FLYING LESSONS for February 2, 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:

The closest I've ever come to a gear-up landing happened while I was in the instructor's seat of a twin-engine Beechcraft Baron 58, flying an instrument approach (in clear skies) with the Pilot Receiving Instruction (PRI) entering a right circle-to-land maneuver out of the VOR 14 approach at Wichita's Mid-Continent Airport to enter a left downwind for Runway 1L.

As soon as the pilot leveled the Baron's wings on the downwind leg, I "failed" the left engine by reducing throttle. The pilot announced aloud "We have an engine failure" (per my preflight instruction, a trigger mechanism to blast through the period of denial that usual accompanies unusual status in flight) and processed the Engine Failure in Flight procedure from memory. This included retracting the Baron's landing gear.

Most light twins (and the Baron is no exception) cannot maintain level flight on one engine with the landing gear extended at most weights, even with the "dead" engine's propeller feathered. To avoid descending below circling minimums at this point, where the pilot could *not* make it to the runway using the rate of descent that would develop with a windmilling propeller, at least not without making a steep turn (bad idea) to a landing somewhere midfield or farther down the runway (another bad idea, historically). The pilot followed his training and retracted the landing gear, which permitted continuing without descending further.

At that point I moved the engine controls to the "zero thrust" setting, which provides just enough thrust to overcome the drag of the propeller, thus simulating flight with the propeller feathered.

Of course when I began the scenario, the landing gear warning horn began to sound… because the "dead" throttle was aft of the position that causes the gear warning horn to sound (and panel annunciator light to flash) if the landing gear is not extended (see *Debrief* for a note about this from last week's *FLYING LESSONS*). We cruised along at circling minimums until it was time to begin a gentle, continuous left turn to final—the landing gear warning screaming the entire time.

As a multiengine instructor the continuous alarm of the gear warning system was an entirely normal and expected indication for me—you hear it any time you're "simulated single-engine" in flight except when descending in the pattern or on the final approach course of an arrival procedure. So I naturally tuned out the blaring horn, not really equating it to a threat. Unfortunately my PRI seemed to be ignoring the warning too. When time came to descend to the runway he pulled the "good" engine's throttle and began to let down in the turn to final…beeping all the way.

I've never done it (honestly, I haven't), but some MEIs will pull the landing gear warning circuit breaker in single-engine flight to get rid of the distraction of the warning horn. A few training twins actually have a switch to deactivate the gear warnings for this very purpose. In those airplanes, not only do the instructor and PRI need to be very careful about gear extension before a single-engine landing, they also must remember to turn the warning back on when the lesson is done. A manually deactivated landing gear warning horn has been cited as a factor in

more than one gear-up landing.

Coming down final approach I had a bad feeling about this, and noticed the discrepancy between power on the good engine, airspeed, and rate of descent. My PRI, of course, had far less time landing on Wichita Mid-Continent Airport's Runway 1L in a Model 58 Baron on one engine, so he was far less likely to pick up on the visual cues that something wasn't quite right. I immediately looked at the first place I always look when performance doesn't match expectations—the landing gear switch and indicators—and confirmed the Beech's wheels were still up in the wells. Time for a teachable moment…we were still about 400 feet Above Ground Level (AGL) so I prompted the pilot by saying something like "Is everything configured for landing?" The PRI, to his credit, also looked at the landing gear first, and put the wheels down before we were within 300 feet of the ground. After he executed a great one-engine landing ("Notice how much the plane floats in the flare with the reduced propeller drag") we taxied in and had a good debrief about our near catastrophe.

