FLYING LESSONS for March 1, 2012

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:

There have been more reports this week of runway overruns. In some cases a tailwind on landing may eventually be ruled a contributing factor. With that in mind, let's revisit the topic of landing with a tailwind, which we explored in some detail last summer in *FLYING 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.

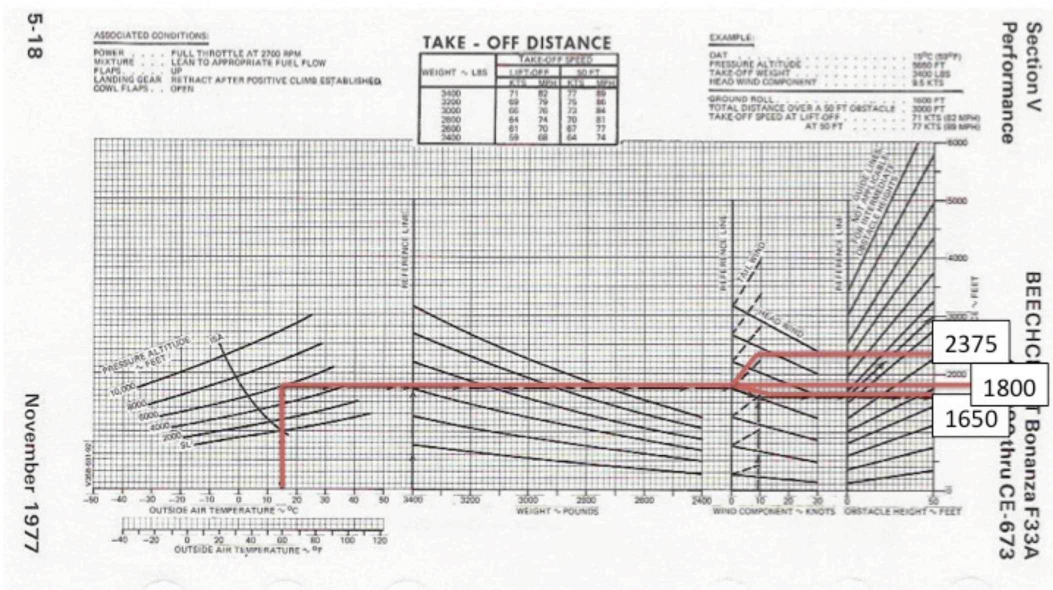
Cessna gives us similar guidance for landings with a tailwind. The Landing Distance chart contains a similar nearly five-to-one difference between landing distance improvement with a headwind component and increased landing distance with a tailwind.

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.



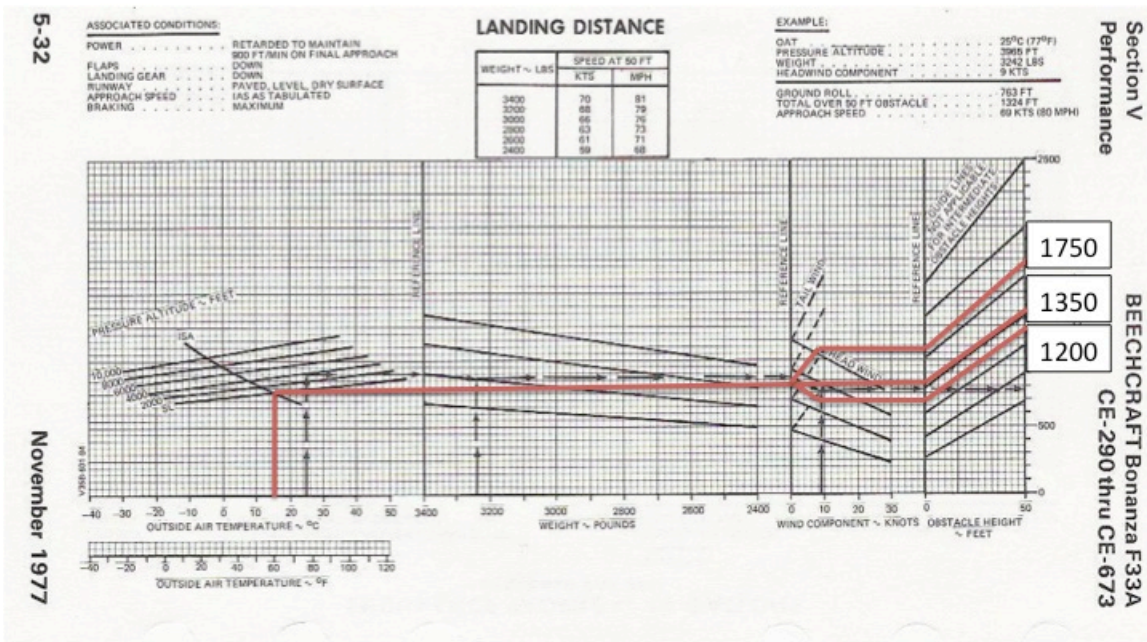
On the Takeoff Distance chart above I've plotted ground roll distance (zero obstacle height) for a roughly 10°C hotter than standard day at Colorado Springs, Colorado. The airplane is at maximum gross weight (3400 pounds). Note that this calculation assumes the pilot adheres to the Associated Conditions 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.

