FLYING LESSONS for July 12, 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 many 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. However, verify all technical information before applying it to your aircraft or operation, with manufacturers' data and recommendations taking precedence. You are the pilot-in-command, and are ultimately responsible for the decisions you make.

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This week's lessons:

Captain "Johnny" Miller is still lauded, years after his death at age 102, as something of a legend in EAA, AOPA, QB and other aviation circles. A literally self-taught pilot, John launched on his very first flight solo after rebuilding a tired Standard J-1 biplane that had been abandoned by its barnstorming owner in 1923, into a career that eventually took him to the left seat of a Douglas DC-8 jetliner, followed by several decades of personal flying in high-performance singles and light twins until his passing well past the century mark. The phrase "from Jennys to Jets" was seemingly created just to describe his extraordinary flying career.

In his final years John wrote a column for *ABS Magazine*, enthralling monthly vignettes of his flying remembrances. I was honored to edit his column for many years as part of my duties at ABS. Many of his columns are preserved in his book *Flying Stories*.

See:
www.bonanza.org
https://store.bonanza.org/store/items/detail/item/73

In a later column John described an event that occurred while captaining an Eastern Air Lines DC-8 through an area of convective weather including heavy turbulence. Although he had slowed the airplane for penetration of a "soft" spot in the line, the airplane was buffeted mightily. At one point his head was thrown in a glancing blow off the cockpit wall and he suffered a brief moment of unconsciousness. Of course the copilot took over and the three-man crew eventually landed the airplane without further incident (there is no accounting of how many passengers this scared away from airplanes for the rest of their lives).

John's conclusions in the article rightfully included avoiding cumulonimbus clouds by a wide margin, staying well clear in visual conditions away from cells is at all possible. But he made a simple yet insightful observation as well—that this incident made him consider that a lot of seemingly unexplainable loss of control accidents, including flight near, beneath and between thunderstorm clouds, might have resulted from a turbulence encounter that knocked the pilot unconscious or even broke the pilot's neck.

That sort of evidence, Johnny remarked, would almost certainly not be discovered during investigation of the aftermath of an in-flight loss of control from high altitude, which usually results in an in-flight airframe breakup.

Just three weeks ago *FLYING LESSONS* focused on attempted flight near thunderstorms and a resulting in-flight break-up. The mishap that prompted that discussion was the fatal attempted penetration of a line of severe storms by the pilot of a Beechcraft Bonanza. Shortly afterward it was confirmed that the horrific disintegration of a family's PC-12 turboprop in the flight levels was preceded by flight into a thunderstorm. And just this week, the wings separated from a King Air during flight near thunderstorms over Texas.

See:
www.mastery-flight-training.com/20120621_flying_lessons.pdf
www.kathrynsreport.com/2012/05/plane-crashes-into-pond-near-east.html
www.kathrynsreport.com/2012/06/pilatus-pc-1247-n960ka-6-killed-in.html
www.marshallnewsmessenger.com/news/one-dead-in-plane-crash-near-karnack/article_18b18087-b205-515e-9955-7fb18b40c468.html

In-flight break-up does not usually occur in controlled flight. If the pilot slows the airplane to its weight-adjusted turbulent air penetration speed before encountering turbulence (because above that speed serious or even catastrophic damage may occur from the *very first bump* that exceeds moderate intensity), the hazard of the aircraft falling apart in flight results only if the aircraft exceeds its Never Exceed speed (V_{NE}) and subsequently exceeds ultimate flight loads—usually 150% of the design category load (e.g., Normal, Utility, Aerobatic) as defined during aircraft certification (or computed for an Amateur-Built Aircraft).

Captain Miller may be right—airplanes may be pelted by hail, doused by precipitation and even struck by lightning and still remain intact enough, long enough, for a skillful pilot to get safely on the ground. But the turbulence encountered in a thunderstorm may be enough to wrest control away from the pilot, or to render the pilot unconscious from concussion or neck injury, leading to the loss of control.

An airplane on autopilot when encountering thunderstorm turbulence will attempt to hold altitude and course, but can quickly exceed the autopilot's maximum trim force—handing the pilot an airplane entering an unusual attitude in an out-of-trim airplane. Caught by surprise, such a pilot may lose control as well.

