How far can you spit?

Tom Knauff

YOU PROBABLY HAVEN'T THOUGHT ABOUT your personal spitting distance recently; however, you can point to a spot on the ground that you most likely can reach. How do we make this spitting distance estimate? Even though most of us don't practise distance spitting, we all have a sense of this not very familiar distance. How far can you jump on a standing broad jump? How far can you throw a ball?

Most of us don't indicate these distances in units of feet. We judge the distance with respect to a familiar angle. Spitting distance is a pretty steep angle to the ground. We can point to the ground at a somewhat familiar steep angle. Throwing a ball distance is a shallow angle. Hitting a golf ball, a still shallower angle. Using angles to judge how far we can spit, throw, and hit is a basic skill we learn as children. It is a skill second nature to all of us and is easily understood.

The TLAR ("That Looks About Right") landing technique takes advantage of this simple angle method by teaching the few angles necessary to perform a safe landing. While flying, we might ask, "Can you glide to that house?" If the angle to the ground is steep, we can easily and confidently predict the gliding distance is within reach.

"Can you glide to that further farm field on this side of the lake?" This angle is shallower than the one to the house, but still relatively steep, so we believe we can comfortably glide to that field.

"How about gliding to the other side of the lake?" Now the angle is shallow, and you would have doubts about the ability of reaching the other side.

Even though distance is a factor, the primary judgmental tool we instinctively use is the angle to the point on the ground.

Judgement tools We judge distance with a few visual clues. Angles, as described above, is the most important. Other judgement tools include relative sizes of familiar things, and depth perception.

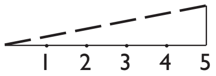
Distant objects appear smaller than near objects. Houses, animals, and people all appear smaller with increasing distance. Some objects are so small they cannot be seen at far distances. Sailors use standard size windows of a distant house (approximately 3 feet x 5 feet) to judge distance from shore because they can first see a window when they approach one mile from shore. (Try this experiment while driving along any highway; spot a house in the distance and observe at what distance you can clearly see the window. Houses can be seen from a far distance, but this varies with house/building size.) Glider pilots use similar clues. Cows can be seen from a far distance/altitude, but their legs only become visible when the glider descends to 800 feet. Sheep legs become visible at 500 feet.

Depth perception uses angles perceived by our binocular vision and is only useful within 500 feet of an object. Some people, including pilots, have no depth perception at all. Depth perception is an important judgement tool once the glider descends to circuit altitude and especially on the final approach.

People do not accurately judge distances related in feet, yards, miles, or metres. Ask a group how far it is to some distant object, and they will respond with a wide range of guesses. Asking how high they are over the earth by looking down will result in what can only be described as educated guesses. This is especially true when flying in unfamiliar territory. For a person from the eastern USA flying in the west, how is a yucca or a cactus to be used for a relative-size reference?

Teaching pilots to land using the altimeter works in power planes as long as the altimeter setting is correct and local field elevation is known. Without this information a pilot must use judgement based on basic judgemental skills described above. Glider pilots routinely land in unfamiliar terrain and must be prepared for a landing in farm fields and must be taught the necessary judgmental skills.

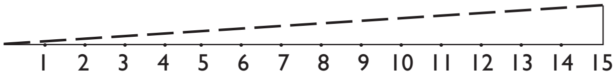
The necessary angles Modern gliders are built to certain minimum standard design criteria. Dive brakes or flaps will allow most gliders to descend (no wind) with fully opened dive brakes, on a glide angle of about 5:1. A pilot who has learned what the five to one glide angle looks like and flies the landing pattern to arrive on final approach below the five to one glide angle will easily descend to the desired landing point using the dive brakes.



However, the pilot must not fly so far from the landing point that the gliding angle is too shallow. The shallowest glide angle is the maximum glide angle in still air. This can be a very shallow angle, with some gliders able to achieve a glide angle of 60 to one!

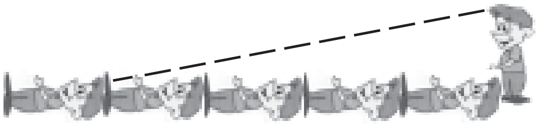
A glider might have an L/D with the dive brakes closed of 30 to one. It is a very interesting exercise to measure off the distance/angle of 30:1 and see what this looks like. It seems impossible! With the vagaries of the winds and turbulence, no sensible pilot would test this shallowest glide angle during a landing. Therefore, a pilot should divide the maximum glide angle in half to be reasonably conservative.

This would give a final approach "cone" between 5:1 and 15:1. Simply learning what these two angles look like would allow a pilot to safely arrive at the intended touchdown point with confidence, assuming relatively calm winds. More about winds later. So the trick to accurate, safe landings is to fly the landing pattern so as to arrive on final approach below 5:1 and above 15:1.



