GETTING THE MOST OUT OF YOUR CANOPY

If you watch a busy landing area for a while, it becomes obvious that some skydivers are masters of their canopy. They land gracefully and safely where they want to, every time. It looks effortless. Others do well sometimes, but often seem to be on the verge of losing control. Still others are clearly either novices or intimidated by their canopy - their landings lack precision and grace. And the parachutes aren't the deciding factor. Look closely; some of the best landings will be on older, well worn canopies, while the finest new equipment can be dangerous in the wrong hands.

The difference is in the pilots. The good ones have an intuitive understanding of aerodynamics and the experience to completely control their environment. And over the years, experimentation has taught them some practical techniques to get the most from their parachutes.

The Spot and the Winds

In the previous chapter we looked at the problem of airspace management without taking the spot into consideration. If you are jumping from a large airplane, or from a small one with a bad spotter, your opening point may be less than ideal. But there is a lot you can do about this under canopy. By learning a few tricks about canopy flight, you can optimize early in the ride where, when, and how you will land.

First of all, keep in mind that altitude is your friend. The more altitude you have, the more options you have. This is another good reason not to pull low. Under an open canopy at 2,500 feet you have forty percent more options than someone in the same spot open at 1,500. This means more time to acquire vertical canopy separation, more time to assess the wind conditions, and if necessary, more alternate landing areas to pick from.

Your first priority after a successful deployment is to avoid collisions. Once that is done, determine where you are and head for the dz. You will already have this information if you checked the spot during exit or freefall; now you need to decide what to do with the knowledge. Incidentally, I often see people land out because once they were open they stowed their slider, removed booties, or did some other trivial task while flying away from the dz! These things can be done just as easily flying towards the landing area instead of away from it.

Depending on the circumstances you will be in a perfect spot (which we won't consider here) or one of three variations of a not so perfect one:

long, short, or off the wind line. In each of these cases there are certain strategies that will help you out. And in all of them your best plan will be influenced by the amount of ambient wind. On a no wind day the plan is the same regardless of position: for the greatest range, trim your canopy for distance. Most parachutes fly flatter, and just as fast, if you hold in a couple inches of rear risers or about one third brakes.

Optimizing Glide

Finding your best glide position takes a little work. A variometer and airspeed indicator designed for hang gliding is ideal, but observation works too. Try flying next to a similar canopy and applying brakes or rear riser trim to flatten your glide. You will notice that you can flatten the glide quite a bit before you loose much forward speed. Another trick that you can use by yourself and which will come in handy often is to learn to visualize your glide. To do this, watch the ground ahead of you. Looking

at a point far ahead, you will notice that point will appear to rise relative to you. That means you will land short of the point. Look just a little ahead - the point will sink relative to you, since you will pass it in flight. Somewhere between will be a point that doesn't move - where you will land if nothing changes. (Illustration maybe including into wind and downwind variations.)

With practice, you will be able identify this point quickly. Once you can do so, whether you are facing into the wind or running with it, you can check and see what your best glide is. Generally, when facing into a strong wind you want a steep angle of descent for the greatest forward speed and the least amount of time at the wind's mercy. Full drive (toggles all the way up) will produce the best results when you are trying to penetrate into a strong wind. Front riser input is even better, but few people have the strength to hold down their risers for long.

If you are upwind and have a little breeze to work with, the reverse will be true. In this situation, apply brakes to get your slowest descent rate. Most modern canopies reach their slowest descent in about 50% brakes. You might loose some air speed, but you will gain distance. Why? Let's say your canopy descends at 1,200 feet a minute in full drive but only 800 feet a minute in half brakes. If you are open at 2,400 feet, that means a two minute ride in full drive but three minutes in half brakes. Now, say the canopy will fly 30 miles per hour in full drive, 20 in half brakes. Add a ten mile an hour wind and your ground speed will be 40 and 30 miles per hour, respectively. In two minutes at 40 mph you will cover about 7,200 horizontal feet. In three minutes at 30 miles per hour, you will cover about 8,100 horizontal feet - quite a gain! Therefore, whenever you are spotted long upwind, you are better off using some amount of brakes. How much will depend on the particular canopy, winds and spot.

