FLYING LESSONS for September 2, 2021

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 in your success as the 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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This week's LESSONS:

It's Standard Operating Procedure (SOP) to avoid flying closer than 10 miles from a thunderstorm, no closer than 20 miles from storms identified as "severe." From Chapter 7 of the *Aeronautical Information Manual* (my emphasis added):

> There is no useful correlation between the external visual appearance of thunderstorms and the severity or amount of turbulence or hail within them. ***The visible thunderstorm cloud is only a portion of a turbulent system*** whose updrafts and downdrafts often extend far beyond the visible storm cloud. Severe turbulence can be expected up to 20 miles from severe thunderstorms. This distance decreases to about 10 miles in less severe storms.
>
> Weather radar, airborne or ground based, will normally reflect the areas of moderate to heavy precipitation (**radar does not detect turbulence**). The frequency and severity of turbulence generally increases with the radar reflectivity which is closely associated with the areas of highest liquid water content of the storm. NO FLIGHT PATH THROUGH AN AREA OF STRONG OR VERY STRONG RADAR ECHOES SEPARATED BY 20-30 MILES OR LESS MAY BE CONSIDERED FREE OF SEVERE TURBULENCE.

See https://www.faa.gov/air_traffic/publications/atpubs/aim_html/chap7_section_1.html

I've addressed this in much greater detail in past *FLYING LESSONS* and in an article in the October 2015 *Twin and Turbine* magazine. In that article I address exactly what we need to be keeping separated *from*:

> Dr. David Strahle developed an operating logic in the 1960s that pioneered digital transmission of weather radar information, eventually into the cockpit in flight. Dave is known as "the father of datalink radar." A very active IFR pilot, he is an expert on weather radar interpretation and regularly consults with Government and private authorities and air crash investigators. His profession is as a radiologist...who better to analyze radar cross-section returns with a fresh, new outlook than someone whose industry-leading career is interpreting cross-section imagery of cancer patients?
>
> Dr. Strahle is the extremely-rare authority who not only knows his stuff, but is also makes it extremely easy to understand the very advanced topics as a speaker and lecturer. I've heard him speak on inflight radar uplinks four times, and would do so again in a minute. I highly encourage you to watch for him on the speaking circuit and attend his presentations. In his Oshkosh 2015 talk, he emphasized: **It's generally safe to fly through areas of light precipitation ("green" returns on most radar plots), *if there is no moderate or greater precipitation associated with those clouds*.**
>
> However, Dr. Strahle tells us, ***if there is* any *moderate precipitation in the radar plot (generally yellow), you need to remain at least* 10 miles away from even the light (green) returns *that surround the heavier precipitation. If there is heavy (often, but not always, orange or red) or extreme (darker red, white or other) precipitation, remain at least 20 miles away from even the light (green) returns*.**

> Why is this? Research shows that individual thunderstorm cells will "share" or "exchange" energy, creating massive areas of instability and turbulence between them that may be invisible to radar...and even to the eye. If there is any precipitation at all in an area of storms with moderate or greater precipitation returns, anywhere in the cluster, researchers tell us there is the chance of extreme turbulence hazard. Dr. Strahle warns that **if thunderstorm a complex has enough energy to create yellow or red radar returns, it has enough potential to create turbulence anywhere within or near the cloud.**
>
> **So, what exactly should you stay 20 miles away *from*? If there's moderate, heavy or extreme precipitation in the cell at all (yellows, reds or worse), it's not safe to be *anywhere* in the precipitation footprint of that cell. Remaining 20 miles clear of that thunderstorm means staying 20 miles or more away from the outside edges of *even the lightest, green radar returns.***

See: http://twinandturbine.com/article/turbulence/

Thunderstorm avoidance means avoiding any precipitation, even areas of "green," if they are part of a complex that includes yellow, red or worse returns.

Similarly, when approaching an airport for landing it's just as vital to stay away from storm-related turbulence. The closer you get to the ground the less room you have to recover in a turbulence encounter. Don't think it's safe to fly under the clouds outside of precipitation either. The same *AIM* reference cited above also adds:

> Turbulence beneath a thunderstorm should not be minimized.

