FLYING LESSONS for April 27, 2017

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.**

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

Pursue ***Mastery of Flight***™

This week's LESSONS:

A Terrible, Encouraging *LESSON*

My worst fears have been confirmed. I first learned of the crash that prompted our most recent *LESSON*, the takeoff loss of control and fatal, fiery collision with the ground during the first flight of a Piper PA-12 after complete restoration, very shortly after it happened. It was just before I boarded the first leg of a commercial flight on my trip home from Sun n Fun. Three hours later, changing planes at Chicago, I got an update—and a couple dozen texts and emails from friends wanting to be certain I'd heard, and wondering what I thought might have happened.

See http://www.mastery-flight-training.com/20170413-flying-lessons.pdf

A small handful of friends know (because I texted with each privately) that, although I clearly had virtually no information on the event at that point, I voiced a "gut feeling" that investigators would find the controls to have been reversed and operating backward. I hate that I've been doing this long enough, and fatal crashes are predictable enough, that I could have that visceral perception with basically nothing to go on. But something just told me Air Crash Investigators (ASIs) would determine that was what happened.

That feeling is why I focused on post-inspection/maintenance/modification/restoration/repair (IMMRR) test flight in the last report, including this passage that specifically addressed what my instincts told me:

> **Pay special attention** to these things:
>
> - **Primary and secondary flight control continuity, correctness and connections.** Do the controls move in the proper direction and smoothly reach full travel in all directions? You may not be able to see the stick or yoke while you move the elevators, or vice versa: you may need a helper to make the first check. Ensure the controls are mounted correctly and secured, including safety wire, cotter pins, paint or putty markers where required, etc.

The National Transportation Safety Board (NTSB) investigated the crash on-site (unusual for a one-fatality crash) and has already published its preliminary report. Although the conclusions have not yet been drawn they may as well have been—for the NTSB "Prelim" notes no pre-impact failure of the engine or airframe but includes this very specific detail (emphasis added):

> The elevator control cables were found attached to the upper and lower ends of the elevator control horn in the tail of the airplane. Elevator control cable continuity was established from the control horn to the forward and rear control sticks. Manipulation of the elevator control cables revealed that ***a nose-up control stick***

> ***input resulted in a nose-down deflection of the elevator and vice versa***. Further examination revealed that ***the elevator control cables were improperly rigged, such that they were attached to the incorrect (opposite) locations on the upper and lower elevator control horn***.

See https://app.ntsb.gov/pdfgenerator/ReportGeneratorFile.ashx?EventID=20170408X41518&AKey=1&RType=Prelim&IType=FA

The likely scenario is that the pilot, highly experienced in flying DC-3s early in his 35-year airline career, held neutral elevator as the Piper accelerated down the runway and its tail lifted off the surface. As speed built he would likely have pushed the controls forward to raise the tail further, but because the controls were reversed this *would* have input UP elevator and *could* have propelled the airplane into the air at a very slow speed with the accordant high angle of attack. Sensing this, the pilot would have pushed the controls forward more, but that would only increase the UP elevator and make matters worse. In a very few seconds the angle of attack would have passed critical with the pilot doing the right thing in the cockpit but doing precisely the *wrong* thing the way the controls were mis-rigged. It would have been very confusing, and happen very fast. The highly experienced pilot didn't have time or altitude to diagnose the problem and alter thousands of hours of experience that said "back to nose up, forward to nose down" even to save his own life. There's video—I have no desire to see it; NTSB apparently has, and it's their job, not mine—that almost certainly shows something like this tragic—and fast—sequence of events.

You only have to go back two issues of *FLYING LESSONS* to find a discussion of the vital need for determining that controls are ***both* FREE *and* CORRECT** as part of the Before Takeoff checklist. In fact, since my work responsibilities prevented me from publishing the *LESSONS* while at Sun n Fun, the "controls check" *LESSON* was the most recent issue and still front-and-center on the Mastery Flight Training website at the time of the crash. Although the March 30, 2017 report focused on what I called **the second controls check**, that of an autopilot and electric trim system, it began by harkening back to our May 19, 2016 discussion of multiple general aviation, business jet and even military transport crashes directly attributed to the pilot or crews' failure to detect blocked or locked flight controls prior to takeoff on what would become multiple fatality crashes.

