FLYING LESSONS for April 8, 2021

FLYING LESSONS uses recent 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 airplane have little direct bearing on the possible causes of aircraft accidents—but knowing how your airplane's systems respond can make the difference as a scenario unfolds. So apply these *FLYING LESSONS* to the specific 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:

Why Bother?

From an NTSB preliminary report posted this week:

> A witness reported that he heard an engine run-up being performed before the airplane's departure. He stated that the engine was sputtering, "like rough idle." He heard cycling of the propeller "a few times" and the engine backfired when power was increased during each sequence. He further reported that the engine rpm sounded "…high, very high. From low to full rpm repeatedly which was more than a normal run-up. He was doing it fast." The witness did not observe the airplane's takeoff.
>
> According to recorded air traffic control communications, the airplane was cleared for takeoff from runway 10L and the pilot was instructed to enter the left downwind leg of the traffic pattern [from the recorded ATC communication I heard, to depart the pattern to the west], which was acknowledged. There were no distress calls received from the airplane during the flight.
>
> A pilot-rated witness who was located about 775 ft and 307° from the departure end of runway 10L reported that he observed the airplane in a very low climb at a "very slow rate." He attributed the takeoff to be a soft field takeoff. The witness had diverted his attention when he heard the airplane suddenly experience a total loss of engine power, adding that it "failed completely." At that time the airplane was about 100 to 200 feet past the departure end of the runway and at an altitude "definitely lower than 300 feet above ground level." The airplane remained at the same attitude for 1 to 2 seconds, then started a "gentle" right bank while maintaining same pitch attitude. The airplane then "stalled," spun, and pitched nose down. He heard a bang sound and noted an explosion….

See https://www.mastery-flight-training.com/20210315b36tc-fatal-pembrok.pdf

This was the same fatal crash that was captured on a home security camera with video and that received wide distribution. It was more horrible not only for being so graphically captured on video and killing the two rated pilots aboard, but because it also killed a four-year old boy in a vehicle on the ground that was hit by the crashing aircraft, and seriously injured the boy's mother as well. This tragic event served as the basis of the March 18, 2021 *FLYING LESSONS Weekly*.

See https://www.mastery-flight-training.com/20210318-flying-lessons.pdf

In that report I'd focused not so much on the obvious discussion of whether or not to attempt to attempt to return to the departure runway after power loss immediately after takeoff (although I did open a discussion of whether to use urban-locked airports at all, comparing them to other airfields pilots routinely discuss avoiding because of lack of engine-out options). If the pilot-witness reports are correct—and given the outcome, it's likely they are—then even the staunchest advocates of attempting to return to the departure airport would not recommend attempting anything other than an essentially straight-ahead controlled impact from the height at which the engine finally gave out.

Instead, I discussed the issue of deferring engine overhaul indefinitely, I homed in on the engine itself, the apparent reason why the pilot was faced with a turnback decision in the first place. Since-removed sales information for the accident aircraft showed the engine had about 360 hours in service toward its published 1600-hour Time Between Overhauls (TBO), but that it had been **25 *years*** since that overhaul occurred...averaging about 14 hours' use per year over that time. Sales literature also noted a "top overhaul" (replacement of cylinders, presumably all six) "only" 49 operating hours earlier, but that the "top" was done earlier, revealing the engine had been run an average of less than five hours per year since then.

TBO is published at 12 years in service *or* the time in service, ***whichever comes first***. *FLYING* LESSONS readers added in later Debrief items that the airplane had been rejected by previous buyers because of engine corrosion. Yes, for most operators TBO is merely a recommendation. You can run an engine longer if you wish. However, the less frequently an engine is run the more susceptible it is to corrosion in ways that often cannot be detected even by oil analysis. Engines that's don't make their published TBO within 12 or 15 years or so very frequently need to be overhauled or replaced *on condition* well before the recommended TBO.

Engines that make it to TBO (or beyond) historically reach that limit in five to 10 years, according to aircraft valuation services that track engine overhaul or replacement times. Where the **time-in-service** TBO limit (1600 hours in this case) is based primarily on ***engine wear due to operation***, the **calendar time-in-service** recommendation (typically 12 years in service regardless of engine model or manufacturer) is based more on ***engine wear due to inactivity***, and the corrosion that may result. As I wrote in the March 18 report,

> I'm not saying that engines must be overhauled or replaced at TBO, or at some fixed percentage beyond TBO. But in a single-engine airplane we cannot fly the engine until failure. Even in a twin it's far better to overhaul or replace before an unexpected failure severely tests your single-engine training and currency.

