CANOPY TRAINING MANUAL

Student CT, CT 1 & 2

MARTIN SKRBEL

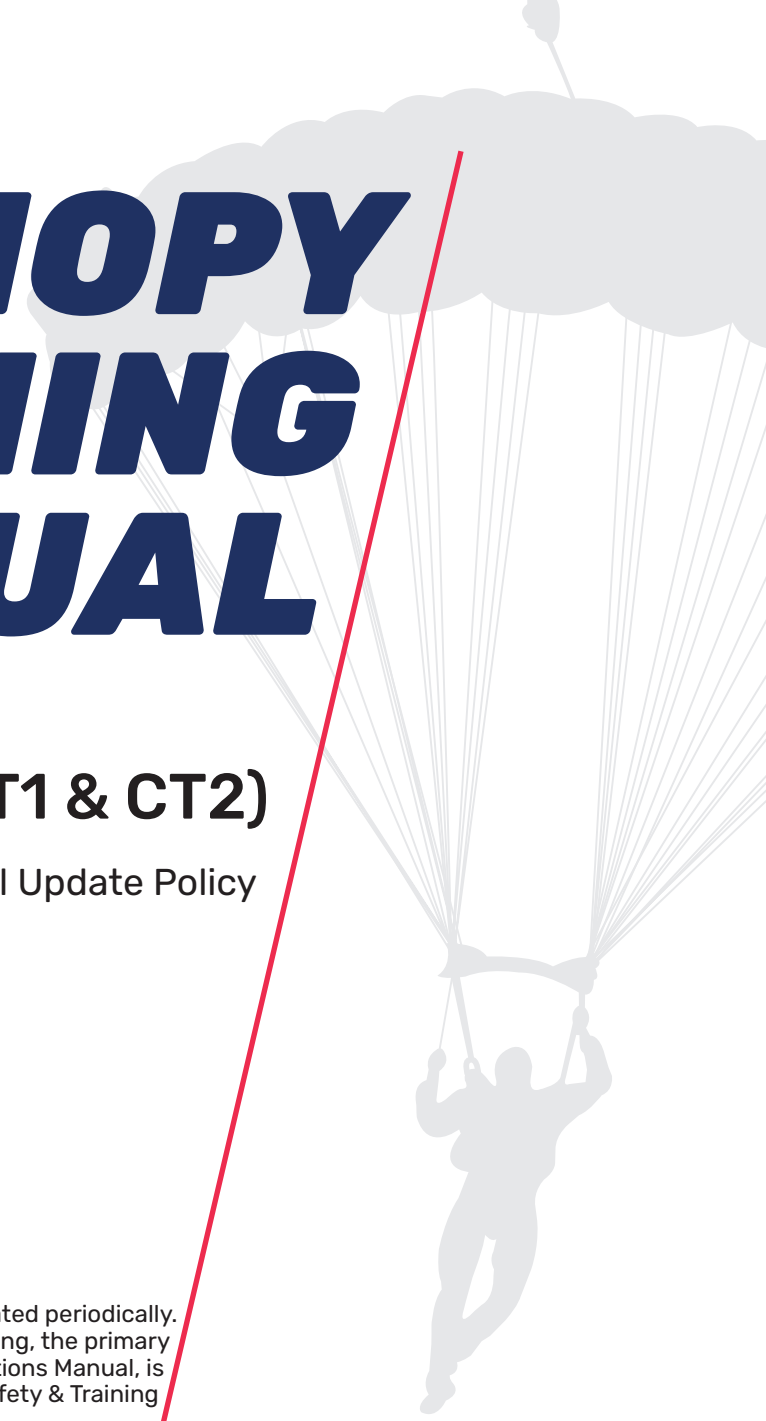
STAY SAFE

BRITISH SKYDIVING

CANOPY TRAINING MANUAL

(CT, CT1 & CT2)

British Skydiving Manual Update Policy



The British Skydiving Canopy Training Manual is updated periodically. As British Skydiving rules are continually evolving, the primary operational document, the British Skydiving Operations Manual, is regularly updated at meetings of British Skydiving Safety & Training Committee which are held every two months.

Therefore, in the case of any conflict between rules or requirements set out in the British Skydiving Operations Manual and any other British Skydiving manual, the provisions in the British Skydiving Operations Manual shall always have primacy as the definitive statement of the current position.

The acronym TAP (Traffic, Altitude, Position) was first devised by Brian Vacher's Safe Flight School in 2003. The copyright is now used by Flight-1 LLC and is used by other canopy training organisations and National Governing Bodies worldwide, as it is widely accepted as best practice when teaching awareness under canopy.

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SECTION 1: INTRODUCTION

WARNING

Errors made flying a canopy can be disastrous to you and others, and can result in serious bodily injury or death.

Please heed this warning! Canopy flying is extremely good fun and can be very addictive!
It is easy to become fixated or unaware of others around us.

The facts are:
1. The vast majority of injuries to skydivers are caused on landing.

2. Most could have been avoided.

3. No jumper ever sets out to hurt themselves on a jump, but lots do.

4. We all have a duty of care to those flying their canopies around us.

5. Furthermore, there is a common attitude of "it won't happen to me!".

6. The intention of the Canopy Training system is to help you learn good skills now, so that you can continue to develop your skills as you change canopies.

This manual is designed to help improve your canopy handling skills and provide the prerequisite information to complete the British Skydiving written examination for qualification as an A Licence holder. This will hopefully allow you to fly your canopy better, and also give you the ability to be in control of any situation when it starts to get out of hand, and therefore reduce the likelihood of injury.

Please do not see the Student CT, CT1 and CT2 exercises as a hurdle to a particular licence.
These are key life-saving skills that you need to practise so that they become instinctive.
You cannot learn Canopy flying in one reading; please use this manual as a reference to regularly read even once you have your licence.

Please note; this manual is designed to supplement your initial and any subsequent training provided by a British Skydiving Affiliated Parachute Training Organisation (PTO) instructor or coach. It does not replace proper training or instruction.

It is not, therefore, a "do it yourself guide". All exercises must be briefed before attempting them.

You must gain instruction and / or coaching from a properly qualified instructor / canopy training coach before attempting any of the techniques described in this manual.

The information in this manual is based on the personal opinion of the authors. Whilst all efforts have been made to ensure that it is correct and up to date, it may contain information that is incorrect and, or out of date. This manual will be periodically reviewed, if you have any comments or suggestions, please contact the British Skydiving Canopy Working Group via your Chief Instructor and changes or updates can be made.

The Canopy Training System

The requirement for Student Canopy Training, and CT 1 and 2 is set out in the British Skydiving Operations Manual section 2. Each set of exercises requires a briefing before each set of exercises is to take place, and completion of a written assessment based on this manual.

Canopy Training during the student syllabus will now include:

- Flat turns on at least 3 descents demonstrate the ability to fly the correct landing pattern for that PLA in the conditions for the day without conflicting with other jumpers and land safely on the intended landing area.
- Increase the range of the canopy using the toggles.
- Demonstrate a reasonable level of canopy handling, flying the correct landing pattern and landing safely on the PLA.
- Canopy Training written test Form 240A.

CT1 post A licence now requires:

- Demonstrate the ability on 5 descents to carry out the correct landing pattern for that PLA in the conditions of the day and land safely on the intended landing area.
- Complete 5 pre-declared safe landings, within an area of 50 metres diameter.
- Check the stall point, fly the canopy on deep brakes and carry out flat turns on at least 3 descents.
- Rear riser turns, as an avoidance manoeuvre, on at least 3 descents.
- A CT1 written examination Form 240B.

CT2 will become a requirement for gaining British Skydiving C licence and make it possible to increase your wing loading.

CT2 requirements:

- Check the stall point using toggles, fly the canopy on deep brakes and carry out flat turns on at least 3 descents.
- Check the stall point using rear risers and fly the canopy using risers on at least 3 descents.
- Demonstrate the ability to fly the correct landing pattern for that PLA in the conditions for the day without conflicting with other jumpers and land safely on the intended landing area.
- Complete 5 pre-declared safe landings, within an area of 25 metres diameter.
- Rear riser turns, as an avoidance manoeuvre, on at least 3 descents.
- Receive a full safety brief on the following:
    - Collapsing and Stowing of slider
    - Loosening of chest strap under canopy
    - Removal of booties
    - Use of camera under canopy
- A CT2 written examination Form 240C.

Record sheets for the briefing and the exercises can be found on the British Skydiving website: **www.britishskydiving.org/**

For those already part way through the previous system your CI can credit you across the new CT system.

Further training methods:
Canopy Formation Grade 1 and 2 (CF1 and CF2) teach you perform canopy flights in close proximity with other skydivers whilst in a controlled environment, including building your first canopy formations. In CF1 you will spend whole jumps learning to utilise all of your canopy inputs whilst flying relative to a coach one to one. In CF2 you will learn to safely perform group jumps of up to 4 canopy pilots and apply what you have learnt during CF1.

CF progression will introduce you to additional training on canopy collisions and how to best respond to them with appropriate emergency procedures. You will also become more confident flying in close proximity to others whilst maintaining visibility, which can be an invaluable lifesaving skill when you find yourself flying in a busy pattern. In addition, CF canopies have 7 cells and a low aspect ratio which means they fly similarly to a modern reserve. It can be a great way to familiarise yourself with this type of canopy prior to finding yourself in an emergency situation.
As with all other training, you should not attempt canopy formations without relevant experience and coach supervision. CF training can start with B licence and 100 jumps and the appropriate briefing.

CT3 and CT4 are to teach you how to learn “high performance” landings and are covered in their own manual. The path to high performance landings needs consideration and a lot of training. You should not attempt any of the CT3 or CT4 exercises until you have the relevant experience and have received the coaching.

SECTION 2: THE CANOPY AND ITS CONTROL

If you understand a little about how your canopy flies it will not only give you confidence and enjoyment but will help you avoid flying it badly or, even worse, dangerously.

Below is a very basic explanation to help us later understand the processes we will experience in all the CT exercises.

The basic canopy.

Once your canopy has fully deployed it will be flying forward through the air and be descending at an angle, the "glide ratio". The air pushing in through the nose helps it maintain the internal pressure within the canopy, and therefore its shape. The lift the canopy generates is up as shown in figure 1. With you suspended under the canopy, without putting any control inputs in, the canopy will generate lift and the glide-ratio of the canopy, and therefore your rate of descent, will depend mainly on; the size of the canopy; its design; the speed you are flying it at; and your weight. A more detailed discussion about the aerodynamics of canopy flight can be found in Section 8 A Further Guide to Canopy Flight.

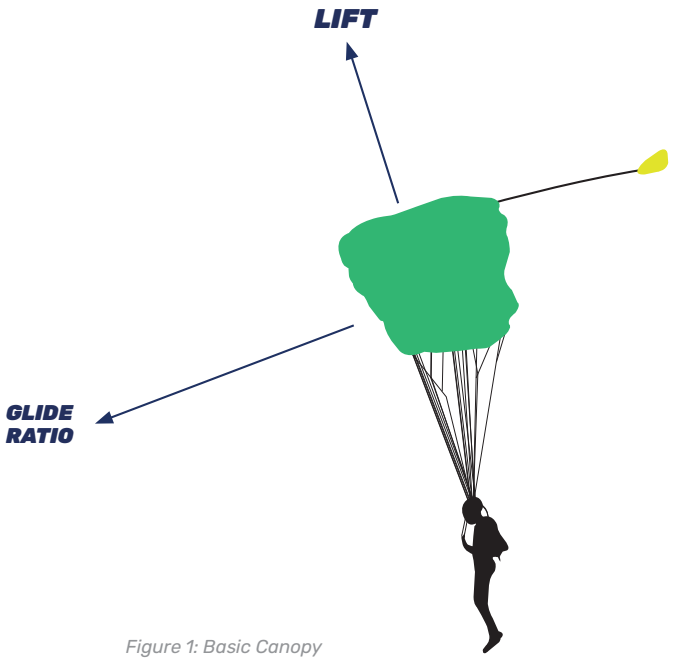


Figure 1: Basic Canopy

Remember, your groundspeed will depend on the speed of the air you are flying into or with, i.e., if you are facing into, across or with your back to the wind.

You will have already experienced the basics of canopy control:

↘ To turn: pull a toggle, left for left, right for right.
↘ To stop the turn: put both arms back up on full drive.
↘ To trim for landing: gently pull the toggle to your shoulder until the heading is corrected.
↘ To flare for landing: pull both toggles all the way down equally.

Remember you must look in the direction you want to turn before pulling the toggle to ensure the airspace is clear of traffic, also that you have enough altitude to complete the manoeuvre, and that you remain in a position where you can make it to the airfield.

What happens in a turn?

If you pull one toggle down, that side of the canopy slows due to increased "drag". The canopy begins to turn around that side and the canopy rolls and the canopy pilot swings outwards from underneath the canopy. This further causes the canopy's "pitch", its angle relative to the ground, to change and for it to dive towards the ground. The result is an increase in the rate of descent. If the rotation continues

the speed and pitch will increase further, and so therefore will the rate of descent. You will quickly lose height in such a "spiral".

The faster / harder you put in the input the faster all the above will happen.

As you release the input the canopy will take a finite amount of time to "recover" to normal flight. In that time, you will swing back under the canopy as a pendulum would swing back. You may have felt this if you have spiralled the canopy and let the toggle back up quickly: you swing back but as you haven't lost all the extra speed yet, you may feel the canopy generate more lift, and then return to its normal flight as the additional speed is lost.

Figure 2: Lift in a turn (Photos Courtesy of Performance Designs)

The increase in speed and loss of height during a turn, are why we must never turn low to the ground, and the canopy should be 'flat' above your head during landing.

The fact that it takes some time for the canopy to 'recover' after the input is removed, and that during the recovery the canopy will have extra speed and a higher rate of descent, is why your canopy inputs should always be 'level' before landing. This will become more apparent and important on faster higher performance canopies if you progress to them.

What happens during a flare?

If you pull both toggles down you will alter the shape of the rear of the canopy. If the toggles are applied quickly and all the way down the canopy pitches up, which will result in your body swinging forward. This will trade the forward speed for lift and generate the most lift it can from normal flight.
It will also create the most drag the canopy can and will slow its forward movement.

If this is done at the correct height you will land softly.

Do this too high and you will swing back under the canopy having already traded your forward speed for lift and your rate of descent will increase. This landing will not be as soft as the optimum and you should make sure you fully complete the flare and be ready to PLF.

If you release the toggles at this point, the canopy will attempt to surge forward to “recover” to its normal flight. This acceleration is fast and results in a much higher rate of descent. Done too low you will not have time to have a second attempt at a flare.

This is why you have been taught, as a student, that if you flare too high you must hold the toggles down. Landing in this surge can result in serious injury.

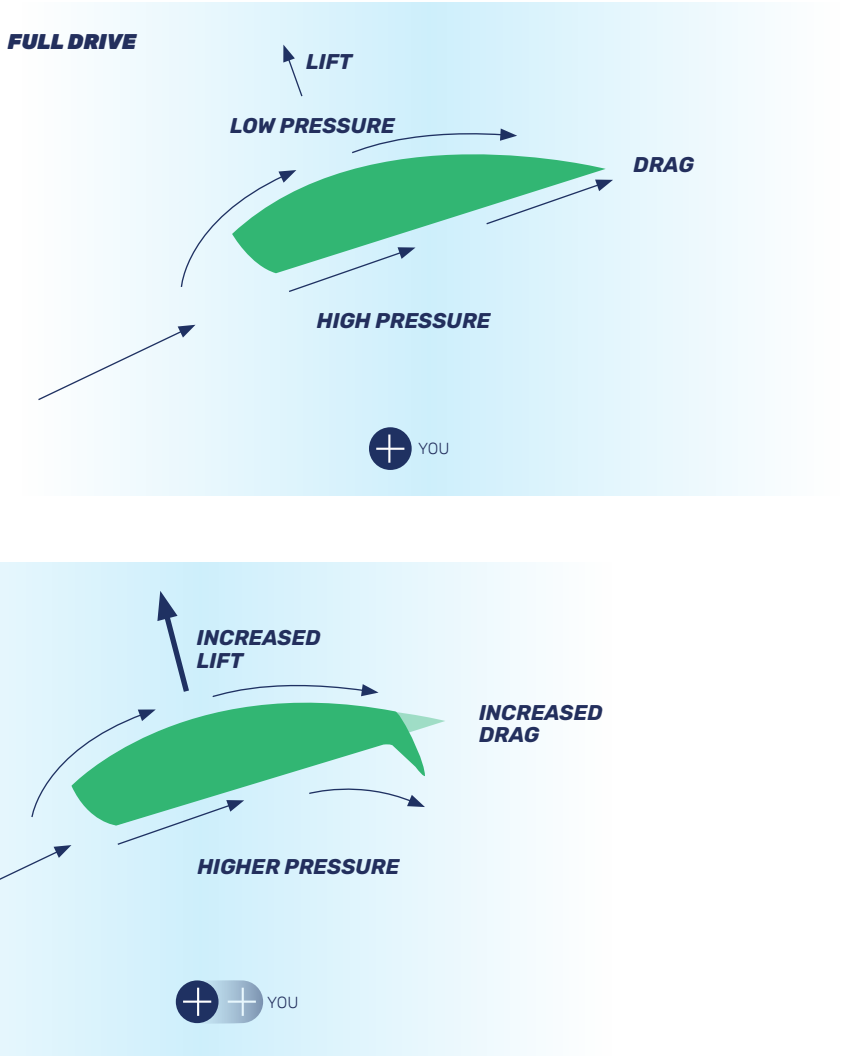


Figure 3: Flaring

Slow flight.

If you pull both the toggles down it will distort the back of the canopy and increase the drag, resistance against the air, and slow the canopy's forward speed down.

This means that by applying some toggle input evenly to both sides you can enter "slow flight", by applying more toggle input you can go slower. However, you will reach an input where the drag created is much greater than the lift generated, and the canopy will again have a higher descent rate, it is said to be "sinking".

We can use this slow flight in several situations, the main one being to extend the range of the canopy. This is discussed below in Section 3B Increasing the range of the canopy to help you make it back more easily to the landing area.

Slow flight can also be used to buy yourself some time, if you are beginning to feel "overloaded" or stressed under canopy. For example, if the airspace is becoming busier it can become stressful under canopy. By applying some brake, it will give you a little more time to assess the situation and hopefully resist putting in a radical input that could lead to a collision or low turn. This is discussed further in Section 4 Common mistakes to learn from.

Slow flight; The "stall".

Stalling a canopy may cause fear for most jumpers. However, exploring stalls and the slow-flight range of a canopy gives skydivers a better understanding of how their canopy works, and helps them to fly better landing patterns. In time improve accuracy and achieve consistently soft landings.

What is a 'stall'? A stall is when the canopy stops generating lift as a wing. This can happen in a couple of ways.

In a held flare, the canopy will lose its forward airspeed and the canopy may begin to lose its internal pressure, and therefore its shape. The symptoms of the onset of a stall are that the canopy will feel a "buffeting", it will go quiet, the toggle pressure will be soft, and the canopy will begin to deform if held in the stall.

Full developed "Toggle Stall"

If this happens it will stop generating lift and is starting to stall. If the stall continues the canopy will lose its shape fully and the jumper's rate of descent will increase significantly. To recover from the stall the input that has caused the stall needs to removed steadily and evenly. The canopy should begin to recover to its normal flight characteristics.

(Video example can be found by searching for "Canopy Training: Toggle Stall Exercise" & "Skydive the Mag" on YouTube)

Note if the toggles are thrown back up the canopy will surge forward, if done unevenly this can cause an uneven recovery resulting in line twists.

A canopy designed for students is designed so that in slow flight the canopy should retain enough internal pressure to maintain its shape regardless of how long the flare is held down. Therefore, you may not be able to fully stall your student canopy, but can begin to feel the symptoms.

For information the other stall that can happen is if you flare hard and swing forward far enough the canopy can be pitched up so that the air does not flow over the canopy in a way that will generate lift.

All Stall check exercises must be completed, and returned to normal flight, well above your safe minimum cutaway altitude.

Slow flight; “flat turns”.

Whilst maintaining “slow flight” the canopy can still be controlled and turned.

When faced with a landing problem such as avoiding other skydivers, a hazard, or overshooting your intended landing area, it is preferable to use a flat turn with a minimal amount of toggle input.
This is a lifesaving skill and should be practised at a safe altitude until proficient.
This will help you land under a flat and level canopy. Carrying out a sharp turn at low altitude may well cause serious injury or could be fatal.

(Video example can be found by searching for “Canopy Training: Flat Turns” & “Skydive the Mag” YouTube channel)

Elevation Flat Turn.

By raising a toggle from slow flight, the canopy will turn towards the lower toggle. It will begin to accelerate again, but as the input isn’t as large as a full toggle input the rate of turn will be slower. You will swing out less, therefore the canopy is “flat” compared to a larger toggle input.

If the input is held the canopy will continue to accelerate, and you will swing out from under the canopy, and the rate of descent will increase significantly.

Depression Flat Turn.

From “slow flight” toggle input if you further depress one toggle the canopy will turn towards the lower toggle. This is because you have already slowed the canopy down with both initial toggle inputs, and then you applied even more brake to one side of the canopy the rate of turn will be even slower than the elevation turn. It will also produce more lift and further slow your descent.

It will however generate more lift. In an emergency situation it is possible that it will lead straight into the landing flare. If this happens, the steering toggles must not be let up but both brakes should be depressed fully, straight from the flat turn to carry out the flare and use a PLF to minimise the chance of injury.

Caution should be taken when flying in very deep brakes at close to the stall of the canopy, that is why this should be practised up high until you know your canopy’s stall symptoms. Stalling close to the ground could result in serious injury.

Further Control Inputs.

↘FRONT RISERS

If you pull both front risers down, the canopy will be pitched more towards the ground and this will markedly increase the forward speed of the canopy, but you will also lose height quicker.

If you pull down one front riser it will pitch that side of the canopy down and cause a turn in that direction. The canopy will roll and you will swing out like the toggle turn, but the rate of turn and descent rate will increase more quickly as you are not increasing the drag like a toggle input would.

You can lose a lot of height very quickly using the front risers and therefore front risers should only be used under supervision for CT3 training or CF1 / CF2 training.

Using the front risers near the ground can result in very serious injury or be fatal.

↘REAR RISERS

Pulling down on the rear risers alters the shape of the rear of the canopy. This can be more efficient in certain situations as it flattens the canopy without increasing the drag as much as using the toggles.

Unless you possess Herculean strength, it will not be possible to hold the rear risers down for extended periods of time until you are on a smaller canopy.

If you do try however, you must keep your hands in the steering toggles at all times, and reach as high

as you can up the rear risers and pull down evenly. The higher you reach, the more leverage you get.

Something to note though is the rear riser stall, this can occur with less warning than the toggle-induced stall, and become a more defined stall more quickly. As part of the CT2 exercises you will practise identifying this so that you can avoid it happening. If it should stall, or show symptoms that it is about to stall, (a marked "fluttering" of the tail), then raise the risers gently back up evenly to normal flight.

↘REAR RISER CANOPY AVOIDANCE MANOEUVRE

The main use for the rear risers in the early part of your jumping career is for the "Rear Riser Canopy Avoidance Manoeuvre".

After opening you may end up flying towards another canopy, to avoid a collision, you must make swift decisive inputs. You will have already been trained to turn away and to turn right if you are on a head-on collision course.

In this situation it is normally quicker to pull the rear riser and turn away than to pull and release the toggles and apply an input.

Care should be taken not to accidentally release the toggle in the process of pulling the rear riser. You will practise this as part of your CT1.

↘HARNESS

These inputs are an aerodynamically clean method of turning as they do not change the drag of the rear of the canopy to the same degree as other inputs. The input is created by increasing the weight on the leg straps by leaning into the direction of turn. One method of practising this input on the ground is by sitting on a seat and leaning more weight on one bum cheek and lifting the other off the seat.

The shoulders should remain pointing in the same direction to avoid twisting which makes the turn less efficient. Harness turns are more effective on smaller canopies with the chest strap loosened off. On larger canopies you will find other inputs are more responsive.

SECTION 3A: CREATING A FLIGHT PLAN

Flight Planning involves knowing where we want to fly and having a plan for executing it. It also incorporates how we monitor and change the plan during our canopy flight.

We will firstly introduce how to create a good flight plan, secondly look at some core skills to use while flying your flight plan, and then finally look at techniques to make assessments and how to adjust your flight plan if it isn't going exactly to plan.

The importance of a good flight plan cannot be understated. If people paid as much attention to it as they do dirt-diving, there would certainly be far fewer incidents. Regardless of what you are about to attempt in the sky, you will always need to fly your canopy and land it!

We will concentrate on the actual landing process in the next chapter.

Creating a Flight Plan.

Flight planning begins on the ground before every jump. From an initial plan we are in a better situation to assess it and make updates.
When creating the plan, you will need to take into account the following factors:

Preparation:
↘ Where you want to land
↘ Any hazards around or on the way to the PLA
↘ The strength and direction of the winds
↘ The direction of jump run and your expected opening point
↘ The flight pattern and landing direction
↘ Where the ideal holding area is
↘ Where do I fit in the whole lift?

Planning:
↘ Putting it all together
↘ Set up heights and your landing pattern

Prevention:
↘ Am I capable to handle all these conditions?

Preparation.

Remember that many of these factors can change throughout the day and should be checked before every jump of the day. This will mean that changes that have happened can be planned for rather than having to be dealt with under canopy, which gives you a better chance of a successful flight plan.

Where do you want to land?

You should speak to your instructors /coaches or DZ Control to confirm the correct Parachute Landing Area (PLA) for your level of qualification.

Any hazards around or near to the PLA.

From your orientation brief, you should have been briefed of the location of any hazards near to the PLA and around the DZ. Some of these hazards, such as the runways, may well have their own rules for when and at what height you can overfly them. Others due to their size or the weather conditions might cause turbulence and might be better avoided. Ensure that you know what the local rules are so that you can avoid these areas if needed.

The strength and direction of the winds.

The strength and direction of the wind is the single biggest factor that affects us as skydivers when trying to land our canopies. Most PTOs will use a windsock to show you the direction and strength of the wind. This information will normally set the majority of the rest of your flight plan. Be aware that the conditions change throughout the day and should be checked before every jump.

The lower winds that you can see with a windsock will give you information as to the type of landing you will make, i.e., if you will be going forward quickly on landing, or coming straight down. You can then mentally prepare yourself better so it will not be a surprise.

