FLYING LESSONS for August 18, 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:

Convention has it that we take off and land into the wind. We learn from very early in our training that taking off into the wind helps get us aloft sooner, and that landing into the wind permits us to stop in a shorter distance.

But how much does it matter, actually? Does it hurt to try to take off with the wind at your back, or land with a tailwind? Is there enough of a difference that, if the pattern is otherwise completely empty of traffic, that you should still conform to the standard and take off or landing into the wind, even if that doesn't make sense for your direction of flight? Well yes, it does.

Most Pilot's Operating Handbooks (POHs) will carry at least some caution or warning about tailwind takeoffs and landings. Combine the recommendations of a few and you can derive some good rules of thumb about tailwind takeoffs and landings, to decide if it's worth the risk.

For example, the Cessna 172S POH gives some fairly precise guidance on the relative effects of a tailwind versus the "conventional" headwind takeoff. Note 3 from the Takeoff Distance performance chart tells us that we should decrease the takeoff distance we derive from using the chart by 10% for every nine knots of headwind. But it also tells us to increase takeoff distance by 10% for every *two* knots of tailwind component.

NOTES:

1. Short field technique as specified in Section 4.
2. Prior to takeoff from fields above 3000 feet elevation, the mixture should be leaned to give maximum RPM in a full throttle, static runup.
3. Decrease distances 10% for each 9 knots headwind. For operation with tail winds up to 10 knots, increase distances by 10% for each 2 knots.
4. For operation on dry, grass runway, increase distances by 15% of the "ground roll" figure.

Put another way, a tailwind component has almost ***five times*** the performance effect as a comparable headwind component. If we normally take off into the wind to improve takeoff performance, we *really* want to avoid taking off with a tailwind because the performance will be significantly impaired.

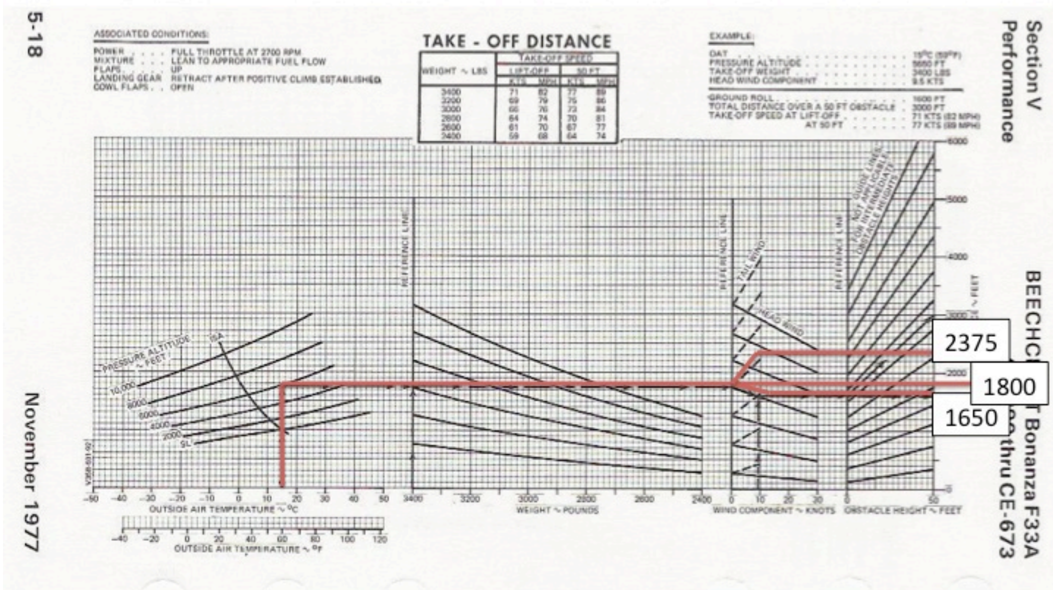
Cessna gives us similar guidance for landings with a tailwind. The Landing Distance chart contains a similar nearly five-to-one difference between landing distance improvement with a headwind component and increased landing distance with a tailwind.

