FLYING LESSONS for February 7, 2013

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

FLYING LESSONS is an independent product of MASTERY FLIGHT TRAINING, INC. www.mastery-flight-training.com

This week's lessons:

Autopilots bear watching. Their proper functioning reduces workload and makes flying much more precise. Act unexpectedly or fail completely, however, and an autopilot rapidly turns a safe, predictable path into a surprising departure from controlled flight. If the pilot is startled enough, and fails to intervene in a split moment, the autopilot can suddenly drive the flight into extreme hazard.

The hazard of auto-driven loss of control is greatest in phases of flight when speed or configuration changes cause a change in airplane trim. Examples are right after liftoff, as the airplane levels off after climb or descent, when the pilot extends flaps and (as applicable) landing gear, and when the airplane slows down or pitches down to follow a programmed descent or approach.

An airplane was flying an autopilot-coupled instrument approach last week when its pilot reported a radical nose-down pitch change—strong enough to "blow at least two windows out" and possible damage the airframe. The pitch change occurred four or five miles from the airport inbound on an ILS approach using a GPS for primary guidance, say persons who spoke with the pilot. No small feat, the pilot was able to recover the aircraft and land.

That's about all we know so far about this particular instance. The mission of *FLYING LESSONS* is not to explain specific events (that's why we have the skilled professionals of the National Transportation Safety Board), but instead as the fine print above says, to "[use] 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."

Three possibilities come immediately to mind. First is an autopilot or trim malfunction resulting in a rapid nose-down trim change. I've experienced a pitch trim runaway in an A36 Bonanza and the onset and rate of departure downward in pitch was very surprising.

A second possibility is a pilot/technology interface error, i.e., loss of autopilot mode awareness [a term I learned from Greg Feith at the Great Lakes International Aviation Conference in January] and a pilot's sudden switch in autopilot modes as he or she discovers it's not in the mode the pilot wants or expects—with the autopilot diverging from what the pilot planned.

See http://en.wikipedia.org/wiki/Greg_Feith

A third possibility this time of year in the northern mid-latitudes is tailplane icing, which--if it results in a tail stall—gives precisely the pitch-over described by the pilot in the event that suggests these *FLYING LESSONS*. Tail angle of attack is increased with flap extension [a *LESSON* of Colgan Air 3407]. If the tail is contaminated with ice, extending flaps can drive it past its icing-degraded critical angle of attack. We do know that surface temperatures were below freezing and METAR reports indicate clouds varied from broken to overcast at about 3300 feet above ground level. The flight was apparently cruising VFR on Top of the clouds and presumably descended through potentially ice-laden clouds in its arrival.

See:

www.youtube.com/watch?v=_ifKduc1hE8
www.ntsb.gov/doclib/reports/2010/AAR1001.pdf

When flying by autopilot, watch its operation very carefully. Be especially wary when the airplane is changing pitch or heading or speed, or any time you're changing the airplane's configuration (flaps and/or landing gear position). Be especially watchful any time the trim position is changing—the possibility always exists that the trim will run further than expected.

An autopilot is not a "set and forget" technology—for all its capability and precision, your airplane's automation is not foolproof and, as electronics age along with our airframes, the possibility of malfunction grows greater.

An autopilot is a very capable, but very stupid copilot: it will usually do precisely what you tell it to do, whether or not that's what you really wanted. And any time you try to change modes in a hurry (such as if you thought it was in V-LOC mode but you'd left it in GPS, and you find and try to fix your mistake as you're intercepting the glideslope) you—or it—is more likely to fail in your efforts.

Use your autopilot to help you fly the airplane, but never let it fly by itself.

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

---

Debrief: Readers write about recent *FLYING LESSONS:*

There was a significant amount of reader mail in response to "Why Mastery Flight Training Has No Airmanship Award" in last week's edition.

See www.mastery-flight-training.com/20130131flying_lessons.pdf

Here's what some of you said:

Jim Lauerman, retired president of long-time *FLYING LESSONS* sponsor Avemco Insurance (link above), writes:

> All I can say is, "Amen!"

…and frequent Debriefer Woodie Diamond chimes in:

> **"….we congratulate and reward superior flying skills we call "airmanship" that, all too often, merely rescues the pilot (and passengers) from the results of his or her poor planning and decision-making…."**
>
> Awesome statement!

