Plane & Pilot

TOP PILOT TIPS

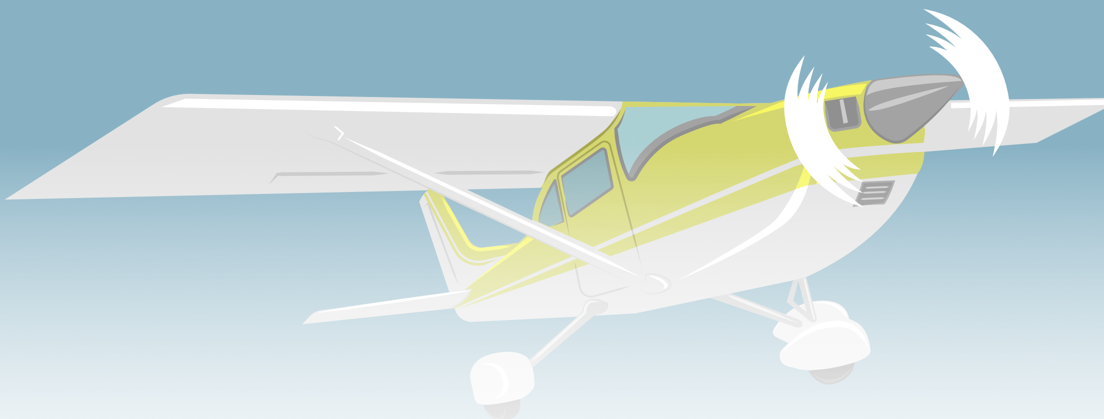
FOR STAYING ALIVE

STAYING SAFE At Treetop Level

WHY REAL PILOTS KNOW How To Slip

USE LESS RUNWAY And Save Your Brakes

NIGHTTIME TIPS: To Avoid Blinding Yourself



Top Pilot Tips For Staying Alive

From loss of control to runway departures, the big risks to little airplanes are well known. And yet, they stubbornly keep their place at the top of the NTSB's list of hazards. Here's a handful of our most popular articles on how to cut those very risks.

BY PLANE & PILOT

The biggest risks in light aviation are a small group...loss of control at low speed... and at high speed. Loss of control while maneuvering, while milling about in the dark of night and while trying and failing to stay in visual conditions.

All of these accident types can be lumped under the heading of "pilot error," which when you think about it, is as big a category as imaginable. Getting shot down or having your wing fall off wouldn't qualify, but most accidents that do happen go down because the pilot tried something they shouldn't have tried or didn't do something they should have done. A lot of times they've gotten away with just such bad behavior in the past.

But why do pilots try to do the, well, not the "impossible" exactly because anecdotally at least, we know that pilots get away with these kinds of "pilot errors" all the time. So they're they're not trying to do the impossible at all, or even the "improbable." They are doing something that statistically speaking has a higher risk of failure of the most disastrous kind than doing it some other way or just not going flying at all.

Trying to thread one's way through severe weather is a case in point. Pilots do it all the time. I've done it a hundred times myself. It's not a question of whether one should do it..it's the nature of flying IFR on convective days… it is part of flying. No, the question is, how should one thread one's way through severe weather, how wide a berth to give a big cell, or now long a gap between storm clouds will stay that way. There are no hard and fast answers to any of those questions, but knowing how to ask the questions helps pilots develop the judgment they need in order to avoid being on the wrong side of the safety ledger sheet.

Often these questions, like "How do you brake?" are subjects that either don't seem important or seem too obvious, though it doesn't take much reflection to realize that they are a lot more complicated than we might appreciate and are, indeed, fundamental to safe flying.

These collected articles represent a tool kit for safer flying. In many cases, they offer specific suggestions for avoiding the worst kinds of surprises, like how to avoid stalls in the traffic pattern, and in other cases, they provide an overview of a subject we might not have given enough thought to, or perhaps, not enough thought to *lately*.

YOUR GUIDE TO STAYING ALIVE WHILE FLYING LOW

The joy of flying low is no secret, but the risks are real. Arm yourself with the tools to stay safe.

By LeRoy Cook

"If you're going to fly low," said my first flight instructor, "you had better know how to do it right." We then cranked up the old Aeronca Champion and went out for a low-level dual excursion around the countryside. As I found out during his pre-planned route, things looked different from a traffic-pattern perspective. We didn't break any minimum-altitude rules, we just didn't climb up to the usual 2,000-feet AGL cruising level. For his training objective, flying at 800 feet or so was low enough.

