

Surviving Off-Field Landings: Emergency Landing Pattern

By Wally Moran



About Wally Moran



Wally Moran is a retired airline captain and spent much of his career as a training instructor and check airman on aircraft including the Boeing 747 and 767. He has held a flight instructor certificate for over 50 years. He is a Designated Pilot Examiner for airplanes and gliders and has given over 4000 hours of flight instruction in single engine, multiengine, gliders and seaplanes. Wally has been awarded the FAA Wright Brothers Master Pilot Award in 2013

About Bob Martens



Bob Martens is a nationally known speaker, consultant and aviation safety expert. He retired from the FAA after spending 17 years as a Safety Program Manager. In this role, he delivered hundreds of live seminars devoted to General Aviation safety. Bob retired from the USAF (rank of Colonel) in 2000 after 30 years of active and reserve duty. He was an Aircraft Commander in a C-5A and also served as Flying Safety Officer and Chief of Safety with the 439th AirWing. Bob has logged thousands of flight hours in both military and GA aircraft.

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Bob: Wally, I think you certainly appreciate and share with me my passion for teaching pilots the emergency landing pattern and being solid in this area of flying. We've done a previous program on this, but given the fact that when you're out there flying your glider, you're essentially making an emergency landing every time you fly, I thought it would be great to pick up whatever insights you can provide us with regard to this crucial area of our flying.

One of the subjects we talk about is the fact that every single emergency landing is inherently different. The variables could be all over the place, but having said that, we're going to be striving for consistency in our landing patterns in an emergency. How do these two areas come together?

Wally: Well, Bob, certainly every emergency landing is a unique situation. However, you will find there are many similarities, and recognizing that, we can train and practice on those areas to ensure our proficiency.

Sadly, what I often see during flight exams and training is the pilot attempting to do something they've never tried to do before when performing the emergency landing. What do you think the chances of success are when doing a new maneuver for the first time, especially when under the stress of an engine failure or a real emergency?

Yet I see pilots attempt to go straight into a field from 4,000 feet, or make a downwind at 3,000, or a base leg at 2,000. Since it's almost impossible to practice these kinds of approaches, this most often results in a gross overshoot or undershoot, which now leaves the pilot low, with very few satisfactory options.

Don't we have an obligation to ourselves and our passengers to be proficient in this important maneuver? Thinking about this problem and doing some proactive work now could pay off big time if we ever need it.

Bob: Wally, I couldn't agree with you more. What are some of the things you do as a glider pilot to improve your chances of a successful landing once the engine's not running?

Wally: Well, as a glider instructor, Bob, I've logged over 1,500 dead-stick landings. I regularly teach glider pilots how to get the airplane on the ground safely. The secret to getting that glider into the field is to use the same, consistent pattern every time.

This consistency helps establish an awareness of appropriate glide angles and can be used at the home field or in the event of an off-field landing. Off-field landings are not uncommon in the glider world and are routinely done without any incidents.

The same technique is also the secret to successful emergency landings for power planes. We need to plan and practice a standard pattern which we'll use every time. Doing it this way provides two distinct advantages.

One, a standard pattern constantly allows the pilot to adjust his approach as he flies through lift and sink and changing winds. Secondly, it's something

we can practice on a regular basis, so we're apt to be more proficient when the time comes.

Bob: Wally, can you describe for us what this pattern looks like?

Wally: Sure, Bob. The standard pattern should start on downwind leg. There'll be more touchdown spot, including the spot that we've chosen in the field that you've helped us select in an earlier workshop.

We should do that at approximately 1,000 feet above ground level, and at a distance it'll put that touchdown point at about a 45-degree angle below our wing. This will be closer than the typical landing pattern that a power pilot is accustomed to.

Bob: It sounds easy enough, but how do I determine 1,000 AGL when I'm landing in a strange field?

Wally: First of all, one should always have a general idea of the elevation of surrounding terrain if they're keeping up with their navigation. Furthermore, we'll get a chance to practice every time we enter the traffic pattern, Bob. If we just pay attention, you'll soon recognize the fidelity of ground objects from this altitude.

It's an altitude we use regularly every day. If we look out the window and try to establish references, it'll become quite easy for you to do it even in a strange place.

As a further exercise, you can fly out to a sparsely populated area where you know the elevation. Level off at 1,500 feet AGL. Look around, descend to 1,000 feet, and note the difference. Then descend to 500 feet if it's safe to do in this area and note the difference again.

Climb back up to what looks like 1,000 feet without your altimeter and see how you do. I'll bet you'll be pretty close. Practice this exercise from time to time and keep it fresh in your mind.

Also, each time you enter the pattern, descend to what looks like pattern altitude to you without the use of the altimeter, then check to see how well you did. You'll be surprised how well you can do. You can practice this every time you fly.

Actually, it's not important to be 1,000 AGL on our downwind as long as we set up the 45-degree angle. Your altitude will compensate for the distance. If you're a little low, you'll be closer. If you're a little high, you'll be farther out.

Bob: It sounds like a helpful exercise, Wally. Okay, so now I'm abeam my touchdown point at 1,000 feet AGL. What do I do now?

Wally: Every airplane has a minimum and a maximum glide angle. The minimum glide angle is at the best glide speed with minimum drag. The maximum angle is with maximum drag and a slip.

Now all we have to do, Bob, is keep our flight path between these two angles somewhere and we'll land on the spot. Gliders have a great advantage over power planes in this area as the best glide angle is typically much flatter than a power plane.