Thank you both.

David Kenny is Manager of Aviation Safety Analysis for AOPA's Air Safety Institute. David comments:

> Thanks for your forceful and accurate statement on fuel mismanagement! Most GA accidents are avoidable – but it's hard to argue that any other kind of accident is more avoidable than this. There

> is simply no legitimate excuse for running out of fuel, or for misconfiguring the fuel system so that usable fuel fails to reach the engine(s) before the aircraft reaches the ground.
>
> Technology may have played a role in the decrease in fuel mismanagement accidents between 2000 and 2008 – the number on non-commercial fixed-wing flights dropped by half over that period. An internal analysis by the Air Safety Institute found that airplanes less than 10 years old were much less likely to suffer these than older examples of the same models, ***regardless of whether the newer airplanes had glass panels or conventional analog instruments.*** Since 2008, however, the number of fuel-management accidents has begun to creep back up, as you illustrated with that graph from the *Nall Report*. The reasons for this discouraging development aren't yet clear, at least to me.
>
> Thanks for putting this problem front and center once again. This is one Lesson we, as a community, never seem to finish learning.

You're welcome, David. That's an interesting data point, that newer airplanes have (or at least before the economic downturn *had*) a lower-than-fleetwide incidence of fuel mismanagement mishaps. I wonder if newer airplanes' addition of low-fuel lights was enough to do the trick…again, at least while the economy was good. Thanks!

Reader Bob Beabout recounts:

> It is hard to imagine that a supposedly experienced instructor would take off on a 32-minute flight with 32 minutes of fuel on board? As dumb as that was, we never stop learning and need constant reminders. The fuel starvation graphs [from AOPA's *Nall Report*] you included with the Jan. 31 *FLYING LESSONS* were excellent eye openers.
>
> Looking back, I can think of three instances where I landed with less than 20 minutes [of] fuel. In analyzing each event there was something I could have done differently that might have prevented the situation. And after 60 years and 26,000 hours in the cockpit I'm having fewer new learning experiences, but I know a new one is out there waiting for me!

Australian reader Peter Gordon writes:

> Great article Tom. After reading *FLYING LESSONS* 31 Jan 13 regarding the Cirrus fuel exhaustion accident followed by the deployment of the Ballistic Parachute, am I correct in understanding that deployment of the parachute and the subsequent damage caused to the fuselage by the ballistic rocket "totals" the aircraft whether a successful "landing" is made or not?
>
> How can fuel management involving such a short flight of only 130 nm return with an Instructor results in an outcome that 'totals" the aircraft due to extremely poor flight planning. Unbelievable!

Although there are a few cases where a Cirrus airplane has been rebuilt and flown after deployment of the parachute system, the CAPS is designed for occupant survival, not survival of the airframe. The COPA website cited last week notes that terminal velocity under the 'chute is 1700 feet per minute, or about 30 mph descent into the ground. The Cirrus seats and structure, like a race car, is designed to make that impact survivable, if not necessarily one a pilot can "walk away from." That's a great goal, assuming the pilot pulls the Red Handle because the airplane cannot be flown to a lower-energy impact under control. In most cases of a CAPS deployment within the envelope (airspeed below 133 KIAS, altitude at least 1600 feet AGL) has successfully protected the airplane's occupants.

Bryan Neville, who is FAA's safety program outreach manager, adds from his own experience:

> I too was amazed at the news that for a short flight they thought they could fly on fumes! Was the POH faulty? I hesitate to refer to "Aviation Arrogance" as the cause!
>
> When I was an active flight instructor, I would ask pilots (at opportune times, of course!) three questions – Where are you? Where do you want to be? and, How will you get there safely? This is a good exercise on the ground (where teaching takes place) in front of a chart and then in flight (where demonstration of learning and practice take place). Just another way to help pilots learn to be situationally aware.

Those are great "how goes it" questions for any pilot, Bryan. Part of the issue may be that pilots tend to think about fuel burn in terms of cruise fuel consumption—"my airplane has five hours of fuel on board," etc. Cruise-fuel thinking can cause us to forget that fuel consumption may be

much higher during takeoff and climb. Even if the climb is short, the first quarter hour in flight is going to use much more than one-quarter-hour's worth of gas. If a pilot cuts his/her fuel reserves to a minimum using cruise fuel burn to estimate fuel required, he or she may come up short…as did the Cirrus pilot who prompted our discussion. Thanks, Bryan.

