FLYING LESSONS for June 28, 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:

Recently I was instructing an experienced pilot in his V35B Bonanza. The pilot's V-Tail, originally designed for 285 horsepower, has been modified with an IO-550R engine developing 310 horsepower maximum at sea level. Even at a safe 5500 feet (about 3000 above ground level in central Kansas) the engine produces significant residual power at full idle, helping keep the light V35B aloft.

As frequently happens when practicing stalls in the fairly light, forward-center-of-gravity condition common to training flight, the Bonanza did not attain a traditional "stall break" when I asked the pilot to fly an approach-to-landing, power off stall. Doing a good job of flying the recommended one-knot-per-second deceleration in the stall maneuver, the pilot increased back pressure and the airplane slowed. Soon the stall warning horn was sounding and the indicated airspeed was hovering in the mid-50 knots range, but the nose didn't seem to want to drop.

The pilot continued to apply back pressure until I pointed at the vertical speed indicator (VSI). Although the nose was still high the VSI was showing a nearly 800 foot per minute rate of descent. The stall warning was blaring and the pilot was trying to make it stall, not realizing the airplane had settled into what's commonly called a "mush": an uncorrected descent caused by high drag at a high angle of attack—a stall by another name. We were going down, and if we were on final approach or trying to clear a tree line on departure we would quickly descend into obstacles. Yet it appeared to the pilot that the airplane had not stalled, not yet.

Adding back pressure only made the mush more pronounced. When I pointed out the indications the pilot found that mush recovery is the same as that for other stalls: reduce the angle of attack (AoA), unload the wing (generally, reduce the bank angle with rudder), add power, and reduce drag (flaps up, gear up).

I don't blame the pilot for failing to recover at the onset of mush. We instructors generally don't do a good job of teaching how to recognize a mush, or why "mush awareness and recovery" is as important as that of stalls and spins. It's as if we barely think about the vertical speed stall-recovery trigger, with an asterisk and in fine print:

> Recover at the first aerodymamic indication of stall*
>
> *or if the vertical speed shows a descent with the elevator in or near the full up position

The recently updated (June 2012) U.S. Federal Aviation Administration Practical Test Standards for Private pilots includes "Stall/spin awareness" as a Special Emphasis Area on Practical Tests, but it doesn't give us much guidance:

> ***Stalls and Spin Awareness***
>
> During flight training, there must always be a clear understanding concerning stalls and spin awareness. All stalls at the Private Level will be in accordance with FAA policy. All stalls will be recovered no lower than 1,500 feet AGL for single engine airplanes; 3,000 feet AGL for multiengine airplanes, unless the manufacturer recommends a higher altitude to initiate the recovery.

The FAA *Airplane Flying Handbook* does bury this point in a chapter-long discussion of stalls and stall recoveries:

> In the power-off stall, the predominant clue can be the elevator control position (full up elevator against the stops) and a high descent rate.

The FAA's criteria for satisfactory recovery:

- Maintains a specified heading, ±10°, if in straight flight
- Maintains a specified angle of bank not to exceed 20°, ±10°, if in turning flight, while inducing the stall
- Recognizes and recovers promptly after a fully developed stall occurs
- Retracts the flaps to the recommended setting; retracts the landing gear if retractable, after a positive rate of climb is established
- Accelerates to VX or VY speed before the final flap retraction
- Returns to the altitude, heading, and airspeed specified by the examiner.

