FLYING LESSONS for September 8, 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.

If you wish to receive the free, expanded *FLYING LESSONS* report each week, email "subscribe" to mastery.flight.training@cox.net.

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This week's lessons:

A recent (U.S.) National Transportation Safety Board preliminary accident report states:

> The pilot reported that while in cruise flight at 10,500 feet MSL, a total loss of engine power occurred. The pilot saw something fly out of the engine compartment when the engine cowling flew open. The pilot declared an emergency and attempted to land at [a military airfield]. The pilot was unable to land on the runway but landed on a field south of [the] runway. Preliminary investigation revealed that the number 4 cylinder and piston was missing from the engine. A review of the airplane records indicated that the engine had been overhauled less than 40 hours prior to the accident.

Catastrophic engine failure in flight is rare, but it does happen. It's especially tragic and disappointing when a failure occurs shortly after engine overhaul, maintenance or cylinder replacement. These things should be built to last, we tell ourselves. And they are…if they get through the initial operating experience.

Just like pilots, however, mechanics, technicians and manufacturing employees are subject to human error. The errors that inevitably occur should be discovered and corrected during quality assurance. But rarely they may slip through the inspection net and manifest themselves in build-up or installation error. The human factor may have occurred earlier in the production process, and be a defect in manufacture of a subassembly. The metals themselves may be flawed if something went wrong as far back as the forging process.

We may not be able to detect the approach of a catastrophic engine failure. That's why we need to remain practiced and vigilant for an engine failure in any phase of flight, whether flying a single- or multiengine aircraft. The many more moving parts of piston engines make them more prone to failure than turbines, but turboprop and jet engines sometimes quit as well.

This vigilance is necessary even (and perhaps especially) in the first hours after engine overhaul, installation or modification. That's because any defect in the production or installation of an engine is most likely to show up fairly early in that engine's lifetime—tolerances are tight enough, operating stresses are great enough in normal operation as it is, so if some engine part isn't up to standards it probably won't last long in operation.

In fact, industry slang for engine failure shortly after overhaul or installation is "infant mortality," because of the low Time-in-Service (TIS) of engines that fail because of manufacturing or installation error. Failures resulting from materials defects or human effort usually show up in the first 100 hours of operation, according to many engine experts. Get past the infant mortality stage, they'll tell you, and as long as you avoid overtemping the engine, prevent internal corrosion and keep fuel flowing to the engine in flight, it should run without fail for a good, long time.

The heightened possibility of early engine failure, however, suggests we approach risk management a bit more conservatively in the first 100 or so hours after installing a new or overhauled engine, or a major engine component (such as a cylinder overhaul or replacement in a piston engine). Note that for many recreational pilots, this may be most or all of a full flying year. Although we should *always* plan our flights with the thought that an engine might quit at any time, we should be doubly conservative about flight planning when flying with a new engine.

Those who rationalize their thinking rightly claim that an engine is no more likely to fail over water or mountains or forests or extensive urban development, or at night or in instrument meteorological conditions (IMC).

What is not often considered, however, is that the *consequences* of such a failure are much more extreme in the dark, in the clouds and/or over uninviting terrain. In up to the first 100 hours of new-engine operation, perhaps we should fly high and avoid night, IMC and unforgiving surfaces because statistically a new engine may be more likely to fail than one that has stood the test of time (in service).

Do you agree? Do you have suggestions for a new-engine risk management protocol, including inspections, borescope checks and oil analysis in addition to limits on the type of operation you'd fly with a new engine? Please share your ideas to benefit your fellow pilots.

Questions? Comments? Suggestions for a new-engine risk management protocol? Let us know, at mastery.flight.training@cox.net

September 2011 articles by Thomas P. Turner:

Moving Down to Light Sport
The accident rate is actually higher for "traditionally" experienced pilots than it is for new pilots in Light Sport airplanes. Here's why, and how to beat the odds.
Aviation Safety

Safety Pilot: High and Dry
It's the turbulence you don't see that'll get you.
American Bonanza Society

Choosing Your Takeoff
There's more than one way to get in the air...and sometimes you have to choose the right way.
Pilot's Audio Update

The Post-flight Inspection
Sometimes the best time to check is right after you're done flying.
BAC Talk

More than a Habit
After 20 years of practice, my pre-takeoff ritual may have saved my life.
Australian Bonanza Society

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

Debrief: Readers write about recent *FLYING LESSONS:*

Last week's *FLYING LESSONS* contained a discussion of airspeeds for descent and turbulent air penetration, speeds that (if computed and correctly flown) protect the airplane from exceeding design limit load (so no damage takes place) and ultimate load (so no immediately catastrophic structural damage occurs). Reader Woodie Diamond anticipated my planned follow-up report this week by emailing this insightful comment:

