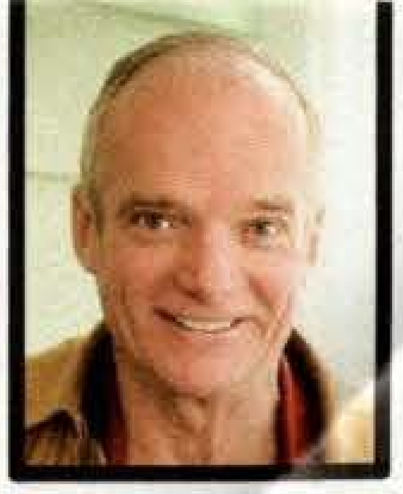


CHARLIE PRECOURT

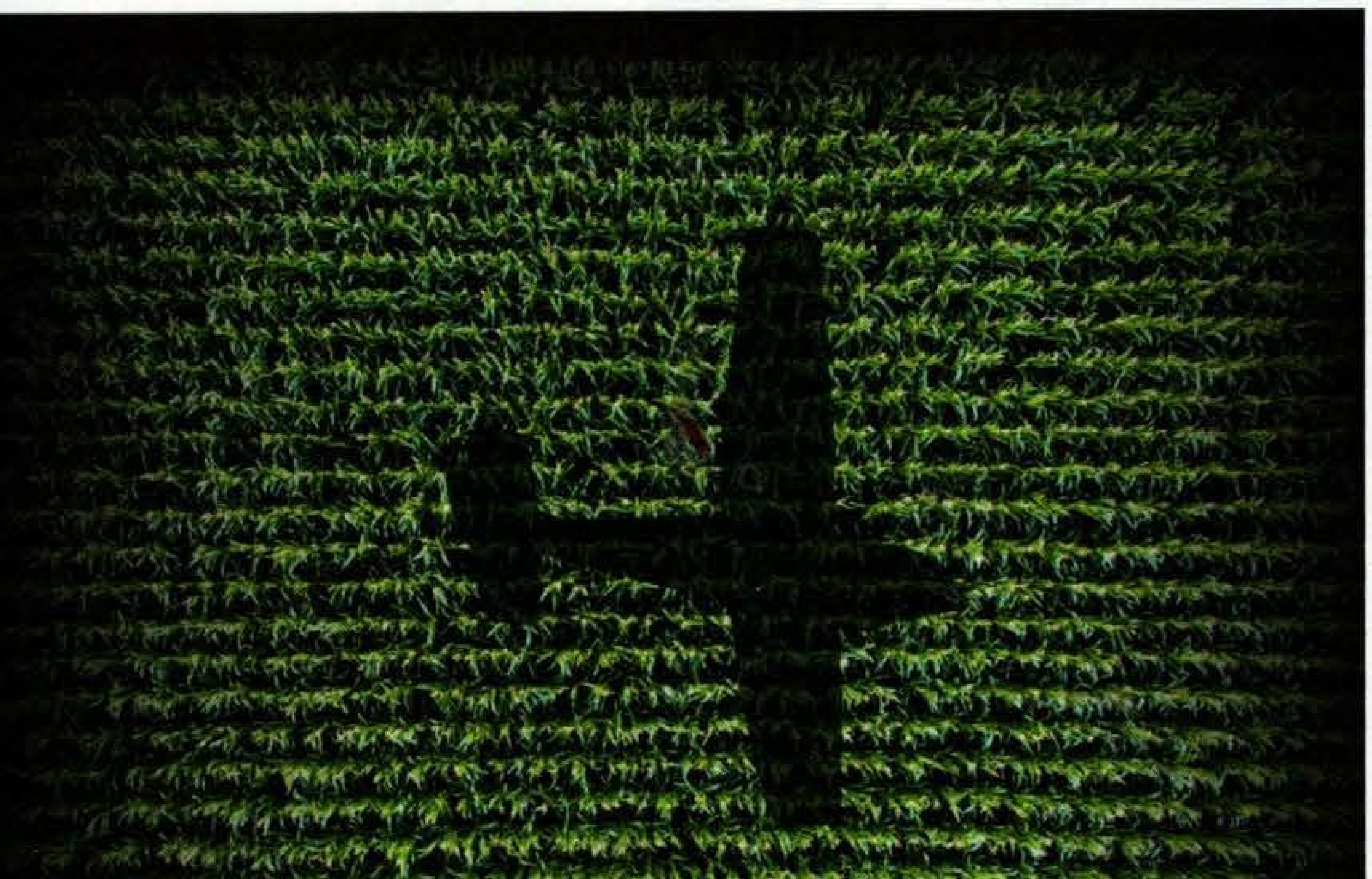
COMMENTARY / FLIGHT TEST

Revisiting Engine Failure Training

Building proficiency in handling the unexpected

BY CHARLIE PRECOURT

REACHING A RUNWAY in an engine-out training scenario has always been one of my favorite training exercises. Obviously, we can't achieve a runway landing in every scenario, so a big part of this training is also meant to build judgment for when to go for a runway and when to find an off-field alternative. When you think about it, engine failure, especially in a single-engine aircraft, is among the most serious emergencies we might face. Yet we can anticipate and train for this eventuality and increase our chances for success. The challenge comes with the endless number of circumstances we might confront — takeoff, climb-out, cruise, in the weather, on approach, or in the pattern. It really boils down to a math problem, knowing the numbers for your aircraft and following the primary rule — fly the airplane first.