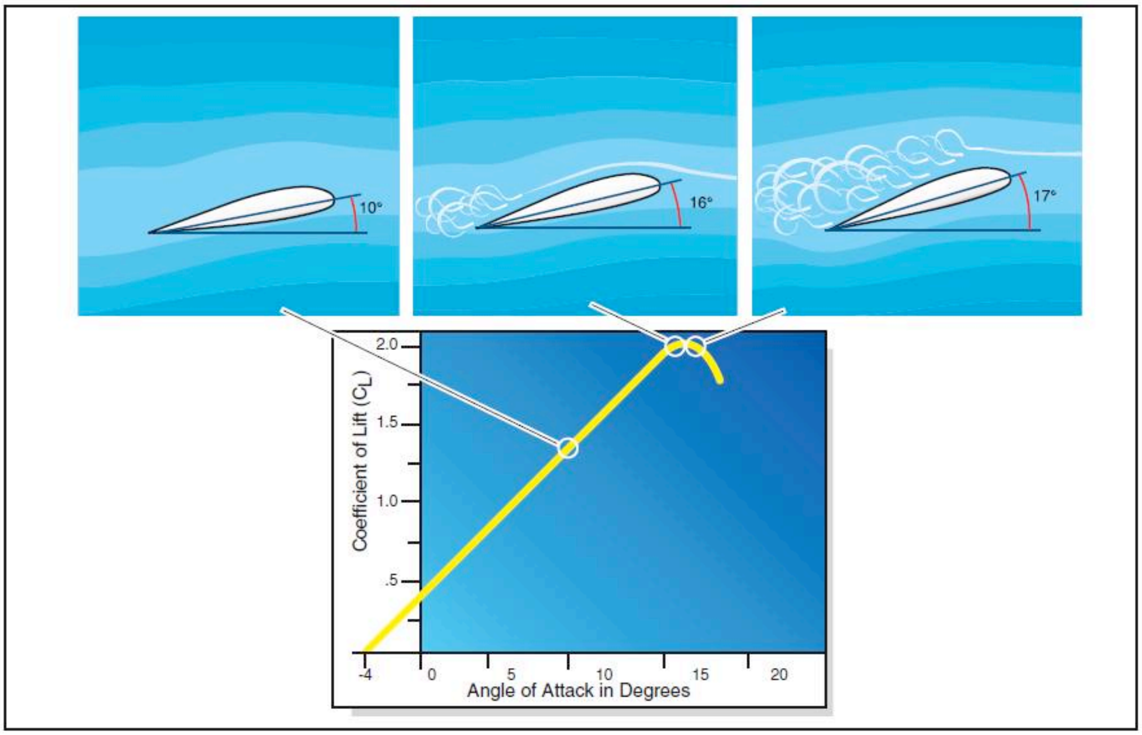

Figure 4-2. Critical angle of attack and stall.

Although the assumption may be that pilots learn the cause of stalls and the proper recovery technique from other sources during training, the term "angle of attack" does not appear in the Practical Test Standards. But if you think about stalls in terms of AoA and not just pitch attitude, you can easily visualize a condition where the airplane's nose is pointed up but the wing is stalled and the airplane is going down.

Most airplanes don't have an AoA indicator, but the condition would be obvious in an airplane so equipped. With or without an AoA display, *this* is the level of awareness we must attain to safely fly in the airport environment.

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

Debrief: Readers write about recent *FLYING LESSONS:*

Reader Peter Cassidy writes about last week's discussion regarding thunderstorms and in-cockpit weather display systems:

> I believe two subjects in the article warrant more discussion: (1) strategic vs. tactical and (2) Increasing aircraft utility. Here are my thoughts.
>
> 1. I've long wrestled with the distinction between strategic vs. tactical use of NEXRAD in the cockpit. I've come to the conclusion that the distinction is not helpful. When you are in the air, it's all tactical. **It's all about weather avoidance even when the weather is 100 miles out.** Calling your planned route and actions strategic or tactical is meaningless. We're telling pilots that if you are xx miles from thunderstorms you're being strategic, but when you go closer you're being tactical. Nonsense. **The job for the pilot is to interpret to data to ensure a safe flight taking into consideration the capabilities and limitations of the available data.** This applies to airborne radar as well; different tool, different limitations, but same goal. I would like to see us stop using the strategic/tactical distinction and focus on the importance of developing a solid understanding of the tool's capabilities and limitations and how to use it to the best advantage. I have pilot friends who fly with NEXRAD but won't spend the time to really learn its capabilities and limitations because they say they only use it for strategic planning. *Ever experience un-forecast weather?*

Exactly! "Strategic" and "tactical" are terms most of us use in weather avoidance instruction, and then we spend most of our time explaining what we mean by each term. Sources of weather in the cockpit—from active radar to NEXRAD to lightning detectors to calls to Flight Watch to your eyes—are all "go there" or "don't go there" decision-making aids. As Peter points out, taking the time to fully understand the use and limitations of each source, and keeping those limitations in mind at all times, permits making decisions about how close you can get to weather hazards. Peter continues:

> 2. The John King reference concerning NEXRAD and aircraft utility is off the mark or at least incomplete. As well as improving flight safety, NEXRAD in the cockpit it clearly a tool that can increase aircraft utility. There are many flights I make today because I have NEXRAD available and the level of safety is at least as good as before I had it if not better. People who play down the utility aspect of NEXRAD in the cockpit are not doing a credible job of representing the usefulness of the tool. **The effectiveness of NEXRAD in its impact on both safety and utility is strictly a matter of how the pilot applies it.** Here John King is right about pilot psychology, but it's not unique to the use of NEXRAD in the cockpit. The issue in this accident is about pilot judgment. The tool at hand just happened to be NEXRAD. The bottom line on this is that pilot decision making is critical when you are in the air, especially around weather. **Pilots need to be cognizant of their tendency to take on more risk than is reasonable** notwithstanding having a good understanding of the capabilities and limitations of tools available like NEXRAD in the cockpit. **We need to get over the notion that we're better than the average pilot**.

