

# Canopy Skills Guide

Be a Better Canopy Pilot

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## Skydive City/Z-Hills



This is a collection of articles that pertain to students and up-and-comers who want to improve their canopy skills and become better (and safer) pilots.

While this information may not make much sense to someone doing their first skydive, it will certainly make sense and help your skills when you get to the 10-20 jump range.

Consult with instructors as needed to ensure that the techniques here are something that will work for you and PRACTICE PRACTICE PRACTICE

TK Hayes – Updated November 2011

***Credit Given Where Credit is Due:***

Skratch Garrison, Bill von Novak and Performance Designs & myself allowed us to use the enclosed material, given in its original form.

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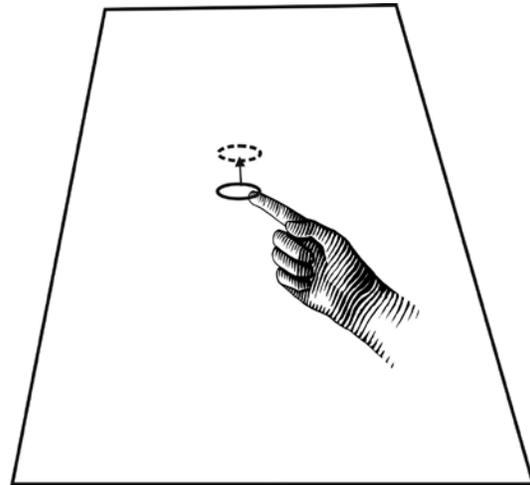
# TK's Accuracy Seminar

## ***Understanding the Target moving 'up' or 'down'***

This concept has been explained over and over again – and you probably have heard it already.

As you descend under parachute – the horizon appears to be rising in your field of view. Since you can never reach the horizon, you can assume that objects rising in your field of view are unreachable – you are undershooting them.

If you look down, as you fly over objects on the ground, they appear to move down relative to your field of view. You are

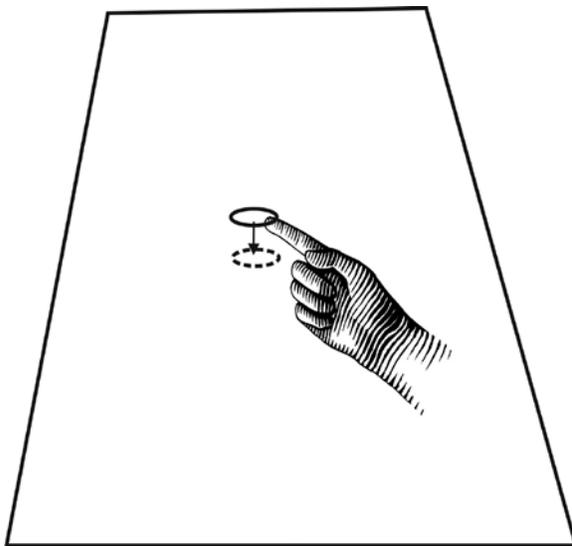


**Figure 1. Target Appears to move up**

overshooting those objects, so you can also assume that an object moving down in your field of view means you are overshooting it.

It can help if you use your finger, extended at arms length, held against a distant object, close one eye, and then watch the movement of the object relative to your fingertip.

If the object is rising relative to your finger, then you are undershooting it. Figure 1.



**Figure 2. Target appears to move down**

If the object is falling relative to your finger, then you are overshooting it. Figure 2.

It is far easier to see overshooting than undershooting. Distant objects hardly appear to move at all, (smaller slight movement), while objects closer to you (overshooting) is more obvious since the objects are closer to you.

Somewhere in the middle of the picture is a spot that is not moving at all. If the winds stay the same and you never change direction of your parachute, then that is where you will likely land.

However, this is not exactly where you *WANT* to land. The purpose of the seminar is to make your *INTENDED* target to be this 'non-moving spot'

## ***The Safety Side of the Accuracy Trick – making back to the DZ***

One of the neatest things about this concept is that it works at any altitude, distance, wind speed and/or under any parachute. We have all opened our parachutes a long way from the dropzone, looked back at the DZ and wondered if we can actually make it home.

So as soon as you open, check your parachute and start heading back to the landing area, look at where you want to land (the finger trick works).

If you see the landing area moving down in your field of view, then it means you are overshooting it. i.e. you can make it home. (Barring any radical changes in wind or your flight path, like spirals etc.)

If you seen the landing area rising, then you are undershooting it. i.e. You cannot make it home.

### ***Can you improve the situation if you are undershooting from a long spot?***

YES, most definitely. Almost all parachutes these days (Zero-P and 9 cells) will float or carry further, if you either put some brakes to add some lift or use rear risers to flatten the glide angle.

Large parachutes (students and such) are difficult to rear-riser due to the size and strength it takes to do so. A slight application of brakes (ear or shoulder level) will improve the glide ratio, sacrificing only a small bit of forward speed. This is a general rule for parachutes, any may vary depending on the parachute.

The best way to find out the best flying configuration for any given parachute is to talk to the manufacturer of the parachute. They have done hundreds and thousands of test jumps and can best offer the right information. Most publish the Flight Characteristics of the canopies, which offer great information and should be studied.

**Excerpt from the  
Performance Designs  
Website – Spectre Canopy  
Flight Characteristics:**

*“Many canopies being used today, including the Spectre, actually glide farther or “float” when flown in brakes, although the Spectre is not quite as “floaty” in brakes as canopies*

Back to solving the real problem of getting home to the DZ. If you are undershooting your landing area, then try some brakes. If you can then see the dropzone ‘moving down’ in the field of view, then you have much improved your situation, and staying in brakes for a period of time should help you to make it home.

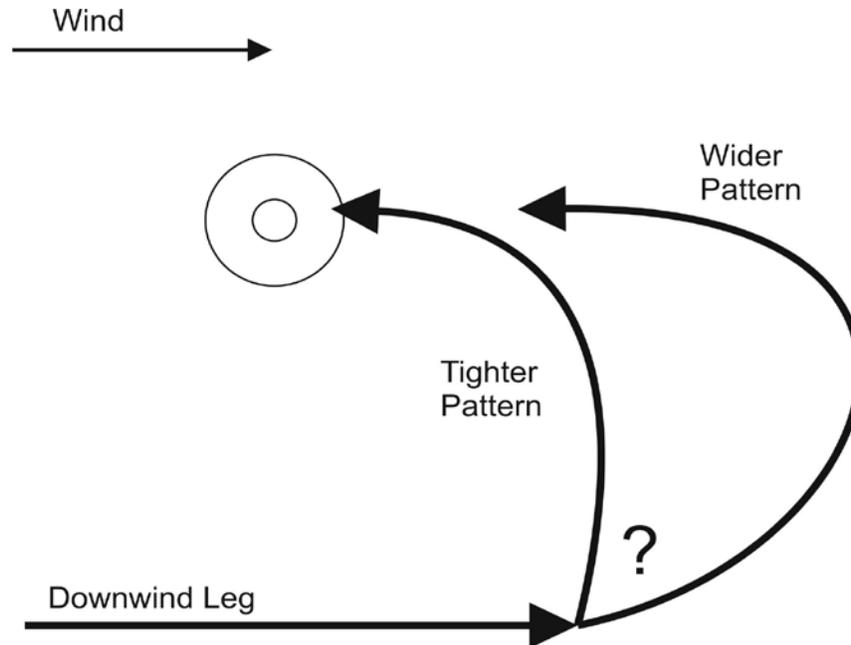
Why? Because it is simply smarter to land in the normal landing area if you can. Landing off the DZ simply introduces more obstacles, unknown landing areas, and therefore higher risk, etc.

If you have applied brakes and you are still sinking relative to the dropzone, then OK, you need to make a decision to land somewhere other than the dropzone, but closer to you. This is an OK decision too. The point being that you can make this decision within 15-20 seconds of opening your parachute, giving you more time and opportunity to choose an ‘out’ landing area.

In conclusion, the accuracy trick should be used every jump, as soon as you open, verifying your position relative to the DZ, deciding immediately if you can make it back or not, and then making the decision to land out if needed, maximizing your time to pick the landing spot and set up for a good safe approach.

