



**Danish Parachute Association**

**CANOPY PILOTING MANUAL**

**FOR STUDENTS**

# Introduction

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Nowadays skydiving accidents are very rarely caused by equipment malfunctions.

When accidents happen, it's often under a fully functional main canopy – and most often they happen when the skydiver hits the ground – during landing.

This is why safe canopy piloting and landing are the topic of this Canopy Piloting Manual. It's intended for all skydiving students up until they've obtained their Skydiving License (called C License in Denmark).

This manual consists of a theoretical and a practical part. Each section of theory ends with a set of assignments to complete with your instructor. The last part of the manual provides some practical exercises, that you have to do during your jumps. Agree with your instructor before each jump, which exercise you will do and make sure to get feedback and approval afterward.

For manual students, the stages in this Canopy Piloting Manual match the stages of the education.

For AFF students, Stage II of this Canopy Piloting Manual are for AFF Levels 1-7.

Although the manual is primarily intended for teaching skydiving students, licensed skydivers will also benefit from doing the exercises, for example, when you have a new parachute. This will help you get to know your parachute quickly and safely.

*Enjoy your fun and safe canopy piloting!*

This Canopy Piloting Manual and any part of it may be freely copied and distributed.

Danish Parachute Association (DFU), Instructors Committee (IU for "Instruktørudvalget" in Danish), March 2006.

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# Stage I

## Canopy Piloting

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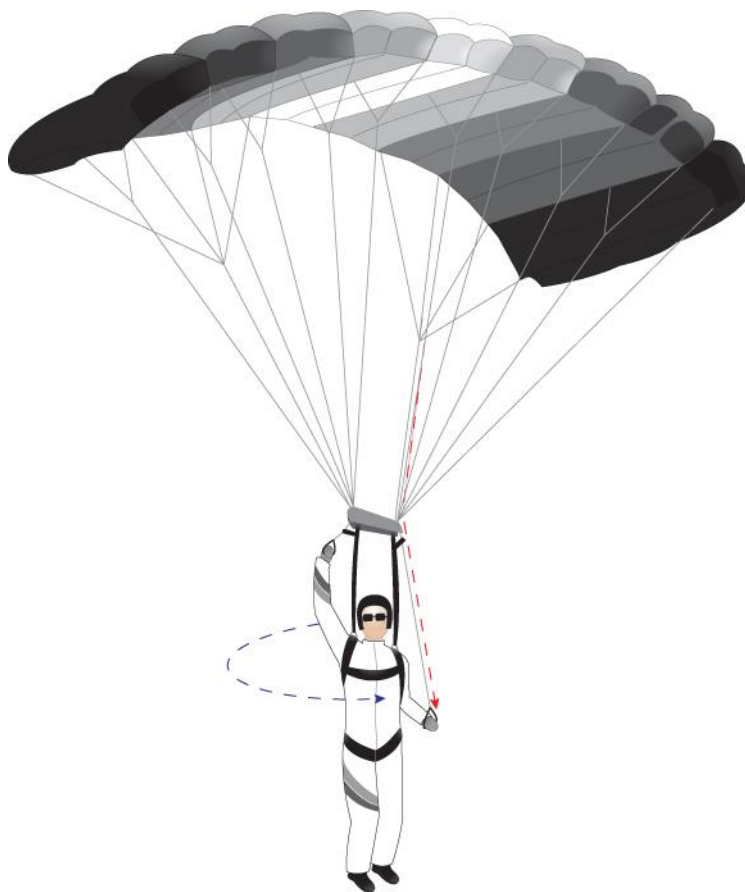
### Steering principles

Contrary to the early parachutes that were round and could not be steered very much, a modern ram-air parachute can be steered to an accurate landing.

The basics of steering a parachute are simple; pull the left toggle to turn left, pull the right toggle to turn right.

The toggles are connected to the steering lines that are attached to the rear edge of the canopy on each side. When you pull a toggle, you pull one side of the rear edge down and thereby brake that side of the parachute. This makes the parachute turn for as long as you hold down the toggle. When you bring the toggle back up, so you're no longer pulling down the rear edge of the canopy, you will start to fly forward again.

The farther down you pull the toggle, the faster the parachute will turn.



*Figure 1: Pull down a toggle in order to turn the parachute to that side.*

When you pull on a toggle and the parachute turns, your downward speed increases at the same time. The more you turn, the faster you fall. Therefore, it's a very bad idea to turn at a low altitude. We will get back to that later.

