FLYING LESSONS for January 5, 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:

My father's logbooks say he paid $12 an hour to rent a nearly new PA-18 Super Cub back in the late 1960s. We look back nostalgically on those sorts of prices, forgetting that adjusted for inflation that would be about $82 per hour today. Although that price is probably about 40% below what flying a nearly new two-seat airplane today would cost (reference the rental price of Light Sport aircraft), when you factor the significant economy of scale provided by Government subsidy of general aviation (via GI Bill benefits to World War II and Korea-era veterans) and the obvious increase in fuel prices far beyond inflationary norms, the case can be made that today's airplane prices aren't so outrageous as we'd like to think.

Charles Lindbergh and Amelia Earhart paid $1000 for about five hours' instruction apiece (enough to solo) in the 1920s, according to their autobiographical accounts. That's about $12,900 in 2011 dollars…more expensive than a full, 40-hour Private Pilot package today.

The truth is that flying has *never* been cheap; it has always required a serious financial commitment, and often sacrifice in other areas of our lives. The good thing is that, for most of us, *it's worth it.*

But the cost of flying keeps us constantly on the lookout for ways to reduce our aviation expenses. For some it means cutting back on the total number of flying hours each year. Others have made a decision to fly less expensive airplanes, even if that means reduced performance. I don't see any sign that the pilot population as a whole is skimping on the flight training they receive, but the costs are probably keeping many pilots from seeking the additional or specialized instruction they want (or need). This may be playing a part in fairly flat accident rates when usage of general aviation airplanes appears to be significantly down compared to the mid-2000s…and remember how bleak we thought things were then?

There is growing evidence in the mishap record, however, that airplane owners may be responding to the high cost of flying by deferring maintenance of their aircraft. This happens precisely as the average age of a general aviation airplane tops the 40-year point (how much extra maintenance did *you* start needing after you turned 40?). Maintenance issues cause a fairly small percentage of airplane accidents, but when there's a failure often component age plays a part.

It's duty cycles and Time in Service (TIS), not calendar age per se, that matters in airplane aging (see AOPA's free Aging Aircraft presentation). As an airplane ages, however, it has more fatigue exposure either by duty cycles, operational TIS or (if the airplane isn't used *enough*) potential corrosion. As airplanes age, therefore, we need to be inspecting and maintaining them *more* (think of what the word "maintenance" really means).

See http://flash.aopa.org/asf/agingaircraft/swf/flash.cfm?. Full disclosure: I helped review and write part of this program.

It was perhaps "more OK" to defer maintenance items in airplanes when they were much newer. Now we need to be more selective about what we can and cannot defer. In many cases lower-cost airplane ownership is a function of finding safe, legal ways to do things yourself…for instance, oil changes, tire replacements, and similar approved Owner Performed Maintenance

items. In others, it means increasing the scope, depth and frequency of inspections to delay recommended overhauls and replacements, when advanced system monitoring and Condition-Based Maintenance permits detecting deterioration before actual failure occurs.

See:
http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=e23b603650ea3e3ab0a1e76797584733&rgn=div9&view=text&node=14:1.0.1.3.21.0.363.14.52&idno=14
http://en.wikipedia.org/wiki/Condition-based_maintenance

But accident history suggests there are some systems that can fail without significant warning, the failure of which is frequently catastrophic to passengers or the aircraft itself. One example is a failure instrument pneumatic system (vacuum or pressure pump). Another is a failure of the attitude indicator itself. A third is failure of components of retractable landing gear systems. There are other, similar examples of common failures that are serious enough to kill, and/or to total the airplane.

History shows the chances of fatal loss of control is very great when primary attitude instrument or the system that drives it fails. You can mitigate that risk by proactively overhauling instrument air pumps as suggested by the manufacturer. If you wish to avoid that expense, your other options are:

- installing independently powered back-up attitude instruments in a panel location visible in your primary scan,
- installing a rate-based autopilot that works even when the attitude indicator does not,
- staying proficient in hand-flying the airplane at night and (if rated) in IMC, and/or
- investing in regular, demanding "partial panel" training and simulator-based training so you can swiftly detect a failed instrument and transition to hand-flying using supporting instruments.

You can avoid airplane-grounding events like landing gear failures (in fixed- as well as retractable-gear aircraft) by having the system thoroughly inspected by a mechanic expert in type at annual, possibly removing some components to check for internal corrosion that can't be seen without removing them from the airframe and Magnafluxing others to ensure their internal integrity.

