Five Crosswind Traps

*By Ray Leis. This article originally appeared in **Aviation Safety**, Jun. 2005.*

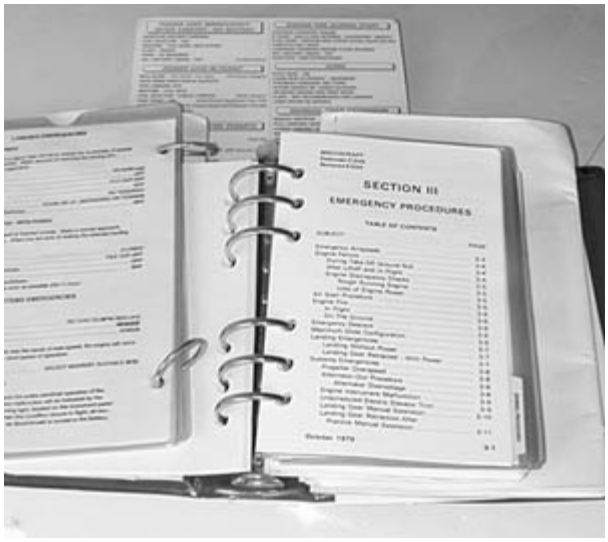
Airmanship

When the spring and summer flying season returns in a few months, many general aviation pilots will realize they haven't flown much during the winter. As a result, they usually have lost some of the skills honed during the previous year's flying season.

Up to a point, crosswind landings can be challenging and fun. But landing can become hard work when the wind howls, gusts and bounces you and your passengers around. Still, a successful outcome depends on you, the pilot. One of those skills -- especially useful during the spring -- is handling a crosswind while landing. Pilots should be thoroughly familiar with all methods for dealing with a crosswind -- the slip, the crab and the slip/crab combination -- and, even if you have been trained to use one method, there are times when another may be very useful. But, regardless of the crosswind approach method you use, several traps exist to trip up the unwary, or the unprepared.

1. Use Flaps, Or Not?

Owner's Manuals, Pilot's Operating Handbooks, Airplane Flight Manuals and other publications contain basic and confusing information about using flaps during a crosswind landing. You'll find that one manufacturer may recommend partial flaps for a crosswind landing, while another may recommend a "minimum flap setting" consistent with conditions like the runway's length. Still other airframers deal themselves out of the game; they make no recommendations at all. It's as if crosswinds don't exist for their airplanes.



POH Checklists

The FAA has certification rules requiring that an airplane must be controllable in a 90-degree crosswind at a velocity of 0.2 x V_{so}. Of course, V_{so} is the airplane's stall speed in the landing configuration, so if V_{so} is 50 knots, 50 x 0.2 = 10 knots. In this case, the airplane must be controllable in a 90-degree, 10-knot crosswind. In other words, if your airplane stalls at 50 knots in its landing configuration (i.e., with full flaps), a direct, 10-knot crosswind shouldn't bother it.

On the other hand, if the crosswind velocity exceeds 0.2 x V_{so}, you're not necessarily in test-pilot territory, but you must understand that control authority may be limited: You could run out of rudder or aileron at the wrong time.

The lower landing speed and shorter ground roll available when using flaps results in less wear and tear on the brakes and tires. But you still have to ensure effective directional control of the airplane is maintained at the slower speeds. This is when knowing the airplane and understanding what a "direct crosswind at 20 knots with gusts to 30" actually means.

2. The Balloon

Ballooning -- whether caused by over-control or by mistakes in judging the descent rate -- can occur even in calm-wind landings. It can happen as a result of pitching up too enthusiastically in the round-out maneuver or as a result of establishing a too-steep pitch attitude in the flare. In a no-crosswind situation, it usually means you are carrying too much airspeed into the flare and have pitched the airplane to its landing attitude before any excess lift has been bled off. The unwanted altitude that you gain at the wrong time as a result of ballooning will depend largely on the airspeed and/or how rapidly the pitch attitude is increased.

