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# Anatomy of a Crosswind Landing

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Two Techniques

Anatomy Of A Crosswind Landing

Use a sideslip, a crab or a combination to stay aligned with the runway. Or go somewhere else.

By Rick Durden

It never fails. You reserve the airplane for an early morning departure on the family vacation. Then the kids and the packing and the delays add up, so you launch hours late, and arrive at beautiful Lake Runamuck as one of the kids becomes spectacularly ill, the other is screaming about the dead batteries in the GameBoy, the turbulence reaches its glorious maximum, the winds are 270 at 15 gusting to 20, and the 75-foot wide runway is oriented north and south.

The last two pilots in the pattern were using Runway 18, so you figure you'll follow the crowd. You remember the maximum demonstrated crosswind component for this airplane is 17 knots. You know it's not a limitation, but you consider it was a professional test pilot who did the demonstration, so, as you haven't really done any serious crosswind practice for at least a month—okay, okay! It was six months ago and it wasn't pretty—so, maybe, despite your ingrained determination to complete the mission, you should admit to yourself your ability to control the airplane and make a safe landing under these conditions is not a sure thing.

## Outside The Box

As common sense kicks in, you leave the pattern, add a little power and climb about 500 feet, then pull the power back, lean the mixture and take a minute to decide what to do.

You recheck the airport diagram and see there is an east-west grass runway. It's only 2000 feet long. Why didn't you consider it? Well, because no one else is using it, it's not paved and the FBO where you rented the airplane says no grass runway operations. It seems to you that right now, in high summer, landing on a grass runway into the teeth of a 15-to-20 knot breeze is a heck of lot smarter than landing at a 90-degree angle to that same wind.

So, you announce your intention to land on Runway 27, fly the pattern and make a normal landing. Your spouse comments on how nice it is to land on the grass. You taxi in, holding the ailerons carefully for the wind and tie down the airplane. As you are picking up the bags to walk into the FBO you hear a horrible squealing noise as one of those airplanes in the pattern for Runway 18 loses control on the rollout, scrapes a wingtip and describes a graceful curling path right into the airport fence. You run to the site and help the stunned pilot and passengers out of the airplane.

## Velocities

Later that evening, over a cold beverage, your spouse asks you what happened to that other airplane and you find yourself talking about crosswinds, and telling your spouse the story of your very good primary instructor who took you out for about an hour and a half of takeoffs and landings on a day when there was a stiff crosswind.

He taught you some things that stuck. The first precept you resisted for a while until you

understood the reason for it: Carrying any extra speed on the approach is not a good thing and can be just plain dangerous. He taught you to come down final at 1.3 $V_{SO}$, the published approach speed for the airplane, adding only half of the gust factor and no more. You initially argued with him, explaining that if you tacked on 10 or 15 knots, the airplane was a lot easier to control and you could keep it lined up with the runway better than when flying at book speed.

Your instructor had smiled patiently and then asked you to continue thinking about the approach. Sure, it was easy to line up on final, but where things truly matter on a crosswind landing was not on final: It's over the runway itself, in the flare, touchdown and especially the rollout. You have to deal with all of the speed you are carrying on final in a way that brings the airplane to a stop where you desire. The speed and mass of the airplane are energy, and energy is a squared function.

He reminded you that energy equals mass time acceleration squared. If you double your speed, you don't double the force of the impact, you quadruple it; therefore, any extra speed is a very bad thing if you are not going the direction you desire to go. If you have any extra speed when you flare to land, what's going to happen? Right, you're going to float. And while you are floating along there, in ground effect, the wind has time to act on you. There is a huge chance you are going to start drifting downwind. To stop the drift you may force the airplane onto the ground while still going fast, hitting either flat or on the nosewheel, while going sideways. Now you are faced with trying to salvage a landing that is in serious trouble. Can you do it? Do you want to be in that position?

## Voices In Your Head

The incident at the airport has your spouse hanging on your every word and you can hear your old instructor clearly in your mind. "So, let's fly the airplane at the speed the manufacturer published, after all, it's the speed you flew when you first soloed and it worked just fine back then."

