FLYING LESSONS for September 9, 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:

Twice I have had to turn a lineperson driving the Jet Fuel truck away from turbocharged piston airplanes that had the word "Turbo" or "Turbocharged" on the outside of the aircraft.

Although many FBOs' tanks and trucks have jet-fuel nozzles that won't fit into a piston airplane's filler port, not *all* have been so modified…and history shows an industrious yet uninitiated line-guy may somehow fill the tanks with the wrong fuel anyway. Don't depend on nozzles and filler-port restrictors alone to prevent misfueling.

All piston-airplane pilots should personally supervise fueling of their aircraft whenever possible, even more so if the airplane design may make it more likely to be misidentified as a turbine aircraft.

If circumstances make this impossible then you need to double-check that the fuel received is the right grade. Assuming it's mixed with avgas already in your tanks, you may not be able to tell by draining the fuel sumps. Check fuel receipts and double-check the price charged per gallon. May sure everything adds up to the right grade of fuel for your airplane.

To understand stalls you must fully understand the concept of *angle of attack.* In engineering terms the angle of attack (AoA) is the angle between the relative wind and the mean chord line of the wing. In what may be **the** classic aviation text, *Stick and Rudder*, Wolfgang Langewiesche puts it more succinctly—AoA is "the angle at which the wing meets the air."

In most general aviation airplanes lift increases with an increase in angle of attack, until it peaks at about 17°-18°…what we call *critical angle of attack.* Increase AoA further and lift is still generated…the wing does not go from "flying" to "not flying" instantaneously.

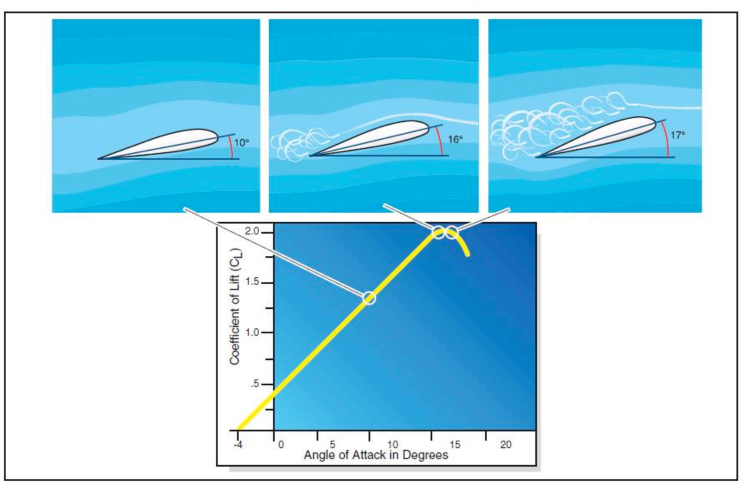

Figure 4-2. Critical angle of attack and stall.

But lift does decrease precipitously once past the critical AoA. Drag also increases rapidly, and performance degrades even more. Although control is not lost when flying at angles of attack beyond critical, attaining most performance goals is impossible.

It's commonly assumed—incorrectly—that a stall occurs at a given stalling *speed.* Stall speed is in fact drilled into us as we learn to fly, and when we check out in new types of airplanes. Frequently we're instructed to memorize the published stalling speed of the airplane, as if we flew the airplane precisely at its maximum certificated weight for long periods of time…since published V_{SO} and V_{SI} are valid only at the airplane's maximum gross weight.

Any number of different stall speeds are valid, depending on the airplane's configuration, its current loaded weight, and, perhaps least understood of all, depending on the G-load on the airplane at the time.

G-load times loaded weight equals the effective weight of the airplane at any give time. This in turn determines the indicated airspeed at which the wing will stall, with adjustments for extension or retraction of flaps, slats and other lift-enhancing devices.

Stall concept #1: *Angle of attack*, not airspeed, is what determines whether the wing is stalled.

Stall concept #2: Airspeed may indicate proximity to a stall in many cases, but there are routine (and abnormal) flight regimes where stalling speed will differ significantly from the published values.

Next week we'll continue our somewhat unconventional *FLYING LESSONS* on stalls.

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

Like what you see, but want better presentation? Help underwrite *FLYING LESSONS* through a secure Paypal button or by mailing a check to the address at www.mastery-flight-training.com. ***Thank you!***

Debrief: Readers write about recent *FLYING LESSONS*

Reader Andy Reardon writes about engine indications on takeoff and a timely decision to abort:

> Another great and thought provoking article. Consistent with my long term suspicion that engine failure on departure in a twin or single are typically ignition/fuel-related (including pump failure), I have developed the habit, after bringing the engines to full power at the beginning of the takeoff roll, of immediately checking the fuel flow meter and the bars on the engine analyzer; if a fuel-related malfunction exists or is developing, it will probably manifest itself on one or both of those instruments. What better time to discover the problem?

