The Last 500 Feet

Let's talk about the only mandatory flight maneuver: landings. Specifically, where do pilots get sloppy, lazy, or just go wrong between the base-to-final turn and the moment when the airplane is ready to turn off the runway?

Airspeed and AOA

Catherine: Be militant about airspeed control. 61 knots is not 60, and 59 is not 60.

Catherine: Stopping distance is a function of velocity squared. If you normally touch down at 60, but you touch down at 70 instead, that's a 17-percent increase in speed but a 36-percent increase in stopping distance. At my short home runway, pilots who add too much speed in the name of "safety" may overrun the runway.

Dave: An angle of attack (AOA) indicator is tremendously useful. The biggest takeaway from flying with an AOA indicator was that I mostly flew too fast. It's great to be a zealot for speed control … as long as it's the right speed.

Angle of Attack (AOA) indicators give a visual (and sometime auditory) indication of the angle of attack relative to the optimum L/D.

Doug: Airspeed control is critically important, and most pilots fly too fast. But I'm not using an AOA indicator. I'm looking outside and setting the appropriate attitude for speed, and using power to adjust glide angle to remain "on spot." When I see a PIREP for plus or minus 10 knots on final, I wonder where the pilot was looking.

Catherine: If you add too much airspeed in gusty conditions, you'll just be working harder for longer in those gusty conditions to put the plane down on the runway. Or you'll force it down too soon.

Ryan: Airspeed is really a proxy for AOA. Published POH speeds are usually for gross weight, and adjusting for weight puts you at the correct AOA. An AOA indicator could, in theory, save you the trouble.

To adjust published speeds for weight:

$$V_{adjusted} = V_{gross} * \sqrt{\frac{\text{Current Weight}}{\text{Gross Weight}}}$$

Catherine: Fly final with a light touch and let the airplane speak to you. If the nose pitches down naturally, that's the airplane telling you that it's lost some airspeed and its natural stability is correcting for it.

Doug: Trim maintains an angle of attack. Trim correctly on final, and the airplane will do the work for you.

Wally: Practice without the airspeed (or AOA) indicator is very valuable. Pilots are usually surprised how well they do without it. It's a real confidence boost.

Catherine: You can tell a lot about airspeed just by sound.

Pilot Input Can Cause the Problem

"I recently watched a PIO where a Cessna 210 approached the airport way too fast. You could see it coming.

The first touchdown was on the nose wheel a bit, and he bounced very nicely back up in the air. The second touchdown was a little harder. I was watching him with a friend, and I said "Three times and you're out."

Sure enough, he insisted on trying a third time and he busted the nose wheel off the airplane. No injuries to people, but the airplane didn't like it very much." —Wally

Pilot-Induced Oscillation (PIO): When pilot inputs result in oscillations of pitch, roll, or yaw—usually of increasing amplitude.

Catherine: I try to make my entire downwind, base, and final a continuous power reduction so that there is no big power reduction right before the flare.

Accuracy Landings

Doug: I look for a precision landing every time. Not that I always get them, but I pick an aim point and look to put it on that aim point.

Catherine: I regularly practice power-off 180 landings. They ensure that you are intimately familiar with the drag qualities and the gliding capabilities of your aircraft.

Doug: If I were emperor, the power-off 180 accuracy landing would be a required student pilot maneuver. Back in the day, all landings were made power-off.

Dave: Practicing power-off 180s is great, but your normal landings should be with power. Otherwise, you're just making your normal landings into emergencies.

Forward Slips

Doug: Many pilots are only comfortable slipping left (i.e., with the left wing low and right rudder). But if you're going to forward slip, do it in the same direction as the sideslip you'll need for the crosswind. The transition between forward slip and sideslip will be easier.

Catherine: Flying a Saratoga into my home airport, which is surrounded by trees, the engine quit on final. I'm here today because I fly high approaches and am almost always slipping on final. If you add a crosswind, I'm slipping for two reasons.

Doug: Don't carry power in a forward slip. It's at cross-purposes with the goal of the forward slip: losing altitude.

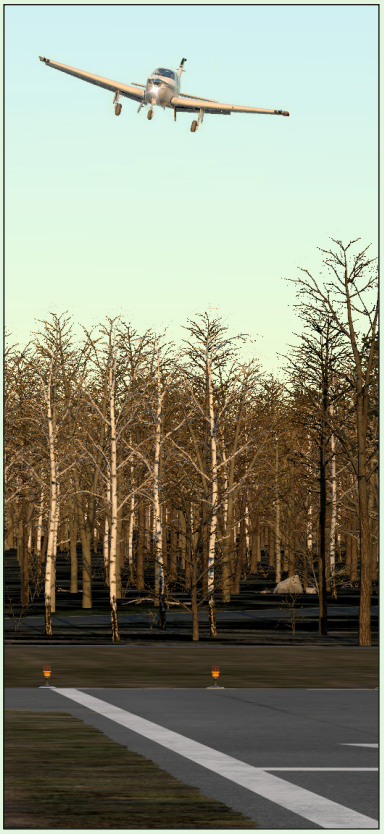
A Slip Can Look Drastic from the Ground

"A number of years ago, I was putting my plane away when a police officer came into my hangar and said, "Ma'am, are you all right?" I said I was just fine.

