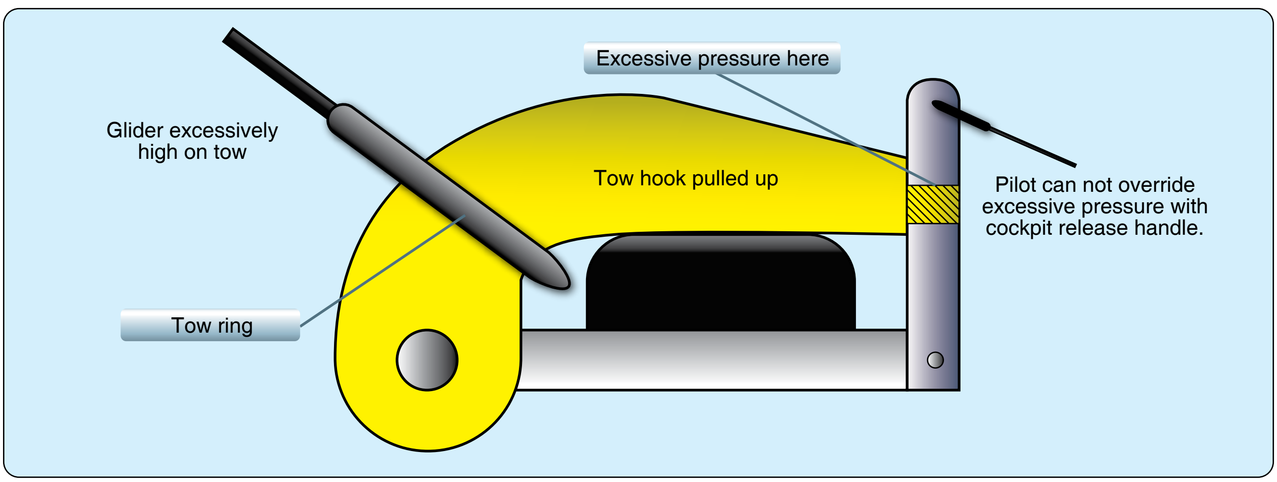

Figure 8-5 A Schweizer tow hitch under upward tension.

Failure of the release mechanism in both towplane and glider occurs very rarely. If it does occur, radio or tow signals between glider pilot and tow pilot should confirm the situation. One option has the glider and towplane landing without releasing from one another. Once a descent to the gliderport or airport begins in this scenario, the glider pilot should move to and maintain the low-tow position and use spoilers/dive brakes to avoid overtaking the towplane. The tow pilot should plan a shallow approach that avoids obstacles and allows the glider to touch down first. The towplane could experience a hard landing if the glider pilot uses the wheel brake excessively and slows the towplane below its flying speed. The glider pilot should use the spoilers or dive brakes to stay on the runway and use the wheel brake only as necessary to avoid overtaking the towplane.

A second option in a dual release failure situation involves the glider pilot breaking the towline while within gliding distance of the landing field; however, using this slack-line procedure increases risk of entanglement and could damage the glider or towplane if the line does not break as designed. The pilot flies the glider above the towplane, dives down to develop slackline, and then fully extends the dive brakes and/or spoilers to induce a tension overload. As the towplane accelerates without the load of the glider and the glider decelerates due to the increase in drag, the towline should come under sudden tension and break free. If the glider pilot cannot verify that the line break occurred at the glider's weak link, the glider pilot should land using the landing procedure for an attached line in the GFM/POH.

The following sections discuss five tow failure situations for which a pilot should have a plan. While the best course of action depends on many variables, such as runway length, airport environment, density altitude, and wind, all tow failures or emergency releases have one thing in common: the need to maintain control of the glider. For example, the pilot should avoid stalling the glider or dragging a wingtip on the ground during a low altitude turn.

Tow Failure with Sufficient Runway To Land and Stop

If a tow failure or deliberate release occurs prior to towplane lift-off, the towplane either continues the takeoff or aborts the takeoff. If the towplane aborts the takeoff, the tow pilot should maneuver the towplane to the left side of the runway. For a glider still on the runway, the glider pilot should pull the release, decelerate using the wheel brake, and maneuver to the right side of the runway. If the glider becomes airborne, the glider pilot should pull the towline release, land ahead, and be prepared to maneuver to the right side of the runway. [*Figure 8-6*, panel 1] Pulling the towline release in either case ensures that the rope remains clear of the glider. Since local procedures vary, both the glider pilot and tow pilot should know any specific gliderport or airport procedures.

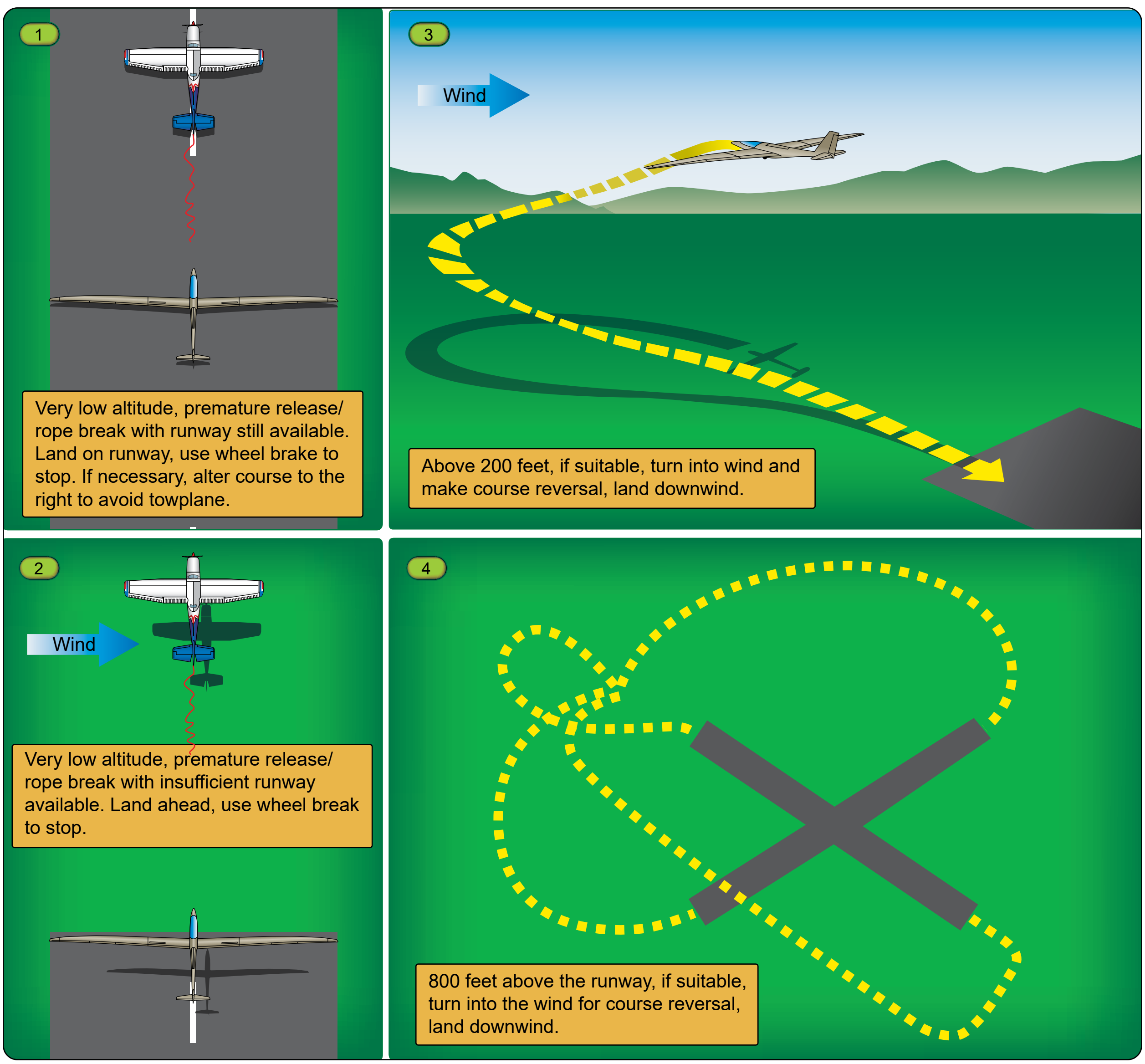

Figure 8-6. *Situations for tow line break, uncommanded release, or power loss of the towplane.*

Tow Failure after Takeoff—Glider Unable to Return to Airport

When an inadvertent release, tow line break, or a signal to release from the towplane occurs at a point at which the glider has neither sufficient runway directly ahead to land nor sufficient altitude (typically 200 feet above ground level) to make a safe turn back to the field, the pilot should land the glider ahead. [*Figure 8-6*, panel 2] Glider pilots should consider any attempt to turn at low altitude prior to landing as high risk because of the likelihood of dragging a wingtip on the ground or stalling the glider. Landing ahead and slowing the glider as much as possible prior to touchdown and rolling onto unfamiliar terrain often provides the best outcome. Low speed means low impact forces, which reduce the likelihood of pilot injury or damage to the glider. Glider pilots should look on both sides and ahead when choosing the best area for an off-field landing. While more altitude provides more range during an emergency, landing under control supersedes getting to a "perfect" landing area almost within glide distance.