Consider these *LESSONS* when considering the expediency of a tailwind takeoff or landing.

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

I apologize that this week's report is a day late. Last night we went live with a major new pilot education and safety program in my work with the American Bonanza Society, and last-minute details rightly demanded most of my time this past week and especially last evening.

See:
http://www.bonanza.org/index.php?option=com_content&view=article&id=815&Itemid=138
www.bonanza.org

Congratulations!

Congratulations to these true professionals, who have been recognized by FAA and the aviation industry as the tops in their field for 2012 in the General Aviation Awards Program:

2012 NATIONAL AVIONICS TECHNICIAN OF THE YEAR
Eric Christopher "Rick" Ochs of Gahanna, Ohio has been named the 2012 National Avionics Technician of the Year. He owns and manages Spirit Avionics Limited, an FAA certified Part 145 repair station at Port Columbus Airport (CMH) in Columbus, Ohio.

2012 NATIONAL AMT OF THE YEAR
Marvin Hornbostel of Junction City, Kansas is a recipient of the FAA's Charles Taylor Master Mechanic who has been working more than 50 years as an airframe and powerplant (A&P) technician. He has held inspection authorization (IA) for 40 of those years.

2012 NATIONAL CFI OF THE YEAR
Master CFI Hobart Caleb "Hobie" Tomlinson of Huntington, Vermont, has been named the 2012 National Certificated Flight Instructor of the Year. He is employed by Heritage Aviation at Burlington (BTV) and is an independent flight instructor as well as a designated pilot examiner (DPE). Not only is he a current 5-time Master CFI but in 2010, he earned the FAA's Wright Brothers Master Pilot Award [for over 50 years of accident-free flying].

2012 NATIONAL FAA SAFETY TEAM REPRESENTATIVE OF THE YEAR: Jeanné Carole Willerth of Lee's Summit, MO, is the 2012 National FAASTeam Representative of the Year. Her personal mantra is "*aspire to inspire before you expire!*" She believes true leadership requires giving back. Whether it is lobbying for general aviation, recruiting new members for the 99s, or fulfilling a Vietnam veteran's last wish for a flight over Kansas City, Jeanné is a leader. Her mother, a "Powder Puff Derby" cross country air racer, taught Jeanné to fly at the Cessna Pilot Center (CPC) in Omaha where she instructed. Catching the air race bug, Jeanné went along as her mom's copilot in two All Women's International Air Races.

Congratulations also to all who were selected by local and regional FAA offices to represent each region in the national competition. Read the full details of each award winner on the General Aviation Awards Program website.

See:
www.GeneralAviationAwards.org
www.generalaviationawards.org/award-winners

Debrief: Readers write about recent *FLYING LESSONS:*

We had another apparent light twin fuel exhaustion event this week, the second in the same make and model of twin-engine airplane in a week's time. Reader Mike Friedman adds to last week's discussion on "running out of gas":

I wonder how many fuel exhaustion accidents occur because people are not taught how to manage their fuel. I know I wasn't taught anything other than "don't run out" and remember to change tanks. How or when to change tanks was left up to me and more important, **I was left to figure out the correct decision making process**. There are two pieces to this equation – first is deciding in advance where in the flight is the decision point for making a fuel stop and the second is where is my remaining fuel. The two are somewhat tied together.

