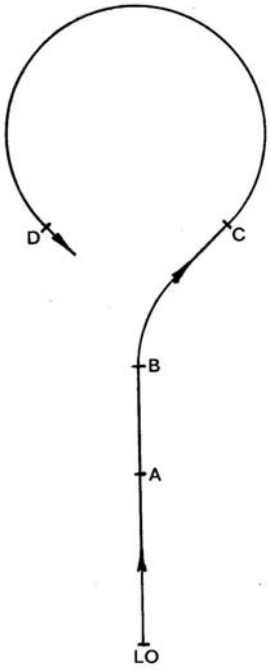
Tech' Desk', The 180 Degree Turn

Every year we hear of serious accidents when pilots attempt to turn back to the runway after engine failure, with too little altitude. So let's take a look at this maneuver. How much altitude is enough and how do we make the most of what we have when the engine dies?

The object is (although under too much pressure and too little time for planning and execution) to get the aircraft back to the runway or take-off strip, near the point of lift-off, but going in the opposite direction. Consequently, a simple 180-degree turn will not do this for you. It will get you going in the opposite direction, but not in line with your take-off run, and unless you are fortunate to have a brisk headwind right down the runway, it will leave you well short of reaching the runway.



In the diagram (right), assume your lift off point is LO. If your engine quits at point A, you will continue on the same heading for the duration of your reaction time, (somewhere between ¾ and 2 seconds or even longer). At this time (point B) your nose will be coming down in your effort to maintain flight, and you will be mentally reviewing your options. Aviate, Navigate, Communicate! By now you will have used up about 15 seconds and possibly 100 ft. of altitude, depending on your climb-out airspeed. Time to act!

On our RV-9A, our flight test for the 'Best Glide Speed' turned out to be 80.5 KIAS, and our altitude loss for each minute at that airspeed was 520 feet. These are important numbers to establish, and remember.

To execute, (at point B), check for traffic and turn right 45 degrees setting up your best glide speed. Note your new heading on your DG, (point C). Then, again checking for traffic, immediately roll out to the left, maintaining a rate-one turn for 270 degrees, (to point D). This will theoretically put you on a 45 degree intercept to your original take-off heading.

That's the theory. If your take-off was into a breeze you will have an advantage of distance, since now your approach is downwind. The important thing to realize and remember is that from the time of your emergency, you will require about two minutes to execute all of the above. If your sink rate is around 520 FPM this means you will need a good 1200 feet of altitude with no obstructions to make it, and all of it under immense pressure.

During our numerous tests, we set up the aircraft at gross weight, and climbed to 4000 feet AGL. We cleared for traffic, and then went through the procedure outlined above. Our altitude loss for the 6 or 7 tests was always very near the 1100 to 1200 ft. mark. And knowing what our best glide speed and altitude loss per minute of glide, these numbers would be expected.

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Tech' Desk', The 180 Degree Turn, Cont'd

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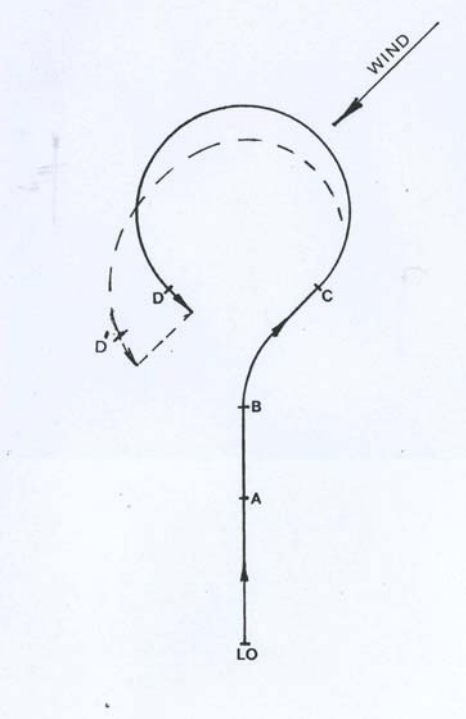
What was not expected was the effect of a 45 degree cross-wind. If you look at the revised dia-



gram, you can see the effect of this cross-wind. If you fly the procedure precisely, your final location will be displaced by the effect of the wind during the time of your maneuver as shown at D'.

Another point that became obvious to us was, that even if we could complete the 180 degree turn in the above prescribed procedure, we would still end up a long way short of the runway. Simply put, if we use our Vx of 68 KIAS, with a climb rate of 840 feet per minute, in order to reach the 1200 foot AGL altitude at which we could enact the 180 turn, we would have flown a forward distance of nearly 9837 feet, or 1.86 miles. (68/60 x 1200/840 x 6076 = 9837) That's a very long way to stretch a glide!

So what can we learn from this flight test?

Know your Numbers: Our best glide speed is 80.5 KIAS, at which speed, and on a standard day, we will loose 520 feet of altitude and travel forward a distance of 8152 feet, or 1.54 miles per minute. (80.5/60 x 6076 = 8152)

Know your Glide Ratio: for each 1000 ft. of altitude loss, we will travel a distance of 15,677 feet or 2.97 miles, a glide ratio of 1 to 15.6. (1000/520 x 8152 = 15,677)

TO SUMMARIZE:

To complete a 180 degree turn-back, we will need at least 1200 plus feet of altitude, on a day with no wind or with a wind directly on our initial flight path.

If we do turn back, we will still most likely not be in a position to reach the point of departure. We may be able to reach a cross runway or taxiway that gives us the advantage of distance.

If our altimeter reads less that the 1200 feet AGL, we must land ahead with limited ability to turn to either side. Our ability to reach a suitable off-field landing site straight ahead or to either side will depend entirely on our altitude AGL, our glide ratio, and how the distance-to-the-landing site fits within these two parameters.

If you have experienced an engine failure, with the resultant pucker factors, you will know that rational thought becomes very difficult and only training and preparation for the eventuality carry the day. As we think about these issues it becomes very clear, that with an engine failure on climb-out, the altitude AGL shown on our altimeter is our guide as to which maneuvers are available to us. We cannot stretch a glide, and only a stall or stall-spin will be the result if we try.

Jack Dueck, EAA HAC, TC, FA