Because I've seen some backlash on the internet chat lines and bulletin boards, comments generally advocating flying until the engine gives an indication of trouble, I feel the need to state it more emphatically: ***If you plan to fly an engine to failure, you're planning to have an inflight engine failure.*** You can address the engine at a time of your choosing, or it may eventually happen at the worst possible time.

This brings us back to **the new *LESSON*** I derive from the additional information provided in the NTSB preliminary report on the tragedy that prompted this discussion: **Why do we even bother** with preflight inspections and Before Takeoff engine run-ups, if we're going to ignore unexpected or abnormal indications and rationalize them away in our desire to fly anyway? All too often we hear cases of airplanes being flown with known mechanical discrepancies. **We cannot let our desire for flight to be so strong that we ignore obvious signs that the aircraft is not as ready to fly as are we**.

The accident airplane's engine didn't fail at two to three hundred feet above ground level. ***It failed on the run-up pad*** when it did not perform as it should during the Before Takeoff checks. Most likely it failed 10 years before, but the owner chose a less costly—and for engine bottom end longevity, totally ineffective—top overhaul instead.

But forget the entire question of whether an engine should be overhauled or replaced at a given time-in-service, or after a certain number of years in service, or what it costs, or whether there are lower-cost options available. Commit yourself to this:

1. **Complete the entire Before Takeoff checklist** including engine run-up. ***Do not rush*** the engine checks out of your desire to fly, a perceived need to expedite because of traffic or an Air Traffic Control clearance or void time, a feeling of "mission" because you're volunteering on a charitable flight or park of a group flying activity, or simply because you've done this a bazillion times and never had a problem before so you don't expect to have one now.

2. **Take the time and focus your attention** to actually ***see, hear*** **and** ***feel*** that the engine is working properly at each step of the checklist.
3. **Stop immediately** if anything is not exactly as it should be at any point during the check.
4. **Resolve any discrepancy** if you find the unusual indication may be the result of something you did that you can fix in the cockpit.
5. **Repeat the failed step** if you found a discrepancy and fixed it. Accept nothing but the correct indication on this second attempt.
6. **Cancel the flight** if there is a discrepancy you cannot correct or for which your attempted corrective action was unsuccessful. Take the airplane back in. Report the discrepancy and all indications to a mechanic and ground the airplane until it is resolved.
7. **After the mechanic repairs** the discrepancy, the next flight is a return-to-service operational test. Treat it as such—no passengers (except perhaps the mechanic to observe the results), fly in good day, visual conditions, make a local flight, observe and record indications, and discuss the results with your mechanic. Follow all the steps above, and if the discrepancy is not yet resolved don't fly it as-is "to gather data" or "to see how it performs."

30 years of flight instruction and aircraft accident record trend monitoring has revealed this to me: **If you think something about flying is a mere formality or a waste of time, focus on doing that thing correctly and thoroughly *every time*.** Airplanes are so reliable, and mistakes are usually so correctable, that personal and professional aviation are really quite safe. When accidents happen it's usually the result of decisions and actions made or not made, even when the *probable cause* turns out to be a mechanical failure. ***Complacency about checklists and indications is*** **far more dangerous** ***than failures of the machinery itself***.

If the accident pilot had paid attention to what the engine was trying to tell him, and followed the steps above, he would never have attempted takeoff under those conditions. It may have only delayed the inevitable failure, or it may have convinced the owner it was time for engine overhaul or replacement before the next flight. But regardless of the overhaul decision, **simply paying attention** would have prevented the loss of the two pilots aboard, and the horrible tragedy of the little boy, his mother and their family.

That's "why bother" with the Before Takeoff—and all other—checklists. They remind you of **what *looks, sounds and feels right***…and if things aren't right, they prompt you to **do something about it** while there's still time.

Instructor, retired Air Force pilot and *FLYING LESSONS* reader Scott "Gunny" Perdue posted an update on the accident that prompted these *LESSONS* this week. I saw that his video was posted on his FlyWire YouTube channel while I was writing this week's report but purposely did not view it until after completing my final draft to avoid cross-contamination. Gunny's analysis is excellent as always, covers many of the same points I make here, and expands on several others. Take a look.

See https://www.youtube.com/watch?v=N4_BTILPAyw

Questions? Comments? Relevant experience? Send them to mastery.flight.training@cox.net.

Debrief: Readers write about recent *FLYING LESSONS:*

Reader Peter Tracy was one of several who responded to my comment in last week's *LESSONS*, wondering why more airplanes do not have a BOTH (or ON) fuel selector setting:

> Here is a post which explains in simple terms why low wing airplanes (with rare exceptions) do not have "both" settings on their fuel selectors, while high wing airplanes generally do have a "both" setting.

