FLYING LESSONS for September 26, 2019

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FLYING LESSONS uses recent mishap reports to consider what *might* have contributed to accidents, so you can make better decisions if you face similar circumstances. In almost all cases design characteristics of a specific airplane have little direct bearing on the possible causes of aircraft accidents—but knowing how your airplane's systems respond can make the difference as a scenario unfolds. So apply these *FLYING LESSONS* to the specific airplane you fly. Verify all technical information before applying it to your aircraft or operation, with manufacturers' data and recommendations taking precedence. **You are pilot in command and are ultimately responsible for the decisions you make.**

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This week's LESSONS:

We've been discussing off-airport site selection in the event of engine failure in a single-engine airplane. We've covered ideas for preparing the cabin and passengers for touchdown and evacuation.

Let's back up a step, however, and review some considerations for gliding from altitude, assuming the engine failure occurred in cruise flight. More to the point, let's discuss something that is almost never presented in training: when is it appropriate to fly at Best Glide speed, and if, when and how must you make the transition from Best Glide to Landing Without Power speed?

First some definitions:

- ***Best glide*** airspeed is the indicated airspeed at which the airplane will travel the greatest horizontal distance for altitude lost. It's the speed to fly to ***get to*** your engine-out landing zone. Best Glide is usually the best lift over drag speed (Best L/D)—the manufacturer may publish some other speed if it has determined that speed nets the best glide results.

Actually best glide is an ***optimum angle of attack***. But general aviation airplanes rarely have angle of attack indicators, and until you get into business jets those light airplanes that *do* have AoA sensors and displays do not have systems as consistently accurate as are airspeed indicators.

- ***Landing without power*** airspeed, by contrast, is the speed at which vertical speed is lessened to the minimum while still providing a safe margin above stall speed and control authority sufficient to arrest the airplane's descent for flare and landing. The reduced indicated airspeed covers less ground and descends at a steeper angle; this is the speed to ***land at*** your touchdown zone once you've reached it.

This may be the airplane's ***minimum sink*** or least rate of descent speed; however, the published landing without power speed may be greater than minimum sink to provide the necessary control authority and stall margin.

The General Aviation Joint Steering Committee (GAJSC) has determined that a significant number of general aviation fatalities could be avoided if pilots were better informed and trained in…flying their aircraft at the best glide speed while maneuvering to complete a forced landing. The FAA Safety Team has published a *Safety Enhancement Topic* sheet, **Best Glide Speed and Distance**…a two-page overview.


General Aviation
Joint Steering Committee
Safety Enhancement Topic

FAA Aviation Safety

Best Glide Speed and Distance

The General Aviation Joint Steering Committee (GAJSC) has determined that a significant number of general aviation fatalities could be avoided if pilots were better informed and trained in determining and flying their aircraft at the best glide speed while maneuvering to complete a forced landing.

What is Best Glide Speed?

Is it the speed that will get you the greatest distance? Or is it the speed that gets you the longest time in the air? Or are these two the same — the longer you fly, the further you go? Well, as so often is the case, best glide speed depends on what you're trying to do.

Going the Distance

If it's distance you want, than you'll need to use the speed and configuration that will get you

Keep in mind that this speed will increase with weight so most manufacturers will establish the best glide speed at gross weight for the aircraft. That means your best glide speed will be a little lower for lower aircraft weights.

Need More Time?

If you're more interested in staying in the air as long as possible to either fix the problem or to communicate your intentions and prepare for a forced landing, then minimum sink speed is what you'll need. This speed is rarely found in Pilot

See http://www.mastery-flight-training.com/glide-and-distance.pdf

Interestingly, at least to me, most pilots are taught to fly at Best Glide speed in the event of engine failure, but not the Landing Without Power technique. In practice, the instructor pulls the throttle to idle to simulate an engine failure; the pilot establishes Best Glide speed while maneuvering toward a field or other emergency landing zone, then maintains Best Glide until the field is "made" and the instructor calls for powering up and going around at no less than 500 feet above ground. The task of slowing from glide to landing without power speed is rarely discussed, and engine-out glides, in practice, and almost never carried all the way to a landing (on a prepared runway surface).

Although the Knowledge objectives of the FAA's Airman Certification Standards (ACS) for Private Pilot require the applicant to demonstrate understanding of the "importance of best glide speed and its relationship to distance" and the "difference between best glide speed and minimum sink speed," the Skills actually evaluated in flight call for the pilot to "establish and maintain the recommended best glide airspeed, ±10 knots." The ACS does not evaluate the skill of slowing from that speed to minimum sink or Landing Without Power speed in the airplane.

