FLYING LESSONS for January 17, 2019

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National Flight Instructor Hall of Fame inductee

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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Pursue ***Mastery of Flight***

This week's LESSONS:

A flying club student and instructor had just completed a night training flight. Securing the aircraft, one of the pilots noticed a long stripe on the bottom of one wing—paint, and not a color associated with that aircraft. There was no evident damage, but the foreign paint was a troubling mystery.

Investigation revealed the paint color matched a short, upright obstruction alongside the ramp, but farther down the line and away from the path the night-flight crew had used to exit and return to the tie-down area. The squawk was at least one flight removed from this student and CFI…and whoever taxied or pulled the airplane over the pole had either not noticed his/her error, or knew it happened but did not squawk the airplane and ground it pending a mechanic's inspection.

What was especially troubling, however, was that the crew who found the mis-matched paint had preflighted the airplane (in the dark, using a flashlight), but did not notice the now-obvious "occult" paint before taking off. There was no damage to the airplane's wing, but there could easily have been, damage they might not have noticed before attempting to take off.

I'm as guilty as the next guy when it comes to sometimes wanting to rush a preflight. No, I was neither the student nor instructor in this case (or the flight before, either). But there have been several times when I have had to stop myself, take a deep breath, and slow down to make a *real* inspection of an airplane before launch, because I was in a hurry to fly. This is when discipline in using a preflight inspection checklist is golden, inspecting part of the airplane and then confirming with the checklist you've not missed anything before moving on to the next part. Any time you get distracted or rushed, go back to the end of the last section you confirmed by referencing the checklist, and resume your inspection from there.

We inspect airplanes at the worst possible time, when we're ready to fly. Our thoughts can easily drift to the flight itself, to explaining about airplanes to a new passenger, or to discussing the upcoming session with a student. **It's dangerously easy to rationalize away a squawk found when you're wanting to go fly.**

Why are we conducting an inspection at all? Despite the overall mechanical safety of general aviation, regardless of our comfort with flying and/or with the specific airplane, the hard truth is that ***airplanes are terribly unforgiving of mechanical imperfection***. The chance of an engine failure or partially blocked control travel or a structural issue is slight. But the

consequences of any of these can be heartlessly severe. My first flight instructor taught me to take the time to thoroughly inspect an airplane because ***"the airplane is trying to kill you, it's up to you to catch it in time."*** That's the attitude with which we need to inspect our airplanes.

Would the night crew have canceled its flight until a mechanic was available to inspect the wing in the light of day if they had seen the paint stripe during preflight? I hope so. ***Would you?***

Fight the temptation to accept a broken airplane because an emotional or scheduling "need" to fly. As that same colorful instructor told me, **"Unless someone is shooting at you, no one *needs* to fly"** on any given day (or night).

You can avoid some of the pressure of a preflight inspection by conducting an equally thorough **post-flight walk-around** after landing and securing the airplane. You won't be rushed to get into the air; any squawks found can be addressed in the time between then and when the airplane is next scheduled to fly.

A post-flight inspection is a good time to wipe off bugs and grime while it still comes off easily, instead of making it harder with time. In cold weather, use this time to brush snow off wheels and landing gear components, so it won't freeze into brakes or retractable gear mechanisms. **It's your responsibility** to identify any discrepancies *after* a flight so the next pilot knows beforehand what works and what doesn't, or if you're the next pilot, that discrepancies can be found and repaired before you want to fly again.

But just as the temptation to rush into the air threatens our preflight inspection, so does our zeal to complete our trip to destination, return to more earthly pursuits after a flight, or move on to the next student prompt us to rush through a post-flight airplane check, or much more likely, skip it altogether.

Constantly ask yourself ***"What am I missing?"*** in your pre- and post-flight inspections.

If you don't have time—you have somewhere you need to be quickly, you want to get your passengers to their ultimate destination, you need to debrief a flight student or similar—budget time in the next day or two to go back and post-flight the airplane. This still allows you to catch discrepancies before you're under pressure to fly, and gives you time to get any issues addressed before you plan to fly again.