You're right, Andy...and I do about the same thing. Here's what I teach when beginning the takeoff roll:

1. Throttle(s)—FULL
2. Manifold pressure(s)—CHECK
3. RPM(s)—CHECK
4. Fuel flow(s)—CHECK

About this time:

5. Airspeed—OFF THE PEG
6. Oil temperature(s) and pressure(s)—CHECK
7. EGT(s)/TIT(s)—CHECK

If any of these steps shows an abnormality, retard the throttles and abort the takeoff.

Reader John Hodgson writes about stalls:

> I don't accept that even a student pilot will only react to a stall after it occurs (if that was the intent of the comments). That is lousy training. The six impending signs of a stall, which should be obvious to anyone who is well trained and current, are:
>
> - reducing airspeed, as seen on the ASI
> - increasing deck angle
> - reducing noise level
> - controls getting sloppy
> - buffet felt through the stick
> - sense of kinesthesia, (through the seat of your pants), and
> - the stall warning horn [and/or light].
>
> A CFI who will not stall a training aircraft is not meeting their obligations to keep the student safe and should not be instructing.
>
> Stalls should be reviewed and practiced no less often than the biannual Flight Review. Power on, power off, straight and level and accelerated. Incipient and developed. Recovery from the onset of the buffet to holding wings level in deep stalls (which show the rapid rate of descent).
>
> An aerobatic pilot will be aware of the stall well before it occurs and already have determined the responses that will depend on what is the next intended maneuver.

Excellent, John, and I agree. In last week's *FLYING LESSONS* I quoted the FAA Practical Test Standards (PTS) for the different levels of pilot certification not to advocate a higher level of proficiency for pilots with "lower" certification; in fact my goal was the opposite, to point out the PTS do not require "full" stalls in the higher levels and, since stalls are not *required* in Flight Reviews, that a more experienced pilot may have gone far longer since practicing stalls than a newer aviator. You have reached the same conclusion—that currency in stall recognition and recovery is a function of the Flight Review and other recurring training and practice, recommended for *all* pilots regardless of the certificate held.

FLYING LESSONS reader and widely published author Mike Busch writes:

> Tom, your most recent issue of Flying Lessons prompts the following comments:
>
> ***Normally aspirated multiengine airplanes** frequently reach aerodynamic stall before loss of directional control capability in a Vmc demo. The engines develop less power when at a safe Vmc demo altitude. Therefore there is less asymmetric thrust and wing stall speed is reached first.*
>
> Nowadays, with the advent of STC'd vortex generators which (among other things) greatly improve rudder authority at low speeds, even turbocharged piston twins often have Vmc lower than Vsi.
>
> ***Some airplane brakes** are very effective, and effectiveness means lots of friction, which in turns means heat. Be especially careful to restrict hard braking to only when it's needed. Otherwise, control taxi speed primarily with power, using brakes as little as possible.*
>
> Also, to the extent that braking must be used to control taxi speed (and/or to provide directional control when taxiing tricycle-gear aircraft with a free-castering non-steerable nosewheel), the use of brakes should be confined to brief episodes of firm brake application punctuated by long intervals of brake non-use, rather than continuous light brake application (a.k.a. "dragging the brakes."). This problem has historically been particularly epidemic with the Cirrus SR22, because it has (1) a non-steerable nosewheel, (2) a very large engine for its weight with consequent very high idle thrust, and (3) a fixed gear with tight wheel fairings that limit the flow of cooling air to the brakes. These aircraft have a history of brakes catching fire, which was addressed both by an Airworthiness Directive and by an aggressive campaign of pilot education in the Cirrus community. The AD requires (among other things) that the brakes be fitted with temperature-sensitive stickers that turn dark if the brakes have been over-temped. Checking the color of the stickers is a pre-flight item as well as a 50-hour maintenance item.
>
> *In reading the accident reports, it appears that there is a potential common cause. Two recent accidents shared the same "recent registration". Could it be that inadequate pre-purchase inspections are the culprit?*

> While it could be true for those two specific accidents, I don't think it's true in general. It's a safe bet that the overwhelming majority of "recent registration" accidents are caused by low time in type by the pilot, not inadequate pre-purchases inspection by the mechanic. Historically, at least three-quarters of accidents are caused by the pilot and less than one-quarter by the machine. Also historically, only about half of the machine-caused accidents are caused by inadequate or incompetent maintenance.