Always take a reference of the wind direction relative to the sun or large local very prominent landmark so that if you cannot see the windsock, you know which way is into wind. Bear in mind that over the course of the day the sun will have moved, so you need to do this before every jump.

Remember that the winds aloft can also vary with height. It is common for the winds to vary in direction and strength with altitude.

The direction of the jump run and your expected opening point.

As a student you should have been dispatched in the correct areas and your instructors should always have ensured that you were correctly briefed. As you complete your student jumps and become a licenced jumper, the onus will be on you to know what the direction of jump run is and where you should be leaving the aircraft. In light wind conditions it is not uncommon for the first and last jumpers to be opening over a mile apart. In this case, the same flight plan cannot work for everyone and it is necessary for all jumpers to have their own individual plan to get them back to the PLA.

Your opening point will vary depending on where you exit the aircraft, and the amount you drift with the upper winds.

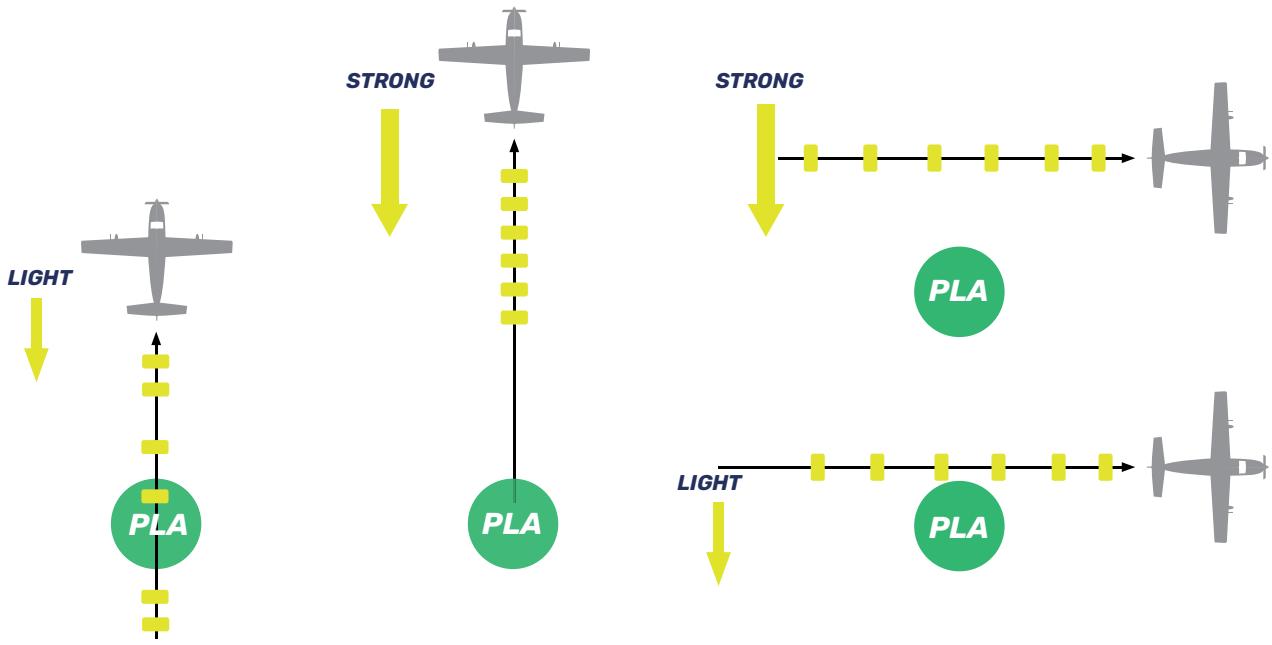


Figure 5: Types of run-in

Drop zones tend to use two kinds of run-ins: into wind or crosswind as shown in figure 5.
The effect of the wind strength is on each of these run-ins is illustrated in Figure 5. With a run-in into wind the canopies should open on the wind line and be in a position to fly with the wind, or against it, back to the PLA.

With the crosswind run-in you may not be able to just turn and run with the wind back to the PLA, you will need to think about where to fly.

Landing Pattern and Direction.

As a student you would have been taught to fly a standard landing pattern.
Normally this will be made up of three heights and legs:
1. Leaving the holding area (approximately 1000ft), the “downwind leg”
2. Turning cross wind (approximately 500ft), the “base leg”
3. Final, (by approximately 300ft), the “into wind leg”

The patterns will either be left or right-handed as shown in figure 6. In the left-hand pattern all your turns should be to the left, and right for a right-hand pattern. The heights shown are purely examples and you should use what you have been taught.

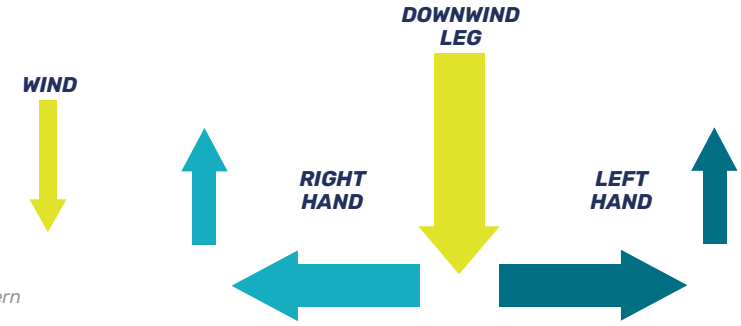


Figure 6: Landing Pattern

There are three basic landing pattern models we can try to fit our conditions best. Those shown in figure 7 are left-hand landing patterns; if you need it to be right-handed then mirror image it.

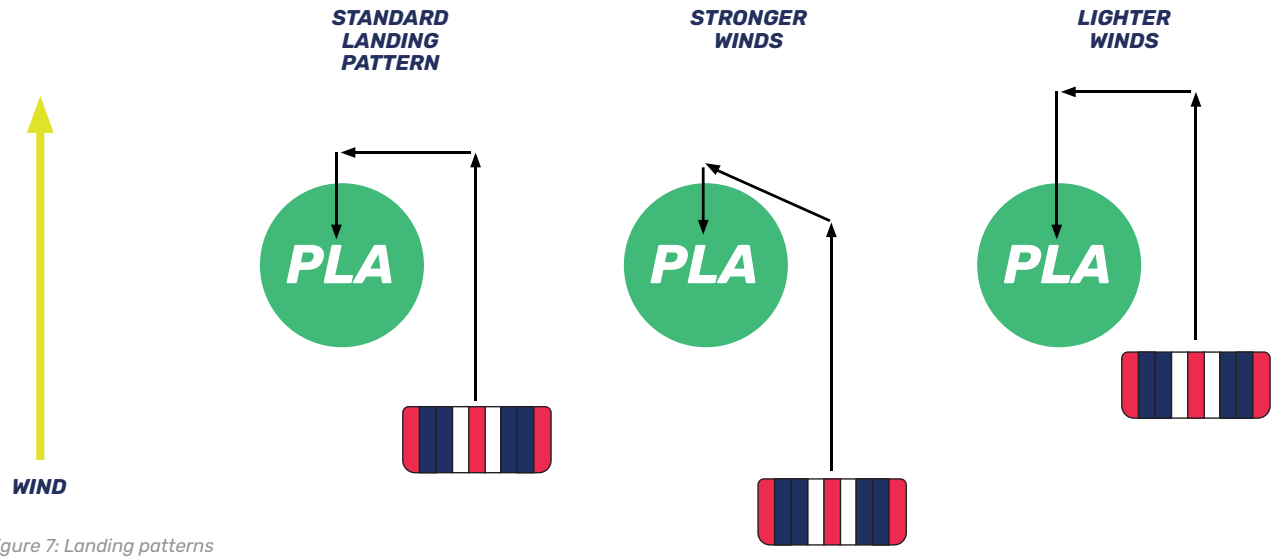


Figure 7: Landing patterns

Our standard landing pattern was what you were probably taught as a student. Now you have a few jumps you should be thinking about how you can adjust it due to the conditions.

The effects of wind strength are:

↘ **Stronger Winds**

1. You will travel further when facing downwind (with the wind at your back), on your downwind leg.
2. On the base leg if you turn directly across the wind, you will 'crab' with the wind and drift further down wind.
3. You will travel less when facing into the wind.

↘ **Lighter Winds**

1. You will not travel back from an upwind holding area as far or as quickly.
2. You will not drift / crab downwind as much on your base leg.
3. You will travel further into the wind, allowing you to go a little further past your base leg turn set up point.

As you progress through your student jumps and in preparation for jumping as a licenced jumper you will find yourself jumping in busier and busier skies, with more jumpers flying and landing at the same time as you. It is now therefore more important that you fly the same pattern as all the other jumpers. You must confirm the correct pattern of that day before every jump, as some DZs will vary the landing pattens due to the conditions and local hazards. It can even change during the aircraft climb to altitude; you must know where the landing direction indicator is.

The landing pattern in use will not only let you know what direction everyone is intending to land in, but also which direction they will approach the PLA. This will prevent lots of different landing patterns which would increase the risk of a canopy collision, either in the landing pattern or close to the ground. Conditions can change, particularly if the winds are light, and it must be remembered that we do not have to land into wind, and that you should be able to land your canopy safely crosswind or down wind.

Where the ideal holding area is.

In the simplest terms, the holding area is an area up wind of the intended landing area where you can safely lose altitude; remain free of hazards; to perform canopy exercises safely; and be in a suitable position to start a landing pattern when the time comes.
If the winds are stronger this area will be further upwind relative to the PLA. You can use the wind to help you fly back to the PLA more easily.

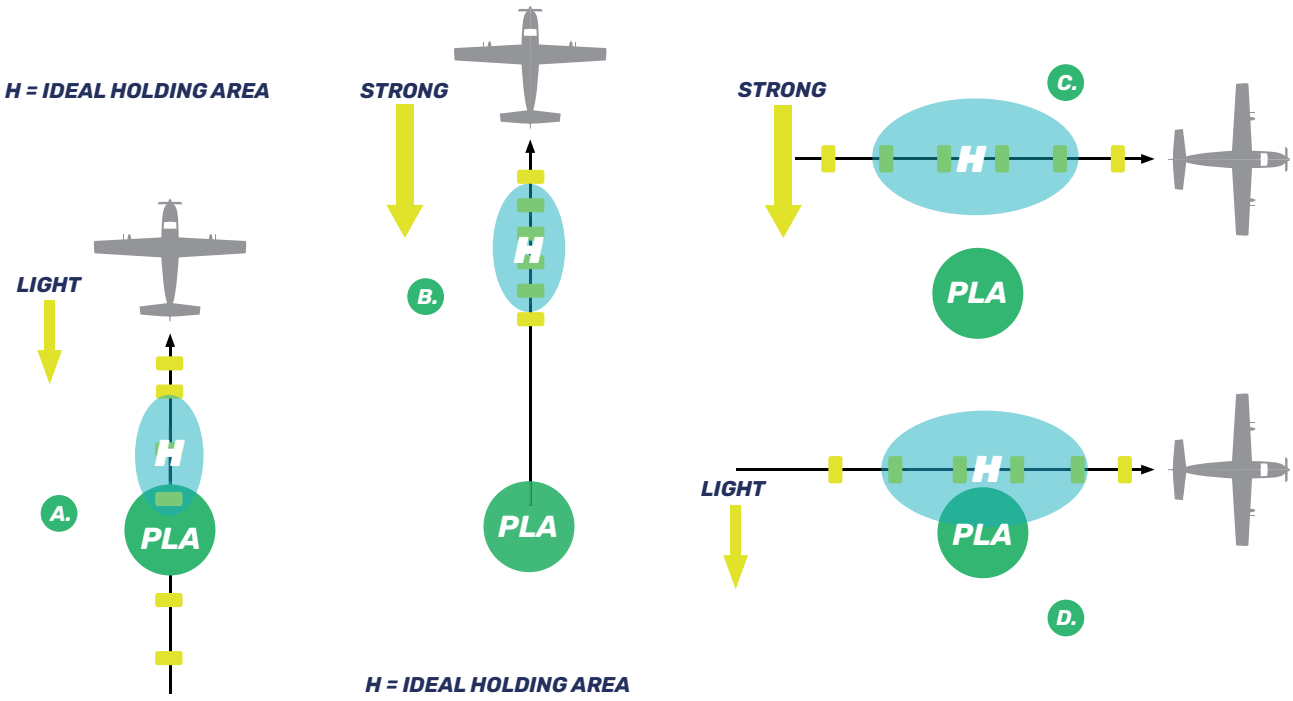


Figure 8: Ideal holding area

Even in zero winds it is worth making sure your holding area is in a place such that you can leave it to fly a standard predictable landing pattern, rather than everyone just converging on the PLA.

Be wary of how you approach the holding area. In scenario A above the first canopies to open often believe that they must do everything to get to the ideal holding area and will fly directly up the jump run; they are shortening the separation between the groups and increasing the risk of a collision or being hit by a free faller who may be opening lower than them.

Before flying up or down the run-in make sure the next group is open and your airspace is clear.

How big a holding area do you have?

When you fly your canopy, you need to be aware of your heading and track over the ground. Your heading is the direction you are facing, your track is your movement across the ground. They will not

necessarily be the same. As can be seen below in figure 9, if the wind is coming from your side, you will drift that way with the wind. If it is light there will not be much effect on you, and as the wind becomes stronger from the side it will become more pronounced. To reduce the effect of a strong wind it may be necessary to offset yourself to counteract the drift as shown in (d) below to remain in your holding area.

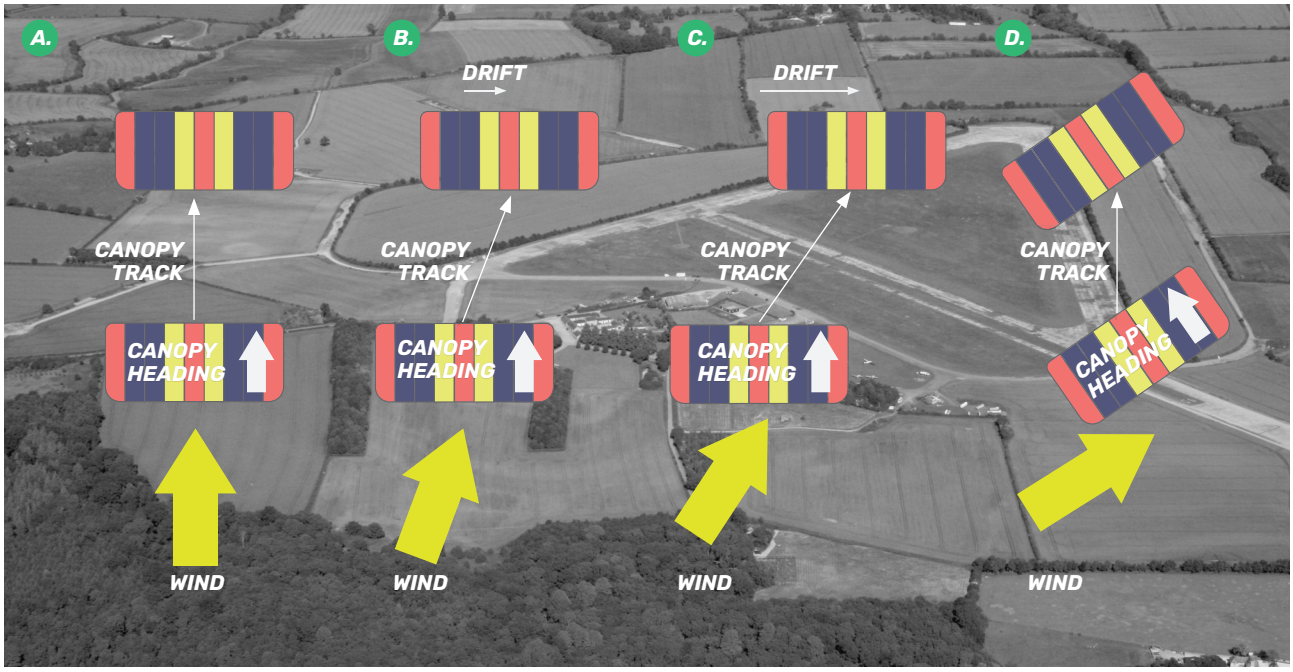


Figure 9: The difference between 'heading' and 'track'

The strength of the wind will therefore affect the size of our holding area, as shown below in what is called 'the cone of drift'. This defines the area the canopy can stay in subject to the winds and be able to make it to, as shown in the diagram below.

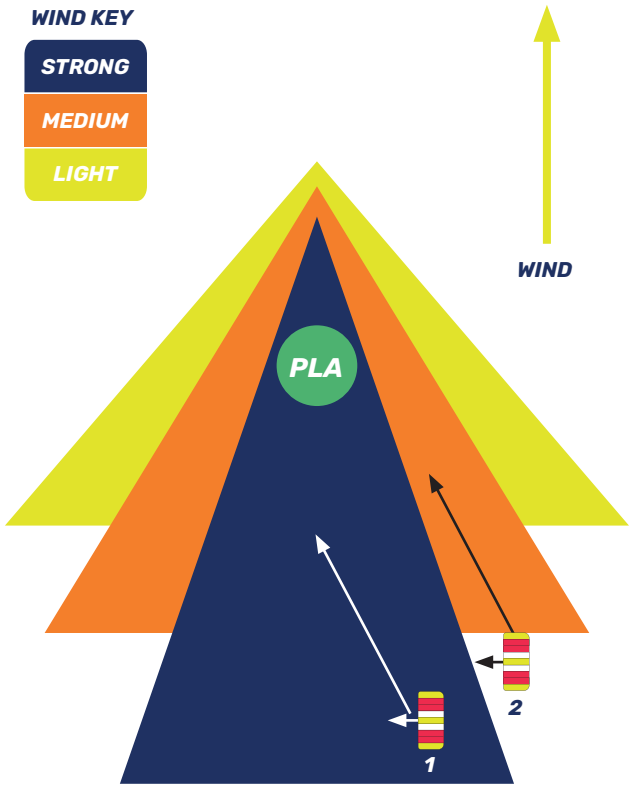


Figure 10: Cone of drift

In the stronger winds canopy 1 facing across the wind will crab along the white line and remain in a place to be able to make their landing pattern. Canopy 2 although facing towards the area in front of the PLA, because it is so far outside the "strong wind" cone of drift will follow the same track across the ground as canopy 1, but will not be in a position to make a good attempt at a landing pattern, and would end up most likely landing off the PLA.

This is why you must carefully monitor where you are during the descent as it is easy to fly out of your holding area.

In essence, the stronger the winds the narrower the cone of drift and hence narrower your holding area will be. This will need to monitored more carefully so that you remain in a good position to start your landing pattern.

To compound the issue as said above the upper winds may not be aligned with the ground winds, so the direction you need to hold into wind may change as you descend. You will need to keep assessing the different wind strengths and directions, and adjusting for them.

Where do I fit in the whole lift?

You should always find out where you will be in the exit order of the lift and use this to adjust your flight plan. As you can see from Figure 8: Ideal holding area, it is impossible for us to always open in the ideal holding area.

Regardless of the exit order protocol used at your PTO you will know where you fit in the exit order. You can minimise the risk to yourself and other jumpers by learning to avoid traffic. This starts before we even take off by knowing the characteristics of your canopy and of the others on your lift. This does not have to be overcomplicated, but it is very useful to know how fast your canopy flies in comparison to those around you. It is also good idea to look for any other groups on the lift and assess if you are going to catch up the group before you, or be caught up by the group after you. This is where knowing your canopy comes in. If you are one of the slower canopies you should be prepared to allow others to pass you before entering the landing pattern, as this will give everyone more separation and a clearer approach for landing.

Planning - putting it all together.

You should now have sufficient information about the environment and the conditions to make a flight plan.

For this you should use "set-up points", these are points on the ground that you will try to fly through at set altitudes, they do not need to be pinpoint accurate. Typically, you would work backwards from where you want to land; where to make your final turn into wind; where to make your base leg turn; where to start your downwind leg from; which indicates your ideal holding area.

You can then use these set-up points when you actually jump to assess how well you are following your flight plan and make adjustments if necessary.

Set-up points.

↘ Landing

You should aim to land in the centre of your designated area as far as possible from all the hazards or obstacles, including other jumpers, that might distract you from landing your canopy safely. You should plan to clear any hazards such as fences with plenty of height, you should also allow for a safe overshoot area. As you gain more experience you can try to improve your accuracy. Initially you should instead be concentrating on flying the same predictable pattern as all the other jumpers and carrying out a good final approach and landing.

↘ Final Into wind turn point

This is the point at which you will turn onto your final approach to land, and is probably the most important turn you will make. From this point onward you should allow the canopy to fly on full drive until it is time to initiate the landing flare. It is permissible to make small trim turns to maintain your final heading but it should be remembered that every toggle input, however small, during this phase will affect the speed and rate of descent of the canopy and make it harder to achieve the best landing. Based on your assessment of the wind conditions you will know how fast you will be going forward on landing, or if you will be coming straight down.

Where your final turn will be will depend on your canopy characteristics and the wind conditions. Most modern sports canopies fly at a glide angle of 3:1 when on full drive. That means that, in still air, for every foot that you descend you will travel forward 3 feet or approximately 1 metre, so on a nil wind day, if you carry out your final turn at 300 feet, you should expect to travel approximately 900 feet (300 metres) before landing.

Therefore, as shown in Figure 7 in light winds you should carry out your final turn 900 feet (300 metres) downwind of your target area. As the wind increases you move this point closer to your intended landing area, up to the point where if the winds are as strong as the forward speed of your canopy, the turn should be directly over the PLA.

You can think about which of the landing patterns in Figure 7 is the most applicable and look for a landmark to make your turn over, or close to.

This final turn should always be high enough to ensure that you have given your canopy enough time to fully recover from the turn, before you need to start your landing flare. A good guide for most canopies is a minimum of 300ft for completing the turn, which will allow for a good landing and any minor corrections that may be needed.

The final turn height must take priority over the position or you may push yourself into making the final turn in the correct place but too low, which can result in serious injury.

↘ Base-leg / Cross wind turn point

The next set-up point is where you are going to turn onto your base or crosswind leg. It is a very important part of your landing pattern as it allows you enough time for a good look at your landing area, to check that it is clear of hazards, with enough time to take avoiding action if needed. The turn onto your base leg should be carried out at around 500-600 feet, meaning that you can travel approximately 300 metres across the ground during your base leg. This ensures that the downwind leg and the final leg, where traffic is going in opposite directions is adequately separated.

As discussed earlier you need to be aware of your heading and potential track due to the wind. This will affect where you need to make this turn. You can compensate for the drift in a couple of ways as shown below figure 11.

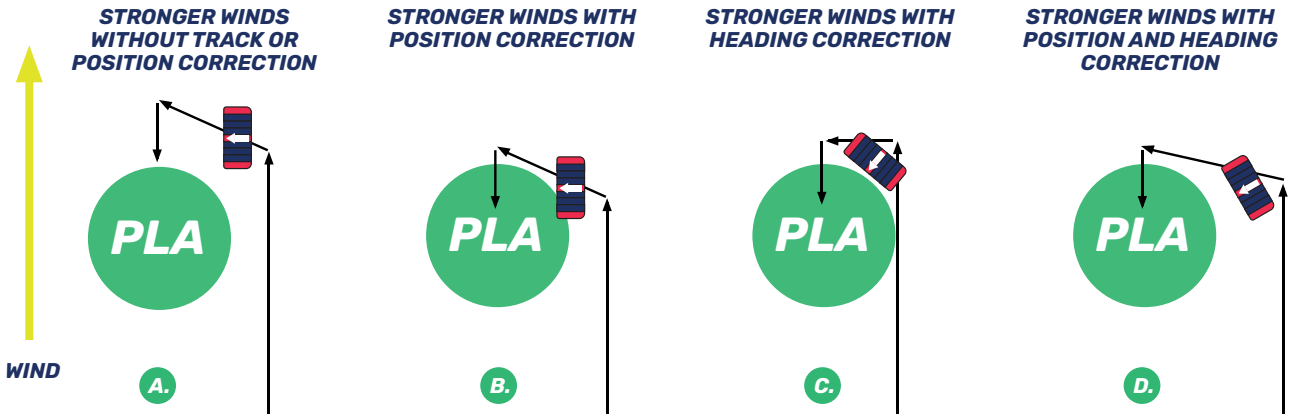


Figure 11: Base / Cross / Into-wind turning points

Not anticipating the drift is what often puts jumpers too far downwind before starting their final into wind leg. If you plan to be aware of this you shouldn't get caught out as shown in (A) above.

The simplest way to compensate is to move the turn point more up wind as in (B).

(C) shows you could compensate by turning at the original point but turn your heading more towards the PLA. If, however, you leave it too late to make this turn you will already be too far down wind to make it to your intended landing area. Furthermore, will also shorten the distance you will travel on your cross-wind leg which can lead to you landing nearer the edge of your landing area, and flying your into wind leg closer to those still on their downwind leg.

(D) is a combination of heading and track correction, with the advantages that you can see traffic to your right; you are not too far downwind and are in a better position to turn into wind higher if necessary.

As the wind strength increases you need to be aware of the effect it will have on your drift and be ready to adjust as necessary. One option can be to bring this turn point closer to your landing area, so that your pattern is not quite as wide to reduce the drift. However, this should not become habit, as flying too close on the downwind leg encourages looking down at the landing area, not looking in front at canopies flying into wind towards you. Also, with a very short base leg it becomes nearer to a 180 degree turn rather than two separate discrete 90-degree turns which means you have to fly past where you want to land, and with your back to this area it is difficult to see any hazards.

↘ **One-thousand-foot point**
This is the point from which the landing pattern begins after you leave your holding area, this is the start of your downwind leg. From the information you have gathered above you should be able to work out where you would like this point to be.

Your downwind leg should always be flown parallel to your final into wind leg, with an offset the same distance that you will fly on your base leg. As described above the downwind to base turn point is dependent on the wind conditions. The stronger the wind, the further you will travel across the ground and the longer downwind leg will be. Therefore, it will also be necessary to move your downwind leg start point to allow you to fly this leg without too much need for adjustment, and still arrive at your base leg turn point at the correct height.

The more accurate you are with this first set-up point, the more accurate your landing is likely to be. If you pass over this point at exactly one thousand feet then you can go straight into your landing pattern. If you are too high, or too low, you can amend your plan to suit, by either controlling the canopy to maintain or lose altitude, or by changing the landing pattern, or if needed choosing a new landing point. Remember that just because you have entered your landing pattern others may not have and it is vital that you keep maintaining a look out for other canopies.