Tow Failure above Return to Runway Altitude

A glider pilot may consider and attempt a downwind landing on the departure runway if the glider possesses sufficient altitude to make a course reversal. [*Figure 8-6*, panel 3]

The pilot should only attempt a course reversal and downwind landing option if within gliding distance of the airport or landing area. In ideal conditions, this maneuver typically requires a minimum altitude of 200 feet above ground level. If there are strong headwinds, the pilot should consider that the glider will reach 200 feet AGL with less distance traveled across the ground. This may allow for landing-ahead options on the existing runway compared to reversing course, landing with less return runway available, at a considerably higher groundspeed, and possibly risking overshooting the entire runway on return.

The glider pilot has responsibility to avoid the towplane if the tow terminates due to a towplane emergency. Since, the tow pilot deals with that emergency and may maneuver the aircraft abruptly, the glider pilot should never follow the towplane down.

After releasing from the towplane at low altitude and if the glider pilot chooses to make a turn of approximately 180° for a downwind landing, the pilot should maintain flying speed. The pilot should immediately lower the nose to a pitch attitude that maintains the appropriate airspeed. If a rope break occurred, the glider pilot should release the rope portion still attached to the glider to avoid any entanglement.

During a course reversal, the pilot should make the initial turn into any crosswind using a 45° bank angle. This bank angle provides a safe margin above stall speed, incurs an acceptable amount of altitude loss, and completes a course reversal in a timely manner. Using a shallow bank angle may not allow enough time for the glider to align with the landing area. An excessively steep bank angle may result in an accelerated stall or wingtip ground contact. Provided the departure drifted downwind and the pilot makes the turn back to the field into the crosswind, the glider may only need minor additional course corrections to align with the intended landing area. Throughout the maneuver, the pilot should maintain the appropriate approach speed and proper coordination to maximize range.

While downwind landings result in higher groundspeeds, the glider pilot should maintain the appropriate approach airspeed. Landing downwind results in a shallower than normal approach, and the pilot may use spoilers or dive brakes to control the descent path during the straight-in portion of the approach. Higher groundspeed becomes especially noticeable during the flare. After touchdown, the pilot should use the spoilers or dive brakes and use wheel brakes to slow and stop the glider before any loss of directional control. During the latter part of the roll-out, the glider may feel unresponsive to the controls even though rolling along the runway at a higher than normal groundspeed.

Tow Failure above 800' AGL

When the emergency occurs at or above 800 feet above the ground, the glider pilot has more time to assess the situation. Depending on the gliderport or airport environment, the pilot may choose to land on a cross runway, into the wind on the departure runway, or on a taxiway. [*Figure 8-6*, panel 4] In some situations, an off-gliderport or off-airport landing may be safer than attempting to land on the gliderport or airport.

Tow Failure above Traffic Pattern Altitude

If an emergency occurs above the traffic pattern altitude, the glider pilot should maneuver away from the towplane, and release the tow line if still attached. The glider pilot should turn toward the gliderport or airport while evaluating the situation and then decide whether to search for lift or make an immediate return to the gliderport or airport for landing. Pilots should remember their obligation when dropping objects (such as a tow line) from an aircraft according to Title 14 of the Code of Federal Regulations part 91, section 91.15, and not create a hazard to persons and property on the ground. [*Figure 8-12*, panel 4]

Slack Line

Slack line is a reduction of tension in the tow line. If the slack is severe enough, it might entangle the glider or cause damage to the glider or towplane. The following situations may result in a slack line:

- Abrupt power reduction by the towplane
- Aerotow descents
- Glider turns inside the towplane turn radius [*Figure 8-7*]
- Updrafts and downdrafts
- Abrupt recovery from a wake box corner position
- Glider dives toward towplane [*Figure 8-8*]

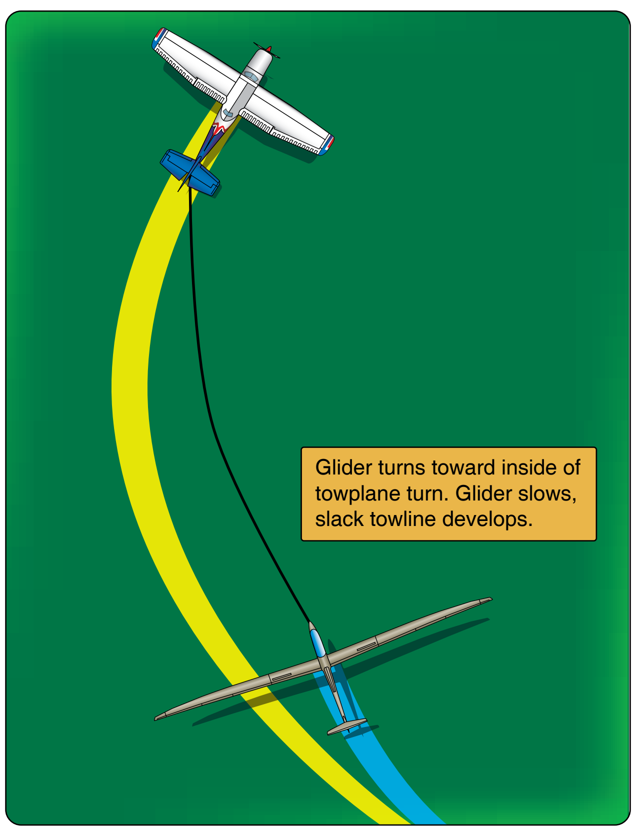

Figure 8-7. *Glider bank steeper than that of towplane, causing slack in tow line.*

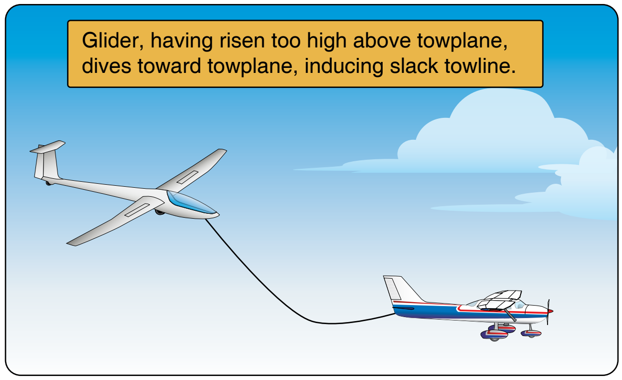

Figure 8-8. *One method of generating tow line slack.*

When the towplane precedes the glider into an updraft, the glider pilot perceives the towplane as climbing faster and higher than the glider. Then, as the glider enters the updraft, it climbs higher and faster than the towplane did. As a result, the glider pilot pitches the glider over to regain the proper tow altitude, gains airspeed more quickly than the towplane, and creates a slack tow line.

A glider pilot should initiate slack tow line recovery procedures as soon possible by increasing drag. For example, the glider pilot may slip back into alignment with the towplane. If slipping motion fails to reduce the slack sufficiently, careful use of spoilers/dive brakes can decelerate the glider and take up the slack. As the tow line tightens and the tow stabilizes, the glider pilot removes the extra drag and resumes the desired aerotow position. The glider pilot should immediately release from the aerotow if the slack in the tow line becomes excessive or gets beyond the pilot's capability to recover safely.

Common errors regarding a slack line include:

- Failure to take corrective action at the first indication of a slack line.
- Improper procedure to correct slack line causing excessive stress on the tow line, towplane, and the glider.
- Failure to decrease drag as tow line slack decreases.

Ground Launch Abnormal & Emergency Procedures

Abnormal Procedures

The launch equipment operator manages a speed-controlled winch some distance from the glider, and the initial tow speed and tension could vary. A tow line speed too great could exceed glider limitations while a speed too low may make liftoff difficult, prevent further climb after liftoff, or result in stall after takeoff. The pilot should use appropriate radio calls and augment with visual signals if necessary, to direct the launch operator to increase or decrease speed. The pilot should release the tow line and land ahead if an abnormal situation develops.

A launch mechanism malfunction may interrupt a ground launch. A gradual deceleration in rate of climb or airspeed may be an indication of this type of malfunction. If suspecting a launch mechanism malfunction, the glider pilot should release and land ahead. However, a pilot might confuse an unintended opening of the spoilers with a winch malfunction if the pilot does not notice the spoilers opening. The pilot should quickly check the status of the spoilers if performance appears degraded during the tow.

