J. MAC MCCLELLAN
BETTER PILOT / LEFT SEAT

Aborted Takeoffs

What to do when something goes wrong early in a flight

IT'S BEEN ALMOST 40 years, but I still remember the takeoff clearly. The runway was pretty short, just around 2,000 feet long. My Cessna 140 was not too heavy because I was alone, but then you are never too far below maximum takeoff weight in the little taildragger if you have fuel in the tanks.

The Cessna 140/120 airplanes have many fine flying qualities. In fact, they were among the most advanced of the two-seaters designed and built as World War II was ending. The airframe is all metal, the 140 had flaps, and a capable electrical system put it pretty far ahead of the Taylorcrafts, Pipers, Champs, and others of the day.

But with only 85 hp and a propeller pitched to deliver decent cruise speed, the Cessna is not much of a climber. I thought about taking up botany because I spent so much time examining tree leaves at close range just below the landing gear of my 140 after every takeoff.

My 140 was a low-time airplane in great shape. I bought it from the original owner who had kept all of the documentation, including the Cessna production test pilot's report from when he flew the airplane in August 1945. The airplane flight manual was one page long and listed a few limitations such as maximum takeoff weight—usually called "gross weight" in those days—engine oil temperature limits, and a few other specifications. Totally absent was any performance data, such as how much runway is required to get into the air at specific weights, elevations, and air temperatures.

PHOTOGRAPHY BY **JIM KOEPNICK**

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Whether Cessna collected and recorded detailed performance data on the 140, I don't know, but it certainly wasn't available to owners. We operated based on the wisdom of the old-timers who had been around long enough to learn from others, or at least observe what hadn't worked. And the tribal wisdom was that a 2,000-foot-long runway was plenty for a 140 to depart so long as the field was not at high elevation, or it wasn't a really hot day.

So I began this takeoff with nothing more than a couple hundred hours of flying experience and no real data on what to expect. Just seconds after I lifted off and was probably 10 to 15 feet in the air, something happened. I don't know what. The engine coughed, sputtered, hesitated, or made some strange sound. I think. Actually, I didn't think. For whatever reason, I yanked the throttle to idle, the airplane plopped back on the runway, and I was able to stop in what pavement was left.

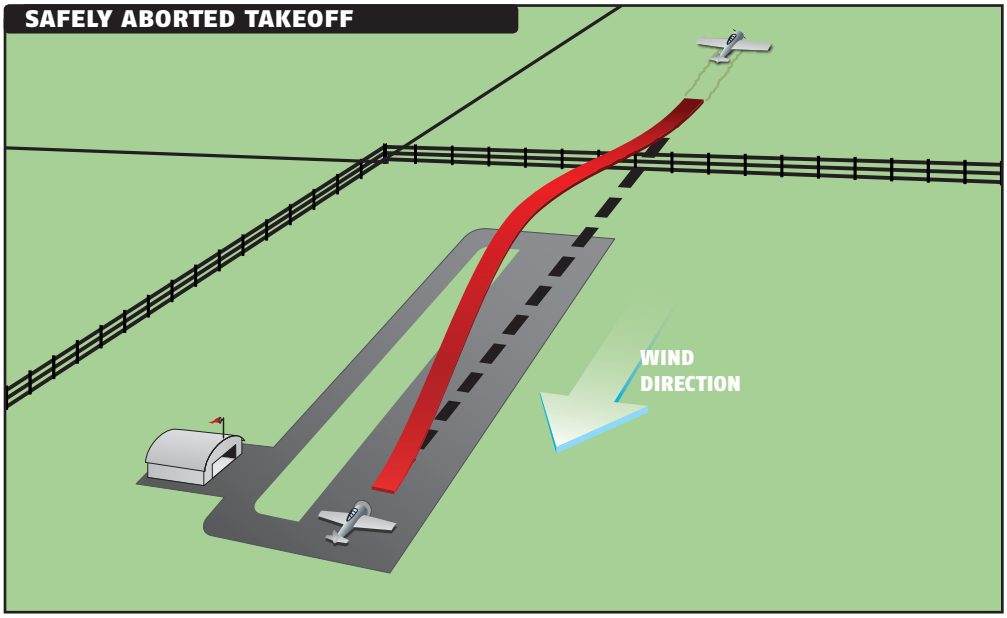
After taxiing back the engine ran perfectly no matter what I did with the mags or carb heat. If it had really skipped a beat on the takeoff, I couldn't be sure, but there was zero evidence that anything was wrong with its operation. I rolled down the runway again and flew on home.

That I was able to land and stop after the aborted takeoff was just pure luck. But my instincts were correct. With doubt about the engine operation my chances were better to be down on the runway and decelerating, even if I ran off the end, than to be in the air and fly past the safety of the runway with what I believed to be a failing engine.

