

FLYING LESSONS for August 25, 2011

suggested by this week's aircraft mishap reports

FLYING LESSONS uses the past week's mishap reports to consider what *might* have contributed to accidents, so you can make better decisions if you face similar circumstances. In almost all cases design characteristics of a specific make and model airplane have little direct bearing on the possible causes of aircraft accidents, so apply these *FLYING LESSONS* to any airplane you fly. Verify all technical information before applying it to your aircraft or operation, with manufacturers' data and recommendations taking precedence. You are pilot in command, and are ultimately responsible for the decisions you make.

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This week's lessons:

In [last week's *FLYING LESSONS*](#) we discussed the significant, negative performance impact of taking off and landing with a tailwind. Using Cessna and Beechcraft performance charts as examples, we postulated that tailwinds have a roughly three to five times greater impact on takeoff and landing performance, negatively, than do headwinds improve takeoff performance. In other words, a little headwind helps a little, but a little tailwind hurts a lot.

See www.mastery-flight-training.com/20110818flying_lessons.pdf

But sometimes it makes sense to intentionally take off or land with a tailwind. For one, the runway may be so long that there is no doubt the airplane will become airborne or come to a stop on landing in the available runway length even with a tailwind. In that case it may be better to conform to ATC's direction, local noise abatement procedures or other airplanes' traffic patterns with a tailwind than it is to go against the grain just to have a headwind component.

Another case when intentional tailwind takeoffs and landings make sense are so-called "one-way" airports, those that because of local terrain or obstacles require taking off and landing in one compass direction—landing to the west and taking off to the east to avoid a hill off the west end of the airport, for instance.

A third situation is when there is a significant slope to the runway. A runway that climbs or descends steeply with horizontal distance will adversely affect airplane performance with or without a wind. The slope may be enough to make an airport a "one-way" strip, at least for some airplanes, with or without obstacles close to the departure ends.

So how can you decide whether a runway is one-way because of runway slope? Most Pilot's Operating Handbooks assume a level runway surface on their Takeoff and Landing Performance charts...in other words, you're on your own to predict performance when the runway has a slope.

Diamond Aircraft's DA-40-180 POH, however, does give us some guidance. Look at this Caution. A 2% slope (a change in elevation of two feet per 100 feet of horizontal distance, or

CAUTION
A ground slope of 2% (2 m per 100 m, or 2 ft per 100 ft) results in an increase in the take-off distance of approximately 10%. The effect on the take-off roll can be greater.

two meters for each 100 meters) creates a 10% increase in takeoff distance. The effect on the takeoff roll may be even greater, i.e., the distance to take off and clear an obstacle increases 10% with a 2% slope but the airplane will roll even more above "book"

distance before the wheels leave the surface. The POH doesn't tell us, but it's not too much of a stretch to expect the performance to increase by a similar percentage if you take off downhill on a 2% slope. Certainly it would be worth experimenting under controlled conditions with a very light airplane and a long, downward-sloping runway before tacking a short, downhill runway for real.

Diamond has a similar note in the DiamondStar's landing performance discussion, identical except that it replaces "take-off" with "landing" as appropriate.

Now let's consider winds from last week's discussion. Two knots of tailwind component is worth roughly 10% change in airplane performance (using the Cessna and Beech charts as

examples). Consequently it takes about two knots of tailwind component to balance the effect of taking off downhill on a 2% slope or landing up a 2% slope (using the Diamond Aircraft POH as a single data point).

What's the practical application of this estimate? Conventional wisdom is that it's better to take off downhill and land uphill than to take off and land into the wind on sloping runways. However, this (very) preliminary correlation of various POH data suggests that the amount of tailwind it takes to make even a downhill landing or uphill takeoff a bad idea is very slight—just a couple of knots. It seems a good idea to take off and land into the wind even with a 2% runway slope.

Sometime, with safe experimentation, we learn the limits of POH-derived performance when the charts don't cover all the variables. Then we can make our own, informed decisions about what works for us in our airplanes. For example, for a few years I flew a turbocharged Baron from a short runway (3400 feet, short in 58TC terms, anyway) with a little more than a 3% slope. With practice at weights as light as I could get, I found that it indeed *was* more comfortable landing uphill and taking off downhill from that airport, with tailwind components up to as much as about 10 knots.

Perhaps some readers are more familiar with the physics than I and have done the math, and can provide definitive answers. It seems likely, however, that the degradation in performance working against a runway slope is not additive, but instead multiplicative with slope. Regardless, empirical data told me it made sense to take off and land with slight tailwind components on that particular runway. Regardless, I tried to fly the airplane as light as safely possible, especially on landing—the turbo Baron has a lot of inertia that makes landing distance more critical than takeoff in that specific model.