Reader John Townsley reminds us that although new technologies may modify the outcome, "all this has happened before, and it all will happen again":

> Pilot decision making, like it or not, often subconsciously includes automatic risk mitigation from installed equipment or system infrastructure. We see it all the time. During flight planning the pilot thinks, "I'll always know exactly how much gas I've got because my Mark IV gas checker tells me how much I've used." But, the fuel cap wasn't tight or someone didn't completely fill the tank… Or "it's great that I've got a coupled autopilot and GPS … I can just bore right through the 'haze' [a euphemism for "clouds"] and I can make it home in time for that football game…" But vertigo gets him and maybe he unintentionally disengages the autopilot.
>
> Your discussion of the CFI who heroically pulled the red handle and saved the day (when the aircraft ran out of gas) is similar to many others. Another Cirrus driver who was an IFR student in training [note my use of the word '*driver*'] recently killed himself + 3 when he ventured into IMC near Chicago. No IFR ticket, had to make the trip so he could attend an important football game at home… end of story and four lives.
>
> I ran across an old USAF accident report from 1958 recently that captures the essence. Two B-52 bombers loaded with state-of-the-art equipment collided and crashed in eastern Washington while in the pattern. Why? Several reasons, but high on the investigative list was "**an inordinate amount of reliance placed on electronic aids**…"

That seems to be a recurring theme not only in the latest designs, but overall in our increasingly tech-influenced cockpits. Thanks for the trip in the wayback machine, John.

Reader Paul Sergeant agrees—technology has promise and pitfalls. It's up to the pilot to choose which most influences a flight.

> I started driving (and flying) in the late 1970s. I never let the fuel in my car go below 1/4 full without immediately searching for a place to fill up, because I didn't trust the analog gauge and didn't want to run out of gas. In my late 1960s [Beechcraft] Bonanza, I also don't trust the gauges, and unless I'm calculating fuel burned by time from a known full state, I never let the gauges get into the yellow arc without filling up. After all, those gauges are only accurate when empty, useful but not pertinent information.
>
> On the other hand, my cars have all recently had "miles to empty" displays. I always fill my car up when the warning light illuminates with 50 miles to go. My wife lets hers get down to less than 10 miles to go regularly. That's fine, but it cuts into margin – what if all the gas stations with 10 miles have no gas, or no power to pump it? Unlikely, but it could happen. I think it's also possible that too detailed fuel information can lead to smaller margins in the air. And it can be wrong.

Good points, Paul, which echo the statistics David Kenny cited.

Reader and aerobatic instructor Bruce Williams illustrates a superb reason *not* to try to arrive with a minimal fuel reserve:

> Thanks for the latest issue of *FLYING LESSONS*. I entirely endorse your analysis and conclusions about fuel-related accidents.
>
> A recent incident at San Carlos, CA (KSQL) reminds me of another example of unforeseen circumstances—that are also out of the pilot's direct control. A Mooney landed gear up on the airport's only runway, closing the field for an extended time.
>
> I use that basic scenario in simulated situations and real-world flight training. You're heading to your intended destination. The weather's good, you got a briefing, checked the NOTAMs, etc. Yet as you approach the airport, another pilot lands gear up, ground loops, or misses a taxiway and ends up blocking the only runway. Do you have enough fuel to handle a diversion or delay? What if the weather is IFR, but the only approach above minimums is to the runway that is out of action? Or maybe the intended destination is in VMC, but the nearby alternates are fogged in (as might well be the case at an airport like KSQL) or backed up for approaches?
>
> You didn't create the problem. Your airplane is working fine. But if you're running on fumes (for the reasons you described), you have put yourself in bind.

That's a perfect example, and given the high rate of landing gear-related mishaps (LGRMs), a very real possibility. Thanks, Bruce!