The high drag approach can usually be much steeper. The first one is by design, they glide well. The second is because gliders have excellent dive brakes. This gives the glider pilot a wider range of acceptable angles and therefore makes their task easier.

There are some things we as power pilots can do to increase our range of angles. The first is to be sure we can fly the airplane precisely at the best glide speed. Of course, we need to know what that speed is first of all. Doing so will improve our range and effectively improve the lowest angle acceptable for us.

Then we also need to be sure we're proficient in using all the high drag tools we have including slips, landing gear, and flaps. This will give us the best angle we can get on the high side. Naturally, we only do what's permitted by the POH.

The greater spread we can achieve between the flattest and the steepest glide angles, the easier it will be for us to make an accurate approach. Both of these items require regular practice to maintain proficiency. This is practice that may pay off big time if you need it.

Now that we're in the proper position and at the proper altitude, we can proceed past our touchdown spot, but we must be constantly keeping it in our scan so that we can recognize any changes to our angles. We must remember that any tail wind we have now will be head wind, which we must penetrate when we turn final.

If the wind is very strong, we'll not need to go too far on the downwind. If it's light, we need to allow a little more room. As our angle to the touchdown spot begins to decrease, we need to turn base leg. This is our key position.

As we constantly reevaluate the angle to touch down, we can either allow the base to widen out, or if we're feeling a little low, we can proceed more

directly to the runway. This gives us the ultimate ability to adjust our approach as we recognize the need.

An important point here is that one must maintain a constant airspeed as we go around the pattern, as changes of airspeed will give a false impression of our approach progress.

Diving at the field will make the picture look better, but it isn't going to shorten the landing. We'll still have to get rid of that energy someplace. Trying to stretch the glide by pulling the nose up won't work either.

Usually the airspeed will be best glide speed, but maybe more depending upon wind conditions. What is important is that it is constant and not faster than your normal approach speed, therefore trimming the aircraft for the appropriate speed is essential.

Establishing a downwind at approximately 1,000 feet AGL and on a 45-degree angle out has us close enough and low enough to easily recognize changes to our approach, but most importantly gives us the ability to alter the base and final approaches as needed.

Bob: Wally, why not hedge our bet a little bit and use an altitude higher than 1,000 feet on downwind? That seems safer.

Wally: Sounds like a good idea, doesn't it, Bob? Downwind legs that are significantly higher than 1,000 feet require us to go well past the field in order to lose enough altitude. That makes the base leg turn farther up and subsequently the final that much longer and more difficult to judge.

Long straight-in approaches are also difficult to judge. They provide few opportunities to adjust the approach and are rarely practiced. One thousand feet allows us to have a safe, but close-in pattern.

However, it's good to arrive at your selected field as high as possible. Then one can fly around the field looking for unseen issues, such as power lines, obstructions, and obstacles. Flying around the field allows you to adjust your track as needed to arrive at the proper spot and provides you valuable time to prepare for the landing.

Bob: Wally, there are those who advocate a spiraling-down approach over our intended landing spot. What do you think about that approach?

Wally: I've seen some pilots try it, but I don't recall seeing it ever work out for anybody. If you think about it, you'd have to be very lucky to have the spiral end at the proper altitude and heading to make a landing.

Furthermore, with this method, you have your back to the landing spot half the time, so it's very difficult to see how you're doing.

Speaking of practice, that's one of the advantages of using this type of pattern. We can practice it at many airports and safely take the maneuver all the way to touchdown. We simply set up at 1,000 AGL on the proper downwind, confirm there's no traffic in front of us, pick a spot somewhere on the runway, and close the throttle.

I like to pick a spot about 1,000 feet from the end of the runway. Now, adjust your base leg as needed to land on the spot. I'll bet if you haven't practiced recently, you won't do very well at first.

Guess what? That's the way your forced landing would have happened if it had been for real. Better get out and practice some more. Be sure to keep it safe and go around any time you're uncomfortable with the approach. This approach should not require any dangerous maneuvers.

If we practice this pattern and the associated skills often, we'll be ready if the real thing ever happens. Won't the added confidence and knowing that you just did one last week be reassuring? The time and effort you spend could pay off big time if you ever need it.

Bob: That all sounds good, Wally. What about if I get my engine failure at low altitude where I don't have 1,000 feet to play with?

Wally: Low altitude engine failures are dangerous, and unless the pilots are very lucky, they often turn out badly, Bob. Naturally, the overriding factor is to maintain aircraft control all the way to touchdown. Even if one must land in treetops, or even rooftops, doing it in a controlled manner at the slowest possible ground speed will significantly reduce the potential of injury.

Landing into the wind is the one factor that will produce the lowest touchdown speed. Landing with the crosswind is less desirable, but acceptable. Landing downwind should be avoided if at all possible.

How the pilot does that depends on the terrain and the altitude. One of the most important steps we can take to improve our odds in this area is to give the problem some thought prior to every takeoff, and have a plan of action. All professional pilots have a pre-takeoff briefing, and that includes the engine failure scenario.

Drive around your local airport. Look at the opportunities for a forced landing. Last, but not least, spend as little time at low altitude as possible. We can do this by using the proper climb-out speeds like VX and VY.

Bob: Wally, this is terrific insight. It is so dramatic that daily, glider pilots are routinely making engine-out landings safely and efficiently while in general aviation emergency landings far too often end in disaster.

The powered pilot has the same tools available that the glider pilot does, but they're not practiced on a regular basis. I think that's the key that we power pilots need to recognize the need for, and integrate that into our training so that when the time comes, we're as good as the glider pilot at getting the airplane on the ground.