### **Teaching & Learning 'Real Accuracy' using this technique.**

The objective of this learning process is to make better decisions on the downwind and downwind/base leg of your canopy flight:



**Figure 3. Decision Time - a Wider or Tighter Pattern to final?**

Figure 3 shows a good example of a typical downwind-base-to-final approach. I hope, with these techniques to help you a better decision on your pattern based on your altitude, winds, but mostly based on *WHICH WAY* the intended target is moving relative to your field of view.

### ***Exercise 1 – Watch obstacles on the ground***

During any point of your canopy flight, you can simply pick obstacles on the ground in front (or off to the side) of you and watch them for up or down movement. A building, a barn, a hangar or a tree. Watch objects closer and further away. Use the fingertip if you need to and watch each obstacle for a few seconds to see the movement.

Again, further objects have less and smaller movement than closer objects. The purpose of the exercise is repetition to train your eye. Do this every skydive during your flight home.

An object need not be right in front of you to see this movement. Look at things that off to the side of your flight path. Do you see them moving down?

## **Exercise 2 – Practice solo jumps with a final approach at 2500+’**

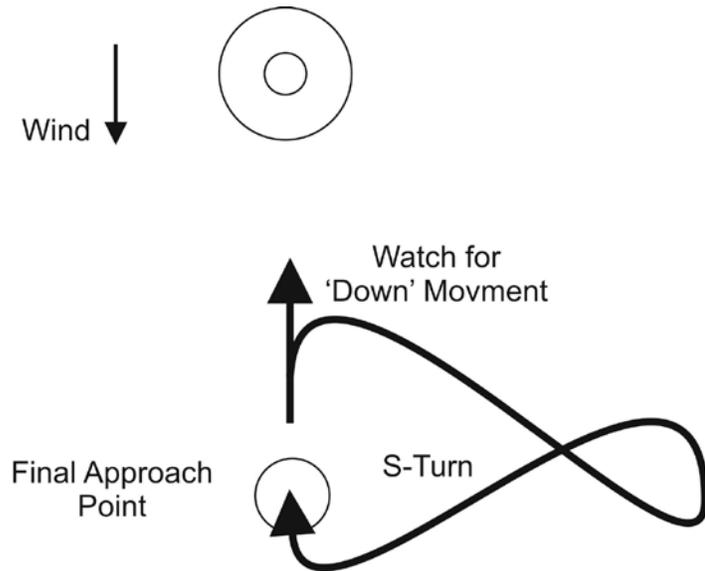
Normally we fly to a holding area (upwind of target), then enter a base leg to a final approach point (200-300’).

A good exercise is to open and check your canopy, then immediately fly to the final approach point, and set up for a final approach, but say at 2500’ or even 3500’.

You will, of course, overshoot. But again, the purpose here is to train your eye to see the downward movement of the target as you overshoot it.

Line up on the wind line as best you can, and the moment you recognize and see the target moving down, do a figure 8 or S-turn and come back to the final approach point again, stop and watch the target. Again it will be moving down, and repeat the S-turn again.

The purpose here is that you can practice your final approach 3-5 times on each jump, rather than just once. Set up at 2500’, then 2000’ then 1500’, etc. until you are at an altitude where you feel you need to stop turning and fly straight in to final landing.



**Figure 4. S-Turn Practice on 'Simulated Final'**

We are not asking you to do anything here that makes you uncomfortable, like low turns. Depending on your experience level, this could be 500’ or even 50’ when you stop the exercise. Fly and land normally.

I expect that you will already be closer to the target than you ever have been before – since this is the first time you really focused on the target itself and its movement.

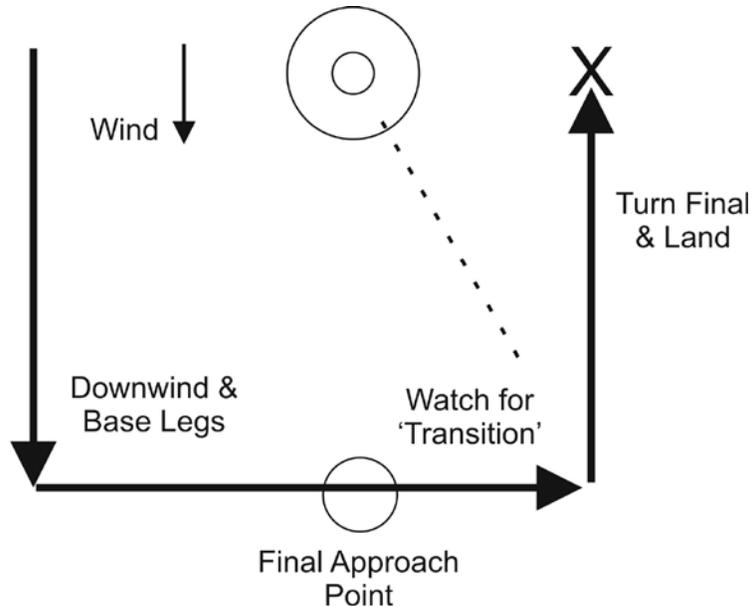
As well, each time you saw yourself overshooting (downward movement of the target), you did an S-turn to burn off altitude. Most people need to do this exercise for 2-5 jumps to really have their eye trained, meaning you did 6-15 approaches total).

**NOTE:** This is not considered to be an acceptable way to fly your parachute ‘normally’ in the landing pattern with other canopies in the air. This exercise is only for the purposes of training your eye & making corrections.

No one wants someone zig-zagging across the final approach area at or below 1000’

### **Exercise 3 – Recognizing the transition on Base Leg**

As I said earlier, the up/down movement occurs whether you are flying directly at the target, or flying away from it, or along side of it.



**Figure 5. Learning the 'Transition' on Base Leg**

During this exercise, fly a normal landing pattern, then turn your downwind to base leg, and then watch the target. It should be moving down relative to you (overshooting), continue to fly the base leg, but watch the target. Eventually, you will be flying away from the target, which also means that eventually the target will begin to 'move up' in your field of view (undershooting).

In order for the target to go from moving down to moving up again, it had to go through 'zero' or the point of no movement. The whole point of this exercise is to train your eye to see the transition from overshooting to undershooting.

When you see the transition of the target moving up, then simply do a turn to final and land. Ensure that you have 'outs' when you do the final turns since you may not be in line with the target when you turn.

What you will find is that you are pretty much landing in line with the intended target

Again, for this exercise, no radical turns, nothing too low or stupid, we are not trying to scare you, just get you to recognize the transition from downward to upward movement of the target.

## Exercise 4 – Go for the Target

The final step is to simply go for the target when you see the transition from 'target moving down' to 'target moving up'

Diagrams of landing patterns showing nice 90 degree turns from downwind to base to final are nice, but the fact is that we do not fly our parachutes like that. We fly with much smoother curves and turns throughout the pattern.

If you are on the downwind leg, watching the target, and you see the target suddenly move up and away from you, then you need to 'cut the corner' and close the distance between you and the target.

Figure 6 shows a good example of that.

If you are already on your base leg, and you reach what you think is the 'Ideal Final Approach Point', but the target is still moving down, then continue to fly a little further, or fly a wider pattern until you again see the transition.