Instructors, this is our challenge to live by example. Include a post-flight airplane walk-around inspection in all your lessons, flight reviews and instrument proficiency checks. Insist your students evaluate the airplane's condition after a flight at least as much as you require a preflight inspection, and that they diligently report any squawks for their mechanic and/or if someone else may be flying the airplane. Make it as normal for them as a good preflight…don't sign their logbook until they're done. And live up to the example—always assume a student is watching you, and never let them see you violating your own rule.

I need to keep working on this myself. I hope you'll accept the challenge as well.

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

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Debrief: Readers write about recent *FLYING LESSONS:*

Debriefing heated up following last week's Winter *FLYING LESSONS*. Reader Mike Dolan sent this in:

> This is one of the best sets of winter flying cautions I've seen. I'm reluctant to leave my airplane parked outside overnight in winter. I do have the gap seals mentioned. Good place for water to accumulate and turn to ice once aloft.
>
> Also, **I'm reluctant to sample fuel outside in winter due to the possibility that the quick drain won't fully shut off.** Inside a warm hangar is the only place I check fuel. If you must fly an overnight winter trip somewhere, perhaps it's worthwhile to put the plane in an expensive heated FBO hangar and pay for a rental car if needed.

Reader John Townsley writes:

> Thanks for yet another very thoughtful newsletter. I don't know how you've kept up the pace with weekly production of gem-filled messages. This list reminds me yet again why I need to do a thorough preflight. After all, I may be the first to arrive at a mishap if any one of cold weather problems you mention is not discovered, then mitigated.
>
> As I read through your list I was struck by how many items could be summarily restated as "TRUST, but VERIFY." **Every aircraft flies on a healthy injection of money, but the pilot and crew survive on *trust*.** Your C172 was left out years ago because you trusted the FBO to follow through and stick your bird in the hangar... But it didn't happen.
>
> Next you had ice flecks in your fuel which resulted in fuel starvation. You trusted the previous pilot/instructor to top off the aircraft, trusted the last IA to check the fuel cap seals, trusted your fuel supplier to have good filters on the fuel system. **I fill my aircraft to the brim after every flight in cold weather**, and do owner assisted annuals so I own the problem if my fuel caps leak. We're stuck with the fuel system operator's opaque maintenance schedule, but we can at least check objectively for other contaminants like Jet-A and particulates.
>
> Great advice regarding **heating the cockpit. I heat mine for about an hour** with a *very* carefully placed ceramic heater anytime the temperatures drop below 40°F. Yes, I could start the preheating ritual at a colder temp, but that magic point on the thermometer is not well defined anywhere I know of. Anyhow, my gyros seem to like my arbitrarily selected temperature.
>
> I have to disagree with both you and your A&P about the "object of preheat is to warm the oil". **It is *also* to heat up dissimilar metals** (aka "cylinders") so differential expansion after engine start doesn't also generate accelerated (abnormal) wear. Not being a metallurgist, I have to *trust* those who are to give me good advice. One bit of particularly good advice I've picked up from several years of reading manufacturer "engine tips" is that cold soaked steel and aluminum have very different rates of expansion when exposed to heat. Yes, we need to have oil warmed so it will flow, but it's very much in our interest to heat the cylinders to prevent premature cracks and all that would entail. When traveling away from home I usually throw a couple of blankets in the back to drape over my cowl, stuff into the gap at the bottom of the engine, and wrap the prop when I pre-heat. An alternate purpose for the blankets is to augment my survival kit.
>
> "Cold to Hot" was a great lesson in trust. Thanks! I too learned to carry a tire pressure gauge in my kit. Though I no longer fly aircraft other than my own I've noticed (and corrected) many times that even after a NON-owner assisted annual tire pressures may be 15-20% low. I've also found company and other un-named "charitable organization" aircraft with tire pressures well below POH recommend numbers. Hence, **while I assume other pilot, mechanics, etc. will check and correctly pressure tires, I do it myself.** Experience has shown that my own aircraft tires will usually retain pressure. [Note "usually"]. So I still use my gauge to verify my ride's pressures during my first preflight.
>
> Thanks again for sharing your experiences.

See http://www.mastery-flight-training.com/20190110-flying-lessons.pdf

Reader Scott Snider adds:

> You may get a bit of push back on one of your winter flying tips. In the "Real Objective" section you wrote:

> "**The object** of preheating an engine isn't to get the cylinders or the crankcase warm. The objective of a preheat is to get the engine's *oil* warm enough to flow smoothly, so it does not resist the motion of engine parts, and that it properly lubricates those parts so they can spin and move."

