FLYING LESSONS for August 16, 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:

From the NTSB:

"Shortly after takeoff, the pilot of a Cessna 172 reported '…the aileron cable broke and …trouble keeping the aircraft in straight and level flight.…' According to numerous eyewitness reports the airplane appeared to be maintaining level flight and subsequently banked to the right, as viewed from behind, descended, and then impacted the water in a right wing down attitude.

"One eyewitness, in an aircraft that was following the accident airplane on final, reported that the airplane had 'made some zigzagging' prior to the aircraft banking to the right. The airplane fatally impacted the water surface with the right wing tip. The airplane cartwheeled and disappeared below the water surface.

"The airplane was recovered from the water. Inspection of the airplane showed the right aileron cable was separated at the pulley near the top of the left aft doorpost."

See www.ntsb.gov/aviationquery/brief.aspx?ev_id=20120726X21557&key=1

It may not have been possible to detect any problem with the aileron controls during preflight inspection or even in the Before Takeoff control checks. Certainly, if there is any unusual noise or obstruction to movement when you move the flight controls to the stops during your exterior walk-around, or anything at all out of the ordinary when you conduct your Controls—FREE AND CORRECT checks before taking the runway for departure, *cancel the flight and get the controls checked* by a maintenance professional.

With the average age of a general aviation airplane exceeding 40 years, we (and our mechanics and inspectors) need to pay special attention to items that didn't use to be problems, but now have the potential to cause catastrophe given the thousands of hours of fatigue exposure on a frequently flown airplane.

What may be even worse is an airplane that is not flown frequently. Airplanes that sit for long periods between flights are subject to something more hazardous than normal fatigue—corrosion. This brings us back to one possible factor in the fatal Cessna crash. Most aircraft control cables are impregnated with corrosion-protection oil when new. Over the years the oil within control cable strands will attract dirt and grime.

It's natural when seeing a grungy cable to wipe it clean. Doing so, however, can remove the corrosion-proofing lubricant from the cables, making them susceptible to rust and breakage. If you do clean a control cable, you need to follow up by re-lubricating it properly. We don't know if this was a factor in the Cessna crash, but it has been found to be a factor in control cable strand breakage on other airplanes, that might lead to a tragedy like that described by the NTSB.

Many *FLYING LESSONS* readers like to participate in the maintenance of their airplane. If you're a hands-on airplane owner, don't do *anything* without discussing it with an experienced mechanic.

There's a good reason all maintenance must be done by or under the direct supervision of a certificated mechanic—because without knowledge of the hazards, even seemingly simple and obvious things like cleaning the crud off control cables can have devastating long-term effects on airworthiness if done incorrectly.

From the NTSB:

"Prior to departing the pilot of a turbocharged Beech A36TC Bonanza observed that the right wing fuel tank was leaking at the sump. He removed the fuel tank cap, and observed that the tank was absent of fuel. The pilot [later] stated that the left wing tank contained approximately 33 gallons.

"The pilot departed and flew approximately fifteen minutes before turning on course. He [later] stated that, approximately 15 miles from the airport, the left fuel tank gauge indicated about 1/8 full, but shortly after, the gauge "shot up" to a 3/4 full indication. While on final approach for landing, at an altitude of approximately 200 feet, the engine experienced a total loss of power. The pilot switched the fuel tank selector to the right tank, and performed a forced landing to a field short of the runway.

"Postaccident examination revealed the left fuel tank gauge indicated 1/8 full, while the right fuel tank gauge indicated 1/4 full. The fuel tanks were visually inspected and no fuel was observed in either tank. The FAA inspector reported there was no fuel staining observed on either wing, and that when actuated the right fuel sump operated normally."

See www.ntsb.gov/aviationquery/brief.aspx?ev_id=20120801X82257&key=1

A frequent pilot shortcut is to estimate airplane endurance based on a typical cruise power fuel burn. In the A36TC, a routine cruise fuel flow might be 17 gallons per hour at roughly 65% power. This might cause the pilot to estimate he had just under two hours of fuel on board when taking off on 33 gallons of avgas.

But fuel burn for takeoff and climb is usually significantly higher than expected cruise fuel consumption. Pilots of turbo Bonanzas with whom I fly routinely comment on how takeoff and climb to even an 8000 - 10,000 foot cruising altitude will "go through a quarter tank of fuel" at the 33-35 gallon per hour flow required at high power in a low forward airspeed (i.e., low air cooling) flight regime. If 10 gallons (1/4 tank in the A36TC) was burned for takeoff and climb, that leaves about one hour and 21 minutes remaining at a typical 17 gph moderate cruise.