↘ **Two-thousand-foot point**
This is an interim check, you should be preparing to start your landing pattern and making any adjustments necessary to meet it at the correct height. All canopy exercises should be finished by this height to allow you to concentrate on the landing pattern.

You should also be making a definite decision that you can make it safely to your intended PLA. If you have not made it to your holding area you need to be thinking if you can make it through to your landing pattern set up points. If you are not sure then you need to be considering an alternative safe landing area.

↘ **Opening point**
Working with the run-in direction, the wind strength and direction, and where we will be in the exit order, we should be able to predict roughly where you are likely to open your canopy. This gives you your first point to assess your flight plan with.

Prevention.

Now you have made a plan you should check if you can make this plan work.
Am I capable of handling all these conditions?
A large canopy without much weight under it can be more mentally demanding to fly as you may end up going backwards in strong upper winds, and this can become stressful.

You may also be coming straight down after your final turn, so you must ask yourself:
↘ can I fly my pattern well?
↘ can I land straight down / going backwards?
↘ Will anything you have planned change quickly? For example, is there bad weather approaching
↘ Are the winds forecast to change?

Prior to achieving an 'A' licence a student is limited to 15 knots ground winds, which you may have handled well. Now with an 'A' licence the ground speed wind limit becomes 20 knots. If student skydivers are on a hold you might think "great, more slots", but are you able to handle the full extent of these conditions?

Remember, no one is forced to jump. Make sure you make the right personal decision and if you are not happy wait and check the conditions again. The conditions being above your personal limits should not be part of your motivation to downsize to a smaller faster canopy. This may give you more penetration into the wind, but can be more unforgiving of inexperienced piloting.

Although the conditions may be "in limits" they may not be in your own personal limits.

Flight plan conclusion.

When you have made your flight plan, double check it. This can be done by watching other canopies from the ground, asking yourself if they look like they are in the right place or if they are making hard work of it. Do not be embarrassed about asking for help with your flight plan.

Your instructors may have a printed map you can draw on with whiteboard pens, or some people find it helpful to print a Google Earth map of their drop zone to draw on the winds and their canopy patterns for that day.

Remember a flight plan cannot always be followed exactly; where you open can change and the conditions can change. But with a plan to start from it is less stressful to amend this initial plan and land successfully on the landing area.

In more challenging conditions the flight plan becomes more important and having it already well practised is vital.

SECTION 3B: USING AND ADJUSTING YOUR FLIGHT PLAN

Once open you should carry out all your safety checks and fly clear of all other canopies. You should then check straight away that you have opened in your intended area relative to your flight plan and begin to follow it.

This section will look at how to measure if your flight plan is going as intended and how to deal with factors that can cause you to have to modify the flight plan you have made.
Remember that sometimes things are outside of your control, but you must be able to deal with them.

Regardless of how the jump has gone you must forget it and concentrate on the canopy flight. You can debrief the freefall later, but you must land the canopy to be able to go and do it all again.

Under Canopy - Traffic Priorities TAP.

You will have already been taught the first set of priorities that you will encounter under canopy.
You always check your canopy and ensure that it is fully deployed, free from all nuisance factors and fully controllable before carrying out any further manoeuvres.

For the rest of your canopy flight, you can use the following mnemonic in conjunction with your flight plan:

T - TRAFFIC
A - ALTITUDE
P - POSITION

TRAFFIC.
Traffic will always be something to avoid. Initially, once you have confirmed you have a good canopy, your next priority must be to ensure that you are in clear airspace. Have a good look all around and if there are any other jumpers near to you or flying towards you, steer away into clear airspace immediately.
As you descend you should keep continually asking yourself:
↘ Where is the nearest canopy?
↘ What direction are they going?
↘ Are there any canopies close to the beginning, middle or end of their manoeuvre?

ALTITUDE.
Initially you need to ask, "Have I opened at the correct height?" as this will immediately affect the flight plan process.
If all is going to plan you need to constantly ask yourself:
↘ Am I able to make / stay in my holding area?
↘ Have I got sufficient height to carry out my next manoeuvre without it affecting my flight plan?
↘ Am I above the minimum height needed for the manoeuvre?
↘ With the height available, can I still land safely on the PLA?

POSITION.
This is when you check where you are, relative to the altitude you have just checked, and see if you can carry on with your flight plan or if you need to modify it.

TAP should become your new mantra, TAP, TAP, TAP... Once ingrained it becomes more natural to assess if you are in the correct position to do what you intend, to adjust your plan, and decide what will have to wait until the next jump.

TAP can be implemented as a "scan" that you follow as per Figure 12

Figure 12: Traffic, Altitude and Position

As you descend the references you are checking against will change, but the process will be the same Traffic, Altitude, Position....

It may be that you have been taught another acronym instead of TAP, if your instructor or coach is happy with you continuing to use it then carry on. The important thing is that you are continually checking the three things regardless of what you call them.

Key skill to TAP is Observation.

Whilst flying our canopies all skydivers should maintain excellent all-round observation throughout the canopy flight from opening until landing. This is most easily maintained by keeping the head up and the eyes moving constantly to observe any other canopies within or close to your flight path. Skydivers should resist the temptation to fixate on the ground, a target, or become otherwise distracted.
We should be aware of traffic the whole time, not just when we ask ourselves TAP.

If at any point you see another canopy and assess that if they turned closer you might have to take an avoidance procedure then they are already too close. It takes two canopies to have a canopy collision but only one canopy to avoid a collision. Be proactive and always be the canopy that will make the appropriate avoidance procedure. Remember to steer away from a converging path, and to turn right on a head on course as shown in Figure 13.

Never assume the other canopy can see you, or that they will make an avoidance manoeuvre.

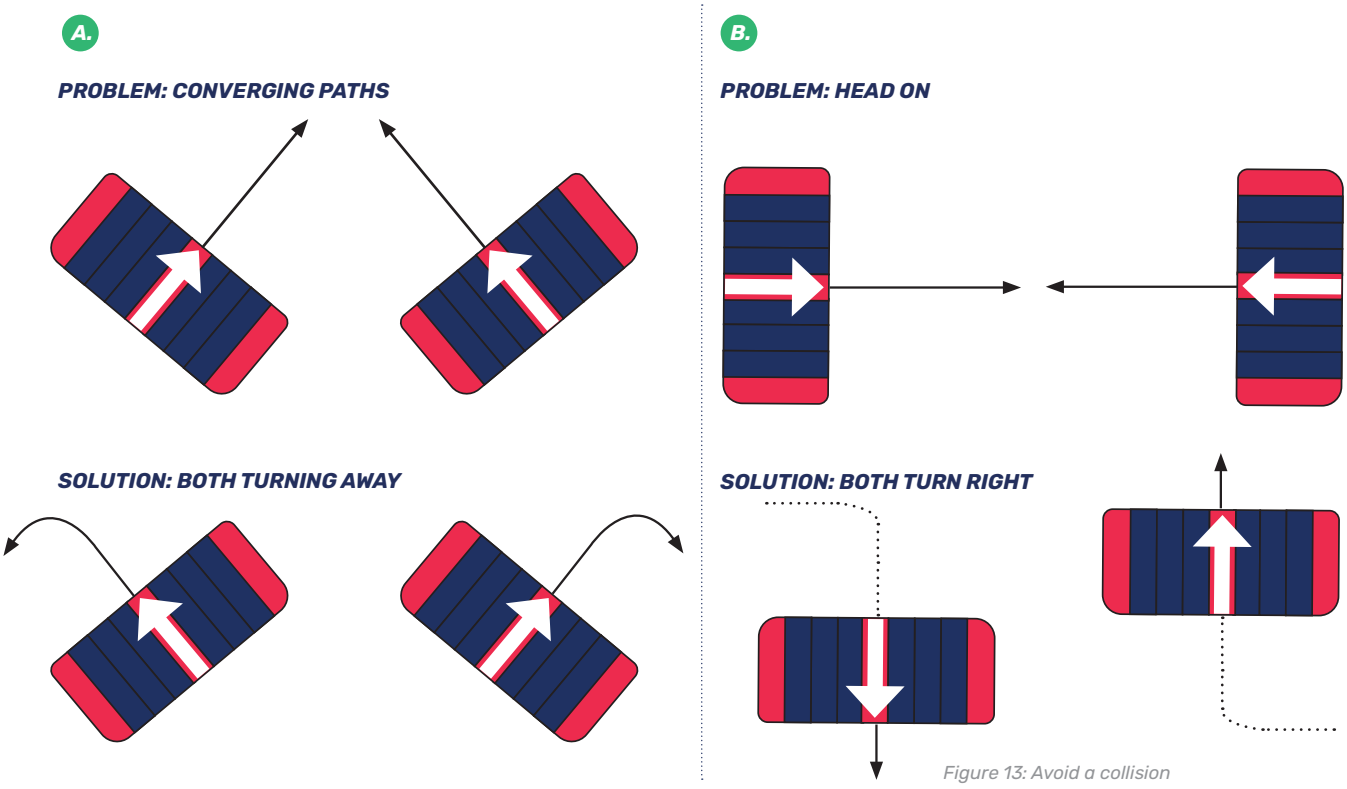


Figure 13: Avoid a collision

Position checks.

As you descend the questions you will need to ask yourself under canopy in the 'position' part of TAP will change. Relative to the airspace you have just checked and your altitude, will any other canopies or your height require you to change your plan?

After opening:

- ↘ Have you opened in your intended opening point?
- ↘ Are you in the correct position relative to your flight plan?
- ↘ Will you still be able to land safely on the PLA?
- ↘ Will you make it to your holding area?

In the holding area or on the way back:
↘ Will you still be able to land safely on the PLA?
↘ Can I stay here until my landing pattern?
↘ Am I going to make my landing pattern set up?

Landing pattern:
↘ Have the winds changed (e.g., Am I travelling back faster than anticipated, do I need to change set up points?)
↘ Will I remain clear of hazards?
↘ Will I land where I want and, if not, what changes do I need to make?

If you are in the correct place, we must ask ourselves "will my next manoeuvre take me out of place?" If you feel you will not be able to land safely on the PLA you must choose an alternative landing area that you can use.

"The Accuracy Trick."

You need to be able to assess if you will make it to a point of your flight plan, and also if you will clear any hazards.

Working out if you will reach a point is a technique that should be practised on every jump, regardless of whether you open in your intended area or not. The more you practise, the more competent you will be at working out whether you are actually going to reach it and be able to deal with that sooner.

Your canopy will fly with a glide ratio through the air. The block of air you are in may also be moving, this is the wind. From first principles: when you open, look down at something on the ground not far in front of you, you should fly over it and it will go down in your field of vision. Similarly, the horizon, which you can never reach, will go up in your field of vision. If you then work a little bit up from the first and down from the horizon you will find "the steady point". This is where you would land if you didn't make any further control inputs. You should see motion in the areas you will cover, or not reach as shown below in figure 14.

Figure 14: Finding the steady point with the accuracy trick

Once you understand this you can use it to judge if you will make it to your intended area.

Pick the centre of your intended landing area as your reference point on the ground. If the point is going down in your field of vision and assuming you do nothing else and the wind doesn't change, you will overfly that point. This is obviously a good situation to be in, as you should be able to fly your landing pattern and land on that point.

If the point remains steady in your view, as in the angle doesn't appear to change, then this is the point where, if you did nothing else and the wind didn't change, you would land. This isn't so great as if you are flying from upwind you will probably have to take a downwind landing to land on that point. If this is the case then you will need to try and increase the distance that your canopy will cover given its time in flight to allow you to turn back into wind, or pick a different landing point.

If the reference point is going up in your field of vision, then you won't make that point and will have to try and increase the distance that your canopy will cover. If this doesn't work, you will need to choose another landing area.

If you decide that you need to find another area to land, you should then repeat the process using that area as your reference point.

This technique can equally be applied to reaching the PLA after opening; reaching a holding area or a set-up point; or clearing hazards at any point in your flight plan.

Increasing the range of the canopy using toggles.

If you have found that your intended landing area or reference point either remains steady or is going up in your field of vision, you need to try to make the canopy fly further whilst losing less height by increasing the range of the canopy.

Using toggles to extend the range will only work if you are upwind of the landing area or reference point and flying towards it, i.e., with the wind at your back.
When you want to extend the canopy range in the same direction as the wind you can apply brakes, by pulling down evenly on the steering toggles. This will slow your descent rate of the canopy, thereby increasing the time in the air, giving the wind more opportunity to extend the canopy's flight given its time in flight.

To learn this technique, you will need to practice and find out how much brake we will need to apply:

- Keep your eye on the point that remains steady and apply about a quarter brake. Hold that position for about 5 seconds and look to see if your steady point starts to go down in your viewpoint. If it does then you have just increased the range of your canopy and will make it past that point. Check this point against your flight plan to see if the new range will be sufficient to correct your flight plan. If you think you need to extend it further go to stage 2.

- Choose your new steady point and apply a bit more brake. If that point starts to go down in your field of vision then you will make it to that point and beyond. Again, check this point against your flight plan to see if the new range will be sufficient to correct your flight plan.

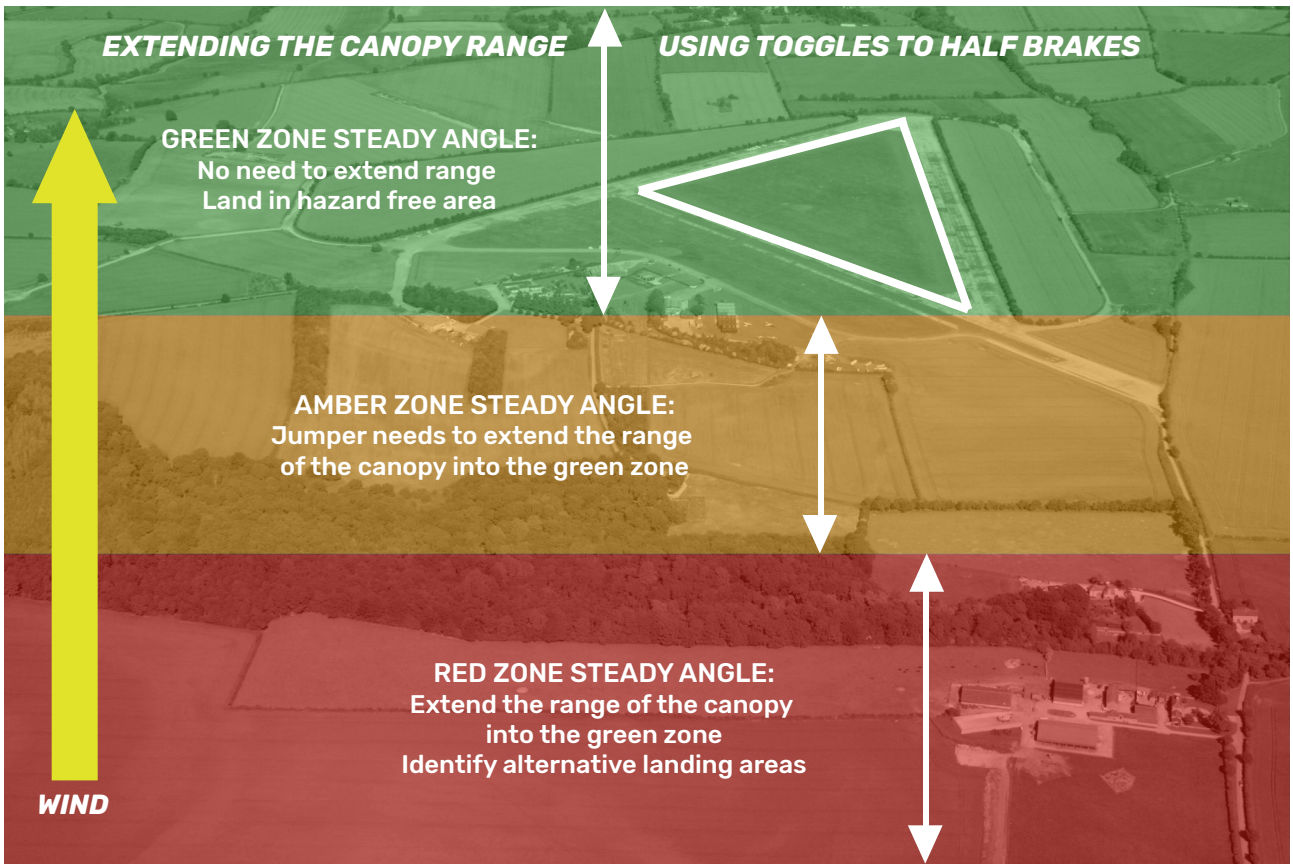


Figure 15: Extending the canopy range -Photo courtesy of Stuart Meacock at Hinton.

The diagram above shows the effect of applying the brakes, if your steady point is in the red zone you will not make it to the landing area shown in the white triangle. If you apply some brake and you find that the steady point is now in the orange zone you can see that this is still not enough and you need to extend the range further. If your steady point was originally in the green zone you should make it, but must make sure you will have sufficient height to turn back into wind. If you feel 'uncomfortable' being further away you can still extend the range and lose the height once you are closer.

If you continue this sequence, you will inevitably find a brake setting where the steady point starts to go up in your viewpoint. This indicates that you have gone beyond the optimum brake setting for that day (you have applied too much brake), your canopy is said to be "sinking". If this is the case go back to the last brake setting that gave the best glide angle.

Remember:
If you have any concerns that you may not make it to a point of your flight plan or your landing area you must try and extend the range as soon as possible. Extending it too late can give you a false sense of security that you will make it, but you may end up without sufficient height to make a turn back into wind (as shown by the yellow line below in Figure 16).

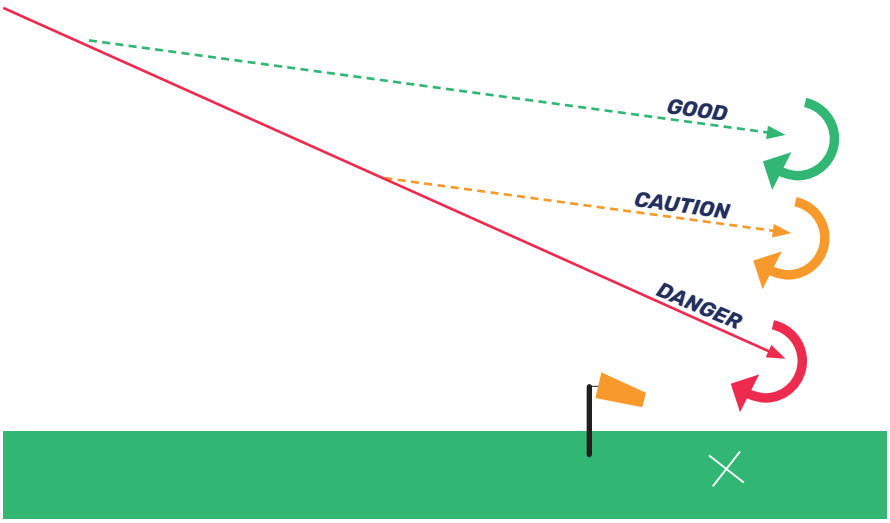


Figure 16. When to extend the range of the canopy.

The steady point is the place where you will land if you do nothing else and the wind does not change. If you are flying with the wind from an upwind location, it will inevitably mean a downwind landing. You should therefore choose an alternative place to land, if possible, between your present location and the steady point that will give you enough time to turn into wind. However, it may be that the most appropriate area to land is actually behind you and back up wind.

A lot of incidents happen with people overextending the range of their canopy and making unnecessary low turns to get back into wind. A decision made earlier could have prevented these incidents.
When using the accuracy trick and trying to increase the range of the canopy, make sure you keep your head at the same angle throughout. Lifting your head up as you apply brake will give you false information on where the canopy is actually going to land.

Avoid getting so fixated on angle changes, steady point shifts, that you lose altitude and spatial awareness. Always keep using TAP and make sure you leave yourself plenty of altitude and space to plan a safe approach and landing, be it on the PLA or otherwise.

Remember, this technique to extend the range will only work if you are upwind of the drop zone travelling with the wind at your back. If you find yourself down wind, applying brake will decrease the forward speed of the canopy and, in most instances, the distance covered.

Increasing the range of the canopy into wind.

If you are downwind, use the accuracy trick to work out whether you will make it back to the drop zone. You can try to increase the forward penetration of the canopy by adjusting your body position.

This is achieved by reducing the drag as much as possible:
↘ Legs together.
↘ Raise the knees.
↘ Arms up at full drive with arms behind the risers.
↘ Leaning forward slightly against the chest strap.

On larger canopies this will not suddenly increase the performance of the canopy, but may be enough to stop you going backwards if the winds are strong.

If, after trying to increase the penetration, you are still not going to make it back, then work on choosing the safest area to land in that you can find.

You must always decide early. Locating an out landing and flying a safe pattern into it is far more favourable to finding out you won't quite make it back at 500 feet and needing an urgent re-evaluation of the situation.

Increasing the range with rear risers.

You will hear people talking about “using their rears to get back”. At the CT1 and CT2 stage the rear risers will probably be too heavy to hold down for any significant length of time to get the benefit. However, as you change canopies you may find that this is a technique that will work for you. Before you try however, you should get briefed by an Instructor or Coach.

Using rear risers to adjust the glide angle is an advanced technique that is often performed incorrectly and can actually reduce the distance flown if not done correctly.

The perceived advantage to using the rears instead of toggles is that this method does not increase the drag as much as the toggles. The canopy will fly slower but is generating more lift than in its normal flight configuration. As with the toggle method hopefully the canopy will then travel further with the wind when coming back to the PLA from up wind.

The disadvantages are as already stated: the rear risers can be heavy to hold down compared to the toggles, and some canopies will stall more easily on rear risers with less warning than stalling using the toggles.

Furthermore, the rear risers on modern canopies can appear too efficient! They can encourage jumpers to push their luck to try and make the PLA. The jumper's frame of reference slows down. When the jumper realises that they need to make a flat turn they do not allow for the height lost as the canopy accelerates back to its normal flight characteristics, which happens as the risers are released, and before the toggles can be pulled to make a flat turn. Therefore, when already low the canopy loses more height quickly before the flat turn can be made, often ending in an injury. If you make sure you transfer from rear riser input to braked slow flight above a safe height, by 1500ft, you will already be in a better configuration to make any required flat turn.

Figure 17 below shows a canopy that has been stalled on a rear riser landing; you can see how the canopy has deformed. This landing technique must not be undertaken without the appropriate coaching.

Figure 17. Rear riser landing under a stalled canopy by Paul Dorward

Only attempt to extend the range of the canopy with the rears after being briefed appropriately.

If you do use the rears, you must transfer from the rear risers to braked slow flight by 1500ft and have a safe landing area selected.

Adjusting your flight plan.

At all times under canopy, you must be the pilot and not just a passenger; you must assess and take control of the situation.

The section below is to help you make a better assessment of your flight plan so you are less likely to end up stressed and make a mistake that could cause you injury.
It is impossible to list every eventuality and give a correct solution. Below is a list of common adjustments you may need to make to your flight plan, but the key is to assess and act early.

1. Not opening in the expected area
Don't panic. If you open further up or down the wind line than you expected, first assess where you are relative to the original plan and identify where you ideally want to be, then use the accuracy trick to see if you can make it to that holding area. If you are closer to the PLA than expected, try to get to the holding area being aware of other traffic making its way back towards it; if you are further away you need to extend the range of the canopy earlier rather than later. If successful you can always lose excessive height in the holding area.

If you are off the wind line, assess if you can make it across back onto the wind line, being aware of the cone of drift, and if you cannot then you should select a safe place to land off the PLA allowing you height to assess and select a safe hazard-free area.

2. The conditions have changed

a. The wind direction has changed

You may not be able to see the windsock from where you are, but you should be able to assess your own drift. If you look down and see that you are crabbing you should correct for this and assess where your set-up points are. If you turn your canopy and face what you think is into wind, you should be able to see if you are going directly forward, or in very strong winds backwards. If you are crabbing then you are not directly into wind, as shown in Figure 9: The difference between 'heading' and 'track'.

If you can see the windsock pointing in a different direction or have assessed your drift you can rotate your flight plan as shown in figure 18: Change of wind direction.

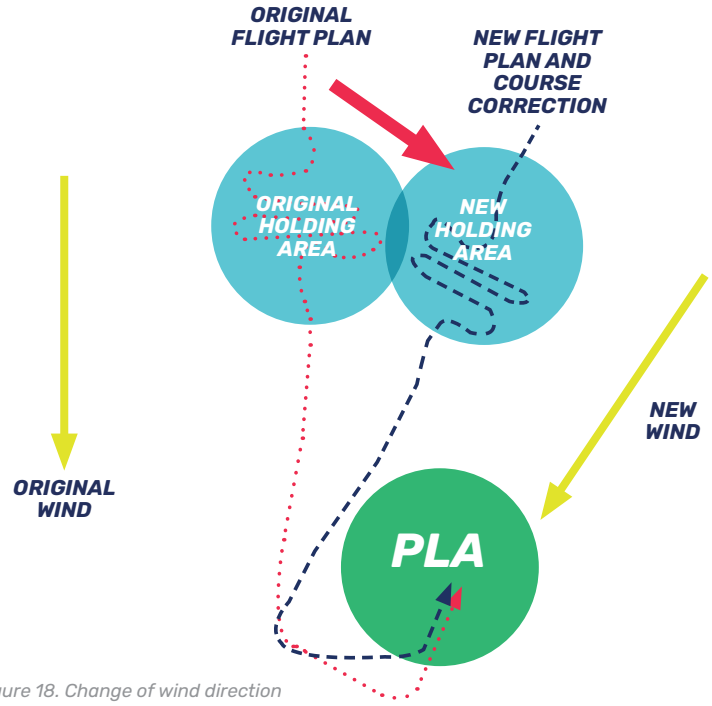


Figure 18. Change of wind direction

Under canopy you will also need to check the landing direction if an indicator is used.

Care must be taken on the final approach as others may still be landing in the originally planned direction. In this case you may need to accept a cross wind landing, or elect to land clear of the other traffic.

b) The wind strength has increased

If you find yourself heading back to your holding area quicker from opening upwind, or slower from open downwind than expected, you will need to assess your drift. If you are not going forward when facing into wind, then the wind strength is strong, and you must try to stay upwind in your holding area to be in position to start your planned landing pattern. You must be aware that if the wind has picked up you must concentrate on flying as good a pattern and any canopy exercises may need to wait until the next jump.