Excellent comments all, Mike. Thank you. Regarding the earlier reader comment about "recent registration" mishaps, I agree that the biggest contributor to accidents is most certainly low pilot experience in type. In fact that's why I track the statistic, to point out the very real need for transition into a new airplane regardless of pilot experience or if the new airplane is "less capable" than what the pilot has usually flown. Reader George Wilhelmsen (whose comment you quoted) suggests that maintenance may be an issue in some "recent registration" mishaps, pointing out the need for a good prepurchase inspection and for the new owner to aggressively pursue any mechanical squawks on the airplane. New owners should be aware of both issues and how they may affect safety.

Reader and instructor pilot Dan Ramirez provides a tip about engine failures in twin-engine airplanes:

> As always, I enjoy the awesome information you and your readers put out! One thing I may add if you please, When I instruct in twins, I always suggest that the pilot always keep his heading bug on the course being flown. After awhile it becomes second nature. Why do I think it is so important? Well, I have flown with many experienced twin drivers who could not tell me a foolproof way of identifying a sick or dead engine in IMC. The solution is simple. **STEP ON THE BUG!!!**
>
> When the heading bug moves to the right, step on the right rudder! When the bug moves to the left, step on the left rudder! Your dead foot immediately tells you what engine gave up the ghost! I practice this with all twin drivers under the hood and I have even done it in IMC. Works great and builds confidence quickly!
>
> Thanks again for your concern for everyone's safety!

Thank you, Dan, for yours.

Twin Time

Questions from two readers this week concern multiengine operations:

Baron 55 pilot Gregg Goodall writes:

> Hey Tom. I religiously read your weekly newsletter and thoroughly enjoy it.
>
> Being a new multi-engine pilot, I read the current article about loss of engine with particular interest. I was taught and agree with what you and the contributor have written with one exception that I would like your opinion on.
>
> The background is this: after taking my check ride, I had to have 10 hours of dual in the Baron before I could solo. So, I hired a local instructor who is a retired airline captain and now flies King Airs for a living. In his early days, he ferried all models of Bonanzas and Barons across the country for a dealer and so he has considerable time and experience in all Beech models. He is also an AP/IA and a friend I have known for quite some time. So this seemed to be a good choice for me. During this training, we went thru all of the check ride maneuvers and all was good for him except one thing. On take-off and upon reaching rotation speed, he had me remove my right hand from the throttles and place it on the yoke. He said that at the point of rotation, unless you were on an exceptionally long runway at a major airport (which was highly unlikely), the only decision was to continue the take-off, pitch for blue line and go straight ahead and that there should be no temptation to retard a throttle or anything else at that point or to go thru the identify verify routine. Once the airplane is under control and, if and when time permits, then go straight for the prop lever for the engine on the side that you swing to…dead foot dead engine…and feather it. Then, if time permits, go thru the emergency checklist.
>
> Made sense to me so that is what I am doing. What do you think?

I replied: At anything except the very lightest weights, a Baron (like most light twins) cannot accelerate out of an engine failure with the gear down, even if you feather the correct propeller *immediately* and retract the landing gear *right away.* Attempting to climb out will almost certainly result in an extremely rapid deceleration toward Vmc. This is why we emphasize "positive rate, gear up" in multiengine airplanes...because the riskiest part of a twin-engine takeoff is the time between liftoff and retraction of the landing gear.

Consequently your best chance of survival of an engine failure right at takeoff is to "chop the throttles" *immediately*, lower the nose and land straight ahead. Because you'll have a half second or more of denial, followed with as much as a second to react, I feel you need to have your hands on the throttles to be ready to chop the throttles before the airspeed becomes critical.

Here's what I teach as a "line-up litany" for every takeoff takeoff in a twin:

- If the gear is down, I'm going down
- If the gear is up, three degrees up

That latter item comes from the fact that in Barons (and many light twins) will attain "blue line" speed at about three degrees UP attitude, if the gear and flaps are up and the "dead engine" propeller is windmilling. Immediately adjusting attitude to three degrees above the horizon will provide the best possible performance at that point if the gear and flaps are up. This means maximum climb or minimum descent, depending on airplane weight and density altitude. After feathering the propeller drag is reduced and a higher pitch attitude (seven degrees UP, to be exact) causes the airplane to fly at blue line.

Your extremely experienced instructor may well be able to fly an "accelerate-go" takeoff if an engine gives out at exactly the wrong time. But I have instructed dozens (maybe hundreds) of Baron pilots in the FlightSafety simulator, and virtually none of them were able to fly out of an engine failure while the gear was still down. From that experience I wouldn't try it myself, and I teach my students to acknowledge there's a short period of extra risk after liftoff and before the gear is up, when the best option is to land straight ahead just as you would if the engine gave out in a single-engine airplane.