More great observations. Having spoken with John King many times, I believe he'd agree with your point that NEXRAD is just one example of how many pilots *believe* they are making better decisions because they have invested in a technology, when they may be unconsciously increasing the level of risk because they are not using that technology properly. Certainly NTSB experience confirms that NEXRAD is frequently an easily identifiable example of misuse of cockpit technology. Thanks, Peter, for your insights.

See www.mastery-flight-training.com/20120621_flying_lessons.pdf

Reader/instructor Tony Johnstone adds:

> The weather accident you reference (I believe it was a King Air flown by a 500-hr pilot- I read the NTSB reports almost as religiously as you!) is eerily similar to the close-to-home PC12 one a couple of weeks ago in Florida. Same scenario, low-time (at least in type) owner-pilot, get-there-itis, flew right into a big Florida storm at FL260 and broke up in flight killing a family of 6. Could have waited, gone a hundred miles north or south and got around (not too long at 255 kts), but selected neither of those options. I'm pretty sure he had some type of onboard weather +/- radar but obviously had no concept of the power of a big southern spring storm.
>
> As you probably remember, my dad learned to fly in WW2, at No. 5 British Flying Training School in Clewiston, FL. Years ago he told me about being sent off to search for a B-25 that had flown into one of those monsters. The engines from that aircraft were recovered approximately 25 miles apart. I have maintained a healthy respect for thunderstorms all of my flying career, I can't think of any circumstance which would cause me to intentionally fly even close to one. The USAF policy is stay 25 miles away, that works for me. Unfortunately, I think with the increased availability of in-cockpit weather information, we are going to see more accidents like these as folks think they can "pick the way through". All the referenced comments below are right on, **technology will sometimes overwhelm common sense, nature will win every time**.

Thank you also, Tony. I was writing about an A36 Bonanza in last week's report, but the King Air and Pilatus examples are valid case studies as well.

Reader Don Bowles chimes in:

> Tom, I absolutely agree with several of the points you make about relying on NEXRAD weather data to make strategic decisions. On April 19, 2006, my wife and I departed Dallas Executive in a 1980 [Cessna] T-210 for Amelia Island, SC, with an en route refueling stop flight planned for Peachtree City, GA. By the time we cleared Shreveport [Louisiana], our Garmin 396 XM handheld showed serious weather building in the Atlanta area. So I asked ATC for a diversion to Montgomery, AL for refueling. As we overflew Mississippi, the storm turned deep red/purple and upon inquiry, I was advised by ATC of reported straight-line winds approaching 100 MPH.
>
> Tragically, this is the storm that killed Scott Crossfield, an aviation legend and extraordinary pilot, also flying a Cessna 210. I've read the NTSB early report on his crash, and no mention was made of any storm avoidance equipment on board. I've often wondered what might have been the outcome had Mr. Crossfield been watching NEXRAD weather as he took off from Prattville, AL. that day.

Thanks, Don. Frequent Debriefer David Heberling closes out this week's comments:

> All of my formative years of flying in the 70's and early 80's were done in airplanes with no weather radar. We had to go by what we saw out the windshield to make our decisions to continue or divert. I still operate my Beech Bonanza that way to this day. I **get all of the weather information I can on the ground, and then keep assessing the weather as I fly**. Yes, it would be nice to have some in flight weather capability. I will be upgrading to a tablet computer that will have that capability soon. However, I understand the limitations of such weather.
>
> In my day job as an airline pilot, I have weather radar at my disposal, which I can use in a tactical sense because it is constantly updating the weather presentation in front of me. Uplinked weather has no such capability and can only be used in the strategic sense as you and many others have pointed out. This issue is a psychological issue because of the various cognitive biases humans exhibit. **Confirmation bias is something pilots have to be made aware of** as it can lead pilots down the primrose path of destruction. We are learning so much more about our cognitive processes with more being discovered every day. What we cannot do, is shrug our shoulders and accept that we are simply "wired" that way. **We can be proactive and guard against falling prey to confirmation bias by making sure we pay attention to all of the data in front of us and understand the limitations of that data and ourselves**.
>
> Most small general aviation airplanes are not all weather capable transportation machines. Pilots flying turbine powered aircraft would probably argue that point. These airplanes go faster, fly higher, and have more equipment than their combustion engined brethren. However, what they forget to consider is that **no airplane, other than storm hunter aircraft, are designed to withstand thunderstorm penetration**. Technology is a wonderful thing. However, it is a two-edged sword. **While [technology] brings new capabilities into the cockpit, it becomes dangerous if we do not understand its limitations**. We have to

decide whether we are lords over our technology, or does our technology lord over us.

Thank you, David. Readers, what do you think? Mastery.flight.training@cox.net.

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