ON FORCED LANDINGS
BY
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The pilot was cruising along 7500 feet above the ground when suddenly the engine quit. Chances are, he just ran out of gas. I have to think of *some* reason why he all of a sudden found himself gliding.

Maybe he was flying in his antique airplane whose engine was designed and manufactured a long time ago. Airplane engines of yesteryear were not the reliable machines we are blessed with today. Back then you were well advised to be in the habit of scanning for cow pastures, since forced landings were more a part of a pilot's normal experience than they are today. Many pilots still consider it important to keep up a constant scan for open spaces and level ground within gliding distance when flying in single-engine airplanes. There are also pilots who think it's not worth the risk to fly single-engine airplanes in IFR conditions, over mountains, out of gliding distance of dry land, or at night. Some even consider it foolhardy to venture aloft at all without the redundancy of two or more engines.

To be brutally honest, engines do fail us from time to time. The good news is that these days the probability of an engine problem serious enough to require an immediate landing is extremely low. The other good news is that, if a pilot is faced with an

unplanned return to earth, it is a relatively simple matter to terminate the flight without undue risk to people or property.

I've had six occasions when my engine became uninterested in further toil. Five of those six times I landed pretty much where I had intended to land anyway. Never have I put a scratch on an airplane or a passenger as a result of such a landing. It may have been luck once or twice or even three times. But *six*? I'm not really all that hot a pilot. I have to believe that a forced landing is not a hugely demanding task, at least not in a little single-engine airplane with a slow landing speed.

I have omitted from my collection of forced landings the ones I accomplished in gliders. These remarkable flying machines have such low sink rates that it takes very little rising air to keep them aloft.

The low sink rate of a typical glider, no greater than about 200 feet/minute in still air, allows the pilot lots of time to set up a landing pattern and regulate his angle of descent using flaps and dive brakes. All in all, it is much easier to make a precise landing in a glider than it is in an airplane.

When flying a glider, the pilot often flies at the so-called "best L/D" speed, the airspeed that gives the most lift for the amount of drag created. Airplanes also have speeds that will result in minimum sink rates in addition to those that provide maximum glide angles. In the owner's manual for a modern airplane,

they give a “best glide speed,” which puts the pilot of an engine-out airplane pretty close to what he needs for best performance. Without getting too deeply into the lift vs. drag discussion, there is a difference between the speed that will keep you in the air the longest and the speed that will result in the farthest horizontal distance flown during a particular amount of altitude loss. In order to cover more horizontal distance, you should fly around five knots above the maximum L/D speed. You should also put on a little more speed if you have a headwind and fly a little slower with a tailwind. In the heat of the moment, I suspect, the difference in performance among these various speeds is nugatory. If speed control this precise is necessary to make your chosen landing place, you might want to consider choosing a closer location for your return to earth.

Most light planes that I fly seem to come down at something less than 500 feet per minute, about two and a half times as fast as the low-performance gliders used for training purposes. The airplanes, however, are moving about twice as fast through the air, thereby covering more territory, than the glider. So the glider pilot has the advantage of having longer to dwell on his situation, but he may not be able to penetrate a headwind much better than the airplane pilot with a dead engine, in the absence of rising air that glider pilots call “lift.”

A pilot should realize that most light single-engine airplanes are pretty good gliders. Flying at the best glide speed helps. Stopping the propeller can also be of some benefit. The typical light plane engine has enough compression to keep the propeller from windmilling, but getting the whole system stopped can be tricky. It may be necessary to slow the airplane to near its stall speed before the prop stops spinning in the slipstream. If you think you're going to be gliding for as much as several minutes, stopping the prop is probably worth your consideration.

Some airplanes are equipped with constant-speed propellers. Pulling the propeller control all the way back so that the propeller blades are at their maximum pitch also helps to reduce the drag of a windmilling propeller.

I teach my students that here are different priorities for high-altitude and for low-altitude engine-out emergencies (The first priority at any time, of course, is to keep the airplane under control). If you're up at cruising altitude, say, between five and ten thousand feet above the ground, I suggest that your first priority is to get the engine running again. A common cause of the thing quitting is that it's not getting any fuel. Check to see where the fuel selector is set, and move it to a different setting. I figure if it quit when you had the left tank selected, it sure can't hurt to try the right one. Also, you might want to turn the magneto switch to another setting. I had a partner

in a plane get a very rough engine out over the swamp just east of Lafayette. He cured the problem by switching off one of the magnetos. The other mag worked just fine, and he made it to the airport without further ado. The problem was that the bad mag was working against the good one, firing the fuel-air mixture at the wrong time. If you are flying a machine with a carburetor, of course, apply carburetor heat. If there is an auxiliary fuel pump or a boost pump, turn it on. If it was off at the time the engine quit, it's probably not going to hurt anything to activate the thing. If you are flying a fuel injected plane, there may be an alternate air source you can open up, just in case your powerplant is suffering for a lack of oxygen

If the engine is getting gasoline, air, and fire, there are not too many other things that will keep it from running, at least nothing you can fix up there in the air. But this point bears repeating: *Keep the bird under control*. Set up a reasonable pitch attitude and get it trimmed. Using your autopilot, if you have one, might also be a good move at this time.