Spots that are off the wind line are also common. In this situation, don't fly directly towards the dz. If you do so, your canopy flight will take the shape of an arc across the ground as the wind pushes you sideways while you fly forward, constantly changing heading to stay pointed at the target. Instead, take an angle that points upwind of the landing area and again watch your path over the ground. If your ground path is a straight line to the landing area, you are doing fine. If it is curving ahead of you, you are crabbing too much. If the curve sags behind you, you aren't crabbing enough.

Landing Out

Sometimes the spot is so bad all the piloting technique in the world can't salvage it. Landing out is a fact of life. It is also a common factor in landing injuries: an out landing may involve a tight landing zone, no wind indicators, unforeseen hazards, or all of the above. If there is any possibility of landing out, start making your plans up high! In fact, the time to plan for an out landing is before you get in the plane. It is always a good idea to note the prevailing wind direction and speed. Most drop zones will be able to provide an aerial photo showing hazards, good alternate landing areas, hostile neighbours, etc.

If you are landing out and forgot to check the winds earlier, start looking for indicators. Distant fires or dust can help. In areas with lots of foliage, you can sometimes tell by observing grass or trees. If some people are making it back to the dz, watch them: they will be close enough to see the wind sock. You can also look for cloud shadows on the ground.

For that matter, your own shadow is a good indicator of ground speed, if you can locate it while high enough for the information to be of any use. Even if you can't determine wind direction, remember that a crosswind or downwind landing is still much safer than landing in a turn. In fact, one of the more common causes of so called "hook turn" injuries is from unintentional low turns. The scenario is simple: running downwind from a long spot, the pilot doesn't realize until too low they are flying downwind. Then they try to turn into the wind without enough altitude. Most canopies need at least two hundred feet to complete a fast toggle 180 degree turn with a safety margin to spare. Practice turning in half brakes for just this eventuality. A turn in brakes doesn't use nearly as much altitude as a full toggle turn.

Regardless of where you land, you will have a choice of how you approach - either a left or a right hand pattern. Always pick the one that flies over the fewest obstacles and offers the most alternatives. That way, if the wind is stronger than you expected you still have some options.

Common Landing Problems and Their Solutions

Before we look at specific landing problems, here is some general advice. If you have trouble landing your canopy, or you are relatively inexperienced and planning on buying a canopy, have someone your size and weight who really knows what they are doing jump it. They can give you a good idea if the problem is your technique or if it lies in the canopy itself. I also highly recommend video. The common piloting problems discussed below are easily eliminated by one or two video reviews, provided the coach is competent.

Depth perception

We'll get this out of the way at once, since I believe it is the least common problem. Detailed and useful depth perception doesn't occur until we are within fifteen or twenty feet of an object, and in parachute flying this is when we already need to be acting. Furthermore, for novice jumpers there is a timing problem. When your brain finally says "I'm about 15 feet up" it starts an equation based on what would happen if you jump off an object and accelerate constantly till impact OR one based on a steady state descent like the one you are in. It isn't programmed yet for the deceleration you experience as you flare. So depending on your eyes and brain, you might flare high or not flare until too late. This is compounded if there are confusing conditions: twilight, very flat surfaces such as concrete or Astroturf, unusual lighting, tilted surfaces (hillsides), unusual vision (jumping without your usual prescription eyewear), and other eye/brain variables. The only solution I know is experience. Have someone who is real good call the flare for you on several jumps, but only if you are not already flaring correctly. See the other problems below before you put all the blame on depth perception. Usually your brain figures out the depth thing after at most a dozen jumps. Therefore, if you still have trouble flaring it's more likely a technique or equipment problem.

Flaring too high or too low

This is a very common mistake and the way most schools teach a flare only makes it worse. Instructors commonly teach students to make a single flare motion, knowing that a two stage flare is a bit complicated for a first jumper. And since they don't want the student to flare high, they often tell them to flare fast and low. You can get away with this on huge

canopies, but it will hurt you when you transition to something requiring more finesse. Flaring is like applying the brakes on a car. It doesn't need to be done all at once, at the last possible moment.
[DIAGRAM UNDER CONSTRUCTION]
Connect the x's from left to right to complete this diagram of what a canopy does in a good flare. The numbers above the line indicate horizontal speed, and the ones below are vertical speed. This is an example only; student canopies fly slower, low aspect ratio and slow canopies have a shorter flat spot in the flare.

