FLYING LESSONS for February 7, 2019

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National Flight Instructor Hall of Fame inductee

FLYING LESSONS uses recent 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 airplane have little direct bearing on the possible causes of aircraft accidents—but knowing how your airplane's systems respond can make the difference as a scenario unfolds. So apply these *FLYING LESSONS* to the specific 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.**

FLYING LESSONS is an independent product of MASTERY FLIGHT TRAINING, INC. www.mastery-flight-training.com

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This week's LESSONS:

Recently one of my favorite FaceBook aviation feeds, Bold Method, posted a 2013 YouTube video of an Airbus engine failure during takeoff:

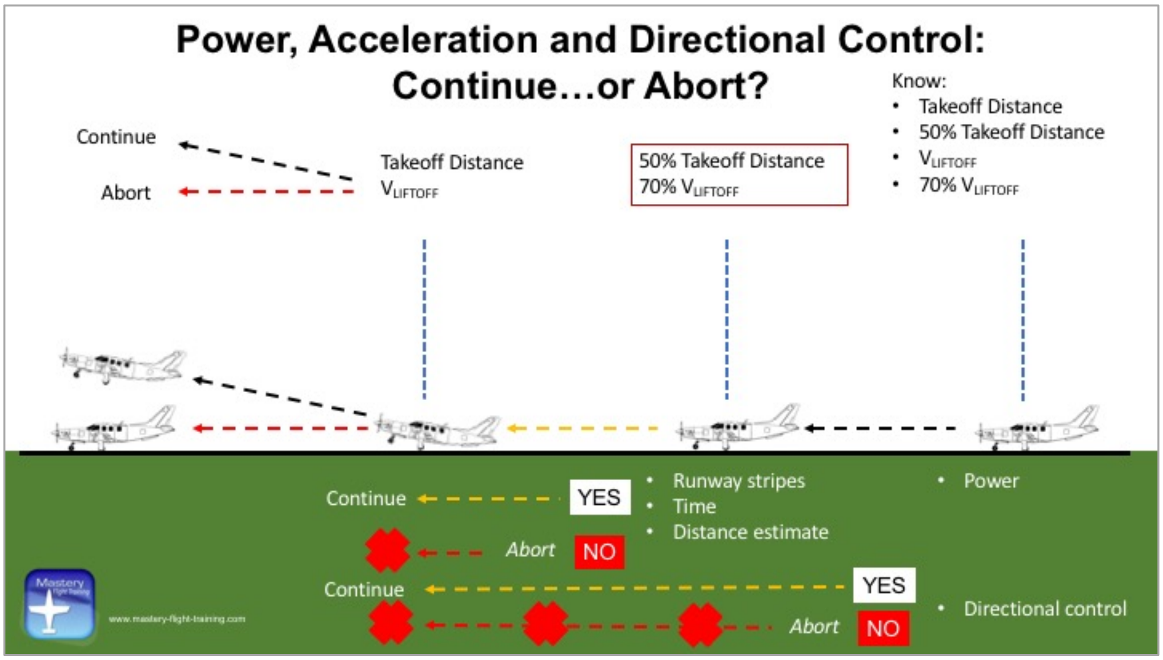
See:
www.boldmethod.com
https://www.youtube.com/watch?v=PS1YAX70edc&app=desktop#

The crew did a masterful job of reacquiring directional control—even keeping the runway stripe between the main gear—and aborting the takeoff. It's the sort of thing professional air crews regularly train for…and in this case, the training shows.

Most of us don't get that kind of training, or in the frequency experienced by airline pilots. Even professional jet pilots don't usually get takeoff abort practice in single-pilot operations and non-air carrier aircraft they may fly. Airline or otherwise, it's very rare to have to abort a takeoff. But will you be ready if you must? What might trigger you to abort a takeoff on the ground? How will you recognize the need in time to properly respond?

Think back to your very first *FLYING LESSON*. You learned a lot. You were probably overwhelmed with new stimuli and new information. Still, you probably had your hands on the throttle and the controls for your very first takeoff in a light airplane. Sure, your instructor was doing most of the work, and was spring-loaded to anticipate your mistakes and shortcomings. If you had a good instructor, he or she made you at least *think* you made that first takeoff…and virtually every one since.

But did your instructor teach you not only how to add power, ease back on the stick and pitch into the blue, but also what specifically to look for as you begin and accelerate through takeoff? Did you *ever* learn how to anticipate performance and to monitor actual performance against those expectations, and precise cues and criteria for determining whether you can continue your takeoff under varying airplane weights, density altitudes and runway surfaces, or when it's time to abort the takeoff attempt positively, without hesitation—because you *know* the airplane isn't performing well enough to safely take off?