If you suspect that this is the case, another clue can be any other jumpers you can see. If they are all 'holding' into the wind, there may be a reason. On your downwind leg, which will be faster than expected, you may clearly see those on their into wind landing leg not going forward much. These clues should lead you to initiate your base leg turn earlier and be prepared for drift during the crosswind leg. Remember to keep assessing to try and stay within the cone of drift or you will not be able to make it back to your intended landing area.

3) Lower altitude than planned

You may have opened lower than you wanted to, or have lost height dealing with a nuisance factor. This

can lead to you not being able to make it back to the PLA. You must make an early decision whether you can make it back, and find somewhere safe to land off the PLA if not. You must not keep saying to yourself, "if I clear that field, I can make it there, and then try to get there...."

4. Congested Holding Area.
Larger aircraft means more jumpers all heading to a similar holding area. Larger PTOs may also be using multiple aircraft that are dropping jumpers relatively close together. You may find that you end up catching up the tail of the previous lift, which are also more likely to be the slower canopies, and in all probability lower experienced, jumpers.

You must limit the turns you do, fly predictably, and be aware of all those around you. Even if you believe you have the right of way you should not expect everyone to have seen you, and you should refrain from attempting any CT exercises. If you feel uncomfortable, try to move to the edge of your holding area, being aware of the cone of drift so you won't land off the PLA, and take a wider circuit and land a little further away. It is better to have a slightly longer stress-free walk than end up not wanting to jump again near people.

Further canopy flight considerations.

HOW TO DEAL WITH TRAFFIC
Traffic avoidance will remain your priority for the rest of your canopy flight. The risk of canopy collisions increases with more jumpers in the sky. As you complete your student jumps and prepare to jump with other licensed jumpers, it is vital that you learn to always avoid all other canopies. Use these three rules to help you stay safe:

1. Never fly towards another canopy.
You cannot assume that they have seen you, you must always assume they haven't.

2. Never fly directly above another canopy.
They cannot see you because their own canopy is in the way.

3. Never follow directly up and behind another canopy.
Their canopy disturbs the air as it flies through it. If you fly through this disturbed air, you may encounter their wake turbulence which can affect / collapse your canopy. See Section 6 Further Survival Skills for more details on turbulence and how to deal with it.

"The Stack"

The "stack" is the order of the canopies once open and flying back to the PLA. There will be a range of canopies on every lift and it often makes sense for the smaller, faster canopies to land first out of the way of the progressively larger remaining canopies.

When you consider where you fit in the whole lift as part of your flight planning stage you may be able to amend the exit order with the Jumpmaster to sort out any possible canopy conflict. Sticking to the stack should be part of your plan.

However, this is not always possible and you may encounter a conflict in the stack. This should be sorted as high as possible to allow everyone enough time to plan a safe landing.

If you need to overtake, ensure it is safe to do so and that you will not interfere with anyone else's flight plan. You can speed up your descent by carrying out a few turns; do not just spiral down through the stack. If you find that you are constantly catching up the parachutist in front, but do not want to pass them, use your steering toggles and slow flight to stay above them. Be aware of causing difficulties to the people further behind you. If this does not work, then think about using another part of the landing area to allow you a safe landing pattern in clear space.

If in doubt remember:
1. If your canopy is faster, you should overtake high, don't leave it until finals to have a traffic problem.
2. If your canopy is slower, don't overtake, take your time and fit yourself in with the traffic flow and use brakes or risers to maintain your distance if needed.

3. High performance canopy pilots, licensed skydivers and Tandem Instructors must give priority to solo student skydivers.
4.High performance canopy pilots and licensed skydivers must give priority to Tandems and solo student skydivers.
5.High performance canopy pilots must give priority to all other canopies.

Fly Predictably and Conservatively.

Most people at some stage will have been put off their own canopy descent by someone else flying unpredictably nearby or in their field of vision. This can be distracting ad can cause you to lose track of where you are and put you out of position relative to your flight plan.

If you have had a bad experience where you have been scared by another jumper's canopy flight and have the appropriate qualifications, B licence + 100 jumps, try a CF jump or flying relative to a canopy coach to familiarise yourself with the experience. An easily panicked jumper is at a higher risk of making a mistake than a calm and collected canopy pilot.

If we think about the bigger picture, we are leaving the aircraft spread out along the jump run but are trying to return to relatively the same place.
If you fly conservatively and reduce the number of turns you do, you will not be that distraction to other jumpers.

If all you want to do is to razz around on your own canopy, it is your responsibility to ensure your airspace is clear and that you will not be a hazard to other jumpers. The best way to do this is to go and jump solo.

Cutting your losses.

You may feel that with your assessment you are not going to make it back to the PLA as intended.

Decide if you need to land off early and stop trying to push it to get back.

Fewer people are injured landing off the DZ relative to those injured trying to get back and making low turns.

The height at which you make this decision height, you must set with your experience for your DZ and in consultation with your CI or instructors.

Flight Plan Summary.

There is a lot to consider in a full flight plan and it takes experience to be able to deal with all the changes that can happen under canopy.

Try to stick to the following list:
↘ Make a good plan and try to stick to it.
↘ Use TAP.
↘ Adjust your plan as necessary.
↘ Adjust the range of the canopy earlier rather attempting to do it during your landing pattern.
↘ Fly predictably and conservatively.
↘ Try to keep to the stack.
↘ Choose an alternative landing area if required by a suitable height and stick to your decision.
↘ Adjust your landing pattern to suit the conditions earlier rather than later.

SECTION 4: LANDING

If you have followed your flight plan and landing pattern, you must now turn your attention the landing. We will discuss an improved flare technique and some tips if the landing pattern does not go quite to plan.

The "Two-Stage" flare.

You were probably taught "Wait until 10-15 feet above the ground, flare fully, and hold it down". This simple technique is great for the first few jumps and due to the good design of student canopy available means people generally land safely. However, it doesn't take into account; people are not good at judging 10-15ft; people flare at different speeds; all the canopies will have different weights underneath them.

To progress your technique, the idea of the "two-stage" flare is to feed the flare in by pulling progressively down on the toggles to approximately two thirds to three quarters of the toggle range. Ideally you will then be at about 3 ft off the ground when the full toggle depression can be completed.

(Example "Canopy Training: 2 Stage Flare" & "Skydive the Mag" on YouTube)

By way of explanation, the canopy achieves enough lift during the first half of the flare to slow down its descent rate. As air speed is reduced, the canopy ceases to generate as much lift and therefore starts to descend towards the ground, by applying more brake at this stage, we convert the remaining airspeed into lift for a controlled landing.

Advantages

- Allows you to correct for minor errors of your judgement in the flare so you can finish it as close to the appropriate time as possible.
- The second and more critical part of the landing is performed at a slower speed, thus making it easier to judge.
- By performing the flare over a longer period of time more speed is lost allowing a slower and more controlled landing in any wind condition. This will also begin to develop the skills we need for smaller and more responsive canopies.
- It stops people from applying the brakes too aggressively and potentially stalling the canopy. This type of self-control is a skill required with higher performance canopies.

Disadvantages

- Psychologically if someone has had a poor landing, they begin to believe that if they start to apply the toggles earlier it will slow the landing and make it softer. However, you actually need the speed to transfer into lift. So, applying the toggles too early will in all likelihood actually lead to a harder landing.
- If you find yourself with significant pauses between the first and second stage you may be initiating the first part too high. Equally if you do not have time to fully complete the flare you may be initiating the first part too low. In either case try and get a coach or instructor to film and critique your landing.

Landing Priorities.

You should already have been taught the three landing priorities. These are:

1. Land under a flat, level, flared canopy.
2. Land into a hazard free area.
3. Land into wind.

Remember that whatever happens on any jump you must land the canopy and do it safely to be able to jump again. Therefore, whatever flight plan you have flown, or wherever you have ended up, these priorities must be applied in this order wherever you land every time. In particular, landing into wind must not be made at the expense of the first two priorities.

From our brief examination of how the canopy flies in Section 2 we should now understand:

1. LAND UNDER A FLAT, LEVEL, FLARED CANOPY

- **Flat** – the canopy has recovered to its normal flight and the lift the canopy is generating is up and not out as happens in the turn. Remember, you could have made a turn, removed the input but the

canopy is still diving towards the ground. This will become more important as you move to canopies that take longer to 'recover'.

- **Level –** there is no asymmetry in any input being applied by toggle or harness input.

- **Flared -** flaring the canopy slows both its forward speed and rate of descent. Therefore, if you are to hit anything, be it the ground or a hazard, it should be at a lower speed. This should reduce the risk of injury as compared to flying at full speed on landing.

As discussed above the speed of the flare should be dictated by the canopy to avoid stalling the canopy. It is permissible to make minor changes to your heading by using short toggle inputs, or "trim turns", but your canopy must have time to recover to its normal flight characteristics.

You must not attempt to make a turn close to the ground that you cannot complete or that does not give the canopy sufficient time to recover back to normal flight.

2. LAND INTO A HAZARD FREE AREA

Avoiding hazards is a fundamental on each and every jump. The following principles will help you to avoid hazards:

- Plan ahead.
- Avoid hazards early.
- Focus on a safe area.

Plan ahead

Knowledge of the Drop Zone from your DZ brief and knowing where you can land safely if you cannot make the intended landing area is invaluable. If you have planned your flight plan properly you should be aware of the most likely potential hazards. Hazards tend to be stationary and don't appear out of nowhere!

Avoid hazards early

The best way to avoid hazards is to identify and steer clear of them as early as possible. Be careful in the event of an off landing. If landing in an unfamiliar area, look for the less obvious hazards such as powerlines and plan to avoid them early.

Even if you cannot identify a physical hazard, you should also avoid colour changes as these often indicate a hazard, be that natural or manmade. To test this, look at your DZ map and look at colour changes, between fields or wherever. You will see that whatever delineates the areas of different colours is likely to be some form of hazard, such as a fence, ditch, or even a significant slope.

If you have to avoid a hazard you must make an early decision and if necessary, land cross or down wind. Remember to flare and adopt a good landing position.

Focus on a safe area

If you keep looking directly at an object, there will be a tendency to steer towards it. This is known as target fixation. Make a positive decision, turn your canopy onto a safe heading and focus on a clear safe area. You should then avoid the hazard(s).
Remember it is better to use small flat turns make any adjustments to your heading if you are at low altitude.

3. LAND INTO WIND

Flying into wind slows our ground speed down. The slower our ground speed, the lower the risk of injury. As described above the canopy loses height and gains speed in a turn. Therefore, if you have made a mistake with the landing direction, you must resist the urge to try and turn back into wind.
If you have made your final turn and find that it is not into wind or there is a hazard, you should consider how much you can turn.

Diagram 15 shows example size of turns for the height you are at. The heights shown here are examples, for example a higher performance will need more height to make the same turn. Therefore, as you change canopy you will need to think about the heights.

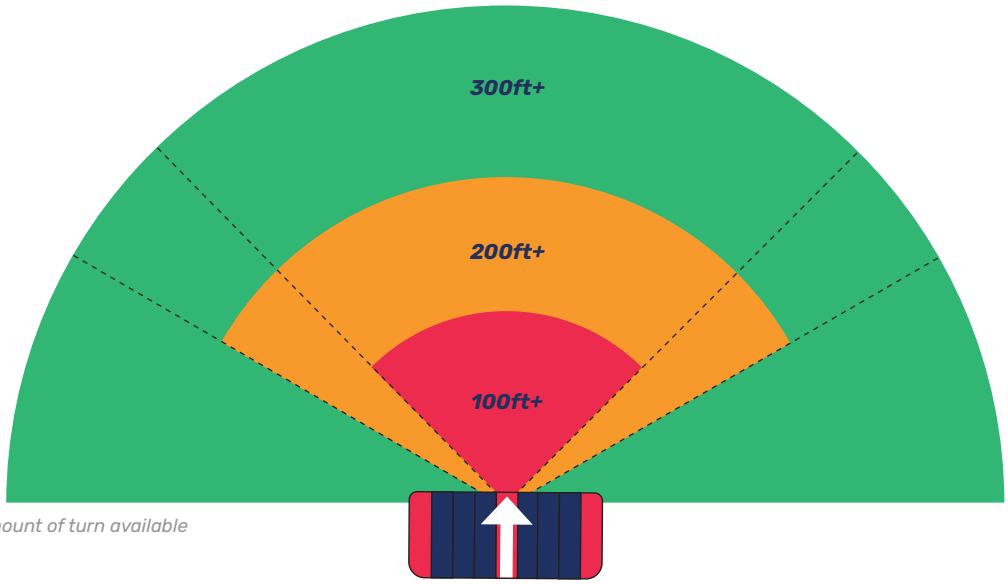


Figure 19. Amount of turn available

Example:
↘ 300ft 90° either side of straight ahead.
↘ 200ft 60° either side of straight ahead.
↘ 100ft 45° either side of straight ahead (i.e., a possible arc of 90°).

As you descend from your final turn you can see the amount you can safely turn reduces. You can still trim or turn away from a hazard you haven't seen, but only by a small amount. Landing downwind or cross wind are acceptable, the canopy flies the same and it is just the ground speed that changes our perception.

If you should find that you are in this situation and furthermore there is a hazard in the limited range you can turn in, you can still turn but still need to make the correct size turn for the height available.

The key point is that even though the hazard is there you still have options to turn, but now you are more limited. So, from 300ft you now only have 90° to the right of the hazard; 60° to the right at 200ft and 45° to the right at 100ft.

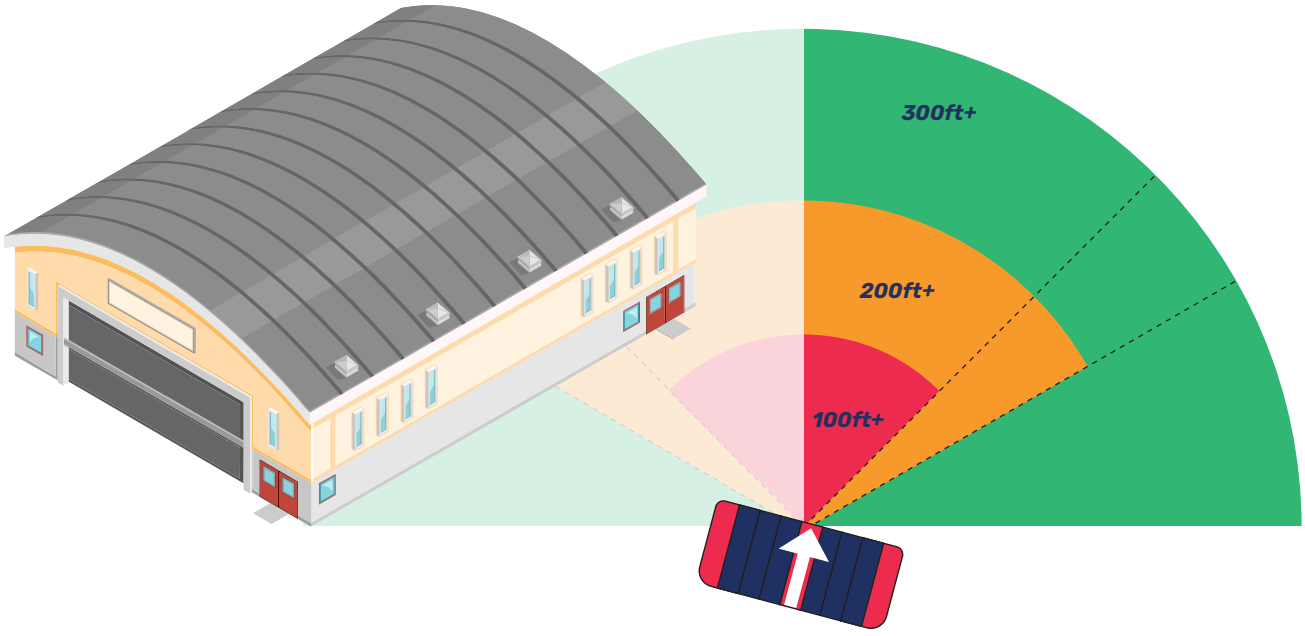


Figure 20. Reduction in the amount of turn available.

It is essential to keep calm and take control of the situation, and remember that you only need to make a small turn and you will land clear of the hazard. It may not be exactly into wind, but it is still a far better option than aggressively pulling on a toggle reactively and hitting the ground hard.

Using flat turns, you may be able to increase slightly the amount of turn you can make but you should be looking forward and checking for hazards.

Resisting the temptation to bury a toggle to "get out of dodge" is the hardest instinct to overcome, but can literally be a life-saver.

How to deal with

1. Cross wind landing

Landing crosswind can sometimes give the impression that the canopy is turning, normally towards downwind, when in fact it is crabbing across the wind. Counterintuitively, a lot of people will flare more on the side towards the direction of the crabbing and start the canopy turning. Now the canopy is not level and they will impact in that direction. If you are to land crosswind, keep the canopy level, flare evenly and be aware that you may be crabbing.

2. Down Wind Landing

We all make mistakes and most people have ended up in this position at some point. The key thing is to stay calm. It is important to remember that you are not descending any faster; all that has increased is your ground speed, which may appear to be pretty fast. Your increased ground speed will cause you to cover a lot more ground than on a normal landing. Therefore, it is important to look forwards and check for hazards, including other canopies landing into the wind.

Do not panic, a sharp turn at this stage can result in serious injury. The added ground speed will quite probably scare you, possibly tempting you into a high flare. Keep calm and concentrate on performing a smooth and even two stage flare. If it feels like it will be too fast to stand up or run, keep your feet tight together and raise them out to your front. Try to flare slightly froward in this case so your hands do not become the first point of contact with the ground, and aim to touch the ground with your feet first in front of you and sit down on one butt cheek to protect your coccyx, lean backwards and slide to a stop.

Figure 21: Sliding landing position

Flare recovery manoeuvre.

If you are making a turn and realise you are too low to complete it, you must still flare the canopy fully. This is a skill you can practise at altitude by initiating a turn and stopping it by flaring fully part way round.

You should also try this for the slower flat elevation and depression turns. In slow flight you need to be conscious of stalling the canopy (you will learn about your stall point in the CT1 exercises). You should remember that as you are carrying less speed the canopy will not generate as much lift in your flare, and the landing may be hard. Be prepared to PLF.

Common mistakes to learn from.

This section details some information that can help you under canopy.

GETTING STRESSED UNDER CANOPY

One of the most common causes for people making poor decisions under canopy is stress. If you find yourself getting stressed under canopy at any point, do not panic. This is a normal reaction to crowded airspace or having to make changes to your flight plan. The list below, with the acronym BLADA, can help you recover control of the situation:

↘ Brakes

Firstly, apply half brakes to decrease your descent rate and buy yourself some more time. Breathe, take a big deep breath and slowly exhale. This will increase the oxygen flowing, as you may have held your breath!

↘ Look

Look around and check what options are open to you. Check your airspace is clear, look for flight patterns to fit into, look for the landing direction. Identify any hazards as early as possible.

↘ Assess

Make an assessment of what to do, following your training for the stage you are at. Do you need to make a turn to follow the pattern? Are you about to land, and need to ensure your landing priorities are met? Remember flat and level flared canopy before anything else.

↘ Decide

Make a decision based on your assessment. This should be the safest course of action. It is better to have a slightly longer walk after landing further away, than put yourself into a stressful risky situation.

↘ Act

With your decision made you need to act and follow you intended action confidently. This action, e.g., turning, should be appropriate for the required situation. When over stressed we can sometimes make inputs that are too aggressive or too timid due to our body's natural reaction to dealing with fear.

FLARE TOO HIGH/LOW

This is very common, especially during the first couple of jumps. Looking straight down can cause "ground rush", an optical illusion that makes the ground appear as though it is rushing towards us. This distorts our ability to assess our actual distance from the ground. A great remedy is to look forwards at an angle of about 30 degrees towards the ground, look beyond where you are actually going to land. By looking ahead, rather than straight down, it is easier to judge your height above the ground.
Work on the timing of your flare by matching it with the speed that you are approaching the ground. If approaching fast, flare slightly quicker and if approaching slowly, use a slower timed flare.
If your problems persist, ask to have some landings videoed. This is a great tool to compare what you think you are doing, with what you are actually doing.

UNEVEN FLARE

An uneven flare occurs when one toggle is pulled down further than the other. This is definitely one to be avoided. As the canopy turns, there is a natural tendency to put a hand out in order to prevent a fall. This pulls the offending toggle down even further, and increases the rate of turn. A simple solution is to concentrate on pulling down evenly on both toggles, whilst executing your flare. This will be easier to achieve if you can see what your hands are doing. Try keeping your hands slightly in front of you, so that you can see them during the flare, and adjust as necessary to keep them even throughout. Another tip is to flare all the way until your hands or knuckles meet at the bottom of the flare. Concentrate on flying the canopy all the way until your feet are firmly on the ground. If you feel that you are going to fall over, adopt a PLF position and accept the fall. Again, viewing a video of your landing can really pay dividends.

High wind landings can cause you to think more about collapsing the canopy than actually landing it. This causes a similar situation to that explained above, where the jumper, subconsciously preparing to collapse the canopy after landing, ends up causing a turn before landing by pulling down on one toggle more than the other. In higher winds you will need to actively collapse the canopy, but only do this after the landing is fully completed and your feet are firmly on the ground. In other words, keep flying the canopy all the way to touchdown, and if you have got it wrong, or are unsure, adopt your PLF position and accept the fall. You should then release one toggle and collapse the canopy as quickly as you can.

NO FLARE

It sounds simple, but it is fundamental to any good landing that the canopy must be fully flared. Often people are seen to just not flare enough. To remedy this, get plenty of practise up high in the holding area whilst you have time. Once you are happy that you can make the landing area safely, try a few practice flares. As mentioned above, pushing your hands slightly forwards will allow you to keep an eye on how far your hands are actually going down during your practice flares, and aid you to committing the correct flare technique to memory.

LEG STRAPS AND / OR HARNESS ADJUSTERS UNEVEN

As discussed in Section 2 the harness can be used to turn the canopy. Therefore, if the harness is not fitted correctly, it can cause the canopy to turn. This usually happens when your leg straps and / or harness adjusters are tightened unevenly. The problem will normally go unnoticed during the early stages of the canopy flight, as you are most likely to compensate with the steering toggles subconsciously. The turn may also be so slight that it goes unnoticed at higher altitudes. The problem becomes more apparent when both toggles are depressed fully for landing because one side of the canopy effectively flares more than the other due to the imbalance in canopy loading, this causes a turn. To avoid this, make sure your leg straps and harness adjusters are evenly tightened.

Different wind conditions

HIGH WINDS

Higher wind conditions generally make landing the canopy easier, but it does however have its own problems.

When landing into wind the ground speed of the canopy, the speed that you appear to be moving across the ground, is slowed down considerably. Having a reduced ground speed makes it easier to judge the height for landing. If, however, the flare is started too early, it can be unnerving as it may feel as if you have completely stopped and are hovering above the ground. If the canopy is not directly into wind at this stage, you will find yourself drifting sideways during the landing which can be unnerving. If this happens, apply smooth toggle inputs, steering the canopy through the flare to maintain your landing direction and keep the canopy above your head, ensuring that you complete it evenly.

Both of these problems can be overcome by, as already mentioned above, continuing to fly the canopy. Using the two-stage flare technique can reduce the chances of flaring too high and make it easier to maintain a heading throughout the landing.

LOW WINDS

Low wind landings have the advantage of being less extreme if the canopy is facing into whatever wind is available. They do however have the disadvantage of making all landings appear faster. You will cover a lot of ground on your final into wind leg, so it is important to look well ahead for hazards and avoid them by making smooth toggle inputs. A faster landing can be harder to judge, as the canopy is unlikely to come to a complete stop. In this situation a two-stage flare will definitely help, as it will reduce the speed of the canopy before landing. Try not to rush the landing and remember the first stage of the flare is to level the canopy and reduce the descent rate, but you are not ready to land until the second stage has been carried out and you have reduced the forward speed. Try to keep your feet off the ground as long as you can and resist leaning to put a foot down until you are confident you can run the landing off. Make sure that you fly the canopy until the landing is over. If you think you are going to fall over, adopt a PLF position and accept the fall / slide.

And if it all goes wrong...

If it is inevitable that you will hit a hazard there is no point acting like a rabbit in the headlights of a juggernaut. **You must do everything you can to minimise the risk of injury:**

- ↘ Try to flare the canopy as well as you can so you slow it down.
- ↘ Legs together, turn your body side on to the hazard.
- ↘ Mouth closed, chin on your chest.
- ↘ Try to PLF if you can.
- ↘ Debrief your pattern and thought process with an instructor / coach as soon as you can to learn from the landing.
- ↘ Report any injuries to your CI.

After landing.

After landing it is also important to maintain airspace awareness of other canopies that are coming in to land. Some canopies can dive to the ground quickly and cover a large horizontal distance, even though they seem far away at first. All skydivers under canopy should make small trim adjustments if they find another skydiver on the ground within 10 metres of their canopy path. If you are on the ground and feel that another skydiver under canopy is going to collide or come very close to you, the best solution is to drop to the ground rather than dive to one side or the other. Wearing your helmet on the walk back until you are well clear of the PLA is also a good idea.

Landing Summary.

Apply the landing priorities appropriately on every jump.

Take time after each jump to consider the pattern you flew, and your landing. Think how you could have improved on any aspect of your flight. If you are not sure, ask, don't just hide from it.

Accept that sometimes we get it wrong and that to improve you must critique your performance. If you find you have a couple of landings that need improvement it is easy to lose confidence, but you must ask for help. Even just getting a landing videoed and debriefed can help correct errors and reduce the risk of later injury. Be willing to accept constructive criticism about your pattern and landing. Often, if we've had a bad landing, this can be hard to do, but listen as it may stop you having a serious injury in the future.

Learn to enjoy the canopy ride, it shouldn't be something to fear.

SECTION 5: GAINING YOUR QUALIFICATIONS

Now you have read and hopefully understood some more about canopy flight, this section sets out how to do the exercises to gain your CT qualifications.

Safety Considerations.

All attempts at the required exercises should be made:
1.After being briefed. All exercises must be briefed beforehand by an appropriate Instructor or coach.

2.Jumping solo. This is the ideal situation, as it will give you more control over where and at what height you open and should allow clearer airspace to carry out the manoeuvres. This is better than trying to tag the exercises on the end of a larger group skydive.