Ballooned landings come in two types. One is the plain, steady-wind variety, where your height above the runway is increasing, and the airplane may be close to stalling out. Recovery from this is just as you practiced during your primary training: Add a touch of power, lower the nose slightly to stop the airspeed decay and then use coordinated pitch and power inputs to establish the proper flare attitude and gently descend to the runway. Improper recovery from a ballooned landing can result in touching down first on the nosewheel. And that's bad.

The serious variety of ballooning doesn't involve just your height above the runway, the power setting or the airplane's pitch attitude. Instead, with a gusty crosswind, you can also lose directional control at the same time the positive pitch attitude and decaying airspeed rob you of control authority. If you lose your crosswind correction in the confusion, annoyance and distraction of the moment, you are in a serious balloon and the outcome is rarely a good one.

The best solution in this situation is to get the heck out of there: Smoothly add full power while reestablishing or maintaining what's left of your directional control. Establish a pitch attitude that keeps the wheels off the runway and allows the airplane to accelerate while getting back your directional control. Go around, remembering that a full-flap configuration will result in higher pitch forces than you may be used to. For the next landing, remember what you did wrong, especially when it comes to an over-enthusiastic flare and airspeed control.

3. The Bounce

We've all bounced a landing or two. In a crosswind situation, however, the bounced landing can be both more likely and more dangerous. This is because of the greater potential for loss of directional control at low airspeds and high angles of attack with a crosswind.

Runway Threshold

A bounced landing can result when the flare is made too slowly in a tricycle-gear airplane or too late in a conventional-gear airplane. Whatever you are flying, hit the runway hard enough and you will bounce. The force with which the aircraft strikes the runway (and how the pilot used the elevators at that instant) will depend on how high you will bounce. Again, the severity of a bounced landing in a crosswind situation depends not on how high you rebounded but on whether you have lost your crosswind correction.

The corrective action for a bounce depends on how severe it is. It's the same corrective action for ballooning: Add some power and control the pitch to establish the proper flare attitude. One rule to paste up on the panel: Any time you experience an excessive bounce or balloon (10 feet is excessive), apply power and execute a go-around.

Many landing accidents result from the pilot's failure to react effectively to a balloon or a bounce. It is possible to recover from a bounced landing by applying power and "easing" the airplane to the ground. There are some highly proficient pilots who can get away with it, consistently. If you're not that experienced, you better take the airplane around, and think about how to correct your technique on the next landing.

If you use engine power during a balloon or bounce, the airplane's nose should never be pointed down any lower than a level pitch attitude.

4. Landing Attitude

What is the landing attitude in the airplane that you fly? The easiest way to understand the landing attitude for your airplane is to practice some slow flight … flying level, at minimum controllable airspeed, in the landing configuration. This slow-flight attitude is usually close to the level pitch attitude in most airplanes, lower than the landing attitude.

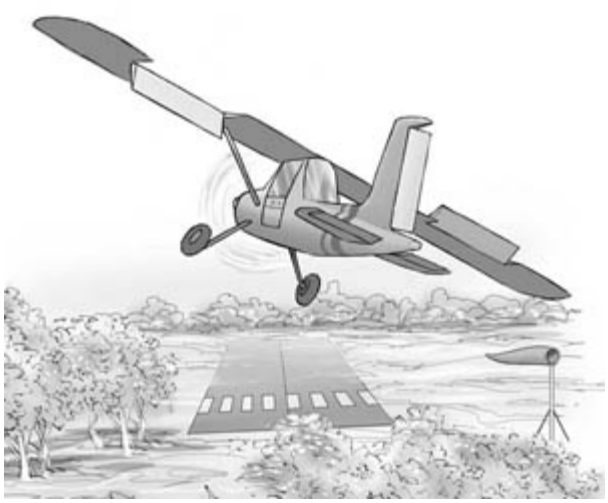
How does this relate to a crosswind landing? In two ways. First, if the pitch attitude is greater than the landing attitude, the resulting airspeed decay will mean more difficulty in maintaining directional control. Second, and presuming there is adequate runway in front of you, a shallower pitch attitude than normal is appropriate, along with a bit more power than normal. As a result, you'll probably be carrying slightly more airspeed into the flare and, to prevent ballooning, will want to pitch up more gently and not increase the pitch attitude to as high an angle of attack as you would without a crosswind.

