CHAPTER 7
Launch and Recovery Procedures and Flight Maneuvers

This chapter discusses glider launch and takeoff procedures, traffic patterns, landing and recovery procedures, and flight maneuvers.

AEROTOW LAUNCH SIGNALS

Launching a non-powered glider requires the use of visual signals for communication and coordination between the glider pilot, towpilot, and launch crewmembers. If the aircraft and launch crewmembers are equipped with compatible radios, communication is enhanced over hand signals. Aerotow launch signals consist of pre-launch signals and in-flight signals.

PRE-LAUNCH SIGNALS FOR AEROTOW LAUNCHES

Aerotow pre-launch signals facilitate communication between pilots and launch crewmembers preparing for the launch. These signals are shown in Figure 7-1.

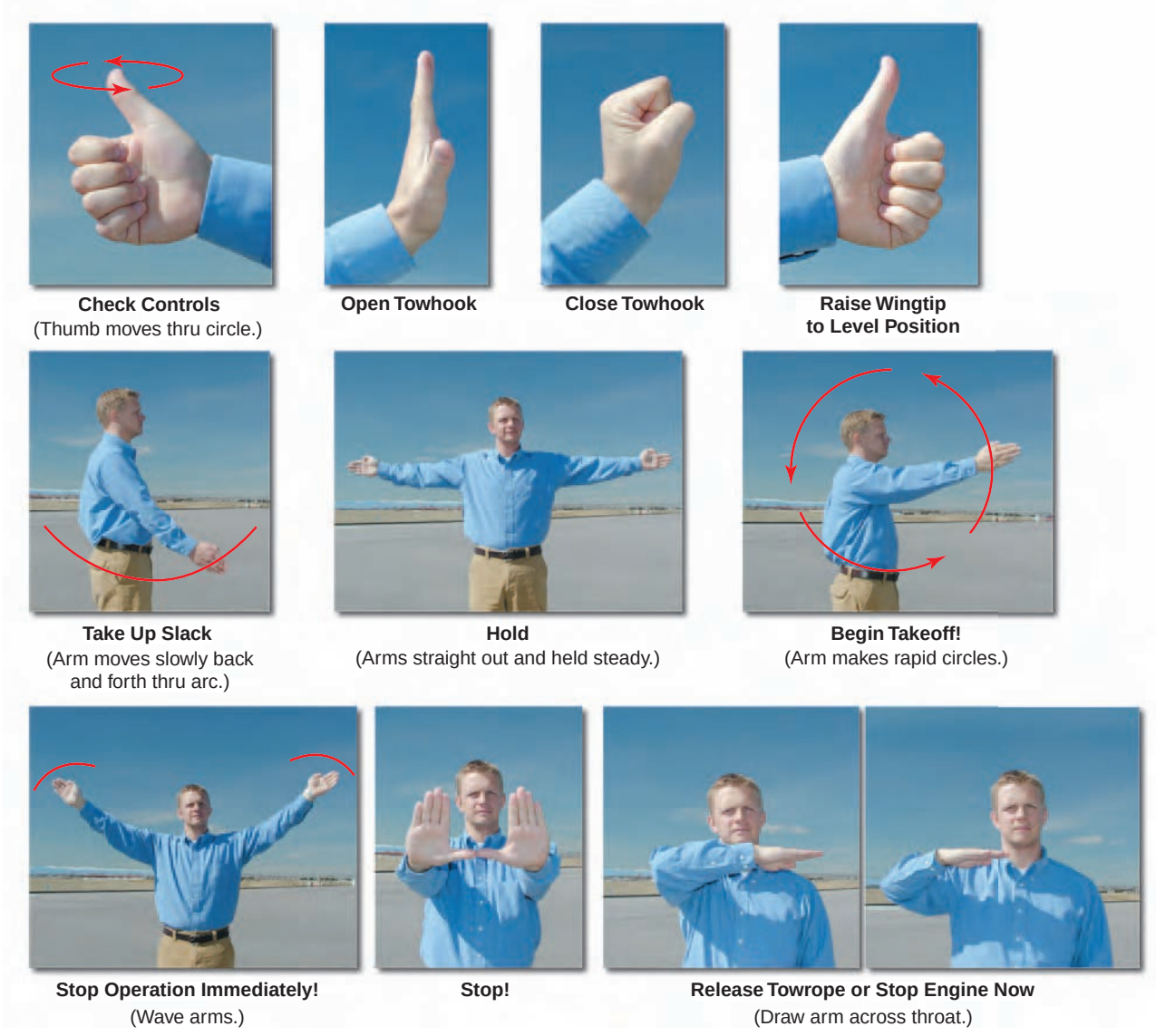

Figure 7-1. Aerotow pre-launch signals.

IN-FLIGHT AEROTOW VISUAL SIGNALS

Visual signals allow the towpilot and the glider pilot to communicate with each other. The signals are divided into two types: those from the towpilot to the glider pilot, and those from the glider pilot to the towpilot. These signals are shown in Figure 7-2.

TAKEOFF PROCEDURES AND TECHNIQUES

Takeoff procedures for gliders require close coordination between launch crewmembers and pilots. Both the glider and towpilot must be familiar with the appropriate tow procedures.

AEROTOW TAKEOFFS

Normal takeoffs are made into the wind. Prior to takeoff, the towpilot and glider pilot must reach an agreement on the plan for the aerotow. The glider pilot should ensure that the launch crewmember is aware of safety procedures concerning the tow. Some of these items would be proper runway and pattern clearing procedures and glider configuration checks (spoilers closed, tailwheel dolly removed, canopy secured). When the required checklists have been completed