If convention, science and good sense tell us to remain well clear of thunderstorms in cruise, approach and landing, then why do we keep trying to take off just ahead of a storm? Consider this report from *AVWeb* this week:

> All four people and a dog aboard a Cirrus SF50 VisionJet walked away from…an accident…at…Lansing, Michigan…. The single-engine jet went through a fence at the end of a runway during a takeoff attempt with a thunderstorm approaching the airport. A wind shear alert was issued just before the aircraft was cleared to take off, according to ATC recordings posted to YouTube with a simulated cockpit view of the crash sequence whose accuracy is unknown…. Weather at the time of the crash…was unstable with thunderstorms in the area and gusty winds. A cell passed over the airport just after the crash and dumped a half inch of rain in about 20 minutes as firefighters put out the blaze. It has not been confirmed if the weather was a factor in the crash.

See:
https://www.avweb.com/aviation-news/four-people-dog-walk-away-from-cirrus-jet-crash/?MailingID=705&utm_source=ActiveCampaign&utm_medium=email&utm_content=Afghan+Pilots+Seek+Asylum%2C+Drone+Mystery+Deepens&utm_campaign=Afghan+Pilots+Seek+Asylum%2C+Drone+Mystery+Deepens-Monday%2C+August+30%2C+2021
https://www.youtube.com/watch?v=Kn7W-Kcp-g8

A posted transcript of the LiveATC recording includes this exchange stated to be from the accident sequence:

> Tower: N1GG Taxi 28L via C, B
>
> Tower: Vision Jet 1GG We do have a storm rolling in from west to east, I can offer you opposite direction off of 10R if you Prefer.
>
> N1GG: Yeah let's do that that way we can turn and get out of here.
>
> Tower: Roger, and Winds 280 @ 7, RW 10R taxi via C, C1, B, Cross 24
>
> N1GG: C, C1, B, and 24
>
> Tower : Convective Sigmet Warning (Hazardous Weather advisories on another frequency possibly)
>
> N1GG: Tower, this is GG we will be ready to go when we get to the end for release.
>
> Tower: 1GG Roger, just be advised we do have Oscar on the ATIS we got some new weather on there as well.
>
> N1GG: Copy that, we will get Oscar, but we are ready to go when we get to the end ahead of the storm
>
> Tower: Cleared for takeoff.
>
> N1GG: Cleared for takeoff GG
>
> Tower: Jet 1G,G Wind sheer Alert, 20 KT + (plus) on 1 Mile final for runway 28L Approach
>
> Tower: Vision Jet 1GG Tower, Do you need any assistance?

Departing away from the storm potentially set the airplane up for a wind shear from the tail as the gust front reached the airplane. A shear from the tail is a performance-robbing event—indicated airspeed decreases during the transition into the moving air mass, reducing lift. For the brief moment the airplane is in this transition it may stall, or at least climb much less well, and impact the ground. At least that's one possibility the information we have so far suggests the NTSB will likely investigate.

See https://archive.liveatc.net/klan/KLAN-Aug-24-2021-2230Z.mp3

We usually consider SOPs for thunderstorm avoidance in cruise flight. We often think about it when making an approach and landing. But the turbulence and wind shear hazards of thunderstorms apply *any* time you're in the air…or trying to get into the air.

Don't try to beat a storm. Do not attempt to take off when a storm is within 10 miles, or if the storm is severe, when even the "green" precipitation is within 20 miles of the airport.

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

Debrief: Readers write about recent *FLYING LESSONS:*

Reader Brian Sagi continues the discussion of last week's Debrief:

> …adding to the *LESSON* that arose from the Challenger accident:

