Performance Characteristics of the
PD Velocity

This document describes in detail the opening, flying, and landing characteristics of the Velocity in comparison to a **similarly sized** Stiletto. There are also a few flying tips. This will help potential users of the Velocity learn as much as possible about the canopy before deciding to jump it.

The Velocity is intended only for very experienced pilots who have already flown a small elliptical canopy for several skydiving seasons, and consider themselves very current and very proficient. If this doesn't describe you, keep jumping and keep learning, but stay away from the Velocity, especially if it's a smaller canopy than you're used to. If you decide to go for it, we suggest you make several solo jumps on the Velocity opening above 6000 feet, or higher if it's a small one. This should give you the freedom to really explore the canopy unencumbered by other traffic.

I. Flight characteristics:

General Impressions:
The Velocity has the largest flight speed range of any canopy we've ever jumped. It is an absolute blast to fly. It responds very quickly to toggle, riser, or harness movements, and feels very "connected" to your body. Its cross-braced structure makes it feel very rigid. The swoops on a Velocity are the longest we've seen from any canopy, especially when using a smooth aggressive approach. The Velocity lands great, even at the maximum placarded wing loading, after a normal straight-in approach without front risers. There should be no problem using very conservative straight-in approaches in the beginning, especially if you've done a few recently on your present canopy of similar size. The flight performance information below assumes the canopy size is the same as what you're used to. Obviously, things happen much faster than described when down sizing.

Straight flight at full glide:
The canopy is slightly faster at full glide than the same sized Stiletto, but has a much higher rate of descent. The Stiletto has a much flatter glide at full glide, with the Velocity pulling out in front.

Straight Flight in brakes:
The control range on the Velocity is slightly longer than a Stiletto, but gets progressively shorter as you downsize. Like the Stiletto, the Velocity will really flatten out when flying in the brakes. Getting back from long spots using this technique is easy, as long as you get deep enough in the brakes. The speed slows down noticeably, but the descent rate slows dramatically, which is the key to performance on long spots upwind. Flying the Velocity in deep brakes is also an excellent method of creating more vertical separation from other traffic prior to landing.

Stall Characteristics:
When using with careful control inputs, and recovering as smoothly as possible upon the first indications of a stall, the Velocity has a slightly less radical stall compared to a same sized Stiletto. This is due to the fact the canopy initially bends in the middle less than the Stiletto at the start of the stall, which makes heading control less difficult. This situation changes quickly, however, if the pilot does not take immediate action to recover upon the first indications of a stall.

As with any high aspect ratio elliptical canopy, the Velocity will become very difficult to keep on heading if the stall is allowed to develop fully, with line twists being a distinct possibility. Also, when recovering using too aggressive a technique, the Velocity is more likely to recover with closed end cells, turns, slack lines, and rapid altitude loss, even if the initial stall was quite gentle. As with the Stiletto, radical stalling maneuvers are likely to result in an unrecoverable situation on a Velocity, so such maneuvers should not be attempted, especially during turns.

Turns from full glide:
The Velocity tends to dive much more than a Stiletto during turns from full glide, even when the turns aren't very radical. Gentle toggle turns from full glide create a similar flight path to gentle front riser turns on a Stiletto. Though the Velocity doesn't take much toggle movement to produce a turn, it does require slightly more toggle input and pressure than a Stiletto, to achieve a given turn rate. The ultimate turn rate of the Velocity is faster than a Stiletto. The Velocity builds up and retains a lot more speed in a turn from full glide than a Stiletto, in even a gentle turn. This is partly because of the steeper glide, but mostly because the Velocity airfoil is very clean aerodynamically. If jumping a Velocity in a smaller size than you're used to, be smooth and gentle on the toggles. Yanking a toggle down might cause such an abrupt turn that you get a three-ring slammed into the side of your head!

Braked turns in low speed flight:
The turns flatten out a lot while in the slow flight mode, when compared to turns at full glide. However, you still need a healthy respect for your speed and rate of descent while in brakes, especially if you've down sized from your previous canopy. The ability to make turns in brakes while losing little altitude diminishes rapidly as you downsize any canopy, which is a good reason to be cautious about making a big change in size.