History reveals pilots have a terrible record avoiding loss of control when a primary flight instrument fails in Instrument Meteorological Conditions (IMC) or in dark night conditions. Add turbulence and disaster is almost assured.

As soon as control is lost in turbulent conditions, a spiral is likely, followed with grim rapidity by a very high-speed vertical impact with the earth or, if the airplane is high enough when the spiral begins, a terrifying in-flight break-up.

Even among large airliners thunderstorms are a serious threat. Scheduled airliners are among the very safest of any transportation mode. Fatal accidents are extremely rare, yet the most common cause of fatal scheduled airline accidents is attempted takeoff or landing in the vicinity of thunderstorms. Again, the deadly hazard isn't rain, hail or lightning, it's the wind shear that results from thunderstorm turbulence.

In mid-June *FLYING LESSONS* reported the U.S. National Transportation Safety Board issued a released a Safety Advisory on in-cockpit NEXRAD weather displays, noting the critical need to consider the "date stamp" when using weather uplinks to make safety decisions in flight. As noted in the Advisory, "the in-cockpit NEXRAD display depicts where the weather ***was***, not where it ***is***." Cockpit-uplinked weather may be as much as 20 minutes old—longer than the entire life cycle of many thunderstorms, and therefore inadequate for assuring safe separation in close approaches to depicted radar returns.

See www.ntsb.gov/doclib/safetyalerts/SA_017.pdf

Likewise, other types of thunderstorm detectors, such a spherics (StormScopes and StrikerFinders that plot the approximate bearing and range to lightning strikes) and airborne radar are subject to interpretation and error…requiring careful evaluation before venturing anywhere near thunderstorms.

The technology that permits us to detect thunderstorms in flight has changed significantly for the better. The aerodynamic and human factors that require us to use that to technology avoid thunderstorms by a wide margin have not.

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

Debrief: Readers write about recent *FLYING LESSONS:*

Reader LeRoy Cook thanked me for mention of Tom & LeRoy's Aeronca Adventure in the July 8th *FLYING LESSONS*, and added:

> About all I would have added to the preflight was "structure", which is the other killer item after "gas & oil" and "controls."

Thanks again, LeRoy. Reader and flight instructor David Dewhurst comments on recent *LESSONS* about "mush" recognition and recovery:

> You are correct about the danger of the mush. Actually, a number of airplanes behave the same way. A stall break cannot be produced from an Apache, Aztec, early model 182, Columbia/ Corvalis 350, Sundowner, Tri-Pacer or Ercoupe. Others cannot produce a break when loaded at the forward CG limit and include [the Piper] Cherokee and Saratoga. The Mooney will produce a stall break only when the elevator trim is rolled to near a full-up position because the angle of incidence of the stabilizer is changed, adding to the elevator authority. I am sure there are others.
>
> The point is that is common not to be able to produce a stall break. For that reason, we teach that **reaching the aft elevator limit is the same as a stall break.** The pilot is instructed to keep adding up-elevator in a smooth continuous motion until either a stall break occurs or the aft elevator limit is reached. Either event triggers the recovery procedure. The idea is to execute the maneuver with the minimum altitude loss and to avoid settling into a mush.

Without getting too mutually congratulatory, Dave, you're right as well. Given my experience pointing out mushing conditions in instructional settings, however, and the number of responses I get from *FLYING LESSONS* readers who say this was new to them, *and* the lack of mention of mushing conditions or recovery upon reaching aft elevator in the Practical Test Standards and a glancing mention in other FAA pilot training guidance, I'm not sure you shouldn't have said "*For that reason, my instructors and I teach…"*—because "we" should not be construed to include the entire flight instructor community.

Dr. Dave Rogers, professor emeritus of aeronautical engineering at the U.S. Naval Academy and personal aircraft owner, adds:

> As your student discovered, and my tuffed stall videos show, you can hold a Bonanza in a stall with the inboard wing fully separated and the outboard wing still flying (unseparated) all the way to the ground. To recover, i.e., **to "unstall" the wing all you need do is relax the back pressure, reduce the angle of attack, and the separated flow reattaches.** Addition of power is only required to reduce the rate of descent.