My process for a long trip is as follows: From testing, I know that the tank I take off on and climb will have 15 minutes less fuel in it than the other tank. I therefore take off on the left tank and switch to the right at the top of the climb (usually about 30 minutes into the flight). I then run the right tank dry. When it goes dry, I go back to the left. Usually it takes about 3:15 to run the right dry – so, that means my left tank should have started with 3:00 of fuel, and I used 30 min of it on the take off and climb. When I switch tanks back to the left, I have 2:30 fuel on board. If it will take me more than 1:30 to get to my destination, I stop for fuel. Note that I am making that decision while I have 2:30 left on board, with plenty of time and options. Also, when I arrive at my destination, I have 1 hour of fuel, all in one tank and I don't need to be worrying about having six gallons in each with both needles bouncing on empty wondering if it will quit on final and I'll have to make a last minute tank switch.

I'm not suggesting that this is the correct plan for everyone, only that **I think most people don't have a plan at all**. **They do the fuel calculation before departure and have no plan in mind for assessing how it is going en route** or when or where they will make a final decision on continue or stop for fuel.

One other thought – I'll bet that for all of those fuel exhaustion accidents, there are many, many more where the airplane landed with 10 – 15 minutes of fuel on board. These reflect the same lack of planning, they just have the benefit of better luck.

I bet you're right, Mike. I'm not a fan of running a tank completely dry, except as a controlled experiment while flying over an airport or—as one *FLYING LESSONS* reader suggested last time this subject came up, during a ground run after landing with a small but conservative amount of fuel in that tank. The objective is to determine the true capacity of that tank, so you can fly it almost all the way down to empty without causing what I call an "intentional engine failure in flight" that history shows is not always recoverable, even at altitude.

FLYING LESSONS reader Tom Rosen really got me thinking a while back when he opined that instead of knowing when the tank will run out of fuel, the timing of which may change with any number of variables, the more useful information is to know **how much fuel remains in a tank when it indicates ¼ full** on the cockpit gauge—because that knowledge prompts action well before an engine quits at a possibly inopportune time, and before you commit to the remainder of your trip burning from a single fuel tank that may have venting or other issues that make its fuel unobtainable to an engine.

Frequent Debriefer David Heberling adds:

My solution to the running out of gas scenario is this: I artificially inflate my average fuel burn. While I usually burn 11.5 to 12.5 gallons per hour, I use 15 gallons per hour as my planning number. That, and I have a four-hour bladder.

It would behoove every pilot to **use conservative numbers when flight planning**. It also helps to use online flight planning tools to see if unusual winds are going to cause your range to shrink. Also, if the winds are forecast to extend your range, cut the expected wind in half. You have to **remember that these are "*forecast*" winds**. **They do not always work out as advertised.**

Even though it may seem so "newbie" to check your fuel burn at regular intervals, be advised that the pros in the flight levels do that on all legs longer than one hour. Even though the fuel gauges in our GA airplanes are not up to the standards of FAR 121 aircraft, they still have to be accurate when indicating "empty". Many of us have modern fuel computers in our panels and [the analog fuel gauges] should be included in an hourly systems check.

All of the above are methods to keep from becoming a statistic in the accident database. One more is a **question every pilot should ask themselves," What if I am wrong?"** Are you willing to bet the farm on the answer?

Thanks, David. That's the type of decision-making we need to stop airplanes from falling out of the sky at their zero-fuel weight.

Incidentally, FAR 23.1553 is often used to support the notion that general aviation fuel gauges are only required to be accurate when the fuel tank is empty. 23.1553 reads, in full:

> A red radial line must be marked on each [fuel quantity] indicator at the calibrated zero reading, as specified in 23.1337(b)(1).

23.1337(b)(1) refers to the determination of "unusable" fuel in a tank. However, FAR 23.1337 also requires that

> There must be a means to indicate to the flightcrew members the quantity of usable fuel in each tank during flight. An indicator calibrated in appropriate units and clearly marked to indicate those units must be used.