I strongly suspect, however, that simply flying the airplane at the appropriate speeds for liftoff and final approach will do more to assure you can use a runway that meets your airplane's needs than any additional benefit that derives from playing the tailwind-vs-runway slope game.

Are you faced with a similar decision? Don't "wing it," don't do it because someone on the internet (like me) or the local ace tells you to, and certainly don't try it simply *hoping* you'll get the performance you need. Gather as much available information as possible, using data from your POH as primary but not completely discounting very general rules of thumb from others to help you fill the gaps. Then conduct some controlled experiments at light airplane weights and varying the variables as few at a time as possible, being ready to chop the throttles and abort a takeoff early if you don't get the initial performance you need, and to power up and go around at all points of the landing attempt, including after the wheels are on the runway if necessary.

If you're not willing to educate yourself and conduct controlled experiments, doing your homework, calculating the performance, then reducing the margins of wind, weight, slope and distance only a little at a time, then don't try the unusual at all.

Airplanes usually fly extremely well in the middle of their approved envelopes. For almost all of us, almost all of the time, there's no need to get close to the edges of the envelope.

Questions? Comments? Let us know, at mastery.flight.training@cox.net



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Debrief: Readers write about recent *FLYING LESSONS*:

Reader and aviation elder statesman “Old Bob” Siegfried, a retired United Air Lines captain who in retirement was instrumental behind the scenes in getting some elements of GPS navigation we now take for granted approved by the FAA, writes about recent *FLYING LESSONS* concerning directional control on landing:

Just a small comment. In the braking action discussion, it was mentioned how important it is to use the rudder to keep the airplane pointed in the correct direction. It always saddens me to see the aileron drag effect not mentioned at all. As we both know, in many airplanes, it is the strongest force available when in the three point attitude. Sure wish the effect was taught more widely.

Yaw created by aileron drag can indeed be used to aid in directional control. As Bob alludes (by mention of the “three point attitude”), this effect is frequently more powerful in tailwheel airplanes with all three wheels on the ground. Antique airplanes without differential ailerons (i.e., whose ailerons deflect the same angle upward as they do down) are even more controllable through adverse-yaw steering. On an empty ramp or a wide runway, see if you can change your airplane’s direction at a moderate taxi speed by moving the ailerons alone. If your airplane responds to aileron movement on the ground, practice to use that to your advantage when taxiing, taking off and landing in crosswinds. Thanks, Bob.

Reader Fred Wilson provides a counterpoint to the discussion of tailwinds on takeoffs and landings. Fred writes:

As Shakespeare said, "Much Ado About Nothing." Commercial airliners with hundreds of people aboard routinely take off and land with (up to) a 10 kt head/tailwind. So, taking off increases T/O roll by 32%. This matters somehow? Yes, if you are taking off of a runway that's only 1,000-1500 feet long. How often do we do that (most of us)? Increase the temperature 20-25 degrees and you also increase T/O roll considerably. Do we worry about it? Of course not. That why they make long/longer runways.

True, Fred. And thanks! I wrote last week’s *LESSONS*, however, because at least two airplanes are known to have suffered runway overruns with tailwinds on landing in the previous week. Apparently not everyone has gotten the word yet that it does make a difference when they *do* try to use shorter runways.

And George Boney points out:

Plus, if you land with the wind the rudder stops working before the airplane stops (Very important if there is any crosswind component). Into the wind, it still has some authority even if you are completely stopped.

Good point. Thank you too, George.

Reader and current CFI candidate Alex Gust (how’s that for a great name for an instructor pilot?) attended my presentation “[Strategies for Avoiding Fatal General Aviation Accidents](#)” in the FAA Safety Center at the most recent AirVenture at Oshkosh. Alex writes:

I just wanted to thank you for your presentation at Oshkosh this year! I’m adding your main points to my portfolio on ADM. I especially like "Bust the Myth of Utility". That’s a hard fact to face, but one that I agree will make us much safer if we’re able to accept it.

Thanks, Alex. Best of luck on your CFI! I’m saving that particular point, “Busting the Myth of Utility,” for detailed development in future writings. For now, however, let’s just say that improving the fatal general aviation mishap rate requires (among other things) that we come to grips with the fact personal aviation is not an all-weather, any-schedule transportation system. You will have to cancel trips; you will have to change your plans. Sometimes it’s only a matter of a few hours or an overnight delay, or just the choice of a slightly longer route or simply a different altitude. But to refute the marketing slogan of one major airplane manufacturer a few years ago, flying lightplanes is *not* “life without delays or cancellations.” More on this important point in future editions.

