If the Engine Fails-Keeping it Simple
By John K. Morris

Nobody likes the idea of having to *really* deal with an engine failure. One of the primary reasons for operating the PC12 is because of a very reliable engine that should never fail! But to not prepare for the possibility is worse than the engine failure itself.

So we do prepare by on-going training and hanger flying discussions on how best to handle a particular situation, in this case an engine failure during cruise flight (or above several thousand feet AGL).

Over many years of instructing the PC12, I have heard multiple ways of accomplishing the task of returning to terra firma after an engine failure in flight. This article will deal with what I believe is the simplest method to reduce the thought process from what could be a very stressful event into a successful outcome**.**

There are three steps to do and here they are:

1. **Establish Glide**
2. **Nearest Airport**
3. **Key Point to Landing**

That's it. Of course, you should already be familiar with steps one and two and maybe three, but I will now break down the components of these three elements and, after a little practice (in-flight with the engine running), you should be able to do these steps easily.

Step 1 ESTABLISH GLIDE

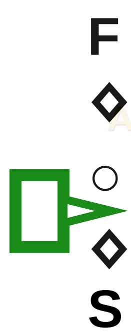
The first thing that you should ask yourself, and me, is "Is this an engine failure or a partial loss of power"? Also, "How can I tell which of the two it is, in a timely manner"? I will fully answer those questions at the POPA convention this coming May. For the purpose of this article the obvious answer is that the engine has failed.

And, oh by the way, it's NOT VFR, or daytime, or both. Sea level or flat is too easy and not real. You have got to THINK about it.

So, of course the first thing you should do is Shut Down / Feather the Engine. I know you were already thinking about establishing glide but first things first. If you do not feather the engine, you will reach the ground a lot sooner than expected!

The glide ratio of the PC12, or any aircraft, is not affected by weight. The only variation is the speed of the glide, which is determined by weight. Maintaining the correct speed is very important for maximum glide and critical when making turns. Using the Glide Speed chart from the POH (see below), along with the distance and time performance charts, the approximate vertical rate of descent and glide speed can be determined.

The optimal (glide ratio) rate of descent is approximately 800 feet per minute. The glide speed to maintain the 800-foot per minute rate will require more information and time to calculate. If we simply set this rate using the VSI, when stabilized, and the AOA indicator, with the angle [AN] box-TOP, centered to the middle, open circle on the EADI (see drawing below), the approximate indicated glide speed will result. Note: The center pointer of the AOA [AN] box is the 1.3 V_S ref speed and the optimal glide speed is somewhat slower than the ref speed for the particular flap setting.



Glide Speed chart from POH

WEIGHT-LB	KIAS
10450	116
9920	114
9040	110
8160	105
7280	99
6400	92

Once glide speed is established, engage the Indicated Airspeed **(IAS)** Mode on the autopilot, and autopilot ON if not already activated.

Step 2 NEAREST AIRPORT

This step is more than just finding the nearest suitable airport, so be patient and read on.

First, before you do anything, I have to ask what might be considered an insulting set of questions, but:

1. **Do you know how to find the nearest airport from your GPS?**
2. **What is your nearest airport criteria selected in your GPS?**
3. **How much runway will you really need to land?**

Don't forget density altitude! I can answer the criteria question. 1500'-2000' should cover the density altitude. I am not sure if the database for airports holds 1500' or fewer length runways.

Once the nearest airport is selected, proceed toward the airport using Heading (HDG) mode from the autopilot, Not NAV mode!

Next, does the nearest airport have a published approach? If so, load in the nearest approach runway from your present heading. Next, locate the runway-end waypoint from the loaded approach and select direct to the runway-end fix. (If no RW-end fix then the MAP should do). Next, engage OBS for the RW-end or MAP fix just directed to. If you were operating the autopilot on NAV mode at this moment your course would change with the movement of the CDI. This is why you should be on HDG mode.

Adjust the CDI on the EFIS to the runway heading. Another point to this procedure is to set the EFIS to the CDI page with GPS as the primary NAV source, NOT the GPS moving map page with the CDI indicator across the bottom, as the moving map will be selected elsewhere and your attention should be limited to airspeed/altitude and position relative to your landing point. Now since the CDI is probably not pointing directly towards the airport, how do we navigate towards our desired fix? You should select one of the bearing pointers to the GPS being used for this procedure, available from the EFIS control panel. It will point to the fix selected, the RW-end fix maybe? And it will show distance to that fix from either the lower left or lower right corners of the EHSI, depending on which bearing pointer is used. Note: If an approach is not available, then proceed to the airport diagram page of your GPS and select the nearest runway alignment (OBS engaged) on the EFIS CDI. In either case, if time permits, from the above step you should look at the airport page for relevant information prior to your un-scheduled arrival, such as ATIS, since if you can, it would be nice, but not necessary, to land into the wind.

Select the moving map page on your GPS, or better still, the MFD, if available. Reduce the map scale to a MAXIMUM of 2 miles. To me this is a very important component. This "procedure" is usually practiced in a controlled environment with the element of failure really not a factor and the visibility sometimes not impeded. In an IFR environment you may not see the airport until 500-700' AGL (we hope). Do we always fly day VFR? Leaving the scale at 2 miles, or even 1 mile, will give you the airport diagram / runway(s), when within that distance to your present position. At greater scales the airport environment becomes a symbol. Even if we are making a straight-in approach, knowing were we are relative to the runway is very reassuring and necessary, since even if it is not going the way we would like we still must configure the aircraft for touchdown. In known prior incidents the pilot(s) were so pre-occupied that the flaps were never deployed. It is forgivable to “forget” the landing gear but not the flaps since stall speeds are predicated on flap position and a reduced stall decreases our touchdown speed. Also, once the scale is set, **leave the darn GPS and MFD alone.** You’ve still got to maneuver the airplane.