Why would you ever fly so low? As he explained, it might be necessary to stay that low just to remain in VFR conditions when the weather suddenly collapses and you need to turn around and get back home. And we occasionally participated in Civil Air Patrol search missions, which had to be conducted at low level. Amateur attempts at aerial photography require some expertise in flight at low altitude. Plus, once in a while you just want to go sightseeing instead of riding an electronic course line in the upper airspace.

I will note here that all of these kinds of missions carry with them considerable additional risk. How much is hard to say, but it's a lot. These kinds of flights aren't common, and yet the accident record shows an inordinate number of accidents blamed on low-level manuevering, or "buzzing," as we often refer to it. Accidents caused by mistakes when maneuvering at low level are usually fatal ones, and the accidents have a common theme: The pilots who were flying low had little experience with low-level flying, they were doing so on the spur of the moment, and they had, hence, not formulated a plan.

There are also regulatory and neighborly considerations. As my grizzled CFI pointed out, there are some operational differences to be observed when flying at low level. We need to be considerate of other people, such as those living under our flight path. To reduce our noise footprint, we should pull the power back to a low-cruise setting and stay

Flying low gives you a view of the world you can't get from 5,000 feet AGL. But before you do it, make sure you know the rules of the air and carefully study the terrain and obstacles you'll encounter along the way.

away from built-up housing areas. Even though we're not flying over a town, there can be clusters of developments along highways, and there are isolated schoolyards and even airports that should be avoided. Open countryside is our objective, although we may encounter a farmhouse along the way.

WHAT'S LEGAL?

What are the regulations concerning minimum altitudes to be observed? The "minimum safe altitude" rules have been essentially unchanged since the 1940s, which means they are not always logically applicable in this day and age. But from a legal standpoint, you can fly as low as 500 feet above open countryside or 1,000 feet above congested areas and open-air assemblies of persons, as measured from the top of any obstruction within 2,000 feet of the aircraft. The 500-foot rule also applies to lateral distance from any structure or person when flying below 500 feet AGL over water or unpopulated areas. Even when I learned to fly, these were considered DUMB rules. Flying at 500 feet above the ground should be considered a last resort, reserved for extracting oneself from an emergency bad-weather situation. One should avoid using the ancient rules written for J-3 Cubs when operating faster, less-maneuverable modern airplanes.

What hangar lawyers often fail to recognize is the beginning paragraph of FAR 91.119, which makes the pilot responsible for maintaining an altitude allowing for the safe execution of an emergency landing "without undue hazard to persons or property on the surface" after an engine failure. Regardless of the verbiage that follows it, the FAA expects pilots to add enough extra altitude to carry out the duties inherent in this sub-paragraph (a). If found to be negligent in this respect, you may be subject to a violation.

Bear in mind that the ADS-B Out data stream is a game changer when it comes to proving culpability. No longer is it possible to contest the opinion of eyewitnesses or the momentary hit of a transponder reply. ADS-B knows all and tells all, right down to ground level.

Therefore, it behooves us to do our low-altitude flying with regard to today's exigencies. Flying low is still a valid option, but a growing population sprawl and more tender sensibilities require us to exercise due care.

THE WAY TO DO IT

As we leveled off at a few hundred feet, my CFI pointed out the diminished perspective afforded by low-level flight. Landmarks came and went quickly—now you see it, now you don't. One needed to keep track of one's location on the chart and, more importantly, what was ahead on the route, because there wasn't much visual warning of its approach. Practically speaking, we would have fewer forced landing options if our engine quit down on the deck, another reason to keep our eyes outside, constantly watching for possible safe havens or avoiding unlandable areas.

To make the task of low-level pilotage easier, a common solution is to pick a road, waterway or rail line going in the right direction and just follow it. That makes it simple to anticipate the presence of the next town up the road, bearing in mind that twists and bends in the track will frequently alter your compass direction. And when you reach a fork in the road, you have to take it, as Yogi Berra said, so make sure you go the right way.

The temptation today, of course, is to just tap a destination into the GPS and follow the magenta line, an unerringly straight path across hill and dale. While sufficient for maintaining orientation, the pink pathway can lead you into places you don't want to traverse. Special airspaces abound, and you'll want to give congested areas and airports a wide berth. While I may create a GPS route when flying at low-level, I'll swing off it as necessary, taking comfort in knowing that it's there on the screen if I get disoriented.

