

## NOTES ON CROSS-WIND TECHNIQUE

Just look around the airport on a breezy day. The weather might be beautiful, but the tiedowns will be full: almost nobody else goes flying on a windy day. A lot of the utility and enjoyment of flying is lost that way (but then again, maybe it's best that some people stay home -- especially if they're the kind of Sunday pilots who can't hack it.)

At API, it's obvious that ordinary winds don't bother any of us much, but it's also obvious that we're not all that good at handling them. Chirp marks on the shoulders of the tires, particularly on the nosewheels, say that some of us have hit nosewheel first while drifting sideways. Other shortcomings in landing, take-off, and taxi techniques have been noted from time to time. Since things left to themselves run downhill, it's necessary to remind everyone that good crosswind technique is essential in those tricky moments when, at an altitude of zero to a few inches, you are trying to maneuver yourself accurately in the air with respect to the all too solid surface of the earth.

When it comes to cross-winds, if you feel you're not sharp, you ought to get Harold and go out to shoot a few takeoffs and landings when the winds are up.

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Since Harold can't reach us all in the course of a season, and since an instruction opportunity may not coincide with suitable wind, I am issuing some operating notes on the subject, based on Mike Salour's memo of June 2, 1975. While the flying mags publish no end of general drivel on cross-winds -- open any Spring or Fall issue -- Mike said it all in his memo, which I have incorporated into the thoughts offered here.

Unfortunately, reading (or re-reading) about cross-winds won't necessarily make you do it right. You've got to know it all in your bones. Plan on getting some practice out in the real thing.

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There are two basic approaches to cross-wind landings, the crab approach and the slip approach. They both work, but in either one, you had better know exactly what you're doing. Some experienced people use a combination of both methods, making a transition from crab to slip, which is also fine if you know what you're doing (but quite dangerous if you don't!) Takeoffs involve the opposite, a transition from slip to crab, and can likewise be dangerous for the same reasons.

#### The Crab Approach

The crab is the easier of the two landing methods to understand, but is somewhat more difficult to execute well. The crab on final approach is fully equivalent to that used for drift compensation in level flight. The aircraft is turned in the direction of the cross-wind to maintain a track over the extended runway center line. It remains in balanced flight right up to the last moment before touching.

Actually touching down in a crab, however, would be disastrous: the resulting side loading on the gear might cause gear failure, rip the tires off, or bring on a vicious ground loop. According to the books, what you're supposed to do, at the last possible moment before touchdown, is "kick out the crab" with the rudder, in order to line up the axis of the airplane with its direction of motion. This is fine when it works, but it is hard to do it consistently every time, particularly with airplanes like ours which are floaters rather than sinkers. If it doesn't work, the book leaves you on your own.

The crab approach does have some advantages: the airplane remains in balanced flight right up until the moment of touchdown. The pitot-static instruments read accurately throughout the approach, and with experience, the degree of crab gives an exact indication of the amount of cross wind. A go-around, if necessary, is commenced from a balanced flight condition.

On the other hand, a crab approach in a severe crosswind may impair the pilot's view of the runway. When kicking out the crab, the downwind wing will be increasingly blocked from the relative wind by the fuselage, causing it to lose lift with respect to the upwind wing and thus to drop, with all the accompanying danger. Finally, if the kickout is made too soon and the airplane floats, in level flight, the airplane will immediately begin to drift sideways, causing severe side loads when it finally does touch (or, if a further kick-out correction is applied, it will then be aimed to run off the downwind side of the runway. Trying then to straighten the aim during roll-out will create a disastrous centrifugal force tending to tip the airplane toward the downwind side.

#### The Crab-to-Slip Transition

A more effective technique for the kick-out phase of the crab approach is to bring the airplane in with power on, slowing to near-power-off stall speed when close to touchdown. At the kickout point, the airplane is cross-controlled to make it slip into the wind, thus counteracting drift while at the same time killing the airspeed and lift. The upwind wing is lowered and opposite rudder is used against the turn, to keep the aircraft lined up with its direction of motion down the centerline of the runway. Concurrently, power is reduced and the nose is pulled up a bit into landing attitude. The combination of power reduction and unbalanced, slipping flight kills the lift and puts the aircraft at or near a full stall condition. It soon lands on the upwind main gear, and while still being held in the slip, it presently flops down on the other wheel, with most of its lift gone, and finishes the rollout in level attitude, while the pilot continues to hold the controls against the wind. Levelled out, with no angle of attack, no speed, and no lift, it's all through flying for the moment, and thus is protected from bouncing, ballooning, or being picked up by a gust and skittered sideways.