What does it mean to know the numbers? In short, knowing how much performance you can extract from your aircraft when you are engine-out. What are the glide speed and glide ratio? How much altitude do you lose in a 360-degree turn at max glide speed (both in cruise and in landing configuration)? How far can you glide from a given altitude? In the space shuttle (obviously an engine-out scenario), we lost 12,000 feet of altitude for every 90 degrees of turn in the arrival phase prior to rolling out on final — yikes! In the MiG-21, we needed 6,000 feet from a high base position to make a turn of 180 degrees to the runway. In the L-39 jet trainer, I could achieve a full 360-degree overhead turn to touchdown from only 1,000 feet above the runway. What do you need for your aircraft?

If you don't really know what to expect of your aircraft, you can easily learn in a controlled manner. For the takeoff phase, go to a safe altitude in your practice area, say 3,000 feet above the ground, and fly a simulated takeoff climb, at climb speed, and chop the power and perform a 180-degree turn. Measure how much altitude you lost. Then add 50 percent to that and make it your minimum altitude to attempt a return to the runway if you ever lose an engine on takeoff. Why add the 50 percent? Because if you perform a 180-degree turn, you'll be offset by your turning radius from the runway centerline requiring you to turn further than 180 degrees to angle back to centerline for landing. Reduce the offset by planning this turn into the crosswind. So a simple 180-degree reversal maneuver ends up closer to 270 degrees of turning in the return-to-the-runway scenario. If you don't account for this, you can end up in the dreaded stall-spin crash attempting to get to the runway. If the engine fails below your minimum turnaround point, fly straight ahead or make minimum turns to pick the best off-field spot. And fly the airplane all the way to a stop!

Now for the takeoff phase, you have some math that works for you — a minimum turnaround altitude. Bank angle matters, too. Do a turn at 30 degrees of bank and another at 45 degrees; you will be surprised at the difference in altitude loss. The absolute minimum altitude loss for a turn reversal occurs at pretty steep bank angles — but that's not a place to be when you're close to the ground. Make sure you always maintain best glide speed or slightly higher.

ILLUSTRATION BY BRANDON JACOBS

For cruise scenarios, we add some more math. How far away from a runway can you be and make it if you lose the engine? If your glide ratio is 12-to-1 (lift-to-drag ratio max is 12), then for every nautical mile high you are (6,000 feet altitude), you can glide 12 nm distance. Obviously, this is without wind, so you'll need some margin for that, too. Here's where knowing how much altitude you lose in a 360-degree turn really helps. If you have enough margin to glide to a runway and still perform a 360-degree turn over the field, then you are in pretty good shape. That extra altitude will allow you to align with the best runway for landing. If you have ForeFlight, you can use the Glide Advisor feature to help you with this math (see "New Tools for Max Glide," Flight Test, July 2017).

Engine failure, especially in a single-engine aircraft, is among the most serious emergencies we might face. Yet we can anticipate and train for this eventuality and increase our chances for success.

My favorite exercise is to go to a nontowered field when there's no traffic, pick various starting altitudes and distances, pull the power to idle, and perform a glide to the runway. Go to 6,000 feet at 12 miles out, as in the 12-to-1 glide ratio airplane example above, and see what you can do. Enter from a variety of angles. Use the math for your airplane's glide ratio and speed. Each time you set up the exercise, go through the pilot's operating handbook engine failure procedure, maintain best glide speed, aim for the center of the airport until you get close enough to determine whether you can achieve a particular runway, and then execute the close-in procedure. What's that? The close-in procedure is establishing check altitudes at key points in the pattern to your chosen runway, such as 1,500 feet midfield downwind, 800 feet turning base, and 300 feet rolling out on a half-mile final. These key checkpoints, which are repeatable and reliable for the performance of your aircraft, are what you should develop in your own training. My numbers are only a generic example. The goal is to take any initial condition at a distance from the airport and manage your glide and energy to arrive at a known point relative to a landing runway that provides you the "numbers" you need to reach the runway. So, as you fly these approaches, you should get very familiar with what it takes from midfield downwind, abeam the numbers, and turning final. In the military, we called these "key positions." Being at or a bit above the key numbers is the goal. Always keep a little money in the bank. Initially, aim for a touchdown one-third of the way down the runway, and carry 5-10 knots above best glide speed on final. Glider pilots usually use half spoilers on base and final, allowing them to extend the glide if they misjudge the glide on final. Remember, you are going from a tailwind on downwind to a headwind on final.

Once the runway is made, you can always dump extra energy by adding flaps, performing a slip, or extending a base to final turn. Go out and try a number of these. If you can't make the runway, go around and make note of that initial condition and try again from a bit closer-in condition. Over time you will gain a really good feel for what's achievable. The more situations you practice, the better you'll be at handling the real thing.

Remember, too, that your goals include optimizing performance by establishing best glide speed immediately upon losing the engine (simulated or real) and holding it all the way into where you know you can reach the runway. If you can't reach the runway, find a suitable off-field alternative and fly your key positions to that chosen location. Get the checklist down pat — it enables you to potentially recover power and get you back to a field if there's time to troubleshoot. The most important thing in all of this, though, is to maintain aircraft control. Fly the aircraft first!

Your goals include optimizing performance by establishing best glide speed immediately upon losing the engine (simulated or real) and holding it all the way into where you know you can reach the runway.

This proficiency exercise is a good one for all of us in single-engine aircraft, but it is particularly important if you are preparing to enter Phase I flight testing of a new homebuilt. As we roll out our new *EAA Flight Test Manual* to help builders execute Phase I flight testing, it is worth noting that we recommend building proficiency in the same or a very similar aircraft prior to testing your new aircraft. We also recommend that you remain within gliding distance of a suitable runway until you have confidence in your engine. The NTSB identified engine failure and subsequent loss of control as one of the most common accidents in Phase I. That's why we've been pursuing initiatives like the Additional Pilot Program and publishing the *EAA Flight Test Manual*.

So, go out and have some fun and learn what your aircraft can do if you ever lose power in flight. You'll be glad you did come the day you get surprised.

Fly safe. EAA

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