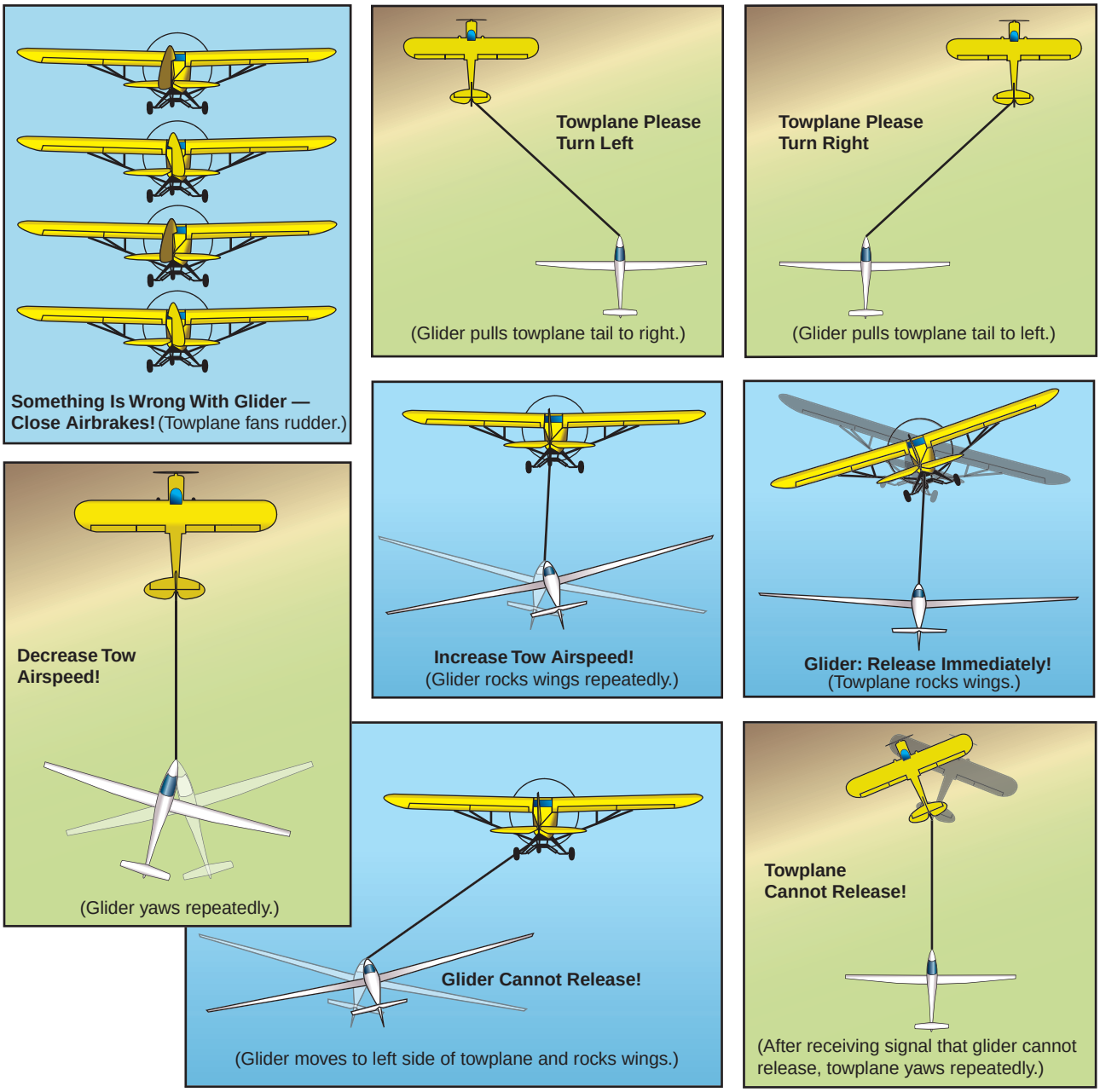

Figure 7-2. In-flight aerotow visual signals.

and both the glider and towplane are ready for takeoff, the glider pilot signals the launch crewmember to hook the towrope to the glider.

NORMAL TAKEOFFS

The hook-up should be done deliberately and correctly, and the release mechanism should be checked for proper operation. The launch crewmember applies tension to the towrope and signals the glider pilot to activate the release. The launch crewmember should verify that the release works properly and signals the glider pilot. When the towline is hooked up to the glider again, the launch crewmember repositions to the wing that is down. When the glider pilot signals "ready for takeoff" the launch crewmember clears both the takeoff and landing area, then signals the towpilot to "take up slack" in the towrope. Once the slack is out of the towrope, the launch crewmember verifies that the glider pilot is ready for takeoff, then raises the wings to a level position. With the wings raised, the launch crewmember does a final traffic pattern check and signals the towpilot to takeoff. At the same time, the glider pilot signals the towpilot by wagging the rudder back and forth, concurring with the launch crewmember's takeoff signal. The procedures may differ somewhat from site to site, so follow local convention.

As the launch begins and the glider accelerates, the launch crewmember runs alongside the glider, holding the wing level. If there is a crosswind, the launch crewmember should hold the wing down into the wind, but not in a way as to steer the glider from the wingtip.

When the glider achieves lift-off airspeed, the glider pilot eases the glider off the ground and climbs to an altitude within three to five feet of the runway surface, while the towplane continues to accelerate to lift-off speed. The glider pilot should maintain this altitude by applying forward stick pressure, as necessary, while the glider is accelerating. Once the towplane lifts off, it accelerates in ground effect to the desired climb airspeed, then the climb begins for both the glider and the towplane.

During the takeoff roll, use the rudder pedals to steer the glider. Control the bank angle of the wings with aileron. Full deflection of the flight controls may be necessary at low airspeeds, but the flight controls become more effective as airspeed increases. [Figure 7-3]

In most takeoffs, the glider achieves flying airspeed before the towplane. However, if the glider is a heavily ballasted glider, the towplane may be able to achieve liftoff airspeed before the glider. In such a situation, the towplane should remain in ground effect until the glider is off the ground. Climb-out must not begin until the previously agreed upon climb airspeed has been achieved.

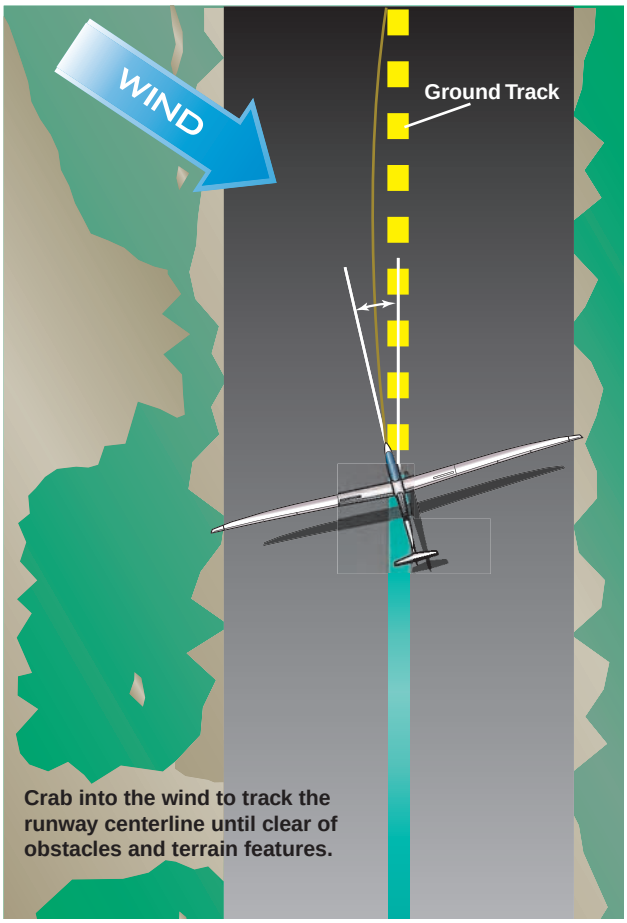

Figure 7-3. Tracking the runway centerline.