From all I've read the reason for pre-heating isn't to warm the oil (though this was gospel for many years) but to **warm the entire engine because the various types of metal in an engine have different coefficients of expansion/contraction**. One example: the rapid heat rise and resultant expansion of the piston vs the cylinder causes scuffing in the upper region of a cylinder. Multi-viscosity oils flow well even at low temperatures. This article by Mike Busch explains pre-heating methods including the metal coefficient of expansion/contraction issue.

See: https://www.avweb.com/news/maint/182846-1.html

Mike Busch makes some valid points, although I have not seen any data on the clearances issue nor does Mike cite any in his article. That aside, even with "normal" tolerances it's vital that the oil must flow to lubricate the engine almost immediately when the starter begins to turn the crankshaft (and everything else). There's no disputing that when the temperature gets cold we need to warm the engine *and* the oil. So where should we direct the heat? Reader Gil Buettner writes:

> Having lived in the north most of my life, I have learned many of your winter *FLYING LESSONS* the hard way. I sold my V-tail Bonanza a few years ago, but I did fly it in Michigan, Wisconsin and Minnesota winters. Without a Tanis or other aviation style preheater, I used a simple oil pan pad to warm the engine from the bottom overnight before a flight. **A heavy blanket over the cowling helped contain the heat** until I was ready to go.
>
> In one of your *LESSONS*, you say, "the best preheat comes when you put the heater hoses not into the nose inlets, but up from the bottom of the engine, through cowl flaps openings in airplanes so equipped …." I recall reading in the Owners Manual for my Continental IO-550 that the engine maker specifically warned not to do this with forced air. As I recall, the concern was uneven heating of different metals. This reinforces the other thing you mention, that slow, low heat is better than shorter higher temperatures.

My copies of the Continental Motors IO-series engine manuals don't mention dissimilar metals issues—it's all about the oil. They even advise against running the heat through the "cowling 'bug eye' inlets," at least unless the source of heat is substantial. It specifically advises directing heat to "primarily to the oil sump and filter area," and only after heat has distributed in the cowling to "periodically feel the top of the engine and, when some warmth is noted, apply heat directly to the upper portion of the engine" to "provide sufficient heating of the cylinders and fuel lines to promote better vaporization for starting."

Where does this leave us? Thoroughly warming oil is the key to engine preheating, but **a complete preheat requires directing heated air *throughout* the engine compartment**. This only works if you direct air on the oil sump, which is almost always on the bottom of the engine, and then follow up as necessary with warmth in other areas as well.

See http://mastery-flight-training.com/tcmpreheat.pdf

There's more. Reader Samuel Dawson writes:

> I had something similar to your experience in a 172, but I was teaching in a [Cessna] 150. The airplane was stored outside. A cold front came through dumping a bunch of rain, followed by low temperatures.
>
> The following day was clear with temperatures right at freezing but rising. The preflight was normal, no water in the fuel samples. As the flight lesson progressed, temperatures steadily increased though I didn't really pay attention to that. I concluded the lesson by having the student approach the nontowered airport from altitude for a simulated engine-out to a landing. Several miles out the engine coughed a few times, then quit.
>
> I told the student the scenario was now real and to run through his engine failure flow. We got over the airfield and started circling for the approach. I let the student keep flying as he was doing fine. Several times the engine came back to life, would run for a few seconds, then quit. I told the student to just anticipate the engine not working.
>
> We eventually spiraled down for a safe landing. On short final, the engine started again and ran roughly until we taxied in and shut down. The mechanic came out and asked if I had sumped the tanks. I assured him I had, but we tried it again. And got over a gallon of water.

> Our best guess was that water seeped through the fuel caps into the tanks as the cold front came through. As the temperatures plunged, the water froze. When we sumped the tanks the water was still frozen, but as the lesson progressed it melted. Fortunately, we were in an ideal place when the water hit the engine.
>
> Due to weight restrictions, we couldn't top off the 150 after flights but if an airplane is kept outside and weight isn't an issue it might be a good idea to do so. Inspect the fuel cap gaskets and maybe consider replacing them every few years if the airplane is stored outside. These ones didn't look in bad shape but obviously were no longer serviceable.