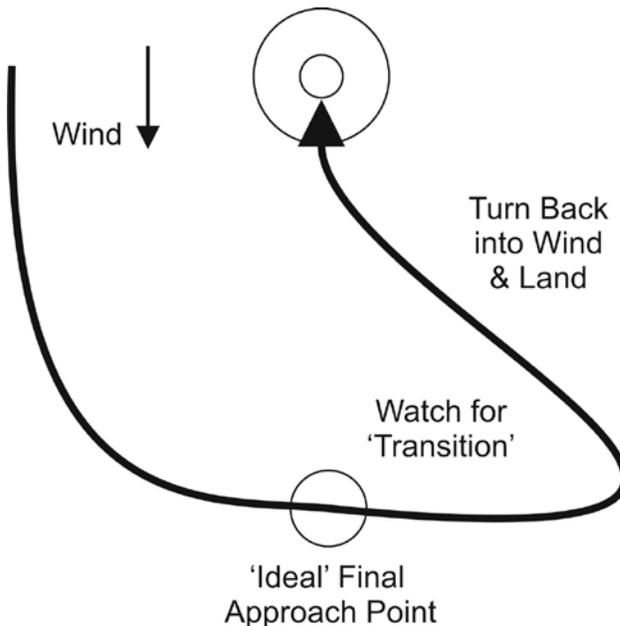


Figure 7. Example of a 'Wide' base-to-final

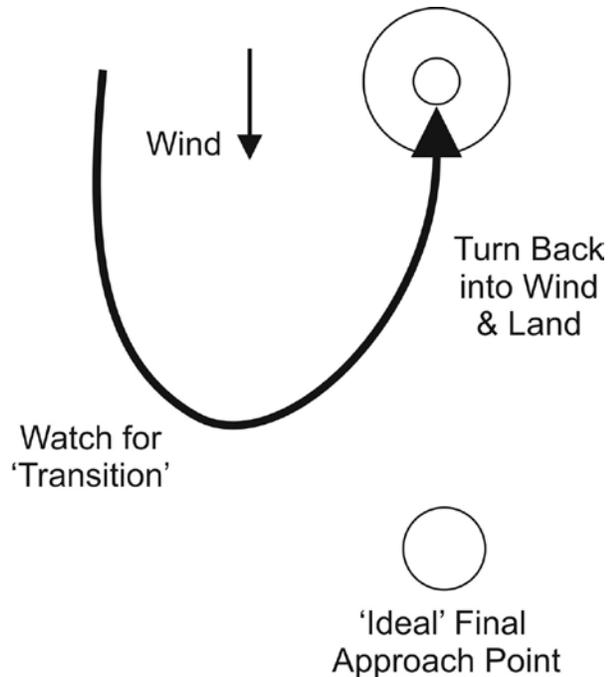


Figure 6. Example of 'Tight' base-to-final

You can then turn more than 90 degrees, come back to the target, correct into the wind and land.

What you will find, over time, is that the target will become the spot that 'never moves', especially during the downwind to base leg of your flight.

You will simply automatically adjust your flight path by paying attention to the movement of the target.

*Target is moving up and away*

Move closer to it.

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*Target is moving down and under?*

Move farther away from it.

With practice, you will get to the objective described in Figure 3 – making a better decision on downwind-base leg of needing a wider, or tighter pattern to still land on the target.

### ***Common Mistake***

***Overshooting on Final*** – Students, low-time jumpers, and for that matter, a large number of experienced jumpers tend to overshoot their targets anyway.

The mistake they often make is to put brakes on to slow down, thinking they will land shorter. We already discussed this earlier in the section about “Making it back to the DZ”. Adding brakes **makes you go further** by adding lift.

I cannot stress enough that if you are overshooting, then you have to ***INCREASE THE DISTANCE*** between you and that target. And you can only accomplish that by making a turn, even slightly, away from the target.

Yes, some parachutes are designed to ‘sink’ in deep brakes, but these are advanced topics using specialized parachutes like the Parafoil, Accutron and several other accuracy canopies.

For most skydivers, jumping 9-cell Zero-P canopies, moving away from the target is the simplest maneuver. If you have any moderate wind, that can as simple as a slight sideways turn, allowing the wind to push you further from the target, until you see the ‘transition’ again and turn back on target.

### ***Land any Parachute, Anywhere, Anytime***

Throughout the exercises, we have never once talked about what size of parachute we are jumping or wing loading. Nor have talked about wind speed.

That is because these issues do not enter into it. Whether the winds are high or light, large or small parachutes, the technique is the same. The spot that is “not moving” is still the spot you will land on.

What you will find is that larger parachutes on high wind days will cause the target to “move up” more quickly when you are on downwind to base leg, therefore you will have to stay closer to the target to keep it from moving.

And if you jump some hot-rod high performance parachute, you will notice on your base leg, that you are still overshooting, so you have to move further away, probably further than usual. But the target will eventually begin to “move up” and then you turn to final.

For advanced canopy pilots, you will also find that high performance hook-turns may still cause you to overshoot the target, generally due to the increased lift and glide generated by the parachute at high rates of speed.

So you may build in a small time delay to adjust for that before you turn to final. i.e. the target begins to move up, wait 1 second....2 seconds.....then hook-it, swoop down and level out short of the target, but gliding over it.

Bottom line is that if you use this technique, train your eyes to see the movement, your hands will begin to automatically adjust using the toggles to keep your position relative to the target.

“Land any parachute, anywhere, anytime”

**David TK Hayes**

*USPA AFF-I, IAD-I, TAND-I, PRO, S&TA*

*CSPA PFF, IAD, Tandem, Rigger, Coach II*

*6800 jumps, 6 dead centers in Canadian and US Accuracy Nationals using a Sabre 170 loaded at 1.5lbs/ft<sup>2</sup>*

# Wings Level

Skratch Garrison – 07/31/2002

I've been thinking for some time about a final bit of advice, some catchy canopy control phrase, to say to students when they are about to go up. This morning it finally came to me:

## ***Wings Level - "When you're close to the ground keep your wings level"***

This covers a lot of ground. Most of the injuries I can think of violated this principle.

You can survive a lot of horizontal embarrassment by pulling your breakables in and doing a PLF. The

vertical stuff is what hurts, and that mostly comes when your canopy is not level.

There are three common situations: turbulence, SLAMMs and flaring.

## ***Turbulence***

One feeling of turbulence is the canopy suddenly rocking/tilting right or left. If it tilts to the right our untrained reaction is to raise our left hand to catch our balance, and lower our right hand to catch ourselves. This causes a hard right turn and slams us into the ground.

Under canopy we must retrain ourselves to think "Wings Level!" and counter the tilt with our toggles.

Tilt to the right:

- Think "Wings Level!"
- Left toggle down / Right toggle up

- Canopy overhead
- Back to neutral or continue flaring or ...

If we're flaring when this tilt to the right happens another part of our reaction is to raise our left leg up and reach for the ground with our right leg. This is an injury prone position to hit the ground in.

Our ground-based habits are strong, and it takes some effort and practice to use only canopy control, our hands and toggles, while we're still in the air.

Active control is the idea, you fly the canopy, don't let it fly you.

## ***SLAMMs - Stupid Last Minute Moves***

## ***SLAMs - Stupid Low Altitude Maneuvers***

I got this term from Rick Horn. It refers to last minute panic turns, which happen when people:

- Get too low before facing into the wind (Get-home-itis)

- Try to avoid last minute obstacles
- Chase the windsock

Large-scale canopy strategy - thinking ahead - is the approach to focus on here. The idea is to get up wind of target, and then fly a landing pattern. It starts before you even put your gear on.

- Get a flight planner (an aerial photo of the drop zone).
- Go outside and look at the ground winds.
- Draw both left and right hand landing patterns for these winds.
- Pick one or the other based on obstacles and other factors.
- If the winds are still the same when you jump, this is the one you will try to use.

The actual jump often happens differently than the plan. The point here is to learn a process, a way of thinking, and an approach that keeps you out of the awkward situations and last minute moves in the first place.

Now draw the jump run (what have previous loads been doing?). Mark where the first and last groups got out. (watch the actual jump or ask people who have just landed where they got out). If the uppers are strong mark both exit and opening point.

Now put yourself in the shoes of someone who has just opened.

I'm here, the windsock is still the same, and so my two possible landing patterns are there, what do I do between now and later to get from here to the onramp, the beginning, of the landing pattern I want to use?

Should I run? Should I hold? Should I crab?

If I keep facing the way I'm facing now, where will I land?

There's an obstacle, a lake, some trees, a power line between here and there. Can I fly over it? Should I fly over it? What if the wind changes and I land on

it? Is that a disaster? Or just inconvenient?

If I can't make it back, where's a clear spot that I can land in? Which way is the wind blowing and therefore what landing pattern should I fly?

Can I make it back but the wind has changed, the windsock is moving? What's my new landing pattern and how do I get from here to the onramp?

Is the windsock going in circles? Are the jumpers ahead of me landing in all directions? Should I move my landing pattern over a bit and land outside the swarm of clueless Sunday drivers?

Am I too long but the wind is at my back so I can pull a few inches on the toggles and come down slower and ride the wind back?

Am I down wind and don't want to blow away so I should face the wind and pull a few inches on the front risers and get down quicker?

Have I by some miracle of forethought made it to the onramp of my chosen landing pattern? How do I handle it now?

As a student they told me the 1,000 - 600 - 300 ft technique, but most experienced jumpers gauge the pattern by angles and rates.

On a light wind day I fly the down wind part at a certain distance from the target so the target is at the correct angle down from me. I fly down wind until the target is maybe 45 degrees behind me and turn crosswind. Once again the target is at the correct angle down from me. At the magic moment I turn on final.

If I'm too low in the pattern I can cut across corners and shorten my flight path. If I'm too high I can go into brakes, come down slower but steeper, and bleed off unwanted altitude.