The point is that you may be able to put off the major overhaul or replacement costs for a couple years or a few hundred hours, but you can't do it safely without incurring some additional costs and down-time to track the condition of vital parts. You might be able to save some, but not all, of the costs in the short term. But given that you'll have to do the replacement or overhaul eventually, it may end up costing you more in the long run.

If you're renting or flying someone else's airplane, you depend others to supplement your own visual inspection before you fly. The good news is that commercially operated airplanes are often required to undergo more frequent inspections (e.g., 50-hour and 100-hour checks in addition to annuals) that, done properly, will help monitor the condition of "monitorable" items. And many non-U.S. *FLYING LESSONS* readers are required under their home country's regulations to follow the manufacturer's overhaul recommendations regardless of condition.

What you *can't* safely do, however, is simply defer maintenance without following some sort of increased inspection and maintenance plan, or "fly until something breaks." Way too often, we appear to lose pilots, passengers and folks on the ground, and airplanes seem to be totaled, because of an ill-advised attempt to shortcut the true cost of flying.

See www.avweb.com/news/savvyaviator/savvy_aviator_47_reliability-centered_maintenance_part_1_195709-1.html

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

Debrief: Readers write about recent *FLYING LESSONS:*

We had several readers chime in about last week's *LESSONS* on wake turbulence. Reader and aerospace engineer Dr. David Rogers writes:

> The following statement in the latest Flying Lessons is not quite correct.
>
> "Spanwise flow of air across the top to the wing 'spills off' the wingtip, swirling into a horizontal tornado with potentially incredible force."
>
> The air that forms the tip vortex comes from under the wing not the top. I have video of a wing in a near-stall during a 45 deg. bank that clearly shows this.

Thanks, Dave. Reader Stephen Hertz adds:

> I really enjoy reading *FLYING LESSONS* and find them very informative. However, your recent article on wake turbulence may be interpreted to perpetuate a myth that somehow an aircraft taking off or landing is generating "more lift" and therefore more wake turbulence. Your article really didn't say that but a lot of folks will read it that way. In normal flight, aside from brief moments when the wing may generate more lift than required (as when you abruptly pull back on the stick), a wing will generate lift equal to the weight of the aircraft. This is even true if an aircraft if climbing or descending in normal flight attitudes (e.g. no aerobatics). So an airplane with flaps down, high angle of attack, flying slowly generates no more lift than if it's at FL350 going Mach 2.0 in a "clean" configuration. The lift an aircraft generates is only due to its weight, not its configuration (again, we are talking only about normal flight). **What the configuration does affect is the nature of the wake which I think was the point of your article.** Keep up the good work. We are always learning.

That's true, Steve. We are more concerned about wake turbulence in the airport environment because that's where we're all funneling in and out of the same space and are therefore more likely to encounter each other's wake. "Seeing" and avoiding wake turbulence is a required skill outside of the airport traffic area as well. Reader Scott Jackson echoes these thoughts:

> Always a timely subject to remind pilots of. If I may be permitted a few observations: The flow that causes the vortices at the tip is actually the air on the bottom trying to get to the lower-pressure area on top of the wing, by going around the wingtip. **The flight condition which causes the strongest vortices is the one where the aircraft is at its highest angle of attack: heavy, clean and slow.** Once the flaps and slats are extended, the angle of attack is reduced, resulting in a lessening of the strength of the vortices. Thanks again for a great newsletter.

Debriefing regular David Heberling adds his heavy-iron and lightplane experience, and touches on the quandary that faces all attempts at improving aviation safety—reaching the unreachable. David writes:

> Another good subject that all pilots should be familiar with. Wake turbulence is a problem even for the heavy iron. I fly the Airbus single aisle models and experience wake turbulence quite often flying out of KPHX [Phoenix, Arizona]. When taking off to the east off of runway 7L, the initial departure track is the same for each airplane for several miles after takeoff. This is especially true of RNAV departures where there is no allowance for offset to avoid wake turbulence. Even with same size and weight aircraft, there is still quite a bit of roll induced when encountering the preceding aircraft's wake. When I hand fly non -

RNAV departures (definitely frowned upon at my company), even with full aileron deflection against the roll, the Airbus will still roll 20 to 30 degrees before responding to my input. It is truly annoying for us and I am sure my passengers wonder what is going on.