Good news How do we judge a 5:1, full dive brake, glide slope? You are exactly one-person height tall. If you are laid on the ground and flipped end for end five times, stood up and then look back to the beginning point, you would be looking at a 5:1 glide angle. You could get a tape measure and do this exactly, or you can simply pace off the distance.

Do this exercise: your height is equal to two of your strides. A stride is longer than a normal step — it is an extended step. So, place a marker on the ground as the starting point and pace off 10 strides. Turn around and look at the marker. You are looking at the all-important 5:1 full dive brake, no-wind glide angle.



Learn what this looks like, just as you have learned how far you can spit, and you can land any glider safely on any reasonably sized, level surface. Simply fly the landing pattern so as to arrive on the final approach high enough to glide to the landing area, but below the 5:1 glide slope. It is no more difficult than this.

Interestingly, if you observe landing gliders at your local glider club, you will notice the most common error in all of the sport of gliding is being far too high on final approach. The proof is the percentage of time pilots are using full dive brakes on the final approach, and the number of pilots who land longer than desired compared to those who land short.

What about wind? Wind can be your friend. It allows for a steeper approach and a slower touchdown speed. There is almost always some wind. On the other hand, we seldom fly in very strong winds. Certainly, low time pilots should avoid very strong conditions. A headwind will permit an ever steeper approach, however, a 5:1, no wind approach is reasonably steep, and will be reduced to 3:1 or even steeper in a head wind. There are rare occasions when a steeper than 5:1 is desirable.

Don't go too far How far should you go, or, a better way to look at the problem, is how shallow an angle should you fly the final approach?

More pacing exercise: continue the exercise above by pacing off the distance necessary to simulate a 10:1 glide slope. An additional 10 strides will equal a total of twenty strides from the beginning marker. Look back to the marker and observe a 10:1 glide slope.

Next, continue the exercise by pacing off another ten strides for a total of thirty strides, equaling 15:1. Looking back to the starting point, the angle looks shallow. This is a conservative glide slope used while flying a 30:1 glider in the landing pattern considering normal winds, and low-level turbulence/shear. You don't have to be this far out, or on this shallow a glide angle, but it is an easy, conservative glide slope for almost all normal conditions.

Take a look. OK, now pace off another 30 strides, which will equal a total of 60 strides, simulating a glide ratio of 30:1. It is a very shallow angle. You might even measure off the glide angle of modern sailplanes that achieve glide ratios of 40, 50 and even 60:1. It is hard to believe what is possible.

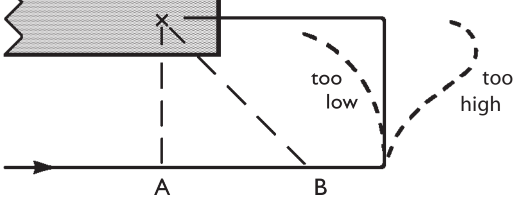
Again, very shallow angles are not normally used in landing patterns. Normal landings are flown so as to arrive on the final approach below the 5:1 glide slope that full use of dive brakes permits. Of course, any maximum performance maneuver is more difficult than a lesser one. Using full dive brakes and descending at the steepest possible glide slope is more difficult than a slightly shallower, less than full dive brake landing. The round out and flare with less than full dive brake occurs over a longer period of time, making it easier. So, learn what 5:1 looks like and try to fly the pattern to arrive on final approach at a slightly less steep angle.

Judge your performance on every landing. What percentage of the final approach did you need to use full dive brakes? What percentage with none?

How to arrive on final Once you learn what a 5:1 glide slope looks like, you will attempt to arrive on the final approach below this important angle. How do you do this?

The landing pattern must be high enough to accommodate a normal final approach. Key points in the landing pattern are used to develop the judgement necessary to make safe landings.

The base leg is very important as it will allow a pilot to make necessary adjustments when errors of judgement or atmospheric quirks occur. A proper, all-important base leg allows the pilot to make adjustments to enter the final leg at a proper angle. The base leg must be long enough to make adjustments. Too low? Turn early towards the landing area, cutting off some of the base leg, and close the dive brakes, or if high, turn away from the landing area slightly to extend the final approach, while possibly using some dive brakes to get down to the proper final glide angle (below 5:1.)



In order to have an adequate base leg, which permits these adjustments, the downwind leg must be a respectable distance from the landing area. The most common error preceding a landing accident is a pilot flying too close to the landing area on the downwind leg. It is human nature and a very common error. You will see it every day at any gliderport.

Circuit height Power planes typically use 1000 feet, and sometimes higher. If you are flying at a power plane airport, it is important to comply with the local rules. However, glider pilots need all their faculties when landing at a strange site. Since depth perception is most useful below 500 feet, the downwind leg needs to consider this important judgement tool. For these reasons, at a point on the downwind leg opposite the touchdown point in calm conditions, the pilot should be at 500 feet.