Wind gradient (a sudden increase in windspeed with height) can have a noticeable effect on ground launches. A significant or sudden wind gradient may increase indicated airspeed and exceed the maximum ground launch tow speed. [*Figure 8-9*] When encountering a wind gradient, the pilot should push forward on the stick to reduce the tension on the tow line, which reduces indicated airspeed. The only way for the glider to resume climb without exceeding the maximum ground launch airspeed involves signaling the launch operator to reduce tow speed. After the reduction of towing speed, the pilot can resume normal climb. If launching using a winch with automatic tension control, the glider pilot uses conventional pitch changes to control airspeed and climbs at a higher rate if wind speed increases in a gradient.

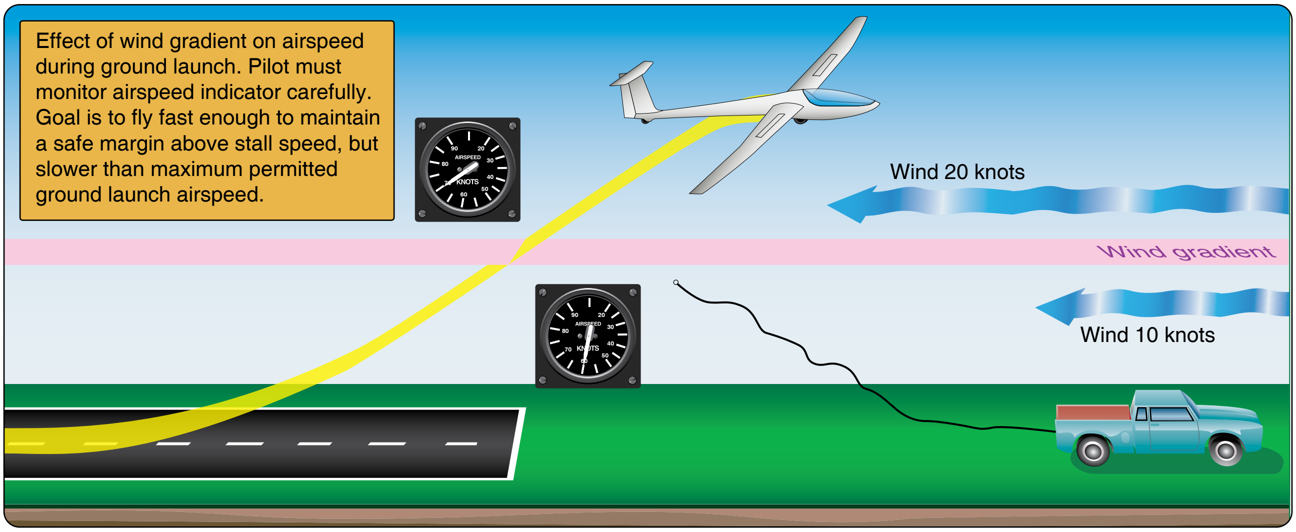

Figure 8-9. *Ground launch wind gradient.*

Emergency Procedures

A broken tow line may cause an emergency during a ground launch. [*Figure 8-10*] When a tow line failure occurs, the glider pilot should pull the release handle, immediately lower the nose of the glider, and maintain a safe airspeed. Distinguishing features of the ground launch include nose-high pitch attitude and a relatively low altitude for a significant portion of the launch and climb. If a tow line break occurs and the glider pilot fails to respond promptly, the nose-high attitude of the glider may result in a stall.

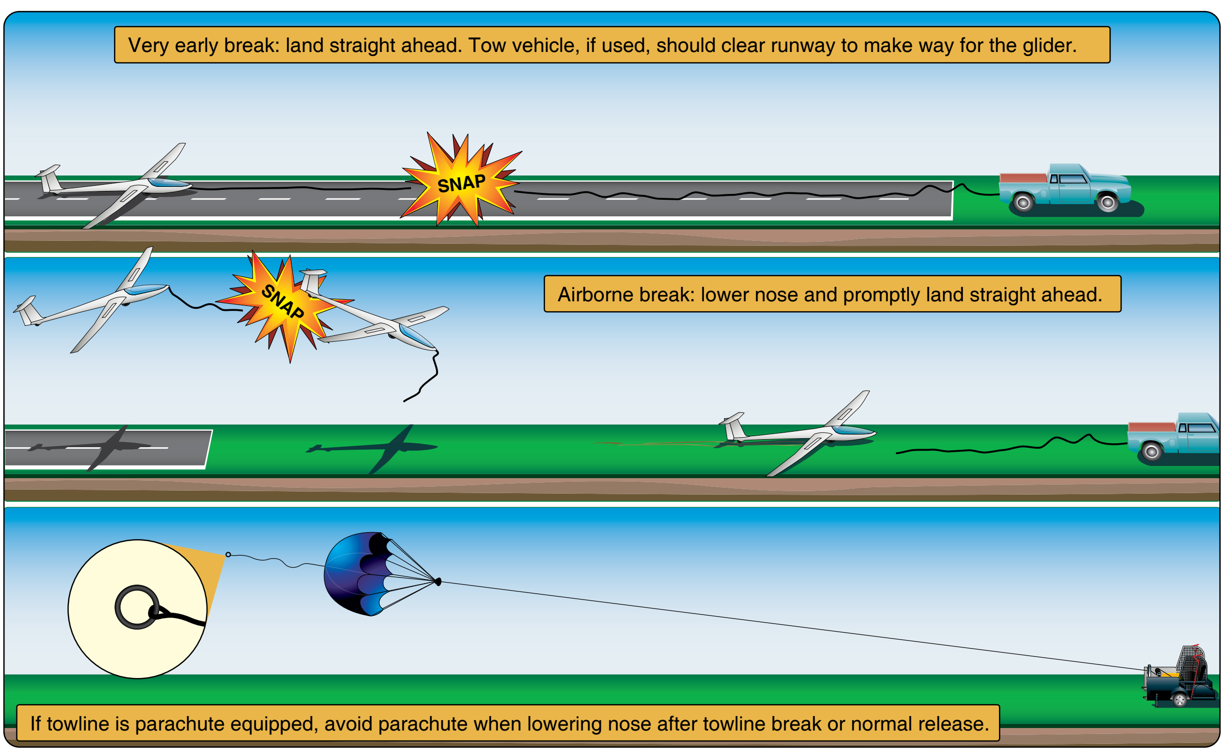

Figure 8-10. *Ground launch tow line break.*

If the glider tow release mechanism fails, the pilot should fly at airspeeds no lower than best lift over drag (L/D) airspeed. The pilot should fly over and then past the ground launch equipment. This method allows the glider tow hook back release to activate or the tow line weak link to fail. The ground launch equipment also uses an emergency release mechanism in the event the glider tow release fails. Winches should have a guillotine to cut the tow line, if necessary. If using a motor vehicle for a ground launch, it should also have some form of backup release mechanism.

Self-Launch Takeoff Emergency Procedures

Prior to takeoff, the pilot should formulate emergency plans for any type of failure that might occur. Thorough knowledge of aircraft performance data, normal takeoff and landing procedures, and emergency procedures as outlined in the GFM/POH help bring about the successful management of any emergency.

Mismanagement of the aircraft systems through lack of knowledge may cause serious difficulty. For instance, if the spoilers or dive brakes remain open during takeoff and climb or open inadvertently, the self-launching glider may not generate sufficient excess power to continue climbing. Other emergency situations may include inflight fire, structural failure, encounters with severe turbulence, wind shear, canopy failure, and inadvertent encounter with instrument meteorological conditions (IMC).

Possible options for handling emergencies depend on altitude above the terrain, wind, and weather conditions. As a part of preflight planning, pilots should review the effects of density altitude on glider performance, the takeoff runway length, landing areas near the gliderport, and potential air traffic that could affect the pilot's approach and landing decisions. Emergency options may include landing ahead on the remaining runway, landing off field, or returning to the gliderport to land on an available runway. The appropriate emergency procedures may be found in the GFM/POH for the specific self-launching glider.

Spiral Dives

An excessive low-nose attitude during a steep turn may result in a significant increase in airspeed and loss in altitude, which indicates a spiral dive. If the pilot attempts to recover from this situation by applying back elevator pressure only, the limiting load factor may be exceeded, causing structural failure. To recover from a spiral dive, the pilot should first reduce the angle of bank with coordinated use of the rudder and aileron, and then smoothly increase pitch to the proper attitude.

Common errors during spiral dives include:

- Failure to recognize when a spiral dive develops.
- Rough, abrupt, or uncoordinated control application during recovery.
- Improper sequence of control applications.

Spins

During a spin, the glider follows a downward corkscrew path. A spin entry may occur after an aggravated stall of one or both wings that results in rotation around the vertical axis. As the glider rotates around the vertical axis, the outer wing develops more lift and less drag than the inner stalled wing, creating a rolling, yawing, and pitching motion. [*Figure 8-11*] The pilot may not realize that the critical angle of attack has been exceeded until the glider yaws toward the lowering wing.