See http://www.mastery-flight-training.com/continue-or-abort.pdf

So how do you know when you can continue, or when you must call it off and abort? You do so by knowing ***before you board the airplane for takeoff:***

- The power management technique required for takeoff power under current conditions, and the panel indications that confirm or refute attainment of that power;
- The takeoff distance required under the current environmental conditions and airplane weight;
- One-half of that takeoff distance, and how to visualize that 50% point during takeoff;
- The liftoff or rotation speed to be used to obtain that takeoff performance; and
- 70% of that liftoff or rotation speed.

Knowing these vital things gives you most of the information you need to determine, as you go, whether you may continue or you must abort. How do you use them to decide?

1. At power-up, confirm not only that you have power, but that you have the *right amount* of power as determined by conditions. Propeller speed, manifold pressure, turbine pressure, turbine speed, fuel flow—however you measure power output in the airplane you fly, check ***If you have the expected power, continue. If you do not, abort the takeoff***

now, before you go any further…you can look into it after you've powered down and ensured you're completely stopped while you divert your attention.

2. During acceleration, ***re-confirm power and engine indications while there's still time to abort*** if there are any discrepancies. For example, in addition to the power indications in a piston-engine airplane I also check oil temperature and pressure just after moving the throttle to full. I then check the main elements again—exhaust gas temperatures, fuel flow, and oil pressure—after seeing the airspeed indicator rise off its peg…at about 40 knots. **If any indication is unexpected, reduce power to idle and apply braking as necessary** to come to a controlled stop on the runway.
3. In the absence of acceleration charts and tables in most civilian airplanes, a commonly used tenet is that ***the airplane should be at 70% of its liftoff speed as it passes 50% of its takeoff distance*** under current conditions. **If the airplane is at or beyond this speed at the proper time you can continue. If not, abort without delay**.
4. One more thing: ***If you are having difficulty maintaining directional control at any time on the departure runway, abort the takeoff.*** Reduce power to idle; apply rudder and aileron for control, and brake gingerly and as necessary to stay on the runway. It might be a blown tire, or a jammed control, or a contained turbine engine failure like in the Airbus YouTube video. You only know that you cannot maintain runway alignment for some reason. Abort the takeoff, and figure out the reasons why later.

The most challenging judgment is contained within item (3) above—not the 70% of the liftoff speed, because that's pretty objective and well-defined. It's visualizing when you are at the 50% takeoff distance point. For some time I've used and taught the "counting stripes" method—knowing that a paved runway with standard markings incorporates stripes measuring 120 feet long (at least in the first third of the runway on either end) and spaces between the stripes measuring 80 feet, meaning the combination of a stripe and a space is 200 feet. If you compute a 900-foot takeoff ground roll, that's about four and a half stripes, so the 50% point would be a little more than two stripes from the beginning of the takeoff roll.

Of course this method is useless on a grass or otherwise unmarked runway. In that case you may have to pace off the runway and use some prominent spot along the runway that corresponds to your 50% point.

More recently I trained with *FLYING LESSONS* reader Mike Radomsky at his FEIST Simulation Center, for **F**ull-motion **E**mergency & **I**nstrument **S**imulator **T**raining in Las Vegas, Nevada. Mike teaches a "time" method for airplane acceleration. In the Cirrus airplanes the FEIST system simulates, 50 knots indicated airspeed is very close to 70% of the liftoff speed, and under many conditions it takes about 10 seconds to accelerate to 50 knots from a standing start. Hence, Mike teaches use of a timer to ensure the airplane is indicating at least 50 knots 10 seconds into the takeoff roll. We've since been discussing the impact of density altitude on the time to 70%, and other factors, for a class of airplane with a liftoff speed in the 70-knot range. I'll be calculating and experimenting with this method myself.

See https://www.allinaviation.com/aircraft-and-simulator-rental.html

Think of a takeoff as consisting of two main gates: ***power application*** at the very beginning of the takeoff, and the ***acceleration/airspeed/power confirmation*** at the halfway point in your computed takeoff distance. If you meet all your targets as measured at these two gates you can continue the takeoff. But if anything doesn't meet planned expectations at either of these gates, or if some status creates difficulty maintaining directional control at any point, reduce throttle and brake as needed to come to a stop.

Think in terms of these two gates, and I guess taking off *is* easy.