If I've misjudged the whole thing, I remember that it's better to land out and walk back than land in and get carried away on a stretcher, so I do my turns onto cross wind and final at a nice safe altitude, and congratulate myself on what good judgment I have.

It is hard to stress enough the value of persistently trying to fly your canopy on a predetermined course (get up wind of target, and then fly a landing pattern) rather than zooming aimlessly around and then landing.

The value is that trying to make your canopy go where you plan to go in all the different conditions teaches you how to make your canopy go where you \*want\* it to go in all the different conditions.

Canopy control is not simple and it's not easy. There are zillions of variables and circumstances, and on any given jump you don't even know what they all are.

If you put genuine effort into this for 200 - 300 jumps you will start to sort out the patterns and learn what you can and can't do.

Knowing what you can and can't do is especially helpful in staying out of the SLAMMs when you're landing out.

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Sometimes, even when you're thinking ahead, you have to make a turn close to the ground. There is a way to do it and still keep your wings level and that is braked (flat) turns.

The idea is to first go into the right amount of brakes, half brakes, deep brakes, and then use one toggle slightly up or the other slightly down, or both, to turn.

This gives you a change of heading with only a slight bank.

If you were really at 50 or 75 ft when you did this, you just have to land that way (PLF).

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***Practice braked turns up high until they are really comfortable - when you need one close to the ground it will be easy to do.***

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Letting up from deep brakes near the ground is tricky because you drop quite a ways before your canopy resumes its normal glide path.

At some point it's worth spending maybe 10 or 20 jumps edging gradually into this to find out what you can do. It's different with each canopy.

Turn onto final in part brakes. At say 150 ft let up slowly and see what happens. Push gradually (that's \*gradually\*) into deeper brakes, lower altitudes, faster let ups. After while you will get a sense of what you can do.

If you keep pushing you will eventually scare yourself and then you will know where the boundary is.

## Flaring

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Another place where you can get wings unlevel is flaring

- Flare too high and then let up
- Flare too high and stall
- Flare unevenly

There is an old accuracy technique called double clutching, where you let the toggles up 6 or 8 inches (not a foot!), let the canopy fly for a moment, then toggles back down maybe 4 or 6 inches.

If you flare too high and just hold it, you will land hard but probably get away with it by doing a PLF.

If you flare too high and then let up, you will land much harder and may not get away with it. Even big, slow student canopies can slam you in if you do it wrong enough.

If you've been practicing double clutching up high where it doesn't hurt, you can impress your friends and coaches with your great canopy control.

If you flare unevenly, one hand lower than the other, you get the canopy tilting one way or the other as in turbulence.

Tilt to the right:

- Think "Wings Level!"
- Left toggle down / Right toggle up
- Canopy overhead
- Back to neutral or continue flaring or ...

Some people look at their hands or bring their hands together at the bottom of the flare in order to flare evenly.

Those can be good short-term techniques, but in the long run it is better to focus on what the canopy is doing.

If the canopy tilts or banks I want to counter with one toggle down and the other up regardless of whether it was turbulence or an uneven flare that caused it.

The flare works in two stages. The top quarter or top third stops your downward speed and levels you out (for a short while). The bottom part slows your forward speed.

This means that in high winds, where you're barely penetrating and your horizontal speed (relative to the ground) is already stopped, you just do the top part of the flare, and you do it much closer to the ground.

If you do a full flare in high winds you get picked up and thrown backwards pretty hard. This will impress your friends and coaches but not the way you want.

The hard part of flaring in no winds is guessing when to start.

You start the top part higher. This levels you out, changes your visual picture, and gives you immediate feedback on how good your guess was.

If your guess was good, then do the bottom part and land.

If you started too high, then pause for a moment, and then do the bottom part.

Part of the trick is where you look.

If you look at the horizon then you can't see the ground well enough in your peripheral vision and you can't tell when.

If you look straight down under your feet all you see is ground rushing by and you can't tell when that way either.

Up higher I'm looking more out ahead.

As I'm starting the flare I look ahead of where my feet are going to touch down

just like you do on an uneven mountain trail.

As my feet are just about to touch down I look more downward just like you do at a rough spot on that mountain trail. What I'm looking for is any rock or uneven spot where I might twist an ankle.

If your flare motions are too slow you don't get the effect, but if you yank the toggles down you just distort the canopy and airflow and that doesn't work either.

If you back off a little from the yank to a definite, strong motion, it works pretty well.

The final bit of flaring technique is to practice PLFs until they are comfortable and natural, because in spite of all this great technique there is nothing like a

PLF to save your body and your pride when you misjudge it.

A point of terminology is that panic turns are not hook turns.

Hook turns, canopy swooping, turf surfing, pond swooping are a form of canopy flying that you can learn about later if you want.

If you are interested, then go to some of the larger drop zones in Florida or California or some place and learn from the people who are already good at it.

Like any envelope pushing around high-speed dirt, it's pretty easy to kill yourself if you fuck up, so it's smarter to build on the experience of others.

Meanwhile, in your day-to-day jumping, *keep your wings level when you're close to the ground.*

Skratch Garrison, [skr@feeltthewind.com](mailto:skr@feeltthewind.com), <http://indra.net/~bdaniels/>

# Survival Skills for Canopy Control

A Seminar by Performance Designs, Inc.

## ***1. Avoid landing accidents by doing all you can to eliminate landing off the DZ.***

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As soon as you're open, evaluate the spot. When faced with a bad spot, quickly find out how far you can go by using the accuracy trick. You can greatly extend your parachute's capability to get you back to the DZ by learning how to use the entire control range to your advantage. The accuracy trick will help you learn how to quickly choose the best toggle or riser position for any bad spot. Why deal with unfamiliar hazards off the DZ? Avoid them through better canopy control.

### **A. The accuracy trick defined: Find the point on the ground that doesn't move.**

1. Choose a point on the ground in front of you. If it seems to move towards you (the angle gets steeper in your field of vision), then you will fly past that point. If the point seems to move up or away (the angle to the point gets flatter in your field of vision), then you won't make it that far, unless something changes. If you keep looking between these two points, you will find one point on the ground that does not appear to move in your field of vision at all. (The visual angle doesn't change.) I call that point the "special point" that doesn't move. The visual angle to all other points on the ground seem to move outward from this point as you travel towards it.

2. If the winds never changed, and you never moved your toggles, you would end up crashing into the ground right on that special point! If the winds do change, you can tell right away because the special point that wasn't moving will start to move as soon as the winds change. That means there is a new point that doesn't move. A new special point replaces the old one. That special point will also start to move if you change your toggle position.

### **B. Using the old accuracy trick to your advantage:**

1. When you have a tail wind and the spot is quite long:

a. Find the toggle position that would take you to a point furthest past the DZ. Then you will arrive at the DZ with the most altitude (and most options) remaining.

b. A simple rule such as, "On a long spot with a tailwind, fly half brakes," may be better than nothing, but it is far from ideal. To avoid the off airport landing, you may need better performance than a simple guideline can give. With a strong tail wind, it is likely that going to deeper brakes will help even more, but how much brakes? Use the accuracy trick to choose what control position works the best in the particular tailwind you have at the time: Find the special point, then add some brakes. See how you have a new special point as you change the toggles? If the

visual angle to the new point is flatter, you are doing better. The visual angle to the old point will get steeper and steeper. Now add some more brakes. If your field of vision changes again just as described, then you're doing even better. Each time you change the toggles, (or each time the wind changes), you will have a new special point. Add more brakes. You're flying really slowly now. If the visual angle to the new point is steeper, then you're not doing as well. If this is the case, the visual angle to the old point will get flatter and flatter. So reduce the brakes back to the optimum.

2. If you have a tailwind coming slightly from one side, and you have a long spot, quickly choose the right crab angle to fly a straight path to the DZ.

a. You've turned towards the DZ and have chosen the best brake position that would take you to a point furthest past the DZ by using the accuracy trick described above. You can draw an imaginary straight line between you and the special point, through the intended landing point. If you start drifting off this line, immediately make a crab angle that will keep you on this line. See how the visual angle to the special point changes as you create the crab angle? Adjust the brakes to put that special point in the best position again. If you were really deep in the brakes, you will probably need less brakes after you create a crab angle.

b. Do not "home" back to the DZ by pointing straight at it while drifting sideways. Since the crosswind will blow you slightly off the wind line, you will likely readjust your heading again and again to point back towards the DZ, without ever counteracting the crosswind at all. This means you will be flying a long arc back to the DZ. The quickest way back is a straight line, so crab rather than home!

