FLYING LESSONS for September 16, 2010

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.

If you wish to receive the free, expanded *FLYING LESSONS* report each week, email "subscribe" to mastery.flight.training@cox.net.

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This week's lessons:

When does a stall not feel like a stall? When it's a "mush." The best way to be familiar with the indications of an impending must is to practice "slow flight"…and more correctly, flight at minimum controlled airspeed.

The term "flight at minimum controllable airspeed" means a speed at which any further increase in the angle of attack or load factor, or reduction in power will cause an immediate stall.

When flying more slowly than minimum drag speed (LD/MAX) the airplane will exhibit a characteristic known as "speed instability." If the airplane is disturbed by even the slightest turbulence, the airspeed will decrease.

As airspeed decreases, the total drag also increases resulting in a further loss in airspeed. The total drag continues to rise and the speed continues to fall. Unless more power is applied and/or the nose is lowered, the speed will continue to decay right down to the stall.

At speeds less than minimum drag speed, the airspeed is unstable and will continue to decay if allowed to do so. Raising the flaps while at minimum controllable airspeed will result in lift suddenly being lost, causing the airplane to lose altitude.

This condition is sometimes called "mushing," a high drag, high angle of attack descent that can result in anything from an inability to climb to a rapid, wings-level descent.

It's not a stall, but the result of a mush is nearly identical. The airplane is unable to maintain altitude, and certainly cannot climb, unless the pilot lowers the angle of attack *and* adds power. In most cases that means altitude will need to be traded for airspeed. The video of an Airbus A320 at the Paris Air Show in 1988 is a chilling depiction of a mushing condition that even twin, high-bypass turbofans could not overpower.

See www.rosswalker.co.uk/plane_vids/videos_20070206_3019874/airbus320_hits_trees.mpeg.

How do you avoid a mush? Maintain a high awareness of your angle of attack. Visualize how the wing is meeting the air, by comparing your attitude to the vertical speed. Airspeed alone won't tell you everything about stalls and mushing…you need to think in terms of angle of attack. Lower pitch and add power if you know you're nearing a slow-flight attitude, while you still have altitude to trade.

Comments? Questions? Tell us what you think at mastery.flight.training@cox.net.

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Debrief: Readers write about recent *FLYING LESSONS*

Reader John Hodgson writes about a recent *FLYING LESSON* about misfueling:

> I once had an FBO put jet A in one tank of my Cessna 414. As always, it was caused by a chain of events. A Jet Ranger had been refueled which requires an adaptor to the fuel nozzle for the reduced size aperture. The adaptor had not been removed after refueling the helicopter; the line man was young and obviously not trained well enough. I walked past and did not notice which fuel truck was being used. Fortunately the line foreman spotted it.
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> We drained and flushed the tank but the lineman got fired which I thought was unfair. Did they think he would make that mistake again?
>
> Bob Hoover had a similar incident that was not spotted before he flew at an airshow. The engines cut out and he landed on the side face of a canyon (if I remember it correctly from *Forever Flying*). When he went back to the field he insisted the same young lineman who had refueled the Shrike was the one he wanted to refuel the P-51 for his next routine. Class act! This incident led to the "Hoover ring" to eliminate the problem but the adaptor still allows filling a piston engine tank with jet fuel.
>
> Now I always check the fuel truck, check the colour of the fuel and smell it.

Reader Phil Webb addresses an item from last week's Twin Time:

> Baron 55 [pilot] Gregg Goodall's question about the wisdom of removing his hand from the throttle is a good example of the dangers of using airline procedures in general aviation operations. The reason airline pilots remove their hands from the throttles at V1 is to remove the temptation to abort after V1. The important difference is at V1 the airline pilot is guaranteed the ability to climb and miss all obstacles while the general aviation pilot has no should guarantee, thus the emphasis on aborting in general aviation aircraft and the emphasis on continuing in airline aircraft. Airline procedures are excellent if flying an airliner but may be inappropriate for general aviation airplanes. Using airline knowledge will also cause your student to miss several questions on their FAA exam, i.e. a wing does NOT always stall at the same angle of attack and stall speed does increase with altitude but in the light airplane world at the speeds and altitudes we operate at they are so close as to be imperceptible.