NOTES:

1. Short field technique as specified in Section 4.
2. Decrease distances 10% for each 9 knots headwind. For operation with tail winds up to 10 knots, increase distances by 10% for each 2 knots.
3. For operation on dry, grass runway, increase distances by 45% of the "ground roll" figure.
4. If landing with flaps up, increase the approach speed by 9 KIAS and allow for 35% longer distances.

Figure 5-11. Short Field Landing Distance

The folks at Hawker Beechcraft, to use another example, don't give us any general rules for adjusting the takeoff distance for head- or tailwind components. They do, however, provide Takeoff and Landing Distance charts to let us determine the effect of head- or tailwinds on computed performance.



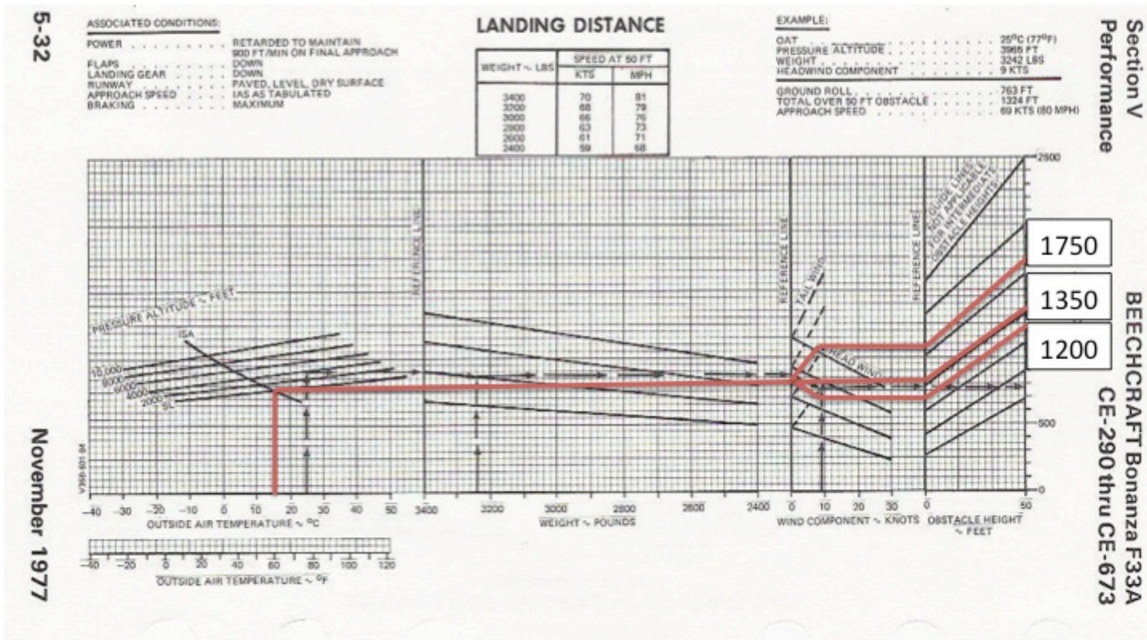
On the Takeoff Distance chart above I've plotted ground roll distance (zero obstacle height) for a roughly 10°C hotter than standard day at Colorado Springs, Colorado. The airplane is at maximum gross weight (3400 pounds). Note that this calculation assumes the pilot adheres to the Associated Conditions technique at the upper left of the chart, and uses the liftoff and 50-foot speeds tabulated for the airplane's weight.

In this example a zero-wind takeoff would require approximately 1800 feet of ground roll before liftoff. Factor in a 10-knot headwind component and the computed takeoff roll distance is 1650 feet, a roughly 9% improvement.

Make that 10-knot breeze a tailwind, however, and the computed ground roll is ***32%*** longer than the zero-wind takeoff—the tailwind's detrimental impact is nearly four times the amount per knot as the positive effect of a takeoff headwind.