The Flightaware.com track of this flight indicates the trip as flown should have taken a hair over one hour if flown direct—leaving enough for IFR reserves *if* the pretakeoff endurance assumption was correct. With the real-world takeoff/climb fuel burn, however, the flight would have barely had enough fuel for VFR minimums at destination…*if* the pilot flew direct.

See http://flightaware.com/live/flight/N6672X

Including the pilot's seashore excursion, he was in the air one hour and 37 minutes—which figures out about right for 33 gallons given the real-world fuel burn of takeoff and climb. It got the pilot within about half a mile of the destination runway.

As an aside the Bonanza (like most general aviation airplanes) has a legally binding airworthiness limitation prohibiting any takeoff with less than a minimum amount of fuel in *each* main fuel tank (13 gallons each, in the case of the A36TC). See the Limitations section of your airplane's Pilot's Operating Handbook or equivalent. This is designed in part to give you a backup if for any reason you do not have the endurance you expect out of the other fuel tank—less fuel than you thought at takeoff, higher fuel burn or longer time aloft than you'd originally planned, or a fuel leak of some sort while in the air.

The *FLYING LESSON* to learn, however, is that short-cutting your flight planning by calculating endurance as a function of cruise fuel burn alone is not a good method of ensuring you'll be able to arrive safely at your destination.

No matter what the aircraft type, you must account for the higher fuel flows of takeoff and climb. Despite the prevailing wisdom, you probably *won't* make up the fuel burned in climb by reduced fuel burn during a descent.

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

Debrief: Readers write about recent *FLYING LESSONS:*

Last week's *LESSONS* included discussion of the hazards of flying after aircraft inspection or maintenance. Like highly qualified pilots, even expert mechanics can suffer from human factors issues. Reader Richard Willis comments about post-maintenance flying:

> I guess your article hit home this week, concerning maintenance. As a A&P/IA, CFII and part time instructor at the local A&P school, post maintenance test flights are hardly reviewed in school. Any qualified pilot rated in the aircraft can do the test flight.
>
> Well yes and no. As a civilian/military MTP [Maintenance Test Pilot] instructor for many years, the young A&P with a pilot's license may or may not have the experience to perform the required maneuvers and even understand the procedures that he/she is performing. The relationship between control movements, power adjustments and flight attitude may make a difference in the MTF procedure and the results of the test being performed.
>
> How do you teach a young inexperienced pilot to perform MTF on an aircraft out of maintenance? Good question. [What about] an aircraft owner who flies 50 hours a year or less, picking up the aircraft from an facility? Well, it's [all dependent upon] faith in the work having been performed [properly] and the pilot/A&P at the facility who performed the work. And [only if required, the pilot who] flew the aircraft, and the IA who released the aircraft for flight. As you are know there is a difference between a Bonanza [or a Piper Seminole, the subject of last week's *LESSON*] and a Cessna 150.
>
> Is it part of our initial pilot training to teach MTF procedures? Or do we concentrate on the tasks outlined in the [Practical Test Standards]? Can we teach both, or should we have a follow-on period of instruction for the [immediate post-checkride] student? Do our CFIs have the experience even, to teach a program on maintenance test procedures? From my experience very few [do] today.

You're exactly right, Richard. Most instructional effort is designed at getting the pilot to a point he/she can fly the maneuvers required for the certificate or rating sought at the time, with little to no time spent on teaching anything else.

For many years I've thought (along with others) that there needs to be a voluntary but solid curriculum for the prospective airplane owner. The program would include things like enhanced pre- and post-flight inspections (because no one else is looking at the airplane between required inspections); performance and engine data collection and analysis, working cooperatively with mechanics and inspectors as part of an airworthiness team (reader Mike Busch taught this as part of his his now-discontinued Savvy Aviator seminars) including (to your point) post-maintenance test flights; and understanding legal documents like airport leases and aviation insurance. Ah but for the time….