Gregg responds:

> Kudos to you my friend. Best explanation yet!!!!!. I am a changed Baron pilot. I do believe he would have me get the gear up but that's too much to remember at those critical moments. I feel safer already knowing I will employee these principles.

Reader Keith Duce, who flies a Cessna T303 turbocharged twin out of Archerfield (near Brisbane), Australia, writes:

> I had a moment in the Crusader brand back a few weeks ago when the return oil line from the turbo broke at the elbow fitting. It was interesting how the training kicks in and everything slows down and becomes manageable. I guess that I was lucky also that I was over an airfield in CAVOK conditions and daytime and that the oil gushing out of this line was coming out of the top louvre vent not the bottom…. I did not shut down the engine but immediately throttled back to idle and monitored the leak and oil pressure on the way down with the idea of shutting down the engine if the pressure dropped. After the event I was annoyed with myself for not immediately shutting down the engine and I thought that I might have damaged the engine. The engine still had 3 quarts left in it and the pressure only dropped on short final. The engine builder and the LAME both said that in their opinion I did the correct thing. What is your feelings on this?

In a twin you have a lot of options when faced with an oil leak. I'm concerned, however, about two things:

1. Fire hazard. You don't know where that mist of oil is going. Especially if it is near the turbocharger or exhaust manifold, it presents a serious risk of fire. This in turn could take out some fuel lines. There have been isolated cases of fires quickly burning through the front spar of turbocharged airplanes.

2. Total engine failure. With oil loss there will, eventually, come engine failure. Before that occurs you may have an uncommanded propeller feather, as oil pressure drops in the prop dome. I'm not as concerned about preserving the mechanical condition of the engine to reduce repair costs (although those costs may be significant). I'd just rather to have the engine failure and/or propeller featuring happen on my schedule. I'd hate to be turning onto final approach and have the prop unexpectedly feather, for instance, or have to deal with an engine failure inside the Final Approach Fix in IMC.

It'd be even worse if some unrelated factor required you fly a balked landing or a missed approach, and the engine would quit on the initial climbout. To get the failure over with I'd rather cause it myself, i.e., at altitude and with plenty of airspeed, I'd pull out the Engine Shutdown and Single-Engine Approach checklists, review them both, then use the Shutdown checklist to feather the correct propeller and secure the engine. Then, I'd set up for and fly a single-engine approach and landing.

We call it "Monday morning quarterbacking" here, and I don't have all the indications and details you had when faced with the decision, but in general that's what I would probably do. Nonetheless, you accomplished the primary goal of getting everyone down safely, and the secondary goal of doing so with the airplane in a condition where it may be used again. So as you say, good on you, Keith!

Keith replied:

> Thanks for the feedback. I never even considered the possibility of a fire but this is a real possibility. The only thing that may have prevented this is that there was so much oil coming out that it might have put the fire out. Faced with the same problem again and lets hope that this does not occur I would follow your advice. The idea of shutting the engine down and getting nicely on top of the situation whilst I am at 9000ft makes good sense. In some ways being over an airfield took away the option in my mind of shutting down the engine and I guess my primary focus was on getting down on the ground to assess the situation and secondly saving the engine. In hindsight the decision was wrong and in fact very wrong. The thing that I love about flying is that I never stop learning. Thanks again for the advice. I wish that you were closer and we could do some flying training together.

Next time I'm Down Under we'll fly together (again).

New FAA Online Course on Taxi and Ground Procedures

The U.S. Federal Aviation Administration announces a new, free online course on two major procedural changes affecting Taxi and Ground Movement Operations. Pilots now require an ATC clearance prior to crossing ANY runway – Active, Inactive or Closed. The course addresses the change concerning harmonization between the FAA and the International Civil Aviation Organization (ICAO). You will learn about the language change from "taxi into position and hold (TIPH)" to "line up and wait (LUAW)".

FAA's objectives in this online course are to review and consider:

- Best Practices during taxi operations
- Air Traffic Control Procedures and Phraseology
- Pilot responsibilities
- Awareness of airport markings and Pilot responsibilities re: Precision Obstacle Free Zone
- Part 91 and Part 135 Single-Pilot Procedures during taxi operations
- Use of Standard Operating Procedures (SOPs) during taxi operations, and
- Best Practices for avoidance of runway incursions.

Go to www.FAASafety.gov and take "Line Up and Wait – LUAW."

See www.faasafety.gov/gslac/ALC/CourseLanding.aspx?cID=155.

Question of the Week

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

Let us learn from your experience, at mftsurvey@cox.net.

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