Precision Landings

By precision or spot landings we are talking about practice for off airport landings, as well as improving our landings at Harris Hill. Therefore we should not practice anything at our own airport that we are not ready to use if we land away from home. This article describes the important judgement points to accurately and safely land a glider at the airport. Add to this a knowledge of field selection and some practice and a pilot should be prepared for an off field landing. All discussion of airspeed uses mph for the Schweizer gliders and knots for the German aircraft. This article has two parts: pattern legs and airspeed control.

Pattern Entry

The first requirement for any landing is to enter the pattern with sufficient altitude. 1000 ft. AGL should be the minimum altitude to arrive in the landing area. You need this altitude and time to look over the airport or field. Assess the wind and choose a landing direction before entering the pattern. If a significant crosswind condition is unavoidable, it is safer the plan a base leg into the wind, terrain permitting. Next select a landing point. A crosswind entry leg is best for off field landings. For landings at our airport a 45-degree entry leg is preferred, but not required. Finally, complete your before landing checklist before entering downwind.

Downwind Leg

The downwind leg is the easiest part of the pattern. The difficult part, if there is one, is when to start. 650 to 800 ft AGL is appropriate. Know what this looks like by eyeing the angle to your selected touchdown point. Altimeters are useless when landing in a field. Look over the field again for obstacles. Move the downwind leg into any cross wind. If the wind is from the pattern side of the field, give yourself more space between the downwind leg and the landing area. In other words, position your glider for an adequate base leg. Once you have established the proper distance from the runway, you should crab to maintain that distance.

Final Approach

We will discuss the final approach before going on to the base leg. A good final approach and touchdown is the desired result of the pattern. The glider should be established on final by 300 ft AGL. The ground track of the final is about twice the length of a short landing field and should be aligned with the landing direction. The glide path should be a comfortable 3.5 to 4.5 degrees or what the glider will do with partial dive brakes. Again, know what this looks like from the air without the use of the altimeter.

Base Leg

The base leg is the key to an accurate landing. It ties the whole thing together. Begin your turn to base based on the angle back to the touchdown point adjusted for the current winds. With no wind you should look back over your shoulder 45 degrees to the touchdown point; less if you are landing into a headwind or are low. This should be a crisp turn. This will give you more time on the base leg. Roll out on base leg with any crab angle established. There must be time here to adjust your altitude and make a good turn to final. Learn what too high and too low look like on base leg and make your corrections early. Have several “tools in your tool bag” when it comes to losing altitude. A good slip or an extended pattern leg can salvage a poorly planned pattern. In the most difficult case of a tailwind on base leg, start your turn early using a moderate angle of bank. If this turns out to be too much or too little you can vary the bank angle as necessary. Always keep the yaw string straight. Roll out on final with your crab angle established.

Aiming point, Round Out, and Flare

Once on final, select an aiming point about a twenty yards short of your touchdown point. Eyeball this point and use your dive brakes to keep it from moving up or down on your canopy. Keep the aircraft moving downward on the glide path until 5 to 10 ft. above the ground. At that point begin to “round out “ to a level attitude. Here you need to lose some speed. When you can raise the nose without climbing, “flare” the aircraft to a tail low attitude and touch down. The distance over the ground this takes depends on your airspeed management.

In the table below four speeds have been given for each of the club gliders. In the first column is V_{so} or the stall speed with the gear down and the spoilers fully open. The next column is to show you the calculated stall speed for a 45-degree banked turn. To the right of that is 1.3 times V_{so}. This speed is commonly called V_{ref} in airplane lingo. It could be a considered minimum approach speed. Lastly, is the calm wind approach speed.

	V_{so}	Stall Speed 45 Degree Bank	$1.3V_{so}$	Approach Speed for Calm Wind
2-33 Solo (mph)	36	42	46.8	55
2-33 Dual (mph)	37	44	48.1	55
1-26 (mph)	30	35	39.0	55
1-34 (mph)	38	45	49.4	55
ASK-21 Solo(kts)	37	44	48.1	49
ASK-21 Dual(kts)	39	46	50.7	49
Discus CS (kts)	38	45	49.4	51
Duo Solo (kts)	30	35	39.0	54
Duo Dual (kts)	36	42	46.8	54

Approach Speed and Wind Additive

This is a difficult subject to write about. There exists a balance between being fast enough while maneuvering in the traffic pattern and being able to slow down for a safe landing. First you should ask yourself what is the primary concern today? Is this a benign day with steady or no winds or a gusty day with significant wind gradient? Is the landing area a huge airport or a smallish field with potential dangers hiding in tall grass?

After much thought, I was unable to come up with one recommended procedure for all of our aircraft. Here are two recommended methods of calculating approach speed. The first takes into account the lower performance of the Schweizer gliders and the fact that new pilots may be flying them. It has plenty of extra speed for sloppy flying. The second method assumes a certain amount of flight proficiency and is a better balance for the high performance aircraft.

<u>The Schweizer Method</u>

For the Schweizer gliders, take the base speed of 45 mph and add 1 mph to it for each mph of wind. Always add 10 mph for unknown wind and wind gradient. For example, a 2-33 flown in winds up to 10 mph would fly 55 mph. A 15 mph wind would up the approach speed to 60. This is a conservative method that works okay because these gliders have enough drag to slow down for landing.

<u>The Yellow Bug Method</u>

It is not as wise to slap on extra airspeed to the higher performance fiberglass machines. These gliders have a yellow airspeed bug. This bug is the recommended approach speed for the aircraft with the maximum permitted cockpit load (i.e. as heavy as you can be without water ballast). If you weigh less, you already have some extra speed. The procedure is to add one half the steady winds plus all of the gust factor to a base speed of 45 knots. If this speed exceeds the yellow bug, fly the higher speed. For example, if flying the ASK-21 with winds of 10 knots gusting to 15, the gust factor would be 5 knots (15 – 10). The wind additive in this case would be 10 knots (one half of 10 knots + a gust factor of 5 knots). You would fly the approach at 55 knots (45+10) vs. the yellow bug speed of 49 knots.

A few words here about personal limitations. If the wind additive is 15 or greater, you should consider whether or not you should be flying gliders at all. Your personal limits may be even lower.

Approach Speed Does Not Equal Landing Speed

In any case, fly the pattern speed you are comfortable with. As long as you are accurately flying a speed based on sound judgement and you know what you have going into the landing you'll be okay. Established on final with wings level you should hold your approach speed at least until two wing spans above the ground or 100 ft. AGL. At this point you will take your last peek at your airspeed indicator and ask yourself "how much extra speed do I have?" Depending on how much speed you have above 45 mph (or knots) you will increase your dive brakes and continue downward while bleeding off the extra airspeed. Most of the time this begins at 50 ft. If you are holding a lot of extra speed it may need to happen at 75 ft. Arrive at the aiming point at 5 ft. AGL and approximately 45-50 mph (or knots). You will not look at the airspeed indicator. Round out and flare. This ensures a low energy, tail-low landing and a consistent amount of float.

You're not done yet

Continue to fly the aircraft to a stop. In the case of a crosswind the upwind wing should be low and after the glider stops it should come to rest on the ground. The glider should not swerve right or left in a cross wind. For FAA accuracy landings the nose must come to a rest within 200 ft. (100 ft. for the commercial test) of a given point without overshoot. You should be able come within inches.