The next step is potentially a life saver. I think getting on the horn and letting someone know where you are is pretty important, especially if you're going down in the boonies, away from civilization. A quick radio call to ATC can get the ball rolling on a rescue mission, sometimes way before your flight plan expires. It also narrows down the search area for the people who, you hope, will soon be out looking for

you. You might also consider activating your ELT manually, lest you forget to do that after you're down.

After you've run the emergency restart check list without success and made your call to ATC, I suggest that the next order of business, during a high-altitude engine-out episode is to select a landing place and turn the airplane toward it. In general, it's better to arrive at your unintended destination with too much altitude than with not enough.

There's a good chance that your GPS navigator has a "nearest airport," or "go-to nearest" function. This would be a good time to punch that up and feed it to the autopilot, if you have one. If you don't, turn the airplane to a heading close to the course indicated on your navigator. Some of the fancier rigs have the ability to draw a circle around the little airplane, representing how far the bird should be able to glide. It would be nice if you could find an airport somewhere within that circle. Otherwise, use your knowledge of your airplane's glide ratio to make a rough estimate of whether or not you're likely to make it. Most light planes have about a 7:1 glide ratio, if that helps. If you don't have a GPS navigator aboard, you're probably getting into one of those Darwinian situations in which your genetic material is going to be eliminated from the human genome through a process of natural selection.

During a recent trial run using the GPS-to-find-an-airport method, I had a friend of mine

under the hood, flying at an altitude I thought would allow him to glide to a nearby airport. We had briefed what we were about to do, so it was no surprise when I pulled the power back to idle in our Cessna182. He selected the "go to nearest" function on the navigator, hit the "nav" button on the autopilot, and ran the restart checklist while our HAL 9000 turned the airplane toward the airport.

Then my friend did something very smart. I hadn't thought about it, but he switched the autopilot to its "heading" function, and turned the airplane about five degrees to the left. His reasoning was that the "go to nearest" gadget was going to take him to the *middle* of the airport, whereas he wanted to set up for a base leg to the runway.

I kept him on instruments until 1000 feet above the surface, then took off the hood. He maneuvered successfully for a landing on the runway, using his break-out-of-the-clouds point as a low key position on right base. The reason I let him get below the clag at 1000 feet is the subject of another essay, but suffice it to say that I have established a personal weather minimum of 1000 ft. cloud bases and 3 miles visibility when I'm out and about in single-engine airplanes. So I figured I'd never be less than 1000 feet up when I got my first look at the putative landing environment.

With any luck, you'll find an airport within your gliding radius, and you might even have some extra altitude when you get there. Your task then would be

to burn away that altitude in a way that puts you at a workable key position allowing an uneventful full-stop landing on the runway.

I now refer to some experiences I've had giving practical tests, mostly to private applicants. Most of the unsuccessful forced-landers arrived on short final with way too much altitude, a result of a ritualistic approach to the problem, combined with two-dimensional thinking. In their haste to get to the landing location, they'd often forget the need to get down. I suspect, if we examined the statistics, that there are more overshoots than undershoots in real life, following these stressful events.

Why don't you try this, from time to time? When you're approaching your destination runway, identify a point from which you think you could make a power-off approach, then chop the throttle and see if you can make it. If not, you might want to go up for an hour or so of power-off approaches from the high key position (opposite the touchdown point on downwind), until you reacquaint yourself with the gliding characteristics of your airplane. From this key position, you'll want to carry some extra altitude, say, a couple of hundred feet, that you can get rid of as you get closer and closer to the runway. A small amount of excess altitude can be shed by extending flaps, angling the base leg out away from the runway, by making "S" turns on final, and by slipping, if that's absolutely necessary. Here again, many applicants

I've watched have been too anxious to slip off extra altitude, neglecting to use their flaps. Slips worked just fine when we were flying J-3 Cubs and Taylorcrafts. But flaps are much more effective in making steep approaches in Cessnas and Cherokees. Don't, of course, hesitate to make slips with full flaps extended, if absolutely necessary. This is a practice that, I promise you, will not lead to a life of regret, and may save you from running off the far end of the runway into a ditch or a chain link fence. Nevertheless, I'd save the forward slip as a last resort in most modern single-engine airplanes.

If you've allowed yourself enough room to maneuver (gotten a normal distance out from the runway on downwind and waited until you have some room on final, altitude permitting), shedding the small amount of altitude you've been keeping as insurance against unforeseen headwinds and small errors in judgment, shouldn't be a problem. Just don't put it off until you're on short final. Throughout the final stages of the approach, the question should be, "Am I too high, too low, or just right?" Then act promptly on your answer. The sooner you make your adjustment, the more effect it's going to have on the final outcome.