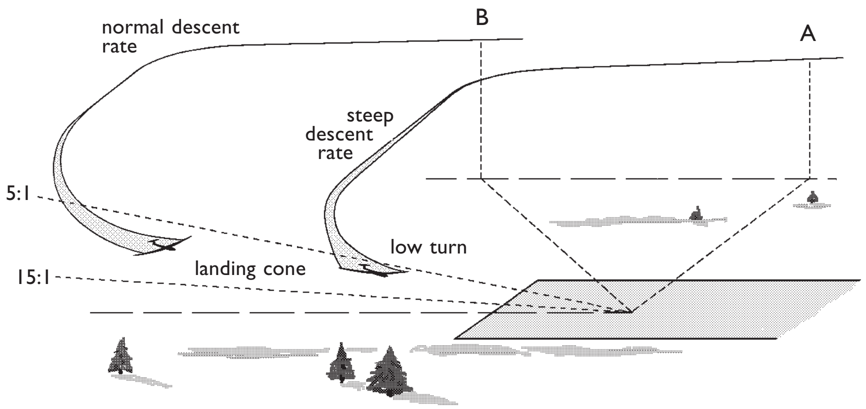
A typical landing field can be assumed to be about 3000 feet long. If this is the case, the glider will be about 600 to 800 feet agl at the midpoint of the landing area. If the wind is blowing, the pattern altitude should be raised, as well as the glider's airspeed. The resulting higher pattern will result in a higher altitude turn from base to final where wind gradient and turbulence can be a hazard.

From the midpoint of the landing area on the downwind leg, the glider should descend at a rate of 200–400 fpm (2-4 kts). This is an important, "how goes it" indicator, and pilots should use whatever dive brakes necessary to accommodate this descent rate on the downwind leg. This normal descent rate indicates what plan of action to use if the descent rate continues.

A low descent rate calls for more dive brakes, and a possible extension of the downwind leg. A too rapid descent rate calls for less dive brakes and a plan of action to turn onto base leg early if the condition persists. (Sometimes it's necessary to land further along the runway when unusual conditions occur.) The downwind leg will continue past the point even with the intended touchdown point (point A) until the pilot determines turning onto the base leg will cause the glider to be below the 5:1 glide slope on the final leg.

If the landing pattern is normal, (altitude, spacing, descent rate) the turn onto base leg will occur after point B, a 45° angle back to the intended touchdown point.

In a high wing glider, while flying the downwind leg past the touchdown point, it is easy to look back to the intended touchdown point. In a low wing glider, the pilot may need to dip the wing to take a peak.



The turn onto base leg This important turn is done at a constant, correct airspeed, and with a straight yaw string. These two skills are imperative to safe flying. The turn, done correctly, only takes five seconds. Pilots must develop the skill of making this turn at a constant, correct airspeed with a straight yaw string.

As soon as possible, after the turn to base leg, the pilot looks at the intended touchdown point and determines if the glider will be below the 5:1 glide slope when the turn onto final approach is made. If not, the adjustments previously described are made.

Airspeed control is critical throughout the landing pattern. It is almost always true that if the glider is flying too fast on the final approach, the glider is too high, and the pilot is trying to make the glider go down using the elevator. This simply exchanges one form of energy (potential) with another form (kinetic) and does nothing to improve the chances of landing on the preferred touchdown point. The opposite can happen when a pilot is too low and attempts to hold the glider up with back stick pressure, causing the airspeed to be less than proper.

If the airspeed is too high, the pilot is probably too high. If the airspeed is too low, the pilot is probably too low.

Airspeed discipline throughout the landing pattern is extremely important.

The dive brakes have three functions:

- Glide path control while on the final approach.
- Touch down control. After the glider arrives a few feet above the ground, the dive brakes change function. The pilot can coast above the ground a considerable distance before it can be held aloft no more and it settles to earth.
- Stopping control. The wheel brake is often connected to the dive brake handle, and thus becomes the stopping control. The glider can coast along on the ground until the pilot elects to stop.

A common error seen on many landings is that the pilot will enter the pattern at a proper altitude and spacing, but use too much dive brake and descend too rapidly, turning onto the base leg about the 45° point, (point B) lower than desired. Since the pilot wants to land close to the approach end of the runway, the glider must continue to descend, making the turn onto final much lower than desired, usually in a wind gradient. Many serious glider accidents occur in this fashion.

Notice that the glider turning further away from the landing spot is still inside the proper landing cones, but above the hazard of low altitude wind gradient. Wind gradient can cause the lower wing to be affected by the rapidly decreasing wind speed at very low altitudes.

Another hazard of low altitude turns is the affect of ground movement rushing past the lower wing tip which can cause a pilot to believe the glider has adequate airspeed, when in fact, it is near the stall.