See:
www.mastery-flight-training.com/20120809_flying_lessons.pdf
www.savvyaviator.com/

Our recent density altitude discussion evoked these observations on the effect of humidity from frequent Debriefer Robert Thorson:

> The humidity performance decrement has been a topic of interest to me ever since a scary takeoff in 1999 with B747 freighter flying from Accra, Ghana to Amsterdam. At maximum gross takeoff weight, outside temperature 30C (a relatively cool night in the region) and very light rain (almost mist), we commenced takeoff. With 3000 feet remaining the airspeed was well below Vr and the thought of going off the end of the runway with 220,000 pounds of ripe pineapples behind me was really ghastly! The 747 has some wonderful attributes so I remembered the discussions about minimum unstick speeds, Vmu (basically how slow an airspeed you can get airborne) being one of them. It takes [the 747] about 1500 feet of runway to rotate and lift off so I pulled on the yoke and we used every square inch of the runway. We and successfully got off, accelerated to normal speeds, and retracted flaps.
>
> I had also considered "radar power" which is in excess of full rated thrust (it means to push the thrust levers until your knuckles go through the radar tube, which in a 747 is on the side so it's just a concept). The Pratt and Whitney JT-9 engines have additional thrust capabilities many other jet engines do not. The aircraft was getting towards the end of its life so you really can't push it so I let that option go. Thankfully no engines quit as we were well below any engine out speed.
>
> We turned north and after an hour, the Flight Deck being deadly quiet during this time, the First Officer turned to me and asked me first, what had happened, and second, how did I know the aircraft would fly that slowly? I responded that I did not know what the cause was and I had read about Vmu and previously calculated it, at various weights, in case I ever got in a bad situation. I was a big performance chart fan. I never really understood all the questions that can come up with contamination, engine intermix, system problems and had read the Boeing performance manual many times as well as done hundreds of "what ifs" with the performance charts. On any given trip we could end up going almost anywhere on the face of the earth, and did.
>
> Well it paid off big, but I still didn't know what happened. Several days later, talking to the Chief Pilot in New York, we decided humidity was the culprit. If you look at many different POHs, AFMs, RFMs, etc you will find that there is no humidity input. Talking to aeronautical engineers the consensus is that it is not significant. Recently I produced a helicopter webinar on the subject and after much research the FAA RFH states perhaps a 3-4% decrement due to humidity. I have also seen recent GA POHs that have a small percentage decrement. [Reader] Mr. Davis may have it right but he will have a very difficult time proving it to all the manufacturers in the world. I think the discussion needs to be resolved with factual data. Piston versus jets, turbo charging and a variety of issues complicate the answer. Intuitively I believe he may be more correct, having been on the short end of that stick!

Thanks as always, Robert.

Last week we also discussed cockpit management and the “sterile cockpit rule” as it applies to flying light airplanes. Reader Woodie Diamond adds:

> Having a flight instructor who is also a United Airlines driver, I am very familiar and constantly reminded of the “sterile cockpit” procedures. His favorite phrase to reiterate that rule is “Time to Fly!” I would add one more to your list, which he also requires [employing the sterile cockpit rule]: Within 10nm of the arriving or departing airport. It’s rather easy to remember and honor this rule on arrival, because this is the point when the landing lights are turned on.

See www.mastery-flight-training.com/20120809_flying_lessons.pdf

Thank you again also, Woodie. Reader Tom Allen notes:

> Great article on distractions while in a critical time of flight. I normally brief my passengers that there will be times when I will ask for silence so that I can focus on the task at hand. So when approaching the airport, I ask that everyone stop talking so that I can talk on the radio, work with controllers and prepare for landing. I also installed an intercom that has “Pilot Isolate”. I have had to use that on some occasions.
>
> I often give the person in the right seat, pilot or not, instructions on the gear down indication and ask that they help me on final approach by getting my attention if we do not have “3 in the Green”. I think they like feeling like they are participating. Often, they will verbally acknowledge “3 in the Green” after I do.

Thanks, Tom. Richard Willis also comments on CRM concepts for general aviation single-pilot operators:

> I teach critical altitude as the space between the ground and IFR approach pattern altitude. My reason is that the procedures in the checklist follow a set steps to get the crew to the ground safely. This way the student

> reads and has the procedures to follow, the time required to process the information and follow ATC guidance allows them to perform required steps in the checklist and react to other out side problems. As flight experience is gained the rule of critical altitude follows then.
>
> In the future can you get more into weight and balance and factors relating to fuel management in flight, fuel transfer? Thanks for a great blog!

Thanks again, Richard. Yes, I do requests…I'll try to work your questions into future editions of *FLYING LESSONS Weekly.*

Comments? Suggestions? Requests? Rebuttals? Send 'em in…to mastery.flight.training@cox.net.

Being Less Dense

Several readers sent along the link to a video that's seen a lot of exposure this past week. The occupants of a Stinson 108 all survived a density altitude-related impact with trees in the mountains of Idaho. AVweb reports that "weather at the time of the accident included an altimeter setting of 30.00 inches Hg with a temperature of 27-degrees Centigrade and a dew point of three. The observations result in a density altitude of 9,167 feet." Four adults were aboard the Stinson.