Let me get one more of my favorite bitches out of the way, and then we'll get to low-altitude emergencies. Many pilots with whom I have flown have gotten the idea, somewhere, that they shouldn't use full flaps or put down the landing gear until they

are on short final. This doctrine assumes that the pilot is coming up way short on his approach. If this is the case, okay, do what you have to do. But if you have been fortunate enough to arrive at your landing area with sufficient altitude, for goodness' sake, get the rollers out at the normal place, and use the flaps however you need them. With all of the pressure and distractions of a power-off approach, this is an excellent time to forget the gear. When do you usually put the gear down? Where do you re-check the position of the gear? Those actions should be performed at their normal times and places, in my opinion, especially in times of stress. Sergeant GUMPS is one of your best friends. He should be used at least twice, engine or no engine. For further rants on this subject, see my essay on landing with the gear down.

If your powerplant goes belly up at low altitude, meaning something below 2000 feet or so, you should put a higher priority on locating a suitable landing area and establishing a pattern that will bring you into a position and altitude from which you can make your landing. I have often been amazed during practical tests when an applicant would start running a restart check list when he was at 1000 feet, heading out over

the water. I suspect that these hapless testees were mentally processing the event ritualistically, as an exercise rather than as a simulation of an engine-out emergency. At these times, they'd revert to their early training, which was a rote procedure taught them by their instructors: something they knew they'd have to do to pass the test, not something they might need to do someday to get down without bending the Reynolds Wrap.

How about getting on the radio? How about squawking 7700? Now, while you're reading this essay, is a good time to think about the appropriateness of these actions. It may help to prepare you mentally if you are up there someday with a dead engine and diminishing options.

Declaring an emergency gives you priority over all other aircraft and it also gives you a limited license to violate FARs, if the emergency is one that requires immediate action. If your emergency does not require one or both of these privileges, declaring an emergency is a waste of time. Nobody's going to send a plane out to tow you to the nearest airport. Talking on the radio and fiddling with your transponder should be given decreasing importance the closer you are to *terra firma*.

Now let's talk about the approach. Many of the applicants I mentioned before seemed to be obsessed with landing into the wind. That's one of those things that becomes more important the more wind you've

got. But there are other factors to think about as well. How about the sun? If the sun is going to be in my face when I turn final, I may opt to accept some tailwind instead, in the interest of having a better view of what I'm doing. You may not have enough altitude to maneuver around so that you can land into the wind. And there may be a flatter, less obstructed landing area that you could use if you were not so slavishly fixated on landing into the wind. It's just a thought.

Sooner or later (Way sooner the lower you are!), you'll probably have made your decision about where you intend to park. There is an oft repeated maximum that you should never change your mind, once you've made this decision. I think this is one of those rules that absolutists and excessively linear thinkers came up with.

If you're over open farm land with about a dozen choices of good places to land, I agree that you should make your choice early and concentrate on making the best possible approach to that place. But if your options are limited you may, in the heat of the moment, have chosen a landing site that is, shall we say, less than optimum. If you notice a better choice, and if getting to that other place doesn't involve frantic, stall-inducing maneuvering, I'd suggest that it is better to revert to "plan B" and switch your attention to the new and better place. This change in your decision should not be done lightly. You should have

a compelling reason why the alternative is the better choice; and you should then focus your attention on getting down successfully at that place.

I once had a partner in a plane who lost his engine enroute and tried to fix the problem, using a pair of vice grips. Thinking he was going to be able to get switched over to a full gas tank in time, he neglected to set up an approach to one of several good fields that were within gliding distance, and he ended up pranging our nice little bird. If there had been only one suitable option for a landing place that day, he might have put a higher priority on making a successful forced landing.

Lastly, let me harangue you as I hope your instructor has already done. No matter where you end up landing, your chances of walking away from the landing are greatly enhanced if you maintain control of the airplane until you are stopped. Another way of putting this is that, folks who lose control of the aircraft prior to touchdown are likely to get themselves injured or killed. Attempting to make the 180^{o} turn back to the runway following engine trouble just after takeoff can be an invitation for the stall/spin gods to get a good crack at you. Suck it up and land somewhere within 45^{o} or so of straight ahead.

So. Now is the time to think about the issues I've raised. Don't wait until you're up there sucking dry air to start developing a plan for success, following a problem with your powerplant. Go get your owner's

manual and look up the recommended best glide speed. Memorize it. Memorize the glide ratio of the bird with the engine dead and the prop windmilling. Get yourself out to the airport and do some precision landings with the power pulled to idle when you're opposite your touchdown point on downwind. Then keep practicing these skills. It's the best way I know of to prepare yourself for the very unlikely chance that you may someday have to land without the benefit of thrust.