See:
http://www.mastery-flight-training.com/20170330-flying-lessons.pdf
http://www.mastery-flight-training.com/20160519-flying-lessons.pdf

The March 30, 2017 report noted that:

> **The purpose** of the control check is twofold:
>
> 1. To determine that the controls move freely throughout their entire range of motion, without restriction or "snags"—the ***free*** part of the check; and
> 2. To confirm that the controls have been connected properly, so they move as expected when the cockpit controls are moved—the ***correct*** part of the test.

We discussed that:

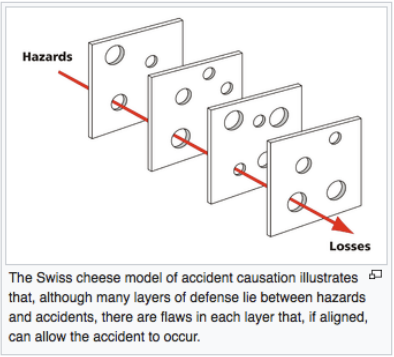
> [An] NBAA study, undertaken at the recommendation of the NTSB following the highly publicized takeoff crash of a Gulfstream jet blamed on control lock engagement, found that ***nearly one in five professionally-flown business jets*** took off without a proper **Controls—Free and Correct** check.

And considered that:

> If professional crews using challenge-and-response checklists and tasked specifically with watching each other to ensure compliance with procedures are omitting the controls check with such frequency, ***what are the chances that pilots of single-pilot airplanes*** without the in-cockpit quality control of a Pilot Monitoring (PM) ***are remembering*** to do a **Controls—Free and Correct** check ***every time***?

Sadly, we learned that *LESSON* again within a week of that report.

One *FLYING LESSONS* reader sent a simple, six-word comment to me after last week's report of the PA-12 crash: ***Tom, how could this possibly happen?***



The Swiss cheese model of accident causation illustrates that, although many layers of defense lie between hazards and accidents, there are flaws in each layer that, if aligned, can allow the accident to occur.

The answer, harsh though it may be, is even shorter: **complacency**. The pilot as builder did not check to catch and correct the error; the A&P mechanic who supervised the work, checked and endorsed the airplane as airworthy and ready to return to service did not find it; and the pilot did not find the error during his preflight inspection or catch it in the last-chance **Controls: FREE and CORRECT** step of his Before Takeoff check. In each of these steps complacency was potentially fatal. That all this happened without the problem being detected—that all the holes in the Swiss cheese lined up, to use a common accident-causation model—is amazing. **But it happened.** No one thinks it could, but it did. And it proves ***how very important* every one of these checks is*, every single time***.

See https://en.wikipedia.org/wiki/Swiss_cheese_model

For nearly 20 years my instrument students have heard me prompt what I call the **Itzhak Jacoby Memorial Instrument Check**. IFR pilots should check the proper operation of the primary flight instruments during taxi, to ensure all are working properly and within tolerance. The IFR Taxi Check is recommended by the FAA's *Instrument Flying Handbook* and evaluated by examiners using the Instrument - Airplane Airman Certification Standards.

Taxiing

1. Magnetic compass moves freely and is full of fluid.
2. Airspeed indicator reads zero.
3. Attitude indicator is erect and stable -- not deflected more than when turning 5^0.
4. Altimeter set within 75 feet of field elevation.
5. Turn coordinator indicates direction of turn -- no flag.
6. Ball moves to outside of turn.
7. Heading indicator turns freely and aligned with magnetic compass.
8. VSI reading zero (if not, note reading).

Dr. Jacoby was a former Israeli Air Force fighter pilot practicing psychology in the United States. He was an instructor in the American Bonanza Society's Beechcraft Pilot Proficiency Program. In and out of BPPP he was considered to be *the* authority on teaching partial-panel flight…that was his flight instructional specialty. He was also very interested in learning and teaching about aviation weather; about a week before Thanksgiving 1999 he called me to suggest we collaborate on a book together as well as a program for him to teach to Beech Bonanza and Baron pilots (this was years before I began working at ABS).

Tragically, however, on Thanksgiving Day 1999 he crashed his Bonanza shortly after takeoff into instrument conditions in what became one of the most damaging single-engine airplane crashes of all time. In addition to the three family members on board being killed, two persons in their homes on the ground suffered serious injury and 25 others had lesser injuries. Several apartment buildings and automobiles were burned on the ground, leaving dozens homeless. What happened? The NTSB determined that Itzhak's Bonanza's Horizontal Situation Indicator (HSI) failed shortly after takeoff as a result of failure of a vacuum pump coupling that would have also affected the attitude indicator. A partial-panel expert, Itzhak would have taught to transition to the Turn Coordinator (or Turn and Bank, if installed) for wings-level information, in additional to the airspeed indicator and altimeter for pitch information.