From either of these airplane types we can confirm the wisdom of taking off into the wind in all but the most unusual cases.

Let's look at the performance change on landing when comparing a headwind component to a tailwind. Cessna's 172S POH has already told us a knot of tailwind is worth nearly five knots of headwind. The Beechcraft F33A POH gives us this sample calculation:



On a standard day at sea level and assuming a maximum gross weight F33A, the landing distance over a 50-foot obstacle (i.e., from about over the runway threshold to the point the airplane stops, assuming maximum braking is applied) is 1350 feet in zero wind. Add a 10-knot headwind component and the total landing distance is 1200 feet, a roughly 11% improvement.

Land under those conditions with a 10-knot tailwind, however, and the total landing distance is 1750 feet—a ***31%*** *increase* in landing distance.

In summary, using these two POHs as examples we can begin to develop some rules of thumb:

- Each knot of headwind component on takeoff improves takeoff performance by roughly one percent, while each knot of tailwind component degrades performance by three to five percent. Tailwinds are three to five times as detrimental to takeoff as headwinds are an improvement.
- While each one knot of headwind component improves landing performance by about one percent, each knot of tailwind component degrades landing distance by about three to five percent. Tailwinds are roughly three to five times as effective at altering landing performance thank headwinds…and the alteration is not in your favor.
- In almost all cases, then, there is very good reason for avoiding tailwind takeoffs and landings, even if it makes more sense for the direction of flight on departure or arrival.

Sometimes runway slope or a one-way airport will cause you to consider a tailwind takeoff or landing. Next week we'll focus on this second contributor to some recent general aviation mishaps.

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

The fifth most common cause of fatal general aviation accidents, according to the U.S. FAA, is Controlled Flight into Terrain (CFIT)—En Route. We've been reviewing reader comment and idea for helping to reduce the effect this scenario has on survivability in general aviation aircraft.

Reader David Heberling, a frequent and enthusiastic commenter in this discussion, writes:

> For those of us who fly along the coastal plains of the east coast, terrain is not usually an issue. While we do not have the Rockies, we do have mountains like the Green Mountains of Vermont, the Adirondacks and Catskills of New York, the Poconos of Pennsylvania, the Blue Ridge of Virginia and North Carolina, and the Great Smokies of North Carolina and Tennessee. So traveling anywhere west of the coastal plain requires terrain awareness. Minimum sector altitudes are posted on sectionals, WACs, and Low Airways charts. Oh, that is right, paper is so outdated. Not! I finally got tired of carrying all of the individual sectional or WAC charts plus all of the Low Airways charts for the east coast. Instead, I bought the atlas style charts for sectionals and Low Airways charts. So easy to use, and so compact. Updates are a breeze.
>
> People come to grief with en route CFIT because they are not aware of the rising terrain along their route. This is a failure in preflight planning and a failure of proper en route monitoring with either paper maps or electronic presentations, or both. At my airline, we carry all of the High and Low airway charts in the cockpit. This is despite the fact that we have moving map NDs with a terrain database. Of course, our displays are not as sophisticated as those from Garmin, Aspen, and Avidyne. But even with those expensive subscriptions and hardware, I would still carry current paper maps. Call me a diehard, but I can see more detail and a larger area than I can see on a little screen in my panel. Information overload can easily occur on modern PFDs.
>
> The other problem with modern GPS is the ability to go "direct". This is not always advisable especially when terrain is a concern. Of course, you would have to know that ahead of time to know if it was a concern or not. In general, it is not a good idea to go direct unless you have good visual conditions. At night, you cannot see the mountain ahead of you. If you want to go direct at night, you better know the minimum altitude required along your route of flight. If you are IFR, it is never a good idea to go direct to the airport at night, even if you know the local area. It is too easy to get disoriented when going into a small airport or to miss the step down fixes on the arrival and approach which are there because of terrain. You might be able to see the airport on a clear night, but you will never see the small hill between you and the airport if you descend without any guidance. If you are IFR in visual conditions at night, it is far safer to get vectored onto the approach. This ensures that you will clear all terrain, and that you are landing on the right runway at the right airport. Even purely visual pilots would benefit from using electronic means as a back up to the Mark I eyeball to ensure they are landing on the right runway at the right airport.