What *FLYING LESSONS* can we learn from this experience, whether we're in a twin-engine airplane or not? First, partly as a result of this experience, over time I made a fundamental shift in my thinking about the role and responsibilities of the flight instructor (and the PRI) on a training flight. The short version is "we teach on the ground; we merely demonstrate, practice and evaluate in flight"—more on that philosophy in future *FLYING LESSONS.*

The more immediate *LESSONS* are that we need to know all the different types of warnings and alarms the airplane we're flying is capable of generating, and every situation that can cause each of those alarms to sound. Why is this knowledge important? ***By knowing what causes warnings to activate, we can anticipate situations that are likely to put us in these hazardous situations.***

In other words, we know what the warning systems "think" is important. We can avoid the hazard the horns and lights warn us about by avoiding the warning activation *conditions* before the alarms go off. And we can anticipate the dangerous possibilities when we find ourselves doing something unusual (for us) in the airplane. For instance, in a single-engine approach there are extreme distractions and hardware system "gotchas" that make you less likely to notice the warning horns and lights. When asked by ATC to "make a 360" for spacing in the traffic pattern, we anticipate that the relatively tight, level turn at low power will lead to a high angle of attack that may result in stall horn activation…and left unchecked, a low-altitude accelerated stall. Know the warning conditions, and you can watch for situations and do whatever is called for to avoid activation of the warning, for a greater margin of safety than the warnings provide.

List the warning horns and lights for the equipment in your airplane: stall warning, gear warning (if an RG airplane), autopilot disconnect, altitude alerts, angle of attack…the list may go on. Know what all the chimes, bells, buzzers and lights mean, and just as importantly, exactly when and why they'll activate. See the Pilot's Operating Handbook (POH) and the Supplements for optional and aftermarket equipment to answer your questions—especially the Systems Description section of each.

Last week's *FLYING LESSONS* talked about missing cockpit alarms because of **task saturation**—failure to perform vital functions because there is so much going on our minds can't process the status to make decisions. This week's *LESSONS* as much about complacency, about "conditioned omission"…missing things because we're so used to hearing alarms and seeing lights that they do not trigger our appropriate response when they sound. It's another way of saying we don't pay attention because the airplane has "cried wolf" too often.

See www.mastery-flight-training.com/20120126flying_lessons.pdf

Threat management doctrine tells us that warning systems are the *second line of defense* against accidents. The primary means of avoiding a mishap is to engineer the cause out of the machine. In the case of gear-up landings that means designing an airplane of near-equal performance with fixed landing gear, so it can't land gear up—our friends at Cirrus have proven

this can work (although designers and marketers naturally salivate at the added performance "sucking up the gear" would add even these very clean designs). The legendary stall-proof Ercoupe and (presumed stall-proof) canard Vari-Eze and similar types are another attempt at hazard-avoidance-by-design. Sometimes it works, sometimes it doesn't…and the design goal is not always met, with hard-landing gear collapses in fixed-gear planes and deep stalls in stall-proof designs. But designing the hazard out of the machine is the first line of defense.

As we've said, warning systems are the second line of defense. If the hazard isn't designed out of the machine, then the machine will warn its operator when the hazard is about to be encountered.

We all depend on our own skills to keep us safe. Threat management doctrine tells us, however, that memory is the *least* effective hazard avoidance strategy. We can mitigate this risk significantly by **regularly** and **properly** using checklists for **all** phases of flight (printed checklists and cockpit flows being the third line of defense). Going it alone on the assumption we'll remember to do everything correctly every time regardless of the workload or distractions is the last line of defense against hazard and tragedy. The wise pilot knows not to rely on memory alone.

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

Debrief: Readers write about recent *FLYING LESSONS:*

CORRECTION: Concerning the video linked from last week's *FLYING LESSONS* showing the gear-up landing of a Socata Trinidad after warnings sounded for nearly a full minute, and my observation about what triggers a gear warning horn, three readers sent me notes with the same point here by Stu Spindel:

> The 'strut compressed' switch merely prevents retraction on the ground and will normally also sound the warning horn. In the example presented, the horn sounded because of the combination of retarded throttle position and gear not down. Two different issues.