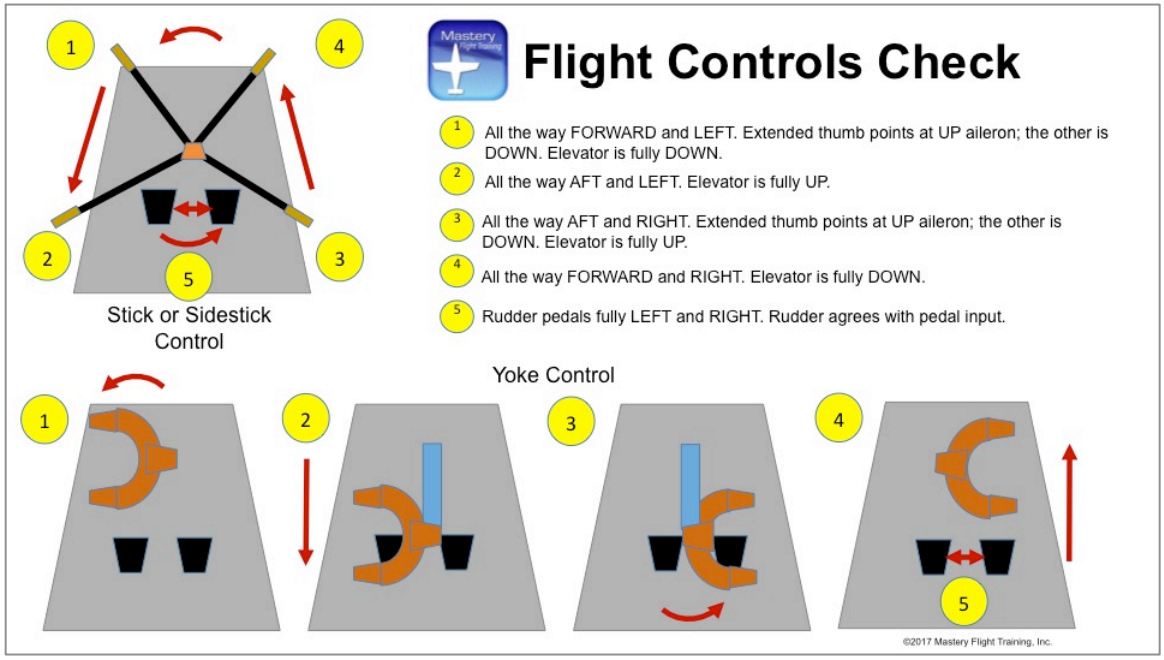
See https://app.ntsb.gov/pdfgenerator/ReportGeneratorFile.ashx?EventID=20001212X20151&AKey=1&RType=Final&IType=FA

Except that the NTSB discovered evidence that the Turn Coordinator gyroscope was not spinning at the moment of impact; more detailed accounts revealed corrosion that indicated the TC gyro had likely not been working for some time. When the HSI died Itzhak had nothing to fall

back on for his specialty of partial-panel flight. I can only assume that, knowing the vital importance of the Turn Coordinator as an emergency back-up, that he would not have flown knowing it was inoperative. I conclude that he was complacent, and did not routinely perform the IFR Taxi Check before departing into the clouds.

Very reverently I began calling these checks—which I find IFR pilots routinely do *not* do when taxiing out for training flights—the **Itzhak Jacoby Memorial Instrument Check**, using his experience to make the *LESSON* "real." Having known Itzhak, and knowing how passionate he was for instrument training, I am certain he would want us all to learn from his experience.

With equal respect I will now point out the **Tom Camman Memorial Flight Controls Check** to all my flight students. Like the IFR taxi check, I find a large number of my students skip the **Controls: FREE and CORRECT** step of their Before Takeoff preparations. If they do perform the check without prompting, most give the controls a little wiggle on way and another, but nowhere near their full range of travel, and without crosschecking that the controls actually move in the proper direction.



A proper FLIGHT CONTROLS: FREE AND CORRECT check is a five-step process that includes moving the controls through their entire range of motion and *visually checking outside the cockpit to ensure the controls move fully in the correct direction at each step.*

Remember the amazing insight originating with the instructors of the Cirrus Owners and Pilots Association: that **loss of *control* of an aircraft is always preceded by loss of *command* of the aircraft**. ***Command*** of the aircraft, in turn, is defined as ***knowing what the airplane is doing and what it will do next***, and by ***the airplane responding to our control and data inputs in the way we expect them to***.