3. What about a headwind on a long spot?

If you have a headwind, the special point that doesn't move will be quite close to you. If you need to fly past this point to get to a safe landing area, you will probably need to use front risers. (Make sure your canopy is quite stable on front risers before using this technique) How much front risers? Use the accuracy trick to find out! Try a little front riser and the special point will move. (The angle will start changing). Try a little more and it will move again. Try a little more. Did the point move the wrong direction? That's too much front riser. See how this method works to determine the best control position in any bad spot situation? How about a headwind coming from slightly from one side?

4. Don't forget to leave yourself plenty of safety margin.

Use the accuracy trick in this way to get back to a safe place, but be careful to avoid fixating on this technique so much that we forget to use our safe options while they still exist. Make sure you leave yourself plenty of altitude and maneuvering room to plan a safe approach and landing.

## ***II. Learn to Fly Defensively***

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### **A. Defensive flying has two basic parts:**

1. Developing such high skill that you get to the ground safely in spite of the stupid things people are doing all around you.
2. Developing such good judgment that you make your decisions in a way that helps create safer situations for yourself and others.

### **B. Stage the approaches to avoid heavy traffic at landing time.**

Many of the worst accidents are collisions that occur at landing time, often because there is just too many canopies going too many directions to be safe! Staging the traffic can help reduce this risk.

1. To create more separation from other traffic, after opening decide quickly whether it is best to float or dive, assuming the spot is good enough to allow for some maneuvering. The goal is to prevent a high frequency of landings occurring in a short period of time. Less traffic density means less chance of an accident. This is similar to the idea that eliminating tailgating reduces the chance of accidents on the highway. To stage the approaches to the landing area, you must look way ahead and predict how the traffic will arrive at the landing area. Then, adjust your flight path so that you have as little traffic as possible when you are landing. The more people on the load using this technique the better! Noticing heavy traffic when you're already on final approach is too late. Planning is the name of the game.

2. How do you stage the approaches? First, look all around you after opening. See where everyone is. Ask yourself two questions: Are you near the top of the bunch or near the bottom? Is your canopy loaded more heavily or more lightly than the others? Then:

**a.** If you're more towards the bottom, and have an average wing loading for the group, then you should land as soon as possible. You're trying to stretch out the time period that all the landings will occur by getting the landing process started sooner. If you don't do this, you may start crowding up the traffic behind you, just like a car driver would if he drove slowly in the fast lane.

**b.** If you're more towards the bottom, but have a big floaty canopy, then the faster traffic will probably catch up and pass you. Where would you prefer this to happen? If you dive down and try to set up on final approach early, you will probably be passed during your final approach. In this case, assuming the spot is good, it might be better to float in the brakes right from the start. This will force the faster traffic to pass you while you are still quite high. Being passed up high is safer than being passed on final approach.

c. If you're more towards the top, then you should try to float in the brakes. You're trying to stretch out the time period that all the landings will occur, by landing later. This is easy if you are on a larger floaty canopy.

d. What if you're more towards the top, but you have a high wing loading?

If you're loaded heavily, you can still probably float in brakes quite well. Try to stay up with the big floaty canopies, until you find the biggest gap in the traffic that is below you. Then you fly down and fill that biggest gap. That gap is usually just in front of the big floaty canopies.

### **C. Learn the habits of others.**

Anticipating the actions of others will help keep you out of trouble. Here are some examples:

#### **1. The indecisive slow-poke:**

This is someone with a big canopy that likes to do sashays while in the final approach area. If you're flying a much faster canopy, don't follow him on his downwind leg. You may get stuck behind him, needing to pass him on late final. The problem is, you may not be able to predict where he will be when you pass! Better to pass him earlier on, or turn your base leg early, landing more up wind than him. Perhaps you can land somewhere else. Just don't cut him off, because he might get overloaded by the whole thing and make a mistake, causing an accident.

#### **2. The last second hook turner:**

This guy loves to do low toggle turns, way lower than you're willing to risk. If you're following him back from a bad spot, don't wait for him to turn into the wind before you do! You'll probably be turning lower than you want to be! If he is following close behind you and below you, he might be obstructing your turn into the wind. Remove yourself from this situation while there is still plenty of altitude.

#### **3. Have you ever known someone who likes landing downwind for fun?**

In today's jumping environment, you have to be ready for anything, so keep lots of options open.

### **D. Diffuse the hot landing area by taking the initiative to land somewhere else.**

Walking is healthy! It's better than being carried back on a stretcher. By choosing to land somewhere else, rather than joining into the already crowded traffic on final to the "cool" landing area, you'll make it safer for yourself, as well as making the "cool" landing area a little less crowded for the others.

### **E. Check the Spot Early During the Skydive**

Many marginal spots are made worse by aimlessly wandering around for a few seconds while figuring out where you are. If you can do so quickly, check the spot during climb out if you're a floater waiting for others to climb out. Check it if

you have an idle second or two on during freefall. Checking the spot early and frequently will give you advance warning of a bad spot. You will know right away which direction to fly the canopy. You might even decide to leave a touch early, to start getting safe separation sooner and therefore permitting a little higher opening too.

## **F. Improve Your Tracking**

You'll get safe separation sooner if you improve your tracking. Then you could deploy your canopy higher and avoid problems with bad spots. This will help you avoid the off airport landing. You can also get more separation, which will reduce chances of a collision during opening.

### **1. How much separation is necessary?**

The higher the wing loading on the load, the more separation is required. Most people are way too comfortable with way too little separation! You should be able to have an off heading opening facing directly towards another jumper and still have enough separation to allow for a rear riser turn to avoid a collision. Blaming off heading openings for canopy collisions is a major cop-out.

### **2. To improve your tracking, first improve your attitude: be dissatisfied!**

You must be dissatisfied with your present tracking, or you will have no real incentive to improve. Satisfaction with your tracking is a trap and an ego protection device. This ego protection device helps you make your bad excuses for poor tracking more believable. One bad excuse is, "That jerk tracked right over my head when I was ready to pull." Really? Or did you track too steeply and not see where you were going? Be dissatisfied and you'll get constant improvement.

### **3. With your attitude changed, now experiment with technique.**

Many people have not really experimented with body positions for tracking, so you often see poor tracking. I suggest that you occasionally devote an entire skydive just to tracking. You'll have plenty of time to experiment. Make sure you track away from the line of flight, to avoid conflicts with other jumpers.

### **4. Avoid these common errors:**

**a. arching.** This is OK for a beginner, but it causes a steep track. De-arching makes the track flatter. Try bending a little at the waist.

**b. knees and ankles bent.** This slows the track, making it mushy and steep. Straight knees and pointed toes are better, and they should push down onto the relative wind.

**c. arms up, streamlined with relative wind.** This causes a steeper track also. The arms should be pressing down onto relative wind to make the track flatter.

**d. legs and arms too close together.** This does not help the speed much, and usually causes difficulty avoiding a rolling motion side to side. A slightly spread

position, with feet almost shoulder width and hands 6"-12" from torso is better because it aids in stability and makes it easier to deflect more relative wind.

**5. When you leave a formation and track up and away, rather than down and away, you're starting to get the hang of it!**

On most jumps the fall rate is fast while doing RW, and the body is arched. Since the track should be de-arched and flat, a good track may actually have a lower descent rate than the formation!

### ***III. Conclusions***

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I have not covered reducing the risks of normal landings and swoop landings because that will be addressed in a different seminar. As you can see, I believe that most of the canopy survival skills are a combination of improving skills and developing better judgment. Because of my emphasis on improvements, there can be no end to this process, and no real conclusion. I do not wish to fall into the too common trap of thinking that I've completed my learning process and I'm safe from harm. I've seen that this is a deadly trap. That is why I would like to encourage you all to share your ideas on the subject with me. I hope I have presented to you some thought provoking ideas and concepts that you can use to help you reduce the risk of accidents at your DZ.

# Flying and Landing High Performance Parachutes Safely

A Seminar by Performance Designs, Inc.

## ***I. General Concepts***

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### **A. Different canopy models of the same size may perform differently, but they will fly about the same speed.**

Wing loading is the biggest determinant of speed. A Stiletto 190 is not faster than a Sabre 190, or even a PD 190! Other aspects of performance will be different, however. (Turn rate, glide angle, etc.) These differences may influence a person's impression of speed.