A much more heightened awareness of the world outside is necessary when flying low. Don't spend more than a few seconds at a time on inside-the-cockpit tasks. A close watch has to be kept on the landscape speeding toward you, which is filled with hazards. Remember the old humorous caution about avoiding flight in the "edges of the air," reminding us to always stay in the "middle of the air." The edges of the air, you see, are filled with tall trees, towers, mountain ridges, buildings and powerlines. All joking aside, never forget that conducting low flight is assuming a greater risk of encountering obstructions. To manage this risk, keep your eyes outside nearly 100 percent of the time. If you have something important to do on your instrument panel, climb up to a safer altitude while taking care of it.

"A much more heightened awareness of the world outside is necessary when flying low. Don't spend more than a few seconds at a time on inside-the-cockpit tasks."

Flying low means staying away from unwelcoming localities. Airports, even little-used ones, should not be overflown at traffic pattern level. Take up a diversion heading that will avoid them by a couple of miles, and make a traffic advisory call to alert local planes of your intentions. Otherwise, an inbound aircraft might think you're approaching to land and will follow you off into the boondocks before figuring out that you're only passing through. Remember, plan ahead for airport encounters; you're not going to see the runways and hangars from a distance when you're down on the deck.

Consider that you have limited communication capability when you're flying below the horizon. VHF frequencies are essentially good for line-of-sight reception, so if you need to talk with someone at any distance, you'll have to climb back up to a more reasonable altitude. Radar contact will also be lost most of the time; even if you see the transponder's reply light flickering, you're not really being painted when out in the low boondocks.

YOU'RE NOT ALONE DOWN THERE

The fatal accident involving two employees of Icon Aircraft in 2017 should serve as a wakeup call for the risks of flying low. The pilot, a high-time test pilot with tons of hours and a strong knowledge of the terrain, chose the wrong canyon to fly into at low altitude. The one selected had no outlet, and by the time he realized it, there was no escape. Flying low carries risk, and flying around high terrain carries even greater risk, far greater.

It's not just terrain. Tall towers are an ever-present hazard when flying low, and not all of them are charted; new ones crop up all the time. GPS alerting may not help much because you're already operating in a continuous terrain-caution condition. The solution is to stay high enough to avoid all but the most unlikely super-tall obstructions by planning in advance. Watch for the large minimum-clearance altitudes on the sectional chart, which change with every lat-long grid, and when you see that number increase, take action. The larger obstruction symbol on the chart is only used when the tower pokes above 999 feet AGL; a 950-foot tower gets the smaller symbol, but it'll kill you just as dead if you hit it.

In addition, avoid flying in the bottom of narrow valleys and canyons; stay at ridge level or above. There are often powerlines strung across the valleys that sag quite low between the supporting structures, so make sure you have clearance above the poles and towers.

Remember to be considerate of the effect of the noise you're making. You may be insulated by the speed of your passage and your noise-canceling ANR headsets, but people under your flight path are not. Rattling windows as you pass by is not a friendly gesture. If you have a constant-speed propeller, dial it back to a low-rpm cruise setting. Most of the annoying noise impact from a light airplane comes from the propeller tips stirring up the air at transonic speed. The fun of flying low is enhanced by reducing airspeed for sightseeing. High-performance, heavy-horsepower airplanes are not suited for such cruising; flying at 3 miles per minute turns the landscape into a blur, so you'll probably want to stay above 3,000 feet AGL if flying such an airplane.

And should you feel the urge to take a photo or two, don't do it at low altitude, where flying the plane deserves your full attention.

Knowing how to manage the risks and challenges of low-level flight is a useful tool for your bag of flying skills, but it's one that can't be taken lightly. **PP**

SLIP SLIDING AWAY

Why being able to slip a plane should be part of every pilot's stick and rudder toolkit.

BY LEROY COOK

The ancient and honorable art of slipping an aircraft to achieve a desired flight path is an excellent tool to keep in one's kit-bag of aviation tricks. Once employed regularly to adjust a landing approach, slipping has become an infrequently used maneuver, chiefly because modern airplanes have been fitted with effective wing flaps that can be used to add drag during landing. The side-slip remains necessary for cross-wind correction, and a forward slip to landing has been preserved for the Private Pilot practical exam. Often, however, pilots do not truly understand the maneuver.

ORIGIN AND PURPOSE

Open cockpit biplanes were (and are) generally flown from the rearmost of the tandem seating positions, located near or behind the lower wing root. Unfortunately, the pilot's view during landing was somewhat obstructed by the assemblage of wings, struts and wires out in front, so it was common practice to side-slip during the landing approach, using rudder to hold the nose to one side while using opposite aileron to lower a wing and keep the rudder from producing a skidding turn. This allowed the pilot to see obstructions in the approach path and adjust his aiming spot. Then, the pilot would kick the rudder bar back into neutral and level the wings during the flare, maintaining runway alignment by watching the edges of the landing track (runways were typically wide and multitudinous at "flying fields" of the day).