See www.mastery-flight-training.com/presentations_and_events.html

Regular Debriefer David Heberling comments on last week's link to the NASA *Callback* issue on "automation fixation." David writes:

Interesting read, that *Callback*. Been there, done that, got the T-shirt. We are all system monitors now. It takes discipline to make yourself do effective monitoring of the automation. When in [airline] training, the mantra "FMA, FMA, FMA" is pounded into our heads. FMA is Flight Mode Annunciator. It alone tells us what mode the automation is in. It sits at the top of both of our PFDs. When making inputs into the FMC, it has to pass the "make sense" test. Did your last entry make sense? Involve the other crewmember to verify the changes you are making. Yes, complacency has an appearance here, as does fatigue, schedule pressure (being rushed in preflight duties), and confusion. When I say confusion, I mean where something does not make sense, or you have a question about what the airplane is doing now. Both of these require that the pilot make his confusion known to not only his partner, but also ATC if that is warranted. When in doubt, ask for clarification.

Scheduling pressure has to be managed by the captain. Aircraft swaps are notorious for putting pressure on the pilots to "hurry up". Add a maintenance item to the mix and the situation is ripe for mistakes of all kinds. When involved in an aircraft swap, make it a point to tell the First Officer to slow down and do a normal preflight. Also tell him, "Do not hurry, or mistakes will be made." If the gate agent is standing in the cockpit door tapping her foot or looking at her watch, turn around and ask them to leave. I believe that they do know they are putting pressure on us, but do not know how dangerous that is. If a maintenance item pops up, tell the gate agent that you have no idea how long it will take to address this issue but will let them know when information becomes available. You have too much to do to worry about an on time departure.

In fact, maintenance issues can throw preflight preparations into disarray because it interrupts the normal flow of preparation. Many times it is prudent to start the preflight sequence all over again once the maintenance issue has been satisfactorily addressed. This is what it means to be captain. You have to show leadership by managing all the different pressures that come to bear on your flight. It is a rare F/O that steps into the void if the captain fails in his duties. However, an F/O should always let the captain know when he is not ready to go. This is not an indication of weakness, just a reminder to the captain that you will not be rushed.

Many times, runway changes come late in the process you are currently in, whether you are just about to push from the gate or on the taxiway to the runway. Since the captain is taxiing the aircraft, the F/O is on his own to make the changes to the FMC. These changes have to be verified by the captain some time before taking the runway for take off. It is up to the captain to make sure this happens. Sometimes it requires pulling off into a holding pen.

Bringing this home for the majority of *FLYING LESSONS* readers: **You are the captain.** There is no first officer. Not only do you have to resolve the issues and make the decisions, most of the time you do not have a qualified pilot alongside you to help, to do tasks you delegate so you have time for other actions, and act as quality control to your flying. You may have many resources to help—others aboard your airplane, ATC and others available by radio, even the checklists in your POH are in effect the airplane's designers and manufacturers giving advice on how to fly the airplane and deal with problems. But ultimately it's all up to you...a self-determination that brings great responsibility, one of the things that attracts many of us to flying in the first place. Thanks for your insight into the world of air carrier operations, David.

Comments? Questions? Tell us what you think at mastery.flight.training@cox.net.



The fourth most common way people die in general aviation airplanes is Collision with Obstacles or Terrain during Low-Altitude Maneuvering Flight. As you'll soon see, it pains me to relate representative samples of this type of "event" (they are no "accident") for your consideration and comments, in the hope that we can do *something*:

Scenario 1

The experimental Cozy Mk IV airplane flew through a 100-foot-deep rock quarry at high speed at an estimated altitude of 20 to 30 feet above ground level. One witness said he waved at the airplane as it flew directly toward him, then banked away from his bulldozer and pitched up to avoid a rock pile. The airplane then collided with the quarry wall about 20 feet from the floor of the quarry. Examination of the propeller blades revealed damage that was consistent

with engine power at the time of impact. **Probable cause:** The pilot's failure to maintain clearance from the wall of the rock quarry.