### **B. A person evaluates a canopy's speed according their individual frame of reference, which has been created through their own unique experiences.**

Example: Jumper A and jumper B weigh the same, jump the same canopy, and have the same number of jumps. They may have completely opposite opinions of the speed and handling of their canopies. Why? Different frames of reference! The canopy may be the smallest one jumper A has flown. He may have chosen it to get more speed, quicker turns, and hotter landings, and might feel that it's a handful! Yet jumper B may have moved up one or two sizes to this canopy, to create more forgiving handling and easier landings than he had previously.

### **C. Choose your canopy size by reflecting on your impression of the canopy sizes and models you've recently flown, combined with your desire to go faster, slower.**

Choosing a canopy this way is much safer than using only a chart published by a manufacturer. Such a chart may be a guide, but cannot be used effectively without applying your own experience. If you don't want to go faster, don't go smaller than what you are using! When discussing the speed and forgiveness of a particular canopy, remember the different frames of reference of the individuals involved.

### **D. It is not necessary to heavily load a high performance canopy to make it fly and land correctly.**

This is a common misconception even with many "experts." If you're not getting good landings on a properly designed canopy flown at lower wing loading, you're not flaring it correctly!

## ***II. Guidelines for Flying Conservative Approaches***

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### **A. Control your canopy smoothly keeping toggle movements to a minimum.**

1. The canopy will fly more efficiently, making consistent landings easier to accomplish.
2. It will be easier for others to predict what you are planning to do.
3. It helps to make the canopy more stable in turbulence.

### **B. Practice approaches at various speeds. Through experimentation, learn how slowly you can approach and still get a reasonable landing.**

1. A slower approach helps you get into tight areas, in part because it reduces the distance the canopy will float before touchdown. How slowly you can make a safe approach and landing depends on your wing loading, the design of the parachute, and how good your technique is. Technique comes only from practice and considerable work on approach and flaring technique:
2. Start with a full glide approach, and flare as you normally would. Then, experiment with flaring technique with the goal of getting a longer plane out in the flare. This additional float means you are now using the available flare power more efficiently, and you are prepared for the next step.
3. Try a final approach with a few inches of brakes applied, and still flare as before. You will probably get less float on this landing, because you had less energy to work with. Assuming the landing was still safe, continue making approaches at this speed, and work on developing a more efficient flaring technique. Again, the goal is to get the canopy to plane out longer.
4. If you are eventually successful in increasing the length of the plane out, it is because you are now using the available flare power even more efficiently. This means you are now proficient enough to try an even slower approach, repeating the process with slightly more brakes. You can repeat the cycle again if you are continuing to get good results.

### **C. If you are an aggressive canopy pilot and like swoop landings, it is very important to practice straight in approaches at various speeds.**

If you believe a hook turn is required for a good landing, you probably need to work on technique. You may have to make a slow approach one day, and you need to stay good at it. It is better to practice in good conditions so you are prepared for the worst.

### ***III. Learning About the Canopy Through More Aggressive Flying***

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#### **A. Understand the various turning techniques for controlling the rate of altitude loss compared to the rate of turn.**

1. Some turning techniques build up a great deal of airspeed with an extremely high altitude loss, even with a moderate rate of turn. (Example: Steep front riser spiral)
2. Other techniques still build up fairly high airspeed, but will produce somewhat less altitude loss, even at fairly reasonable turn rates. (Example: Carving toggle turn)
3. Still other techniques allow turns with little altitude loss, even at fairly reasonable turn rates. (Example: Shallow bank angle in fairly deep brakes)
4. It is even possible to briefly turn with no altitude loss, or even to gain some altitude, by exchanging lots of speed for lift during the turn. (Example: Initiate a flare while flying fast, and gently bank the canopy as you continue to slow the canopy.)

#### **B. Experiment with these turning methods while above 1000 feet, and well clear of other traffic. Do this on every jump, when traffic permits.**

During these experiments, you'll learn about your capabilities and limitations, as well as those of the canopy. By 1000 feet, however, you should be concentrating on flying a smooth flight path that will mesh well with the surrounding traffic.

#### **C. Work your experimentation lower and lower over many jumps. However, make sure you still flare out of the maneuver high enough to allow yourself to return to a normal stabilized straight in approach and a normal flare.**

During this time, you should be able to develop a feel for the altitude loss by looking at the ground, rather than by reference to the altimeter. During this phase of discovery, it is always tempting to continue experimenting with a hook turn to a swoop landing. Don't, even if you have been successful at this before. This is a good time to develop your "approach discipline," by remaining cautious and conservative.

### ***IV. Basic Knowledge Required Before Attempting High Speed Approaches***

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#### **A. Learn when to say no to an aggressive approach.**

1. When there is heavy traffic, either in the air or on the ground.
2. When landing in unfamiliar areas.

3. When the weather conditions are marginal.
4. When you are angry or tired, or are disappointed with your free fall performance.
5. Make sure you err on the cautious side! You can make that swoop landing on a later jump when conditions improve only if you survive this jump!

**B. Even if you are conservative, learn how to make a straight in approach using a small amount of front risers.**

Make sure your canopy is very stable in this flight mode first. Just one to 3 inches of riser will produce quite a change in the approach speed and landing. By becoming familiar with the slightly higher speeds of this approach, you will be better prepared should the unexpected happen and you find yourself screaming along after making an evasive maneuver to avoid traffic near the ground.

**C. Verify that the technique you wish to use works well with the canopy you are using.**

Some canopies have unusual flight characteristics that can take hundreds of jumps to fully explore. Do this exploration up high away from other traffic. Some canopies can become unstable using certain techniques.

**D. Stay with more aggressive straight in approaches for many jumps, before attempting any turning approaches.**

Many people do not work long enough on improving their approach planning and flaring technique on straight in approaches before trying aggressive turning approaches. Many tend to react too late to changing circumstances, and then over-control afterwards. This reduces the distance of the resulting swoop, and indicates that the jumper is over his limit of safety.

**E. Learn the concept of the "corner" and stay out of it.**

The corner represents the change from a vertical diving approach to a horizontal swoop. Make that corner as round as possible. (A large radius pullout started higher is safer than a sharp pullout started lower.)

1. If the canopy's natural tendency to pull out gets you to level flight without pulling any toggles at all, then you were not very far into the corner. This is the safer method.
2. If you need to pull the toggles down to get out of the vertical part of the approach before you can start your flare, then you were too deep into the corner. (Pulling the toggles down in this situation is certainly better than hitting the ground, of course!) The big problem here is that many jumpers do not recognize this as a sign of poor piloting, and do not realize how dangerous this really is.
3. As you can see, the measure of safety on your swoop is how little toggle movement it takes to get to a normal approach angle. Finding yourself deep in the corner should be considered a severe warning that you need to do everything

higher, and start the pullout earlier. A more mellow turn would help too, since the approach would not be as steep to begin with.

4. Also, if you find yourself pulling the toggles down hard and late, it may indicate that your perceptual skills are too slow and your judgment too inaccurate to be making that type of approach with that particular canopy. If your perception and judgment were keeping up with what was happening, you would have applied just a little toggle, but much higher, rather than a lot of toggle at the last instant. Improving perceptual skills goes hand in hand with learning how to better plan the approach. Probably a less steep approach (by turning with less bank) would help!

## ***V. The Turning Approach***

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### **A. When setting up for a turning approach, start with lots of altitude and only a slight turn with a gentle bank.**

1. Be sure to set up all your turning approaches with enough altitude to make the "high altitude loss" turn safe. Then start the turn using the high altitude loss turning technique, and use only a medium bank angle.
2. Evaluate the altitude loss as you turn. If you perceive that you are using up part of your safety margin, change the turn into one that produces less altitude loss. Now you have your margin for safety back again. Starting really high, keeping the bank shallow, and knowing many turning techniques allows you to have plenty of outs.
3. If you have any doubt about having sufficient altitude to do the "high altitude loss" turn, don't waste your safety margin by starting with a front riser turn. Choose a different turning method to help preserve your margin of safety. If you notice during this turn that you are still using part of your safety margin, change the turn technique again to one that allows for even less altitude loss, or simply stop the turn. Remember all of the possibilities you have available.