Braked turns in high speed flight:
If you've converted excess speed (generated from high-speed maneuvering) back into lift by using brakes, very flat or even climbing turns are possible, and come in handy when you need a little extra altitude. Using braked turns while entering and flying in the landing pattern is especially helpful for conserving altitude to be used for additional safety margin on the last turn onto final. Lots of low turn accidents could have been avoided using this strategy. It is important to understand that rapid turns in braked flight will still develop tremendous airspeed and high G-forces, and a lethal rate of descent as well. If you're spiraling toward the ground, going into brakes won't stop the rate of descent unless you stop the turn!

Harness turns:
The Velocity turns very well using only harness movements, especially when the brakes are set. At higher wing loadings, prolonged harness turns become a fast spiral at the ground at extremely high speed, whether the brakes are set or not. One should feel free to make heading changes using harness movements, but blindly spiraling at high speed should be avoided, regardless of the control method, as it can be a danger to other traffic. The harness also works really well to fine tune your heading during the dive after letting up on the front riser.

Oversteer after turns:
The Velocity will oversteer about as much as a Stiletto. Oversteer is the tendency for some canopies to continue to turn after neutralizing the toggles, rather than immediately stopping on heading. The degree of oversteer a jumper feels is heavily influenced by any intentional (or unintentional) weight shifting during the turns. Some people allow themselves to get slung to the outside of a turn, and they feel very little oversteer. Others lean into the turn, but don't lean out during roll out, and they will feel a lot of oversteer. Most people who have been flying highly elliptical canopies for a while use harness movements to roll both into and out of a turn, in conjunction with toggles. Stopping turns using a little opposite harness movement alone works really well on the Velocity, for all but the fastest of turns.

Front riser turns:
The Velocity will dive a great deal more than a Stiletto during a front riser turn. Be really careful of this on your first jumps! Riser pressure starts fairly low at the beginning, compared to a Stiletto, but will increase steadily as the speed builds up. On long, carving front riser turns where you build up tremendous speed, a great technique is to start a turn using the riser, and then smoothly transition to a harness turn as the riser pressure builds up.

Coming out of the dive:
The radius of the Velocity's natural pull out arc is much larger than that of the Stiletto, whether a riser or a toggle initiated the turn that started the dive. The difference will be even more noticeable if you're downsizing. Like most canopies, the Velocity will not pull out into level flight completely unless some brakes are applied. (It will pull out to a flight path that is slightly flatter than the normal full glide angle, but will not as flatten out as much as the Stiletto.) For these reasons, your first few approaches to landing should be very conservative, with very little turn, if any. Start your last turn to final really high! Don't be afraid to use the toggles if you find yourself lower than expected and need to start pulling out of the dive! There is a big difference between the Velocity and the Stiletto in these regards. Compounding this difference is the fact that many Stilettos are set up incorrectly, with the control lines deflecting the tail even with the toggles up. This slows the canopy noticeably at full glide, tightens up the pull out arc a great deal, and may make the Stiletto pull out completely into level flight with little or no need to use the brakes, something it really wasn't designed to do. If you have a Stiletto set up like this, you can expect a huge change when going to a Velocity, especially if you downsize. Also, get rid of the belief (if you have it) that you absolutely have to point the canopy straight at the ground to gain speed for a good landing. You can make some amazing swoops from a normal straight in approach on a Velocity—even without using front risers.

Setting up the Velocity for great front riser performance:
For best front riser performance, it is important to install risers and toggles in the correct configuration to prevent canopy buffeting during riser maneuvers. The Velocity is very stable on front risers, but its front riser performance is effected more by incorrect set up on risers and toggles than a Stiletto. Two factors contribute to good riser performance:

First, the loops (or blocks) on the front riser should be as high up as possible, so that your hand must grab the riser at least four inches (10cm) above the height of the toggle position. This will help prevent too much tail being pulled down when front risering while the toggles are in your hands (where they should be.) If you can't reach up that high on the risers, get shorter ones.