For small GA airplanes, wake encounters are much more treacherous. The key then is avoidance. This particular accident [a fatal mishap that prompted last week's *LESSONS*—tt] is so sad not only because it was preventable. It is obvious that this pilot had no idea what he was flying into. Someone somewhere dropped the ball in his training, or in his [Flight Review]. **Pilots have to learn to be inquisitive during their training and beyond their certificate check ride. We cannot expect to be spoon fed all of the information we will need to know in order to be safe pilots.** In this age of the internet, it is inexcusable for a pilot to be unaware of the dangers of wake turbulence. Pilots need to be aware of wake turbulence on every take off and landing, particularly in no wind conditions.

Keep up the good work, Tom. I am sure that you know that pilots who read your newsletter and other safety sites are not likely to end up in this type of accident. It is the pilot who assumes he knows everything who will run into trouble. In addition, the pilot who does not know what he does not know and refuses to seek out information that will also run into trouble.

Reader Tom Wilkinson takes this thought into discussion of recent *FLYING LESSONS* about cockpit automation:

Once again many thanks for the thought-provoking articles. I tell my students that **the two great things that set aviation apart from every other human endeavor is not only that flying like a bird thing but also the amount of communication and education that is all around.** You will never see a group of doctors for example sitting around talking about the time one of them amputated the wrong leg. Only in aviation is it easy to find someone who will admit they did something stupid and readily tell you the mistake(s) that led up to <insert incident here>. Sometimes for a good laugh, sometimes as a stern warning but always so someone else can learn from it and live to fly another day.

Re: Increased Automation. I agree with those who are saying **the real problem with electronic upgrades and new systems isn't just the threat of getting rusty on basic flying but it's the lack of knowledge about malfunctions and limitations**. Any POH's out there describe what a clogged pitot tube will look like on the instruments on climb or descent? Now add a computer into that mix. Confusion caused by zero information about the system's limits and how the systems react to an out-of-parameters situation is the issue. Bring on the automation but please, the procedures need to be written now on what to do if things get crazy. The engineers did a great job with glass cockpits but didn't anyone ask, "What if...?"

Emergency procedures for every aircraft in the 20th century were indeed written in blood. Are we making the same mistake in the 21st century? I think we are.

Thanks for all you do.

Thank you, Tom. Excellent observations!

Reader Tom Clarke of Naval Air Station "Pax River" (the U.S. Navy's airworthiness and flight test center) answered last week's reader observation about indications an autopilot is trending toward failure..but has not failed yet. Tom writes:

The autopilots on the P-3/L-188/early B707s have two features that help keep you from getting a "surprise" when disconnecting. The first is the red "Trim Fail" light that illuminates when the autopilot is no longer automatically trimming the elevator and the autopilot is holding whatever force is required. The second is the "Three Axis Trim Indicator" which shows the relative amount of force/displacement that the autopilot is holding in an axis. The idea is to check the 3 axis indicator to see if the a/p is holding a lot of deflection in one axis before you disconnect.

If the autotrim were to fail at high altitude/high speed, there will be a lot of nose down trim rolled in and if you disconnect on short final, a severe pitchdown would occur. The idea is to deal with it whilst plenty of altitude remains to work on it!

This may be common to other aircraft of the period, but am not sure whether the new "gee whiz" airplanes of today have similar systems. There are raging controversies in the commercial world over the use of automation versus "hand flying skills". AF447 was certainly the most visible example and I suspect that the industry/regulators will work hard on striking a balance. I don't get to ride in front seats much anymore, so as a passenger I hope they do!

Thanks for your input, Tom. Scott Jackson is back with one more observation, something I need to be more careful about as well. Scott…

> Regarding Mike Busch's statement that falling EGT always indicates the failed engine, I think readers should understand that this applies only to piston engines. While Mastery Flight Training's audience is probably heavily-weighted to those airplanes, advice like that could lead to trouble when dealing with a turbine engine that is experiencing almost-any malfunction other than a flameout. Surges, stalls, severe damage: all are accompanied by increasing EGT, not a dropping one. I attended a Cessna 210 course at Santa Maria many years ago and the engine lectures given by Mike were well worth the fee.

I agree. See www.savvyaviator.com for more.

Thanks, readers…I'm always amazed at the level of expertise so freely given in the Debrief each week. Do you have something to add? Tell us what you think, 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
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