Several of the fatal accident events involved purposeful, low-altitude flying—aerial application (although the high G-resistant cockpits and restraints of agricultural airplanes make these impacts surprisingly survivable), pipeline or wire patrol, and (in helicopters) ranch-type work like animal herding and wildlife census. In these cases it takes a lot of preflight planning to prepare for obstacles that may not be highly visible from low altitude at aircraft speeds. For aerial reconnaissance work (pretty much everything purposely low-altitude except aerial application flights) there's a strong case to be made for carrying an observer to handle the "mission" chores while the pilot focuses on the flying and obstacle-avoidance tasks.

For the vast majority of us, flying should adhere to the minimum regulatory altitude requirements except when necessary for takeoff and landing. When planning a flight in visual conditions, do something radical—as David suggests, get out a Sectional chart and physically *draw a line* representing your route. Choose significant landmarks (four-lane highways, large power plants, etc.) that will be apparent even in low visibility, from low altitude. Divide your flight into segments between your landmarks and for each segment:

- **Find airports**—*always* know the direction and distance to the nearest airport, in case you need to divert.
- **Look for obstacles** (terrain and towers) within 10 miles either side of your route, *including* possible diversion routes.
- **Pick a minimum safe altitude**—a minimum height to clear each obstacle and between each landmark, including your diversionary routes; and
- **Have an "out" for each route segment**, a known direction and altitude that gives you better terrain and obstacle clearance.
- **Using a GPS?** Don't skimp on your preflight planning. The GPS may go out or stop receiving at a bad time, and not all GPSs have obstacle information (even detailed databases will likely miss new cell towers and other recently added obstructions).

That way, you'll know beforehand the minimum safe altitude for every segment of your flight. If you find yourself in a situation that suggests you should descend below that altitude (clouds, visibility, ice, winds, whatever), divert immediately using your planned escape route for that segment, to avoid becoming the next to fit the Top 10 #5 category.

If you're flying IFR, you can do the same with a Low Altitude En Route chart. Know the minimum safe altitudes for each segment of your trip including escape routes. If you're traveling off-airways (and who among us doesn't go GPS Direct or accept a "direct-to" vector now and then?), use the minimum sector altitudes on the IFR charts, and consider doing the same exercise using VFR Sectional charts.

Synthetic Vision Technology (SVT) can be a great boon to avoiding CFIT. But don't trust the SVT or its database blindly. For instance, I've had demonstrated to me that SVT airport information may paint the airplane right on the runway centerline when lined up on one end of a runway, but well off the side in the grass when on centerline of the same runway on the far end. In other words, SVT is only as good as the precision of the database, and the scope of accurately presenting the entire world electronically is overwhelming. Instead, use SVT the same way you should employ a lightning detector (StormScope or StrikeFinder) in areas of thunderstorms…use SVT to stay well clear of terrain and obstacles, not to pick your way between the towers, fly along a canyon or riverbed, or line up on an unseen runway.

To reduce the fifth most common cause of fatal general aviation crashes:

- **Readers, challenge yourself** to become more altitude-aware in your preflight planning, and the accurately track not only your position but your height above terrain as you fly along en route.
- **Instructors and examiners, challenge your students/applicants** to brief you on minimum safe altitudes for each segment of a planned flight to show they'll employ good CFIT avoidance technique along the route, including any emergency "outs".

Next week we'll begin discussion of the Top 10 #4 cause of death by general aviation: terrain impact during maneuvering flight. Thanks to all readers who have contributed comments to this discussion.

Questions? Comments? Additional ideas? Let us learn 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