Second, make sure there is sufficient slack in the control system. The control system should appear quite bowed at full glide, due to the drag of the lines. Having the control lines tied too short deflects the tail, which makes the initial toggle turn rate feel snappier, but reduces canopy speed at full glide, reduces the speed and angle of the dive, and causes buffeting.

A kill line collapsible pilot chute is mandatory!
This is a third factor that contributes to good front riser performance, but it goes much farther than this! It is very important to have a very dependable collapsible pilot chute on a Velocity. Due to the very high speed that can be attained with a Velocity, the pilot chute must be collapsed after it's not needed, and it must stay collapsed. A bungee style collapsible is not recommended as it may inflate when it's not needed, and really change your flight path. This can be a problem on any small high aspect ratio canopy, and it's not often mentioned. At best, it will cause a rapid loss of speed and change in flight direction. The worst scenario would be if the pilot chute suddenly inflates during initiation of a radical front riser turn, or during an aggressive stall recovery. In this situation, it is possible that the pilot chute could "stop" the center cell while the end cells continue to fly forward toward each other until they touch, causing obvious problems! Again, this can happen on any high aspect ratio canopy, but it has a bigger effect of a high speed one. A kill line pilot chute avoids this possibility.

II. Landing the Velocity:

General Impressions:
(It is assumed that the prospective Velocity pilot is already very proficient at landing their present canopy, so this is not a “how-to” description!) Landing a Velocity is a real pleasure, once you become accustomed to the high approach speed! A Velocity can be slowed down much more at the end of a landing than similarly sized canopies, even more than many canopies much larger. Most people don’t expect this, and put their feet down prematurely on their first Velocity landings, touching down faster than is necessary. Consistent landings, with minimum possible speed at touchdown time, are necessary before downsizing to a smaller Velocity. It is important to be smooth on the toggles while planing out, or the distance will be reduced, and the touchdown speed will be higher than necessary.

Straight in landings, no front riser:
Since the Velocity has a steeper approach angle than a Stiletto, a straight in approach feels similar to an approach made with a small amount of front risers on a Stiletto. Many aggressive pilots are afraid of straight in landings, but they can be accomplished quite well on the Velocity, even at very high wing loadings, if the technique is right. You have lots of excess energy, which makes it easy to level off and plane out for a long distance, if you get the technique and timing right. A big part of the technique is to avoid the common mistake of being “twitchy” on the toggles all the way down the final approach. This nervous habit scrubs off a surprising amount of speed, which certainly won’t help the flare! Harness movements are great for making minor course corrections smoothly.

Aggressive turning approaches:
If you’ve already been doing them for hundreds or thousands of jumps, then your skills will probably transfer to the Velocity. This assumes that you keep the down sizing within reason, and start your approach much higher than you are used to. Really watch the altitude loss! **This is a very dangerous game, one that is very unforgiving of error.** Two ideas to consider: First, for the front riser crowd, don’t think of a toggle turn as dangerous in and of itself. With the Velocity’s speed and rate of descent, you may find yourself too low for a front riser turn, and a carving toggle turn may save your day. Second, a long carving turn initiated really high will build up much more speed than a radical snapping turn, so you’ll get longer swoops. Do remember, however, they take a lot of space and a great deal of altitude, and may not be appropriate in traffic. The ability to switch to a more mellow approach at any time is the mark of a great canopy pilot. Be courteous to the slower traffic.

III. Opening characteristics:

Definitions:
The first part of the opening force you feel is called the **snatch force**. It is the force you feel when the canopy first gets to line stretch. The second phase of the opening is called the **snivel**, during which the canopy is overhead but the slider has not yet begun to travel down the lines. The third stage is the **inflation**, during which the slider travels down the lines and the cells finally pressurize.

Snatch force:
The snatch force on the Velocity is equal to, or slightly higher than on a Stiletto, mainly due to the extra bulk and rigidity of the canopy. The brake setting is deeper as well. This is important for reducing the flying speed on opening, but it also contributes to a slightly higher snatch force. We feel the trade off for safety is worth it. Neat flaking of the canopy during packing will reduce the snatch force.