Biplanes didn't need flaps to steepen their landing approach, because they were amply supplied with drag and readily descended with power off. However, as more-slippery monoplanes came into vogue, "air brakes" were developed. We refer to them as "flaps" these days. They were a godsend because they could be lowered to bring the aircraft down at a steeper angle and reduce landing distance. Pilots who had been trained in biplanes, or in Mr. Piper's early Cubs that retained the biplane's aft-seating for PIC, still knew how to slip, even when graduating to flap-equipped airplanes.

Paved runways eventually limited one's choice of landing directions, so crosswinds became more of an issue, so slips were used to neutralize the inevitable crosswind drift. This required the use of a side-slip, touching down on the upwind tire first. Steerable and lockable tailwheels replaced the old tailskids, and better brakes were developed to aid ground control. As tricycle landing gear supplanted the old "conventional" gear arrangement, pilots began to forget how to use a slip for landing approaches and touchdowns, largely because they didn't need to use them as much as they once did.

SLIPS, SEPARATE AND DISTINCT

There are two types of slips, each defined by its purpose and outcome, even though both require similar control inputs. A forward slip is used to steepen the landing approach, when wing flaps have already been lowered and aren't producing sufficient effect or when flaps aren't available for some reason. A side slip, on the other hand, is required when a crosswind threatens to push the aircraft off the runway or, at the very least, the landing gear is going to suffer side load from the wind's drift effect.

Both types of slip require opposing rudder and aileron inputs, an unnatural act normally punishable by a tongue-lashing from the instructor. In this case, however, cross-control is a good thing, because we

What a forward slip looks like from the outside on short final.

ILLUSTRATIONS COURTESY OF REDBIRD FLIGHT

are purposely flying in an uncoordinated manner to achieve a proper outcome. Modern airplane designs, chiefly tricycle gear types, are not provided with a great amount of rudder effectiveness—compared with tailwheel airplanes, that is, because the innate stability of a nosewheel configuration doesn't require as much yaw control. By limiting rudder capability, designers are able to avoid much of the risk of inadvertent spin entry.

Thus, rudder effectiveness will be the limiting factor in how much slip can be achieved, rather than the aileron's ability to counter the rudder input. You will run out of rudder long before you reach the aileron's limit.

HOW IT'S DONE

Looking first at the forward slip, let's assume that we are on final approach with some excess altitude that threatens our ability to land in the available runway space. We can go around to make an extended traffic pattern on the next try or add more flaps, if they are available. Or we can try the venerable forward slip, which might save the day.

Since we're already aligned with the runway, we need to make a coordinated turn of about 20 or 30 degrees of heading change, pointing the nose to one side of the runway, then we'll hold that heading with rudder while inputting aileron, opposite to the rudder. The airplane will then track along a line offset from the aircraft's longitudinal axis, FORWARD toward the runway as before, hence the name "forward slip." You may be looking at the runway out of the side window, but the airplane is heading directly toward it.

Because the airplane is flying sideways through the

A side slip keeps the nose of the plane pointed where you're headed, or close to it.

You might need to add some additional control inputs if the wind is strong. If it's blowing really hard, you might run out of rudder, though the good news is that the wind normally dies down as you get closer to ground.

air, presenting the side of the fuselage to the airstream, considerable drag is produced, and the descent angle thereby increases. Reassure any passengers that this is a normal, desired mode of flight, as they may consider why they are being thrown against the side of the cabin. If not descending steeply enough, add more rudder and the requisite aileron to counter it. As we said, you'll often be pressing the rudder against the limit stop. As you approach the ground, or reach a normal glidepath, smoothly release rudder to let the nose swing around to the runway heading and level the wings for the touchdown.

This is obviously a time to beware of stalling the airplane, as you are flying cross-controlled close to the ground, with only landing-approach airspeed. Maintain the nose attitude that was working before you entered the slip, and take care not to increase angle of attack. If the airplane has a single static port, the airspeed indicator will be affected by the slip; slipping toward the static source adds ram air pressure into the opening, lowering the indicated airspeed, while slipping the other way raises IAS. Keep the nose down and expect the airspeed to come back to normal as you recover from the slip. Airplanes with dual, connected static ports will not be affected by a slip.