- **Opening high.** Between 5000 - 7000 feet should be adequate. Let the manifest / DZ control / jumpmaster / other people on the load know you are opening high.

- **On your current canopy.** These drills should be completed on the canopy you are current with, and not the one you want to downsize onto. You should understand these new skills on a canopy you have jumped already.

- **With a flight plan.** Prepare it and get it checked by your instructor or coach. This is more important now as your attention is deliberately being split between flying the canopy back and your exercises.

- **Using TAP.** Before carrying out any canopy exercise always check Traffic (other canopies), your Altitude (have you got enough), and Position (location in relation to the holding area and PLA).

- **In suitable conditions.** That will allow you to stay in the correct place to do the exercises. You should be in your holding area, in clear airspace and with confidence that the conditions will allow you to remain in that holding area and be able to make it safely back to the PLA. You should try and start any turn manoeuvres into wind so you won't travel as far across the holding area.

- **Above your minimum cutaway height.** It is unlikely that on a canopy in good condition any of the exercises will cause your canopy issues, but all canopy exercises must be completed above your safe minimum cutaway height and with sufficient height to still be able to fly the correct landing pattern and land in your intended area. To ensure enough time for this, all exercises should be completed by a minimum of 2000 feet.

- **Under supervision.** Your Instructor/Coach should ideally video, debrief and record your training in your logbook and on the relevant record sheet.

Pre-licence student CT exercises.

- **FLAT TURNS EXERCISE ON AT LEAST 3 DESCENTS.**

The aim of these exercises is to learn how to make your canopy turn with a minimum amount of roll and altitude loss. If you find yourself in a tight situation this skill may very well save your life.

On the first jump to gain a 'frame of reference' in clear airspace use TAP and make a large single toggle full depression turn. You should feel yourself roll into the turn and the canopy begin to pitch towards the ground. Do not go more than 360-degree turn. As you release you should feel youself swing back under the canopy; this is the recovery. You may feel a sensation of going up, which is the additional lift the extra speed causes.

Next depress the steering toggles so that they are at about half brakes, which should be just below chest level; this is 'slow flight'. The canopy's forward speed and rate of descent will decrease. Check your airspace and TAP and you will now try to make the canopy turn with as little roll as possible.
Do this first by elevating one toggle slightly. You will feel the canopy turn towards the depressed toggle, not as quickly as your first turn but the rate of turn and the amount you will swing out will increase if you keep the toggles where they are.

After say 90-180 degrees return to the half brake setting and the canopy will stop turning, use TAP and turn back the other way into wind by elevating the opposite toggle.

TAP and depress one toggle further down, this is the 'depression' turn, this should feel slower than the elevation turns, and you shouldn't feel yourself swinging out as much.

After say 90-180 degrees return to the half brake setting and the canopy will stop turning, use TAP and turn back the other way into wind by depressing the opposite toggle.

Ensure that you never pull the toggles down further than the position that caused the canopy to stall. If you do inadvertently stall the canopy, do not panic and smoothly carry out a stall recovery. Carry out a TAP check before repeating the exercise.

On further jumps you can increase the amount of turn to learn how to do these turns. But please note that if you need to make these turns close to the ground to avoid a hazard, you will probably only need to make a small turn to avoid it rather than attempting to make a full 180 degree turn to change your heading.

The turn sizes here are for you to practise the entry; the exercise; feel the sensation; and the recovery to normal flight.

(Example: search "Canopy Training: Flat Turns" & "Skydive the Mag" on YouTube)

This exercise is needed to qualify for CT and your A licence and must be carried out on three separate descents, debriefed and signed for by a qualified instructor.

↘ **EXTENDING THE RANGE OF THE CANOPY USING THE TOGGLES ON AT LEAST 3 DESCENTS.**
This is a technique that when used in the correct situation will allow you to travel further back to the PLA when you are travelling in the same direction as the wind. In light winds it may be difficult to appreciate the benefit.

Start by positioning yourself up wind of the PLA, TAP, then turn to face towards the PLA. Look for the steady point where you would land if you made no further inputs. Hopefully, in the conditions students can jump in you will find this position already beyond your intended landing area.

TAP and apply some brake, about 15cm and hold this position. You are now slowing down the canopy's forward speed and rate of descent. The steady point should rise in your field of view. The idea is that the block of moving air you are in will carry you further across the ground.

TAP and apply some more brake, again about 15cm, and check your steady point. You may find it goes up again in your field of vision and you would travel even further.

Repeat until you find the steady point coming down in your field of vision. This is the point where the canopy has gone past the best glide angle and now the canopy is not being as efficient. Go back to the last brake setting you had and hold it for a short while to extend the range.

Be aware that if you continue to keep applying the brakes you make approach the stall point and this should not be held.

Remember to keep checking your TAP as you practise this; in particular you must always make sure you have sufficient height.

This exercise is needed to qualify for CT and your A licence and must be carried out on three separate descents, debriefed and signed for by a qualified instructor.

↘ **DEMONSTRATE A REASONABLE LEVEL OF CANOPY HANDLING, FLYING THE CORRECT LANDING PATTERN AND LANDING SAFELY ON THE PLA.**
It is important as you near the end of your student jumps that you can show the ability to fly a correct flight plan. Within only a few more jumps, you will be a licensed jumper and might want to start to jump using slightly smaller or faster canopies. This may also be in higher wind conditions and flying and landing at the same time as all the other jumpers on your lift. The only way to do this safely is to be able to fly the correct pattern, and to be able to understand correctly what the other jumpers are intending to do, and explain clearly what you intend to do.
You will need to show the ability to land safely within your landing area, carrying out the correct flight plan for the conditions of that day.

Prior to jumping you should talk to your instructor and be able to tell them the following:
↘ Your intended landing area.
↘ Your intended landing direction.
↘ Your landing pattern including where your turn points will be.
↘ Your flight plan including your heights and check points.
↘ Your intended opening point and the aircraft run in direction.
↘ How you will deal with any eventualities such as opening in a different place to expected.

You should then be monitored to ensure that you fly your plan wherever possible, and if needed make the correct adjustments to the plan to still land safely.

This exercise is needed to qualify for CT and your A licence and must be carried out on three separate descents, debriefed and signed for by a qualified instructor.

Additional exercise: Two Stage Flares.

As discussed in the landing section the two-stage flare can be used to improve your landings. Although not explicitly part of the CT system this is a skill to practise. You must be briefed and cleared by your instructor before you attempt this exercise.

(Example search "Canopy Training: 2 Stage Flare" & "Skydive the Mag" on YouTube)

↘ **THE TWO STAGE FLARE:**
Check TAP and pick a heading. Make sure the canopy has been in full flight for at least ten seconds, this is a good habit to get into for your actual landings as well, then initiate the first stage of the flare to level the canopy out. As you feel the lift starting to fade then increase your toggle input evenly down to your 100% brake setting. At this point the canopy should just continue to move forwards slowly and you should still be on your chosen heading. Slowly let the steering toggles back up on to full flight / drive. Check TAP and have another go.

Try and complete as many practice flares as possible. This should at least give you increased confidence when it comes to landing the canopy at the end of your flight.
Creating a good flare from your canopy is much a case of developing a feel for how the canopy is reacting to your toggle input.

Notes:
The above flare technique descriptions have been kept deliberately short, as there are many different factors that will affect the flare technique used. To this end, it is imperative that you get a briefing from an appropriately qualified instructor or canopy coach before jumping an unfamiliar canopy or practising the above techniques.

If, during your practice flares, you find that the canopy is not staying on heading, it may well be because you are not depressing the toggles evenly or are leaning to one side in the harness. Try flaring with your hands moving down in front of you, rather than a circular motion out to the side. Your hands should meet at the same time at the lowest point that you can reach in front of you. If you have your landing filmed you can visually check that they are coming down evenly. Relax in the harness and just allow your arms to do the work during the flare.

SECTION 6: FURTHER SURVIVAL SKILLS

The following sections of the manual are aimed at qualified skydivers and gives extra information not previously taught.

Turbulence.

Now you are able to jump in stronger wind conditions you may encounter turbulence at any time during your descent. Turbulence is the disturbance to air that you are moving through. Your canopy normally relies on smooth air to flow over and under your canopy to create its lift.
Turbulence can be caused by a number of factors:

1. HEAT TURBULENCE:
This is caused when air is heated on a surface; it will stay stuck to the surface heating until eventually it pops off as a bubble or 'thermal'. Different surfaces heat at different rates, and as the air is released it rises up through the cooler surrounding air that sinks to replace the warmer air. Patterns of warm air rising and cool air sinking to replace it are responsible for making the air bumpy, or 'thermic'.

For example, a hangar roof or a large expanse of concrete / runway will heat up and cool at a different rate to a grass landing area next to it and this can cause turbulence if flying over those objects. The rising air also drifts with the wind so an area downwind of those objects could also experience severe turbulence, and should be avoided if possible.

Heat turbulence can only occur after undergoing the heating process. Therefore, it is less likely to happen at the start of the day. It also tends to start off small and then increase. So, if you feel it starting in the morning and it's a warm day it is unlikely to reduce until much later in the day as it cools.

In severe cases, heat turbulence can cause the air to rise and rotate, and in certain conditions this process intensifies and creates "dust devils". The rapidly spinning air can rise quite high from the ground and be catastrophic to canopies flying in or near them.

These conditions increase the likelihood of dust devil formation:
↘ Large flat areas clear of vegetation, such as desert, cropped fields or tarmac expanses.
↘ Clear skies to heat the area well.
↘ Light or no wind to prevent the heated air at the surface mixing with the cooler air above.

Dust devils, although rare in the UK, can occur in the summer, but can be very prevalent at foreign PTOs. They can sometimes be spotted by the debris and dust they lift up. If you see them starting to appear you should give consideration to whether you should be jumping.

Heat turbulence can also be associated with flying under or near to large cloud formations and again can be encountered at any altitude.

2a. OBJECT TURBULENCE
Objects in the path of strong winds will disturb its flow and cause turbulence. These can be manmade such as buildings or hangars, or natural such as hill formations, trees or hedges. The turbulence can extend downwind several times the height of the obstacle, and therefore you should allow a good safety margin of at least 10 times the height of the object to avoid its turbulence.
Object turbulence will not only be close to the ground. On windy days turbulence can be caused by the

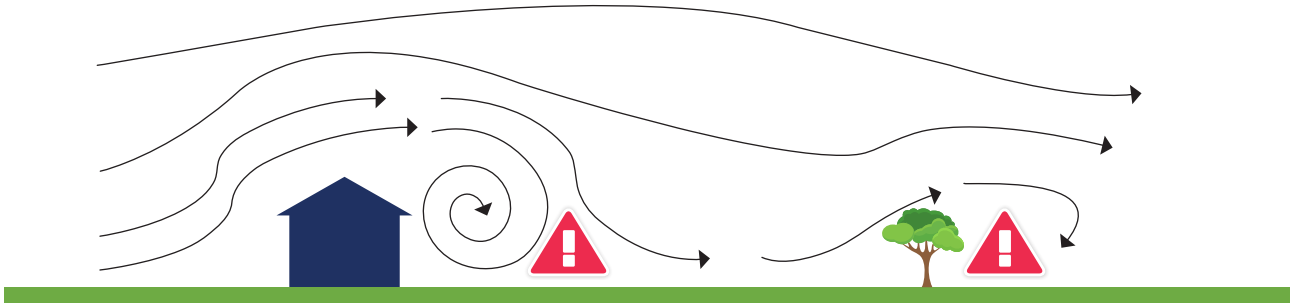


Figure 22. Object Turbulence.

wind passing over high features such as hills or mountains a long distance from the landing area. Due to the size of the features this could extend thousands of feet up.

2b. WAKE TURBULENCE
Moving an object through an airflow can also cause turbulence. As a canopy flies through the air, it disturbs it and as the air is moved the canopy will cause vortices behind it. This is called 'wake turbulence'. It cannot be seen in the air but to visualise it better, drag your hand through a bath of water and you will see the vortices behind your hand. These vortices can depressurise your canopy and cause it to collapse.

Wake turbulence can last for a while and in the case of a canopy will be up and behind the canopy. Therefore, you must never fly in the area up and behind the canopy, or land behind them, or across the path a canopy has just taken.

Figure 23. Wake Turbulence.

3. WIND SHEAR
Wind shear is the turbulence that occurs at the junction between two blocks or moving air. It is most commonly felt when the upper winds are at marked different directions. Again, this turbulence can cause canopies to collapse.

Flying through turbulence.

Likely turbulence should be avoided whenever possible by planning your landing pattern to avoid areas of known turbulence, landing clear of all hazards, and other canopies. Try not to land directly downwind of any obstacles that might cause turbulence.

It may be impossible to always avoid flying through turbulence. If you do encounter turbulence, try to minimise the toggle inputs and allow the canopy to fly through it at as close to its full speed as possible. This will help keep the canopy pressurised and keep its wing shape.

If turbulence causes part of the canopy to depressurise and collapse, the canopy will normally try to reinflate and continue to fly. This will often throw the canopy off your original heading.

Sometimes an end cell will collapse, and this will cause the canopy to turn towards the collapsed cell because the opposite side is generating more lift. Allow the canopy the time to reinflate on its own before pulling the toggles, then only once reinflated try to correct the heading. You may end up landing crosswind if this occurs close to the ground. If you were to pull the inflated side's toggle to counter the turn, the canopy will roll and can present the top skin of the canopy to the wind. This inflated side can be pushed under the canopy, losing a lot more canopy surface that was generating lift.
Therefore, if you suspect turbulence, land away from hazards that will allow for unpredicted changes of heading.

If you do encounter turbulence close to the ground, adopt a PLF position in anticipation of a hard landing. If you hit turbulence during your landing, be ready to speed up the flare to ensure the canopy is fully flared before landing. If being bumped around on landing, this is the only time you may need an asymmetrical flare to control the heading of the canopy.

Turbulence Basic Principles:
↘ Be aware of the different types of turbulence - Heat, object, wake, and shear.
↘ Do your best to avoid it.
↘ If unavoidable, learn how to keep control of your canopy whilst flying through it.

Landing off.

Landing off from the parachute landing area is a rare occurrence. However, since this type of landing may carry extra risk, it is vital to have a plan on how to manage this additional risk.

Firstly, prevention is the key. Ensure after your post opening drills you fly directly back to the holding area, increasing the range of the canopy as required. Any canopy drills must take place in the holding area, as starting them away from the holding area increases the chances of landing off.

It may be advisable if you are toward the end of the exit order to pull a bit higher, especially if there are lots of groups onboard the aircraft. The height you are deploying must be cleared by the jumpmaster.

Use the accuracy trick to assess if you are going to make it back to the landing area. If you are clearly not going to make it back with enough time to complete your pattern you must start planning an alternate landing area early.

Look around for clear fields on your flight back. Select a suitable open field by at least 1000 feet. Watch out for poles in the field, as they will normally be supporting cables. You should not land close to the edges of any field as this is where hazards such as fences, hedges, and trees are located. Try to fly a regular 3 leg landing pattern, using the sun or landmarks to orientate yourself for ideally an into wind landing direction.

It is critical you land a flat and level flared canopy, in a hazard-free area. Into wind if possible but not at the expense of the other higher priorities.

Seek to make contact with the DZ controller via mobile, or other means to let them know your location.
When walking in farmers' fields please walk down tram lines and avoid trampling over crops.

Flying your reserve canopy.

If you have deployed your reserve you should remove twists, release the toggles and take a breath. This is just a different type of canopy that flies the same (hopefully better than your main did!) and is often the first 7-cell non low-porosity canopy you have jumped.

Assess where you are against your flight plan and whether you can make it to the PLA. Your reserve may have a steeper glide ratio so do not expect to make a huge glide from a faraway opening, and remember you are also probably lower than planned. Therefore, keep checking with the accuracy trick and extend the range if you need to. If you cannot confidently make the PLA select a safe area to land in and apply the landing priorities.

If you think you can make your planned PLA, fly a conservative landing pattern. It may be better being in

Figure 24. Reserve canopy photo courtesy of Performance Designs

a bit closer to the PLA than normal, but try to keep the heights the same. Remember accuracy isn't key, just a safe landing.

If you are able to make it to your holding area, try to hold a little closer than normal.

Your reserve may not flare as well as your usual canopy so it is always worth doing some practice flares regardless of where you will land, and being prepared for a slightly harder landing.

If you see someone under their reserve, give them a wide berth and the right of way. They have just had a stressful time and may not be fully concentrating on everything around them.

Never attempt to catch anyone's reserve pilot chute, freebag or their main canopy.

In recent years it has become popular to fly a demonstration reserve canopy fitted into your own equipment. This allows you to try it without the stress of the actual reserve ride, and experience how they fly and land.

In sport jumping CF canopies are most similar to reserve canopies and can be a good alternative to try.

Better separation.

The purpose of tracking after a jump is to create enough horizontal separation between you and other skydivers to avoid a canopy collision on or immediately after opening. The duration or length of the track depends on the number of people in any particular group. The larger the group the further you need to track to achieve the same separation. The track-off height needs to be adjusted to keep the deployment height around 4,000ft to allow for a fully deployed parachute by 3,000ft. Any new tracking positions should be briefed by an instructor or coach.

Break off tracking.

Throughout the progression system on the route to becoming qualified, students are taught how to track, focusing on altitude awareness and directional control. Once we are qualified, we develop our technique into a faster, flatter track that gains more horizontal distance with minimal height loss. All skydivers should be disciplined by breaking off at the correct height and ensuring that everyone tracks away from the centre point of the formation with an equal amount of airspace each.

The more people we jump with the better our tracking skills need to be. We should only jump in larger groups if our tracking skills are competent enough to gain the necessary airspace clearance. After

Figure 25: (Photos courtesy of Ally Milne and Martin Skrbel)

opening everyone on group jumps needs to ensure they keep flying away from the group's centre point before they TAP and then carry out their post opening flight drills. Turning back to the landing area before checking TAP or having an off-heading opening can quickly reduce your canopy separation.

Tracking dives.

The purpose of tracking dives and British Skydiving Tracking (TR) progression is to track in formation with other suitably qualified skydivers. British Skydiving B Licence is required to begin TR progression. This type of tracking can have a much larger vertical speed component and is not suitable for use as break off tracking. Due to the fact that an entire skydive can be spent tracking, a larger distance can be covered. Flight planning a tracking dive is critical, therefore only experienced trackers should navigate the group.

If the tracking group opens close to the line of flight (where other skydivers have been dropped), they must avoid that airspace until the next groups have opened. There may be some scenarios where the landing area is on the other side of the line of flight. You must only cross the line of flight once you have seen the canopies from the next groups open. If you fly under or towards the line of flight before the next groups open you risk a freefall/canopy collision. Tracking dive flight planning that avoids this situation is critical.

Cloud management.

Although jumping through complete cloud cover is prohibited there may be some rare situations where cloud builds very quickly or a large body of cloud moves into your path to the holding area.

Firstly, on the ride to altitude check the cloud base and the height of it. You may not hit this exact cloud but it can give you a general idea of the heights.

In the event you are above the cloud and cannot see the ground then you can use the sun to orientate yourself back to the PLA. Avoid flying into the cloud where possible, flying around it if you can. Keep checking TAP as you do not want to go too far away from your flight plan. The airspace around clouds can be turbulent. If you are towards the end of the exit order you may see other canopies opening on the line of flight. This may assist you to orientate yourself back to the PLA. Some of the ground may be visible and if recognised can help you to find the PLA.

If you open in cloud, check the canopy and take control. Keep turns small because if you spiral you will probably drift downwind closer to the previous group. Keep checking TAP and be aware that you will not see other canopies until the last moment so do not get distracted with your slider for example. You may need to open a full-face helmet to get better vision.

If you find yourself flying your canopy into a cloud and you do not know your heading, then fly your canopy straight for about 10 seconds, make a slow turn, and repeat this process. The aim is to reduce the horizontal distance you cover, because if flying straight with no heading awareness you might fly too far from the PLA.

How to deal with a brake fire.

On deployment a brake may be prematurely released from its opening brake setting.

This can be caused by several reasons:

↘ Poor kit maintenance not keeping the toggle in place through the snatch of deployment.
↘ Slider pushing down and knocking the toggle off.
↘ Not setting the brake correctly before packing.
↘ Jumper reaching up and holding the risers through the deployment.

With one brake unstowed the canopy will begin to turn. This will soon accelerate and you can lose a lot of height quickly. Brake fires can also be very disorientating.

Therefore, if on opening your canopy is turning, check the canopy properly first for any cause of deformation (line over or tension knot). If the canopy looks normal, look at the brakes and flare the canopy. This may rectify the problem, if it does not you must perform your emergency procedures.

Twists on experienced canopies.

You will have been taught that nuisance factors will most probably clear on a student canopy, but to check your altitude relative to your minimum cutaway altitude.

Twists above your head will generally clear on canopies used by licensed jumpers, but you must monitor your altitude as you try to clear them. You also need to be aware that on faster canopies you can travel a lot further with twists and may end up way off your original flight plan.

On canopies with more performance there is the risk that the twisted canopy will turn and begin to dive towards the ground. This can be caused by leaning in the harness as you try to kick out the twists. The canopy is now no longer above your head and can be descending very quickly. You must be altitude aware if you are going to try and clear the twists; be ready to perform your emergency procedures.

Canopy collisions.

Canopy collisions are one of the most serious situations that we can find ourselves in as a skydiver, and for this reason avoiding other skydivers under canopy must be your highest priority. As a student, you will have been taught the drills to carry out in the event of a canopy collision which are the basis of the drills you should carry out as an experienced jumper. These need to be reviewed now that you may be jumping a smaller and faster canopy and therefore the consequences of a collision could be different or worse.

In any event:

- ↘ You should do everything you can to avoid a collision by taking direct action to steer away.
- ↘ If you cannot, and are on a head on collision course, the higher canopy should flare in an attempt to pass over the other canopy.
- ↘ If you are going to hit jumper-to-lines or jumper-to-canopy, protect your emergency handles with one arm and spread out your remaining limbs to avoid going through the lines.
- ↘ If you are going to hit jumper-to-jumper, curl up and protect your head and handles.

Collisions can result in different scenarios:

Glancing.

This is the most common type of collision where two parachutists collide and do not become caught up with each other. The canopies glance off and may continue flying. Collisions can be canopy to canopy; canopy to line; canopy to person.
You may not have seen the canopy you have collided with until impact.
After the canopies have separated you must check:

Altitude – check what altitude you are at as this will help you make decisions.

Canopy – check your canopy and lines for damage and decide if you can land it safely. If it is damaged and you are above your minimum safe cutaway height it is best to perform your emergency procedures. If you are below your minimum safe cutaway height you should stick with what you have and if you feel you cannot land it deploy your reserve.

Persons or canopies wrapped together.

The following are the drills that should be carried out following a collision, the acronym ACT can help you manage these situations:

Altitude. Keep checking and shouting out the altitude regularly. The other jumper may not be able to see their altimeter.

Communication. Due to the faster canopy speed, the collision itself may result in injury and may also result in distorted canopies causing rotation which might be very disorientating. For this reason, it is vital that there is good communication between both jumpers to ensure both know the situation and what the other jumper intends to do. This can be hampered by full face helmets.

When assessing and communicating, the following should be considered.

- Are both jumpers conscious and do either have any injuries?
- Are either of the canopies good and capable of landing you? This will establish if they can see what's happening. If they are the top canopy, it's quite likely that the bottom canopy could be wrapped around them.
- Keep reading out the altitude. If the other jumper is wrapped up, they may not be able to see their altimeter.
- Only use positives, rather than negatives. It is better to say "stay with it, stay with it" than to tell someone "Don't cutaway". Negatives could be misheard in that situation and if all the other jumper hears is "cut away" that could prove disastrous for both jumpers.

Teamwork. Once you have assessed the situation there are a number of options. Teamwork is required as doing the following actions in the wrong order could be fatal. It is important you know what to do wherever you are in the situation as communication could be impaired, especially by full face helmets.

ABOVE 1500FT WITH ONE GOOD CANOPY AND ONE COLLAPSED AROUND ANOTHER JUMPER.
If you are wrapped in another jumper's canopy and you are unable to clear it, continue to try. You will likely have a good canopy above you and cutting away will result in you going into freefall whilst wrapped in a canopy which could result in a fatality. Tell the lower person you are trying to drop them. Monitor your altitude and if you can, call it out regularly.

If it is your canopy that is wrapped around the other jumper and you are suspended beneath them, check that you are free from any lines/material, check your altitude, allow the top canopy to try and drop you. If they do manage to drop you and your canopy reinflates check your canopy properly.

If they communicate that they can't drop you; or are not communicating and you are approaching your minimum cutaway altitude you should cutaway and deploy your reserve.

The top canopy should wait until the bottom canopy has cut away or has been dropped and reassess their canopy before deciding their next action. If your main canopy is good, you should land, it even if you remain wrapped in the bottom canopy and are unable to see where you are going. You should use your knife to cut a hole large enough to get your head through to see if possible. If the top canopy is not flying well and you are unable to clear yourself from the bottom canopy, consider pulling your reserve without cutting away. (This is because if you cutaway and fall into the canopy wrapped around you it may smother your reserve deployment.)

ABOVE 1500FT WITHOUT A CONTROLLABLE CANOPY YOU CAN LAND.
If one jumper has passed through the lines of the other jumper's canopy in the collision and the two canopies are now tangled together - the jumper who passed through the lines, usually the top jumper, should check they are CLEAR, with no material below their 3 rings, attached to their body, or their container, check their altitude and then cutaway. Once clear the other jumper should check their canopy and perform their emergency procedures if required.

If it just the canopies caught together, try to clear them by flaring, if they do not release, cut-away then the other canopy can then cut-away.

BELOW 1500FT WITH AT LEAST ONE GOOD CANOPY.
Cutting away below this height might be very dangerous and the only option is to land under the one canopy. This should be flown in a flat and level configuration. If possible, reduce the descent speed using your brakes but be cautious of stalling the canopy. If you feel the descent rate is too fast the top canopy should consider putting their reserve out too. It may be hard to judge this, but there may be increased wind noise or your audible if fitted may indicate it.

BELOW 1500FT WITHOUT AT LEAST ONE GOOD CONTROLLABLE CANOPY.
To cut-away is not an option however without a good canopy doing nothing is also not an option. In this situation the best option is for you just to pull your reserve. Although not ideal, if it clears the entangled canopies, it should inflate and give enough lift to survive the landing, focus on keeping any flying canopies flat and level above you. If only one reserve deploys then that jumper will bring the pair to the ground.