With more modern airplanes and the performance data that comes with them, it is possible, and prudent, to make a takeoff abort plan in advance using the facts available instead of the by guess and by golly of yesteryear.

MAKING A PLAN

Takeoff planning is taken to its highest level in jets and other transport category airplanes where all possible factors are considered. Airport elevation, air temperature, runway slope, wind, the takeoff weight of the airplane, and any rain or snow contamination on the runway all impact takeoff performance. When all of those factors are considered the airplane flight manual shows a required takeoff runway length. That minimum length allows distance to accelerate to a decision airspeed (called V_1) and then abort the takeoff if something goes wrong just before reaching that decision speed.



Before takeoff decide your best option for a forced landing that is close to the extended centerline of the runway. Trying to turn back to the airport at a low altitude often ends up with deadly results.

ILLUSTRATION BY JOHN A. JOHNSON

The flight test data show that if the pilot immediately retards the power and applies maximum braking, there is enough runway left to stop from a rejected takeoff at V_1.

The most obvious safety requirement for transport airplanes that any general aviation pilot can adopt is to build in plenty of margin for something to go wrong. For example, if your pilot's operating handbook (POH) says you need 1,500 feet of runway to clear a 50-foot obstacle under the weight and atmospheric conditions of the day, doubling that to 3,000 feet gives you lots more options.

In a single-engine airplane, or non-transport category twin, the V_1 takeoff decision speed is always going to be less than takeoff rotation airspeed. Obviously, if you're still on the ground and something goes wrong, you need to stay on the runway and stop.

Before each jet takeoff the pilot goes through a pre-takeoff briefing. It includes the clearance of what heading to fly and what altitude to climb to, but the pilot also discusses what could go wrong on takeoff and what he plans to do if that happens.

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KNOW WHAT COULD GO WRONG

A key part of the briefing is to list the possible bad events that would cause the pilot to abort the takeoff. At the top of the list of reasons to stop on the runway are urgent problems such as engine fire indication, a red warning that indicates failure of an essential system, and, perhaps most importantly, loss of directional control.

Any pilot would yank the power back if he had a fire indication on takeoff, or noticed that the flaps were not set as intended, or the alternator conked out, but any doubt about positive directional control is, to me, the most important reason to abort a takeoff.

Strong gusts of wind, slippery runway conditions, or a failure in the steering system could all cause a pilot to start swerving on the runway. Or, maybe you're just not having a good day and the airplane starts to get away from you. What accident history shows, and what the people who write the rules for takeoff procedures in large airplanes know, is that if you start to drift off the centerline during the takeoff roll, the situation usually gets worse as the airplane accelerates, not better.

So, remind yourself before each takeoff that if the nose starts to point somewhere other than down the centerline, pull the power back and brake. Running off the runway is the most common single cause of takeoff accidents and one you can avoid by recognizing the problem quickly and getting the airplane stopped.

Pilots of transport airplanes don't have to make decisions about what to do if an engine quits after liftoff because the remaining engine or engines have demonstrated in certification testing that they produce enough power to continue to climb. But in the light airplane, single or twin, the pilot must take action if the engine misbehaves after liftoff.

The fact is that normal airplane brakes are more effective in stopping than the engine thrust is in accelerating. So if you needed 1,500 feet of runway to accelerate to flying speed and lift off, the brakes can stop you from that same speed in less distance. If the runway was at least twice as long as needed for takeoff, that means you have runway left to get back down on the runway and stop if a problem develops shortly after liftoff.

Another important pre-takeoff consideration is to decide your best area for a forced landing that is close to the extended centerline of the runway. Trying to turn back to the airport from a low altitude is a certified killer, so before starting the takeoff you want to have a spot in mind to head for that offers the best chance if something goes wrong. It takes time to think, so time spent thinking before takeoff is time you don't need to spend before reacting if an emergency occurs.

RAISING THE GEAR

A continuing controversy in the piston airplane training establishment is when to raise the landing gear after liftoff. Those who advocate for leaving the wheels down until reaching the far end of the runway claim the reduced climb rate caused by the drag of the extended gear is worth it in case you need to land on the pavement.

Those of us who bring the gear up at positive climb indication counter that we want the extra altitude as quickly as possible. And we also pay our insurance bills. Rarely is anyone hurt during a gear-up landing on a runway in a light airplane, so if I slide it on after an emergency I'll give thanks to be there and call my agent.

Bottom line, the takeoff is the only maneuver in flying that gives us unlimited time to plan in advance. The more we consider what could go wrong, and develop a procedure to deal with that emergency, the safer each takeoff will be. EAA

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