Scenario 2

Witnesses reported that the Titan Tornado II flew about 10 feet above a truck traveling southbound on a highway. It was then observed flying straight and level at low altitude over the two-lane highway, the propeller was turning, and the airplane did not appear to be in distress. Two miles later, a witness saw the airplane make a sharp left turn eastbound to line up with the westbound lanes of a perpendicular interstate highway. Ground scars showed that during the turn the left wing of the airplane contacted the shoulder of the highway prior to the airplane colliding head-on with a westbound car in the number one lane. No evidence of a mechanical malfunction or failure of the engine was found during postaccident inspection of the engine. There were numerous suitable areas for landing on and adjacent to the southbound highway prior to reaching the interstate highway. The pilot's autopsy report noted evidence of severe coronary artery disease treated with bypass surgery and stent placement. The pilot also had a history of high blood pressure and non-insulin dependent diabetes. It could not be determined whether the pilot was intending to land on the highway, or if his medical conditions played any role in the accident events. The pilot did not hold a current medical certificate. **Probable cause:** The pilot's failure to maintain clearance from a vehicle during a low-altitude flight over a highway.

Scenario 3

A witness to the accident reported that the V35 Bonanza went straight up, stalled, started to spin downward, and then dove straight toward the ground before pulling up. The witness stated that he watched the airplane do the same maneuver a second time, again going straight up, starting to spin downward, and then go straight down before impacting a field. The witness said that a few weeks prior to the accident he observed the accident airplane performing the same maneuvers. All flight control components were accounted for at the accident site. The airplane was equipped with a single control column with a single yoke, which is commonly referred to as a "throw-over yoke." The single control arm, to which the single yoke is attached, was observed separated from the control column; this precluded identifying which pilot was manipulating the controls at the time of the accident. Examination of the engine and airframe revealed no evidence of any preexisting mechanical anomalies. **Probable cause:** The failure of the pilot to maintain clearance from terrain during a low altitude maneuver.

Scenario 4

The pilot of a Cessna 180 was on a cross-country flight during daytime visual meteorological conditions. A witness near the accident site reported observing a high-wing airplane similar to the accident airplane flying about 20 to 30 feet above the ground at a high rate of speed. The witness stated that the airplane was low enough to startle a herd of elk near the airplane's flight path. The witness continued watching the airplane as it pitched up and to the left, making a 180-degree turn steep enough to allow him to see the tops of both wings. There were no known witnesses to the accident sequence. The wreckage was located near the base of a mountain range about 2 days later, after being the subject of a missing airplane alert notice. Accident site documentation of the ground scars, contact evidence on the trees, and impact damage to the airplane were indicative of a high-speed controlled flight collision with trees and, subsequently, the ground. Examination of the airframe and engine revealed no evidence of any preimpact mechanical anomalies. **Probable cause:** The pilot's failure to maintain clearance from trees and terrain while maneuvering at a low altitude.

It's challenging to dignify this sort of, frankly, suicidal (and homicidal) flying with serious commentary on risk management. Flying is one of the ultimate expressions of freedom, but with freedom comes responsibility—just as the freedom to carry firearms does not permit the bearer to pop off a few rounds in the local shopping mall for sport, even if you “were safe” and “didn't mean to hurt anyone.” I think it's absurd that this kind of activity is so common that it's the fourth most common way people die in general aviation.

The good news, however, is that if this is indeed one of the biggest killers, then that tells me general aviation done right is a lot safer than some might think. It's unrealistic to think the highway buzzers and quarry skimmers and amateur aerobats are going to read something like *FLYING LESSONS*, recognize the error of their ways, and reform to be better citizens of the air. That's why this discussion of the Top 10 #4 cause of fatal general aviation accidents now challenges safe pilots like you and me to answer questions like:

1. How do pilots like this sneak through the cracks of flight training and medical certification?
2. Who is best positioned to identify pilots like these, and what should those persons do to intervene?

before the pilot kills someone and removes another airworthy airplane from our dwindling fleet?

3. Is there anything we the general aviation community do, consciously or subconsciously, through words or actions, that reinforces this type of activity?
4. What responsibility do we have to ground pilots who act like this?

Past discussions of the Top 10 causes have focused on pilot technique and decision-making. This month's topic is much less about pilot training and much more about ethics, group dynamics and the limits on personal freedom. In other words, it's likely to spawn a lot of reader commentary. Please join the discussion with your opinions on the four questions above, and any other topics these scenarios prompt you to cover...all reader comments will be treated with respect, and if you ask, anonymously.

In many ways this may be the most important discussion in the entire series of Top 10 causes. Let us hear from you, at mastery.flight.training@cox.net.

Share safer skies. Forward *FLYING LESSONS* to a friend.

Flying has risks. Choose wisely.

Thomas P. Turner, M.S. Aviation Safety, MCFI
2010 National FAA Safety Team Representative of the Year
2008 FAA Central Region CFI of the Year



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