Unfortunately, there are so many factors in a canopy collision that a simple “one stop fix” is not possible. Please seek advice from your CI or a CF coach for more detailed information.

Remember that it takes two canopies to have a collision, but only one person to avoid it happening.

There is only one certainty that if you cutaway too low it will result in a fatality.

Considerations under canopy: Full Face helmets, Booties, Collapsible sliders and Cameras.

As we gain experience throughout our skydiving progression, we may choose to use ancillary equipment that may increase our post opening flight drill workload. Below is a guide to introducing some common good practice for these items, and minimising risk when in use. Like all aspects of skydiving, initially these will require a brief by a coach or instructor, and conscious thought to incorporate into our post opening flight drills. After time these drills will seem like second nature, although it is during this initial phase of building muscle memory, or when we are uncurrent that we will need to take most care. You should only make one new addition to your flight drills at a time and only once the new addition is completed without thought should another be added. These optional additional flight drills should only be completed as secondary drills after a first TAP.

FULL FACE HELMETS

These helmets can be worn by British Skydiving B licence jumpers that have been briefed. A full-face helmet has an increased level of personal protection. However, some older full-face helmets can obscure and prevent in-air communication, and in cold weather they can fog up and reduce visibility. Fogging can be reduced by regular cleaning of the visor. Some modern designs have air vents and/or a mouth cover to ensure a smooth airflow and reduce this risk. Skydivers should practise on the ground the technique of opening and closing the visor with their gloves on, as they may wish to open the visor under canopy, and practise looking for their handles and RSL to see if the helmet obscures their view.

BOOTIES

Some skydivers remove their booties, if worn, under canopy. This is not advised unless you have checked TAP, although it is recommended that they are left on to prevent this unnecessary post opening flight drill. Leaning in the harness to reach your booties can cause your canopy to turn. If you should remove your booties it must not take priority over maintaining clear airspace.

Figure 26: Photo courtesy of Zach Barnes

COLLAPSIBLE SLIDER

Once the slider has completed its role in the opening sequence, its function is redundant for the remainder of the canopy flight. It will then sit directly above the risers vibrating and flapping until landing. It is this movement that can, on faster canopies, increase the friction on the lines. This is the reason that on some equipment the slider can be collapsed after opening. Skydivers should TAP before collapsing their sliders. For the initial uses of a collapsible slider completing the drill will require looking at the draw strings, pulling them through far enough to allow them to lock in place. You should then do another control check to make sure you haven’t jammed a brake through the slider. However, as the skydiver gets used to using this system it should be completed without looking directly up so that excellent all-round observation can be maintained. It should be noted that the slider needs to be reset before packing, and this should be practised and checked on the ground.

Figure 27: Photo courtesy of Emma Reynolds

Once experience has been gained collapsing the slider the next optional step in development is to bring the slider over the main toggles before they are unstowed. The advantage of this is to allow the main canopy to spread and open up more so that it may fly more efficiently. If skydivers do this step, then they must do so with caution as knocking a toggle can occur if rushing or not careful. If this happens

the other toggle should immediately be released so that the canopy does not begin turning. Before trying this drill, the kit should be checked and practised on the ground with an instructor or coach to ensure this is compatible with the toggles, slider and risers. Once the slider is collapsed it can be stowed in an appropriate stow or just kept behind the head.

LOOSENING CHEST STRAP

Loosening the chest strap allows the canopy to flatten its shape a bit more and that can help the canopy increase its glide ratio. This is most noticeable on smaller canopies. The chest strap should remain threaded at all times under canopy and this drill should only be performed with chest straps that have a stitched fold over. This drill is completed before the toggles are released, after the slider has been collapsed and bought down carefully over the toggles. Care should be taken about how much to loosen off the chest strap when performing stall exercises or any close proximity canopy flight. Chest strap extensions can be used to further open the canopy however these should only be made by or cleared by a British Skydiving Advanced Rigger as the extension becomes part of the harness. It should also be noted that by loosening the chest strap, emergency handles will have moved and may be more difficult to find should they later be required.

Figure 28: Photo courtesy of Emma Reynolds.

REMOVABLE SLIDER

A further step to reduce drag from the slider is to use a removable slider. This equipment is only required on very high-performance canopies. This flight drill adds a considerable workload, and if removing the slider, the skydiver should first TAP before any attempt to remove it. They should work towards completing this drill without looking up at the slider to maintain excellent all-round observation. Care should be taken to stow the slider somewhere it will remain secure so that it does not come loose and fly into the field of vision, or worse drift off into the unknown.

CAMERA

Cameras can be worn by British Skydiving C licence holders once briefed and cleared by a CI. Wearing a camera has two risks connected with canopy flight after opening. Firstly, care should be taken to ensure the camera does not get caught in the slider if collapsing or bringing the slider further down over the risers. Secondly the camera can provide a distraction factor. Some skydivers may choose to turn the camera off after opening. This post opening drill should be performed last as it is the lowest priority. Many people however choose to keep the camera rolling to film the canopy flight and the footage can be used by their CT coach or used to debrief themselves. Filming of other canopies should not be attempted until experience in this area has been developed and cleared by the CI. This is due to people fixating on the camera target and potentially forgetting to maintain all round observation.

Figure 29: Photo courtesy of Emma Reynolds.

Summary.

All of the above actions can take between 15 and 30 seconds each to complete depending on your competence. Care should be taken to make sure they do not distract you from maintaining good observation of the traffic around you, your altitude and position.

You should leave your brakes set while performing these tasks and may need to maintain heading control with the rear risers. However, you need to constantly be aware of your altitude and if anything is causing these tasks to take longer than they should you should stop and concentrate on flying your canopy. You can lose a lot of altitude and cover a large distance during this time and you need to remember that you need to have you brakes off an be in full control well above your minimum safe cutaway altitude.

Responsibilities.

You have a right to land safely as do those flying around you.
If you see something dangerous speak to an instructor or your CI: you may prevent a future incident.
Debrief yourself after every landing, not just ones for CT exercises.

Ask yourself:

- ↘ Did I land safely where I intended; how could I improve my landing?
- ↘ Did I fly a good pattern; was I predictable; did I land where I wanted to?
- ↘ Did I get affected by someone else's pattern? Did they realise? Or did I affect someone else?
- ↘ Did I fly safely around all the others in the sky?
- ↘ Did I do anything unpredictable?

Be honest with yourself. If you landed short or overshot think about why and how you could improve without needing excessive / radical adjustments. Was your pattern predictable? Did you see everyone in the landing pattern? Did anything take you by surprise?
The best way to get debriefed is to be watched and filmed by a coach or instructor.

Human Factors

Our social responsibility should start before you jump. No matter how well you have been briefed and planned your jumps, other factors can seriously impede our decision-making ability. The list below is non exhaustive; you will know yourself better than any instructor, so be honest to yourself.

No one is ever forced to jump, “better to be down here wanting to be up there, than up there wanting to be down here”.

All skydivers should be aware of a variety of key performance factors that can affect our physical and mental abilities. Not all skydivers want to be the next champion, and for most it is a fun weekend hobby, but when we are learning and progressing, we can do so more efficiently and with less risk when we take these factors into consideration. A small dip in our performance might only hamper our progression or the quality of our jumps, however a big enough decrease can be a contributing factor in an incident that might cause harm to ourselves and others.

↘SLEEP

Having a good night’s sleep before skydiving is an important factor than can ensure the body is prepared for the day ahead. Many studies have shown a clear link between sleep and performance in sports. Moderate sleep deprivation can cause slowing of reaction times to the same degree as a drunk driver over the blood alcohol limit. A good night’s sleep after a busy day jumping can also help the brain process the skills and abilities learnt during the day. Care should be taken when waking up early and driving a long distance before a busy day jumping, as your abilities may begin to lag as the day progresses. Driving up the night before may be beneficial for maximum performance.

↘HYPOXIA

When skydiving at 15,000 feet we have a reduction in the available oxygen for the body to use, although hypoxic effects can begin as early as 4,000 feet. Sometimes when under canopy we may have held our breath due to stress, so taking a breath in these conditions and making a conscious effort to control breathing reduces the likelihood of this performance factor. On the aircraft ride up we can reduce

the amount of oxygen the body requires by minimising talking and unnecessary movement. Smoking directly before skydiving has a detrimental effect to the body's ability to absorb oxygen.

↘ALCOHOL
Consumption of alcohol before skydiving is prohibited, but also care should be taken that overindulgence the night before does not leave a skydiver still under the influence. It should also be noted that alcohol negatively affects the quality of sleep.

↘FEAR/EMOTIONAL
Part of the thrill of skydiving is not the absence of fear, but the challenge of facing the fear. Fear is a normal survival emotion but, in some cases, too much can affect the brain's ability to think logically.

However, in extreme situations fear can trigger a variety of actions. High energy fear reactions such as Fight or Flight can cause over-aggressive canopy inputs. Equally, the freeze fear reaction can cause no inputs when a necessary reactionary input is required. Times when we are likely to encounter more fear than normal include jumping new canopies, visiting a new PTO, skydiving after a layoff, or jumping in increasingly large freefall groups. When facing these situations, it's easier to take a step back and turn everything down a notch until this is overcome. Fear will decrease gradually with exposure. Lack of fear can cause boredom, or worse complacency.

Fear should be differentiated from other life or emotional stresses. Skydiving is a great escape from real life, though when under a great deal of emotional stress, we might not perform at our best, and sometimes its better leaving the kit at home and visiting the PTO just for socialising.

↘TRAINING
Skydivers perform at their best when skills are kept current by regular jumping. Gaps in training regardless of the cause can cause skill fade which may take a few jumps to regain. This currency should be re-established before moving on to learning new skills, or jumping new canopies, and this is critically important when fast high-performance canopies are used. Lack of currency might also require the use of larger canopies and advice from instructors and/or CT coaches should be sought.

Remember, you are only as current as your last flight. If it has been a while don't try anything new and do be cautious.

All skydives including canopy flight patterns must be rehearsed for best performance. This should happen both on the ground but also by visualising in the aircraft before exit.

↘ENERGY
A busy day of skydiving can cause the body to consume a larger amount of energy then normally required. A supply of food and snacks on standby is a good idea, and any extraneous food items can be shared with your instructors and/or CT coaches.
Also be aware that skydiving can be physically and mentally exhausting, especially in the early stages of progression. Sometimes it is better not to push for one last jump.

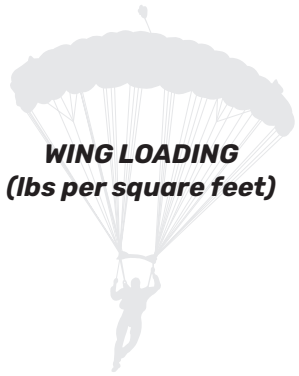
↘DEHYDRATION
It is important to keep the body hydrated throughout a jumping day. Dehydration has a large negative effect on how the body can perform physically and mentally including causing dizziness, lack of concentration, increase of stress hormones, decreasing the body's ability to control temperature, and reducing co-ordination to name but a few. A good tip to avoid dehydration is to drink plenty of water and pee often and clear. This factor is especially important on hot sunny days.

SECTION 7: MORE CANOPY RESOURCES

Wing-loading.

Your instructors will have decided what size canopy you should jump initially and this will have been based primarily on your "wing loading".

Wing loading is a calculation that is done to predict how a canopy will fly:



WING LOADING (lbs per square feet) = ***EXIT WEIGHT (in lbs to include all kit and weight belt)*** / ***SIZE OF CANOPY (in square feet)***

If you only have your weight in kilos multiply by 2.2 to get your weight in pounds.

While not the only factor to consider, wing-loading is the single biggest determinant of the flight characteristics of a canopy. The more weight you suspend from a canopy of any given size or design, the faster that canopy will descend, and the faster it will fly forward through the air.

A heavily loaded canopy will also respond more aggressively to any kind of input, and take significantly longer to recover from a dive. The canopy is ultimately much more demanding to fly safely and competently, therefore downsizing must be progressive and gradual.

Conversely, a lower wing-loading on a canopy will cause it to fly and turn slower, and will have a slower rate of descent. The canopy will be less responsive to pilot inputs.

Although if flown inappropriately injuries can happen on all scales of wing-loading, the chances of injury and their seriousness increase with wing loading.

To calculate your wing-loading your exit weight must include all kit such as jumpsuit, rig, helmet, and any weight belts to be used.

As a student you will have been limited to:
0.8 lbs per sq ft for your first jump and 0.85 lbs per sq ft after your first jump.

Although there are some caveats: Exceptions to the above are permitted where a manufacturer has published that a higher wing-loading is suitable; and should the manufacturer recommend a lower wing-loading the lower limit must be applied.

These recommended wing-loadings can be found in the manufacturers' canopies' manuals or on their websites. They may change over time, and should only be applied to that particular canopy.

Some canopies can see marked changes in performance based on the wing-loading, going from very docile at low levels to much more responsive at higher wing-loadings.

Wing Loading is not a one size fits all method and will have outliers for those at the extremes of size and weight. Manufacturers measure their size differently, hence this is just a guide to how the canopy will fly.

British Skydiving now use Form 330 to show the minimum size canopy permitted with your experience. Determining your correct canopy size should not be dictated by what the minimum shown in the chart is. If you are comfortable on the canopy that you are using you should not feel under pressure to downsize until you want to and are ready to do so.

Are you ready to downsize?

Downsizing is often seen as the quickest way to get extra speed, and hence fun, from a canopy. However, without the skills to fly a faster canopy it can become a simple step to an injury that can take you away from jumping for a while.

So, you now have a few jumps on your current canopy; how do you know when you are ready to downsize?

There is no set of prescriptive exams to do, it should be discussed between you and your coach and CI; they know you and your abilities, your current canopy, and where you are jumping.

You should be confident on the canopy you are jumping and ask yourself the following questions:

1. Are you current on your canopy?
2. Are you flying a good pattern with consistency and being predictable under canopy?
3. Are you normally landing with reasonable accuracy in varying conditions?
4. Are you landing well, i.e., standing up each time?
5. Are you comfortable in a close stack or congested traffic?
6. Are you confident of landing well in the extremes of the conditions that you jump in? Can you handle a nil wind landing or control one at the upper limit of your wind conditions?
7. Can you handle the canopy if you misjudge something, such as landing crosswind?
8. Can you fly the canopy well in slow flight?
9. Would you be confident landing off the main PLA or DZ?
10. Will you be able to remain current on your new canopy?

Your coach or CI may have their own exercises they would like to see you perform well prior to downsizing.

You should be very honest with yourself and be open to constructive criticism from your coach to address any issues raised with the above. As an analogy, consider that not everyone is a great driver and is suitable to drive a high-performance car.

Remember to always seek advice before downsizing from the coach or instructor who knows you best, and who is unbiased and not just trying to sell you a canopy.

Downsizing.

Downsizing needs to be done in conjunction with British Skydiving Form 330 and only with guidance from an Instructor or suitably qualified coach.

When you keep the same canopy design and downsize you are increasing your wing-loading, as described above this will increase the speed that the canopy will fly, both across the ground and toward it.

The higher wing-loading will penetrate into wind more. This can be useful in high wind conditions where you may previously have struggled with your current canopy.

However, when the winds are light and you are deep, the higher wing-loading canopy will not be able to glide as far as the larger canopy, given the amount of altitude lost. Although, a good pilot can diminish this difference somewhat with a thorough understanding of the slow flight characteristics of their canopy, and by being well practiced at increasing the range using brakes and / or risers as qualified to do so.

The higher wing-loading canopy will also cover more ground during the landing flare, but timing the flare properly will be more difficult. It will also be significantly more painful when the flare is mistimed. The higher wing-loaded canopy will be easier to stall with less indication at a higher speed too.

If your landings are consistently good you will probably find real enjoyment in landing a smaller, faster canopy well. However, if you've been struggling with landings every now and then, downsizing will almost certainly make them worse.

When you downsize you will be jumping with shorter lines; and also have an increase in the rate that the canopy will turn.

Shorter lines mean a more responsive canopy to every type of control input. Therefore, a more wing-loaded canopy will turn faster for a given amount of input, causing you to swing out further and will take longer to recover from the dive caused by the turn. Therefore, the amount of height that you will lose in a turn will also increase.

This is all true regardless of wing-loading and why wing-loading shouldn't be the only factor in your decision to downsize. Even if you are loading a canopy lightly, shorter lines mean a more aggressive wing. This means that a person weighing 190lbs jumping a 190 square foot canopy has a more docile canopy than a person weighing 170lbs jumping a 170 square foot canopy, even though both wings are loaded at exactly 1lb per square foot.

You should also always check the manufacturer's guidelines for the canopy as some modern canopies' characteristics can change significantly as the wing-loading increases.
If you do decide to downsize you should only go one canopy size at time, and no further until you are competent on that canopy.

Changing canopy design.

If you are considering changing canopy type you should also give consideration to its design and flight characteristics.

There are many factors that affect a canopy's performance, these include the shape of the canopy; the aspect ratio; if it is crossbraced; the trim; the recovery arc; and the materials it is made from.

↘ **SHAPE**
The shape of the canopy is a significant factor in how much lift it will develop and many of its flight characteristics. The cross section of the canopy from front to back is the "aerofoil" and how it generates lift is discussed more in the Section 9.

The "planform" refers to the shape of the canopy when viewing from directly below, it considers the length of the chord, the distance from nose to tail, at the wingtips compared to the centre of the canopy

Generally, most canopies are classified as either:
↘ Rectangular (the chord is the same length at the wingtips as it is in the centre of the canopy)
↘ Tapered (the chord at the wing tips is smaller than at the centre of the canopy, and may be tapered at the leading edge, or the tail, or both)

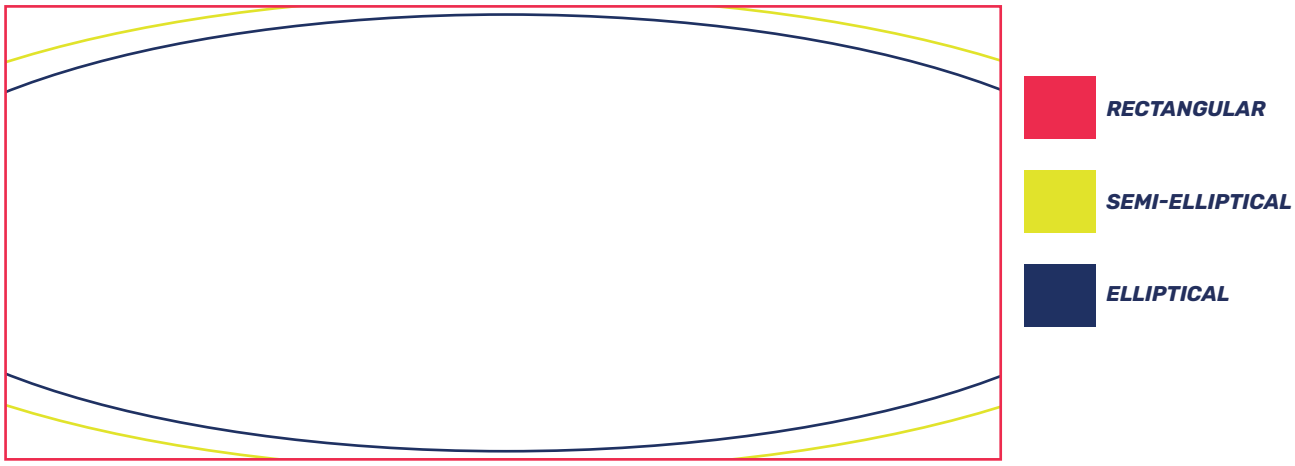


Figure 30: Canopy Shape.

Tapered can be further described as semi-elliptical (where just the outer cells are tapered), elliptical, fully-elliptical, Scheumann planform, depending on the amount of taper and where it is. Tapering is designed to reduce the drag at the wing tips; reduce toggle pressure; increase stability; increase roll rate of the canopy.

Figure 31: Image courtesy of NZ Aerosports

Beware, although these terms have become associated with levels of performance it does not always correlate, as most modern canopies will have some form of tapering to a degree. The tapering can be moderated by the designer and does not automatically mean a tapered is ultra-high performance, figure 31 above is actually a Student canopy from NZ Aerosports.

Generally speaking, however, the more rectangular designs are more docile, some tapering are an intermediary, and the more tapered designs are higher-performance, and therefore more demanding to fly.

For the most part, more tapered canopies will have a much more powerful turn, and will take more altitude to recover from a turn than a less-tapered counterpart. As well as being more 'ground hungry' and will dive harder in straight and level flight.

While an important factor in the design of the canopy, the planform must also be considered with the aspect ratio and trim. Therefore, a canopy should not be judged on just one design parameter.

The Aspect Ratio.

This is the relationship of the span (wing-tip to wing-tip) of a canopy to its chord (front to back) measurement.

A canopy 20 feet across and 10 feet from nose to tail has an aspect ratio of 2:1. For a skydiving wing: 1.9 is a low aspect ratio; 3.0 would be high. For non-square canopies the aspect ratio is calculated by dividing the square of the span by the canopy area.

A low aspect wing will need to have a deeper canopy profile to generate the same amount of lift as a higher aspect ratio canopy. Low aspect wings are more commonly 7 cells and because they have fewer cells and lines, they tend to pack slightly small for the same wing area. 7-cell canopies are more likely to open on heading; have a tighter turn radius; and less likely to suffer line over malfunctions, and are less violent in partial malfunction scenarios. They also have more forgiving stall recovery characteristics.

To make a higher aspect ratio canopy manufacturer use 9 cells. A higher aspect ratio canopy can have a thinner profile and

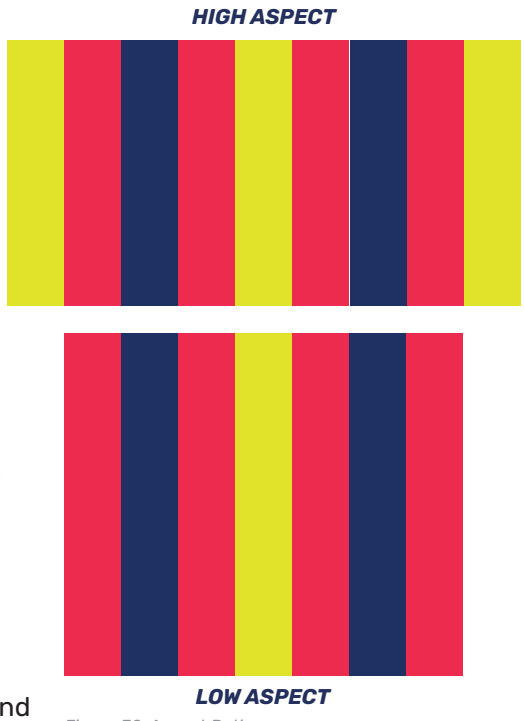


Figure 32: Aspect Ratio

be less subject to drag and will be faster as a consequence. A 9-cell canopy may therefore give better penetration into wind. Higher ratio canopies tend to be able to glide further that a comparable sized low aspect ratio. Less toggle pressure is needed on a high aspect canopies and the response will be more.

Crossbracing.

Canopy designers found that as they increased the aspect ratio of the wings the cells would deform and the pressure in the end cells was lower than desired and could lead to partial collapses of the wing. To strengthen the structure of the canopy designers included crossbraces that are essentially extra, diagonal ribs inside the cells of the canopy. They can be additional diagonal supports from the loaded rib diagonally up or instead of being divided into two segments, the cell is divided into thirds as shown above. This has the diagonal ribs running across the two outer segments of each cell. This increases rigidity and stability of the canopy, and allows for a thinner-profile wing.

Because the early crossbraced canopies opened too quickly, it was found that closing the nose off slowed the initial inflation of the canopy and made the openings softer.

Crossbracing also allows for a 7-cell canopy to be designed with the planform of a 9-cell, but without as many lines, thus reducing drag while keeping the tapered wing with a high aspect ratio and short lines. Due to the added ribs inside the canopy, a crossbraced canopy has a much higher pack volume that a non-crossbraced canopy of equivalent square footage.

The crossbracing can make the canopy more responsive and must be treated with respect.

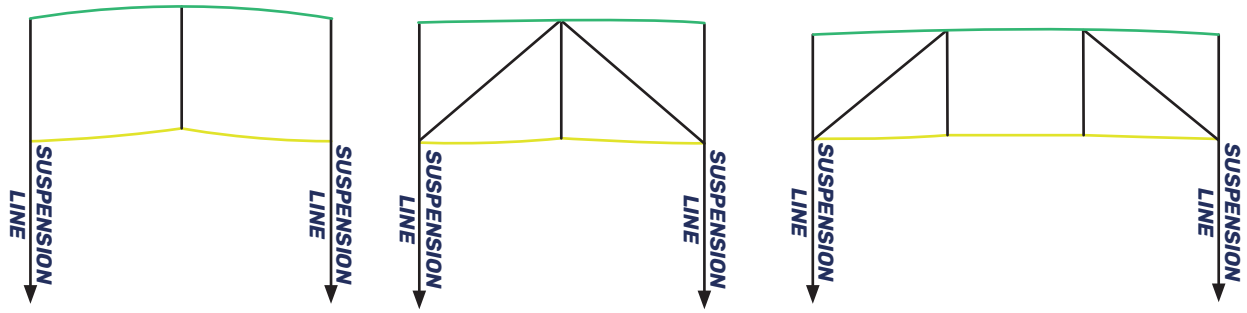


Figure 33: Crossbracing

The Trim.

The trim is set by the lines and refers to the angle at which the canopy will descend, the angle of incidence. A more nose down (steeper) trim will cause a higher descent rate and more stability, conversely a less steep trim (more nose up) will slow the descent rate but makes the canopy more susceptible to turbulence.

A canopy with a steep angle of incidence will have a stronger flare due to the increased speed, and require less input for this flare. A steeper trim canopy will be more stable in brakes and recover from stalls faster. A less steep canopy will glide further than a steeper one.

The trim will therefore have a great effect on its performance.