Questions? Ideas? Opinions? Send them to mastery.flight.training@cox.net

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Debrief: Readers write about recent *FLYING LESSONS:*

Reader Lorne Sheren wrote about last week's *LESSON* on the Unique Risks of the Business Pilot, including the urge to rush through preflight inspections when you are the only person looking at the airplane between required inspections (usually once per year):

> I do a complete check [of my aircraft] around once a month, spending an hour looking for things that are rubbing under the cowl, and any other issues. I pull off the [lower cowling] gill plates on [my] Bonanza. And **I do this on a day when I'm *not* flying**. My only task is to do a very thorough inspection of whatever I can reach. I often find hoses rubbing and fasteners loose. Occasionally a bulb that's out (not as much now with LEDs). Plus- it's a great way to become more familiar with your aircraft.

Thanks, Lorne. I try to do the same thing with the airplane I manage.

See http://www.mastery-flight-training.com/20190131-flying-lessons.pdf

Reader Mark Sletten takes us back to our discussion of engine preheat, and some other readers' thoughts that dissimilar metals expansion, not cold-oil viscosity and lack of oil pressure, is the issue that drives engine preheat requirements. Mark writes:

> The dissimilar metals argument is misunderstood. No matter how much you preheat, you still have to warm up the engine prior to departure. Why? Because **the temp[erature] change (from ambient to preheat complete) you can affect with a preheater is maybe one-tenth of the temperature change the engine will experience from startup to normal operating temperature.** For the initial start you just need the engine to be warm enough to start and keep running while causing the least possible wear. **The faster you can get oil flowing, the less engine wear will occur**, which is why it's a good idea to heat up the oil. **But unless you can preheat the engine all the way to normal operating temp, dissimilar metal expansion is going to occur during idle warm-up, period.** The purpose of the preheat is to get the oil warm enough to flow, and get the cylinder heads warm enough to support fuel vaporization and combustion. ***Then*** you warm the engine to minimum operating temp at idle, with the least stress possible on the engine, allowing the dissimilar metals to get hot enough prior to takeoff to minimize the expansion issue.

That is supported by all of the engine manufacturer information I can find, Mark, as I discussed in the January 17th report. If you look at the relative change in temperature it makes sense, too. In general, engine preheat is usually recommended at temperatures below about 40° Fahrenheit (about 5° Celsius). Also generally, the minimum cylinder temperature for takeoff is around 200°F or roughly 95°C, and the temperature change usually occurs quite rapidly at ambient temperatures not requiring preheat. Throw these into a chart, and include also conversions into the Kelvin scale, and you can look at the relative differences:

F	C	K
20	-6	266
40	4	278
200	93	366

As Mark writes, the 20°F change between a typical preheat and non-preheat temperature is dwarfed by the rapid 160°F increase from a non-preheat 40 degrees to low Cylinder Head

Temperatures (yes, wear in the interior of the engine case may be more of a concern than the CHTs, but we don't have any direct way to measure interior temperatures or the relative rate of change). In degrees Celsius there's a 10 degree change between typical preheat and the suggested engine preheat threshold, while the engine rapidly warms at least 89°C soon after start from that preheat threshold temperature. Express it in the scientific Kelvin scale and there's a 4% change in temperature from typical preheat to the preheating threshold, and a 32% change in temperature from that threshold to minimum CHTs.

I'm sure there are learned *FLYING LESSONS* readers out there who can (and probably will) debate this, but I don't think our engines are so poorly designed that they lose minimum operating tolerances with a small reduction in temperatures below an arbitrary 40°F/5°C preheat threshold. We can (and should) wrap up the discussion thusly: **when preheating an engine warm the oil**, because you need good oil flow regardless of the engine's temperature. But **take time to warm overall engine** as much as possible (manufacturers say it's to permit good fuel vaporization for start), and while you're at it it's important to **warm the battery if possible, and gyroscopic instruments** as well so they don't bind up in their own cold internal oil.

See http://www.mastery-flight-training.com/20190117-flying-lessons.pdf

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

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If you're in Wichita this weekend…

I'm presenting **"Decision Points: Lessons from Local Weather Accidents"** in this event:

Wichita Area Aviation Symposium

National Weather Service Symposium
On Saturday, February 9, 2019 at 09:00 Central Standard Time
Location:
Double Tree Hotel
2098 S. Airport Road
Wichita, KS 67209

Select Number:
CE0788881
Description:
This meeting is a National Weather Service presentation concerning how weather impacts aviation.
To view further details and registration information for this seminar, click here. The sponsor for this seminar is: **FAASTeam.**

See https://www.faasafety.gov/SPANS/event_details.aspx?eid=88881

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Pursue *Mastery of Flight.*

Thomas P. Turner, M.S. Aviation Safety
Flight Instructor Hall of Fame 2015 Inductee
2010 National FAA Safety Team Representative of the Year
2008 FAA Central Region CFI of the Year
Three-time Master CFI