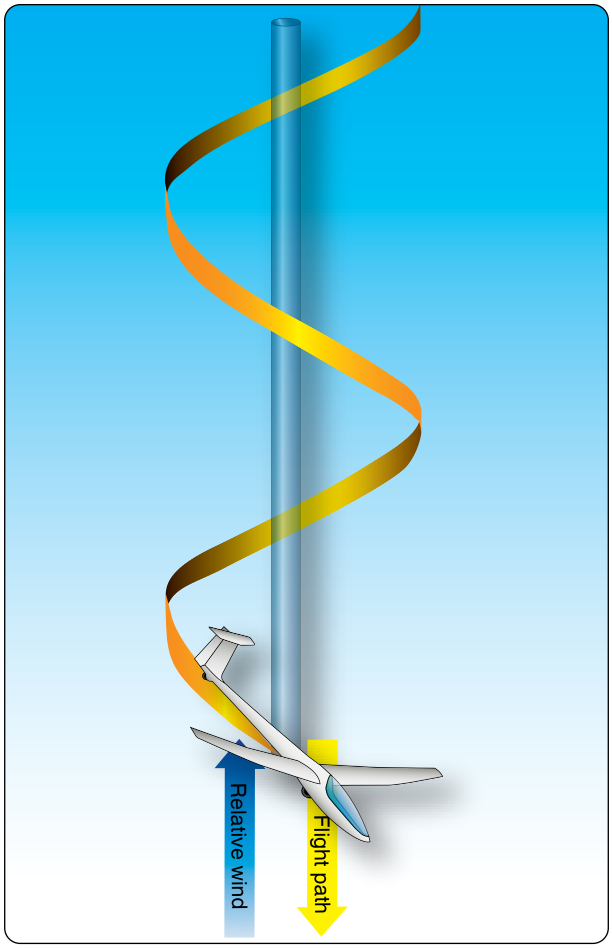

Figure 8-11. *Autorotation of spinning glider.*

Many gliders need considerable effort to enter a spin and require good judgment and technique to intentionally enter a spin. However, these same gliders may enter a spin accidentally if the pilot mishandles the controls in turns, stalls, and flight at minimum controllable airspeeds. This fact explains why pilots should practice stalls and develop the ability to recognize and recover from them.

Continued practice of stall recognition and recovery helps the pilot develop an instinctive and prompt reaction to prevent a spin. The pilot should apply immediate corrective action any time the glider approaches spin conditions, and the pilot should immediately execute spin recovery procedures if a spin occurs.

A flight instructor may demonstrate spins and spin recovery techniques with emphasis on any special spin procedures or techniques required for a particular glider. Before beginning any spin operations, the following items should be reviewed:

- GFM/POH limitations section, placards, or type certification data sheet, to determine if the glider is approved for spins.
- Weight and balance limitations.
- Proper recommended entry and recovery procedures.
- Any requirements for parachutes as given in Title 14 of the Code of Federal Regulations (14 CFR) part 91.

Before any flight, and especially one with intentional spins planned, pilots should check for excess or loose items that may affect the weight, CG, and controllability of the glider. Slack control cables (particularly rudder and elevator) could prevent full control deflections and delay or preclude recovery in some gliders.

Prior to initiation of a spin, the pilots should check the flight area above and below the glider for other air traffic and not spin if any conflict exists. Clearing the area may occur while slowing the glider for the spin entry. All spin training should initiate at an altitude high enough for a completed recovery at or above 1,500 feet AGL and within gliding distance of a landing area. The following paragraphs describe four phases of a spin.

Entry Phase

In the entry phase, the pilot provides the necessary elements for the spin. The spin demonstration entry procedure begins much like a stall. However, as the glider approaches a stall, the pilot smoothly applies full rudder in the direction selected for spin rotation and full back (up) elevator to the limit of travel. The pilot should maintain the ailerons in the neutral position during the spin procedure unless the GFM/POH specifies otherwise.

Incipient Phase

The incipient phase begins as the glider stalls and rotation begins. As an incipient spin develops, the indicated airspeed should read near or below stall airspeed. This phase can run until the spin develops fully, which may take up to two turns for most gliders. Instructors commonly use an incipient spin for introduction to spin training and begin recovery prior to the first of 360° of rotation. In this phase, the aerodynamic and inertial forces have not achieved a balance.

Developed Phase

The developed phase occurs when the glider's angular rotation rate, airspeed, and vertical speed stabilize with the glider in a nearly vertical flightpath. Equilibrium occurs in this phase as aerodynamic forces and inertial forces balance and the attitude, angles, and self-sustaining motions about the vertical axis become constant or repetitive.

Recovery Phase

This phase may last for a quarter turn to several turns. To accomplish spin recovery, pilots should follow the manufacturer's recommended procedures. In the absence of the manufacturer's recommended spin recovery procedures, pilots should follow the following steps for general spin recovery:

1. Ailerons to neutral. Ailerons may have an adverse effect on spin recovery. Aileron control in the direction of the spin may increase the rate of rotation and delay the recovery. Aileron control opposite the direction of the spin may cause the down aileron to move the wing deeper into the stall and aggravate the situation. Retract flaps, if extended, as soon as possible after spin entry.

2. Apply full opposite rudder against the rotation. Ensure full (against the stop) opposite rudder until rotation stops. As spin rotation stops, neutralize the rudder. If not neutralized at this time, the deflected rudder may cause a yawing effect in the opposite direction.

3. When rotation stops, apply a positive and brisk, straightforward movement of the elevator control past neutral to recover from the stall. Slow and overly cautious control movements during spin recovery may result in the glider continuing to spin indefinitely, even with anti-spin inputs. A brisk and positive technique, on the other hand, results in a more positive spin recovery. Hold the controls firmly in this position until airspeed begins increasing.

4. With rotation stopped, angle of attack below the critical angle, and nose-down attitude, airspeed increases rapidly. Make smooth pitch control input of sufficient magnitude. Pulling up aggressively may cause a second stall and spin during the recovery. Waiting too long to pull up could lead to high airspeed and excessive G-loading.

The FAA recommends these recovery procedures for use only in the absence of the manufacturer's procedures. Before any pilot begins spin training, the pilot should understand any spin recovery procedures provided by the manufacturer.

The most common problems in spin recovery include pilot confusion when determining the direction of spin rotation and whether the maneuver constitutes a spin or a spiral dive. An inclinometer does not indicate the direction of a spin. A high or increasing airspeed indicates a spiral dive. In a spin, the airspeed reads at or below stalling speed.

Common errors when encountering/practicing spins include:

- Failure to clear area before a spin.
- Failure to establish proper configuration prior to spin entry.
- Failure to correct airspeed for spin entry.
- Failure to recognize conditions leading to a spin.
- Failure to achieve and maintain stall during spin entry.
- Improper use of controls during spin entry, rotation, or recovery.
- Disorientation during spin.
- Failure to distinguish a spiral dive from a spin.
- Excessive speed or secondary stall during spin recovery.
- Failure to recover before descent below safe altitude.
- Failure to recover with a landing area within gliding distance.

Off-Field Landing Procedures

Off-field landings may occur in the vicinity of the launching airport due to unexpected rapid weather deterioration, a significant change in wind direction, unanticipated amounts of sinking air, disorientation, lack of situational awareness, tow failures, and other emergencies. In these situations, a precautionary off-field landing may present less risk than an approach back to the airport. If the pilot loses sight of the airport or if the glide back to the airport comes up short for any reason, the attempt to return to the airport may result in damage to the glider or injury to the pilot.

A glider pilot should always be prepared for off-field landings as the absence of sufficient lift may require an off-field landing. Even when flying in a self-launching glider, the engine or power system could fail.

The basic ingredients for a successful off-field landing include an awareness of wind direction, wind strength at the surface, and obstacles along the approach path. The glider pilot should select suitable landing areas while airborne with sufficient height and time to plan and perform a safe approach and landing, and then make an accurate landing to the actual selected field.

These basic ingredients for a successful off-field landing can be summarized as follows:

- Recognizing the possibility of imminent off-field landing.
- Selecting a suitable area, then a suitable landing field within that area.
- Planning the approach with wind, obstacles, and local terrain in mind.

- Executing the approach, landing, and stopping the glider as soon as possible.
- Contacting ground crew and notifying them of the off-field landing location.

Denial represents the most common off-field landing planning failure. The pilot experiencing denial finds it easier to focus on continuing the flight and attempting to find a way to climb back up and fly away. This false optimism leaves little or no time to plan an off-field landing if the attempt to climb fails.

When planning an off-field landing, flying downwind offers more range and a greater area to search than flying upwind. After selection of a landing zone, wind awareness allows the pilot to plan the orientation and direction of a landing approach into the wind to shorten the landing roll. Pilots should visualize the wind flowing over and around the intended landing area including how low altitude turbulence may exist in the area downwind of hills, buildings, and other obstructions.

