

Landing-The Last 100 Feet

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In recent articles from SSF, you learned the skills of flying a good, hopefully Goal Oriented Approach to the landing site. In this article, I would like to address the final moments airborne through touchdown and rollout.

Well, you made it! You have flown a good approach, are stabilized, and ready to make a great landing. To back up just a bit, what exactly does it mean to be stabilized? First, consider configuration: landing gear down, flaps to landing position, and spoilers extended as required. Second, being on-speed: the SSF recommends a speed of $1.5 V_{SO}$, or whatever is recommended by your glider's POH, plus a wind additive. Third: on glide path, which means for a nominal 3:1 approach, you ought to be about 300 feet out from your aim point at 100 ft AGL. These latter parameters are NOT something I look to achieve, but are going to be about right for a framework describing a normal short final.

Now it's time for a good landing-but what constitutes that? For our tactical Navy brethren, that would mean catching a 3-wire, (the third arresting cable in from the stern of an aircraft carrier) and slamming the mains onto steel. For us more sane USAF Fighter types, that would mean touching down with minimum float or sink rate in the center of the runway, 500-1500 down from the threshold. For heavy drivers, the "grease job" is highly desired, so as to minimize the disgruntlement of passengers or cargo-the smoother the better. In all cases, it's often been said that "any landing you can walk away from is a good one," or, "a good landing is one where the aircraft is re-useable without major maintenance."

All kidding aside, I would say that for Glider Pilots, a good landing is one in which all aspects of speed and rate of descent are controlled to within desired parameters, so that a smooth touchdown is made just beyond the aim point, and the glider is under complete control, avoiding all obstacles, until brought to a safe stop. So, how do you do that?

The last 100 feet should be spent concentrating on maintaining runway alignment, correcting for drift and tracking the centerline, modulating spoilers to maintain the desired glide path, and adjusting pitch to maintain airspeed. This close to the ground, all of these corrections should be small and timely, to avoid over-correcting.

At some point before touchdown, the glider's pitch attitude must be increased to reduce sink rate prior to landing, and in fact, when done perfectly, will result in a zero rate of descent at the moment of ground contact. (rarely happens for me, but I try!) This part of the approach is sometimes referred to as "the flare," but I prefer the term "round-out." The term "flare" comes from powered aircraft landings that involve increasing the angle of attack to at or near stall at

touchdown, a condition I want to avoid in gliders. The term "round-out" is more appropriate for our glider landings because we don't want to be near stall at touchdown, but a bit above it to better control our last few feet before ground contact.

One technique I use to round-out consistently is to have my spoilers extended about half way during those last 50 or so feet on approach, and keep them that way until touchdown. That way, I have eliminated the drag variable, and can concentrate on aim point and airspeed. If at that point I realize I need the spoilers closed to make it to the runway, I do so. (either I didn't really have a stabilized approach, or I encountered sink on final-which is why the spoilers are only half extended, ready to be closed) If I had to close the spoilers to make it to the runway, I will have a hard time getting down through ground effect, descending those last few feet, and although having approached the ground at a shallow angle, will likely float and land long. If I find myself in this situation, there are 2 mistakes I might make trying to "hurry up" the final few feet of descent. The first of these is to nose over, in an attempt to force the main wheel onto the ground. This will likely result in bouncing back into the air, and doing so at an uncomfortably low airspeed. The second is to extend the spoilers, which will likely result in a very hard landing, possibly damaging the glider.

So, what if I do all the above and discover at 50 feet or so that I am steep in my approach, and further down the runway than desired? There are safe solutions for this: either increase spoilers a bit to correct down to the glide path while adjusting pitch to maintain airspeed, or choose to accept a long landing. In either case, the goal is to have a minimal rate of descent at touchdown.

Touchdown at last-time to relax! Well, not quite, because the landing is not over until the glider is at rest. One of the key ingredients to a successful landing roll-out is keeping the wings where they should be: level, if there is no crosswind, or slightly wing low into a crosswind if present. This really helps the glider track down the runway in a straight line. Knowing that gliders love to weathervane into a crosswind, be ready for corrective rudder inputs as the ground speed dwindles. If directional control is in question, stop the glider as soon as possible using wheel braking or the landing skid as applicable.

One last issue for consideration is how close to the stall speed we want to be after performing the round-out. There are different schools of thought on this issue. The European method is to complete the round out with a high angle of attack, even approaching stall, so that the glider is in a nose high attitude that usually results in the main and tail wheels touching down simultaneously. The motivation for such a round-out is that it will result in the lowest possible energy state, which could be good for landing off-field.

My preferred method is to round out such that the landing attitude is very similar to the takeoff attitude-almost a level flight sight picture. That way, touchdown forces are relegated to the main gear, which is designed to accommodate landing loads, versus the tail wheel, which by comparison is quite fragile. To insure staying on the ground after touchdown and helping



dissipate energy quickly, I like to extend the spoilers toward full, just like an airliner does, which also makes wheel braking more effective. With regard to energy state and landing off-field, my preference is to touch down with some maneuvering energy remaining, to avoid obstacles not seen until the last minute. The ability to maneuver at the last minute has saved my glider more than once!

After considering all the above, go out and practice. If you have questions, bring them up with your favorite CFI-G, perhaps during your next Flight Review. In any regard, by digesting and practicing the above, all your landings can be happy ones!