CROSSWIND AEROTOW TAKEOFFS

Crosswind takeoff procedures are a modification of the normal takeoff procedure. The following are the main differences in crosswind takeoffs.

- The glider tends to yaw, or weathervane, into the wind any time the main wheel is touching the ground. The stronger the crosswind, the greater the tendency of the glider to turn into the wind.
- After liftoff, the glider tends to drift toward the downwind side of the runway. The stronger the crosswind, the greater the glider's tendency to drift downwind.

Prior to takeoff, the glider pilot should coordinate with the launch crewmember to hold the upwind wing slightly low during the initial takeoff roll. If a crosswind is indicated, full aileron should be held into the wind as the takeoff roll is started. This control position should be maintained while the glider is accelerating

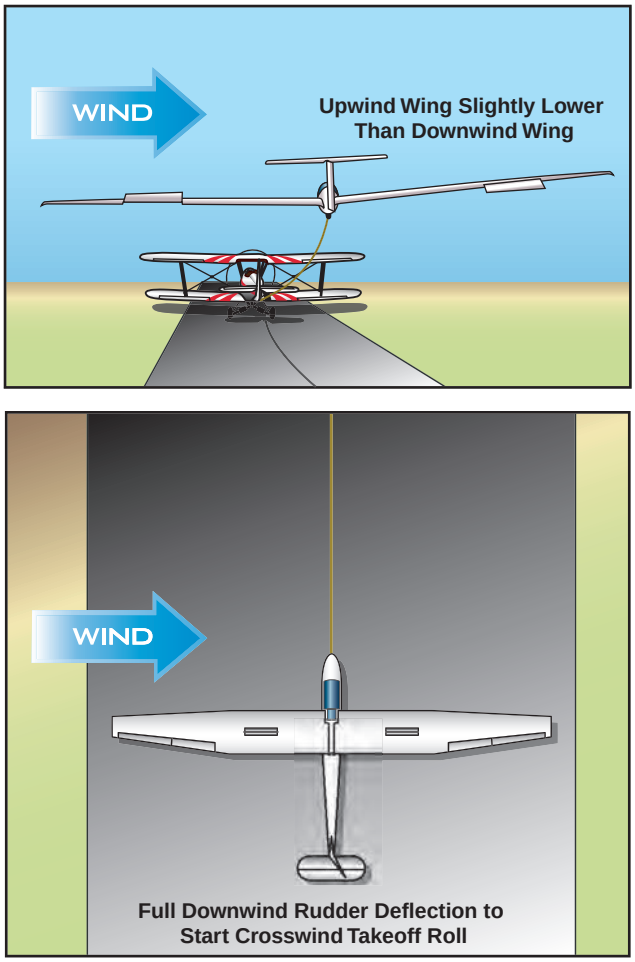

Figure 7-4. Crosswind correction or takeoff.

and until the ailerons start becoming sufficiently effective for maneuvering the glider about its longitudinal (roll) axis. With the aileron held into the wind, the takeoff path must be held straight with the rudder. This requires application of downwind rudder pressure, since the glider tends to weathervane into the wind while on the ground. [Figure 7-4]

As the forward speed of the glider increases and the crosswind becomes more of a relative headwind, the many mechanical application of full aileron into the wind should be reduced. It is when increasing pressure is being felt on the aileron control that the ailerons are becoming more effective. Because the crosswind component effect does not completely dissipate, some aileron pressure must be maintained throughout the takeoff roll to prevent the crosswind from raising the upwind wing. If the upwind wing rises, exposing more surface to the crosswind, a "skipping" action may result, as indicated by a series of small bounces occurring when the glider attempts to fly and then settles back onto the runway. This side skipping imposes side loads on the landing gear. Keeping the upwind wingtip slightly lower than the downwind wingtip prevents the crosswind from getting underneath the upwind wing and lifting it. If the downwind wingtip touches the ground, the resulting friction may cause the glider to yaw in the direction of the dragging wingtip. This could lead to loss of directional control.

While on the runway throughout the takeoff, the glider pilot uses the rudder to maintain directional control and alignment behind the towplane. Yawing back and forth behind the towplane should be avoided, as this effects the ability of the towplane pilot to maintain control. If glider controllability becomes a problem, the glider pilot must release and stop the glider on the remaining runway. Remember, as the glider slows, the crosswind may cause it to weathervane into the wind.

Prior to the towplane becoming airborne and after the glider lifts off, the glider pilot should turn into the wind and establish a wind correction angle to remain behind the towplane. This is accomplished by using coordinated control inputs to turn the glider. Once the towplane becomes airborne and establishes a wind correction angle, the glider pilot repositions to align behind the towplane.

COMMON ERRORS

- Improper glider configuration for takeoff.
- Improper initial positioning of flight controls.
- Improper use of visual launch signals.
- Failure to maintain alignment behind towplane before towplane becomes airborne.
- Improper alignment with the towplane after becoming airborne.
- Climbing too high after liftoff and causing a towplane upset.

TAKEOFF EMERGENCY PROCEDURES

The most common emergency situations on takeoff develop when a towrope breaks, there is an inadvertent towrope release, or towplane loses power. There are five planning situations regarding in-motion towrope breaks, uncommanded release, or power loss of the towplane. While the best course of action depends on many variables, such as runway length, airport environment, and wind, all tow failures have one thing in common: the need to maintain control of the glider. Two possibilities are stalling the glider, or dragging a wingtip on the ground during a low altitude turn and cartwheeling the glider. [Figure 7-5]

Situation 1. If the towrope breaks or is inadvertently released prior to the towplane's liftoff, the standard procedure is for the towplane to continue the takeoff and clear the runway, or abort the takeoff and remain on the left side of the runway. If the towplane loses power during the takeoff, the towpilot should maneuver the towplane to the left side of the runway. If the glider is still on the runway, the glider pilot should pull