Pilots should use a methodical approach to an off-field landing based on a set of decision heights. The pilot should select a general landing area no lower than 2,000 feet above ground level (AGL) and select the intended landing field no lower than 1,500 feet AGL. At 1,000 feet AGL, the pilot should commit to flying the approach and landing.

Pilots should consider safety rather than an easy retrieval as the highest priority when selecting a landing site. During an off-field landing approach, the pilot will likely not know the precise elevation of the landing site. Since this makes the altimeter less useful, the pilot should fly the approach and assess the progress by recognizing and maintaining the angle that brings the glider to the intended aiming point for the landing site. When landing with a tailwind (due to slope or one-way entry into the selected field due to terrain or obstacles), the pilot should use a shallower approach angle.

A good approach clears each visible obstacle, including clearing any poles and wires by a safe margin. From the air, wires may not appear until right in front of the pilot, whereas towers supporting wires appear from a greater distance. The pilot should assume that wires run between telephone poles, supporting structures, and buildings. The pilot should plan to overfly any wires that may be present, even if not actually seeing them.

The pilot should select a field of adequate length and one with no visible slope, when possible. Any slope visible from the air becomes steep when close to the ground. Color may assist in assessment of slope. High spots often appear lighter in color than low spots because soil moisture tends to collect in low spots and darkens the color of the soil. If the landing will occur on a slope, landing uphill works better than downhill. With a slight downhill grade, the glider will stay airborne longer and experience a longer landing roll, which may result in a collision with objects at the far end of the selected field.

A pilot familiar with the colors of local seasonal vegetation can identify crops and other vegetation from the air. Tall crops generally present more danger than low crops. Pilots should also avoid discontinuities such as lines or crop changes since these discontinuities often indicate the presence of a fence, ditch, irrigation pipe, or some other obstacle or machinery that could damage a glider.

The recommended approach procedure should include the following legs:

- Crosswind leg on the downwind side of the field
- Upwind leg
- Crosswind leg on the upwind side of the field
- Downwind leg
- Base leg
- Final approach

This approach procedure provides the opportunity to see the intended landing area from all sides. Pilots should use every opportunity while flying an off-field approach to inspect the landing area and look for obstacles or other hazards. [*Figure 8-12*]

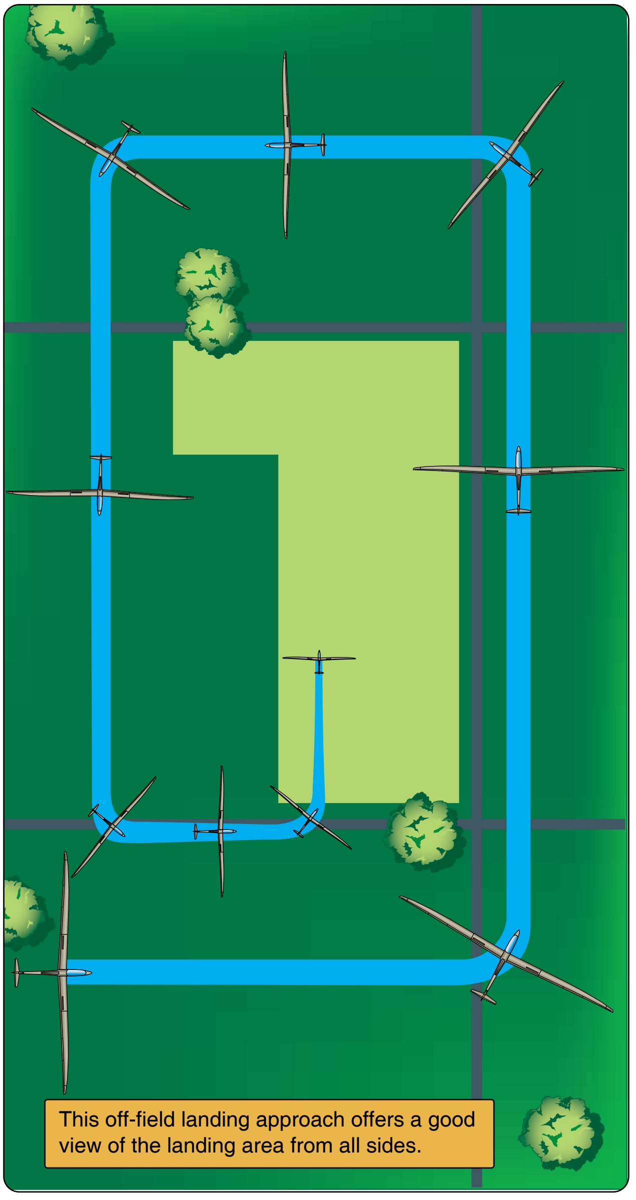

Figure 8-12. *Off-field landing approach.*

The pilot should also consider how obstacles affect the length of landing area available for touchdown, roll out, and stopping the glider. Flying over an obstacle 50 feet high means the glider will overfly the first 500 feet or so of the landing area during the descent to flare and landing. If the selected field has obstacles on the final approach path, the field should also allow for the descent, flare, and landing roll after clearing the obstacle.

Aerodynamic drag works better than wheel brakes at flying speeds. Pilots who hold the glider off during the flare and touch down at the lowest safe speed will land within a shorter distance. After touchdown, using the wheel brake immediately will stop the glider and help prevent collision with any unseen obstacles.

Afterlanding Off Field

Off-Field Landing without Injury

A pilot should tend to personal needs first, secure the glider, and then contact the retrieval crew. If cell service exists, the pilot can use a cell phone to call the retrieval crew. To help identify position, the pilot should relay the GPS coordinates. Pilots should write down the coordinates in case the GPS loses power. If able, calling other glider pilots in the area on the glider-to-glider radio frequency or calling the tow plane can assist with retrieval.

Once contact has been made to arrange for retrieval, the pilot may collect any special tools needed for glider de-rigging or installing gust locks on the glider's flight controls. Since a normal retrieval depends on location, weather and time of day, the pilot may need to set up equipment to handle the current or expected environmental conditions.

Off-Field Landing with Injury or Emergency

A pilot should address any critical injuries and contact emergency response personnel, other aircraft, or any other source of identifiable assistance. If cell coverage exists, the pilot can dial 911, speak to an operator, and provide a clear description of the location. If cell service does not work, a pilot may use the glider radio, if operable, to broadcast a Mayday distress call on emergency frequency 121.5 MHz. Many aircraft, including civil airliners, routinely monitor this frequency. Their altitude gives the line-of-sight aviation transceiver enhanced range when transmitting or receiving. The pilot may try any other frequency likely to elicit a response such as glider air-to-air frequency or the tow plane frequency. Some gliders have an Emergency Locator Transmitter (ELT) on board. A pilot needing emergency assistance should activate the ELT, if available. While 14 CFR, part 91, section 91.207 does not pertain to gliders, an ELT or EPIRB adds safety when flying a glider on a cross-country. Personal locator devices offered by several companies use the 406 MHz satellite signal, and GPS technology to accurately track and relay the pilot's location in the event of an off-field landing that requires emergency assistance. Additionally, pilots may elect to carry satellite communications and tracking devices that allow communication even outside of cell coverage.

If the glider comes to rest in a precarious position, the pilot should secure the aircraft if able. An injured pilot should stay with the glider. Rescue personnel can locate the glider more easily from the air than locate an individual. The pilot might obtain protection from the elements by crawling into the fuselage, crawling under a wing, or using any parachute canopy to rig a makeshift tent around the glider structure. After attending to medical needs and contacting rescue personnel, the pilot should attend to clothing, food, and water issues. The pilot should make every attempt to conserve energy. If unsafe to stay with the glider, the pilot should move to a nearby location for shelter but leave clear written instructions in a prominent location in the glider detailing the shelter location.

System & Equipment Malfunctions

Flight Instrument Malfunctions

Instrument failures can result from improper maintenance practices, internal instrument failure, or an external cause. Improper airspeed indicator maintenance might involve failure to connect the instrument correctly to pitot and static lines. External failures include clogging from insects or ice.

Pilots should practice setting normal attitudes for all flight regimes using outside cues including the skills needed to make a safe approach without a functioning airspeed indicator or altimeter. In fact, many older and vintage gliders do not require an operational altimeter. A flight review or periodic instruction provides an excellent opportunity to review these procedures.

Static line contamination affects both the altimeter and the airspeed indicator. If either instrument malfunctions because of static line contamination, the indications of the other instrument may also be incorrect. The pilot should use external cues and evaluate the indications of any instrument connected to the static port. If in doubt about the accuracy of the instruments, the pilot should not rely on the instrument indications. After landing and prior to the next flight, an aviation maintenance professional should evaluate the instrument system.

