FLYING LESSONS for December 15, 2011

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:

It's my general policy to avoid using "crash pictures" in *FLYING LESSONS*. We're trying to draw positive lessons from pilots' experiences, and in most cases there's little to learn directly from an image that appears on a website or in a newspaper after an unfortunate or tragic event. An online video of a large, piston twin-engine airplane (an air cargo Beech Queen Air) that went down in the Philippines this week, however, illustrates some extremely important points that have been a focus of *FLYING LESSONS* this past year. Caution, the video may be disturbing. But if you're inclined, take a look not for grim entertainment, but for education…then come back here for some important *FLYING LESSONS*.

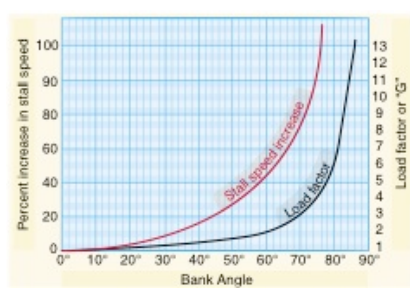
See http://www.youtube.com/watch?v=YqmomTUVsAw

The aircraft appears to have been making a normal, VFR pattern entry, probably crossing midfield or on a crosswind leg (it's unclear where on the ground the videographer was located) to enter on a downwind for landing. The gear was up, and flaps appear to be up. There are popping noises on the video that may or may not be related to engine noise; international mishap reporting sources say the pilot was returning to the airport after reporting dual engine trouble.

Making the turn, the airplane enters a steep bank, as much as 60 degrees bank angle or more, while maintaining level flight. Very suddenly, the left wing drops, the right wing lifts, and the big twin snaps over into a steep spin from which there is no possible chance of recovery.

Let's consider a few possible sequences of events:

- Both engines may have failed completely (perhaps from misfueling; a piston Queen Air looks a lot like a turboprop King Air to an untrained fueler) and the pilot was gliding back in for a landing (engine noise in the video appears to refute this). Attempting to stretch the glide back to the runway by resisting the descent, the angle of attack was increasing. When rolling into a commercial-standards steep turn in nearly level flight, the stall speed increased by over 40% compared to wing-level, constant altitude flight. The inside wing stalled first (it will have a higher angle of attack in a steep turn) and the sudden imbalance of lift snapped the big twin over into a spin.



- One engine failed and the pilot, anxious to get the heavy twin back on the ground, was overzealous in the turn, precipitating the stall.
- Both engines were still developing at least some power and the pilot, anxious to get the heavy twin back on the ground, was overzealous in the turn, precipitating the stall.
- Both engines were developing at least some power, but at the very moment the pilot began a turn the engine on the inside of the turn failed; the pilot did not recognize the increase in roll and yaw that resulted and the aircraft did a V_{MC} roll into the ground.

What can we learn from a tragedy so dramatically caught on video?

1. Adhere to the standard instructors' admonition to keep bank angle shallow in the traffic pattern to preserve a margin between current airspeed and the airplane's stall speed adjusted for weight and level-bank-induced G load.
2. If you have any power remaining at all, be very cautious about your return to the airport. This is absolutely not the time to be using your steep-turn skills in the airport traffic pattern.
3. In a twin-engine airplane, be very attuned to bank angle and rate of turn. If the bank or turn rate suddenly changes, level the wings and hold a constant heading. It's almost impossible to use the "dead foot, dead engine" technique to identify a failed engine while turning. If the inside, "down" engine quits the rate of turn will increase and the nose will pitch down relative to the horizon. If the outside or "high" engine quits the airplane will feel as if it's trying to roll out of the turn.
4. Single-engine or twin, pilots (and passengers, and people on the ground) almost never die when an engine quits and the pilot glides to an off-airport landing. The *precipitating factor* (that which actually causes the crash) that kills people in engine failures is almost always the inevitable ground impact, it's almost always a loss of control followed by *uncontrolled* contact with the ground at a high vertical speed. Keep the airplane **on speed**, nearly **wings level** and **under control**, and history shows your chances of survival are quite good as long as you are properly restrained (including a shoulder harness).