This technique works every time, but it can be dangerous. If thinking to steer by banking, or through some sort of right-left confusion, the pilot lowers the wrong wing, he would hit instantly with a dreadful sideways lurch, and might break the gear or get blown over. If, more likely, he had a tendency to take the aircraft out of the slip at the moment of touchdown, (rather than increasing the bite of the controls as he should) he could pick up lift again, start to

float or balloon, begin to drift, and then touch while still flying and drifting sideways, with the results described earlier. Finally, with the correct, upwind wing down, if he starts a full power go-around at the last moment from the nearly-stalled, cross-controlled flight condition, the aircraft might fall off on the upwind wing, not a nice thing to have happen to you right next to the ground.

### The Slip Approach

While the eventual termination of the slip approach is just like that described above for the crab-slip combination, holding a constant slip throughout the entire approach has definite advantages for some pilots. Well out on final, the upwind wing is lowered and opposite rudder applied to keep the aircraft aligned with the runway heading. The aircraft slides sideways into the wind at a rate controlled by the extent of the wing-lowering. Any mix-up about which wing to put down is quickly caught and safely corrected. The slip is then maintained all the way down until contact is made with the runway, eliminating the need for a precisely-timed kick-out or a last-minute transition. At touchdown, the control inputs are maintained until the aircraft has slowed to a safe speed.

The constant alignment with the runway maximizes average visibility; no particular skill or finesse with the controls is required, and indeed, the method can be used successfully by anyone. Even though the pitot-static instruments don't read correctly, stalling out isn't much of a problem: as long as the airplane can be held in the slip, it won't stall (first it will come out of the slip and then it will stall).

There are some problems, however. At final approach altitude, it may not be possible to compensate completely for the cross-wind. Some initial crabbing may be required, complicating the maneuver. Then, too, holding the plane in a prolonged slip will bring on a high rate of descent, which the pilot must have presence of mind enough to allow for and counteract. Particularly treacherous is the urge to take the slip out right at the last, brought on, perhaps, by the tendency of the cross-wind to diminish just below tree-top or building level immediately above the runway. Removing the slip brings on floating or ballooning as mentioned above, with the results already described.

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In his notes, Mike Salour felt that in general, low time or rusty pilots would have more success with the relatively uncomplicated slip technique, but that it, or any technique, had to be practiced thoroughly before it could be relied upon.

He also pointed out that if you're given a sub-optimum, cross-wind runway (often done at busy air-carrier airports), don't be intimidated: ask for a runway more directly into the wind if you feel you need it, and in any case, ask the tower controllers to call the wind for you on final approach -- particularly when there are gusts and shifting winds.

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He also mentioned some cross-wind desperation maneuvers, such as initiating an intentional ground loop on the runway if the wind exceeds pilot or airplane capabilities. My comment is that this is desperate indeed. Flight planning should always include the possibility of unmanageable cross winds at the destination, and there should always be enough fuel to make it to a place with a runway more directly into the wind.

Additional comments on desperation maneuvers are that there is nothing sacred about the runway center line: land diagonally into the wind if that would help and use the centrifugal force generated as you straighten out to keep the upwind wing from lifting -- but watch out when you slow down: don't let the wind get under the wing!

It's also worth noting that some airplanes, the 172 for example, can be landed in truly gigantic cross-winds with a wing steeply down. Such landings are not recommended at all, however, because of the risk of upset on roll-out.

In a 40 - 50 kt wind (not recommended!) the 172 is best landed directly into the wind -- you can land it directly across the runway on runways as wide as Hanscom's! The approach can be made at near zero ground speed, with the airplane floating straight down (possibly backwards!) in normal landing attitude. I have seen it done.