At least for airplanes certificated under Federal Air Regulation Part 23 (which, admittedly, excludes much of the piston aircraft fleet), FAR 23.1337 at least strongly suggests there must be some designed-in level of accuracy to fuel quantity indicators at marked graduations above the "no usable fuel" level. The zero-usable calibration mentioned in oft-cited 23.1553 doesn't tell us that's the only quantity at which the gauge is required to be accurate. It merely tells us the gauge must be marked with a red radial at that point if the aircraft is certificated under FAR 23.

Part of last week's *LESSONS* was a list of possible reasons a pilot seems more likely to run out of gas just before making it back home. To that list reader Paul Hekman adds:

> In addition to the reasons stated, a couple more: To refuel en route [means]:
>
> 1. (Summer) Need to descend from my nice, comfortable cruising level into the hot, bumpy stuff below.
> 2. (Winter) Need to descend from my nice, comfortable cruising level into the freezing muck on [or near] the ground.
> 3. (Summer) Need to mess with the dreaded hot start [of fuel injected-piston engines].
> 4. (Any time) Each refuel[ing stop] adds an hour to the flight, not to mention the inefficiency of having to get my altitude back.

All quite valid, Paul. I'll add these to the list. Thank you.

I also received comment from a reader who wishes to remain anonymous, who apparently shares our frustration (discussed last week in *FLYING LESSONS*) with the repeated loss of an average of one airplane each week due to fuel exhaustion.

> I don't want to publish my ignorance, but two things occur: 1) the familiar low fuel flashing light on my Prius cannot cost much compared to parting out an airplane, and 2) we have GPS, JPI etc, so the information on fuel remaining is easy to find provided the instrument is provided correct information, so a "range circle" would be pretty easy to depict. I understand that those without equipment have to calculate as we all did in former times.
>
> What kind of people run out of fuel in an airplane? Is their reproduction impaired thereby? Automobile fuel cost is going up and with it, AAA says many more people are running out of fuel [in automobiles].
>
> It must frustrate you to study recurring "stupid pilot tricks" serially. Thank you for what you do.

Indeed it does at times. Thank you, reader. You mention LOW FUEL warning lights and range circles on moving map displays in Technologically Advanced Aircraft (TAAs)—by FAA definition TAA means pretty much anything with a moving-map GPS, although in common practice the term is usually used to identify "glass cockpit" airplanes. Several years ago I investigated the relative accident records of airplanes with traditional and "glass cockpit" variants that are otherwise almost identical…Cessna 172Rs and 172S, for instances, certain models of Mooney and Piper aircraft, and Beech's A36 and G36 Bonanza, essentially the same aircraft except for the avionics and supporting systems.

My research, which I later found was done concurrently with similar but much more detailed (and better-funded) studies by both the National Transportation Safety Board (NTSB) and AOPA's Air Safety Foundation (now the Air Safety Institute), revealed a disturbing trend of much higher fatal accident rates in glass cockpit variants of otherwise nearly identical aircraft types—which both NTSB and AOPA reported as well, in more authoritative ways.

Relevant to this week's discussion, however, I found that (at the time) there was not a single reported instance of fuel exhaustion in any model of glass cockpit airplanes. I attribute that to the superior fuel status displays and warning systems in these newer aircraft, and the GPS moving-map "range circles" our anonymous reader describes. Of course, the comparatively very small number of glass cockpit airplanes in the fleet may be a primary reason for the lack of accident history also.

Turning to other areas of inquiry after learning of the AOPA and NTSB reports, I have not tracked this particular issue closely but believe there has been at least one case of fuel exhaustion in a glass cockpit light piston airplane (a G36 Bonanza) since publication of these reports.

Just today (March 1, 2012), AOPA's Air Safety Institute (ASI) published an updated comparative "glass cockpit" study. I admit I've not yet had time to read the report, but AOPA's press release summary includes:

> The increase in glass panel cockpits in general aviation aircraft has not had a dramatic impact on safety…. "What you have on the panel doesn't matter nearly as much as what you're flying and how you're flying it," said ASI Manager of Aviation Safety Analysis David Jack Kenny [a long-time *FLYING LESSONS* reader and Debriefer]. Overall, glass cockpit displays had a "negligible" effect on the accident patterns among similar aircraft, though data suggests they set themselves apart in the traffic pattern. "We consistently see more accidents during takeoffs, landings, and go-arounds in glass panel airplanes…."