> As always, I enjoyed this week's *FLYING LESSONS*. I believe that you may have failed to take in an important factor when discussing aircraft load design: material age.
>
> If I was sitting in a brand new airplane that just rolled off the factory floor, I would feel absolutely certain that the yellow and red area on the airspeed indicator were true and continue to believe in the "50% margin." However, like most of the general aviation fleet, my 1959 [Beechcraft] Travel Air is constructed of parts and materials that were mostly produced over 50 years ago. That literally means that the material has been used, and perhaps abused, for 48 years before she fell into my loving hands. In addition, like most older aircraft owners, I seldom purchase new parts from the factory as replacements because of cost and availability, rather opting for the far less expensive used parts from the salvage yard. The problem with this practice is that we have little way of knowing the age of the part, how many hours are on the part, and how those hours were flown on the part.
>
> I suggest that in older aircraft, that 50% margin may have narrowed or disappeared long ago, and perhaps fallen below the indications on the airspeed instrument. My suggestion is that there are really only two hours that is important to the airplane: the last one and the next one. There's absolutely nothing you can do about how the last one was flown, but you certainly can control how the next one is flown.

Woodie is correct that I had not yet addressed the next piece of the airworthiness puzzle, the condition of the airplane. Like Woodie, I'm not talking about the visible, external appearance of the aircraft that can be observed during a preflight inspection, or even the interior structure as revealed during an annual inspection. There are big unknowns as well—how much fatigue has the basic structure of the aircraft been exposed to during its operational life, what if any damage has occurred as a result of that fatigue that reduces the load-carrying capability of the airplane, and how does the use of replacement and possibly of salvage airplane parts affect that load-carrying capability.

I have no clear answers to relate, because the entire aircraft industry has yet to define "fatigue exposure" or "acceptable fatigue." Enhanced inspection or repair only occurs when airframe longevity results in damage either visible to the naked eye or, if a particular part of the airplane is suspect because of prior reports of damage in similar areas of similar airplanes, by some sort of super-visual inspection such as a dye penetrant check, ultrasound, eddy current, or another sort of nondestructive inspection technique as mandated by an Airworthiness Directive (or an international equivalent).

The short answer is that we don't know what we don't know. So, as Woodie suggests, we should pad on extra safety margins in airplanes with unknown operational history (i.e., if you didn't build the airplane yourself, or weren't the pilot that picked it up at the factory, and the only one to fly it since). If your airplane's yellow arc begins at 165 KIAS, fly your descents at 150 knots. If your airplane's current, weight-adjusted turbulent air penetration speed is 130 knots, slow to 120 KIAS before entering areas of suspected moderate or greater turbulence. Be conservative.

Don't fear a well-maintained airplane, but respect its growing hours of fatigue exposure. Fly it for the long haul—so it will retain load-carrying capability indefinitely.

For more on "aging aircraft" issues see:

- AOPA Air Safety Institute's free "Aging Aircraft" online course: http://flash.aopa.org/asf/agingaircraft/swf/flash.cfm?
- U.S. FAA's "Roadmap for General Aviation Aging Airplane Programs" (2006): www.faa.gov/aircraft/air_cert/design_approvals/small_airplanes/cos/aging_aircraft/media/roadmapGAAgingAirplane.pdf
- U.S. FAA's "Best Practices Guide for Maintaining Aging General Aviation Airplanes" (2003): www.faa.gov/aircraft/air_cert/design_approvals/small_airplanes/cos/aging_aircraft/media/aging_aircraft_best_practices.pdf
- Australia's "CASA Ageing Aircraft Management Plan: 'Ageing 101' Awareness Seminar: www.casa.gov.au/wcmswr/_assets/main/lib100074/presentation.pdf
- The National Institute for Aviation Research (NIAR) at Wichita State University's "Aging General Aviation Education and Training Website": www.aginggeneralaviation.org

Last week's *LESSONS* also included comments by reader John Hodgson that cited a couple mnemonics he uses for checklists: BC-GUMP and W-FUSTAL. I asked John to define the memory items and he kindly replied:

> BC-GUMP is simply Boost, Cowl Flaps, Gas, Undercarriage, Mixture and Props (which I am absolutely sure you know well). OK, in the Stearman Boost and Undercarriage are irrelevant but I like to maintain a generic list.
>
> W-FUSTAL is commonly used in the soaring world as a pre-landing check; dump Water ballast, Flaps, Undercarriage, Speed, Trim, Airbrakes and L for Landing (Location and Lookout)
>
> Common pre-take off checks used in gliders are:
>
> CB SIT: CB for Controls (and did you do a positive control check?) Ballast, Straps, Instruments, Trim, Canopy [closed and locked] and Brakes [aka spoilers closed and locked]
>
> and
>
> ABBCCCDDE: Altimeter , Ballast, Belts, Controls, Cable, Canopy, Dive brakes, Direction of wind, Emergency procedures.
>
> The RAF used HASELL as a pre aerobatic check list: Height, Airframe, Security, Engine, Location and Lookout.
>
> This must look as if I am a check list junkie but they are easy to remember and work for me and have been used successfully in aviation since the B-17 prototype took off with the control lock installed.
>
> The acronyms are fine for simple aircraft but complex ones should be written out as defined in the POH.