Yep, you're right. Not an excuse, but an explanation: My workload was such last week that I wrote that entire issue in about three hours. I proofed it a few times but missed my mistake—unlike my editorial duties in my professional position (where Stu volunteers significant hours each month as a technical proofreader), I don't have the safety net of a review staff for *FLYING LESSONS*. Although I work hard to fact-check and review my work, sometimes something slips through. I guess that further illustrates my point about focus and avoiding status that doesn't fit your mindset. Thanks to all who wrote for keeping me honest—I apologize for my mistake.

See www.bonanza.org

Reader Craig Sherman wrote about a similar incident in a Socata Trinidad in AOPA *Flight Training* magazine "several years ago" (I've not been able to find it online to provide a link). Craig writes:

> In further hindsight, I think the ANR headset may also have been a factor.

That may indeed be the case, Craig. When ANR headsets were new my fellow instructors and I noticed it was very hard to hear stall and gear warnings in certain airplanes. Not every avionics

system pipes warning horns through the headset. Later headsets and alarms seem to have made this less an issue, but it's entirely possible many airplanes are still out there flying with difficult-to-hear warnings with the type of headset the pilot's wearing. It's important to determine under calm, controlled circumstances whether alarms are, well, alarming enough in actual flight while wearing your favorite headset in the airplane you're flying. Thanks, Craig.

Master instructor Zdravko Podolski asks a good question:

> …are [the] Trinidad's stall warning and gear warning backwards? All the small planes I know of have a steady stall warning horn and an intermittent gear horn. Is it possible that the continuous horn is in fact a stall warning horn if he is approaching at a very low speed and the gear horn only sounds at the end? I hope there are Trinidad pilots out there to clarify.

I believe they are in fact "reversed," Zdravko. It's easier to believe the pilot flew 51 seconds with the gear warning going off than he flew nearly a minute with continuous stall warning. I couldn't find the answer online…*is* there a Trinidad pilot out there who can tell us for certain?

…and reader Tom Allen relates some experiences:

> Years ago, I witnessed a car being hit by train at a railroad crossing. I got out of my car to help this young woman who was scared out of her wits and not hurt too badly. I was interviewed by lawyers from each side. Still today I vividly remember the crossing lights coming on well before the train arrived. Even though the crossing bells must have been blaring, I have no recollection of hearing them.
>
> Not long after I got my [Beechcraft] Bonanza, we arrived and entered the pattern at a local airport. I was showing off my new plane to my brother who was flying from the right seat. I remember thinking we are going way to fast on downwind before turning base. Extending downwind, I looked all around and knew something was wrong but could not put my finger on it. Back thru the checklist, ahhh, we hadn't put the gear down.

Interesting, Tom, especially about the train. As you know, I teach including the sound and performance effect of gear extension as part of the down-and-locked confirmation. Thanks.

Regarding to broader discussion of workload and task saturation, reader Duane Beland writes:

> In response to your article about "Task saturation" I recently had something similar happen to me. I purchased a [Piper] PA32 and was taking lessons from an experienced flight instructor. After several flights my CFI announced that I was doing fine and released me to fly on my own.
>
> It wasn't until several practice flights latter that I noticed that the rpm on the tachometer was only going to 2500 and not to the red line 2800 (I am trying to remember the correct numbers). I then checked the rpm during ground run and found this to be the case.
>
> The prop control cable had been replaced just before I bought the airplane and improperly adjusted. Both the CFI and I missed this error. I had it adjusted and the rpm returned to normal. I attribute my missing this glaring error to my newness to the flying this aircraft, the tach being far to the right and out of my line of sight and task saturation as I learned to fly an aircraft much more complex than I was used to.
>
> I attribute my CFI's failure to seeing this error to the fact that he had been flying a Maule M 6 which has the same engine but with rpm limited to 2400 to restrict its hp for that installation. We both failed to use the checklist properly.
>
> Thanks for your good work!

Thank you, Duane. That brings us full circle to a huge topics we'll delve into later in *FLYING LESSONS*: the proper roles, responsibilities and attitudes of the CFI and the Pilot Receiving Instruction (PRI) during the conduct of flight training.

Readers, 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.

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2010 National FAA Safety Team Representative of the Year
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