See:
https://www.mastery-flight-training.com/20210401-flying-lessons.pdf
https://aviation.stackexchange.com/questions/33995/why-do-many-ga-aircraft-not-have-a-both-fuel-selector#33997

Given that there are some exceptions I'm not certain this is a completely unsolvable design challenge, but I agree that it is a bigger issue in low-wing airplanes. Thanks, Pete.

Reader Mike Blackburn writes about the larger issue of fuel tank selection:

> I read with interest your comments on fuel tank selection this week. I'm reminded of an incident that occurred when I was training. I did the run up in the run-up bay, then as I was taxiing to the hold short line, I changed fuel tanks.
>
> **My instructor noticed this and made me do the *entire run up* and predeparture checklist from top to bottom** again – the reason being that even changing back to the tank I had run up on wasn't a guarantee that the fuel selector was now correct.
>
> **I will NEVER again change the fuel selector after the run up is complete**, until I am at an altitude or location with options. I think the advice to change to fullest tank implores us to start up and taxi on one tank to at least prove the engine will run on that tank, then change to the other for the run up to prove that the aircraft will run on that tank.
>
> Interestingly, I find that most of my run ups have a high RPM period of around 20-25 seconds - in my Sling it would take longer to starve the engine of fuel.... food for thought.

I agree. I used to teach starting the engine on one tank, switching before run up and, even if you forgot to switch tanks before runup, to ***always takeoff on the tank you use for runup*** even though it is not the fullest tank. Now, I teach selecting the takeoff tank before engine start and making no changes to fuel selection until level in cruise. Thanks, Mike.

Frequent Debriefer, instructor and specialist in cabin-class piston twin transition training David Dewhirst addresses the issue of far more complex fuel systems:

> Great article in the April 1, issue. Fuel tank feed and selection are issues. One of the airplanes we operate has six tanks and ten pumps. All need to work for all the fuel to be available for the flight. Regardless of the airplane, here is what we teach:
>
> 1. All the pumps that operate electrically should be checked before engine start.
> 2. Start and taxi on one set of tanks.
> 3. Perform the before-takeoff check on a second set of tanks.
> 4. Select the tanks desired for takeoff.
> 5. Wait for at least 60 seconds after selecting the last tanks before beginning the takeoff.
>
> The first idea is to **assure all tanks and pumps work before takeoff**. The second idea is to **assure the fuel selectors for the tanks selected for takeoff are properly positioned and the tanks actually contain fuel.** Keep up the good work, my friend.

Thank you, Dave.

> First-time Debriefer Clay Harden adds:
>
> On selecting fuel for takeoff, **there are lots of reasons to takeoff on the tank used during run-up, or the tank in use in the last landing for a taxi-back and takeoff.** Contaminated fuel, bad fuel, a problem with the switching mechanism, a clogged fuel line are all well mitigated by the run-up. **Similarly, I would avoid switching tanks in the last ten minutes before landing.**

I agree, Clay. I had intended to continue the discussion this week and focus on fuel selection for landing and for multiple takeoffs and landings, but the Pembroke Pines NTSB preliminary report was posted and I thought it warranted the *LESSONS* attention this week. My suggestions are:

- **LANDING:** Select the landing tank at Top of Descent (TOD), that is, the point where you begin your descent from cruising altitude. Ensure you have enough fuel in this tank to descend, fly an approach or pattern, and if needed go around or miss the approach and climb back to a safe altitude—all without changing the tanks again.
- **MULTIPLE TAKEOFFS AND LANDINGS:** If you must change fuel tanks during training or practice in the circuit, after landing and clearing the runway (or before turning around, if there is no taxiway) come to a stop and change tanks. Then taxi back to the departure end, pausing if needed so at least a full minute passes before the next takeoff (echoing Dave Dewhirst's advice). Don't change tanks on the downwind between landings. Absolutely do not move the fuel selector during a touch-and-go. And again, don't change tanks just before takeoff.

And reader Sean McHale tells us he's off to a great start with his wrap-up about the crash that serves as our example again this week:

> I'm just a student pilot, so take this with a grain of salt. But being a new pilot, **I view each airport I'm planning on taking off/landing at on Google Earth before flying them.** I use it ***to give me a better sense of what I'm going to see on my flight***, but I also use it ***to find alternate places to put the plane down***. Much like briefing various checkpoints in the take-off series, **it's nice to already know what you're going to do beforehand instead of trying to figure it out in the heat of the moment**.

Outstanding, Sean. Please pass along my compliments to your instructor, who (if she/he was the one who taught you this) is doing an outstanding job. And congratulations to you for beginning your flying adventure with habits that promote excellence.

Questions? Comments? Send them to mastery.flight.training@cox.net.

"The great success of *FLYING LESSONS Weekly* is rooted in how often you do the right thing in encouraging all of us to fly safely and showing us ways to do so." – Bruce Dickerson

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