Performance Characteristics of the **PD Vengeance**

This document describes in detail the opening, flight and landing characteristics of the Vengeance (Airlocked nine-cell) in comparison to a similarly sized Stiletto, with an occasional reference to the Velocity. There are also some piloting tips, and a few hints on selecting the right options should you decide to order one.

I. Flying the Vengeance:

General Impressions:

The Vengeance is an easy canopy to like, if you are already familiar with the current elliptical nine-cells. It is a noticeable step up in performance from a Stiletto, yet in some ways, it is easier to fly and land.

Straight flight at full glide:

The Vengeance flies at very close to the same speed and glide angle as a Stiletto of the same size. It is very common to see Stilettos in the field with brake lines set too short, however, making it fly in slight brakes even when the toggles are all the way up. In this case, the Stiletto would seem to have a slightly slower and more floaty glide. The Velocity glides much steeper than both canopies.

Straight flight in brakes:

The Vengeance feels very similar in brakes to a Stiletto, with the Vengeance having a slightly lower rate of descent and better glide angle. This glide makes getting back from long spots upwind easy, perhaps even easier than with the Stiletto. (Downsizing eliminates some or all of this advantage, however.)

Straight flight on rear risers:

The Vengeance has a flatter glide than a Stiletto on rear risers, and feels more rigid and efficient near the edge of the stall. However, you will actually find more useable performance in deep brakes (on either canopy) when the spot is far upwind.

Stall characteristics:

The Vengeance has a slightly less radical stall, and is slightly easier to keep on heading than a Stiletto of the same size, assuming you recover upon the first indication that a stall is occurring. While it is easier to keep on heading during stall recovery, it is more prone to surging forward than a Stiletto. Because the airlocks keep the canopy fully pressurized, it is ready to fly instantly upon raising the toggles. Therefore, only raise the toggles a small amount when recovering, or you will find yourself looking over the tail at the horizon! As with any high aspect ratio elliptical canopy, the Vengeance will become very difficult to keep on heading if a deep stall is allowed to develop. Line twists, closed end cells, turns, slack lines, line twists, and rapid altitude loss are all likely to develop, especially if the recovery is not carefully controlled. Radical stalling maneuvers are likely to result in an unrecoverable situation on a Vengeance, as with any high aspect ratio elliptical, especially when stalling during turns.

Turns from full glide:

The ultimate turn rate on the Vengeance is faster than a Stiletto. Toggle pressure is similar on both canopies, and slightly lighter than a Velocity. The Vengeance dives a little more than a Stiletto during a turn, but less than a Velocity. It also builds up slightly more speed during aggressive turns than a Stiletto, and less than a Velocity.

Braked turns in low speed flight:

You can make a much flatter turn in the brakes compared to at full glide. As with any canopy, you lose much of this characteristic when downsizing.

Braked turns in high speed flight:

If you convert excess speed (generated from high speed maneuvering) back into lift by using brakes, very flat or climbing turns are possible. This Vengeance is even more capable than the Stiletto in this regard, because it has a higher maximum speed capability, and more float in brakes as well.

Harness turns:

The Vengeance turns nicely with harness movements alone. This is especially true when the brakes are set. Some jumpers may have a tendency to over control with brakes set, particularly on the smaller sizes. Make sure your harness is adjusted evenly on both sides, or you will create an unwanted turn.

Oversteer after turns:

The Vengeance will oversteer about the same amount as a Stiletto. Oversteer is the tendency for some canopies to continue turning after neutralizing the toggles. The degree of oversteer a jumper feels is heavily influenced by any intentional (or unintentional) weight shifting during the turns. Oversteer is minimized by rolling out of the turn with the harness upon raising the toggle. A slight opposite toggle input will also stop a fast turn quickly. If you've never flown a highly elliptical canopy before, this will take some time to get used to.

Front riser turns:

The Vengeance dives slightly more than a Stiletto of the same size, building up more speed in the process. This is more noticeable if you've downsized to a smaller size from your current canopy. Be ready to use toggles to pull out quicker in case you find yourself getting into the corner. The front riser pressure is much lighter than a Stiletto.

Setting up the Vengeance for great front riser performance:

It is important to install risers and toggle in the correct configuration to prevent canopy buffeting during front riser maneuvers. First, the dive loops (or riser blocks) should be as high as possible on the risers, so that your hand must grab the riser at least four inches (10cm) above the place where you would grab the toggles. (If you can't reach up that high, get shorter risers.) Second, make sure there is enough slack in the control system. The control lines should appear quite bowed when at full glide. Having the control lines too tight kills a great deal of front riser performance, reducing the speed and angle of the dive, and causing buffeting. It also reduces full glide speed, and makes the canopy flight bumpier in turbulence, while reducing flare efficiency.

A collapsible pilot chute is mandatory:

The kill line type is best, as it gives more consistent openings and stays collapsed during flight at any airspeed. An inflated pilot chute really kills flight performance and reduces flare effectiveness.

II. Landing the Vengeance:

General Impressions:

The Vengeance is an absolute pleasure to land. It will swoop farther than the same sized Stiletto, and will slow down more at the end of the landing. Be smooth! Getting twitchy on the toggles during the approach will scrub off a lot of speed and potential flaring energy. Try to avoid uneven toggle movement, which causes a pronounced rolling from side to side during the flare and plane out. The following text assumes that you have figured out your landings on your present canopy.