See https://store.bonanza.org/store/items/detail/item/85

Reader Ronald Herold causes me to do a little soul-searching, always a good thing in a pilot:

> I do like your newsletter – but it's hard to put out a meaningful newsletter in a well-saturated and understood field as frequently as you do. I used to write a computer newsletter monthly – now I do it quarterly or when I have something to say. We all know what is best – let's say for fuel or weather or whatever. We don't do it. Most of us get away with it. A few don't. Many more shouldn't – but are 'lucky'. I am not justifying it – just saying that taking risks and 'the thrill' is just part of human behavior.
>
> Concerning your previous article – and then realization that it was fuel starvation – there is a reason it takes the NTSB a long time to put out both the preliminary report and the final report. I would suggest that you not use today's news as factual fodder for your newsletter. It risks your reputation and shows your tendency to 'want to take risks'.

I don't really consider myself a risk-taker (my 20-year-old son would certainly not call me one!), but I admit I was too quick to jump on the pilot-does-good bandwagon along with most of the aviation media when we first learned about a successful Ballistic Recovery Parachute deployment. As I said in this week's *LESSONS*, I use recent reports as triggers to discuss recurrent themes in aircraft operation and mishaps. I believe my readers and friends in the ranks and at the highest levels in NTSB, international equivalents and the Air Safety Investigator (ASI) world know I have the utmost respect and admiration for their work. When it comes to hard data I go with the official probable cause reports (such as those from NTSB used by AOPA to compile the graphs in last week's edition). But you're right, I have to be careful not to praise *or* find fault too quickly. And yes, as you know from your own experience, it's a real challenge getting *FLYING LESSONS* out virtually every Wednesday night. Thanks, Ronald!

Frequent Debriefer Karl Fischer chimes in:

> To add to your speculative "guesses" as to why pilots don't stop to refuel: might there be a "refueling reluctance" to stop if the plane…has had a history of a difficult hot/second start [requiring] an extended cooling-off of the engine (30 minutes or more) or lack of GPU [ground power unit] especially as the battery/starter fades? I for one have experienced both many times—but it has never stopped me from having to refuel.

I encounter "fear of hot starts" among many pilots. You may have a point.

My friend Amnon Shmueli, recently retired from the Israeli Air Force where he capped off a career as a fighter pilot and commander of a training and mission support unit using a fleet of high-performance, single-engine piston airplanes (Beech A36 Bonanzas), writes of his experience:

> Fuel or bad managing fuel at flight, from the way I see it is based on discipline! My background is military and I can hardly remember in the last 25 years any forced landing from that reason. Flying is a serious business and requires skill, professionality and discipline! (Even while driving my car I never goes below quarter tank...a habit.)

I think that's the real *FLYING LESSON* here. Pilots stretch fuel reserves out of concern for the cost, unease with the consequences of en route stops (time lost, lack of convenience, difficulty restarting a hot engine) or lack of familiarity with the fuel system and active fuel management. The flight training community as a whole does not adequately teach fuel monitoring and conservation methods. Evidence suggests that technology (glass cockpit systems, or something as simple as Low Fuel Lights) in newer airplanes demonstrably decreased fuel accidents, at least until (coincidentally?) the economy began to decline and fuel prices continued to climb, with the pilot's pocketbook (perhaps?) eclipsing the advances of fuel monitoring.

As Amnon reminds us, take the "personal" out of personal aviation, and fuel mismanagement accidents are almost unknown…at least in his experience. A little more planning and in-flight monitoring, and a few more hard-and-fast personal rules for fuel management and reserves, and we could eradicate this type of crash. Is it worth it to you to be less concerned about maximum nonstop range, and more willing to add fuel not because of price, but because you need it?

Something to say? Let us know, at Mastery.flight.training@cox.net

It costs a great deal to host *FLYING LESSONS Weekly.* Reader donations help cover the expense of keeping *FLYING LESSONS* online. **Please support *FLYING LESSONS* through the secure PayPal donations button at www.mastery-flight-training.com.** Thank you, generous supporters

Magenta Line Thinking

Several readers who attended my presentation "Magenta Line Thinking: The Promise and Pitfalls of Cockpit Technology" at the Great Lakes International Aviation Conference in Ypsilanti, Michigan last month asked for a copy of my presentation slides. They are now posted on the Presentations and Events page of the Mastery Flight Training website.

See:
http://greatlakesaviationconference.com/
www.mastery-flight-training.com/presentations_and_events.html

Share safer skies. Forward *FLYING LESSONS* to a friend.

Personal Aviation: Freedom. Choices. Responsibility.

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