Paraglider physics Why We fly the way we do! - Part 2

In our previous article we learned how a drag curve for an aircraft was generated. If you were to mirror the total drag curve of a wing shown in the preceding article as figure 1, it would closely approximate the polar curve generated for that particular wing. An example of a polar curve is shown in figure 4. The manufacturer of every glider should be able to provide you with a copy of the polar curve for their wing. This information is critical when comparing the performance of different gliders, and can easily prove or disprove manufacturer's claims. In the event that the information is not provided, or readily available, you can easily generate your own polar for any wing you fly using some of the newer variometers coupled with a speed probe.

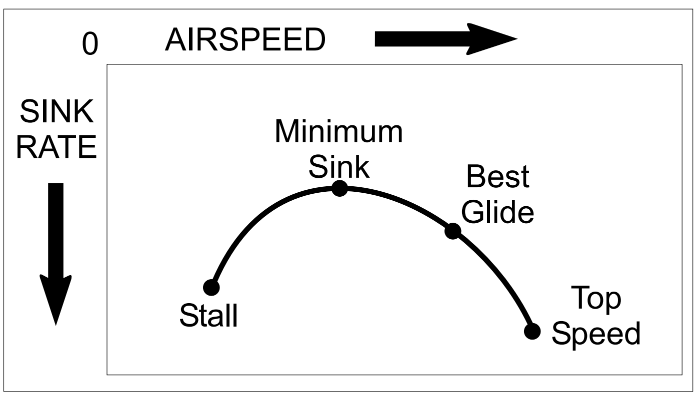

Figure 4 • Polar Curve

A point that causes considerable confusion amongst pilots trying to compare the statistical performance of different wings is that some manufacturers use projected area, span, or aspect ratio, while others use flat Projected is the actual vertical component you should experience in flight, whereas flat is what you would find by measuring with the glider laid out on the ground. Due to the many ways manufactures rig their line sets, comparing projected measurements is probably a better way of getting the true performance criterion than using flat. You should be especially cautious of manufacturers claims where they choose not to provide all the data a pilot should reasonably expect. When the manufacturer tells you that their glider has an extremely wide weight range, a top speed almost double what most competing wings fly at, but refuses to provide the stall speed and/or sink rate of their glider would you not be a little suspicious?

Looking at the polar you can readily see the speeds that your glider would stall at, and the speeds you would want to fly at to obtain minimum sink or the best glide speed in a no wind condition. Why is this information important, and how can we use it? Remember how landing your older glider on a dime was a relatively simple process. Many people claim the steeper approach angle of older gliders makes them easier to land, and they float less. What they may or may not be aware of is how flying at different speeds could dramatically increase their sink rate.

On an older glider, if you were a little high you could either speed up, and you would sink faster, or you could slow down and increase your sink rate, making glide path control fairly easy. Of course pushing it too slowly could also result in stalling their wing generating the glide of a greased anvil. In extreme cases or where approach planning left a little bit to be desired, the use of canopy reduction techniques was also available to help come down quicker.

As a practical matter, you should be able to determine the approximate brake positions to achieve the in-flight performance you desire. At this point I feel obligated to add the standard disclaimer, “Don't try this at home, unless you talk to your instructor about it first.” On a smooth sledder type of day, and at a safe altitude, relax almost all the brake pressure on your glider, and note the sink rate on your vario. Slowly and smoothly apply ½ inch or so of brakes, and wait for the sink rate to stabilize. Apply another ½ inch of brake and wait. As you continue this process you should find your sink rate gradually reducing to a point, and then it will start to increase. Once it starts to increase, let up on the brakes ½ inch or so and you should be flying at the minimum sink rate of your glider. Make note of your hand position, since this is a great reference point to be able to work from.

Once you have identified the minimum sink brake position you should be careful about experimenting with further brake pressure because of the possibility of stalling your wing. If you wish to continue the experiment you can gradually increase the brake pressure symmetrically and you will note the sink rate will increase until the point at which the wing stalls. Naturally this would best be performed under the supervision of a qualified instructor, and at an appropriate location. If you find the brake pressure suddenly getting lighter, you should take appropriate action to regain flying speed, since you are on the verge of stalling you wing!

It is important to recognize that this brake position for minimum sink will not be the same on every flight. Changing the weight of the glider, by physically loading it with a more gravitationally challenged pilot, or subjecting the glider to higher wing loading by turning, will slide the polar laterally requiring you to fine tune your hand position for each flight.

Realizing that there is a front and a back side to the polar curve should help you achieve higher performance levels from your glider. As an example, if you find yourself in a position where you need to maximize your airtime in very light or no lift, while you're waiting for your next thermal to come through; the speed that you fly at is important. If you fly too quickly, the increased drag will cause you to sink faster than you need; while just jamming on the brakes and hoping for the best might put you on the back side of the drag curve. This would cause you to sink faster, and put you much closer to the stall point of your wing than you need to be at.