### **B. Avoid the low turn! If it looks like you need to start with a low altitude loss turn method just to survive, don't turn!**

This is surely an accident waiting to happen. If you think you're good enough to attempt a turn with little or no safety margin, then you're thinking unrealistically about your capabilities. Why? Because if your perception were really that good, why did you get yourself in that situation to begin with? Don't judge your approach technique as good just because you walked away from the landing!

**C. Avoid becoming trapped into the habit of using only one turning technique that requires an exact starting altitude for success.**

Favoring one turning technique, especially a low altitude method such as a sharp snapping toggle turn followed by burying both toggles, is very risky. Because the canopy tends to pull out of the dive almost the same way each time, you require an exact starting altitude and perfect judgment each time. Nobody can be that perfect all the time!

**D. Top priority when you blow it: Wings level on impact!**

If you discover you've blown it, try to salvage the situation by getting the wings exactly level, while still flaring out of the dive. Don't give up, and keep the toggles in the best position right through the impact with the ground.

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***VI. Working on Improving Landings***

**A. Altitude control is the key to no wind landings.**

It is not so important to be at an exact specific altitude when starting the flare, but how high you are when you finish the flare is very important. You should finish the flare so that you have no rate of descent (or at least your minimum rate of descent) when your feet are at ground level.

**B. The speed at which you move the toggles is just as important as the distance they are moved.**

When flaring after a conservative approach, the toggles should be moved fairly quickly to get the canopy to level off. Moving them too slow may cause a mushy sink into the ground. On a high-speed approach, the toggle movement is usually slower, (to avoid a rapid climb,) unless you are digging yourself out of the corner!

**C. For the best landings, transfer the weight from harness to ground gently and gradually.**

If you are at zero rate of descent with feet at ground level, you can gently press your feet on the ground while you continue to sit in the harness. With the first step, you can remove a little weight from the harness, by stepping only lightly on the ground, and more heavily on the next steps, then the next, and so on until all your weight is transferred from the harness to the ground. You can't do this if your canopy is flying too high to allow you to reach the ground! You must also maintain adequate flying speed during this time. No parachute or wing of any type is capable of supporting you without forward airspeed!

## **D. Be careful to avoid using your hands and arms for balancing or protecting yourself during the flare and landing.**

As you will see in the video, the canopy will respond to every toggle movement (or shifting in the harness), even when you are well into the transition to the ground. Look for these errors:

### **1. Lifting one toggle at touchdown**

This is the balance trap. If you feel like you are falling to one side, you may try to stick an arm out for balance, which turns the canopy. You may think it was a side gust.

### **2. Extending a hand out to protect yourself**

This is the protection trap. By extending your hand out to the ground to protect yourself, you unknowingly steer the canopy that direction.

### **3. Lifting both toggles and stabbing the ground with your feet**

This is done usually in anticipation of a hard landing. Stabbing at the ground with your feet only increases the pain. This is usually accompanied by lifting both toggles backwards and upwards, which compounds the situation by causing the canopy to dive harder at the ground.

### **4. Fighting the wind**

Sometimes people let one toggle up and push the other one down prematurely, in anticipation of difficulties in getting the canopy on the ground in high winds. This can produce some really ugly accidents. Make sure you're really on the ground first, and then get the canopy on the ground.

### **5. Tunnel vision**

Though we try our best to avoid it, all of us tend to concentrate more on our flight path, and less on the surroundings, as we get closer to landing time. Sometimes swoopers or accuracy jumpers start having this problem much higher up. This is very dangerous! Try to keep looking around and seeing people!

### **6. Flaring too slowly, too high, or too far, etc.**

Experiment more while up high. Watch the landings of other people, and watch videos of your own landings.

## ***VII. Conclusion***

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- 1. Acknowledge your current limitations.**
- 2. Create safe situations for yourself and others.**
- 3. VOW TO BECOME A STUDENT OF CANOPY CONTROL AGAIN.**
- 4. Have fun!**

# Skills Checklist for Downsizing Canopies

An article by Bill von Novak

While I was an S+TA, I spent a considerable amount of time telling people they shouldn't be loading their canopies so heavily. 90% of the time it didn't work. Skydivers can have a bit of an ego, and when I told them they probably shouldn't downsize yet they heard "I think you're a crappy canopy pilot who can't handle a smaller wing." So they downsized and broke their legs, backs and pelvises with some regularity.

A few years back I met up with Brett, one of the people I'd been lecturing to while I was an S+TA. He told me that he wished he'd listened to me back then. He had broken his femur during a botched landing, been out of the sport for a while, and then came back and really learned to fly his canopy. He took a canopy control course and actually upsized to get more performance out of his canopy. He ended up coming in first in one of the events at the PST that year.

That started me thinking. Maybe the approach I was taking was wrong. Since jumpers tend not to listen to other people who tell them they're not as good as they think they are, perhaps if you could give them better tools to evaluate themselves they could make better decisions about canopy choices. It's one thing to have some boring S+TA guy give you a lecture about not having any fun under canopy, quite another to try to perform a needed maneuver under canopy - and fail. In that case there's no one telling you you can't fly the canopy, it's just blatantly obvious.

So I came up with a list of canopy control skills everyone should have before downsizing. Some are survival skills - being able to flat turn would have saved half a dozen people this year alone. Some are canopy familiarization skills - being able to do a gentle front riser approach teaches you how to judge altitude and speed at low altitudes, and how to fly a parachute flying faster than its trim airspeed, a critical skill for swooping. It's important to do these **BEFORE** you downsize, because some maneuvers are a little scary (turning at 50 feet? Yikes!) and you want to be on a larger canopy you're completely comfortable with before trying such a thing.

The short version of the list is below. Before people downsize, they should be able to:

- |                                                                                                                                                                                                                     |                                                                                                                                                                                                                             |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"><li>• flat turn 90 degrees at 50 feet</li><li>• flare turn at least 45 degrees</li><li>• land crosswind and in no wind</li><li>• land reliably within a 10 meter circle</li></ul> | <ul style="list-style-type: none"><li>• initiate a high performance landing with double front risers and front riser turn to landing</li><li>• land on slight uphill and downhill</li><li>• land with rear risers</li></ul> |
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## Details:

**1. Flat turn 90 degrees at 50 feet.** This is the most important of all the skills. The objective of this maneuver is to change your direction 90 degrees losing as little altitude as possible, and come out of the maneuver at normal flying speed. Coming out at normal flying speed means you can instantly flare and get a normal landing. If you can do this at 50 feet, and come out of the maneuver with normal flying speed at 5 feet, you can flare and land normally.

Every year people die because they decide they simply have to turn at 100 feet and know only one way to do it - pull down a toggle. The parachute dives and they hit the ground at 40mph. To prevent this, not only do you have to know how to flat turn, but you have to practice it enough that it becomes second nature. Then when you do need it, you won't have to think about it.

To pull off this maneuver, start by toggle turning the parachute gently. IMMEDIATELY follow that with some opposite toggle. The idea is that you want to flare just a little to counteract the canopy's desire to dive. Continue adding opposite toggle until you've stopped the turn. At this point let both toggles all the way up. If you feel the parachute accelerate after you let go of the toggles (i.e. it feels like you just flared) use less opposite toggle next time. If you feel like the parachute is diving, like you just did a toggle turn, use more opposite toggle next time. Basically you want to start the turn with one toggle, stop it with the other one, and use just enough toggle to keep the wing from diving but not so much that it does a flare.

It should go without saying that this maneuver should be practiced up high before you ever try it down low. If and when you do try it out low, start at lesser angles (i.e. try a 15 degree turn first) make sure the pattern is clear and make sure conditions are good (soft ground, good winds.) Work up gradually to a full 90 degree turn. I do think it's important to try at least a gentle flat turn very low; we are horrible judges of exact altitudes when we're at 1000 feet, and it's hard to tell if you've lost 50 feet or 200 in a turn. By trying it out down low, you'll get a better sense of what it can do for you, and you'll have the "sight picture" better set in case you have to use it for real one day.

A variation on this is to go to half brakes and then let one brake up. This gives you a flat turn, but by flaring first you "use up" some of the canopy's energy so you can't turn as effectively. On the plus side the turn happens more slowly. If you are about to hit a tree and want to make a last minute turn, this variation might be the way to go, as it combines a turn and a flare.

**2. Flare turn at least 45 degrees.** This does two things - it gives you another tool in your arsenal to dodge last minute obstacles, and teaches you to fly your canopy all the way through to the landing. The #1 mistake jumpers with new HP canopies make is to

"reach out to break their fall" while they're flaring; this of course turns the canopy in the direction they are reaching. Most people decide that this is due to a side gust just as they're landing. I remember one jumper at Brown who, amazingly enough, experienced a side gust seconds before he landed (and always from the right) 40-50 times in a row!