See www.liveleak.com/view?i=835_1344412426

One reader commented:

> "For the grace of God .. there go I..." I once did something similar... in a twin Cessna simulator! Very High density altitude, 10K, one engine failed, then I tried to nurse it for four minutes...unsuccessfully. How many of us would have pulled the plug on the Stinson after about a mile? Gee, so much flat land went under them [before they descended into the trees].

Another wrote:

> Just exactly how long does it take for someone to realize that taking off is a bad idea?! This airplane obviously was not going to fly! This guy not only took off, but settled back at least once that I can tell. In addition, he peddled in ground effect, passing up perfectly acceptable landing areas. INSANE!

Although taking off is seemingly simple (instructors often make us at least *think* we made the takeoff even on our very first *FLYING LESSON*), monitoring takeoff indications and choosing whether or not to continue is a very active process for the pilot.

See my articles "Abort, Abort…" parts 1, 2, 3 and 4. The real *LESSON* is to be ready to pull the power, set it down and bring it to a stop on every takeoff, *before* you get to the point you're aloft in ground effect or with little to no ability to climb…because once you're airborne your options are far fewer.

See:
www.ipilot.com/index.php/learn/6-emergencies/778-abort,-abort!-...and-how-to-avoid-it-(part-1)
www.ipilot.com/index.php/learn/6-emergencies/783-abort,-abort!----and-how-to-avoid-it-(part-2)
www.ipilot.com/index.php/learn/6-emergencies/792-abort,-abort!----and-how-to-avoid-it-(part-3)
www.ipilot.com/index.php/learn/6-emergencies/796-abort,-abort!----and-how-to-avoid-it-(part-4)

If it can happen to them…

1. Dark Night Approaches

This month's NASA Aviation Safety Reporting System (ASRS) *Callback* high"lights" the hazards of dark night approaches, as reported by airline crewmembers. If it can happen to these full-time professionals, then there's something for the rest of us to learn. Read *Callback 391* on Night Visual Approaches.

See http://asrs.arc.nasa.gov/docs/cb/cb_391.pdf

2. The Startle Effect

The most recent journal of the Flight Safety Foundation contains an interesting editorial tying together discussion of the Air France A330 prolonged stall to impact in the Atlantic Ocean, and an Airbus A340 autopilot disengagement event in cruise, also on a transatlantic trip. Both articles, by separate authors and according to the editorial, use the term "The Startle Effect" to describe the crews' initial, incorrect reactions to aircraft reaction as a result of being startled (surprised) by the indications the reactions presented.

"Sometimes [the startle effect] sparks primal, instinctive reaction, instant and inadequate motor responses…," states the report. "These basic reflexes may prove to be incorrect and difficult to correct under time pressure and may affect the pilot's decision-making ability." Investigators conclude that "initial and recurrent training as delivered today [in air carrier operations] do not promote and test the capacity to react to the unexpected. Indeed, the exercises are repetitive and well known to [airline] crews, and do not enable skills in resource management to be tested outside of [the training] context."

FLYING LESSONS reader Dr. Lorne Sheren and I co-authored an article in the November 2011 issue of *AOPA Pilot* that explains how pilots are pessimists in training, but optimists in their day-to-day flying—meaning they look for trouble when working with an instructor but are very likely to be surprised by abnormal or emergency situations encountered "for real." As we wrote, "The real trick to handling an emergency is realizing you have one in the first place." It takes fairly frequent, recent exposure to emergency procedures to be able to respond correctly if the occasion arises.

Even then, a pilot has to "fly through denial" of a problem long enough to acknowledge one exists. To fly through denial requires a pilot have good airmanship instincts, which can only be learned and maintained by practice. Practice can take many forms—flight instruction, simulator instruction, even simply reading and going through the physical motions of procedures while sitting in the airplane in the hangar or on the ramp.

Is your recurrent training preparing *you* for real-world emergencies? Or are you just practicing the same maneuvers and approaches you always do, logging the time without really making the effort to learn something new? Frequent thought about the indications emergencies might present in the cockpit, and practice of how you'd react to the initial indication that *something* is wrong, is the only way to be ready to fly through denial.

See:
http://flightsafety.org
http://flightsafety.org/asw/aug12/asw_aug12_p5.pdf
www.aopa.org/members/files/pilot/2011/november/technique_pessimists.html

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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