This picture is about what a seven cell at 1 to 1 wing loading would do. Many nine cell canopies have a much longer flat spot in the middle. The faster the canopy goes the longer the flat spot in space, though not necessarily in time. From full glide to about a third to half brakes should take a second or two. Then there is a pause as the canopy remains flat and bleeds off speed. Finally, to keep the descent rate slow continue to apply brakes as needed, keeping the angle of attack up and increasing the "flaps" effect for a better slow speed foil (increased camber). Going from full glide to full brakes as fast as possible cuts out the entire middle half of the flare - one second you're flying fine, the next you are at the edge of a stall as airflow separates from the canopy surface. That's why a very fast flare doesn't work well. The canopy needs a smooth transition to flare effectively.

To pick your flare timing imagine a calm day. Put a sheet of blank paper across the drawing to represent the ground. You can easily see that you would rather land towards the end of the flare, where you have the lowest overall speed - a little down, a little forward. Flare too high (move the paper down) and you have a lot of vertical speed. Flare too low (move the paper up) and you have a lot of horizontal speed. Now imagine a day with a ten mile per hour breeze. Move the "ground" up to the optimal point, which is in early part of the second half of the flare - still some forward speed, very little down. This is why 5 to 10 mph days produce the best landings - you have a long sweet spot. But flare too high, and you will be backing up and descending fast. Don't flare enough, or too low, and even though your forward speed is low you still have a lot of downward speed. That's why even on a windy day you need to flare in order to eliminate the downward component. But the windier it gets, the lower you can flare because you only need the first part, the part that flattens you out, not the one that slows you down.

Hopefully this will show why on windy days the common mistake is to flare too high (the other is to undershoot the target, but accuracy is another topic.) On calm days, people tend to flare too low and overshoot. Perhaps this is because our habits aren't based on living in a fluid environment that varies not just day to day but hour to hour. Sailors, kayakers and pilots are used to the idea of life in a fluid and tend to pick this up quickly. People who have led very static lives have a tough time. The bottom line is that you don't need to learn just one flare, you need to learn half a dozen to cover the basic variations in conditions. To do this, you need to combine experience with an understanding of how a parachute flies.

Too much input

This problem occurs when you are indecisive about flare altitude. As a rule "the more you do with your toggles, the harder you land!" Up and down toggle motions cause you to oscillate below the parachute, making it

alternately dive and float. This will also reduce lift since airflow is being disrupted. The net result is an increase in descent rate. Your flight path varies constantly, making the situation even more confusing. You land hard. The only way to fix this is to be decisive. If you flare high, stop. Hold what you have, then finish the flare at the appropriate time. This means if you are in half brakes, don't apply the second half at normal flare height, but somewhat lower - say, waist to head high. Finally, it is easier to speed up a flare than slow it down, so when in doubt, maybe wait an extra second.

Asymmetrical or incomplete flare

There are two manifestations of this problem. The first is that the flare stops at about elbow height. Toggle pressure increases as you go down, so the first half is easy but the last requires quite a bit more strength. No problem on a breezy day, but if you come in hot on calm days it may be that you aren't flaring all the way.

The second manifestation is when one hand comes down further than the other. There are two causes. One is having a weak side, and the other is landing crosswind. Fix the first by shifting your beer cans to the left hand (or whichever is the weak side) when discussing your latest crash and burn after jumping is over. You can also develop the habit of turning with your weak side when you are flying around, to get it more used to the toggle feel.