***Assignments:***

*How can you get the parachute to turn?*

*What will the parachute do while it's turning?*

## Flight plan

The safest place to land is at the dropzone because it's always a large open area without any obstacles. In addition, you will land near instructors and other skydivers who can help, if any problems arise during your landing.

In order to land at the dropzone, you'll have to make a flight plan in advance. It's a plan for how you'll fly from your exit spot and until you're back on the ground. This plan is basically the same as the plan that pilots make before a flight.

At Stage I, making a flight plan means that you and your instructor will point out where you should be at a few specific altitudes. Later, you'll learn how to make the flight plan yourself and fit it to the current circumstances.

The pattern you should fly from an altitude of 300 meters (1000 ft) until you land, is called the Landing Pattern. First, you fly downwind, then perpendicular to the wind and finally upwind. These three parts are called your downwind leg, base leg and your final approach.

Your exact landing pattern will depend on the wind at a given time. In Figure 2 you can see an example of a landing pattern.

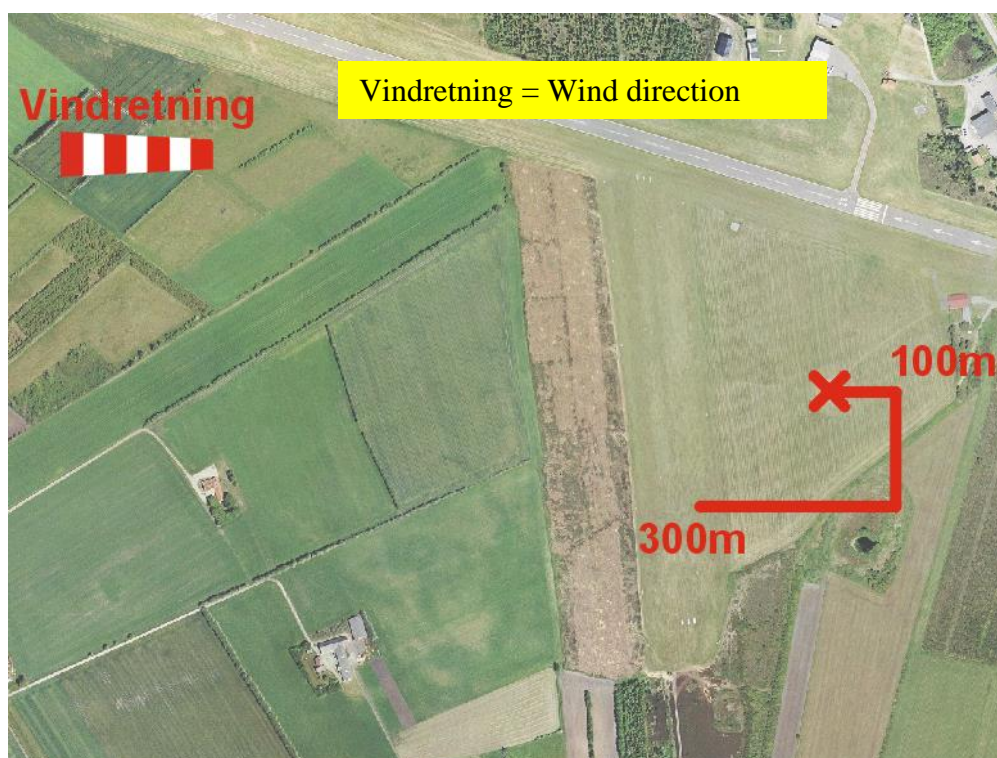


Figure 2: Example of a landing pattern



As the figure shows, your landing pattern starts downwind at an altitude of 300 meters (1000 ft) (the downwind leg) and it ends with the final upwind approach from an altitude of 100 meters (300 ft). These two altitudes are the most important to remember at Stage I.

In order to steer the parachute toward the starting point for your landing pattern (also called the "300-meter point" (1000 ft point)), you can help yourself by identifying a point on the ground between this and the spot where you exit the aircraft. That point is where you should be when you're half way between your exit altitude and ground level. This will give you something to steer by before starting your landing pattern.

A good rule of thumb is: "Halfway down, halfway home". When you have dropped half of the altitude, you should also have flown half the distance to the landing point.

Before each jump, the instructor will go over your flight plan with you, so you know where you should be at the different altitudes. If there are any areas near the dropzone that you are not allowed to fly over, you'll also be briefed on those. For example, it might be a body of water, a runway, buildings, electrical wires or other obstacles.