Unlike having flaps deployed, using a forward slip to increase drag means you won't have the benefit of aerodynamic braking after straightening out for the landing. The airplane will be scooting along in ground effect until it decides to touch down, so you may have to brake aggressively during the rollout.

Does it matter which way you perform the forward slip, left wing down or right wing down? Not really; most pilots, seated on the left side of the cockpit, will push the nose right and slip toward the lowered left wing, for better visibility. And if making a left-hand turn to final, it's natural to detect the need for a slip and begin the maneuver while still pointed to the right of the runway.

The airplane doesn't care which way you slip it. There is a possibility of unporting a fuel tank's outlet in a prolonged slip, should you be foolish enough to be landing with minimal fuel in the tank.

Both types of slip require opposing rudder and aileron inputs, an unnatural act normally punishable by a tongue-lashing from the instructor.

AND THEN THERE'S THE SIDE SLIP...

Rather than slipping the airplane to lose excess altitude, dropping down over obstructions in the approach path, it's also necessary to exercise your crossed-controls skill during a crosswind landing. This is a true side slip, making the airplane move sideways across the runway in exactly the same amount that the crosswind component is moving it in the opposite direction, thereby negating the wind's effect and rolling the landing gear exactly along the runway direction, nose pointed at the centerline. The upwind tire will touch first, the downwind tire will be held off by aileron input for a second until it squeaks down, and the rollout continues with active use of the controls until the tiedowns are reached.

It is inevitable, of course, to avoid the "my way is better" contention revolving around landing in a crosswind. One side insists that there's no need to

A danger of any kind of slip is getting low. It's critical to keep the angle of attack not only within safe limits but with a margin is it's gusty. And when you're low, there's a tendency to pull the nose up instead of adding power, which can lead to big problems.

put a wing down at all, that straightening up from a crabbed approach with a boot-full of downwind rudder will take care of the touchdown quite nicely. And the more artistic purists argue in favor of grinding down final with opposing roll and yaw inputs, adhering to the teaching of the respected masters teaching the Wun Weng Lo method.

Truth is, for those seeking true enlightenment, there's more than one way to fly an airplane, and all of them are right. It is well to consider both methods of countering wind drift during landing, recognizing the advantages and limitations of each one. Some airplanes can't be slipped aggressively as they land, because low-hanging flaps or engine nacelles limit the bank available. For them, approaching in a crab and executing a well-timed yaw maneuver to get the tires aligned with the runway is the preferred method. Airplanes possessing considerable mass will have some stored inertia that will keep them moving down the centerline until the touchdown takes place.

It is well to consider both methods of countering wind drift during landing, recognizing the advantages and limitations of each one.

Light crosswinds can be adequately handled with a stomp on the rudder during the flare. But as the crosswind component cranks up, there will come a time when a side slip will be needed. No two windy-day situations are alike; the technique to be used depends on the aircraft's capability, the amount of displacement between wind direction and runway heading, the wind's speed and gustiness, and the adroitness of the pilot. Be ready to take a wave-off and reconsider your method as you plan another attempt.

At what point do you enter the side slip? It's a matter of personal preference; some pilots like to approach in a crab, using aggressive downwind rudder at the last second to straighten the airplane out for the touchdown. Even so, opposite aileron will be needed during the de-crabbing maneuver to prevent the upwind wing from rising due to yaw/roll coupling in most airplanes.

If the crosswind is strong, I like to set up the side slip while still a quarter-mile out on final, so I can gauge the wind's gustiness and see how much rudder I have remaining to counter the wind as airspeed slows during the flare and touchdown. In this case, the nose remains pointed down the runway, the wing being lowered into the wind while rudder counters the aileron input. Be ready to adjust the side slip if the wind is variable. As always, the rudder's ability to generate yaw input will be the limiting factor; if you're still drifting downwind across the runway with full rudder pressed in, go around and try your luck again, or go elsewhere to land.

Knowing how to slip your aircraft is a vital skill that you'll want to practice when the opportunity presents itself. Consider yourself one of those airmail pilots of yesteryear, leaning over the cockpit coaming to slip expertly into a postal pickup airfield, your white silk scarf flapping in the SLIPstream. **PP**

AVOIDING NIGHT BLINDNESS

And some clever tricks to recover from it.

By Bob Achtel, M.D.