…as did retired airline captain Larry Olson:

> Interesting comments from Gregg on the "decision point" that his instructor taught him. While I STRONGLY suggest that we all have a decision point, I also feel that it should be a point at which the plane is capable of flying. And, I feel like we should "announce" that point, whatever you wish to call it.. go, V1, fly....
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> But that point is rarely with the gear down. I like your "gear down, I'm going down". However, there is a point at which the plane will fly... could be way below blue line, or perhaps not, and that's why I feel it's important to have the takeoff data for every takeoff that's made, and make the "go" point based on the data. Great stuff, Tom. You always provoke some great thought.

Reader Woodie Diamond asks:

> On Saturday, I had [a formation] flight holding short of the runway for takeoff, switched to tower and told them we were ready to go. Tower came back and said "XXX flight, taxi into position and hold. Let me know when you are all ready."
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> Rock [Woodie's instructor] was riding along with me, so I turned to him and said "That's wrong, he should have…" Before I finished my sentence, Rock said "it's okay, go ahead and do it." Considering he is a high time United [pilot] and my flight instructor, I answered the tower "XXX into position and hold" and took the flight out onto the runway. Looking back, and since I just took the FAA course [linked from the latest] issue of *FLYING LESSONS,* I'm thinking I should have stayed put and asked the tower if he meant I was cleared to "line up and wait." What do you think? What should a pilot do if the controller uses the old lingo?

The terminology was changed for a reason—an identified need to clarify instructions to avoid miscommunication and runway incursions. It's just as important for controllers to make the switch in terms as it is for pilots. I would not want to come off like a jerk, but I would simply have read back "XXX will Line Up and Wait." I'd bet he'd have come back with a chuckle and confirmed "Line Up and Wait."

After writing that response to Woodie, I flew with an instrument student and had exactly the same thing happen. And…I didn't correct the controller. I should have, to help us *both* with the new terminology. I vow to practice what I preach and do this if it happens again, not to be confrontational or to be a know-it-all, but because, again, the terminology was changed…for a reason.

New *FLYING LESSONS* reader Marty Vanover writes:

> I do enjoy this weekly letter. Thanks for putting me on your mailing list. I hope I can respond to you this way.
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> I would like to relate something to you that has happen to me. If you have been flowing the BAC forum, you have seen some of my recent posts. As you may know I live in Phoenix and I deal with some pretty high density altitudes. I frequently fly into Sedona, Prescott, Payson and others in the summer to escape the summer heat. I went to Payson (elev. 5100 ft.) and experienced the sluggish performance of a warm Phoenix morning (KCHD). I have to stay below the Class B and pass over Falcon Field below 4000 ft then climb in increments to clear the mountains between Phoenix and Payson. This morning I was alone and no real problem going but the Sierra isn't known for stellar performance. However, after breakfast, the T/O climb out of Payson was abysmal. T/O was very slow to accelerate, but initial climb wasn't scary. After the gear and flap were up I accelerated to best climb of 85 kts and didn't. I had to go to best angle of 71 kts to get a positive rate of climb. Once clear of the terrain I accelerated to 95 kts (my cruise climb speed) and got just a few hundred feet per minute. The density altitude was call out on AWOS as 7000 ft. I have had better take-offs and climb out of Big Bear at heavier weight and 9400 ft D.A. So, I thought there was something wrong. So once back at KCHD and in the hanger, I pulled the cowl off. I thought the air filter may be plugged and reducing air flow, but it looked good. I changed it anyway. I checked down the injection servo intake to see if the throttle was wide open and it was. Then I noticed that there was oil on the inside of the diffuser box (air inlet box). I also saw some metallic substance with the oil.
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> It turned out the oil was from a leak in the area of the nbr 2 cylinder that was running down the intake pipe and dripping into the heat collector around the exhaust pipes. Turning into oil vapor it was be sucked into the diffuser box because the spring on the alternate air door had lost it's spring. The aluminum dust was from the loose door abrading with the side of the diffuser box. So, I had no new spring so I shimmed the spring with a piece of 1/8 inch aluminum riveted to one of the hinge halfs. This held the door closed so I cleaned and reinstalled the diffuser box, but removed the duct to the heat collector, installed the air filter and cowl.
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> The following Saturday, I took a friend with me to Payson for breakfast and again, performance was bad. This time I opted to go over the Class B and it took about 1/2 hour to get to 10,500 ft. holding 85 knots all the way (nbr 1 CHT went to 395). Once at altitude, full throttle and 2500 leaned to peak EGT got me a calculated 137 KTAS on 7.1 gph. A little faster than normal on a little less fuel. After breakfast we took off again with 7700 ft D.A. Very poor T/O performance for our light weight and poor climb again. Once back in the hanger, I again pulled the cowling off. I removed the new air filter to see if there was any evidence of air leaks and there were none. But I did see a faint streak of Permatex in the servo intake. So I pulled the diffuser box and found there was air leaks between the diffuser flange and the servo flange, where I had applied a very thin coat of Permatex the weekend before. I also found the alt. air door could be blown open with my breath.
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> So, I'm lucky I wasn't at a heavy weight out of Payson those two take-offs. I had a friend who has a Sierra down for an engine change check his alternate air door. It was loose too. I figure that mine is now one of the best in the Sierra fleet and it not tight enough to prevent warm air from entering the inlet diffuser box. Essentially, I've been flying around with the equivalent of carb heat on! At the D.A.s I frequently experience, this could have been a disaster. I am and A&P and I know that the alternate air doors are necessary, but they should be closed during normal operations and only opened by the pumping action of the engine when the airfilter is blocked (presumably by ice or maybe a big bird?). Regardless, I have never seen anything on the annual to check the tension on the alt. air door. I believe it should be in the neighborhood of 3-4 lbs, but have not seen that in writing. I am rather unique as I probably encounter higher D.A.s than most Sierra flyers. But, I will bet there all leak hot air in the induction system to some degree.
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> At the moment I'm looking for a source of springs for the alternate air door that will provide sufficient tension to keep it shut during normal operations. I've gotten the word out to the BAC members. I know there was a recent article somewhere on defective carb heat valves (maybe AOPA) causing serious performance degradation. But, the fuel injected engine airplanes are at risk too.

Thanks, Marty, and welcome aboard. This is a great reminder for pilots of all airplanes to estimate takeoff distance and, while "on the roll," compare actual performance to the expectation. If the airplane isn't performing as expected, abort the takeoff right away, fix anything you can identify from the pilot's seat that may have caused the reduced performance (example: mixture control), and if you can't positively identify the problem and fix it from where you're sitting, take it back to the hangar or the ramp and have it checked out by a professional.

Instructor and *FLYING LESSONS* reader Dave Dewhirst writes about engine failures on takeoff in twin-engine airplanes:

> On [airplanes] with the [a very rapid] gear cycle, it makes no sense to leave the gear down past the point of achieving positive rate of climb. In the event of an engine failure with sufficient runway remaining, the airplane will take longer to decelerate and flare for landing than the time required to lower the gear. Leaving the gear down until out of runway is a surprisingly common practice but not the correct procedure. Some other airplanes with electric or hydraulic systems can take as long as 20 seconds to lower the gear and the decision acquires a different dimension. One consideration is the portion of the gear cycle required to actually lower the gear. In one aircraft with a hydraulic system, the time to actually lower and lock down the gear is seven seconds, but it takes another 12 seconds for the gear doors to close and the hydraulic system to cycle off. The airplane can be safely landed after seven seconds. Watch for the gear lights, not the completion of the cycle.
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> We teach a concept of dealing with partial power failure of an engine on takeoff. We have examined a number of accidents where the engine was experienced a mechanical failure on takeoff, but continued to run. The accident occurred because the airplane did not have enough energy to continue flight after the pilot shut down and feathered the broken engine. Had the pilot delayed shutting down the engine for two minutes the airplane may have achieved enough altitude or speed to sustain flight. Using the example of a blown cylinder, the engine is probably toast anyway. See if it can produce power just a little longer.
>
> As you mentioned, there are risks. The engine may seize without the ability to feather the prop or a fire may result. The decision compares a highly likely loss of control with the possibility of other consequences. We do not introduce this to anyone training toward a rating or to people having difficulty handling traditional emergency procedures.
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> Keep up the good work.