What’s all this doing for you? It’s called situational awareness using the available equipment. Good practice everyday.

Step 3 KEY POINT to LANDING

Pilatus believes, as I do, that the ideal key point to landing is to be downwind, *CLEAN*, abeam, ideally .5 – 1.0 nm, of the touchdown point at 1500’ AGL. The touchdown point is considered the end of the runway, not the center since the nearest runway that you may be heading for may only be 2000’. Hence, selecting the RW-end fix from the GPS for distance information (not to mention a bearing point). From the key point, heading downwind, extend the landing gear (free-fall) and flaps to 15°. How long does it take for flaps to 15? How long does it take for the landing gear to free-fall? 22 and 25 seconds, so WAIT for the flaps to 15°, then start a standard rate turn to FINAL, monitoring your position relative to the pre-set (GPS) CDI to the centerline of the runway for bank adjustment. Remember that once extending flaps you will have to adjust you glide speed to the basic known glide speeds with flaps. [Note that while extending the flaps to 15° the vertical rate of descent was reduced giving us a momentary “lift” thereby reducing altitude loss for the turn] Monitor the position of the landing gear. If all works, as it should, by the time you have slowed to the glide speed for 15 flaps the landing gear will show three green. If not, use the hand pump to finish. Once on final you should have approximately 500’ to go, hopefully visual, and about a ¼ to ½ mile to the end of the runway. This will allow for judgment on use of the remaining flaps. Now, how you get to the “key” point is up to you, and with a little help from me, based on the available altitude and distance.

An immediate concern once heading towards the nearest airport is "Do I have sufficient distance"? The performance charts indicate a little over 2nm per 1000' of altitude loss. So a quick "WAG" can be made for that question, but don't forget your current height above ground! For the purposes of this article you will have more than needed miles so you will have sufficient altitude.

So how do you arrive at the "key point" at 1500' AGL?

NOTE: The following moves are where I am also trying to reduce the brainwork in order to help to make the outcome more likely to succeed. The training / hanger flying discussions I am referring to involve how we approach the airport once it has been established that we have sufficient altitude to attempt one of the many "key procedures" solutions.

IF **you have sufficient altitude above the airport, proceed to a point above and near the airport or the "key point to landing".**

Standard-Rate-Turn—A turn of 3° per second. A complete 360° turn takes 2 minutes. A rule of thumb for determining the approximate bank angle required for a standard-rate turn is to divide the true airspeed by 10 and add one-half the result. For example, at 120 knots, approximately 18° of bank is required (120 - 10 = 12 + 6 = 18). At 200 knots, it would take approximately 30° of bank for a standard-rate turn.

Other than inducing drag via landing gear or flaps, how can we safely lose altitude so as to arrive at our key? Turns and time (and patience). What is the standard rate of turn at 110 KIAS? Approximately 17° of bank [see above reference formula]. How much altitude is lost for a 360° turn? Approximately 2000' of altitude [800 fpm plus the additional loss due to banking-maintaining airspeed!]. So doing a 360, 270 or 90 degree, standard rate turn, you should be able to deduce the attitude loss from your position. What happens to the altitude loss if you double the rate of turn (34 degrees of bank)? The altitude loss rate is approximately the same but you accomplished a 360-degree turn in one minute instead of two minutes. See where I am going? By applying this basic knowledge you can maneuver at a point (the key, perhaps?) until arriving at the desired altitude. Remember a holding pattern? 4 minutes, two turns and two straight legs-how much altitude would you lose applying this basic technique? About 4000' of altitude. It should be noted that the autopilot is designed for 25° bank angles. This is why you should not use the autopilot once you start this procedure unless you intend to steepen the bank on purpose.

So what if you arrive at the "key point" to high? If you have the above paragraph settled in you mind then the question is already answered. TIME. Extend the downwind accordingly; keeping in mind the 180° turn to final and the altitude loss during the turn. Don't worry if you are not at 1500 AGL (too low). If you were patient, and had set up the moving map correctly, you would have seen this coming and altered your path to any available runway (or if slightly low, start your standard turn to final immediately at the "key point" while deploying the flaps and gear-still NO RUSH).

Once the set-up procedure is practiced in your aircraft (not that hard to do if you give yourself a chance) the process will take less time than reading this article. I also believe that if you understand this turn/time principle for gliding, you can at least apply this towards any possible landing contingent and not confuse / clutter yourself with the multiple "what if" type "key" approaches.

The following is an approximated turn radius chart based on the Max Gross weight stall speed of 91 KIAS and Glide speed of 114 KIAS.

Bank Angle	**Turn Radius**	**Stall Speed**
45°	**1156'**	**108**
40°	**1378**	**104**
35°	**1651**	**101**
30°	**2002**	**98**
25°	**2497**	**96**
20°	**3176**	**94**
17.5°	**3666**	**93**

"A safe pilot is always learning"

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