FLYING LESSONS for October 7, 2021

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 in your success as the 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.**

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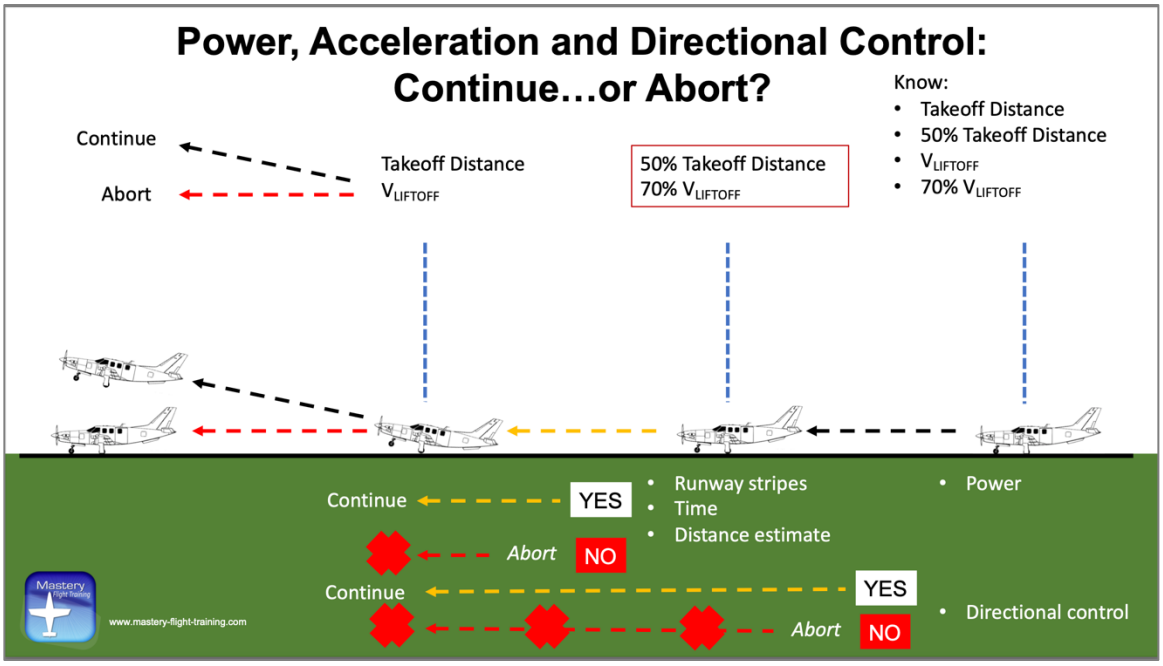
This week's LESSONS:

From an NTSB preliminary report:

> On September 2, 2021…a Cessna 560XL [corporate jet] was destroyed…in an accident near Farmington, Connecticut. The two pilots and two passengers were fatally injured. One person on the ground sustained serious injuries and three people sustained minor injuries….
>
> Two witnesses observed the takeoff roll with one reporting ***the airplane was "going slower" than they had seen during previous takeoffs.*** When **the airplane was about 2/3 down the runway**, one witness noted a **puff of blue colored smoke** from the back side of the airplane. The other witness stated that ***the nose landing gear was still on the ground as the airplane passed a taxiway intersection near the mid-point of the runway*** and he said to a friend with him that something was wrong.
>
> A third witness, who was beyond the departure end of the runway, noted ***the airplane departed the runway in a level attitude***. After clearing the runway, the airplane's nose pitched up, but the airplane was not climbing. **The airplane then impacted a powerline pole**, which caused a small explosion near the right engine followed by a shower of softball-size sparks. After hitting the pole, the noise of the engine went from normal sounding to a much more grinding, metallic sound. ***The airplane then began to oscillate about its pitch and roll axis*** before the witness lost sight of it behind trees.
>
> Postaccident examination of the 3,665-ft-long runway revealed ***tire skid marks from the right main landing gear tire*** that were right of the runway centerline beginning about 2,360 ft from the approach end of the runway. The mark from the right tire continued, while ***a mark from the left main landing gear tire*** was noted left of runway centerline beginning about 2,480 ft from the approach end of the runway. ***The marks from both main landing gear tires continued and veered slightly to the right but were continuous from where first observed to the end of the runway and onto a short width of grass immediately adjacent to the departure end of the runway.*** The grassy terrain beyond the departure end of the runway then sloped steeply downward toward a road, and the elevation change between the runway area and the road was about 20 ft….
>
> **…the parking brake handle in the cockpit, and the respective valve that it controlled, were both found in the brake set position….**
>
> Parking brake valve position and normal brake application were not recorded by the FDR, and the airplane's takeoff configuration warning system did not incorporate parking brake valve position as part of its activation logic…. Further review of the **FDR data revealed** that the longitudinal **acceleration values** recorded during the takeoff roll of the accident flight (0.245g) **were less than the recorded values for the airplane's two previous takeoffs** (0.365g and 0.35g). ***Additionally,*** **the time the airplane took to accelerate from 20 to 100 kts during the accident flight and the previous two takeoffs were 17 seconds, 11.5 seconds, and 12 seconds**, **respectively….**