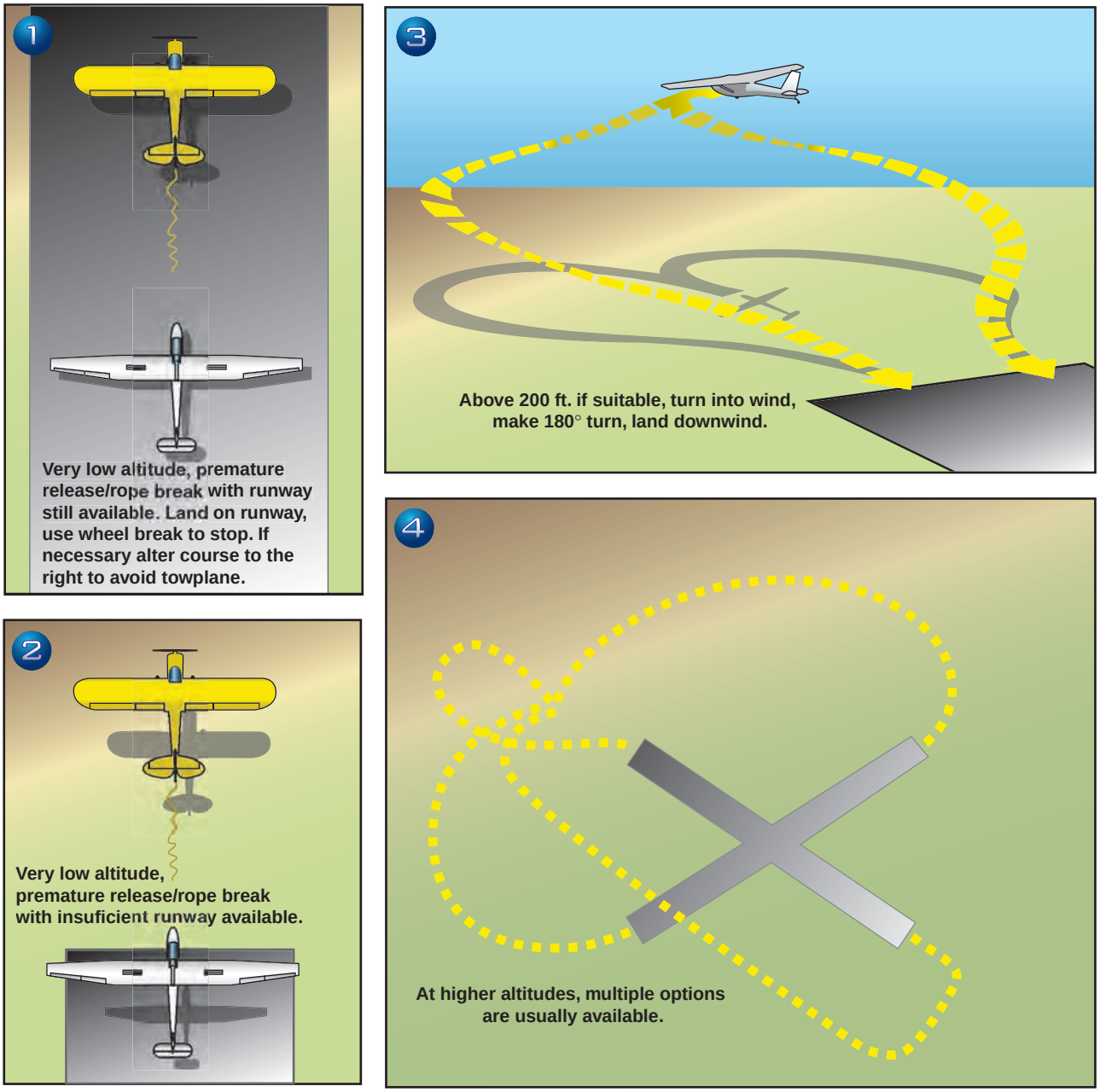

Figure 7-5. Situations for towline break, uncommanded release, or power loss of the towplane.

the release, decelerate using the wheel brake, and be prepared to maneuver to the right side of the runway. If the rope breaks, is inadvertently released, or the towplane loses power after the glider is airborne, the glider pilot should pull the towrope release, land straight ahead, and be prepared to maneuver to the right side of the runway. Pulling the towrope release in either case ensures that the rope is clear of the glider. Since local procedures vary, both the glider and towpilot must be familiar with the specific gliderport/airport procedures.

Situation 2. This situation occurs when both the towplane and glider are airborne and at a low altitude. If an inadvertent release, towrope break, or a signal to release from the towplane occurs at a point in which the glider has insufficient runway directly ahead and has insufficient altitude to make a safe turn, the best course of action is to land the glider straight ahead. After touchdown, use wheel brake, as necessary, to slow and stop as conditions permit. At low altitude, attempting to turn prior to landing is very risky because of the likelihood of dragging a wingtip on the ground and cartwheeling the glider. Slowing the glider as much as possible prior to touching down and rolling onto unknown terrain generally is the safest course of action. Low speed means low impact forces, which reduce the likelihood of injury and reduce the risk of significant damage to the glider.

Situation 3. If an inadvertent release, towrope break, or a signal to release from the towplane occurs after the

towplane and glider are airborne, and the glider possesses sufficient altitude to make a 180° turn, then a downwind landing on the departure runway may be attempted.

The 180° turn and downwind landing option should be used only if the glider is within gliding distance of the airport or landing area. In ideal conditions, a minimum altitude of 200 feet above ground level is required to complete this maneuver safely. Such things as a hot day, weak towplane, strong wind, or other traffic may require a greater altitude to make a return to the airport a viable option.

The responsibility of the glider pilot is to avoid the towplane or other aircraft. If the tow was terminated because the towplane was in distress, the towpilot is also dealing with an emergency situation and may maneuver the aircraft abruptly.

After releasing from the towplane at low altitude, if the glider pilot chooses to make a 180° turn and a downwind landing, the first responsibility is to maintain flying speed. The pilot must immediately lower the nose to achieve the proper pitch attitude necessary to maintain the appropriate approach airspeed.

Make the initial turn into the wind. Use a medium bank angle to align the glider with the landing area. Using too shallow a bank angle may not allow enough time for the glider to align with the landing area. Too steep a bank angle may result in an accelerated stall. If the turn is made into the wind, only minor course corrections should be necessary to align the glider with the intended landing area. Throughout the maneuver the pilot must maintain the appropriate approach speed and proper coordination.

Downwind landings result in higher groundspeed due to the effect of tailwind. The glider pilot must maintain the appropriate approach airspeed. During the straight-in portion of the approach, spoilers/dive breaks should be used as necessary to control the descent path. Landing downwind requires a shallower than normal approach. Groundspeed will be higher during a downwind landing and especially noticeable during the flare. After touchdown, spoilers/dive breaks, and wheel brakes should be used as necessary to slow and stop the glider as quickly as possible. During the later part of the roll-out, the glider will feel unresponsive to the controls despite the fact that it is rolling along the runway at a higher than normal groundspeed. It is important to stop the glider before any loss of directional control.

Situation 4. When the emergency occurs at or above 800 feet above the ground, the glider pilot may have more time to assess the situation. Depending on gliderport/airport environment, the pilot may choose to land on a cross runway, land into the wind on the departure runway, or land on a taxiway. In some situations an off gliderport/airport landing may be safer than attempting to land on the gliderport/airport.