This observation coincides with *FLYING LESSONS'* frequently expressed concerns about the loss of airmanship in today's flight training, especially in well-equipped aircraft—whose owners (and their instructors) tend to focus on learning and using sometimes complicated avionics systems, to the detriment of basic flying skills training in the syllabus…especially in the airport traffic pattern, and in maneuvers that frequently involve high angles of attack and/or challenges to rudder coordination. ASI's summary concludes:

> Airmanship still matters much more than equipment. "Don't count on machinery to save you from bad judgment," Kenny said.

Congratulations on the publication of your research, David and the rest of the ASI team (most of whom are also *FLYING LESSONS* readers, so I thank you publicly here). I look forward to slowing down enough to be able to read it through. I welcome any further insights you might wish to express to the readers of *FLYING LESSONS*—especially if you have any update on the rate of fuel exhaustion events in glass cockpit airplanes, a statistic I did not see mentioned in what was admittedly an extremely quick first look at today's report just prior to my publication time.

See:
www.mastery-flight-training.com/20120223flying_lessons.pdf
www.aopa.org/asf/publications/topics/TAA-Report-022412.pdf

For some time *FLYING LESSONS*, and much of the entire instructional industry, has been concerned with flight instructor professionalism...as the root of the ongoing causes of accident rates and causation. David Heberling writes again, continuing our recent discussion of an airplane with a electrical problem whose pilot who chose to perform a go-around, downwind and gear-up landing, apparently unaware his airplane had a manual landing gear extension procedure for just such an event—and the *LESSON* that the instructor's first duty is to safety-of-flight. David writes:

> When I bought my [Beechcraft] Bonanza, my checkout by an older CFI [Certificated Flight Instructor] was pretty brief. Brief as it was, he did make sure that I knew how the manual gear extension worked. We worked from an emergency checklist and ran methodically through to the end. Since my Bo' does not have electric trim, we did not have to worry about training for a runaway trim. I can identify with my first Bonanza (Debonair) checkout 20 years ago. I had a young CFI who was aspiring to move up to the airlines someday. Since I was an airline pilot, he thought he did not have to show me anything. I had to cajole him into doing stalls and steep turns. We never did go over the manual gear extension procedure. I had to discover that by reading through the POH. We also did only one take off and landing. I was so unimpressed with the checkout, I went back out to the airport on a fairly windy day to do some take offs and landings. The airport lies in a deep valley and the runway runs north and south. The wind was from the west with a nice rotor curling off the ridge above the airport. I had a blast taking off and doing a full stop landing to taxi back for another take off. This was done about six or seven times. I was very impressed with the handling characteristics of the Debonair, it had such a solid feel yet it handled the turbulence and crosswind with

aplomb.

I found the attitude of the young CFI to be troubling. When I was a young CFI (18 and 19 years old) I treated all airplane checkouts the same. Perhaps learning to fly from an old barnstormer (his Boeing F4B-4 hangs in the Naval Aviation section of the National Air and Space Museum) made me realize that it did not matter if they had thousands of hours as ex-navy pilots or as airline pilots. Granted, these were in Cherokee 140's with the gear down and welded. We did not have sophisticated avionics in those days, so all I had to do was make sure they could fly safely. You never knew what you were up against until you let the pilot attempt their first landing. Some wanted to flare too high, while others tried to do power on through the landing. I guess they were just getting ready to take off again if we missed the cable.

We have seen the results of inadequate professionalism of some CFIs in some well-known accidents over the years. The Cory Liddle accident in New York City comes to mind. When the CFI forgets what their [sic] main duty during the flight is, trouble is not far behind.

See http://en.wikipedia.org/wiki/Cory_Lidle_plane_crash

I've had several other comments and observations from readers this past week, but this week's report is already running long (and I'm a day late) so I'll save those for next week's report. Thanks, everyone, for your insights.

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