Successfully maneuvering a twin-engine airplane with one engine inoperative (or simulated so) is far easier if the pilot trims for the asymmetric thrust condition after securing the "dead" engine. In most light twins this involves quite a bit of rudder trim to reduce the rudder pressure otherwise required, which can be quite fatiguing for the pilot. Twin-engine pilots and their instructors (or safety pilots) must remember, however, that when power is reduced on the "good" engine the need for all that trim is reduced or goes away completely. If the airplane is not re-trimmed for the near-symmetric power in the flare and the pilot does not overpower the trim forces, the airplane will diverge from flight path in the direction of the good engine.

To avoid the so-called "rudder trim reversal" condition, most multiengine instructors teach the technique of "dialing out" half or more of the rudder trim during a single-engine final approach...adding a bit of manual rudder pressure at reduced power on short final, to assist with directional control in the flare when the operating engine is at idle thrust.

A full-flying stabilizer (as opposed to a more conventional fixed stabilizer and elevator) can reach its "up" stop if the pilot lets the airplane get too slow, and the nose will drop, hitting the runway with enough force to cause a propeller strike or even break off the nose gear.

More so than in conventionally-tailed airplanes, airspeed control on final is vital in airplanes with full-flying stabilators. If the speed gets below final approach reference speed, don't try to "salvage" the approach. Power up, go around and try it again.

Mechanical failures of retractable landing gear components appear to be the most common reason RG airplanes are totaled. It's not unusual at all for five or six gear collapse mishaps to be reported each week; the cost of repairing even a "minor damage" landing gear collapse averages up to $60,000 for single-engine airplanes, and $80,000 to $100,000 or more for twins, primarily because of damage to propellers and the need to do an engine tear-down inspection, replace parts as needed, and reassemble the powerplant(s).

Regular attention to landing gear maintenance and on-time overhaul or replacement of components is generally recommended, because many pushrod, rod end and other failure modes occur from internal corrosion and stresses that cannot be detected externally. It's more expensive in the short run to proactively follow the manufacturer's recommendations, but a few dollars per flight hour spread over the 2000 or more operating hours recommended by most manufacturers appears to make the difference. Most owners will only have to do it once in the entire time they own an airplane; it's extremely good insurance to avoid one of the most likely ways a retractable gear airplane will meet its end.

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

Last week's scenarios from the Number 1 cause of fatal general aviation accidents, **Loss of Control during Maneuvering Flight**, were randomly selected. It was odd that three of the four included mention of prescription drug use by the pilot (although the NTSB cited medication as a factor in only one of those events). I ran them as they came up to see if it solicited any comment, and several of you indeed did notice the pattern.

However, pilot medical issues are rarely a factor in loss of control (LOC) mishaps. The Philippine Queen Air crash discussed in this week's *LESSONS* is more typical of this sort of event. Here are some other randomly selected **LOC – Maneuvering Flight** scenarios from the FAA's Top 10 List (as reported by the NTSB). As you read each, think about any issues or actions that might have been contributing factors. Then make suggestions for mitigating those factors in your day-to-day flying. Here are more scenarios:

Air Tractor AT-802

The flight was established in an extended climb on a west-northwest course toward the intended destination as it approached a line of thunderstorms. Radar data depicted the airplane passing through 12,000 feet mean sea level (MSL) and continuing to 16,000 feet MSL over a 9-minute period. After reaching 16,000 feet, the flight altered course several times, apparently in an attempt to clear the line of thunderstorms. The maximum altitude return was 17,700 feet MSL during the flight. About 1-1/2 minutes before the accident, the flight reversed to an easterly course and descended from 17,400 feet MSL to 15,200 feet MSL. The airplane momentarily climbed to 16,300 feet MSL during that time. About 50 seconds prior to the accident, the airplane entered a descent from 13,400 feet MSL on a steady southeast course. The descent continued until impact. The airplane impacted an open field. It was fragmented during the impact sequence. Sections of all flight control surfaces were observed at the accident site. No malfunctions consistent with a pre-impact failure were observed during the post-accident examination. The radar data indicated that the pilot operated the unpressurized airplane above 12,000 feet MSL for approximately 24 minutes, and above 15,000 feet MSL for at least 14 minutes of that time. Federal Aviation Administration publications note that at cabin altitudes between 12,000 and 15,000 feet "judgment, memory, alertness, coordination and ability to make calculations are impaired." They also stated that "pilot performance can seriously deteriorate within 15 minutes at 15,000 feet."