Straight in landings without front risers:

The Vengeance feels very similar to a Stiletto of the same size during a straight in approach, but the flare is slightly more efficient, so it is easier to get a great landing. Pilots adapt quickly to the Vengeance's ability to slow down more. Keep in mind the fact that you don't need to point the canopy straight at the ground to build up enough speed to get a good landing. If your technique is good, you can perform great swoops and landings from a normal straight in approach without using front risers, even at a very high wing loading.

Aggressive approaches:

Aggressive turning approaches are similar to a Stiletto of the same size, with a little steeper dive and slightly higher top speed. If you've been doing such approaches for hundreds or thousands of jumps, you'll find it easy to figure out the Vengeance, assuming you don't get crazy on the downsizing. The Vengeance also has plenty of efficiency for carving level flight turns during the swoop. As with most canopies, a long carving turn initiated very high will build up more speed and give you a longer swoop than a radical snapping turn.

III. Opening characteristics of the Vengeance:

General:

They open really nicely! To describe the openings, we need to agree on common language, so here are some definitions: The first part of the opening you feel, when the canopy first gets to the end of the lines, is called the **snatch force**. The second phase of the opening, when the canopy is overhead but the slider is still all the way up, is called the **snivel**. The third stage is the **inflation**, when the slider travels down the lines and the cells finally pressurize.

Snatch Force:

Snatch force is similar to a Stiletto, and less than that of a Velocity. It is adversely affected by using a pilot chute that is too large, by sloppy packing, or if you have excess airspeed at opening time.

Snivel:

The snivel is similar to a Stiletto, and is comparatively shorter when the jumper's airspeed is higher.

Inflation:

The inflation speed is similar to that of a Stiletto. The opening is softer, even though the slider seems to travel down the lines quicker. Opening shock is very reasonable, assuming everything happens in proper sequence. (See the deployment bulletin that comes with every PD canopy.)

Heading control during opening:

The Vengeance is easier to keep on heading during opening, when compared to a Stiletto. This is partly due to the deeper brake setting, the inflation characteristics of the new airfoils, the new planform, and several other subtle design improvements created since the Stiletto was introduced. Though we feel the openings are easier to keep more consistently on heading, slight body movements during any part of the deployment sequence may cause a heading change, or worse depending on the degree of movement. Symmetry in packing helps, as does neatness. Either leave the nose straight, or fold each half toward the center cell without tucking it into the center cell. We do not recommend pushing the nose into the center of the pack job, even a little bit, as this promotes off heading openings. The slider should be quartered evenly to the sides, the front and back, with just a little sticking out in front of the nose. Keep the slider fabric pushed well down in the center, and keep the grommets firmly against the stops on the stabilizers throughout the pack job, until the canopy is in the bag.

IV. Choosing the best size:

General:

The current recommended wing loading range for the Stiletto is now from 0.8 to 1.7 pounds per square foot, depending on canopy size and skill level. If you're pleased with the performance of your Stiletto in this range, staying with the same size probably makes sense. On the other hand, if you really want more speed, going one size smaller will give you this. It will still provide the capability to slow down the canopy as well as a Stiletto that is one size larger, assuming that you're willing to work on your technique if necessary. For these reasons, the wing loading recommendations are the same as for a Stiletto for more conservative jumpers, but for aggressive pilots, the maximum wing loading has been raised slightly, to 1.8 pounds per square foot.

The quality of landing and length of the swoop diminishes as you exceed 1.8 pounds per square foot, on either a Stiletto or a Vengeance. If you really want so much speed that a wing loading higher than 1.8 is necessary, you'll probably get that speed, and better landing performance, from a PD Velocity.

Model	Minimum	Student	Novia	e Int	. Ad	v. Expe	ert Max	. (do not exc	eed)
Vengeance-089	VLC	N/R	N/R	N/R	107	142	160		
Vengeance-097	VLC	N/R	N/R	N/R	116	155	175		
Vengeance-107	VLC	N/R	N/R	N/R	128	171	193		
Vengeance-120	VLC	N/R	N/R	N/R	144	192	216		
Vengeance-135	VLC	N/R	N/R	N/R	162	216	243		
Vengeance-150	VLC	N/R	N/R	N/R	180	238	270		
Vengeance-170	VLC	N/R	N/R	136	204	255	285		

Should you downsize? If so, how much?

If you don't want more speed, don't downsize. If you do want more speed, think carefully about the decision. Think about your current canopy. Is it a real handful to fly? Do you feel comfortable in traffic? Does the thought of a no wind day (or a downwind landing) intimidate you? Are your friends concerned about your flying skills and habits? Think about how you'll handle an unexpected landing in a really tight area. Downsizing may be appropriate if you're looking for more speed and have the necessary skills. If so, we recommend you don't make more than a 15% size reduction.

V. Sizes, pack volume, and other details:

Sizes available:

The Vengeance is available in the same sizes as the Stiletto except we've added a smaller size and eliminated the 190 size. (i.e. 89, 97, 107, 120, 135, 150, and 170) We may introduce a 190 later, if we receive lots of requests for one.

Pack volume:

The pack volume is very slightly larger than the same sized Stiletto. If your Stiletto is an easy fit into your container, a Vengeance of the same size will probably fit well. If it is a tight fit, you may need to either downsize or get a larger container. We're in the process of sending demos to container manufacturers for sizing.

Colors patterns:

You can get any skin or rib in any color normally available, and each pair of airlocks in each cell can be a different color. We recommend choosing a slightly darker color for the airlocks, because it looks cool. (Its easier for us to build it that way too!)