The 70/50 rule suggests that the airplane should be at **70% of its liftoff speed** when it is halfway **(50%) of the ground roll distance**. ***The* decision to abort *should occur halfway into the airplane's planned takeoff roll,*** if the pilot compares indicated airspeed to calculated ground

roll and finds the airspeed lacking. The decision should ***not*** **be *delayed until the airplane is in the air at a high angle of attack and dangerously slow airspeed*.**



When and how to make the rejected takeoff decision (download https://www.mastery-flight-training.com/continue-or-abort.pdf)

Before you board the airplane for takeoff, know:

- 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 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; exhaust gas temperature—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 the reasons why after you've stopped and can 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 in the airplanes I common fly. **If any indication is unexpected, reduce power to idle and apply braking as necessary** to come to a controlled stop on the runway. Don't delay your decision further.

3. **If the airplane is not at or beyond 70% of its liftoff speed when passing 50% of the takeoff ground roll, abort *without delay***. Don't try to force the airplane to fly.
4. ***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 as necessary to stay on the runway. It might be a blown tire, or a jammed control, or incorrectly set trim. It could be an engine anomaly, partial power loss or total engine failure. 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 visualizing when you are at the 50% takeoff distance point. I teach the "counting stripes" method—a paved runway with standard markings has centerline 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.

This method is useless on a grass or otherwise unmarked runway. In that case you may have to pace off the runway or otherwise determine the anticipated liftoff point, and use some prominent spot along the runway that corresponds to your 50% of the way to that point.

Some pilots use a timed method (X knots after Y seconds), but that's dependent on airplane weight and density altitude. For example, I learned from instructors in the Cirrus Owners and Pilots Association (COPA) that they teach ten seconds from power application to 50 knots…which is close to 70% of the airplane's liftoff speed. I found this works well in the Beech Bonanzas I commonly fly as well…at least, most of the time.

Recently I took a student in a Beech Debonair to Colorado Springs, Colorado, for high density altitude training. With a density altitude of over 9300 feet, the computed takeoff distance was about 2300 feet. In this unusual case the "stripe" method works (we used it), but it took a lot more time to attain 50 knots (about 70% of liftoff speed). Since it's may be the more unusual conditions that result in takeoff accidents, it's important to adapt techniques as needed to the conditions as they exist.

We might draw many *LESSONS* from the accident that prompted this week's report—*LESSONS about* checklist discipline, crew coordination, complacency, fatigue and more. Focusing on one, however…

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 power to idle and brake as needed to come to a stop. You'll have plenty of time to figure out what's wrong sitting at zero airspeed and zero height above terrain.

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

Debrief: Readers write about recent *FLYING LESSONS:*

Several reader wrote comments along the lines of these in response to the September 23 *FLYING LESSONS Weekly*:

Reader/instructor Jeff Edwards writes:

> Taxiing while distracted…. Entering waypoints in EFIS instruments was a big one I see as a CFI.

Reader Fred Whitney sums it up nicely:

> This one is very valid, if perhaps made a little more complex than necessary. Summary: **Stop the airplane prior to conducting those activities that require eyes inside!**

As I brief my students before flight, **"Program, then taxi; or taxi, come to a stop, then program. Any time the airplane is moving on the ground your eyes should be focused outside."**

Reader Jeb Burnside, editor of *Aviation Safety* magazine, sent this clarification:

> Thanks for quoting that article from Safety. It predates my stewardship, and Ken Ibold, the former EIC [Editor in Chief], is its author.

Thanks, everyone!

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

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