Altimeter Malfunctions

During the approach to land without a functioning altimeter, the pilot should assess the angle to the target area frequently. Entering the approach from an apparent normal height, or even from a higher-than-normal height provides a margin of safety. If the current descent angle would overfly the target, the pilot applies spoilers or dive brakes to steepen the descent angle. If necessary, a forward slip or turning slip dissipates excess altitude. If the approach angle will result in a landing short of the target, the pilot should close the spoilers or dive brakes and can modify the approach path to shorten the distance to the targeted landing area as needed.

Airspeed Indicator Malfunctions

If the airspeed indicator appears to be erratic or inaccurate, the pilot should fly the glider by pitch attitude for best glide or minimum sink airspeed. Additional airspeed cues include control response and wind noise. At very low airspeeds, controls feel mushy and wind noise is generally low. At higher airspeeds, control becomes crisper and wind noise takes on a more insistent hissing quality. The pilot may amplify the sound of the relative wind by opening the sliding window installed in the canopy and by opening the air vent control. Turbulent or gusty wind conditions generally require additional airspeed to ensure adequate control authority. If in doubt, flying slightly faster than optimum airspeed provides a safety margin above stall speed. However, a speed higher than best glide airspeed increases the rate of descent and decreases range.

Variometer Malfunctions

Variometer failure makes it difficult for the pilot to locate and exploit sources of lift. If near an airport, the pilot may elect to make a precautionary landing so troubleshooting and repair can take place. Without a nearby airport, the pilot can look for clues to sources of lift. The pilot can use the altimeter to gauge rate of climb or descent in the absence of a functioning variometer. Tapping the altimeter with a finger often overcomes internal friction in the altimeter, allowing the hand to move upward or downward. The direction of the movement gives an idea of the rate of climb or descent over the last few seconds.

Compass Malfunctions

If the compass performs poorly or not at all, the pilot should cross-check current position with aeronautical charts and with electronic methods of navigation, such as GPS, if available. The position of the sun, combined with knowledge of the time of day, can also help with orientation. Section lines, major roads, and prominent landmarks often provide helpful cues for orientation and the direction of flight.

Glider Canopy Malfunctions

Glider Canopy Opens Unexpectedly

Canopy-related emergencies often result from pilot failure to lock the canopy in the closed position prior to takeoff. If the canopy opens in flight, the pilot should focus on flying the glider. The pilot should maintain adequate airspeed while selecting a suitable landing area. An open canopy causes higher than normal drag, and the pilot should plan a steeper-than-normal descent path.

If the canopy opens while on aerotow, the pilot should maintain a normal flying attitude and tow position. The glider pilot should not attempt to close the canopy or release prematurely. After continuing to climb with the tow plane to several thousand feet above the ground and releasing the tow rope, the pilot may try to close the canopy only if able to maintain glider control. If flying with a passenger on board and conditions allow, the pilot can direct the passenger to close and lock the canopy.

Broken Glider Canopy

If the canopy breaks during flight, the best response involves landing as soon as practicable. If the canopy shatters, drag increases and the pilot should plan a steeper-than-normal descent path during the approach.

Frosted Glider Canopy

During flight at high altitude or in low ambient temperatures, frost formation or frozen condensation on the inside surface of the canopy can obstruct vision. The pilot should open the air vents and the side window to ventilate the cabin and to evacuate moist air before this occurs. Descending to lower altitudes for warmer air or flying in direct sunlight may help defrost the canopy.

Water Ballast Malfunctions

One example of ballast failure involves asymmetrical wing tank draining. With one wing heavier than the other, the glider may become difficult to control at low airspeeds and during the landing rollout. Another failure involves wing tanks that drain using a central pipe that passes through the fuselage. A leak in this system may trap water in the fuselage. The pilot should determine if a means exists to evacuate the water from the fuselage. If the water collects far enough forward or aft, it may cause an out of CG condition and degrade pitch control. Pilots can regain elevator effectiveness by flying at mid-to-high airspeeds. If pitch control degrades significantly, the pilot with sufficient altitude and a parachute might consider a bailout as the safest choice.

Retractable Landing Gear Malfunctions

During flight, the pilot cannot generally resolve landing gear failures related to mechanical malfunctions. The pilot should fly the approach at normal airspeed and may need to use more spoiler or dive brake than normal during the approach due to the reduced drag. The pilot should land on the smoothest surface available, preferably an area that has good turf to reduce damage to the glider. A full stall, hard, or tailwheel first landing increases the chances of injury and damage, and the pilot should make a soft touchdown slightly above stall speed.

In a gear-up landing, the glider makes considerable noise as it slides along the runway, and the wingtips travel closer to the ground. The pilot should keep the wings level while possible and keep the glider path as straight as possible while using the rudder to avoid collisions with objects on the ground or along the runway border. The pilot should focus on personal safety since no method exists to prevent glider skin damage during a gear-up landing.

Primary Flight Control Systems

Failure of any primary flight control system presents a serious threat to safety. Incomplete preflight assembly represents the most frequent cause of control system failure. The crew should use a written checklist to verify each assembly operation and avoid interruptions during assembly. If interruptions occur, the crew should rerun the checklist from the beginning. A critical assembly check aids in confirming the glider has been assembled correctly and a positive control check prior to flight verifies control system continuity.

Elevator Malfunctions

The most serious control system malfunction involves a failure of the elevator. Causes of elevator failure include the following:

- An improper connection of the elevator actuators during assembly.
- An elevator control lock that was not removed before flight.
- Separation of the elevator gap seal tape.
- Interference with free and full travel of the control stick or system caused by a foreign object such as a water bottle, camera, or unsecured rear-seat cushion.
- A control stick secured by a lap belt or shoulder harness in the back seat.
- A structural failure of the glider due to overstressing or flutter.

If the pilot detects elevator irregularity or failure early in the takeoff roll, release of the tow line (or power reduction to idle in a self-launching glider), may allow obstacle avoidance. The pilot should use the brakes firmly to stop the glider as soon as possible.

In an aerotow launch, the glider pilot should consider the effect the glider has on the safety of the tow pilot and if the glider pilot has a parachute. If the elevator control irregularity becomes apparent after takeoff and if close to the ground with a flat or slightly nose-low pitch attitude, the pilot should release the tow line. If sufficient elevator control exists during climb, staying attached and achieving a high altitude gives the pilot time to abandon the glider and deploy a parachute, if available.

If continuing the climb, the pilot can experiment with the effect of other flight controls on the pitch attitude of the glider. These include the effects of various wing flap settings, spoilers or dive brakes, elevator trim system, and raising or lowering the landing gear. If flying a self-launching glider, the pilot can also experiment with the effect of power settings on pitch attitude.

If aileron control functions, the pilot can bank the glider and use the rudder to moderate the attitude of the nose relative to the horizon. When approaching the desired pitch attitude, adjusting the bank angle can maintain the desired pitch attitude. Forward slips may have a predictable effect on pitch attitude and can be used to moderate it. Usually, a combination of these techniques allows some control of pitch attitude. Although difficult to use, these techniques allow some control. Achieving an altitude sufficient to permit bailing out usually ends in survival as parachutes rarely fail.

Elevator gap seal tape, if in poor condition, can degrade elevator responsiveness. If the adhesive that bonds the gap seal leading edge to the horizontal stabilizer begins to fail, the airflow may lift the leading edge of the gap seal. This provides, in effect, a small spoiler that disturbs the airflow over the elevator just aft of the lifted seal. In extreme cases, this effect can remove all elevator authority.

Aileron Malfunctions

Aileron failures can cause serious control problems. Causes of aileron failure include:

- Improper connection of the aileron control actuators during assembly.
- Aileron control lock not removed before flight.
- Separation of the aileron gap seal tape.
- Interference of a foreign object with free and full travel of the control stick or aileron circuit.
- A control stick secured by a lap belt or shoulder harness in the back seat.
- Structural failure and/or aileron flutter.

The pilot might counteract this failure successfully because each wing has an aileron. If one aileron becomes disconnected or locked by an external control lock, the degree of motion still available in the other aileron may exert some influence on bank control. A glider with limited aileron movement may control more easily at high airspeeds than at low airspeeds.

If both ailerons malfunction and compromise roll control, the pilot may use the secondary effect of the rudder to make gentle bank adjustments while maintaining a safe margin above stall speed. If the pilot applies left rudder in wings-level flight, the nose yaws to the left. If the pressure is held, the wings begin a gentle bank to the left. If the pilot applies and holds right rudder pressure, the glider yaws to the right, then begins to bank to the right. The pilot can use this secondary banking effect of the rudder for limited roll control. However, if the bank angle becomes excessive, recovery to wings-level flight using the rudder alone may become impossible. If the bank becomes too steep, the pilot should use any aileron influence available, as well as all available rudder to level the wings. If a parachute is available and the glider becomes uncontrollable at low airspeed, the best chance to escape serious injury may be to bail out from a safe altitude.