Situation 5. If an emergency occurs above the traffic pattern altitude, the glider pilot should maneuver away from the towplane, release the towrope if still attached, and turn toward the gliderport/airport. The glider pilot should evaluate the situation to determine if there is sufficient altitude to search for lift or if it is necessary to return to the gliderport/airport for a landing.

AEROTOW CLIMB-OUT AND RELEASE PROCEDURES

Once airborne and climbing, the glider can fly one of two tow positions. High tow is aerotow flight with the glider positioned above the wake of the towplane. Low tow is aerotow flight with the glider positioned below the wake of the towplane. [Figure 7-6] Climbing turns are made with shallow bank angles and the glider in the high tow position.

High tow is the preferred position for climbing out because the glider is above the turbulence of the towplane wake. High tow affords the glider pilot an ample view of the towplane and provides a measure of protection against fouling if the towrope breaks or is released by the towplane because the towrope falls below the glider in this position.

Low tow offers the glider pilot a better view of the towplane, but puts the glider at risk from towrope fouling if the towrope breaks or is released by the towplane. Low tow is used for cross-country and level flight aerotows.

During level flight aerotows, positioning the glider above the wake of the towplane has several disadvantages. One is that the towplane wake is nearly level rather than trailing down and back as it does during climbing aerotow operations. Because the towplane wake is nearly level, the glider must take a higher position relative to the towplane to ensure the glider stays above the wake. This higher position makes it difficult to see the towplane over the nose of the glider. Easing the stick forward to get a better view of the towplane accelerates the glider toward the towplane, causing the towrope slack. Positioning the glider beneath the wake of the towplane in level flight offers an excellent view of the towplane, but the danger of fouling from a

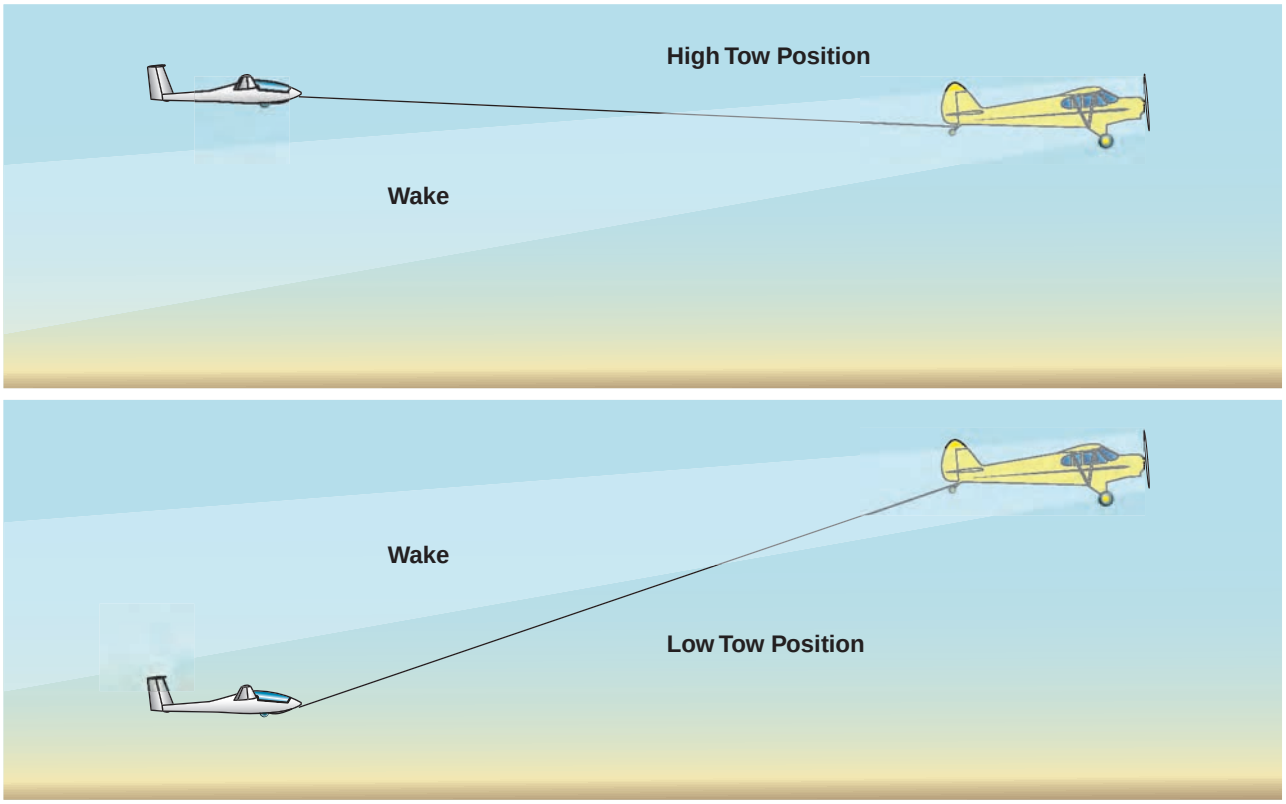

Figure 7-6. Aerotow climb-out.

towrope failure or inadvertent release is greater when flying in the low tow position. Gliders using a center of gravity (CG) tow hook during low tow position on level flight aerotows may encounter the towrope sliding up and to the side of the glider nose, causing possible damage.

Straight ahead climbs are made with the glider in the high tow position. The towpilot should maintain a steady pitch attitude and a constant power setting to maintain the desired climb airspeed. The glider pilot uses visual references on the towplane to maintain lateral and vertical position.

Climbing turns are made with shallow bank angles in the high tow position. During turns, the glider pilot observes and matches the bank angle of the towplane's wings. In order to stay in the same flight path of the towplane, the glider pilot must aim the nose of the glider at the outside wingtip of the towplane. This allows the glider's flight path to coincide with the towplane's flight path. [Figure 7-7]

If the glider's bank is steeper than the towplane's bank, the glider's turn radius is smaller than the towplane's turn radius. [Figure 7-8 on page 7-8] If this occurs, the reduced tension on the towrope causes it to bow and slack, allowing the glider's airspeed to slow. As a