Frankly, in many airplanes it makes no appreciable difference. I randomly selected some airplane types (from my home *Pilot's Operating Handbook* and *Owner's Manual* collection) and tabulated these data:

Aircraft Type	Best Glide Speed	Landing Without Power Speed
Cessna 172S	68 KIAS	65 KIAS
Diamond DA-40	73 KIAS	71 KIAS
Piper PA24-180 Comanche	83 KIAS	N/A
Beech A36 Bonanza	110 KIAS	81 KIAS
Cirrus SR22	88 KIAS	90 KIAS
Beech B55 Baron	120 KIAS	N/A

All speeds above from POH or Owner's Manual with flaps up at the airplane's maximum gross weight

With the notable exception of the Beech airplanes, there is almost no difference between the published Best Glide and Landing Without Power speeds among this selection of aircraft. The three-knot range in the C172S, the two-knot difference in the Diamond DA-40, the lack of published power-off landing speed in the Comanche 180 but the slow Best Glide speed that is about 1.4 times its stall speed, and the two-knot spread in the Cirrus are all within the realm of expected pitch control under the stress of an imminent power-off landing. The Cirrus numbers, in fact, call for *increasing* speed slightly before landing, presumably for control effectiveness.

Knowing the Beechcraft as I do I wondered if the Bonanza (and Baron) is because the Beech POH, unlike some others for airplanes with controllable pitch propellers, recommends pulling the prop control to low RPM to improve glide performance (which it does, quite dramatically). The Diamond Information Manual does not mention changing propeller speed for a glide. I found, however, that the Comanche handbook states:

> Propeller control …. Full Aft to Decrease rpm and Improve Glide

…while for the SR22, which has propeller speed controlled automatically with movements of the throttle (hence Cirrus' use of the term "power lever" for this control), the AFM notes:

> If the propeller is windmilling, some additional glide range may be achieved by moving the Power Lever to idle and increasing airspeed by 5 to 10 knots.

The *LESSON*, therefore, is to research the proper speeds for each airplane *you* fly under various conditions. And then, practice the procedure and determine the best attitude, speed, configuration that works for you.

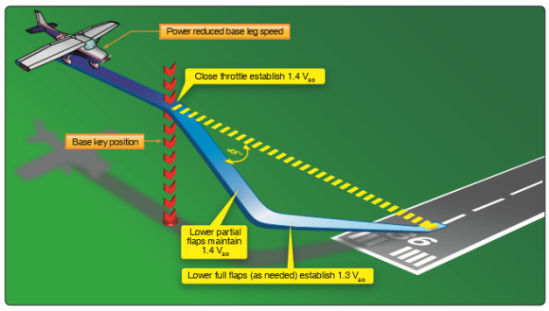
(By the way, I put the Baron on that table for the twin-engine pilots, who almost never consider a power-off glide. It would almost certainly be the result of fuel exhaustion, but regardless of cause there *is* a procedure for feathering both propellers, gliding, and making a dead-stick landing).

Even more discussion comes from one of my favorite sources, Bold Method. It's article "If Your Engine Fails, Should You Fly Best Glide or Minimum Sink?" shows how Minimum Sink speed is derived. It includes decision points in an engine-out descent using the familiar *aviate, navigate, communicate* hierarchy. The article touches on deciding on a landing spot and the use of "glide advisor" range rings on popular Electronic Flight Bag (EFB) software. And it talks about whether to use flaps and/or extending retractable landing gear for an off-airport landing.

But Bold Method also incorrectly continues the discussion of stall speed increase with an increase in bank angle without noting this increase only occurs in level flight…while the rest of the discussion assumes rapidly descending flight. And it's still not clear about when to transition from Best Glide to Landing Without Power speed.

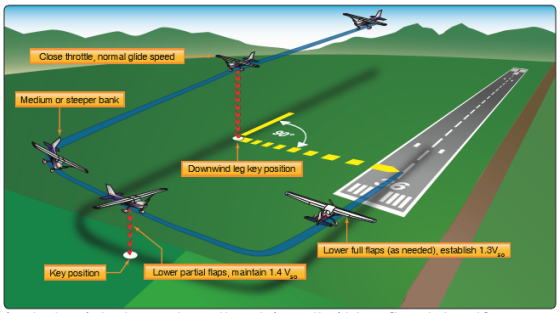
See:
https://www.boldmethod.com/learn-to-fly/maneuvers/how-to-handle-a-power-off-landing-following-an-engine-failure-best-glide-or-minimum-sink-how-to/

It seems reasonable that, in the event of an engine failure at altitude, you should establish Best Glide speed as you aim toward an airport or the most suitable off-airport surface within reach, and once in the immediate vicinity of that runway or surface to slow the Landing Without Power speed for touchdown. The GAJSC brochure makes this point:



Power Off 90° Approach (FAA)

> For any type of gliding approach, you'll want to reach a ***key position on base*** from which you'll know you can make a successful landing. **Until the key position is reached, keep the airplane configured for best glide**. After you pass the key position, add flaps and gear to configure the airplane for landing and fly the final approach at 1.3 times the stalling speed in landing configuration (1.3 Vso). The FAA's *Airplane Flying Handbook* contains several helpful diagrams for different power-off landing scenarios and corresponding key points.



