THE MINIMUM TRIM GLIDE
THIS TECHNIQUE COULD BE YOUR FRIEND IF THE ENGINE QUITS

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The propeller has stopped, and you have a real emergency! The airplane you are flying has become a glider, and the way you manage the next few minutes is critical.
Early in training we are taught to establish *best glide airspeed*. Perhaps you were surprised that such an important number as best glide airspeed is not marked on your airspeed indicator, but requires consulting the pilot's operating handbook (POH) for each airplane. It is a speed that every flight instructor expects you to know cold, and there probably has never been a checkride that does not include a question about it.

However, I have the temerity to suggest it is not a number that must be memorized, because even if properly recalled in an emergency, it is not as useful as you may have been told. (Of course, that may not excuse you from knowing the number for a checkride.)

Best glide speed is the airspeed at which an airplane will travel the farthest for a given altitude. There is only one airspeed that will maximize glide range. A POH will provide that speed and perhaps a table or graph showing how far you can expect to glide from a given altitude above the ground. Most light aircraft glide two to three nautical miles for each 1,000 feet of altitude.

However, certain conditions will affect the resulting glide distance. A typical light aircraft must have its flaps up and the propeller stopped (although I know of no POH that provides cific method to stop a windmilling prop. I suggest that you don't worry about the motion of a ıxed-pitch propeller). For complex aircraft the variable-pitch propeller should be at lowest rpm or feathered. The landing gear must also be retracted. If any of these conditions is not met, there will be increased drag and a shorter glide range (but it won't change the recommended speed).

The maximum glide speed published in the POH applies only to an aircraft at maximum gross weight--a condition that you probably won't be experiencing should you actually need to perform an emergency glide. The only time you can legally be at maximum gross weight is at takeoff, and therefore the published best glide speed is too fast for almost all emergency situations. The most frequent cause of engine stoppage is fuel exhaustion, and if that happens, the aircraft is well below maximum gross weight.

To obtain maximum glide range, glide airspeed must be reduced as the airplane becomes lighter. I am unaware of a POH that publishes a chart or formula to calculate glide speeds for reduced aircraft weights. The formula is a square root function of the actual gross weight divided by the maximum gross weight.

Now assume that you knew--or could compute--the aircraft's current weight and have calculated the maximum glide speed for that weight. (Can you extract square roots in your head?) Is that the speed you really want to use? Maximum glide distance is also dependent on wind aloft. Obviously your gliding range is greater downwind than upwind. However, there may be an advantage to gliding more slowly with the wind, as the increased time aloft allows you to benefit from the wind for a longer time. (Don't spend so much time figuring out how to maximize your glide distance that you overlook a perfect landing site right below you.)

Of course, the opposite is true, too, if you are bucking wind with the glide. While upwind glide distances are always shorter than a downwind glide, maximum upwind range against the wind can be increased a little by increasing glide airspeed. This diminishes exposure time to adverse winds.

But choosing best-glide airspeed based on weight and wind does not complete the calculation. Your engine has stopped. Do you want to establish a maximum-range glide now, while attempting to restart the engine and deciding which direction to go for an emergency landing?

An initial goal might be to establish the airspeed that provides *minimum sink*. This would keep the aircraft aloft for the longest time while you sort out problems. Then when you know where you are going for a landing, you could convert to the airspeed providing the longest glide distance. Minimum sink airspeed will not be found in a POH (unless you are consulting the POH of a glider), but it is always slower than maximum glide airspeed even after adjusted f ight.

Now let's be practical. The engine has stopped, and it's possible that both fuel tanks are empty. Do you have a slide rule or calculator aboard to do the calculations? Do you accurately know the winds you will encounter on the way down? Is it really practical in such a critical situation to do

mathematical calculations? Of course not. And you might not be in a mental state to do them accurately, even if all the data were at your disposal.

As this approach is far too complicated for an emergency, I teach a very simple method to establish an emergency glide. I do not claim it will result in absolutely the longest glide, but I doubt you can do much better in the face of a real emergency.