Snivel:
The snivel is comparable to that of a Stiletto, and much longer than that of a Sabre or a Silhouette. The snivel is considerably shorter when the jumper's airspeed is higher, and snivels considerably longer when going slower. The snivel is also affected by the degree of neatness in the pack job.

Inflation:
In general, the inflation is similar to that of a Stiletto, perhaps a little slower, with a similar peak force. However, the opening may be slightly quicker if you have the habit of deploying at a higher airspeed, (primarily because the snivel will be shorter, so you will not have slowed down as much before inflation.)

Heading control during opening:
The Velocity is easier to keep on heading than a Stiletto. However, like on the Stiletto, even slight body movements in the harness will cause a heading change, for better or worse. See the additional note about heading control at the end of this document.

Factors that affect openings:
The Velocity openings are more affected by differences in airspeed, pilot chute size, and neatness of packing than a Stiletto, with the Stiletto being more forgiving than the Velocity in these respects.
Neatness in packing helps make the openings more consistent. Give the canopy a good shake, to get the fabric to lay flatter before you flake between the line groups. **Pushing the nose into the center of the pack job is definitely not recommended**, as it promotes off heading openings. Either **leave the nose straight, or fold each half toward the center** without pushing it into the pack job. Take care to keep the C and D lines together in the center. The slider should be quartered evenly to the sides, front and back, with just a little sticking out in front of the nose. You should take care to keep the slider grommets firmly against the stops on the stabilizers, with the slider fabric well down inside the center of the pack job. When wrapping the tail around the canopy, roll just enough tail to keep things under control, and don't stuff that roll into the pack job! When bagging the smaller sizes, you may want to delete the first small fold in the slider area, (see the manual,) as the canopy will be too short to complete the rest of the folds!

IV. Size does matter:

General:
As everyone knows, many people have been flying their Stilettos at wing loadings of 1.4 to 2.1 pounds per square foot, rather than staying below the 1.3 pounds listed on the warning label. Those who have been doing this with good success will be pleased with a Velocity at 1.2 to 2.2 pounds per square foot, though it can be loaded as lightly as 1.0 pounds per square foot if that is what a person is used to. The warning label shows this entire range, but this should not be interpreted to mean that a person who can fly and land a Stiletto at 1.3 should go straight to 2.2 on a Velocity! Here is our current thinking (at the time of writing) concerning the wing loading of the Stiletto and Velocity for various experience levels of canopy piloting:

	Min wt.	Student	Novice	Int.	Adv.	Expert	Max wt.
VE-79	79	N/R	N/R	N/R	103	150	174
VE-84	84	N/R	N/R	N/R	109	160	185
VE-90	90	N/R	N/R	N/R	117	171	198
VE-96	96	N/R	N/R	N/R	125	182	211
VE-103	103	N/R	N/R	N/R	134	196	227
VE-111	111	N/R	N/R	N/R	144	210	244
VE-120	120	N/R	N/R	N/R	156	228	264
ST-97	VLC*	N/R	N/R	N/R	116	136	165
ST-107	VLC*	N/R	N/R	N/R	128	150	182
ST-120	VLC*	N/R	N/R	N/R	144	168	204
ST-135	VLC*	N/R	N/R	N/R	162	189	230
ST-150	VLC*	N/R	N/R	N/R	180	210	255
ST-170	VLC*	N/R	N/R	136	204	238	272
ST-190	VLC*	N/R	N/R	152	228	266	285

* = Varies with landing conditions.
N/R = Not Recommended

So what size is best for you?
We strongly believe in avoiding a large change in canopy size when downsizing, regardless of how efficient the canopy is or how it is placarded. Think about your present canopy, and your present skills. Is it a real handful to fly? Do you feel comfortable in traffic? Are your friends concerned about your flying? Really think about whether you want to go faster and are prepared for landing a small Velocity in an unexpected, tight landing area. Downsizing a small amount may be appropriate if you're looking for more speed and have the necessary skills. If not, its perfectly acceptable to stay with the same sized Velocity, or even one a little larger, as long as you're above a minimum of 1.0 pounds per square foot. When downsizing, we strongly recommend no more than 15% increments. You'll need this time to get used to dealing with traffic when you're going so much faster. The ability to fly the canopy really slowly while looking way ahead becomes very critical after down sizing, in order to create enough separation from traffic.