He said a lady called that there was an airplane approaching the runway in distress. Apparently it was my slip.

So I said, "Sir, that's just one of my normal landings."

—Catherine



The Flare

Dave: I put two hands on the yoke in the flare. I know it goes against the standard advice to keep a hand on the throttle in case of a go-around, but for me it just works.

Doug: I do the same thing.

Catherine: Me too.

Ryan: Some pilots won't slip a Cessna 172 because they think the POH prohibits it.

Cessna guidance over the years on slipping a 172 with flaps extended:

1956

Normal landings are made power off with any flap setting. Slips are prohibited in full flap approaches because of a downward pitch encountered under certain combinations of airspeed and sideslip angle.

Approach glides are normally made at 70-80 m.p.h. with flaps up, or 65-75 with flaps down, depending upon the turbulence of the air. The elevator trim tab is normally adjusted in the glide to relieve elevator control forces.

1978

Normal landing approaches can be made with power-on or power-off with any flap setting desired. Surface winds and air turbulence are usually the primary factors in determining the most comfortable approach speeds. Steep slips should be avoided with flap settings greater than 20° due to a slight tendency for the elevator to oscillate under certain combinations of airspeed, sideslip angle, and center of gravity loadings.

2004

Normal landing approaches can be made with power on or power off with any flap setting within the flap airspeed limits. Surface winds and air turbulence are usually the primary factors in determining the most comfortable approach speeds. Steep slips with flap settings greater than 20° can cause a slight tendency for the elevator to oscillate under certain combinations of airspeed, sideslip angle, and center of gravity loadings.

Wally: I vote against this technique. I've never met an airplane I couldn't land with one hand, and I want that other hand free to do other things.

Catherine: I've seen many pilots ruin a perfectly good landing by adding power. I'm not adding power in the flare unless it's a go-around.

Doug: There's a difference between a skip and a bounce. A skip is just a couple feet in the air, and you might add a bit of power to save it. Anything higher than that is a bounce, and one bounce warrants a go-around.

Doug: There's a tendency for some pilots to yaw left in the flare simply due to ergonomics. As the pilot pulls back on the yoke, they run out of space to put their arm, so they unconsciously pull down which banks the airplane to the left. That wouldn't happen with two hands on the yoke.

Dave: Another non-standard thing I do in airplanes with heavy controls is trim nose-up on final such that I'm actually pushing a bit. That makes the elevator a little lighter in the flare.

Wally: I don't do that. You could have an issue with excessive nose-up trim on an unexpected go-around.

Catherine: I trim for the AOA that results in my approach speed, and then do whatever I need to in the flare.

Wally: In many GA airplanes, full nose-up trim results in best glide speed and a level pitch attitude.

Doug: A little extra forward trim can help with wheel landings in tailwheel airplanes.

Wheel Landing: Landing a tailwheel airplane on the two main gear with the tailwheel still off the ground.

Wally: I teach crosswind landings by not landing. Fly the length of the runway and move left and right laterally while keeping the longitudinal axis aligned. There are too many distracting things going on in the flare to learn this properly. Don't overthink it. The rudder controls alignment and the ailerons control lateral position over the runway. It works on every landing.

Link to *Private Pilot Missing Lessons*:

Crosswinds

Catherine: There are two schools of thought for flying final: crabbing and slipping. I'm in the slipping camp. In fact, I fly nearly all of my landings from a slip, because I fly high approaches. I want to be within glide range of the runway as much as possible. For example, on final with a four-light PAPI, they'll be all white for me.

Doug: I also slip down final. The exception is flying charters, where passengers might find a slip disconcerting. But in the end you still need to convert the crab to a sideslip to land.

Catherine: What I love about slipping on long final is as you go through layers of air getting closer to the ground you're always adjusting to compensate for the wind. By the time you touch down, you're in tune with what the wind is doing.

Dave: An attitude of centerline zealotry helps your hands and feet to naturally do what's right. I find that pilots often over correct for crosswinds and end up on the upwind side of the runway.

Catherine: A slip is not necessarily anti-spin. You can spin "over the top" out of a slip. But while a slip is a wonderful maneuver when used with care, there's no virtue at all in a skid.

Runway Alignment With a Crosswind

"Point the nose with your toes." —Doug

Go-Arounds

Dave: We do ourselves a disservice when we say that "you can always go around." It's not a trivial maneuver. Often there's a significant push on the yoke and a significant right rudder required. The sooner you can initiate the go-around, the better. I break it into a deliberate two-step process: Add power to result in level flight, and then transition to a climb with the configuration changes as necessary.

Doug: Go-arounds are one of the least practiced maneuvers, and can be highly dangerous.

Catherine: People worry about the base-to-final spin. In reality, more accidents happen in the go-around phase of flight.

Dave: There are cases where the tower has called a go-around and an accident followed. There are some situations where a landing is the safer option.

Wally: Many go-around accidents occur on the left side of the runway.

Real World Go-Arounds

"I think part of the problem is there's an element of surprise. Either the tower says "Go around" or they had a bad bounce or someone just pulled out on the runway.

When we train and we say, "Okay, let's do a go-around." That's pretty easy. But when a big surprise comes up, you've got that startle factor that messes you up, too." —Wally