My plan to fly my Mooney from Sacramento, California (SAC), to Kerrville, Texas (ERV), was ready for action. The plane was due for its annual inspection in six weeks' time, so I decided to have the annual performed before my trip to Texas to avoid any maintenance issues while en route. »

Still, after the inspection was done, the Mooney Service Center informed me that the annual was complete and my plane was ready for my Texas destination, I still spent over an hour doing a preflight inspection. I needed to be sure that everything was working. I test-flew the airplane during daylight hours and everything seemed to be in order. A late-afternoon departure was planned, so I tested all strobes, position lights and the landing lights. I didn't test my instrument panel lights. I planned to install a glass panel primary display during the coming winter months, but at the time of the flight, I had a standard six pack.

With my good friend Chuck, who's retired from the United States Air Force, I departed from SAC for ERV on an IFR flight plan. Our plan was to spend the night in Tucson (TUS), with an ETA of about 7 p.m. (1900 Zulu). As we passed Gila Bend, the sun began to set. Ten minutes prior to landing, I attempted to turn on the panel lights. Nothing happened! During the annual, work had been done behind the panel. Conditions were marginal VFR. The Mooney M20K has a string of "lightning" lights on the trailing edge of the glare shield. These lights are very bright and are intended to be used after you have been blinded by a flash of lightning. TUS was cloaked in darkness. I turned up the bright lightning lights to enable visualization of my instrument panel. It worked, but in the process, I destroyed my night vision. Neither Chuck nor I could visually identify the field.

> **"I turned up the bright lightning lights to enable visualization of my instrument panel. It worked, but in the process, I destroyed my night vision."**

I shared my predicament with the tower. There were no other aircraft in the pattern. I was given vectors as I circled. I had now minimized my lightning lights. In time, with the airport lights at max intensity, the field came into view. I made a successful landing on runway 21.

However, my vision was still compromised. As there was no other traffic, I shut down on the runway and notified the tower of my situation. By the time a brightly lit truck had arrived, my night vision had returned, and I was able to make out our predicament. The blades of my propeller were less than 3 feet from a runway light. I followed the truck to parking.

NORMAL PERCEPTION OF BLACK AND WHITE

"Adaptation" is the ability of the eyes to adjust to varying levels of light. The retina (the film in our eyes) contains rods and cones. The rod cells are responsible for night vision because the cone cells can only function at a greater intensity of light. The cone cells, which are concentrated toward the center of the retina, are responsible for color vision.

In order for us to transform from day to night vision, we must undergo what's known as "dark adaptation." It's a process we're all familiar with. Think of a time when during daylight hours you entered a movie theater. Your night vision was compromised as you tried to find a seat.

Here's how it works. The pigment in the rod cells is called "visual purple" or "rhodopsin." When the cells are exposed to bright light, visual purple immediately photo-bleaches, resulting in night blindness—the inability to see things in low light. Visual purple in humans will then take from 20 to 30 minutes to regenerate, after which the rods are then more sensitive. Dark adaptation is quicker and deeper in young people than in older ones.

ACCELERATING DARK ADAPTATION

All isn't lost. If you lose night adaptation, you can coax it back with the use of red light. The use of red light to accelerate night vision adaptation has been known since the early 20th century. Red-adaptation goggles, used by radiologists, date back to 1916. Sailors on the bridge of naval vessels and in submarines prior to surfacing use them as well. The uptake for aviation is that we should use a red light source at night to protect night vision.

Many of us use either an iPad or iPhone in the cockpit, which is problematic at night. The intensity of the light emitted from these devices has the potential for destroying our night vision. I tried to bring an approach plate up on my iPad at night, and it was as if someone was blinding me with a bright light.

Many available aviation apps have a dimming feature, but even these are too bright on most devices. The iPad has a very useful, built-in feature that permits you to invert the colors. Several aviation apps have this same feature, or some version of it, some of which just provide a shortcut to Apple's "invert colors" feature.

Less known is that the iPhone has a hidden red screen. This red screen enables the "Color Tint" option. To enable "Color Tint," go to Settings. Then General, Accessibility, Display and then Accommodations. Here you'll find the new location of the Auto-Brightness toggle as of iOS 11 and higher. For the Red Tint, select the "Color Filters" option. You next enable "Color Filters" with the switch at the top of the screen. Next select "Color Tint" as your filter. Scroll down and use the Intensity and Hue sliders to make the screen as red as you like. For maximum redness, they should both be all the way to the right.

You can speed switching from the regular color to red by enabling a shortcut. Go to Settings, then General, then Accessibility. At the bottom, select Accessibility Shortcut. Select "Color Filters." Now

all you need to do is triple-click the home button to switch between the normal screen and red tint. The red tint will preserve your night vision. If at night you find yourself in a situation where you must use a white light, close one eye to unilaterally (one side) protect your night vision.