Sizes and pack volume:
The Velocity is available in seven sizes: 120, 111, 103, 96, 90, 84, and 79. The pack volume is similar to a Stiletto that is one size larger. This varies from canopy to canopy according to, neatness of packing, material and humidity variations.

V. Summary:

Remember, the comparisons described above assumed the canopies were sized the same. Downsizing even a little bit will really spice things up a lot. In other words, expect a Velocity 103 to be faster and much more responsive in every way than a Stiletto 107, because it's smaller. (It will slow down more, if you have the right technique, though.) The Velocity is really fun to fly, but will not replace everybody's Stiletto. Canopy model and size are a personal choice, and much more should go into the decision than the question, "Is it fast, and can I land it?" Choose your canopy while considering the information presented here, and reflecting on your present experience and desires. If you decide the Velocity is for you, we certainly hope you thoroughly enjoy it as much as we have.

Additional notes on heading control during openings:
Many people are very good at heading control on Stilettos or other highly elliptical canopies, but some jumpers have considerable difficulty with this! Some of the solution lies in correct packing, but the largest part of the solution is in the body position throughout the entire opening, from pilot chute launch to collapsing the slider. Some people have a relatively simplistic concept of good body position, being nothing more than shoulders level during the pilot chute launch. In reality, it's much more.

The most crucial concept to learn is that the two halves of the canopy are being controlled (or not controlled) by you, through the two halves of your harness during the whole opening, especially during the inflation. The center cell and slider are a big deflector of relative wind, spilling air into each half of the canopy. How you sit in the harness dictates how much air is deflected into each half of the canopy, which will change how each side inflates. Since asymmetrical inflation of the canopy can load the harness unevenly, it can change your body position. Therefore, maintaining good body position is both a dynamic and an interactive process. Your body position is constantly influencing the opening canopy, while the opening canopy is constantly influencing your body position.

If the pack job and body position are good, you should feel a slight pulsing tension equally on both sides of the harness during the time the lines are unstowing. The snatch force should feel fairly even on both sides. Both knees should drop simultaneously as you transition to a sitting position at this time.

During the snivel, if things are square and evenly loaded, just sit there and pay attention to what is happening through the harness as you scan for traffic. If, during the start of the inflation, one side of the harness is lifting up harder, sit down a little harder on that side. (Don't over do it.) The canopy is telling you it will likely turn away from the side that is loading harder. You are attempting to prevent that from happening by pushing down with just as much extra force it is pulling up. Doing this should prevent the canopy from tipping you to one side, which will eliminate the turn, or at least reduce it. You will turn, however, if you let the canopy lift one side of the harness more than the other.

While some people have heading control problems because they simply "let it happen to them," in the way described above, other jumpers have just as much problem because they are stiff and rigid, wanting to dominate the opening, like a cowboy trying to break a wild horse. It's an interactive process, not a dominating one. The best solution is to go with the flow, being relaxed

and square in the harness, making harness inputs if or when the opening shows a subtle but noticeable trend to load one side of the harness more than the other.

Remember that the proper harness movement is to press down a little on the side that is lifting. Do not try to twist or rotate in the harness against the direction of the turn! Some may call that movement “Body English,” but in reality it is one of the leading causes of line twists. If the canopy turns despite you’re efforts, go with the flow, turning with the canopy to prevent line twists. (Another cause of line twists is a tumbling bag, which you will likely feel right at line stretch. It is usually caused by a riser being caught under the low side of the reserve container during a shoulder low deployment. This can also be caused by a tight line stow very close to the connector links. Leave the last line stow about 18” from the links.)