We've been discussing stalls for the last few weeks. Reader Doug Cheney writes:

> The aviation press lavishes praise on aircraft (especially the new LSAs) that have very benign stall characteristics. We use such an aircraft as our primary trainer. If the ball is reasonably centered, the inexperienced or unaware could venture into a stall with little attention-grabbing clue except for a high sink rate. Absent the nose dropping or buffeting, an aware pilot will pick up the cues (a small sight picture change, sound, feel, VSI, etc) but I'm gravitating to the belief that an extremely benign stall is a bad thing in the training environment precisely because of the lack of cues. Or, assuming the instructors fully understand what is going on and are capable of transferring that awareness to a student, maybe it is a good thing for that same reason- you have to have all your senses tuned in rather than just the sight and feel of the nose or a wing dropping.
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> The scenario that bothers me is one of a student on final, task saturated, focused on the runway, thinking all is well but actually in a stalled condition with a high sink rate which they may not respond to as a stall recovery. Or on base, unaware that [he/she is] more or less stalled then making an uncoordinated turn to final. I'm not particularly experienced with the nuances here and would appreciate any thoughts.

Hi, Doug. I share what appears to be your belief that training scenarios (and hence, training aircraft), should be representative of what the pilot would see in the airplane he/she normally flies. This points to the need for in-depth, type-specific checkout training no matter into what airplane you're transitioning. Is a pilot trained in a Cessna 172 prepared for the light wing loading of an LSA? How ready for an engine-out would a Piper Seneca pilot be if he earned his multiengine rating in a Diamond DA-42, with single-lever power controls and propeller autofeather?

In the situation you describe, a task-saturated, low-time pilot who does not equate high sink rate with a "mush"-type stall…this is a case where the flight instructor must drill the stall characteristics of the airplane into the student before turning him/her loose alone in the airplane. This in turn

raises my primary concern about the wholesale trend toward scenario-based training (SBT) by most larger pilot-training academies and schools. SBT de-emphasizes repetition and skills training, instead flying more “realistic” cross-country trips to show the pilot how he/she will eventually use the airplane. But just as the music student needs to practice scales over and over until the fingerings are instinctive and playing “real” songs begins, so must a pilot-student cover the basics enough that he/she can manage them without thinking when adding skills needed to “really” fly.

I employ short cross-countries and as much realism as possible with my ratings-training students. But eventually an IFR student just needs to practice approaches, missed approaches and holds over and over again until it “clicks.” And primary students need a lot of practice with stall recognition and recovery, more than they’ll get if all training is done in point-to-point flying.

What do you think? This leads us to the…

Question of the Week

> **Do you use Scenario Based Training in primary and/or IFR training? Did you use in a SBT program? How do/did you cover the basics? When do/did you go through the drill and repetition necessary to turn out safe, competent pilots?**

Let us learn from you, and help me improve my instructional technique, with your views at mftsurvey@cox.net.

Last week we asked:

> **Have you ever encountered a stall unexpectedly? How did it come about? What happened?**

Here’s what you said:

> *After acquiring [my private pilot certificate]* and continuing [commercial pilot] training, we were taught after dual instruction to practice stalls in the training area when solo and not below 3000 feet AGL. These were clean, in the landing configuration or with take-off flaps. The knowledge was drilled that you need maximum power for either slow or high speed. The airplane was a Cessna 150 and one of these aircraft stalled in the same attitude. You only knew about the stall from the VSI. One aircraft dropped a wing at the stall angle and the nose dropped, but we were taught only to apply the rudder to correct this while attending to the stall.
>
> I have never encountered a stall while flying on the line, though on one occasion just prior to turning final and on base leg on a Boeing 720, I felt the airplane shudder, I could not account for this for the speed was correct for the flaps and the bank angle, but remember relaxing pressure on the control column as I turned final and called for full flaps. After landing and at the tarmac it turned out we had lost a big chunk of the right inboard flap. One passenger could not control himself and dashed out of the airplane as soon as the steps were connected. He had witnessed the broken piece falling off.
>
> We had a night stop at the station, the aircraft was repaired and a test flight with the engineers was done by me in the morning. My copilot was the Principal of the Airline Flying Academy I had graduated from. That aircraft(AP-AZP)later went on to acquire history when it was hijacked on a scheduled flight from Karachi to Peshawarand flown to Kabul (Afghanistan) on gun point, and then to Damascus (Syria).
>
> On another occasion and this is important, at rotation speed during a heavy weight take-off in a B707 freighter from Orly (France), with a stiff crosswind blowing, I tried to lift the airplane off the runway and felt the stick shaker. My copilot immediately grasped the lower part of the control to prevent further rotation, but I wasn't pulling back. The stick shaker ceased and we continued the climb out. I promised myself I would never try pulling the aircraft off the runway irrespective of the crosswind anymore.
>
> *As an aside from the discussion on stalls* and one that probably none of the regular readers of your great information site might experience is an interesting impending stall recognition signal that was seen in the "classic" 747 (3 man crew cockpits). Way back, when training was still done in airplanes instead of all in the

simulator we would do approach to stalls with the "stick shaker" turned off. A few knots above the stall a rather loud "booming" sort of sound would occur as well as light buffeting. That was the signal to lower the nose and fly out of the situation. The 707 also emitted those "booms" when doing the same maneuver. The stick shaker would have gone off several knots above the "boom" warning so in normal operations if someone were so inept as to get to that IAS/AOA there should be adequate time to recover. Hopefully.

Great issue of FLYING LESSONS this week, your feedback from readers gets better all the time.

I was teaching slow flight to a high school student in her father's C150 a few years ago. She had about 5 hours of dual, flying nicely. We had done some stalls in varying configurations. She did tend to be a little lazy with her feet, however. Slow flight in the 150 on a hot day means full power to maintain altitude (barely) with full flaps. I asked her for a 90 degree turn to the left, she rolled in about 30 degrees of bank and a healthy touch of left rudder (she really needed a little less RIGHT rudder at that point). The airplane snapped straight into a violent and fully-developed spin to the left. Her instinctive response was to bring the stick fully back and to the right (nose down and rotating left). I wish I had an in-cockpit video to record that reaction. We are now in a spin, full power, full flaps, and control inputs for a flat spin.

I took the controls, chopped the throttle and retracted the flaps. The spin stopped almost immediately with the controls neutralized. I asked her what had happened. She figured out we had been in a spin. We then climbed up a couple of thousand feet and spent some time learning spin entries and recoveries.

I would never do anything like this intentionally with a primary (or any) student, but I will say it was a great learning experience for both of us. She uses her feet appropriately and knows how to avoid and recover from a spin. I have spun C150s many times over the last 40 years, [but] I have NEVER seen one that was that dramatic and violent. The outcome might well have been a whole lot different if this had happened to her while practicing solo and she had not had some spin recognition and recovery training.

I don't want to get into the spin avoidance vs. actual experience discussion here, but stall recognition and actual [full-stall] recovery is something that needs more emphasis in my opinion. Personally, I believe that EVERY pilot should go out and get some real spin training, preferably at an early point in their flying career.

While letting down from altitude in a Grumman Tiger, I passed through a serious shear at about 2000' AGL. Since the aircraft was loaded properly, it did what it should and pitched down. After a momentary reaction of pulling on the yoke I relaxed pressure, the airplane accelerated and all was right in the world.

The only stalls I've experienced have occurred during training. Doing a power-on stall during transition training in a Cessna 210, I did have the left wing drop abruptly. We recovered (probably using aileron more than rudder, I'm ashamed to say), and I asked the CFI (who was also one of my partners in the airplane) what just happened. He said, "You stalled the airplane, that's all."

Note: I will not be available to publish *FLYING LESSONS* next week. Watch for the next edition on September 30th.

Fly safe, and have fun!

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