Thanks, David. This is something I teach as well—that the wing begins to generate significantly less lift and significantly more drag when reaching or slightly exceeding its critical angle of attack (AoA, or α), which in most certificated light airplanes is somewhere around 17 to 18 degrees AoA. Interestingly, I continue in the discussion, the airplane's best angle of climb (V_x) attitude is fairly close to the critical angle of attack. That means that if the wing stalls, all it takes to get the wing to near its maximum lift generating capability is to lower the AoA a few degrees. As Dr. Dave writes, adding power is done to arrest descent (in a Practical Test Standards-type stall demonstration or evaluation) or to put the airplane into a positive climb at a flyable AoA (as you would do if stalling close to the ground).

Reader Fred Wilson reinforces this point:

> As all good Ercoupe drivers know, you cannot stall an Ercoupe (yes, you can). The book says you can't. The airplane will continue straight ahead, nose high and descending at 700-800 fpm [in a mush—tt].
>
> However, this is not something to be feared in this airplane. (there are still 3000 of them flying). There are no flaps. There are no rudder pedals. You cannot cross-control, so you can't slip. No flaps to help you descend. How do you get down when you are too high? You mush your way down. It's the only way. (You could "S" turn but that's not for "real" pilots).
>
> I have been at pattern altitude (the 1000' one) over the approach end of a 6000' runway, mushed down, landed and stopped with perhaps 1000' [of runway] left. It is only a question of where to stop the mush. In an Ercoupe, **the instant you lower the nose to near level, the airplane is immediately flying again**. Personally, I would stop the mush at a minimum of 50' above the runway, and 100' is better. (But... I've owned two of them. One in the mid 60's and the other about five years ago).

Charles Lloyd, who gave me my first left-seat experience with an AoA indicator in his beautifully updated Cessna Skylane a couple Christmases back, chimes in:

> Thanks for the education and explanation of high sink rate with no break. Flying a Horton STOL-equipped Skylane gives me the opportunity to see this characteristic many times when by myself or with one other person.
>
> As one who has flown with an Alpha Systems AOA [indicator] for eight years, I endorse this system completely. The red chevron tells you honestly [what] the wing is doing in any attitude or bank angle. Pay attention and the AOA will always tell you about an impending stall no matter what the indicated airspeed.

More angle of attack instruction, from reader Mac Barksdale:

> Tom, Thank you for the lesson on "mushing." For the last few years I have been flying some of the short-wing Pipers: Clipper, Pacer, TriPacer. These planes will behave in a similar manner you described in the mushing *LESSON*. If only [loaded with] a couple people and no bags and perhaps light on fuel, they will do a good job of the rapid descent [you described] and are quite stable throughout. One sure can get them into a short runway that way...and I figure if I ever had to descend into the trees, I would do it in that way with enough airspeed "in the bank" to maneuver into a soft spot.
>
> I suspect this characteristic is the cause of more than a few "hard landings" in the short wings. I teach that in those planes, and make a point of saving enough airspeed or altitude (to convert to airspeed) for the flare. I even put my [Beech] Model 95 Travel Air [piston twin] into some very short places using that same technique. Of course if in teaching mode, I point out that airspeed control is essential and once slowed below safety speed we are committed to hit the ground if one engine quits. So no go-arounds past the midpoint of final doing that trick.

Thanks, everyone. Readers, your *FLYING LESSONS* for the week are:

- A "mushing" condition is common in many types of airplanes, especially in forward c.g. loading conditons.
- Recover at the first indication of stall **or** upon reaching full aft elevator travel, whichever occurs first.
- Lowering the Angle of Attack only slightly will return the wing to its flying range. Add power to resist descent and initiate a climbing recovery.

"If we don't reduce our accident rate, oppressive regulations will be coming out in an attempt to do it for us. We need to take an active role in spreading the safety message to those who need it."

--Gene Benson, Vectors for Safety July 2012

See www.genebenson.com/newsletter/

For piston Beech pilots

The Beech Weekly Accident Update is posted at www.mastery-flight-training.com/beech-weekly-accident-updat-2.html.

Aviation: Freedoms. Choices. Responsibilities.

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