The controls are effective; it just may take some big inputs to get the airplane to go where you want. Now, as you get close in, you transition from a crab to wing down approach. You nail the drift with the aileron and keep the nose parallel to the centerline with the rudder, then you flare and touch down. You don't mess around trying for a full stall landing, you get the nose up into landing attitude and put it on the ground before you float and bad things start to happen. You've got full flaps in there for drag, to maximize the rate of deceleration and help make sure you don't float. You put it on the upwind wheel and progressively roll in every bit of the aileron travel to keep it on one wheel as long as you can. The other wheel comes down and NO! you do not breathe a sigh of relief.

Taking a sip of your drink, you can see your instructor's face as he enunciates every word, adamant in his desire to help you understand what the real risk is on a crosswind landing, and to keep you from ever bending an airplane. "Now, once you are on the ground, not while you are on the approach, you are squarely in the danger zone on a crosswind landing.

Very few pilots crash on the approach. The majority lose it right after touching down. They have too much speed and have touched down either flat or drifting downwind, or both, and they are about to discover that even though the wheels are rolling, they have no rolling control. The tires won't do a thing to keep the airplane going straight; if there's not enough friction for adhesion, they'll just skid.

What makes that fact lead to crumpled aluminum is that the pilots think they've made it back to earth and quit flying the airplane. They center the ailerons and sit there patting themselves on the back for handling a crosswind, and start thinking about turning off the strobes or changing radio frequencies.

Right then it is the flight controls that will keep the airplane going straight and those pilots quit using them; their brains have snapped from "flight" to "ground." The airplane starts to hop sideways and they're puzzled why they can't stop it with nosewheel steering; they get the airplane a bit sideways and things proceed to where the pilots then look stupid in the NTSB report.

Your instructor's voice again intrudes: "I'll say this to you now and every time we land until I see it has become second nature to you—keep flying the airplane all the time. Once you touch down you roll in all of the aileron into the wind and you keep it there throughout the rollout. That aileron deflection gives you flying control, because the airplane isn't done flying. The drag of the downwind aileron helps keep the airplane going straight and not weathervaning into the wind. The upwind aileron also forces the upwind tire onto the ground, increasing its friction and giving lateral rolling control when otherwise there wouldn't be much weight on any of the tires. You use all the flaps because you want their drag to help decelerate as quickly as you can through the region of

diminishing aerodynamic control to a speed where you have rolling control."

## Going to Plan B

Your discourse has your spouse riveted and s/he asks you what you can do if you approach on speed, with full flaps, and as you transition into that wing low and opposite rudder slip thing, you can't stay lined up with the runway. What if you have the controls to the stops and you can't keep the airplane going where you want it to go? You explain that you make a go around, climb to a safe altitude, set low cruise power with the mixture leaned so you aren't burning fuel and take time to plan what to do next.

You frankly admit that there is a question about safely landing in that crosswind and explore your options. If it is late afternoon and the wind is forecast to drop, the best thing to do might be a sightseeing trip in the local area, at reduced power so as not to use up all the fuel and then land in the diminished crosswind. Otherwise, the safe alternative is to find a way to land the airplane into the wind, or at least reduce the crosswind component.

Look for another runway oriented into the wind on the airport or on a nearby airport. Sure, landing at another airport may delay your arrival, but it's a lot less embarrassing to show up late with an intact airplane than to arrive at some previously arbitrarily established time with one rolled into a ball. You explain that it may be possible to land at an angle across a runway, to cut down the crosswind component; it may not be a big difference, but it may be enough to reduce the crosswind from awful to just unpleasant, but manageable.

You also explain that, for some reason, pilots seem to ignore grass runways; maybe because of lack of training or because of insurance policies that exclude coverage for grass runway operations. You point out you always thought it was foolish to pass up a perfectly good runway oriented into the wind, which is why the two of you are enjoying a drink on a pleasant evening rather than running around trying to take care of the myriad loose ends that would have come about had you landed in that strong crosswind and lost control of the airplane.

## Probabilities

You realize the kids have been too quiet, and it's time to make sure they haven't set fire to anything valuable, so you finish up the conversation by recounting that your old instructor instilled the concept of pilot in command in you—and that means making decisions that you think have the highest probability of getting you and your passengers home safely, even if it means doing something somewhat unconventional, or not following the crowd to a runway that you don't think is safe under the conditions.

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