Tom, my friend, lost ***control*** of the aircraft as it lifted off the runway. But he lost ***command*** of the airplane when he moved the stick one way during his Before Takeoff check, the elevator moved opposite the way he would expect…and ***he did not notice the discrepancy*** **and cancel the flight**.

Emphasizing the **Tom Camman Memorial Flight Controls Check** will protect pilots from mis-rigged controls; gust locks left installed; rocks or ice kicked into the controls, jamming them; wiring bundles behind the panel snagging flight controls; and almost any other inhibited control movement or control system failure that can be found before takeoff. I know Tom would want us

to learn from his experience and never repeat what happened to him. Adding a name to the controls check may make it more "real" for pilots…more *memorable*, to avoid complacency.

I'm working really hard to avoid complacency myself. But if I ever do something like Dr. J or Captain C I expect nothing less than for good pilots and instructors to use my experience to teach and warn others.

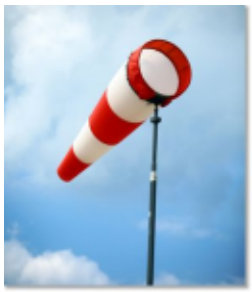
So the NTSB report is **terrible, encouraging news**. ***Terrible,*** because of what happened and how deeply it will affect so many people for so very long. ***Encouraging*****,** because it reminds us that by remembering to do one little step, **CONTROLS: FREE *and* CORRECT** before *every* takeoff, we could easily and completely eradicate a whole class of controls-related crashes that routinely takes down highly experienced commercial and military pilots…and the rest of us.

Yes, I'm talking to *you*! You know what you're supposed to do. You did flight controls checks on every training flight from the very first time you got behind the yoke or stick. If you're instrument rated you began doing the IFR taxi check when you started instrument training. You demonstrated remembering to do these checks, and did them properly, in order to pass the checkride for each certificate and rating you hold.

Keep doing* these checks,** and all the others. Instructors, **show no tolerance** for omitting these and other critical Before Takeoff checks. All pilots, **do them *especially if you think they are a waste of your time…because thinking these life-saving checks aren't important or aren't worth the effort is the first sign that you are becoming complacent. As we've seen, ***complacency kills***…even very good pilots.

Comments? Questions? Criticism? Let us learn from you, at mastery.flight.training@cox.net

---



What's the best way to estimate crosswinds?

Click here for a simple, effective, yet rarely taught tip.

See http://www.pilotworkshop.com/tip/estimating-crosswinds/turner

---

Debrief: Readers write about recent *FLYING LESSONS:*

Many readers responded to the last *LESSONS*. I'll edit out the condolences to keep the length in check. Thank you, however, everyone who expressed sympathies. I knew Captain Tom fairly well and always spent a lot of time with him at airshows where I worked. I was shocked…but nothing like the loss experienced by his family, close friends and co-workers who knew him much better and who deeply feel his loss.

Gold Seal instructor and frequent Debriefer Alan Davis writes:

> I just saw the initial report from the NTSB and was very disturbed to read the initial finding, as I am sure you were as well. It speaks to one of the things that I try to drill over and over - not only to pilots but also to A&P's with whom I speak - the **flight control test**. If you do not individually move the controls, call out what movement should be there, **and *SEE* the control surface(s) move in the correct direction**, you have not done the proper control check. In this case the elevator was rigged backwards, so forward motion increased the pitch up - and unfortunately the pilot did not figure it out in the very short time available before the stall. Of even more import to me is, ***how could any mechanic sign off the work on the airplane without doing and seeing the same thing?***

> This was a total failure on the part of both, and it led to the death of a very good pilot and a friend to many, I am sure. Tell everyone: **Do the real and complete control check, called out and visually confirmed - *EVERY TIME*!**

AOPA Air Safety Institute statistician David Kenny adds:

> This is at least the third fatal accident I'm aware of in similar aircraft (the other two were PA-11s) resulting from the elevator cables having been connected backwards, and that fact having gone undetected until the first test flight. You've written before about **how easy it is to overlook the "*and correct*" part** of the "flight controls free and correct" check. This tragedy brings that *LESSON* home once again.

Reader Andy Reardon says:

> Tom, this is another of your great articles. Sad outcome, but a trenchant reminder to us all.