The crosswind is more subtle. Crosswind landings are actually quite easy, but as you flare you need to keep the canopy flying straight, which means a little extra toggle on the upwind side. Like any technique, this can be practiced. But be aware that you should only practice crosswind landings where it won't confuse others in the pattern. You should be the only one landing when you are working on crosswind technique. Naturally, start with a light breeze rather than a strong wind! The main thing to remember is to look where you want to go, not where you are actually going. By doing so you will automatically keep the canopy flying straight and level. Whether the asymmetrical flare is caused by a weak side or a crosswind, the effect is the same. As the pilot perceives drift to one side, they usually look down where they are going. This turns the canopy even more that way as the hand on the low side comes down and the shoulders rotate that direction. Often the pilot instinctively reaches out for the fall, making it worse - especially if the other hand is forgotten and comes up, a common action. The moral of the story is always look where you want to go, not where you are going. If the canopy is veering left, look straight and compensate with right toggle.

Mechanical problems

A surprising number of canopies come from the factory unevenly built or poorly tuned. Even more slip out of perfect tune after a few hundred jumps. If your canopy has a built in turn, it probably won't flare too well either. Bad line trim can be just an inch of variation, and it takes a good rigger to find this.

Most factory brake settings are wrong. They are built for the average hypothetical perfect wing loading, with no regard to long or short arms, harness configuration, riser length, actual wing loading and other variables. Generally speaking a canopy will have the factory brake mark about three to five inches too low (done so a heavy guy with real long arms can't stall it easily) which means that the last half of the flare

can't be completed. While one or two inches of toggle setting might not seem like much, it is very noticeable when landing on a calm day. Therefore, if you routinely come in too fast on calm days this may be your problem. Experiment first with gripping above the toggle to take out a couple inches of line, then with a wrap around your hands. Once you find a setting that gives you a good flare, move the toggles to that point. Be sure to get a rigger or other knowledgeable person to check the toggle attachment. Having a toggle come loose can be a serious emergency, especially if it happens at flare time!

Some people will tell you that if you move your toggles up too far, you reduce the forward speed of the canopy because it is constantly in slight brakes. You also make it fly less well in front risers due to deformation of the foil. But don't worry too much about this. If you get a better flare and don't fly in risers much anyway, what do you care? We are talking good landings, not the CRW nationals, so use what works for you. Many canopies are just plain dogs, either because of old design and construction or because of wear. F-111 canopies become very permeable and zero-p parachutes lose their line trim. Don't buy old (over 500 jumps) canopies unless you can't afford anything else. If you are in this economic situation, get one bigger than you would if it was new. Generally, don't assume that your landing problem is pilot error if you are under an old canopy. Check for trim problems and toggle setting. And if you are considering buying a used canopy, get a good pilot of your weight to evaluate it first. Old canopies have a very small zone of forgiveness. If you are looking at one of these, think about what will happen if you step out of that zone. Given the choice, would you prefer to spend money on good gear or medical bills?

Inappropriate transition

If the canopy you are transitioning to is just too different from the one you are used to, you will have trouble figuring it out. That's why a 120-pound jumper who learns on a Manta might have trouble on a PD 170. The canopy size may be appropriate, but the difference in flight may be too great. Similarly, if you are used to nine cell canopies, going to the short flare and steeper glide of a seven cell can be a bit of a surprise.

Conditions

Wake turbulence or obstacle generated turbulence can suck you into the ground hard. Chase someone's canopy up high to get a feel for turbulence, but avoid it down low. Density altitude can also deprive you of performance. A rule of thumb is that you lose about three to four percent of performance for every 10 degrees over 70 and/or every thousand feet of elevation. You just don't notice the loss until faced with a stable reference such as the ground.

Terrain

When landing on a slope, unless there is a lot of wind (10 plus) land across the hill, not up or down hill. It is a good idea to practice crosswind landings for just this sort of eventuality. However, be sure your crosswind training doesn't confuse or conflict with other traffic! Finally, there are a couple things to do that will improve your performance even if you already land OK. Cross train: mountain bike, run cross country, ski, kayak, drive - anything involving movement and coordination in a rapidly changing environment. Exercise does a lot more than make you stronger; it makes you mentally more agile. The people who

land really well seem to be fairly athletic, so maybe there is a connection. And obviously, if something isn't working, don't continue to make the same mistake. In several sports I've taught, people seem to intuitively know that repeating a correct action is good, but they don't always understand that repeating an incorrect action is bad. If you aren't happy with your landings, something is wrong. Something can be fixed. Do it!