Probable Cause: The in-flight loss of control due to the pilot's impairment as a result of hypoxia. Contributing to the accident was the pilot's decision to operate the unpressurized airplane at an altitude requiring supplemental oxygen without having any oxygen available.

Bearhawk

The pilot and two passengers departed in a single-engine homebuilt airplane for a local sightseeing flight. Several witnesses reported that the airplane was "low" and "wiggling up-and-down or weaving side-to-side". They added that the engine sounded like it was "missing" or making "popping" noise before the airplane then disappeared behind a row of trees. The examination of the engine revealed that the carburetor's venturi throat and throttle plate were sooted and displayed signatures consistent with back-firing up through the induction system. The discharge nozzle was also sooted. Additionally, use of a carburetor icing chart showed the airplane was operating in the general area of "serious to moderate icing at cruise power or serious icing at descent power" at the time of the accident. A review of a video from a camcorder found in the wreckage revealed that the right seat passenger filmed part of the flight leading up to the mishap. A sound spectrum study of the tape revealed that the engine was operating at a constant 2283 rpm until the last 20 seconds of the recording. During the last section of recording the engine speed appeared to fluctuate between 2220 and 2500 rpm; however, it was not determined whether this fluctuation was actually the engine behavior or an induced effected caused by rapid movement of the camera during the recording. It was also noted that the video revealed what appeared to be a routine flight until the last moments of the tape, when the camcorder captured a quick change in the aircraft's bank, pitch (or both). The tape ended prior to the actual accident/impact sequence. Examination of the airframe and engine failed to identify any pre-impact malfunctions.

Probable Cause: A loss of control in flight for undetermined reasons.

Glastar

The pilot departed on a local personal flight in an amphibious, float-equipped experimental airplane with two passengers. About 40 minutes after takeoff, the burning wreckage of the airplane was spotted by overflying aircraft. The airplane was built by the pilot from a kit, and was designed by the kit manufacturer to have two side-by-side seats in the cockpit. A large cargo area was behind the two front seats. According to a neighbor, the accident airplane was equipped with a third seat, designed and built by the pilot. The third seat was installed in the cargo area and was designed to fold up for use, and was equipped with a seat belt. The only passenger access to the third seat would have been from the cockpit. The kit manufacturer indicated that several builders have designed and built a third seat in the cargo compartment area of their respective airplanes. These seats had been individually designed, as there were no after-market or third-party suppliers of rear seats for the airplane. No maintenance records or construction build records were located for the airplane. No weight and balance data for the airplane was located. According to the manufacturer, the airplane's gross weight was 2,100 pounds if equipped with floats. A calculation of the airplane's estimated weight done by the Safety Board's Investigator-In-Charge, came to an estimated 2,110 pounds without any inclusion of fuel, which indicated that the airplane was overgross at the time of the accident. The airplane appeared to have collided with the ground in a left-wing- and nose-low attitude, an indication of an aerodynamic stall. The airplane was destroyed by a post-crash fire. No pre-impact mechanical malfunctions were found during an examination of the wreckage. An examination of data from a GPS receiver found at the crash site revealed that just prior to the accident the airplane was in a descending left turn, having lost 273 feet in the last 6 seconds before impact.

Probable cause: The pilot's failure to maintain adequate airspeed during maneuvering flight, which resulted in an aerodynamic stall and uncontrolled descent to the ground. Contributing to the accident was the airplane's overgross weight condition.