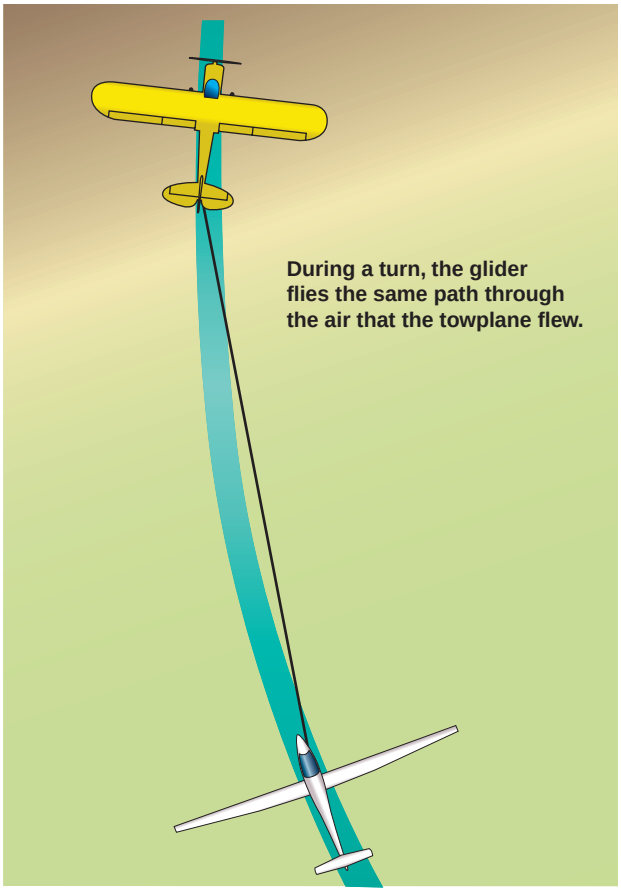

Figure 7-7. Aerotow climbing turns.

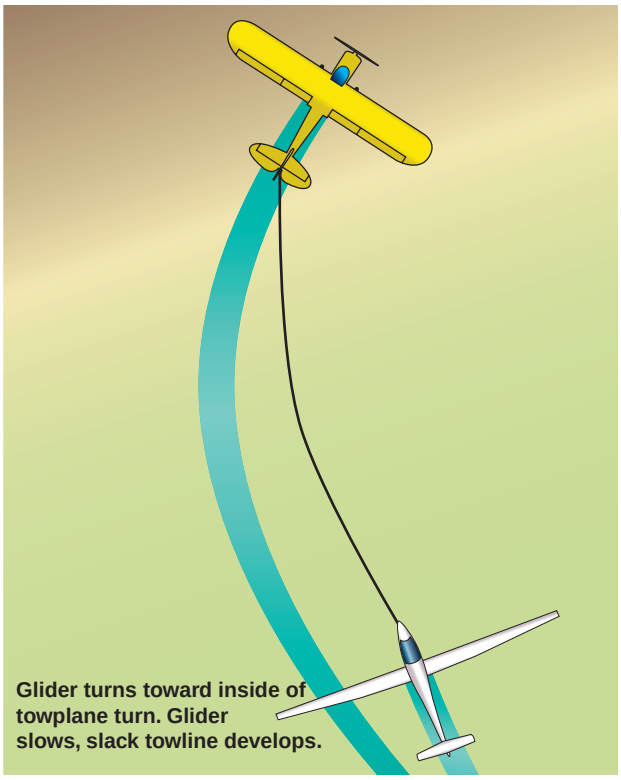

Figure 7-8. Aerotow induced slack towline by turning inside towplane.

result, the glider begins to sink, relative to the towplane. The correct course of action is to reduce the glider's bank angle so the glider flies the same radius of turn as the towplane. If timely corrective action is not taken, and if the glider slows and sinks below the towplane, the towplane may rapidly pull the towrope taut and possibly cause it to fail and/or cause structural damage to both aircraft.

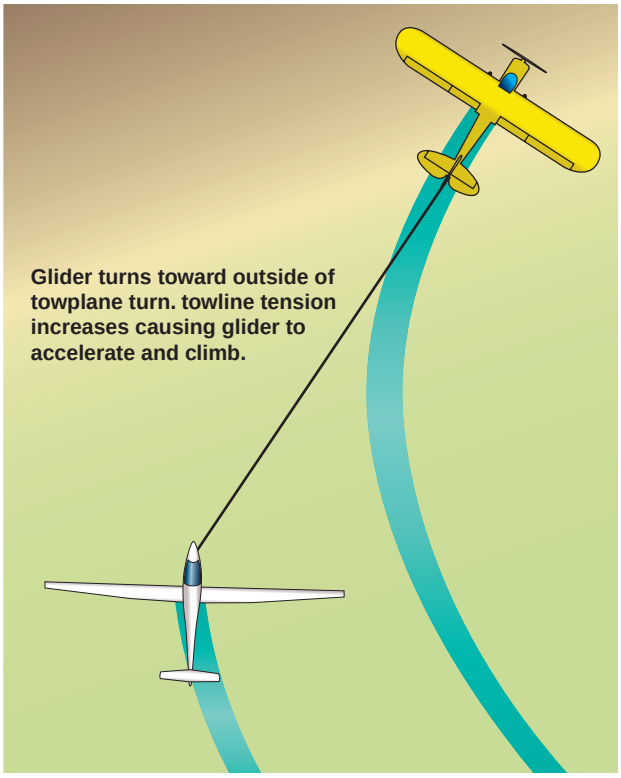

Figure 7-9. Glider bank too shallow, causing turn outside towplane turn.

If the glider's bank is shallower than the towplane, the glider's turn radius is larger than the towplane's turn radius. [Figure 7-9] If this occurs, the increased tension on the towrope causes the glider to accelerate and climb. The correct course of action to take when the glider is turning outside the towplane radius of turn is to increase the glider's bank angle, so the glider eases back into position behind the towplane and flies the same radius of turn as the towplane. If timely corrective action is not taken, and if the glider accelerates and climbs above the towplane, the towplane may lose rudder and elevator control. In this situation, the glider pilot should release the towrope and turn to avoid the towplane.

COMMON ERRORS

- Faulty procedures maintaining vertical and lateral positions during high and/or low tow.
- Inadvertent entry into towplane wake.
- Failure to maintain glider alignment during turns on aerotow.

AEROTOW RELEASE

Standard aerotow release procedures provide safety benefits for both the glider pilot and the towpilot. When the aerotow has reached a predetermined altitude, the glider pilot should clear the area for other aircraft in all directions, especially to the right. When ready to release, the glider pilot should pull the release handle, and visually confirm that towrope has released from the glider as shown in Figure 7-10, item 1. Next, bank to the right, accomplishing 90° of heading change, then level the wings and fly straight, away from the release point. [Item 2] This 90° change of heading achieves maximum separation between towplane and glider in minimum time. After confirming that the glider has released and has turned away from the towplane, the towpilot should turn left away from the release point. [Item 3] Once clear of the glider and other aircraft, the towpilot then begins a descent.

COMMON ERRORS

- Lack of proper tension on towrope.
- Failure to clear the area prior to release.
- Failure to make turn in proper direction after release.
- Release in close proximity of other aircraft.

AEROTOW ABNORMAL PROCEDURES

Mechanical equipment failure, environmental factors, and pilot errors can cause abnormal aerotow occurrences during climb-out.