Thanks, John! Readers, do you have other mnemonic checklists you use?

Reader and aviation insurance executive Randy Kenyon writes about last week's discussion of cockpit NEXRAD uplinks:

> I took a weather class from a renowned expert two years ago. In the weather radar section, he spoke of the lag time it takes for the NexRad to site to sweep (which is getting faster) and the time to send the information back to the central location where it enters a program and does what it does. The final uplink is sent out about 7-9 minutes later. So what we see is in the past.

Thanks, Randy. I'd mentioned that in *FLYING LESSONS* but not quantified it because the total transmission time depends on the service provider used. But yours is an excellent point to rehash—NexRad radar plots are history, not current observations, and certainly not predictions. A pilot must use his/her knowledge of adverse weather development to forecast what conditions might be like when reaching any give point along a route of flight. A tremendous improvement over having nothing at all, weather data uplinks nonetheless are best used to determine whether the forecasts appear to be coming true and, if storms are building, as a means to give areas of suspect additional development a wide berth.

Reader/pilot Allen Herbert, a senior aerospace engineering student and engineering intern for a major business jet manufacturer who I encouraged (in a very small way) as he began his planned career as an engineering test pilot, adds his take on the question of why Pilot's Operating Handbooks (POHs) uniformly show a knot of tailwind on takeoff or landing is three to five times more detrimental than a knot of headwind is beneficial to airplane performance. Allen writes:

> I've often thought about the primary reason behind why performance is so heavily degraded landing or taking off into the wind. It comes down to a couple of factors I believe.
>
> The first is the relationship between ground speed and air speed. When we are landing the aircraft has a certain amount of kinetic energy (KE = .5*m*v^2). But this is not dependent on our airspeed, but rather the ground speed. If an aircraft is landing with the wind the ground speed is higher for the approach airspeed, so from the Earth's point of view, as soon as we touch down that little bit of extra ground speed translates into a huge amount of extra energy that has to go somewhere, usually into the heat in the brakes. The same basic idea applies on takeoff, [when] the reduced airspeed from the tailwind will require a longer ground roll (more kinetic energy) to get the plane off the ground. This obviously requires more runway to accomplish.
>
> The second issue, and less significant, but real contribution is the aerodynamics of the airplane. If we have a

tailwind, we are being pushed from behind. You'll notice that in general GA aircraft are relatively blunt in the front and "pointy" towards the back. This is for drag reduction, it eliminates what's known as separation drag (as much as possible anyway). When you have a component of the airspeed pushing on the airplane from behind you now have what is in effect a wedge to push against. I've notices a similar effect when practicing power on stalls with the wind: the airplane tends to drift on without the stall ever really breaking. This effect is obviously greatly exaggerated in that case but a similar phenomenon could be expected on takeoff and landing.

The most likely reason for a lack of the one to one relationship between headwinds and tailwinds is the combination of the two factors, particularly the second as it is likely a rather non-linear behavior. Though I would be interested to see wind tunnel data on such an effect.

Thanks, Allen! And best of luck in your career!

Readers, 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 I opined last week, part of our challenge is that this particular Cause may be an unsolvable problem. If we must accept that (and I'm not certain we must, not yet), then we should work so this is the last remaining major cause of fatal general aviation accidents. We'll do that by positively addressing the areas where well-meaning, regulations-following pilots who normally exhibit what most of us call "good judgment" and even "common sense" somehow make a decision we (and likely they) would never envision being made while in the command seat of a general aviation airplane.

But reader Jay Graph reminds us there may be a radical option to address the "unreachable" pilots for whom buzzing and low-altitude and aerobatic is apparently an acceptable risk. Jay writes:

> Regarding what we can do about Top 10 Cause #4, "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?"
>
> Well, we are all positioned to identify these pilots. In my state, there is a toll free 1-800-GRAB-DUI number to report suspicious automobile drivers. How about a similar thing for reckless aircraft behavior? All you need to do is report the tail number. Ideally, air traffic control radar would have proof of what maneuvers were done and at what altitude. Even a simple form letter from the FAA to the effect of, "Your airplane was observed flying in a potentially unsafe manner; you might want to take some refresher training" could have a positive effect.

Excellent idea! Certainly cultural attitudes toward drinking and driving have changed over the past couple of decades as a result of peer pressure, and although the problem still exists it is frowned upon by polite societies. A similar, long-term campaign including an idea like yours might change many attitudes among pilots who simply don't know any better. Thanks!

Next week we'll begin discussion of Top 10 Cause #3: Stalls at low altitude.
Comments? We're still here, 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