> One major reason that judging speed in pressurized aircraft is difficult is that the cabin is well insulated. Therefore, even when flying at vastly different airspeeds, the aircraft does not "sound" much different. In a Bonanza, Cessna 182, etc., the pilot is receiving a lot of auditory cues about speed -- the airplane "sounds" distinctly different at 70 knots compared to 110 knots. Of course, in an aircraft with a constant pitch propeller, such as a Cessna 172, propeller RPM sound adds yet another auditory cue to airspeed. None of those auditory cues exist in pressurized aircraft, and even in some well insulated non-pressurized aircraft such as the Cessna TTx and the newer model Cirruses.
>
> Twice in the last year I have flown with students who, on final, were so focused on conflicting traffic that they let their airspeed decay -- from around 110 knots to near stall. One experience was in a Columbia 400, and the other was in a TBM turboprop. Both situations played exactly the same way: the tower controller pointed out traffic ahead on final, and ***the student became so singularly focused on maintaining separation from the traffic that they forgot to scan the airspeed and Angle-of-Attack (AOA) instruments***. Both pilots were highly experienced, and to both it was an eye-opening experience. "How did the airspeed diminish so quickly?" was what they both said after the experience. (On purpose, I elected to let the situation play out, as we were at a sufficient altitude and with sufficient stall margin that safety of flight was assured.) **I can easily imagine how being motivated with making a runway in limited visibility can cause a singular focus on the flight path, to the exclusion of airspeed control**.
>
> The *LESSON* here is that speed control (really, AOA control) in the slow flight regime is paramount. Yes – **you should be "head out of the cockpit" most of the time on final. However, you should also scan your airspeed indicator and, if you have one, your AOA indicator, every few seconds**. This should be second nature.
>
> In the age where military aircraft had only one pitot tube, most air forces would prohibit a pilot whose airspeed indicator became inoperative during flight from landing, unless they were shadowed by a chase airplane flying at proper approach and landing speeds. This is precisely because **it is very difficult to judge speed in aircraft that don't provide much auditory cues**.

Thanks for adding your experience to the discussion, Brian.

See https://www.mastery-flight-training.com/20210826-flying-lessons.pdf

Reader Dan Drew adds to the Debrief about mountain flying and high altitude performance:

> I am reading the book *Mountain Flying Bible Revised* by Sparky Imeson and in reply to your comment about techniques for go arounds in high density altitudes (yesterday's *FLYING LESSONS*), I just happened to be in the section of the book about Takeoffs. On page 2-30 in Chapter 3 the section "Procedure for Leaning - Landing" status "**After descending to pattern altitude, follow the procedure for leaning - cruise to obtain the go-around mixture setting".** That section, starting on page 2-28 covers Fixed Pitch Propeller and Constant Speed Propeller and then breaks it down further to how your plane is equipped, i.e. no EGT or fuel flow, or having an EGT and/or fuel flow, normally aspirated or turbo, and set up like you are in cruise for that density altitude.
>
> Basically, I surmised that he is saying "we are flying leaner in cruise and we just need to **enrichen to what is best power for a possible go around**." The approach power mixture is or may not be adequate for best power for a go around. The old adage of being ahead of the plane and that ***every approach is flown to a missed approach*** and if we land that is just the gravy so just think of "what do I need for a go around as far as power" and set up for that.
>
> I personally fly LOP [lean of peak EGT] and after a couple of times on approach had to go around without changing the mixture, I came to realize that **the little bit of "work" I saved by keeping the mixture lean so as to avoid the extra "work load" of re-leaning for ground operations was to offset by the "oops" I need to quickly enrichen the mixture for go-around** while in the process of pitching up, powering up and cleaning up.
>
> Trying to learn as a flat lander how to safely operate at the higher density altitudes.

Many pilots disagree, but I'm in your camp about getting the mixture on the rich side of peak before approach and landing. I also advance the propeller to the climb setting before an approach in airplanes with controllable pitch propellers. The law of primacy says that under stress you'll do things the way you first learned, and that means "if I need more power I push the throttle control forward." If the mixture is rich of peak that adds power, but if it's lean of peak adding throttle makes it leaner still and that means power will decrease. I like the simplicity of single-lever power control, and again, it's the way you learned first and are therefore most likely to do when surprised.

The trick, then, is to estimate the mixture setting that will result in maximum power in the event of a go-around. If you know the proper fuel flow for climb at the altitude you're climbing from, and/or the exhaust gas temperature for climb, you can fine-tune the fuel for this setting after first becoming established in climb. Thank you for your insights, Brian.

See https://www.amazon.com/Mountain-Flying-Revised-Sparky-Imeson/dp/1880568179

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