Cessna P206

Surviving skydivers said that as the airplane was climbing to the jump altitude of 10,500 feet AGL, the stall warning horn sounded intermittently several times. They paid no particular attention to it because they had heard it on previous flights. When the airplane reached the jump altitude, the pilot signaled for one of the parachutists to open the door. When she did, she told the pilot that the airplane had overshot the drop zone by approximately 1 mile. As the pilot started a right turn back towards the drop zone, the stall warning horn sounded again, then the airplane "rolled off on its right wing" and entered a spin. The skydivers became disoriented and nauseated. Four skydivers managed to bail out safely, but one of them broke her right leg when she struck the right horizontal stabilizer after exiting the airplane. The reserve parachute on the fifth skydiver deployed and became entangled around the tail of the airplane. She sustained fatal injuries. The sixth skydiver was unable to exit the airplane and was found inside, fatally injured. The pilot was seriously injured. Ground witnesses reported hearing the engine RPMs decrease, then saw the airplane spinning. Somewhere between 1,000 and 5,000 feet, the airplane leveled out for a few seconds and witnesses saw a parachute wrapped around the tail. The airplane then spun or dove to the ground. Downloaded data from the onboard GPS and Automated Activation Devices worn by three of the skydivers corroborated these accounts.

Probable cause: The pilot's failure to maintain adequate airspeed, resulting in an inadvertent stall/spin. Contributing factors in this accident were the entanglement of the parachute in the elevator control system, reducing the pilot's ability to regain control.

We received these reader comments on last week's Top 10 Cause #1 scenarios:

> When it comes to performance impairing drugs, pilots should know better. But we all know how people insist on driving when under the influence of drugs. They then extrapolate that experience to flying an airplane, not understanding the difference between a vehicle with two degrees of freedom and one with three. If you your inner ear goes haywire in a car, you can always stop. That is not possible in an airplane. A

strong case of vertigo in the air requires immediate reliance on the aircraft instruments to keep the airplane upright. I remember getting flicker-induced vertigo when flying along through some small puffy cumulus clouds (I was on an IFR flight plan). It was during the day and the sun created a flicker effect as I punched in and out of the clouds in quick succession. When the vertigo struck, I had to hunker down in my seat and focus solely on the flight instruments, and refrain from looking outside. I was never so glad to have been IFR qualified as I was in that instance. If drugs can do the same thing, the VFR-only pilot is lost.

As for the Astra HKS Light Sport, previous advice bears repeating. It does not matter what kind of fixed wing aircraft you fly, high pitch combined with steep banks are a recipe for a stall/spin accident. This is why I have a hard time with the adage that an airplane can stall at any speed and any attitude. This is way too simplistic and makes no connection with where stall/spin accidents are happening. While the adage is true, it bears repeating that if you are in steady state flight, you will not stall. I believe the statistics show that there are specific areas where most stall/spin accidents occur. This is on take off where we are most heavily loaded with people, bags, and gas. If you are over loaded (i.e. above maximum gross weight) and/or at the most aft CG location or beyond, you are more likely to have a stall/spin accident. Add a high density altitude and the probability goes way up. The other place stall/spin accidents are most prevalent is on the base to final turn. These are insidious as the pilot has his attention focused on the runway of intended landing and my not notice what is happening to the airplane as he increases the bank to keep from blowing through the final approach course. Two things can happen here. As he steepens his bank, he also pulls back on the yoke to increase pitch so that his rate of descent does not increase. This loads up the wing and it stalls. Or the pilot increases the bank and a high rate of descent develops. The pilot then pitches up to decrease the descent rate only to end up increasing the bank even more which increases the rate of descent. All of this happens very fast and only 500 feet above the ground, which does not give the unaware pilot much time to recognize what is going on and recover.

A corollary to the base to final turn is the maneuvering flight required to show a passenger some feature on the ground. If the pilot spends too much of his time focusing on the feature on the ground, he can find himself low on airspeed, high on bank angle and nowhere else to go but down. It could be the classic stall/spin or the death spiral. Take your pick.

These three scenarios are critical to a thorough understanding of stalls in airplanes. Maybe simulators are now cheap enough yet sophisticated enough to fully explore these scenarios safely. In actual airplanes, all of these scenarios have to be practiced at a high enough altitude to be safe. Unfortunately, it is below 1500 feet AGL where ground rush is most apparent. The impact of ground rush on a pilot cannot be underestimated. It is these three scenarios that will inform the student pilot why we stress that there will be no banks in excess of 30 degrees in the traffic pattern, no exceptions.

Thanks. Readers, what do *you* think? Let us learn from your insights. Consider the risks, and suggest management techniques, at mastery.flight.training@cox.net.

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

Flying has risks. Choose wisely.

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