Power Off 180° Approach (FAA)

The "helpful diagrams" to which this refers, I assume, are those for the **Power Off 90° Approach** and (that mainstay of Commercial Pilot training and checkrides) the **Power Off 180° Approach**, both described in Chapter 8 of the FAA's *Airplane Flying Handbook*.

See https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/airplane_handbook/media/10_afh_ch8.pdf

Both the Piper Comanche and DA-40 handbooks seem to agree. The PA24-180 manual suggests a "spiral pattern" to landing. The Diamond Star's Emergency Landing with Engine Off checklist is more specific, stating:

> If possible, fly along a short-cut rectangular circuit. On the downwind leg of the circuit the landing area should be inspected for obstacles from a suitable height. The degree of offset at each part of the circuit will allow the wind speed and direction to be assessed.

So let's go back to the question of making this transition from Best Glide to Landing Without Power speed. Although in my experience it's not usually taught this way, when gliding down from an engine failure an optimal profile would be to:

1. Establish Best Glide configuration and speed while aiming toward the best nearby landing zone (which optimally you should have in mind even before the engine quit).
2. While gliding toward that landing zone, attempt to troubleshoot and/or restart the engine.
3. Barring engine restart, transition to the full Glide configuration (change the propeller speed as required).
4. Glide to a position over your selected landing zone, then spiral down over that zone. Unless there is a prepared runway further ahead (but still within gliding range), it's easier to judge your engine-out approach if you travel less distance and spend more time over your touchdown zone.
5. Maintain Best Glide speed until reaching either (a) downwind leg, abeam your selected touchdown spot at 1000 to 1500 feet Above Ground Level, or (b) base leg at 700 to 1000 feet AGL.
6. Transition to the Power Off 180° Approach or Power Off 90° Approach technique as applicable to your altitude and position.
7. Gradually slow (or in the case of the SR22, accelerate) to Landing Without Power speed as you turn tightly to remain within glide distance of your touchdown spot.
8. Change airplane configuration and adjust flight path as needed to arrive just over the touchdown spot at the Landing Without Power speed. This approximates the attitude of a short-field landing at idle power.
9. Flare and land.

How can you prepare for this procedure?

- Practice until you are comfortable with the pitch attitudes that result in the necessary speeds at idle power.
- Practice the Power Off 90° Approach and/or Power Off 180° Approach occasionally.
- Practice short field landings occasionally to keep the sight picture and flare in your memory.
- Know the approximate field elevation below you at all times, so you can judge your height above ground in a glide.
- Be thinking about your engine-out landing options at all times in flight.

Questions? Ideas? Opinions? Send them to mastery.flight.training@cox.net

Debrief: Readers write about recent *FLYING LESSONS:*

Reader Lorne Sheren writes about last week's *LESSONS* and briefing passengers for emergency exit:

> Great discussion. For what it's worth I always tighten my seat belt hard right before entering pattern. It's only been important once. In [my Beech] Bonanza, because door opening is not necessarily intuitive **I have the copilot seat occupant practice opening the door before engine start**. I'll even do this with a family member who has been in the airplane multiple times if it's been a while. Finally, **children and frail elderly [passengers] can't be in a seat row without someone who can get them out**. It's different than an automobile.

Reader Kenneth Bacow goes deeper:

> Thanks for a great series forcing us to think about things nobody wants to think about. One thing that I've added to my passenger briefing, particularly when I have passengers in the back seats of my [airplane], is to both **show them how to open the door** and **then have them demonstrate** to me that **they can open the door**. I'll get them situated in the seats, show them how the seatbelts (and shoulder harnesses) work, and then tell them after I close the door that she should open it from the inside. I've found on more than one occasion that people had trouble remembering which way to turn the latch or how hard to push the latch. Figure **better for them to learn how to get out before we start up than during an emergency** when there might be some more urgency.

And reader Mike Friedman agrees:

> One thing you should add to your list is to **make sure the passengers can actually operate the door** latches. Showing them is not enough – ***make them do it***. In Piper aircraft, they inevitably forget the top latch and struggle with the door expecting it to open. In Beech aircraft, they get stuck on the safety latch in the handle which is quite a bit more difficult to operate from the passenger seat than it is from the pilot seat. The point is having them do it once or twice before engine start is significantly better than having to try it for the first time after an unexpected landing.

Excellent point, readers. Thank you all.

See http://www.mastery-flight-training.com/20190919-flying-lessons.pdf

Questions? Comments? Suggestions? Let us know, at mastery.flight.training@cox.net

Assume the position

The United States Coast Guard Auxiliary publishes a PowerPoint presentation on ditching a light airplane into water. This program includes recommended brace ("crash") positions to brief passengers prior to impact. These same recommendation applies to maximizing chances of survival in any controlled but abnormal ground contract.

See http://www.mastery-flight-training.com/uscg-brace-positions.pdf

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