I was taught the concept by a test pilot for Piper Aircraft Corporation. As part of the FAA certification testing for each aircraft he had to demonstrate a minimum (sometimes called *maximum) trim glide*. Every light aircraft I know will fly with power off and trim at maximum aft position. The airplane will not stall.

That trim point establishes a speed several knots slower than maximum glide range airspeed at maximum gross weight. However, it is a very good estimate of the best-glide speed you need, which we already established is less than the published airspeed for maximum gross weight.

Here is how it is done when you practice--and I strongly recommend you try this out at a safe altitude *before* you really need the method in an emergency. If you do not practice a technique, you are not likely to recall and implement it when needed.

Set the throttle to idle. As the airplane slows, gradually increase trim aft, initially keeping the airplane at the same altitude. At some point you will reach published glide speed, and for demonstration purposes let the airplane begin a gliding descent. Note the position of the trim. It should be well aft, but not at the stop. Now gradually continue to trim aft to the stop--yes, *all the way back*. The airplane slows down even further, but--surprise--it remains stable and does not stall! Take your hands off the yoke, and the airplane continues to glide at a constant airspeed all by itself. You have now established a "min trim glide" (or as some call it, "max trim glide"). You may note the indicated airspeed, but that is not necessary, as you are accepting whatever airspeed the trim commands.

Now you now know how to automatically establish a glide with little fuss, without knowing the glide speed in knots, without looking at the airspeed indicator, and without manipulating the elevator. You can save your brainpower to troubleshoot and pick the best place to land.

When actually needed in an emergency, the procedure is to simply continue aft trim to the stop at a smooth rate that does not balloon the aircraft. You do not need to look at the trim indicator, as you can feel when the trim has reached the end of its travel against the stop. It is a waste of time to even look at the airspeed indicator. You do not even care about published glide speed.

No input is needed on the yoke. At full aft trim, the plane descends in a controlled glide, and almost flies itself.

You can continue in that configuration all the way to the ground. However, when landing is assured there may be an advantage to reconfiguring the airplane for landing--flaps, gear, and more normal landing airspeed. But be forewarned--you must be high, as each of these actions increases the rate of descent and decreases glide distance.

I recently added to this technique for flying airplanes equipped with an autopilot and a GPS. There is a tendency to immediately disconnect an autopilot on engine failure and not engage an autopilot after engine failure. Both of these courses should be reconsidered. So long as there's battery power, an autopilot will continue to function even after the engine has failed. Once established in a min trim glide, why not engage the autopilot? The most basic autopilot will maintain wings level while you troubleshoot, and aft trim will maintain airspeed. More capable autopilots can follow a heading. The autopilot can be an effective copilot and decrease workload in an emergency.

A GPS is also a valuable tool in an emergency glide. It can point you to the nearest airport and tell you whether you are likely to reach that airport. Once established in a glide, the GPS will use your current groundspeed, which reflects the prevailing winds, to indicate the time it will take to reach the emergency airport. Divide the altitude above airport elevation (which is also indicated on most GPS databases) by the rate of descent indicated on the VSI. That will tell you the number of minutes of flight left. It should immediately be apparent if you will have sufficient time to reach the field. Ideally you want to reach an airport with 1,000 feet of altitude remaining, and at minimum 500 feet to spare. Remember, in most cases you will have to maneuver and reconfigure the airplane upon reaching an airport, and that will cost altitude. Resist the temptation to pass up a perfectly good field that will give you plenty of time to set up for a good landing, just because you might be able to glide to an airport.

There is much to recommend the min trim glide, especially its simplicity. Several pilots have reported that they used the procedure in an actual emergency--and it worked! Consider adding it to your emergency repertoire.

Dr. Ian Blair Fries is a CFI, senior aviation medical examiner, and ATP, and holds a Lear [illegible]e rating. He serves on the AOPA Air Safety Foundation Board of Visitors and is cochairma[illegible] the AOPA Board of Medical Advisors.

Ian Blair Fries