The problem with the older style of gliders is that if you want to maximize your airtime, you need to minimize your sink. This creates problems for pilots seeking cross country performance since speeding the glider up to transition between thermals caused unwanted higher sink rates, but if they flew at minimum sink they couldn't go anywhere. Looking at figure 5 we have a comparison of the polar curve typical of the older style glider, as compared to one of the more modern gliders available today. What is really interesting is that the polar curves of some of today's entry-level gliders show performance approaching that of competition gliders of just a few years ago. Notice how the newer gliders have a flatter polar. In the real world, they have a much flatter glide angle as well. The great part of this is that we can have pretty darned good performance from a wing without the

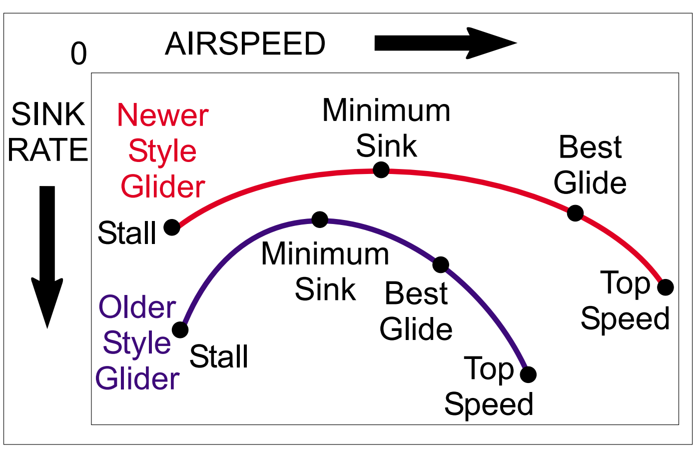

Figure 5 • Polar Curve Comparisons

sometimes questionable handling performance of some of the older “hot ships.”

When transitioning to newer gliders, pilots have been caught by surprise in confined areas when their gliders simply didn't want to come down, and they were running out of room to set their glider on the ground. If you're used to coming in a bit high on landing, and then either speeding up, or slowing down to increase your sink rate; you might be surprised as you come smoking into the LZ and it seems the glider just doesn't want to quit flying. Looking at the polar explains why. Since the performance of today's gliders is much higher, changing the speed just doesn't have as dramatic an affect on the sink rate as you may have become used to. When you combine this with the faster speeds these gliders approach at, it is very easy to overshoot the intended landing area unless you have carefully planned your approach.

If you're a competition or cross country pilot you will really appreciate this type of polar since you can slow down while thermalling, or speed up when transitioning between thermals without incurring a heavy sink penalty. In many cases the newer gliders achieve their best glide rates either hands off the brakes, or in a few cases just after the pilots have engaged their speed bars.

It has been said that landing the newer gliders is much more difficult than the previous generation's gliders, and their difficulty in handling makes them more dangerous to operate. My personal belief is that the newer gliders are probably safer than the older style gliders, but they require their pilots to understand how the performance is different from older gliders to operate them safely. Being able to glide farther and fly at higher speeds gives you many more options when choosing a suitable landing area than in years past. If you find yourself between a rock and a hard place, being able to slow down to minimum sink allows you to maximize your airtime to assess your options, or wait for a thermal to come through to help take you out of your predicament. Of course what’s theoretically ideal may not always be practical. If you find yourself in turbulent conditions, it may be more prudent to adopt a speed that is much faster than ideal, but gives you a better measure of control.

One of the nicer features of the newer gliders is the adoption of split A riser systems. Smaller pilots on older gliders often had difficulty reaching the individual A lines, so using this canopy reduction technique was not always available. The manufacturers of newer gliders realize the importance in the use of little or big ears as a canopy reduction technique for glidepath control, and have made the controls easier to use for all pilots. While ears can help you fine tune your glide path, it is my belief that they should be used when needed, but proper piloting skills will make your approaches far easier and safer. If you have been used to just pointing towards the LZ and hoping for the best, perhaps a better approach technique is in order.

Interestingly, a simple technique for increasing the drag, hence steepening the glidepath and reducing the distance you float over the ground is not even used by many pilots. A simple method of increasing your sink rate is to stand up in your harness. This exposes more surface area to the wind, increasing the drag and hence causing you to sink a bit faster. This gives the added advantage of putting you in a position for a stand up landing, or a Parachute Landing Fall position if things don't work out as planned.

Next article, we'll look at different methods of fine tuning your approach technique so you can hit the spot you want to land, every time…