During the jump itself, you should stick to the flight plan as closely as possible. It's especially important that you make sure not to arrive too early at your defined points. You should also fly in such a way that while you're above 300 meters (1000 ft), you're flying downwind toward your 300-meter point (1000 ft point). Of course, the same applies to the "halfway down, halfway home" rule: You should not be half way home until you're halfway down.

While you're flying your parachute, you can't feel whether you're flying up- or downwind. So you'll need to use other methods to find out which direction the wind is blowing. The easiest one is to look at the windsock at the dropzone or a flag or some smoke.

Another way to know the wind direction is to check it out in advance. You can do this by simply standing on the ground with your face into the wind right before your jump, and note the wind direction compared to where the sun is. Then, if during your jump you fly so that the sun is in that same place, you'll know you're flying upwind. For example, if you look straight into the sun when the wind is in your face, you'll know that you should fly toward the sun on your final approach. Remember that this only works if you do it right before your jump, because the sun shifts over the course of the day and the wind direction might also change.

During your first jumps you'll bring a radio and an instructor will help guide you down. However, you should fly the parachute by yourself as much as possible. The instructor will only say something if necessary.

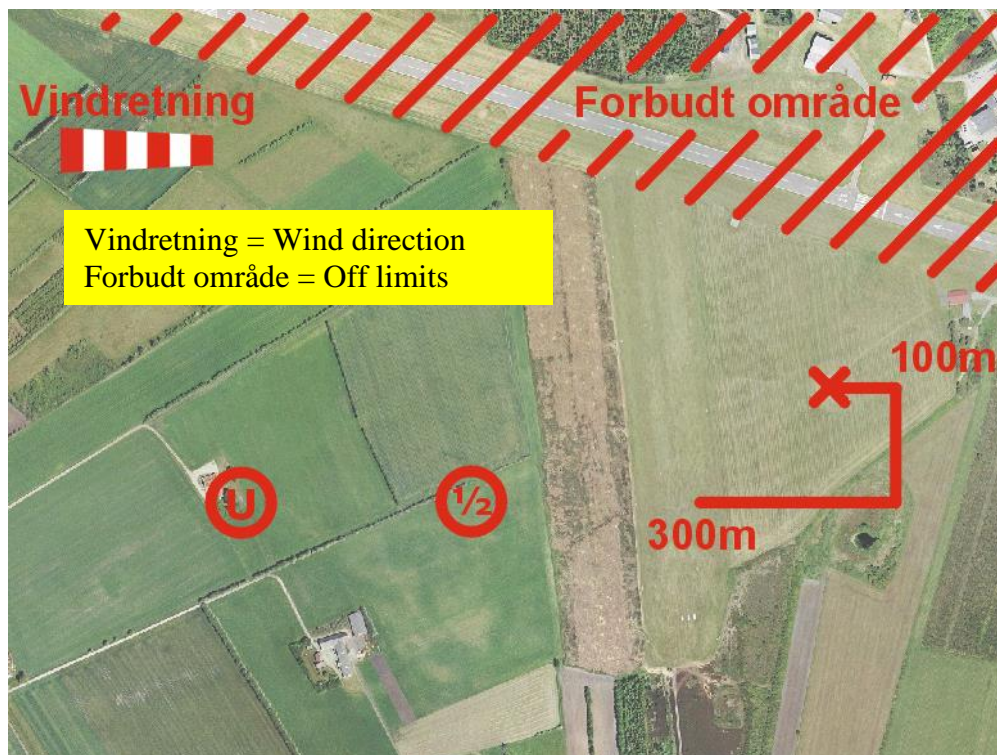


Figure 3: Flight plan with exit spot (**U**), "halfway down, halfway home" (**1/2**), landing pattern, landing point (**X**) and off-limits area

**Assignments:**

Use an aerial photo of the dropzone to answer the following questions:

Where is the landing point?

Where should you be at 300 m and at 100 m?

Where is "halfway down, halfway home"?

What's the wind direction?

What's the landing direction?

Are there any areas that you may not fly over?

# Landing

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## Final approach

Landing in a parachute usually happens very peacefully, if it's done right. Your landing starts already at an altitude of 100 meters (300 ft) when you go into your final approach. A good final approach consists of:

**Arms all the way up:** During the landing itself you can turn the parachute's speed into lifting power so you can reduce both the forward speed and the speed toward the ground at the same time. This is called to flare. To flare well, you'll need as much speed as possible before actually flaring. The speed is achieved by lifting your arms up all the way so you don't brake the parachute.