After the M20K I flew to Kerrville, my next airplane was a Mooney M20M Bravo. I installed a complete Aspen glass panel. I then had the luxury of a primary flight display, multi-function display and angle-of-attack indicator. As the light diminished with the onset of the sun setting, the display automatically diminished in intensity. This auto-dimming feature is true of almost all of the portable and in-panel displays. If you aren't satisfied with the amount of dimming, go to back-light settings and program the brightness of the display you desire. You also have the option of installing a knob to control the brightness of the panel.

FLASH BLINDNESS

Laser light, or other very bright lights (spotlights, search lights), can cause flash blindness when directed toward an aircraft. The bright light causes photo bleaching of the visual purple in the retina. The pilot can be distracted or experience temporary flash blindness. This could cause loss of control of the aircraft, especially during a critical phase of flight such as landing or takeoff. Pointing a laser toward an aircraft is hazardous and has resulted in arrests, trials and jail sentences.

We are all human, and mistakes do happen. Your annual inspection is designed to identify and fix any squawks that might exist. As PIC, it was my responsibility to make sure that my panel lights were operating. Knowing that I might be airborne after dark, I should have tested my panel lighting within the confines of my hangar. I now carry two flashlights with red lenses when I fly at night. And, by the way, I always have a doctor on board. **PP**

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HOW TO USE YOUR PLANE'S BRAKES

Every pilot thinks they know how to brake. Not many of them are right.

BY LEROY COOK

BRINGING A SPEEDING AIRBORNE airplane to a halt seems a simple enough process. Just plop it onto the runway, push on the brakes, and wait for it to slow down. If only it could be that simple. Alas, as with all things aeronautical, there's a little more to it than that.

Early in my career, stopping wasn't much of an issue. Our grass runways provided a certain amount of automatic deceleration, from the brushing effect of turf against tire, and the light trainer airplanes of the day landed at a slow pace to begin with, and their minuscule weight and substantial aerodynamic drag worked together to limit the braking required to reach taxi speed. (Then again, persuading the low-powered airplane to take off was a different story, though a subject for a dfferent article, as well.)

As we graduate into larger, heavier, faster aircraft, there reaches a point at which the takeoff and landing distances quoted in the pilot's handbook begin to equalize. Soon, we find the total distance required to approach and land over a 50-foot obstacle sometimes nears the length of a typical small-town runway. No longer can we safely assume all will be well. Now, we're forced to consider technique as part of the way to safely stop an airplane.

BRAINS BEFORE BRAKES

It sounds odd to say that braking begins well before the wheels touch the tarmac, but it's true. The process needs to begin with stabilizing the landing approach so as to arrive in the zone between runway numbers and fixed-distance markers, not with the stall horn blaring with *only* a safe margin over stall. By doing this, the touchdown can take place with plenty of runway left ahead of, rather than behind, the airplane.

Two issues often crop up that prevent this from happening in normal operation. One is a tendency to use a single, familiar-approach airspeed for every landing: long runway or short field, heavy weight or light load, gusting or calm winds, partial or full flaps. Instead, we should give thought to what approach speed is actually needed and modify it to suit the day's conditions.

The other issue isn't even knowing what the handbook says about achieving optimum landing performance. During our checkout, someone probably told us, "Bring her in at 80 or so," which we henceforth faithfully attempted to do, perhaps with a few extra knots "just to be safe." Don't want to stall out, ya know. You really need to consult the Normal Procedures section of your *POH* to see what the manufacturer recommends, and look at the landing tables in the Performance section, where you'll find the approach airspeed that was used to develop the numbers.

You may be shocked to find that the builder of your aircraft used speeds considerably lower than your normal arrival figure. Yes, it's true that those landing distance numbers were predicated on a new plane with fresh tires and brakes, flown by a test pilot who knew how to get the most out of them. But that doesn't mean you should be using twice or more of the published landing distance in order to get stopped. Most likely, you're flying down final too fast, in many cases much too fast.

It sounds odd to say that braking begins well before the wheels touch the tarmac, but it's true.

ENOUGH BUT NOT TOO MUCH

For certification, the FAA and its predecessor agencies have long relied on 1.3 times landing-configuration stall speed as sufficient airspeed to make an easily controllable landing in light airplanes. The problem is, pilots frequently confuse calibrated airspeed with indicated speed. Just because your airplane shows 45 knots when it stalls with flaps down doesn't mean it's really flying that slowly. An IAS vs. CAS table, if one exists in your *POH*, can show the effect of position error on the airspeed indicator's reading at high angles of attack, which is the reason for the recent surge in interest in AOA indicators. Nevertheless, an airspeed indicator can be used for repeatable performance, as long as conditions, configuration and weight do not change. Take the calibrated stall speed, add 30% and then see what the correction table says the indicated airspeed will be as you fly at 1.3 Vso, or that calibrated stall speed plus 30%.