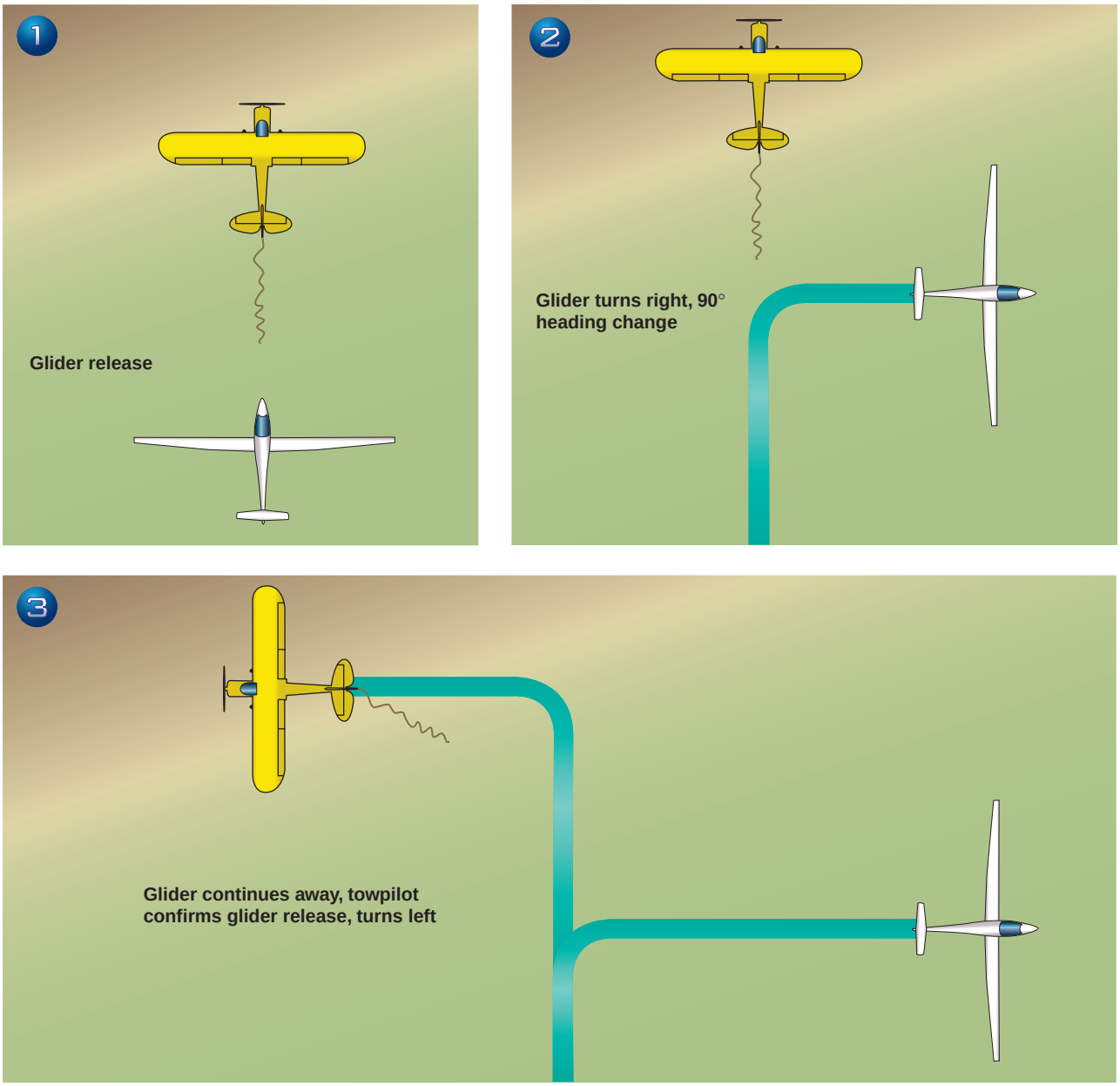

Figure 7-10. Aerotow release.

Mechanical equipment failures can be caused by towrope and towhook failures, towplane mechanical failures, and/or glider mechanical failures. Towrope failure (one that breaks unexpectedly) can result from using an under-strength or worn towrope. Towrope failures can be avoided by using appropriately rated towrope material, weak links when necessary, proper towrings, and proper towrope maintenance.

Towhook system failures include uncommanded towrope releases or the inability to release. These failures can occur in either the towplane or the glider towhook system. Proper preflight and maintenance of these systems should help to avoid these types of failures. Towplane mechanical failures can involve the powerplant and/or flight control. When the towpilot encounters a mechanical failure, he or she should signal the glider pilot to release immediately. This is one of many situations that make it vitally important that both the towpilot and glider pilot have a thorough knowledge of aerotow visual signals.

Glider mechanical failure can include towhook system malfunctions, flight control problems, and/or improper assembly or rigging. If a mechanical failure occurs, the glider pilot must assess the situation to determine the best course of action. In some situations, it may be beneficial to remain on the aerotow, while other situations may require immediate release.

If the glider release mechanism fails, the towpilot should be notified either by radio or tow signal and the glider should maintain the high tow position. The towpilot should tow the glider over the gliderport/airport

and release the glider from the towplane. The towrope should fall back and below the glider. The design of the towhook mechanism is such that the rope pulls free from the glider by it's own weight. Since some gliders do not "back release," the glider pilot should pull the release to ensure the towrope is in fact released.

Failure of both the towplane and glider release mechanisms is extremely rare. If it occurs, however, radio or tow signals between the glider and towpilot should verify this situation. The glider pilot should move down to the low tow position once the descent has started to the gliderport/airport. The glider pilot needs to use spoilers/dive breaks to maintain the low tow position and to avoid over taking the towplane. The towpilot should plan the approach to avoid obstacles. The approach should be shallow enough so that the glider touches down first. The glider pilot should use the spoilers/dive breaks to stay on the runway, and use the wheel brake as necessary to avoid overtaking the towplane. Excessive use of the glider wheel break may result in the towplane landing hard.

Environmental factors include encountering clouds, mountain rotors, or restricted visibility. Any of these factors also may require the glider pilot to release from the aerotow. During the aerotow, each pilot is responsible for avoiding situations that would place the other pilot at risk. For the towplane pilot, examples of pilot error include deliberately starting the takeoff before the glider pilot has signaled the glider is ready for launch, 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 rising high above the towplane during takeoff and climb, or leaving airbrakes open during takeoff and climb.

One of the most dangerous occurrences during the aerotow is allowing the glider to rise high above and losing sight of the towplane. The tension on the towrope by the glider pulls the towplane tail up, lowering its nose. If the glider continues to rise pulling the towplane tail higher, the towpilot may not be able to raise the nose. Ultimately, the towpilot may run out of up elevator authority. Additionally, the towpilot may not be able to release the towrope from the towplane. This situation can be critical if it occurs at altitudes below 500 feet AGL. Upon losing sight of the towplane, the glider pilot must release immediately.