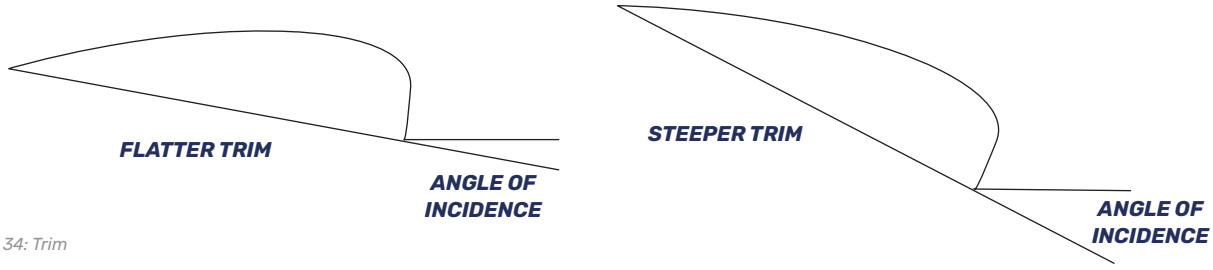


Figure 34: Trim

You may hear people discussing about their canopy going “out of trim”. Lines wear with every use and have a finite lifetime. With use some lines characteristics change, this will deform the canopy from the original shape. Most prominently the outer A lines will shrink more due to the friction of the slider on deployment. This will increase the curve of the wing shape, its “Anhedral Arc”, and it will not generate as much lift as it can.

An out of trim canopy may not open as reliably on heading and may have reduced performance. The brake lines especially as they run through guide rings on the risers can experience a lot of wear. This can actually take a canopy beyond a brake setting that will stall the canopy when flared.

The Recovery Arc.

The recovery arc is the path that you and your canopy take out of a turn or dive as you return to straight and level flight. The amount of time and altitude that this recovery takes varies from canopy to canopy and wing-loading to wing-loading.

A canopy with a short recovery arc will recover quickly and this is advantageous for lower experience pilots if they mistakenly turn lower than they should have. However, if pilots want to induce speed for landing it must be done at low altitude and there is little margin for error.

A canopy with a longer recovery arc will dive for longer and develop more speed, if this turn is initiated too low the canopy will not have chance to recovery to flight flat across the ground. If the pilot does not make an effort to force the recovery it can result in a hard impact. However, with training a canopy pilot can use the increased speed to extend their landing / swoop.

When changing canopy, it is therefore vitally important to learn what the new canopy’s recovery arc is and to be aware of how much height is lost in a turn before the canopy has fully recovered to flight flat across the ground.

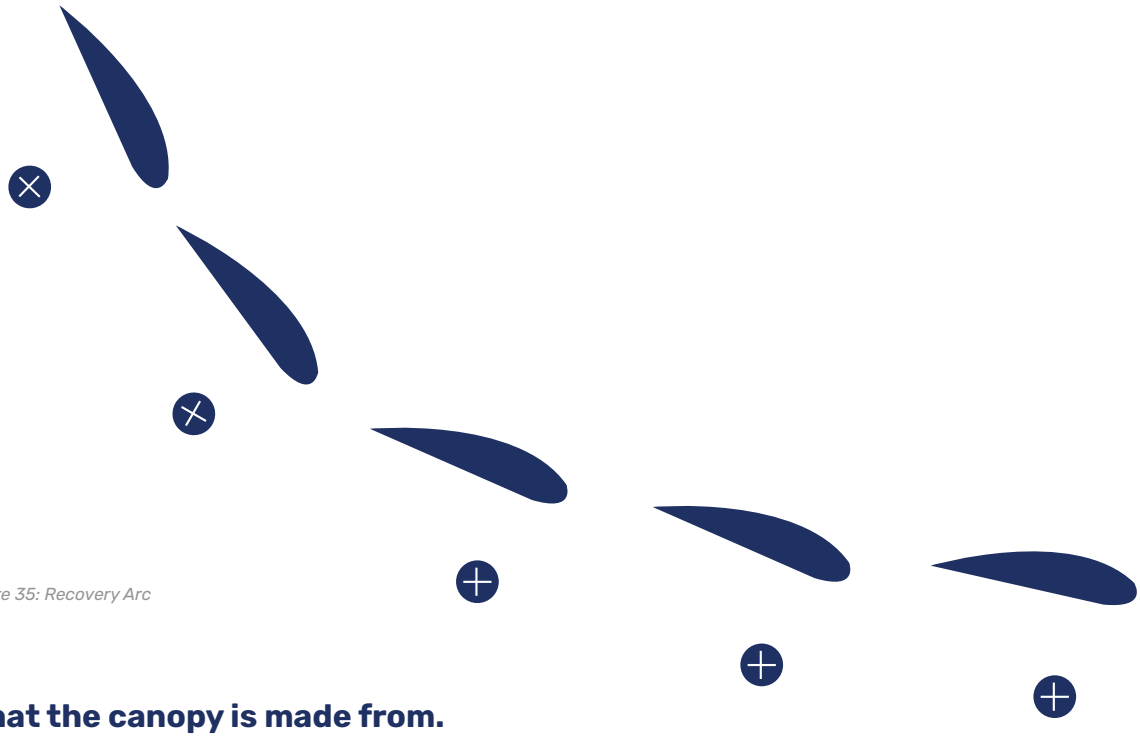


Figure 35: Recovery Arc

What the canopy is made from.

The canopy is made from two main components; the fabric of the wing; and the suspension lines. The materials used to make canopies are graded by the amount of air that can pass through the fabric.

These can be generally classified as low permeability (low porosity) or zero permeability (zero porosity).

Low permeability will allow air to pass through it, the most well-known is what is commonly called F1-11 (although this is a tradename for material that was 1.1oz per square yard). F1-11 is a material that was more prominent in the early manufacture of ram-air canopies and is used in reserves.

F1-11 material can be coated and treated to reduce its permeability to zero, in that no air can pass through the material (when new). This material is called zero-porosity (or ZP for short). Because the air inside the canopy cannot escape through the material the canopy will be more rigid, and generally have a better glide performance than low permeability canopies. Over time the coating of the canopy will wear off and the canopy will become more permeable. This does mean that a canopy's performance will decrease over use.

Most recent canopies are, for the most part, made from ZP, however, there are not a few 'hybrid' canopies available that use a mixture of the available materials.

Your reserve canopy will be made from F1-11 material as the permeability allows it to absorb the very high forces of a terminal deployment, especially when packed to open as quickly as possible. The material is easy to pack which aids the reserve packer to prevent malfunctions and F1-11 is not as prone to sticking together as ZP material which could hesitate a deployment.

Some very high-performance canopies are now made with "sail material" which is zero porosity and a much less flexible material. This strength further increases the rigidity of the canopy. It also doesn't become permeable with use; however, it is a much thicker material so increases pack volumes considerably.

The number of lines will be dictated by the number of cells and the shape of the canopy, some higher performance canopies have fewer lines to rear of the canopy.

The amount and thickness of the lines will also be affected the drag on the canopy, having more thicker, longer lines will affect it more. This is why higher performance canopies use thinner lines.

Transferring onto a "Higher Performance" canopy.

Moving to a higher performance wing is a big step from a lightly tapered canopy even if you are not downsizing.

If high-performance landings do not appeal to you, do not jump a higher performance canopy. There is no need. Your descents/landings will not benefit and you are putting yourself at higher risk by jumping a much more demanding canopy. A lightly tapered sport canopy will give you perfectly safe, enjoyable landings at a conservative wing-loading without having a canopy that will become potentially more dangerous once things start going "not according to plan", such as landing off / amongst hazards / landing downwind.

However, if you decide you are committed to canopy progression and fast, exciting landings you probably do or will want a higher performance canopy at some point. You must get the appropriate coaching ahead of, during and after the transition. All techniques to increase the speed of the canopy for landing are taught in British Skydiving CT3 and 4. You must comply with the licence and jump requirements before you commence this training. You must be a minimum of C licence with at least 300 descents, 100 of which must have been completed in the previous 12 months, including a minimum of 25 on the type and size to be jumped.

What to expect:
The higher performance canopy descends faster and cuts through the air faster. Most will have a relatively steep angle of incidence so as to induce speed. Therefore, these canopies take active piloting to be landed without incident. If you flare late, or fail to flare in time (even without first adding speed) you will do serious damage to yourself. The canopy moves faster on every axis. If you are out of your comfort zone for any reason, you will have less time to think and adjust.

However, the inputs need to be appropriate to what you want the canopy to do. Higher performance canopies will respond to each input, and you will see "pilot induced oscillation" where the pilot continues to overcorrect a previous incorrect input. Remember that if the canopy is turning the lift, it is generating, is not directly up so your rate of descent will increase, and these canopies will unceremoniously dump you on the ground if you tell it to! Therefore, the flare will need to be well timed and you will need a slow, progressive flare to wash off the forward speed and maximise lift on landing.

Most higher performance canopies boast fairly soft openings when they are correctly packed. When packing them, the packer should concentrate on maintaining symmetry. If the canopy opens off heading, you may have your work cut out to prevent line twists. Rotating line twists on a higher performance canopy can become an aggressive malfunction if unable to clear quickly.

If spotted deep, you may need to use rear risers or brakes to increase the glide ratio of your canopy; be careful to know where your stall point is for both modes of input!

Transferring onto a "Crossbraced" canopy.

Moving to a crossbraced canopy from a high-performance tapered canopy is an even bigger step than the one you took moving onto a more tapered canopy. These canopies are designed to be flown and landed at high speed. They will respond to every mode of input far more aggressively than the canopy you have previously jumped.

If you do not land these canopies well, you will be hurt. The only reason to ever jump one is to swoop. Do not consider transferring to a crossbraced canopy until you are safely and reliably making high performance landings on a high-performance tapered, non-crossbraced canopy. As with all these steps, they must be taken when the time is right. Rushing onto a crossbraced canopy will almost certainly result in disaster. Make the transition when you have mastered the canopy you are on, and gain plenty of coaching in advance, during and after the transition.

What to expect:
You must watch your altimeter religiously. You will be descending much faster than on previous kit, and you may risk missing set-up heights if you become distracted. Similarly, learn the slow flight characteristics of your canopy until you are comfortable flying in deep brakes, just above the stall point. You may need to utilise this flight configuration more often than not to control your descent rate.
The openings will vary from canopy to canopy. Largely, they will be fairly pleasant as long as they are correctly packed and you maintain a very good neutral body position through the opening. They will be soft openings, but sometimes take effort to keep on heading and untwisted. The openings can become very unpredictable with rushed packing. Even with good packing, sometimes they will be off heading.

Summary.

It can be seen from the above text that there are many factors that will affect a canopy's flight characteristics. It would be impossible to include all these into a downsizing programme, and this is why the current British Skydiving system is based on wing-loading.

Careful consideration must be made by you, the pilot, if you decide to change canopy design for the type of jumping you are doing. Higher performance canopies with the correct training and conditions can be amazing to fly, they can however, go wrong very quickly, and result in very serious injury. Please always try to get the best advice you can and be patient so that your skills match you canopy rather than playing catch up.

SECTION 8: GAINING YOUR CT1 & CT2 QUALIFICATIONS

This section sets out how to do the exercises to gain your CT1 and CT2.

Safety Considerations.

All attempts at the required exercises should be made as per when you gained your Student CT (see page 40) To recap briefly:

- ↘ Make sure you have been briefed.
- ↘ Jumping solo.
- ↘ Opening high.
- ↘ On your current canopy.
- ↘ With a flight plan.
- ↘ Using TAP.
- ↘ In suitable conditions.
- ↘ Above your minimum cutaway height.
- ↘ Under supervision.

Prior to each jump you should talk to your coach or instructor and be able to tell them the following:

- ↘ Your intended landing area.
- ↘ Your intended landing direction.
- ↘ Your landing pattern including where your turn points will be.
- ↘ Your flight plan including your heights and check points.
- ↘ Your intended opening point and the aircraft run in direction.
- ↘ How you will deal with any eventualities such as opening in a different place to expected.

CT1 EXERCISES
Demonstrate the ability on 5 descents to carry out the correct landing pattern for that PLA in the conditions of the day and land safely on the intended landing area.

The coach or instructor is looking for you to fly a predictable safe pattern and to land safely on the PLA. Accuracy is not a target on these jumps but more consistency in your flight planning and following your flight plan. You should complete these 5 jumps before moving on to the next section.

Pre-declared landings in 50m diameter.

You will need to carry out jumps where you show the ability to land safely and accurately in an area of 50 metre diameter, carrying the correct flight plan for the conditions of that day.

You should then be monitored by your instructor to ensure that you fly your plan wherever possible and if needed make the correct adjustments to the plan to still land safely. You will need to fly a good pattern and demonstrate a good landing.

This exercise is needed to qualify for CT and must be carried out on five separate descents, debriefed and signed for by a qualified coach or instructor.

Checking the stall point.

There are many factors that can influence the point at which a canopy will enter a stall, or indeed, not enter a stall at all. These include, but are not limited to: canopy loading, riser length, toggle setting, harness fit, and even the length of your arms. As you gain experience you will find that toggle settings (the place where the steering toggles are attached to the steering lines) become a matter of personal preference. Your canopy manufacturer's manual should provide details on their recommendations for brake settings. If not, a good general guideline is to have about 2 inches (5cm) of slack in the steering lines. This means that when the canopy is flying with the brakes unstowed and on full drive, the steering lines will appear to have a slight bow in them and it should take about 2 inches of toggle input to have an effect on the tail of the canopy. So, when you pull the toggle down there will be 2 inches of slack to go through before the tail of the canopy starts to move.

During an ideal landing, the canopy should continue to create lift until after you have transferred your weight from the harness to the ground i.e. when your feet are firmly on the ground and your weight is no longer suspended from the canopy by the harness. It is not necessary to stall the canopy to get a good landing. The reason we wish to find the stall point is so that we know how much toggle input is required to make the canopy stall. The point just above where the canopy stalls is our 100% brake setting. This is the setting that, during a flare, will allow the canopy to level off and reach a minimum rate of descent and speed without stalling, which also happens to be the best time to make contact with the ground.

↘CHECKING THE STALL POINT EXERCISE.
The aim of this exercise is to check where the stall point is, how much you can pull the toggles down without risking stalling your canopy and how to recover if you do stall your canopy. It will be vital that you know this before attempting to carry out some of the other exercises later in this manual.

Make sure you check TAP and ensure have plenty of clear airspace in front of and beneath you, then look at the tail of the canopy and note the amount of slack / bow in the steering lines. Pull down both toggles evenly and stop at the point where the tail of the canopy just starts to move. Make a mental note of how far you had to pull the steering toggles down.

Keeping the steering toggles at that same setting, check for TAP. As your canopy may stall, make sure to check the airspace behind and below you, then look back to the tail of the canopy. Gradually pull the steering toggles down. As you do this you will notice the canopy gaining lift, slowing down and getting quieter. Eventually the canopy will reach a point whereby it runs out of airspeed, loses its normal shape and starts to fall backwards. This is the stall point; as the canopy starts to fall backwards, make a quick mental note of where your hands were when this occurred and then conduct a stall recovery by gently letting the steering toggles back up evenly, until the canopy regains its forward speed and normal shape.

It is important that you are able to feel when the canopy is at its stall point. Check TAP again and have another go without looking at the canopy. Try to recognise the point where the canopy starts to fall backwards. This can feel a little weird; remember to keep your toggle inputs smooth.

Notes:
It is possible, particularly if you hold on to the stall for too long, that after the recovery you may have end cell closure and or twists if your recovery isn't smooth and even. To this end, in order to give enough time to rectify any problems make sure you start this exercise no less than 1000 feet above your normal cutaway decision height.

Many low experience jumpers have concerns over stalling the canopy, as they believe that it will cause a malfunction. Providing your toggle inputs are smooth and you only hold the stall for just a second or two before smoothly letting the toggles back up to recover, then it is very difficult to self-induce a malfunction. Holding onto the stall for a longer period of time and making radical toggle movements, such as letting go of one of the toggles during a stall, could however cause problems.

You may find that your canopy doesn't actually stall during this exercise. As mentioned above, there can be a number of reasons for this. This is not a problem. Remember the aim of the exercise was to find out how far you can pull the toggles down without stalling the canopy.

This exercise is needed to qualify for CT1 and must be carried out on three separate descents, debriefed and signed for by a qualified coach or instructor.

Using a rear riser as an avoidance manoeuvre.

When your canopy first opens, an immediate hazard to be concerned about is the proximity of other skydivers. Obviously, if another canopy is very close on opening, you may not have time to carry out your normal drills before making contact. In this scenario, you should reach up and pull down on one rear riser so that the canopy turns to avoid the collision.

Like many techniques in the CT system, it is best to practise avoidance turns with a rear riser so that you are proficient enough to use the technique when you really need to. Remember, when the canopy first opens, the steering toggles should still be fixed in the half brake position. Therefore, you will get

more turn for the input that you use when compared to a canopy that is in full drive.

A good way to practise this technique so that it becomes natural is to use it after the canopy has first opened as a method of turning the canopy so that you are facing towards the drop zone (PLA). You can then release the brakes from their half brake setting.

A couple of points to note:
Practising this technique requires you to make a rear riser input just after the canopy has opened. Remember to check your canopy properly before making the turn.

If during a practice session you have end cell closure and / or twists on opening, then abandon the riser turn and carry out your normal drills for getting out of the twists and / or re-inflating the end cells. If you are about to make contact with another canopy on opening, then make the rear riser turn to move away from the danger. Make sure that your airspace is clear before making any turns.

Remember, the first step towards avoiding a canopy collision on opening is to ensure that you have created enough separation between yourself and other skydivers at the end of each skydive. To this end, get a proper brief on the most efficient tracking methods and practise your tracking at every opportunity.

Be aware of what is going on around you as you track away from other skydivers e.g., if you know there is someone over to your left as you throw your pilot chute and find that your canopy does a left turn during opening, you should also realise that you are probably going to need to make an avoidance manoeuvre.

Just because you are jumping on your own, doesn't necessarily mean that no one will be near you on opening. Keep looking forwards during your safety count to make sure that you have clear airspace.

This exercise is needed to qualify for CT and must be carried out on three separate descents, debriefed and signed for by a qualified coach or instructor.

CT2 EXERCISES

↘CHECKING THE STALL POINT EXERCISE USING TOGGLES

You will have already completed this exercise before for CT1. You will probably now be on a smaller canopy with higher performance. The aim of this exercise is to check where the stall point is, how much you can pull the toggles down without risking stalling your canopy and how to recover if you do stall your canopy. It will be vital that you know this before attempting to carry out some of the other exercises later.

Remember you may have changed to a higher performance canopy (a higher performance canopy is any canopy not explicitly designed for student use) and the stall can happen quicker and feel more radical. This exercise is needed to qualify for CT2 and must be carried out on three separate descents, debriefed and signed for by a qualified coach or instructor.

Fly the canopy on deep brakes and flat turns on 3 descents.

Slow Flight Characteristics.
By exploring and becoming comfortable at flying your canopy around in deep brakes, you will uncover a whole new range of control over the canopy and develop a much higher level of canopy awareness and skill.

↘SLOW FLIGHT EXERCISE

Extend the range of the canopy while travelling with the wind to your holding area try and concentrate on keeping the canopy in its deepest brake setting that you can. You will probably be quite surprised at how much brake you can actually apply before the canopy's glide angle starts to decrease.

When you arrive back in the holding area, check TAP and then if you have sufficient altitude, carry out the flat turn exercise, but this time try applying 3/4 brakes, which should mean that the toggles are at about waist level. Remember, you may be quite close to the stall point on the canopy (see "Checking the Stall Point" above) so only make your flat turns by lifting one toggle slightly.

Notes:
Being on deep brakes will decrease your descent rate and increase the length of the canopy ride. Be aware, this may well mean that Tandem and other high opening canopies will catch up with you and, in a multiple aircraft operation, the canopies from another load. Therefore, make sure that you carefully check TAP before each manoeuvre and check with your canopy coach that is safe to do that exercise on that lift.

This exercise is needed to qualify for CT2 and must be carried out on three separate descents, debriefed and signed for by a qualified coach or instructor.

Check the stall point using rear risers and fly the canopy on at least 3 descents.

You have already tried to find the stall point with the toggles, this time instead you are going to use your rear risers.

The aim of this exercise is to check where the stall point is, how much you can pull the rear risers down without risking stalling your canopy and how to recover if you do stall your canopy.

Make sure you have plenty of clear airspace in front of you, keep your hands in your steering toggles at all times, reach as high as you can and very gently pull down both rear risers evenly. Stop at the point where the tail of the canopy just starts to "flutter" which is the sign the canopy is about to stall. Make a mental note of how far you had to pull the rear riser down. Gently release the risers back up to normal flight. You need to do this evenly.

Notes:
It does not take much more input for the canopy to develop from the initial symptoms of the stall into a fully developed stall. The canopy does not fold as in a toggle stall because you are not depressurizing it in the same way, but altering the angle of attack until the airflow that generates the lift over the wing becomes turbulent and stops generating lift. If you hold the stall the canopy can buck and roll and become uncomfortable and disconcerting, you will also lose a lot of height.

Prior to attempting this it is worth watching the Axis Flight School video "AXIS Foundations of Flight - The Rear Riser Stall" which can be found on Youtube.
www.youtube.com/watch?v=zS-NpRSUowA

You must allow the canopy to recover gently and evenly, if you throw the risers back up quickly the canopy may not reinflate evenly and can dive which can result in line twists. To this end, in order to give enough time to rectify any problems make sure you start this exercise no less than 1000 feet above your normal cutaway decision height.

Many jumpers have concerns over stalling the canopy on the rears, as they believe that it will cause a malfunction. Providing your inputs are smooth and you only hold the stall for just a second or two before smoothly letting the toggles back up to recover, then it is very difficult to self-induce a malfunction. Holding onto the stall for a longer period of time and making radical toggle movements, such as letting go of one of the toggles during a stall, could however cause problems.

This exercise is needed to qualify for CT2 and must be carried out on three separate descents, debriefed and signed for by a qualified coach or instructor.

Demonstrate the ability to carry out the correct landing pattern for that PLA in the conditions of the day without conflicting with other jumpers and land safely on the intended landing area.

The coach or instructor is looking for you to fly a predictable safe pattern and to land safely on the PLA. Accuracy is not a target on these jumps but more consistency in your flight planning and following your flight plan.

This exercise is needed to qualify for CT2 and must be carried out on three separate descents, debriefed and signed for by a qualified coach or instructor.

Completed 5 Pre-declared safe landings, within an area of 25m diameter.

You will need to carry out jumps where you show the ability to land safely and accurately in an area of 25 metre diameter, carrying the correct flight plan for the conditions of that day.

You should then be monitored by your instructor to ensure that you fly your plan wherever possible and if needed make the correct adjustments to the plan to still land safely. You will need to fly a good pattern and demonstrate a good landing.

This exercise is needed to qualify for CT2 and must be carried out on five separate descents, debriefed and signed for by a qualified coach or instructor.

Using a rear riser as an avoidance manoeuvre, on at least 3 descents.

This exercise should be one you are very familiar with already. You will now be flying canopies that have higher forward speeds, even with the brakes set. Therefore, the closing speeds between two high performance canopies can be very quick which leaves little time to react. As the groups you jump with increase in size there will also be more canopies in the sky too and a poor break off can lead to very congested skies. You may be required to steer away from one canopy and avoid another canopy immediately afterwards.

As discussed in the CT1 brief for rear riser turns you need to build up your peripheral vision. It is all very well to avoid one canopy but if the airspace you are turning into isn't clear the consequences can be catastrophic.

As your canopy's performance increases, so will the rate of turn. Therefore, you need to have control over these turns, not just instinctively grabbing the riser and yanking on it as hard as you can.

Remember when practising that this technique requires you to make a rear riser input just after the canopy has opened. Remember to check your canopy properly before making the turn.

If during a practice session you have end cell closure and / or twists on opening, then abandon the riser turn and carry out your normal drills for getting out of the twists and / or re-inflating the end cells. Obviously if you are about to make contact with another canopy on opening, then make the rear riser turn and deal with the twists / end cell closure after you have moved away from the danger. Make sure that your airspace is clear before making any turns.

You should practise how hard you need to pull the rear riser to make a controlled 90 degree turn with a stop on heading, and then check your airspace and make another turn, as if avoiding a second canopy. You can then TAP and if the airspace is clear use the rears to turn and point towards your intended holding area.

This exercise is needed to qualify for CT2 and must be carried out on three separate descents, debriefed and signed for by a qualified coach or instructor.

Receive a full safety brief on the following; Collapsing and Stowing of slider; Loosening of chest strap under canopy; Removal of booties; Use of camera under canopy

All the actions above if not done appropriately can cause harm to you, your canopy, or those around you.

You do not have to perform any of the items listed to gain your CT2, but before you attempt any should follow the guidelines for how to perform any CT drill as listed on page 50 and have received the brief from a suitably qualified coach or instructor.

SECTION 9: A FURTHER GUIDE TO CANOPY FLIGHT.

This section is designed to give you more in-depth knowledge about the aerodynamics of how your canopy flies, and what happens during turns and the flare.

Once your canopy has fully deployed, your weight under it is pulling it down towards the ground. Your canopy is made with the lines being longer from front to back, this gives it a nose down attitude. This is called the “angle of incidence”. This can be seen in figure 36 below:

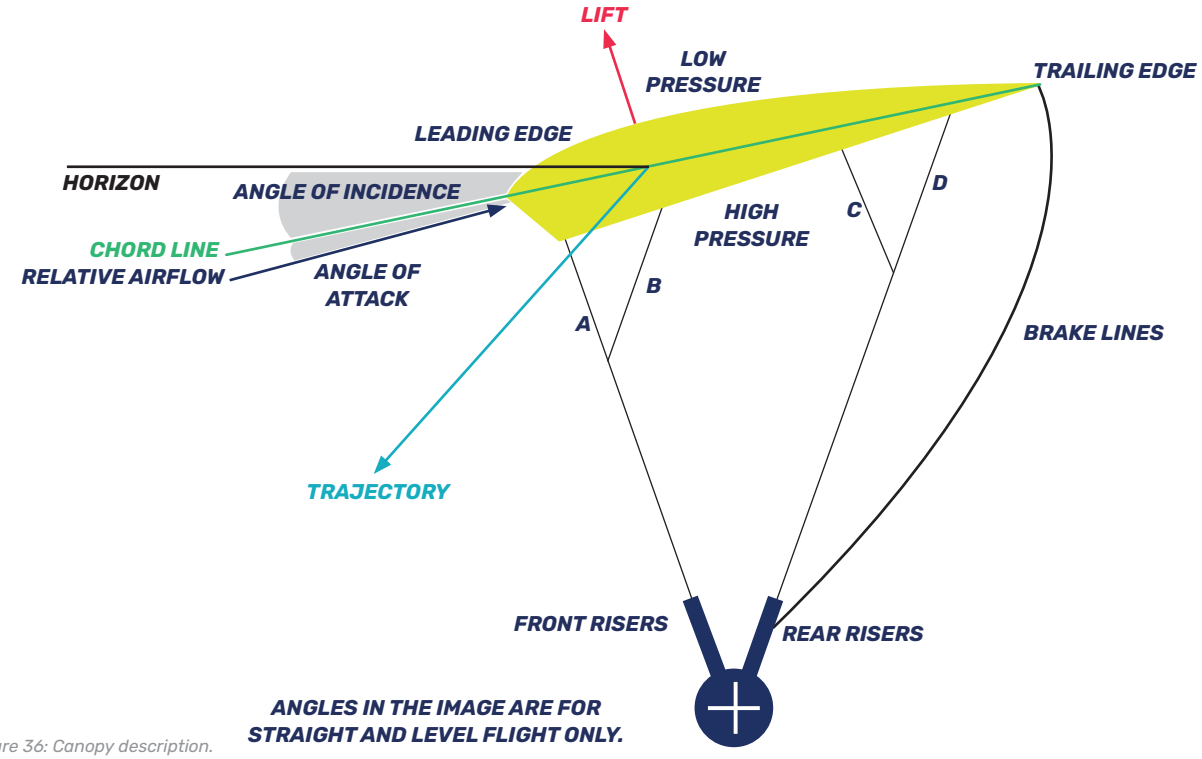


Figure 36: Canopy description.