The idea is to gently fly the airplane onto the runway, all the while maintaining directional control and the proper pitch attitude, so that ground steering can take over from the flight controls at the moment the airplane stops flying. A lot of precious runway can be used up, however, so the runway must be adequate -- long enough and wide enough -- considering the crosswind.

Learning the proper landing attitude for landings with and without crosswinds is where you can get some extra value out of your flight review. Or, if that's too far off, and you are a bit rusty on slow flight, get with your local CFI.

5. The Porpoise

In any landing -- with or without a crosswind -- porpoising can result in a violent, unstable condition, where the aircraft bounces back and forth between the nosewheel (or tailwheel) and the main gear after initial touchdown. Too often, a bent airplane is the result, either from placing too much energy on a relatively fragile nosewheel or from the inevitable loss of directional control and the short but exciting trip off the runway.



Slip Right

What causes porpoising? What usually happens is that the pilot attempts to recover from a bounce with opposite control movement. Wrong move. The airplane and the pilot's reaction time won't mesh, getting the airplane into pilot-induced oscillation, and the porpoising will be aggravated. Repeated, heavy impacts of the aircraft and the ground during the porpoising can result in structural damage to the airframe and the landing gear.

What can a pilot do once the porpoising starts? First, immediately and smoothly establish the normal landing attitude. Maintain this attitude and add power. The power will get back flying speed and control effectiveness, allowing the aircraft to get airborne again, eliminating further bouncing on the runway. Once out of the porpoise condition, the pilot needs to decide if there is enough runway left for a normal landing, or to go around.

Conclusion

By now, you've noticed there is one solution to many of these crosswind traps: the go-around. The decision to go around or not to go around is one of a pilot's most critical airborne decisions. It generally isn't a major issue during an approach, unless you discover an unexpected obstacle on the runway or, in the case of a crosswind, discover you can't maintain directional control because the wind is too strong, the airplane is too slow or the runway is too narrow. The go-around will be tougher if it has to be executed from the flare. The trick is to recognize a poor landing early, with adequate energy and altitude. It's a lot safer and easier than allowing a situation to develop that can get out of control.

The Stabilized Approach

The traffic pattern and the landing approach are where we find the problems leading to a bad landing start to build. A crosswind simply adds more complications and pressure. How can a stabilized approach to landing help in a crosswind?

A stabilized approach means your aircraft is on the proper glidepath, at the correct descent angle and rate and at the airspeed best for pattern position, airplane configuration and weight. The target airspeed for 50 feet above the runway is the reference speed (V_{REF}), which is based on the airplane's stall speed and landing weight (V_{REF} = 1.3 x V_{so}).

Light airplane manufacturers don't provide a V_{REF}, but usually publish a final-approach speed, which has been developed for the point in your approach when you are 50 feet over the surface. The speeds are given for the

maximum landing weight.

One of the keys to making a stabilized approach work best for you is having a specific target speed for each of its segments. Few manufacturers provide these figures, but they are easily developed, basing them on the aircraft's landing performance, or on V_{REF}. I teach the system by adding 5 knots to V_{REF} for final approach, another 10 for the base leg, another 10 for the downwind and, finally, another 10 for the pattern-entry airspeed.

As an example, let's assume we're flying a Piper Warrior (PA-28-161). The published approach speed in the landing performance table is 63 KIAS. So, we use 63 knots for the V_{REF}. Add 10 knots for the turn to final (73 knots), then 10 more for the base leg (83 knots). Add 10 for the downwind (93 knots) and top it off with 10 for the pattern entry speed (103 knots).