Of course, an on-target approach speed doesn't mean you're going to land at that pace, right at the end of the descent. The purpose of flying at 1.3 times stall is to maintain enough reserve energy in the aircraft to carry the slight increase in weight that comes from G-loading as you flare from descent into level flight and to keep a safe margin over stall during the clean-up if you have to execute a last-second go-around. Gusts and wind shear also have to be accounted for in approach planning. Even so, you need to know what IAS will keep you safe and only carry that number across the approach lights, no more.

Crosswind operation has an effect on stopping distances, in that the benefit of an all-headwind component is lost and braking is slightly compromised if good controls application isn't maintained. In most cases, the effect is minor, but pilots may be tempted to use extra speed for their approach because they think it's required for added control during the crosswind landing. Don't pad the numbers excessively just because a crosswind is present. Most importantly, factor the tailwind or headwind effect into your base leg planning, which can cause you to wind up higher or lower than you might normally be when you roll out onto final. Many a bad landing started with sloppy speed control on base.

Once the correct approach speed is in hand, be sure you're flying toward a spot in the first part of the runway, not halfway down it. During a stable approach, there will be a motionless spot, hopefully on the first part of the runway, toward which you're traveling. Look for that paint or tire-mark aiming point to stay steady in your windshield as all other bits of scenery move downward, under the nose, or upward, toward the top of the windscreen. This motionless point is *not* where you're going to touch down, unless you've been trained to land on an aircraft carrier, because there will be a flareout and float during hold-off that will consume a few hundred feet of runway. Aim for the numbers, but don't expect to land on them.

All kinetic energy you carry into the flare has to be dissipated in order to stop, so don't be too casual in getting rid of it. Make sure you've brought the throttle(s) to idle as you level off, and get rid of any excess airspeed before you descend into ground effect, the drag-reducing layer of air that extends about one wingspan above the runway. Don't try to "plant" the wheels to get on the brakes quickly; just allow the plane to land normally, dissipating speed to assure that weight will immediately begin transferring to the wheels.

DOWN AND ROLLING

From touchdown on, the runway surface condition plays a big role in your ability to slow the aircraft. If the pavement is really wet, hydroplaning is a definite risk; the tires will "surf" on a layer of water rather than spin up, providing no braking. To minimize hydroplaning, touch down at slow speed with a firm "dropped in" contact force, which breaks through the water to achieve spin-up.

On a dry runway, apply maximum braking as soon as full weight is on the wheels. Many flight manuals recommend raising flaps right after touchdown to remove residual lift. This carries the risk of inadvertent landing gear retraction, which certainly slows the airplane quickly but requires a lot of power to taxi. Rather than suck the flaps up, I prefer to leave them extended for aerodynamic braking and hold the yoke back to elevate the nose strut, keeping the wings, tail and fuselage at an angle that adds drag during the rollout. This technique will vary depending on the plane you fly.

If you've battled a crosswind to arrive one-wing-low, beware of immediate braking; make sure the downwind wheel is firmly in contact with the pavement. Don't brake hard enough to lock up the tires—tires are expensive, and that squeak you hear on landing is the sound of money leaking out of your bank account. Instead, stand on the pedals firmly and hold the pressure. Pumping the brakes "for cooling" only lessens overall speed reduction and results in a jerky arrival for your passengers. So apply and hold brake pressure, especially early in the rollout, for the most effective stopping. Don't wait until the red lenses of the runway end lights loom in the windshield to make a panic stop. Brake early and continuously. Don't be too gentle either. Use the brakes. That's what they're for.

Air traffic controllers seem to be ever more prone to issue commands to exit at specific taxiways or seek a response about parking while we're still in the early stages of a landing rollout. If you aren't able to comply, respond with "Unable" right away and deal with control of the aircraft first. If you were issued a "Land and Hold Short" landing clearance, you are expected to carry it out because you accepted it as issued. The time to refuse a LAHSO is when it's first brought up, not after you're on the rollout.

Can you match the rollout figure shown in your *POH*? Maybe, if your equipment is in good shape, but you probably don't want to abuse your wheels, brakes and tires just to prove a point. Most of the benefit of short-landing performance is gained by a stable, slow, on-target approach and touchdown. Once down, braking finishes the job. **PP**