Learning to flare turn will help eliminate this problem.

To flare turn, start with a normal flare, then flare *\_slightly\_* more with one toggle. The canopy will turn. Bring the other toggle down to match it, and the canopy will straighten out. It's a dynamic process; rather than put the toggles at a certain position, you have to speed up one toggle for a second, then speed up the other to match it, before you level them and finish the flare. If you balloon upwards, then don't flare as quickly. If you drop to the ground, bring both toggles down more aggressively when they are 'split.' One thing that helps people is to think about where your canopy is rather than what it's doing. Use the toggles to put it off to one side for a moment, then use them to put it back over your head.

This can be hard to practice with a large canopy. I can pull off a 45 degree turn on a Manta, but the flare is over so fast that it's hard to explain what I just did. It's much easier on a canopy loaded around 1:1, so you may want to wait on this one until you get to that loading.

Note that if you combine a flare turn with a flat turn, you can pull off nearly a 180 degree turn at just above 50 feet. Also note that knowing how to do flat and flare turns doesn't mean you can always turn at 50 feet and get away with it - sometimes it's better to accept a downwind landing than make a turn at a dangerously low altitude. But if you do have to turn low (say, you're on course for the electrified fence around the pit bull farm) a flat/flare turn will let you either turn and land normally or turn and minimize the damage caused by landing in a turn.

**3. Land crosswind and in no wind.** These are straightforward. No wind landings are pretty easy; the only issue is that your perception of speed and altitude will be off. Since you seem to be moving faster over the ground when there's no wind (which you actually are) it can seem like a good idea to add just a little brake to 'slow you down' before you land. Resist that urge! Keep that speed in your canopy; you can turn the speed into a good flare only if you start the flare with decent (i.e. full flight) speed.

Crosswind landings can be a little more tricky because of that strong tendency to want to "reach out to break your fall." Counter this by flaring with your hands in towards the center of your body. You may have to PLF on these landings, since you'll have some decent forward speed *\_and\_* have some sideways motion from the wind. If you want to get fancy, try a flare turn after you start your flare on the crosswind landing - you can easily pull off a standup landing if you get turned enough before you put your feet down.

If these work well you may want to try a downwind landing. The benefit to doing that is it will prepare you to accept a downwind landing in the future; you won't be tempted to turn too low to avoid it. Choose an ideal day for this one, with a slippery landing area

(wet grass is perfect) low winds and a clear landing area. Prepare to PLF, and think about "laying it down" on your thigh as you land to start sliding. You can slide across grass at 30mph without getting hurt, but planting your feet and cart-wheeling at those speeds can be very dangerous.

**4. Land reliably within a 10 meter circle.** This is essentially the PRO requirement. This is critical because your accuracy skills are what will keep you from having to turn low. It's very comforting to know that you can land in any 50ish foot clearing if you find yourself having to land out; it's especially important as you get to smaller canopies that need longer and longer runways to land well. Your only option may be a section of road, and you may have to hit the beginning of the road dead-on to have enough room to slow down.

The subject of canopy accuracy is too long to do justice to here, but the top 3 hints I've heard are:

-If you're not sure if you're going to make it over a wire or tree, look at what it's doing with respect to the background. If more background is appearing from beneath the wire or tree, you're probably going to make it.

-As you look at the ground, most points will seem to move away from a central point. Some will rise, some will fall, some will go out to the side. If you look long enough you'll find one point that's not moving - that's where you're going to land if the winds don't change all the way in (which is rare.)

-Going into brakes usually makes you land short in high winds, but can extend your glide in no wind. Front risers almost always make you land shorter.

**5. Initiate a high performance landing with double fronts, and a front riser turn to landing.** I am pretty convinced that front riser high performance landings are a lot safer than toggle turn high performance landings, and double fronts are the safest of all. If you do it too low, or become worried about the landing - just drop the risers and you're back to normal flight.

For double front riser landings, set up a normal landing, aiming for a point a little farther away than you normally do. At 100 feet or so, pull down both front risers. Your canopy will drop and accelerate. At some point above the ground (30-10 feet depending on your canopy) drop the front risers. Your canopy will begin to recover. Before it completes the recovery to normal flight, you should be at flare altitude. Start the flare normally. You

may need to use less toggle than normal, since the canopy is now going faster than you're used to, and the same amount of toggle gives you more lift. You will also plane out farther, since you have more speed you have to bleed off before you come to a stop.

For front riser turns to landing, first try front riser turns out above 1000 feet and get used to how your canopy recovers. Then start by coming in 10 degrees off the wind-line, and making a gentle front riser turn to line up with the wind at ~100 feet. The canopy will dive and accelerate, so be prepared to drop the front riser instantly and flare if you have to. Also be prepared to steer in the flare, since the canopy may not have stopped turning completely before the flare begins. Done correctly, you'll start the flare with more forward speed, giving you a longer plane out.

Make sure your flares are smooth for this! A smooth flare generates more lift for a longer period of time than "stabbing" the brakes. However, don't start the flare at 30 feet - starting the flare that high will slow the canopy down, negating the effects of the front riser approach. If you do find yourself stabbing the brakes to prevent hitting the ground, move the altitude at which you start front risering up.

Probably the most critical skill you will get from this exercise is the development of the "sight picture." Below 200 feet your altimeter is pretty useless, and you should be looking at traffic and the landing area anyway. Eventually you'll develop a sense of what "picture" you should see just before you start that riser turn. The picture will vary with wind, landing area etc. If you arrive at the point where you would normally start the front riser turn, and the picture's not right - abort it and land normally.

Once you have the picture down, and are doing front riser turns that transition to gradual flares, then start increasing the angle. Once you get to 90 degrees you're going to be gaining a lot of speed, so be sure to adjust your sight picture up to compensate. As always, bail by dropping the risers if you feel like there's anything wrong. Once you drop the risers, level the wing with your toggles and prepare to flare. At worst you'll have to land crosswind - but that's a skill you should have by this point anyway.

**6. Land on slight uphill and downhill.** Often, land away from the DZ isn't perfectly flat; sometimes you can't tell this until you're at 20 feet. To prepare for this, find a place in your LZ that's not perfectly flat, scope it out, and plan on landing there. There's not too much magic concerning landing on a slope. You flare more aggressively to land going uphill, less aggressively to land going downhill.

Obviously not all DZ's have slopes. If you don't have a good slope on your DZ somewhere, you may have to put this one off until you're at a DZ that does have one. Beaches are a good place to practice this, since they have pretty predictable slopes down to the water, and overrunning the landing just means you get wet.

**7. Land with rear risers.** Knowing how to land with rear risers can help you deal with a canopy problem like a broken or stuck brake line, and can help you make a better land/cutaway decision when you do have such a problem.

Again, this is best practiced up high. See how far you can pull the rear risers before the canopy stalls. It will stall much earlier with rear risers; memorize where that happens so you don't do it near the ground.

When you try it for real, choose an ideal day - steady moderate winds, soft ground, clear pattern. Be sure to try this for the first time on a largish canopy (one of the reasons you should do these things before downsizing.) Leave your hands in the toggles and wrap your whole hand around the rear riser. That way if things go awry you can drop the risers and flare normally. Start the flare at a normal flare altitude, and prepare to PLF. You may get the sort of lift you're used to, but you probably won't slow down as much before you're near that stall point. Make sure your feet are on the ground (sliding preferably) before you get there.

On smaller canopies, you may want to start the flare with rear risers. Then, once the canopy is leveled out, drop the risers and finish the flare with the toggles (which are still around your hands.) That way you get your vertical speed to zero, which is the critical part of a safe slide-in landing, and can still stop the canopy without hitting the ground going too fast. (This is also a technique used by swoopers to extend their swoops BTW.)

As I mentioned in the beginning, these are skills you should learn before you downsize. If you can't do some of them yet? Get some coaching; it makes a lot more sense to learn them on your larger canopy, before you start jumping a smaller canopy that scares you. Once you can do them all, then try the smaller canopy. And if someday someone cuts you off under the smaller canopy, you'll have the reactions you learned under the larger canopy. Even if you haven't completely adapted those maneuvers to the smaller canopy yet, those reactions will more likely than not save your life.

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