SLACK LINE

Slack line is a reduction of tension in the towrope. 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.

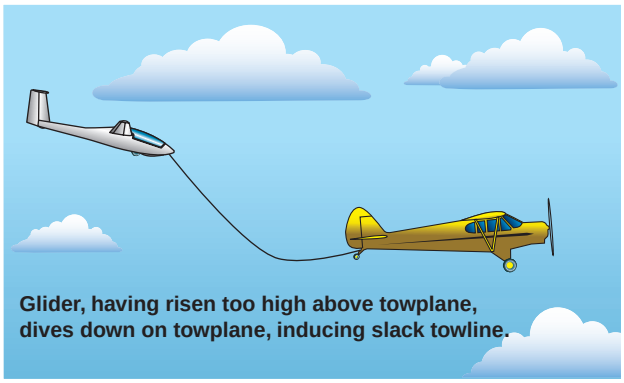

Figure 7-11. Diving on towplane.

- Aerotow descents.
- Turning the glider inside the towplane turn radius. [Figure 7-8]
- Turbulence.
- Abrupt recovery from a high tow position. [Figure 7-11]

Slack line recovery procedures should be initiated as soon as the glider pilot becomes aware of the situation. The pilot's initial action should be to yaw away from the bow in the line. In the event the yawing motion fails to reduce the slack sufficiently, careful use of spoilers/dive brakes can be used to decelerate the glider and take up the slack. When the towline tightens, stabilize the tow, then gradually resume the desired aerotow position. When the slack in the line is excessive, or beyond the pilot's capability to safely recover, the pilot should immediately release from the aerotow.

COMMON ERRORS

- Failure to take corrective action at the first indication of a slack line.
- Use of improper procedure to correct slack line, causing excessive stress on tow rope, towplane, and glider.

BOXING THE WAKE

Boxing the wake is a performance maneuver designed to demonstrate a pilot's ability to accurately maneuver the glider around the towplane's wake during aerotow. [Figure 7-12]

Boxing the wake requires flying a rectangular pattern around the towplane's wake. Before starting the maneuver, the glider should descend through the wake to the center low tow position as a signal to the towpilot that the maneuver is about to begin. The pilot uses coordinated control inputs to move the glider out to one side of the wake and holds that lower corner of the rectangle momentarily with rudder pressure. Applying back pressure to the control stick starts a vertical ascent, then rudder pressure is used to maintain equal

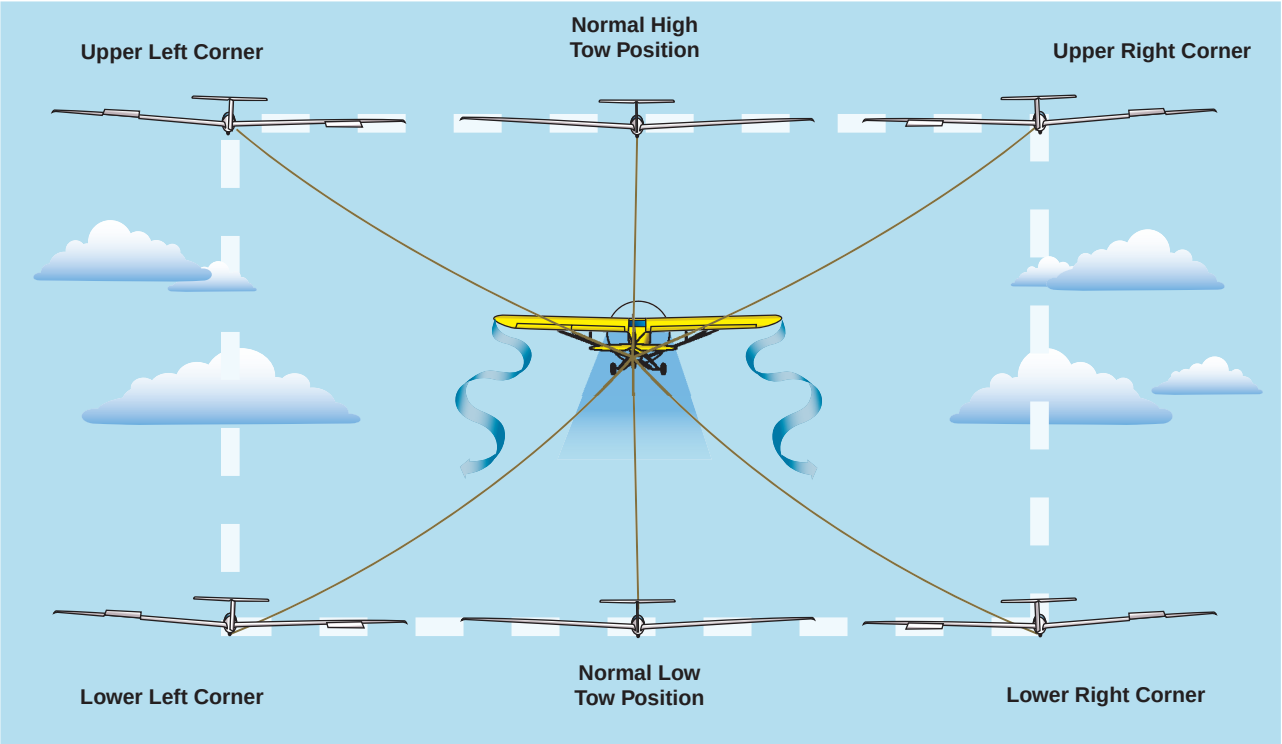

Figure 7-12. Boxing the wake.

distance from the wake. The pilot holds the wings level with the ailerons to parallel the towplane's wings. When the glider has attained high corner position, the pilot momentarily maintains this position.

As the maneuver continues, the pilot reduces the rudder pressure and uses coordinated flight controls to bank the glider to fly along the top side of the box. The glider should proceed to the opposite corner using aileron and rudder pressure, as appropriate. The pilot maintains this position momentarily with rudder pressure, then begins a vertical descent by applying forward pressure to the control stick. Rudder pressure is used to maintain glider position at an equal distance from the wake. The pilot holds the wings level with the ailerons to parallel the towplane's wings. When the glider has attained low corner position, the pilot momentarily maintains this position. The pilot releases the rudder pressure and, using coordinated flight controls, banks the glider to fly along the bottom side of the box until reaching the original center low tow position. From center low tow position, the pilot maneuvers the glider through the wake to the center high tow position, completing the maneuver.

COMMON ERRORS

- Performing an excessively large rectangle around the wake.
- Improper control coordination and procedure
- Abrupt or rapid changes of position.

If pulling the towline release handle fails to release the towline, cycle release handle and try again several times.
If handle still fails to release, fly over winch/auto and allow the back release to function.

Figure 7-13. Testing the towhook.