Reader Stan Stewart had a similar experience:

> I just carefully read this week's *FLYING LESSONS Weekly*, and have a winter flying problem to relate: I went down in a Cessna 150 in a New Hampshire winter back in the early 1970s. The weather was clear, and while the temperature on the ground was below freezing, aloft it was above freezing. Before the flight we drained the tanks, but after about 20-30 minutes in the air, the engine stumbled and quit (continued to windmill, but no power). Carb heat didn't help, so we put it down in a clearing and after landing and getting it stopped, the engine was idling!
>
> We shut it down and got out, and I shook the wings from a wingtip and **we could hear ice rattling around in the fuel tanks!** That frozen water (it had rained earlier in the week, and the 150 was tied down outside) started to melt in the above freezing air aloft and when the water got into the carburetor, the engine quit. I know from experiencing water in the gas in automobiles with carburetor equipped engines, that an engine will idle but will not take throttle when water gets into the carburetor, apparently the idle fuel circuit is higher in the float bowl than the power circuit which feeds from lower in the bowl where the water, being heavier than gas, pools in the float bowl. With the fuel injected engine in my [Beechcraft] Debonair, if the engine ever stumbles or loses power while showing adequate fuel flow, and there is a possibility of water in the fuel, I plan to switch tanks, go full rich [mixture] and run the auxiliary pump to pump the water in the fuel system out through the fuel injection system, through the engine, to get gas to the engine again.

Reader Art Bridge writes:

> We often have temperatures near 0° Centigrade in our hangar in McMinnville, Oregon. The afternoon may be glorious flying weather, so we plan to go. Any value in a couple of shop lights place in the cowling early in the morning, a horse blanket draped over the top of the engine cowling to hold the heat, and a good four or five hours of slow engine preheat? Seems like a safe and inexpensive way to warm the engine block and oil—at least up to the high 30s or low 40s for an easier start.
>
> My question is all about safety: Is it safe to have an electrical cord and light—contained in the shop light basket and good cord—within the proximity of the engine fuel lines and fuel tank selector valve?

I think it is safe, Art, and that's what we did in the example in last week's report. I think it's riskier than an installed system, and much less effective, but if the area near the light is completely free of fuel and oil (including leaks), and you take care to place the lights where they won't shift after you've turned them on and left, the "trouble light" technique is not unacceptably hazardous.

And reader Jock Folan adds:

> I enjoyed this week's Winter *FLYING LESSONS*, very interesting reading.
>
> Your comments about warming the oil and not [just] the engine reminded me of reading about German winter flying operations during WWII and the difficulties they experienced during their first Russian winter, in particular getting the aircraft engines warm enough to start. Their saviours turned out to be captured Russian ground crew who taught the Germans to drain the oil while still warm and store the oil in containers around fires (and you worried about heat lamps) to keep both the oil and ground crew warm. Prior to operations the engines were replenished with the warm oil to enable them to be started.
>
> I am glad that we do not experience the cold weather extremes in Australia that you do in the US, particularly as we do not have the luxury of FBO assistance. My previous trips to the US have always been work related and I have often thought about holidaying in the US and hiring aircraft to travel around. Your Winter *FLYING LESSONS* remind me that should I holiday during the winter months I would have a lot to learn about cold weather operations.

Reader Mike Lapore wraps this up:

> Even though I now reside in Florida, I certainly appreciated the cold weather operations tips.

When living in the Midwest I installed a Reiff preheat system in my Baron. Two things helped make it more effective: first, I purchased a device (Regal Pro Remote, FSTLLC.com) to allow me to activate the system remotely through my cell phone. Saved many trips to and from the hangar to "plug in" the preheat system. Second, I purchased and carried two very, very long commercial grade extension cords, as I had been 'burned' by FBOs who did not have outdoor power within ready reach of where they parked me on their ramp. Thank you for the article, the tips, and the personal stories that made them come alive. Stay warm.....

Thank you, everyone, who added to the Winter *FLYING LESSONS*.

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

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"Thank you for your tireless pursuit of GA safety. I'm certain that you have made a difference."

- Retiring NTSB Member and *FLYING LESSONS* reader Dr. Earl Weener

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