Of course, a stabilized approach requires using the proper relationship of pitch and power. Pitch and power must be adjusted together to guarantee proper airspeed and glide path. The power setting required to maintain straight and level flight (or the pattern entry speed) at V_{REF}+40 is the initial power setting for a stabilized approach. Once computed, this is the target power setting.

Putting this to use, let's say that 2300 rpm results in V_{REF}+40. As we complete the turn to the downwind leg, we reduce power to 2100 rpm and slow to 93 KIAS. Abeam the numbers, we add a notch of flaps and reduce power to 1900 rpm, producing 83 KIAS. On the base leg, we add a second notch of flaps and set 1800 rpm to maintain 83 KIAS. Before turning final. reduce to 1650 rpm and decelerate to 73 KIAS. On final, add the last notch of flaps and allow the airplane to decelerate. You should be close to 63 KIAS by reaching 50 feet AGL. Keeping the power changes on final small will produce the desired result: a stabilized approach and landing.

What about the crosswind? After turning final is the place to apply your slip, crab or combination to maintain runway alignment down the runway's centerline.

Max. Crosswind Component?

The Airplane Flight Manual, or the Pilot's Operating Handbook for light airplanes, usually lists a "maximum demonstrated crosswind" speed. Although many view this value as an operating limitation, it's really more of an advisory.

Instead of representing a limit of, say, control effectiveness or authority, this speed is really only the highest crosswind component that could be found during the aircraft's certification test flights. As such, it isn't a restriction on how to operate the airplane.

Should you go out and try the airplane in this kind of wind? Before doing so, think hard about your health, your airplane and your bank account. Think also about whether the wind is steadily above that published value or gusting past it. Think also about how wide and long the runway you're planning to use is, as well as how badly you need to make that takeoff or landing.

Ultimately, exceeding the maximum demonstrated crosswind component shouldn't be considered unsafe, but it certainly should be considered. You should set some personal limits on the kinds of winds in which you will, or will not, fly.

Crosswind Checklist

In The Pattern

• The old adage that "A good landing begins with a good pattern" is even more true when considering a crosswind landing. Remember not to square off your turns, but to compensate for the wind.

• If the wind is near crosswind limits for your airplane -- 90 degrees and up to 0.2 times the airplane's stall speed in the landing configuration (V_{so}) -- consider not using flaps. Regardless, this is not a good time to use more than recommended for approach or takeoff.

• Estimating the crosswind strength at an uncontrolled field isn't too difficult. Using the one-in-60 angular guesstimate, you can estimate the crosswind component pretty accurately. For example, when at 60 KTAS, each degree of crab needed to hold course indicates a one-knot crosswind component. If you are on final approach at 90 knots KTAS, each degree of crab required indicates a crosswind component of 1.5 knots. If, after turning final at 90 KTAS, you are crabbing 10 degrees, the crosswind is 15 knots.

On Final

• After turning final, establish the crab angle necessary to maintain alignment with the upwind edge of the runway. If you know the gust factor, add about half of it to your final approach speed

• If using the slip method, transition to a wing-down slip from a quarter- to a half-mile out on final. You should be able to feel the amount of control deflection and bank required to hold a straight path direct to the upwind edge of the runway. If you run out of control to maintain this path, abandon the approach and go around.

• You can't safely accept a touchdown point that would be downwind of the runway centerline. Instead, plan to touch down in the center of the upwind side of the runway.

In The Flare

• Never touch down if your heading is not aligned with the runway centerline.

• Use rudder to maintain runway heading and aileron to control drift. Use power to control the rate of descent and elevators to establish the pitch attitude.

• Maintain directional control with rudder and aileron to touchdown.

• Don't touch down until everything is perfect. When the winds are gusting and changing, you may have to make several go-arounds.

• You're not finished flying the airplane until it's tied down.