The shape of the canopy will help drive it forward, and gravity is pulling you down. This allows air to be pushed in through the nose of the canopy and because the tail of the canopy is closed this maintains the internal pressure within the canopy, and therefore its shape.

As a canopy passes through the air it can produce an aerodynamic force called “lift”, which acts perpendicular to the canopy surface that is generating it.

“Drag” is the resistance that affects the canopy as it passes through the air. This acts in the opposite direction to the motion of the canopy.

Lift.

While the complexity of the lift equations is best left to scientists, what is agreed is that the shape of a canopy can generate lower pressure above its top surface and higher pressure below as shown in figure 37. Higher pressure air always tries to move towards the lower pressure, this is what generates the upward force, “lift”, and is shown as being perpendicular to the surface that generates it.

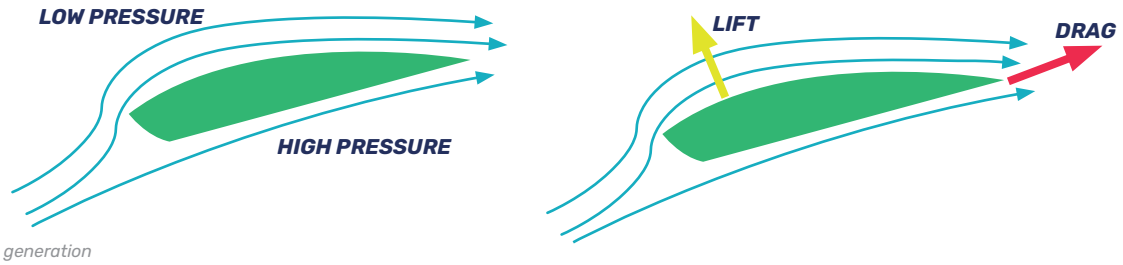


Figure 37: Lift generation

Essentially lift is created by disturbing the air that the canopy flies through. The amount of lift the canopy generates is proportional to several factors; its shape; size; angle of attack; the density of the air it is passing through; and its velocity through the air.

The shape of the canopy.

A canopy has a profile and a planform. Planforms were discussed above and are considered as rectangular or tapered. A canopy shape when seen in cross section, as below, is called an aerofoil.

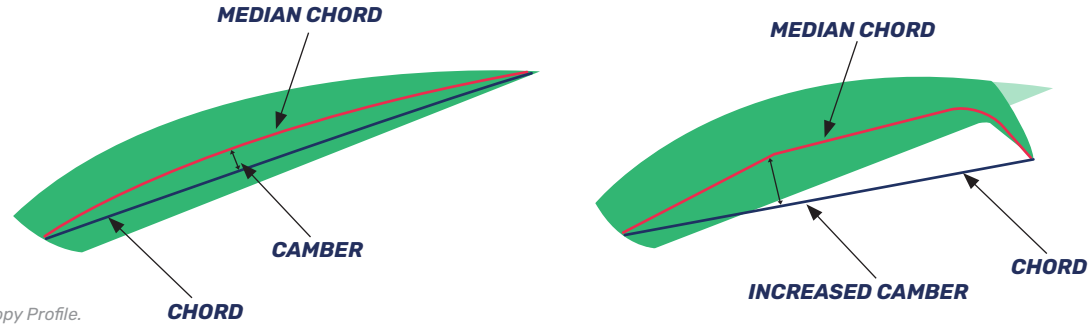


Figure 38: Canopy Profile.

You can see above the top surface of the canopy is curved. The shape of the wing can be described by its "camber". The camber is the difference between the line that passes straight from nose to tail (the chord) and the line that shows the half depth of the wing (the median chord).

As wing camber increases, so does lift produced. An aircraft changes its camber by lowering flaps. A canopy changes its camber by pulling on the tail.

As discussed in Section 7 there are many canopy profiles depending on the tapering that the designer wants. The cross section of the canopy can also change from the centre to the wing tip of the canopy. At the wing tips the higher pressure under the wing attempts to go round the wing tip and can cause vortices to be created. These "wing tip vortices" can reduce the lift the wing tip is creating and cause drag. To reduce this effect the designers will taper the wings.

However, there is no lift for free, the more surface area of a deeper canopy aerofoil presented to the relative airflow the more drag will occur.

Angle of Attack.

The Angle of attack is the angle between the canopy's mean chord line and the airflow it is passing through, the relative airflow.

As the angle of attack increases, the air flowing over the top of the wing has to travel an ever-increasing distance, so the air pressure falls ever lower on the top and therefore the lift increases. Unfortunately, as the angle of attack increases, so does the amount of surface area presented to the air to cause drag.

In normal flight the air passes over the canopy and the flow of the air tries to stay close to the surface, it can be described as laminar. As the angle of attack increases the flow over the top skin starts to become turbulent near the tail, and reduce the lift created. As the angle of attack increases more of the airflow will break away and become less laminar, when the turbulence reaches a certain point, usually above 12°, the wing is said to be stalled. At this point the wing ceases to generate lift and your descent rate will rapidly increase.

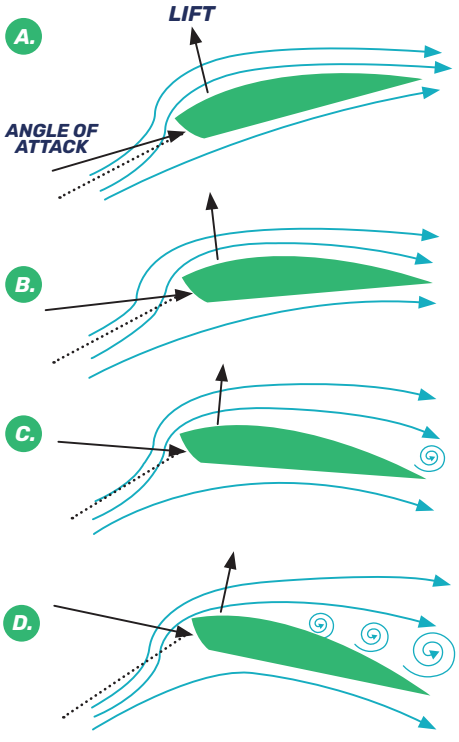


Figure 39: Angle of Attack

The angle of attack is altered by moving your weight under the canopy, for example as you flare the canopy your weight will swing forward and because the lines are not elastic you pitch the canopy up. The other way to alter the angle of attack to cause a stall is to use the rear risers.

In a stall if you release the brakes or rear risers the canopy will surge forward and your weight will move towards the rear of the canopy, this will now pitch the canopy down and reduce the angle of attack. This will also increase its speed.

Speed.

The faster a canopy moves through the air the more air particles will interact with it. Therefore, for any particular canopy the faster it flies the more lift the wing will generate. It is actually proportional to speed squared, i.e., double the speed and you quadruple the lift.
However, as the speed increases so will the drag, at the same rate as the increased lift, proportionally to the square of the speed.

This is why it is important to fly the canopy on landing at full drive until it's time to flare. If you bring the canopy in with some brakes on you will not have the speed to convert to lift.

Size of the wing.

The bigger the wing the more surface area there is to interact with the air particles and generate lift. However, with bigger canopies comes more drag which slows the canopy down.

Air Density.

As we go higher the air becomes less dense, therefore there are fewer air particles to interact with the wing and generate lift. Air density will also reduce with temperature. Therefore, if you travel to somewhere warmer, higher, or both, your canopy will fly and flare differently.

Some manufacturers will give guidelines for the amount your canopy will be affected with temperature and pressure changes.

Anhedral arc.

To get the maximum lift from a canopy we also need to examine its Anhedral Arc. The Anhedral Arc refers to the curvature of the wing as you look at it from the front or from behind. This will vary from canopy to canopy, and is influenced by the length of the lines, and the position of the risers on the pilot. A flatter wing will produce more lift in straight and level flight, thus aiding its glide ratio.

Once the canopy is open the slider has done its job, and you can collapse it to reduce drag. This should only be done after receiving the required brief. The reason it is pulled down or removed is to allow the canopy to fully open to its flattest profile. To further allow the risers to part the chest strap can be also slackened off.

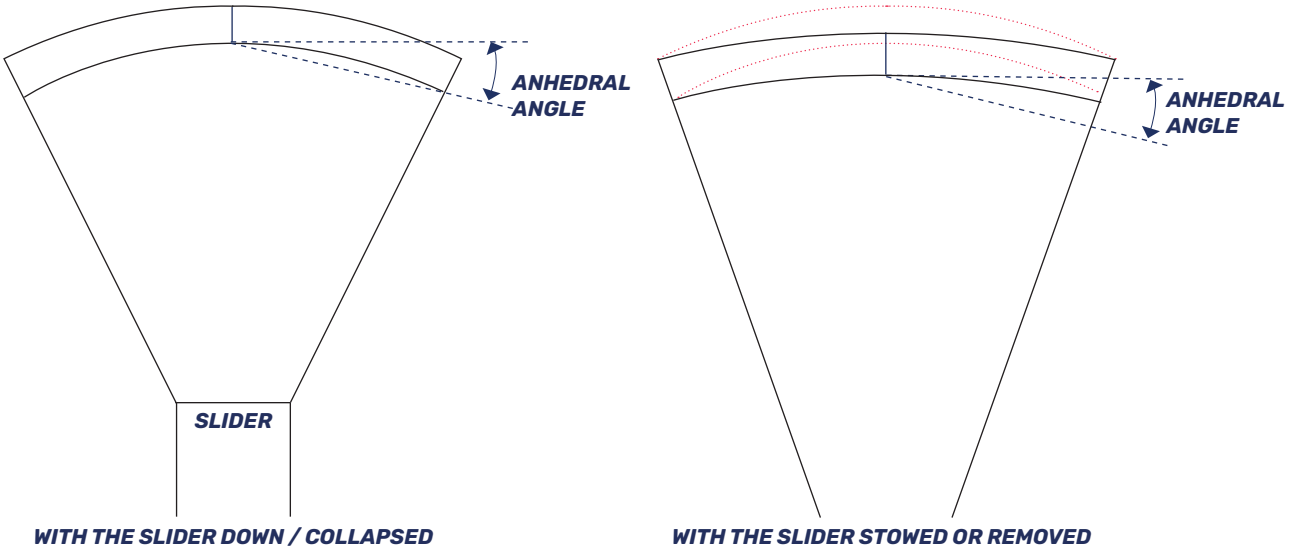


Figure 40: Anhedral angle for a ram-air wing

Drag.

The drag that affects a canopy and its pilot is caused by:

↘ Lift induced drag from the wing tip vortices. This decreases with speed.
↘ Parasitic drag which is made up of "form drag" (the front surface area of canopy and pilot hitting the relative airflow) and "surface friction". Both of these increase with speed.

As already discussed above in planforms, one of the reasons for tapering a canopy is to reduce the effect of the wing tip vortices. The pressure created by wing underneath it tries to push around the end of the canopy to the above lower pressure. This negates the lift at this point and the vortices created cause drag.

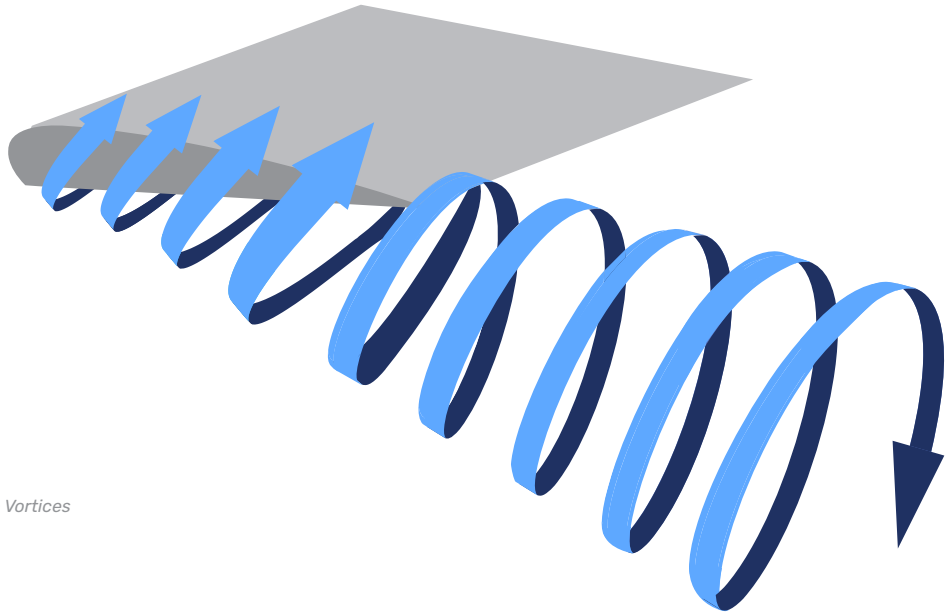


Figure 41: Wing Tip Vortices

Parasitic drag is not caused by the generation of lift, but is the resistance caused by moving an object through a medium, in our case the canopy and pilot through the air. Form drag is caused by the pressure against a body as you try to move it, and the resultant turbulent eddies that occur behind the object that cause the drag. The more streamlined an object the easier it can pass through the air. Surface friction occurs on the surface at the smallest level in that some air particles stick to the surface, if the surface is rough then other particles are deflected around them and small areas of turbulence occur over the wing. This turbulence affects the air flow around the pilot for example with a baggy jumpsuit.

Some of the methods used to reduce drag:

↘ Collapsible pilot chutes.
↘ Collapse, stow or remove the slider.
↘ Remove the deployment bag and pilot chute (Removeable Deployment System RDS).
↘ Thinner or fewer lines.
↘ Thinner profile canopies.
↘ Thinner risers.
↘ Tighter jumpsuits.
↘ A more streamlined pilot position.

Figure 42: Streamlined Pilot Position. (Photo courtesy of Chris Cook)

What happens in a turn?

If you pull one toggle down it deforms that side of the canopy and changes the camber of the canopy. This should actually more lift due to change of shape increasing the lift generated. However, the effect of the drag is larger than the lift so the net result is increased drag. Some very high-performance canopies have now reached the stage where a small application of brake will cause the canopy to turn in opposite direction.

Figure 43: Forces in a turn (Photos Courtesy of Performance Designs)

Due to the different speeds of the sides of the canopy, it will begin to turn, and as one side is producing less lift the canopy will also roll. Your body weight wants to carry on moving in a straight line but because your lines are not elastic you will follow the canopy round. The pitch of the canopy will also change downwards and the canopy will begin to accelerate.

In normal flight the canopy has just your weight under it. In the turn as you are going round you continue to try and move away from the canopy, but you can't because of the lines. We feel this outward

force through the harness digging into your legs and the blood being forced towards your feet.

At this time, you are increasing the perceived weight under the canopy. As discussed above with wing-loading the more weight you put under the canopy the faster it will go, and the more lift it will generate. However, because the canopy is rolled over and pitched down the lift is not upwards, so your rate of descent increases. So, in fact, the canopy is generating the most lift it can in a steep turn. However, as described numerous times before if this turn is near the ground and the canopy is not generating lift upwards (relative to the ground) it will be descending quicker towards the ground.

The faster / harder you put in the input the faster all the above will happen.

As the input is released the canopy will take a finite amount of time to "recover" to normal flight, in that the pilot will swing back under the canopy as a pendulum would swing back. The additional speed will also be lost. You may have felt this if you have spiralled the canopy and let the toggle back up quickly: you swing back but won't have lost all the extra speed yet, and you may feel the canopy go upwards (this lift is caused by the additional speed) and then return to its normal flight as the speed is lost.

What happens during a flare?

When you pull both toggles down you will alter the shape of the rear of the canopy. This will increase the lift and drag that the canopy produces and begin to slow your forward speed and descent rate. If you flare from full drive this will also swing you forward due to your momentum. Because the lines are tight your forward movement relative to the canopy will pitch the canopy up and increase the angle of attack, this will further create more lift and drag. This takes a finite amount of time to happen. If you have timed it correctly, as the canopy loses its speed and the extra lift, you can finish the flare to gain the last available lift and have a smooth soft landing.

This is why a two-stage flare is good, you can feed the first part of the flare in, the canopy will level out and slow down which will give you some more time to assess when to apply the final part of the flare. If you are a little high you can hold it and still have some of the flare in reserve to use at the correct moment to get the last lift out of the canopy.

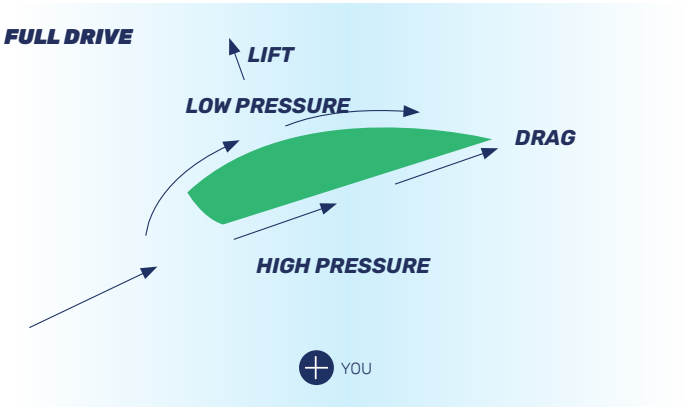
If you flare too low you will not gain the full effect of the lift from the change in shape and increased lift, especially if there is no time for an increase in the angle of attack.

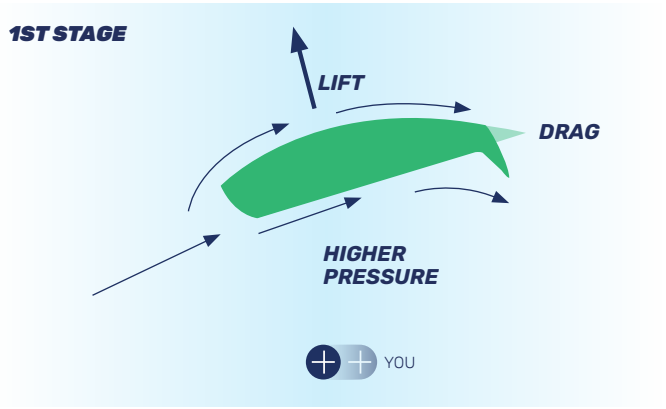
If you flare too high you will swing back under the canopy, losing the benefit from an increased angle of attack, and having already traded your forward speed for lift your rate of descent will increase. This landing will not be as soft as the optimum and you should make sure you fully complete the flare and be ready to PLF.

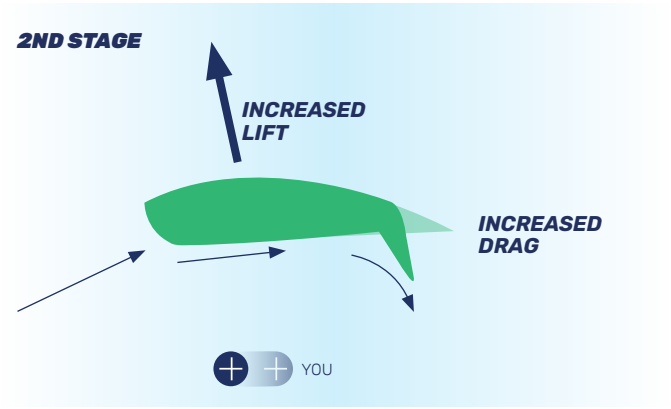
If you release the toggles at this point the canopy will surge forward to "recover" to its normal flight. The angle of attack will very rapidly reduce, and the canopy will pitch down more than in normal flight. You will also lose the lift that was generated from the changed shape of the canopy and will be accelerating downwards. All these factors add up to a rapid acceleration towards the ground which if done too low you will not have time to have a second attempt at a flare.

Landing in this surge can result in serious injury.

This is why a student is taught if you flare high hold the toggles down, a canopy designed for students and loaded appropriately should maintain its shape and not stall, and still give a reasonably slow rate of descent.







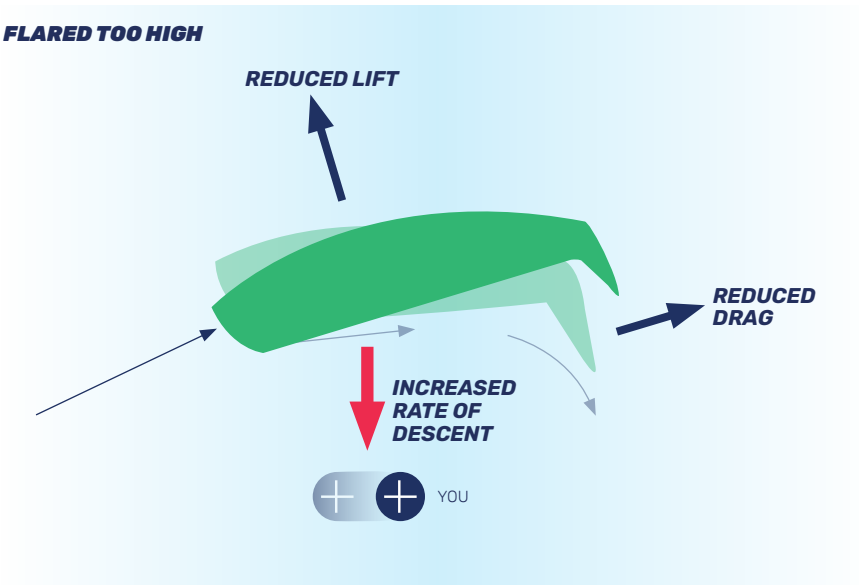


Figure 44: Forces in a Flare.

SECTION 9: FURTHER READING

There is a lot of good information available for further reading. Many of the photographs used in this manual were made available by:

- Axis Flight School - www.axisflightschool.com
- NZ Aerosports - www.nzaerosports.com
- Performance Designs - www.performancedesigns.com

Each of these sites also have extensive further useful information that are good to read. The authors are grateful for their permission to use their images.

Another good resource is Brian Germain's "The Parachute and its Pilot" - www.BrianGermain.com This also includes much a more detailed examination of the psychology of many factors involved in learning to fly a canopy well.

Always remember to check with an instructor or coach before carrying out any manoeuvre or technique you may read about, however reputable you think the resource is.

SECTION 10: GLOSSARY

In this section you will find some key terms used within canopy flying. If you do not understand the explanation given, please ask an Instructor or coach.

Aerofoil: The cross-section of a canopy.

Base leg: Phase of the landing pattern that takes you across the wind line. Also known as cross wind leg.

Brake: To apply brake by pulling down a on both steering toggles.

Brake fire: Premature release of brake control / steering toggle from its half brake setting. Note; steering lines are set on their half brake setting during packing.

Canopy: The parachute.

Collapsible slider: A slider which is intentionally collapsed to reduce drag.

Collapsible pilot chute: A pilot chute that is designed to collapse during deployment of the parachute.

Cocking the pilot chute: To set the pilot chute so that it inflates when deployed.

Cross Wind Leg: Phase of the landing pattern that takes you across the wind line. Also known as the base leg.

Deep Spot: An exit point (point when you leave the aircraft) or opening area that is a great distance upwind from the PLA. Also known as long spot.

Downwind leg: First leg (phase) of your landing pattern.

Elliptical: A term used to describe a canopy shape that is tapered with a curve rather than a straight line, and is designed to give more performance.

Final leg: Final phase of your landing pattern which should be made facing into wind. Also known as into wind leg.

Full drive: When a parachutist has both steering toggles all the way up (arms fully extended upwards) the canopy is on full drive. Also known as full flight, full speed.

Flare: Technique used for landing a canopy.

Flat turn: A steering toggle input which, if executed correctly, causes the canopy to turn with a minimum amount of bank and altitude loss.

Half brakes: By pulling down approximately halfway on both steering toggles at the same time, we apply half brakes. This causes the canopy to fly at half its (full drive) speed.

Holding Area: An area that is upwind of the PLA from which you can easily make it onto the PLA.

Into wind leg: Final phase of your landing pattern which should be made facing into wind. Also known as final leg or finals.

Opening shock: The amount of force applied to equipment and a person when a canopy opens.

Pilot Chute: A device that, once fully inflated in the airflow, pulls on the bridal line which in turn extracts the pin from the closing loop and then lifts the deployment bag out of the container.

PLA: A suitable area where it is intended that parachutists should land.

PTO: Parachute Training Organisation affiliated to British Skydiving.

Quarter brakes: When both steering toggles are pulled down a quarter of their full length of travel (about 6 to 10 inches) the canopy will be said to be on quarter brakes and will fly at 3 quarters of its (full drive) speed.

Riser: Webbing which attaches the lines of the canopy to a harness/container system via the three-ring release system on your harness. There are normally 2 front risers, attached to the front portion of the canopy and 2 rear risers, attached to the rear portion of the canopy.

Semi-elliptical: A canopy that is tapered with a curve on the leading or trailing edge but only for a proportion of the width of the canopy.

Set up point: A point where you should intend to be at a certain altitude

Short spot: An exit point (point when you leave the aircraft) or opening area that is a short distance from or downwind of the PLA.

TAP: Traffic, Altitude, Position. These should be checked before any turn / canopy exercise.

The three A's: Altitude/Airspace/Area. An alternative to TAP. These should be checked before any turn / canopy exercise.

Traffic: Other canopies in the air.