(Needless to say, after such a landing, get help -- don't try to taxi cross-wind in winds like that).

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While these notes may serve as reference for technique (or for harum-scarum emergencies), if you think your cross-wind landings might have put the scallops on the tires, or if you're at all dissatisfied with them for other reasons, get instruction, and deliberately practice when you have the time and are not just going from here to there.

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The thing to avoid is the commonly-seen tendency to drive it on. The pilot, sensing that his landing isn't working out, puts in the throttle and tries to fly the airplane onto the ground in a level attitude. This can only be done at an excessive airspeed. The aircraft, still flying in level attitude, then wheelbarrows along on the nosewheel. The wings continue to generate lift, and the mains are not planted solidly on the pavement. There is no real ability to control direction in this situation. In a cross-wind, this is a recipe for disaster: lightly loaded, the mains skitter sideways underneath the airplane, and it slews around. The pilot may respond by trying to turn with the ailerons, and the wind is able to get under the upwind wing and turn the airplane over. I saw it happen right in front of me one day at Marlboro, to a fellow in a Tri-Pacer.

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## Takeoffs

With all the emphasis on making good cross-wind landings, take-off technique sometimes gets ignored. A proper cross-wind takeoff is something like the reverse of the crab-to-slip transition, and calls for the same wariness.

Taxiing into position, hold the controls against the wind. Have Tower call the wind, or look at the sock. Look up ahead, and note the drift direction of heat waves dancing over pavement, or the motion of dust, bugs, rain, bits of debris, or blowing snow -- whatever. Now make the takeoff run while still holding the controls against the wind, relenting a bit, perhaps, as the plane picks up speed, but being ready to instantly stop any tendency to skid sideways or get blown over by getting the wing down. If you feel the airplane skidding under you, get the upwind wing down and steer with the rudder! It's not unthinkable to finish the run with the airplane heeled over to take off on one wheel, any more than it's not unthinkable to land on one wheel! The main thing is to keep that gear rolling straight in the direction of travel until it is definitely no longer needed, and to keep the wind from getting under the upwind wing.

As a protection against a settling back on the runway while crabbing or drifting after takeoff, hold the plane on until you are sure you will have plenty of flying speed at lift-off, then pull it off the ground in a definite, positive manner. Immediately make a co-ordinated turn into the wind and set up a crab, climbing out in balanced flight along the extended runway centerline. (You don't particularly want to drift sideways -- and you definitely don't want to climb out still holding the slip.)

If a gust drops you and the plane starts to settle back, don't just sit there waiting to hit. Stay right with it! Get the wing down, kick out the crab, and get the plane lined up, then go ahead and let it touch, holding it straight until you've picked up some more speed before pulling it off smartly again. Letting it hit with takeoff power while drifting sideways is pretty bad. Attempting to turn it straight by banking toward the downwind wing is a disastrous move. To save your cookies when settling back after takeoff, use your head and your feet!

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## Taxiing

In taxiing, the trick again is not to let the wind get under the wing -- or the tail. Taxi very slowly, feeling out the wind, and thinking carefully about the needed control inputs before turning. If you feel the wind picking you up and skidding you sideways, turn more into it, using the engine to keep yourself on the taxiway. When taxiing downwind, lowering the flaps will help keep the tail down (but will also give you quite a push from the rear). Raise them again before turning into the wind.

On glare ice, you may have to "fly" the plane clear back to the terminal, crabbing as necessary while running the engine to keep it on the taxiway. Go very slowly, be careful of hitting a bare patch while crabbing ahead with any forward speed, and tap the brakes repeatedly, rather than locking the wheels, to

get what braking action you can. Taxiing downwind is particularly hairy under these conditions (and the flap trick may not be wise). Don't let the forward speed build up! Stay away from everything and everybody; always leave yourself enough room to swing carefully into the wind.

If it gets to be too much, call for help to chock it or walk the wings (and ask yourself what on earth you were doing out there) before the airplane gets turned into a pile of Reynolds Wrap.

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High-wind white-knuckle operations aren't at all recommended. Being able to handle light-to-moderate cross-winds, however, is all a part of a professional pilot's competence, and we need to see more of that at API. Practice!

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