Rudder Malfunctions

An actual rudder failure rarely occurs because removing and installing the vertical fin/rudder combination does not occur as part of the sequence of rigging and de-rigging the glider. The pilot should recognize any obvious directional control issue caused by a rudder malfunction at the very beginning of a launch and abort immediately.

Rudder malfunctions may occur if the pilot forgets to remove the rudder control lock or when an unsecured object interferes with the free and full travel of the rudder pedals. Preflight preparation should include safe stowage of all items on board and removal of all flight control locks. The pretakeoff checklist encompasses all primary flight controls for correct and full travel prior to launch.

During flight, if an object interferes with or jams the rudder pedals, the pilot should attempt to remove it. If removal fails, the pilot can attempt to deform, crush, or dislodge the object by applying force on the rudder pedals. Varying the load factor may dislodge the object but could also result in moving the object and jamming the elevator or aileron controls. If the object cannot be retrieved and stowed, the pilot should consider a precautionary landing.

In the air, the pilot may obtain some degree of directional control by using adverse yaw. During rollout from an aborted launch or during landing rollout without rudder control, the pilot can deliberately ground the wingtip toward the direction of desired yaw. Putting the wingtip on the ground for a fraction of a second causes a slight yaw in that direction; however, holding the wingtip firmly on the ground may cause a ground loop in the direction of the grounded wingtip.

Commonly misplaced objects that can cause rudder control interference include:

- Water bottles.
- Cameras.
- Electronic computers.
- Containers of food and similar items.
- Clothing.
- Sunglasses.

Secondary Flight Controls Systems

Secondary flight control systems include the elevator trim system, wing flaps, and spoilers or dive brakes. Malfunction of these systems may present a serious challenge.

Elevator Trim Malfunctions

When compensating for a malfunctioning elevator trim system, the pilot should apply pressure on the control stick to maintain the desired pitch attitude, and then bring the flight to safe conclusion.

Spoiler/Dive Brake Malfunctions

Spoiler or dive brake system failures arise from rigging errors or omissions, environmental factors, and mechanical failures. Without proper connection, one or both spoilers or one or both dive brakes could deploy without the possibility of retraction. Spoiler or dive brake deployment during the launch or the climb may cause a launch emergency and possible tow failure. Spoilers or dive brakes that deploy asymmetrically, result in yaw and roll tendencies.

If an asymmetric spoiler or dive brake extension occurs and the pilot cannot retract the extended spoiler or dive brake, the pilot may attempt to deploy the other spoiler or dive brake to restore the symmetry, which protects against stalling or a spin. If this condition arises during launch or climb, the pilot should abort the launch, extend the other spoiler or dive brake to restore symmetry, and land.

Environmental factors include low temperature or icing during long, high altitude flights. Lower temperatures cause contraction of all glider components. Uneven contraction may bind the spoilers or dive brakes and make them difficult or impossible to deploy. Any moisture trapped in the system may freeze and interfere with operation of the spoilers or dive brakes. On the other hand, a rise in temperature causes all glider components to expand, which could bind the spoilers or dive brakes in the closed position. This could occur with the glider parked on the ground in direct summer sunlight.

Mechanical failures can cause asymmetrical spoiler or dive brake extension during flight. Causes may include a broken weld in the spoiler or dive brake actuator mechanism, a defective control connector, or other mechanical failure. The glider yaws and banks toward the wing with the extended spoiler or dive brake. Aileron and rudder counteract these tendencies. To eliminate any possibility of a stall or spin entry, the pilot should maintain a safe margin above stall airspeed. While deploying the other spoiler or dive brake relieves the asymmetry, it reduces gliding range. This may be a significant concern if over rough terrain. Nevertheless, a controlled landing in rough terrain has much less associated risk than an asymmetric stall or spin.

Miscellaneous Flight System Malfunctions

Towhook Malfunctions

Failure modes include failure to release and uncommanded release. The pilot should form an emergency plan prior to launch for either condition. A pilot who cannot release the tow line should alert the tow pilot and follow appropriate emergency procedures.

Oxygen System Malfunctions

If a suspected or known failure of the oxygen system occurs, the pilot should descend immediately to an altitude that does not require supplemental oxygen. A pilot deprived of sufficient oxygen, even for a short interval, loses critical thinking capability and may develop a false sense of wellbeing. After descending, the pilot should avoid hyperventilation and breathe normally to restore oxygen to the bloodstream.

For high altitude flights, such as a wave flight, the oxygen bailout bottle should be in good condition and within easy reach if a high-altitude escape becomes necessary. Pilots who make high altitude flights should train for an event requiring glider abandonment, use of oxygen, and proper use of a parachute.

Drogue Chute Malfunctions

Some gliders have a drogue chute to add drag during the approach to landing and enhance a steep approach. The drogue chute stows in the aft tip (tail cone) of the fuselage or in a special compartment in the base of the rudder. If the chute deploys accidentally or inadvertently during the launch, the pilot normally jettisons it.

During an approach, an improperly packed or damp drogue chute may fail to deploy. If this happens, the pilot may use the rudder to sideslip briefly or use the rudder to yaw the glider to attempt deployment. Either technique can increase the drag force on the component that pulls the parachute out of the compartment. If neither technique deploys the drogue chute, the drogue canopy may deploy spontaneously. If this occurs, the pilot has the option to jettison the chute.

Another malfunction involves failure of the drogue chute to inflate. If this happens, the canopy “streams” like a twisting ribbon of nylon, providing only a fraction of the expected drag. Full inflation, although unlikely after streaming occurs, would increase drag substantially. Rather than face any sudden increase in drag and if in doubt as to the status of deployment, the pilot can jettison the chute. Regardless of the malfunction type, the pilot should review approach and landing options for the drogue chute conditions.

Self-Launching Gliders

Self-launching gliders have multiple systems to support powered flight. The pilot should review the GFM/POH for the self-launching glider flown, develop an understanding of the glider systems, and work with a glider instructor as necessary to develop proficiency. Additional systems in a self-launching glider may include the following:

- Fuel tanks, lines, and pumps.
- Engine or propeller extension and retraction systems.
- Electrical system including engine starter system.
- Lubricating oil system.
- Engine cooling system.
- Engine throttle controls.
- Propeller blade pitch controls.
- Engine monitoring instruments and systems.

An engine in a self-launching glider may fail. Failures range from a very slight power loss at full throttle to catastrophic and sudden failure during a full-power takeoff. Fuel contamination or fuel exhaustion cause a significant number of these failures.

Full power operation of an internal combustion engine cannot continue without a supply of fuel, source of ignition, internal cooling, and lubrication. The pilot should monitor the engine temperature, oil pressure, fuel pressure, and revolutions per minute (rpm) carefully to ensure the desired engine performance. Warning signs of impending difficulty include excessively high engine temperatures, abnormal engine oil temperatures, low oil pressure, low rpm despite high throttle settings, low fuel pressure, or abnormal engine operation that includes surging, backfiring, or missing. Abnormal engine performance may indicate complete engine failure will occur within a short time. Even if total engine failure does not occur, an engine that cannot produce full power may create an inability to hold altitude or climb. The best course of action, if airborne, involves landing followed by appropriate maintenance and repair.

Regardless of the type of engine failure, the pilot should maintain flying airspeed and control the glider. Pilots flying self-launching gliders with a pod-mounted external engine above the fuselage need to lower the nose more aggressively than pilots flying a glider with an engine mounted in the nose. In the former, the thrust of the engine during full power operations tends to provide a nose-down pitching moment. If power fails, a nose-up pitching moment occurs due to the substantial parasite drag of the engine pod high above the longitudinal axis of the glider. At low altitudes, the pilot may not have time to stow the engine and will land with the engine extended. The GFM/POH contains authoritative information regarding the correct sequence of pilot actions in the event of power failure.

A power failure during launch or climb may provide limited time to maneuver. The pilot should concentrate on flying the glider, selecting a suitable landing area, and making a safe landing. Troubleshooting should only occur if safe to do so. Even if the pilot restores power, full power may not come back. Flight with partial power may result in an inability to clear obstacles, such as wires, poles, hangars, or nearby terrain.

Inability to Restart a Self-Launching/Sustainer Glider Engine While Airborne

Nearly all self-launching gliders have a procedure designed to start the engine while airborne. This procedure allows the pilot to fly home safely during a flight where soaring flight conditions deteriorate. However, engines may not start in some situations. The reasons include lack of fuel, ignition malfunction, low engine temperature due to cold soak, insufficient battery output, fuel vapor lock, lack of propeller response to blade pitch controls, and other factors. This becomes a serious problem with unsuitable terrain below for a safe off-field landing.