Reader Doug Linville correlates this *LESSON* to other post-shop return-to-service test flying:

> So here's the situation: Time for my static check, so I call my local mobile static check technician. He does his check, signs my logs and I'm good to go. I fly my T-6 and all seems fine. Except, the ASI [airspeed indicator] is reading off compared to my seat of the pants feel. **Something just doesn't seem exactly right.** I call the tech a couple of times explaining my concerns, but he reassures me--and if I really have concerns to have my avionics shop look. Dang! I just spent $200 for him to do that!
>
> I drain the static lines--maybe some water blows out. And fly some more. Peculiar. When I open my canopy, the ASI speeds up. Odd. I mention the irregularity--AGAIN. Nothing from the "expert." Here's what I found: The static line was not reattached. It's just hung free behind the avionics hatch. [Now it's] fixed!
>
> Annual. Flaps don't quite close symmetrically. The pushrod for the flaps is bent due to overspeed. Due to the misinformation on the ASI, I have deployed flaps above Vfe for about three months. All because I didn't listen to that little voice. **When that voice speaks, *LISTEN*!**

Reader Rick Baron does the same:

> Just last week I had a DG [directional gyro instrument] replaced in my Piper Archer III. After the install I did a couple touch-and-goes at my class C airport where the work was done and all was fine. The next day as I was doing a preflight the yoke was sticking, for both rudder and aileron. **At times it was fine and at times it was sticking. *That was a no-go for me.*** I took it back in and apparently a plug behind the DG had dislodged and was caught in the yoke mechanism. The avionics person said it was totally his fault as he had not connected it properly. **The scary thing is it was fine on the first preflight and flight, but the next day it was not!**
>
> I just got my [pilot certificate] a year and a half ago, I just got this plane a year ago, and I just began my IFR training a month ago. At this time I'm considering quitting flying. Not because of my abilities, but *because of all the other possibilities that can lead to a fatal or non-fatal accident,* such as what happened to your good friend. This is not the first time this avionics person failed to perform his job properly although the other mistakes were not as life threatening (such as forgetting to reconnect all the wires in my AP another time when I had it in the shop).

And reader Andy Matykiewicz adds:

> I sat next to Tom at lunch during the January ABS meeting in Daytona Beach. That was the first time we met and I really enjoyed speaking with him and hearing about his experiences and about some of the people we both knew. I decided Tom is someone I would like to know better. I feel his loss and it makes me sad. Like the loss of my son's roommate Jamie from Navy T-45 training who crashed piloting his RV two years ago. Or the young pilot in Kansas who crashed recently just weeks after purchasing a Bonanza. Each accident has elements that make me question if I have what it takes to be a good, safe pilot. ***Is motivation and effort enough to keep me and those who depend on me safe*** and free from the pain I have the potential to cause every time I fly my Bonanza? I suppose that question will always be there sometimes burning and sometimes quietly in the background. ***What I do about it* may be the deciding factor.**

There are many more emails in my Debrief in-box, and I'm certain these will prompt even more. I still contend there is an encouraging note to Itzhak's and Tom's last flights, that repeating each scenario and many like them is preventable by continuing to uphold the level of care necessary to pass even the entry-level tests for a pilot certificate and an instrument rating. The high level of experience Itzhak and Tom had makes us particularly uncomfortable in cases like this—because **we can't say, *"I have so much experience that could never happen to me."***

Readers, what do you think? Can we choose to overcome complacency? Making that choice, can we stick with it? ***What can we do to be sure?***

Comments? Questions? Let us learn from you, at mastery.flight.training@cox.net.

Please help me cover the costs of providing *FLYING LESSONS* through the secure PayPal donations button at www.mastery-flight-training.com.

See https://www.paypal.com/us/cgi-bin/webscr?cmd=_flow&SESSION=jMcKFayMMh_ud6KQj8vXXTFJ53cp9ZrBHs8CfhHj24jzsqiF9aTOisrjgUi&dispatch=5885d80a13c0db1f8e263663d3faee8d333dc9aadeed3fe0b5b299d55fd35542

Or send a check to **Mastery Flight Training, Inc.** to 247 Tiffany Street, Rose Hill, Kansas USA 67133.
Thank you, generous supporters

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

Pursue *Mastery of Flight.*

Thomas P. Turner, M.S. Aviation Safety
Flight Instructor Hall of Fame
2010 National FAA Safety Team Representative of the Year
2008 FAA Central Region CFI of the Year
Three-time Master CFI