The pilot should attempt the engine restart at an altitude high enough to complete a safe power-off approach and landing in case the restart fails. Self-launching glider pilots should not allow themselves to get into a situation at altitude where the only acceptable resolution involves relying on the engine.

Self-Launching Glider Propeller Malfunctions

Propeller failures include propeller damage or disintegration, propeller drive belt or drive gear failure, or failure of the variable blade pitch control system. To perform an air-driven engine restart many self-launching gliders require placing propeller blades in a particular blade pitch position. In the absence of this adjustment, the propeller blades cannot deliver enough torque to start the engine.

Self-Launching Glider Electrical System Malfunctions

An electrical system failure in a self-launching glider may render electrically controlled propeller pitch inoperative or prevent deployment of a pod engine for an air restart. Certain electrical failures prevent activation of an electric starter if used for an air restart. However, if able to maintain a suitable landing spot and with sufficient rising air, the pilot can continue to fly the glider without electrical power. If the pilot cannot reach an airport or suitable landing field, an off-airport landing will occur.

Pilots fly some self-launching gliders at night using engine power for cruising. The glider must have the appropriate aeronautical lighting required for night operations (14 CFR part 91, section 91.209). If carrying passengers, the pilot must meet the recent flight experience to for night takeoffs and landings in accordance with 14 CFR part 61, section 61.57(b).

Flight at night increases accident risk. If an electrical system failure during night operations extinguishes the position lights, pilots of nearby aircraft cannot see the self-launching glider and the glider pilot must assume responsibility for collision avoidance. The glider pilot may also have difficulty seeing the flight instruments or electrical circuit breakers. It makes good sense to have a working flashlight for such an emergency.

The pilot should not reset any circuit breakers if smoke or the smell of smoke is present as recommended in CE- 10-11R1, Special Airworthiness Information Bulletin, dated January 14, 2010, available for download on the FAA's DRS website.

Resetting a circuit breaker in flight may increase the risk of an electrical overload and fire. [*Figure 8-13*] If electrical smoke fills the cabin, the pilot should consider ventilating the cabin and head directly for the nearest suitable airport and land. The aviation transceiver installed in the instrument panel may not function, but the pilot may use a portable battery-operated aviation two-way radio if available. The pilot can also receive landing instruction through air traffic control (ATC) light-signals. The pilot should review 14 CFR part 91, section 125, and the Aeronautical Information Manual (AIM) section 4-2-13, Traffic Control Light Signals.

Figure 8-13. *Self-launching glider circuit breakers.*

Inflight Fire

If a fire ignites, the pilot should do everything possible to reduce the spread of the fire and land as soon as possible. The self-launching glider GFM/POH is the authoritative source for emergency response to suspected in-flight fire. In general, the response includes the following steps:

- Reduce throttle to idle.
- Shut off fuel valves.
- Shut off engine ignition.
- Turn off the electrical system or any device contributing to the fire.
- Consider a slip to keep flames away from the fuselage, if applicable.
- Land immediately and stop as quickly as possible.
- Evacuate the self-launching glider.

After landing, the pilot and any passenger should exit the glider, move upwind and away from the glider, and keep onlookers away. The principal danger after evacuating the glider comes from fuel ignition and explosion, with the potential for serious injury.

Modern gliders contain composite materials and resins that can produce poisonous fumes when overheated or burned. The glider pilot should avoid breathing the fumes and may consider jettisoning the canopy while in flight. This same modern construction also means a fire can spread very quickly. A quick landing or bailing out may save the pilot's life. If the fire spreads to critical structures, the airframe may fail before the landing.

Emergency Equipment & Survival Gear

Emergency equipment and survival gear enhance safety for all cross-country flights.

Survival Gear Checklists

Checklists help the pilot assemble survival equipment in an orderly manner. The essentials for survival include reliable and usable supplies of food and water. Equipment including blankets and clothing helps maintain a safe body temperature, which could become difficult to manage in extreme cold or extreme heat.

Food & Water

During cross-country flight, pilots should carry an adequate supply of water and food (especially high-energy foods such as energy bars, granolas, and dried fruits). If necessary for survival, pilots may drink water from ballast tanks if accessible and free of contaminants, such as antifreeze.

Clothing

Pilots should wear clothing appropriate to the local environment, including hat or cap, shirts, sweaters, pants, socks, walking shoes, space blanket, and gloves or mittens. Layered clothing provides flexibility to meet the demands of the environment since removal or addition of layers helps to regulate body temperature. A parachute canopy can be used as an effective layered garment to conserve body heat or to provide relief from excessive sunlight, and sunglasses can protect eyes from that light. Desert areas may be very hot in the day and very cold at night. Prolonged exposure to either condition can debilitate a stranded pilot.

Communication

Pilots can use radios, telephones, or cell phones to summon assistance. An aviation transceiver can be tuned to broadcast and receive on the emergency frequency 121.5 MHz, the frequency used by a tow plane, the glider-to-glider frequency, or any other usable frequency that elicits a response. Newer ELTs provide a continuous signal on the 406 MHz Search and Rescue (SAR) system and activate either automatically or manually to transmit a unique digital identification code to the first satellite that comes into range. The satellite receives the signal and relays it to a ground station. If there is no ground station in view, the satellite sends it to the first available ground station. The ground station processor measures the Doppler shift of the ELT signal and calculates its position. This calculation is usually accurate to within 1.5 nautical miles on the first satellite pass and becomes more accurate with each pass. If the beacon has an integrated GPS or access to one on board the aircraft, the ELT transmits GPS position with the digital data.

After the ground station has completed processing, it transmits the identification and position to the United States Mission Control Center (USMCC). The USMCC attaches the information contained in the 406 MHz beacon registration database for that ELT and generates an alert message. If the location lies within the continental U.S., the alert is sent to the Air Force Rescue Coordination Center (AFRCC) at Langley Air Force Base, Virginia. The AFRCC then takes the registration data and attempts to ascertain the aircraft's disposition. By calling the emergency contact numbers, or by calling flight service stations with the N-number, they can quickly determine whether the aircraft is safe on the ground and not in need of SAR.

Since most activations result from false alarms, resolution over the phone saves SAR assets for actual emergencies. If the AFRCC is unable to verify the aircraft is safe on the ground, it launches an SAR mission. This normally involves assigning the search to the USAF Auxiliary Civil Air Patrol and may include requesting assistance from the local SAR responders or law enforcement personnel.

The unique digital code of each 406 MHz beacon associates each beacon with a particular aircraft. The beacon registration contains information such as tail number, home airport, type and color of aircraft, and several emergency points of contact. This provides rapid access to flight plans and other vital information and speeds the search effort.

Pilots can supplement the use of electronic devices with signal mirrors, smoke, or prominent parachute canopy displays, which provide a good visual signal during daylight. The pilot can use a parachute canopy and case to lay out a prominent marker for searching aircraft. Flashlights and light beacons work well at night. Fires and flames from combustible material appear visible by night and provide smoke that may be seen during daylight. Signal flares can work during day or night. A whistle provides a good method for making a loud sound, but all audible signals including shouting and other noisemaking activities have limited range.

Navigation Equipment

Pilots use aviation charts during flight planning and to navigate during flight. Chart data can pinpoint the location when a pilot makes an off-airport landing. Sectional charts have a useful scale for most cross-country flights. GPS coordinates also help the ground crew equipped with a GPS receiver and appropriate charts and maps. Commercially available detailed GPS maps make navigation easier for the ground crew.

Medical Equipment

Medical kits routinely include bandages, medical tape, disinfectants, a tourniquet, matches, a knife or scissors, bug and snake repellent, and other useful items. Pilots should check that the kit contains medical items suitable for the current operating environment and replace any used or expired component. Glider occupants should have access to the kit after any emergency landing.

Stowage

Loose items may shift when encountering inflight turbulence, low-G maneuvers, or during a hard landing. Stowing equipment properly protects occupants and maintains integrity of all flight controls and glider system controls.

Parachute

Any parachute should be clean, dry, and stored in a cool place when not in use. Contaminants could reduce or destroy the integrity of the parachute material. The pilot has responsibility to ensure that the parachute meets any required FAA inspection criteria.

Chapter Summary

This chapter presents a variety of abnormal and emergency scenarios. If an emergency should occur during an aerotow, each pilot should act in a manner that allows the pilot of the other aircraft to achieve a safe outcome. Emergencies can also occur during a launch using a winch or vehicle. These emergencies can occur in a matter of seconds, which require split-second decision making. Various emergencies during a self-launch can happen, and the pilot should know how to handle the various emergency scenarios discussed in this chapter. Gliders often fly in steep banks and at slow speeds. Pilot error during these conditions can result in a spiral dive or a spin. Pilots should understand the difference between these two scenarios and know how to recover from each one. Various system and equipment malfunctions can lead to an off-airport landing. Pilots prepare for this eventuality by carrying emergency equipment and survival gear for the weather and terrain they could encounter.