**Legs together and slightly bent:** It takes a long time to learn how to make a perfect landing. Sometimes you'll not land as softly as you would've liked. With your legs closed, so both feet and knees are touching, and with your knees slightly bent, you'll be in the best position to land. It's important to keep this position right up until you're standing on the ground.

**Upwind:** Upwind is the best direction to fly during landing. By flying upwind, your speed relative to the ground will be reduced the most. This is an advantage during landing because it'll make it much easier to bring the parachute in for a soft landing.

**Only small adjustments:** You may need to steer a little bit while you're on your final approach. For example, the parachute may be pushed a little by the wind so you have to steer it the other way in order to maintain your upwind direction. You may also be heading straight toward an obstacle. If you turn during your final approach, it's important to only make small adjustments where you never pull the toggles below your shoulders. The reason this is important is that any turning make the parachute fall faster and at the same time it makes it harder to flare well.

**Assignments:**

*What are the main elements of a good landing?*

*Show the correct body position during the final approach.*

## Flare

To achieve a good landing, it's important to make both a good final approach and a good flare which is the final braking of the parachute right before you put your feet on the ground. A flare is conducted by pulling the toggles all the way down in one smooth, calm movement along your body. Start this movement at an altitude of 3-5 meters (10-16 ft). The best way to determine the altitude is by looking ahead at the horizon, rather than looking down.

If you're wearing a radio, the instructor will count down from 3 to prepare you for the right time to flare. He/she will say "3 - 2 - 1 - Flare". Do not start your flare until the instructor says the word "Flare", even if you feel like you're close to the ground. Be aware that the countdown may not follow a steady rhythm, so be ready as soon as the instructor starts the countdown.

If by accident, you flare too high, it's important to keep your hands all the way down. This makes the parachute come to a complete stop and you'll slowly drop down the ground.

***Assignments:***

*Show a good flare.*

*Where should you look in order to determine the right altitude for starting your flare?*

## Parachute Landing Fall

Although you've learned how to make both a good final approach and a good flare, there is a risk that your landing will be harder than expected. By making a Parachute Landing Fall (PLF) you can avoid injuring yourself in hard landings.

A PLF works to distribute the energy of the fall over more time and over a bigger part of your body, instead of getting the full impact in your legs only.

The most important thing to do in a PLF is to keep your feet and knees together. Keep your elbows at your sides and hold the toggles in your hands. Turn your body slightly toward the landing direction and then roll off your feet, then the sides of your knees, your hips and over the opposite shoulder.

It may sound complicated when you first hear about a PLF, but once your instructor has shown you and you've practiced it a couple of times, it'll be quite easy.

**Assignment:**  
*Show a correct Parachute Landing Fall*

## Safety

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### Obstacles

Even when almost everything goes as planned, you run the risk of getting into a situation where you can't land in an open area. When you make your flight plan, always talk with your instructor about where obstacles are, so you can avoid getting near them.

Some of the riskiest obstacles to land in are electrical wires, water and trees. We'll go over them here:

**Electrical wires:** If you can't avoid landing in electrical wires, you'll have the best chance of sliding in between them if you make yourself as long and narrow as possible, with your arms and legs together and stretched out. If you get caught hanging in the wires, do nothing, and wait for help.

**Water:** At dropzones near water you may be required to wear a life vest during jumps. If you can't avoid landing in water you can prepare for slipping out of your harness by loosening the chest strap before landing. Then land as you normally would; upwind and flaring the same ways as usual. Once you have landed, you blow up your life vest, if you have one, take off the harness and swim toward land. Leave the parachute in the water.

**Trees:** If you can't avoid landing in trees, you should focus on protecting the places where branches may get caught. That is between your legs and under your arms. Do this by crossing your arms, make a fist of each hand while holding the toggles, then placing your hands in your armpits and by pulling your legs together and bending them slightly. Protect your face by putting your elbows up in front of your face. If you get stuck hanging in the trees, don't do anything, but wait.

***Assignments:***

*Show the correct body position for landing in electrical wires.*

*Show the correct body position for landing in trees.*

*What should you do if you have landed in electrical wires?*

*What should you do if you have landed in water?*

*What should you do if you have landed in trees?*

# Stage II

## Canopy Piloting

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### Flight plan

At Stage I your instructor prepared your flight plan. Now you'll learn to do it yourself, and also to evaluate it so you'll get better at landing where you want.

Besides the 300 m and 100 m points, the following are now added to your flight plans:

**Deployment point**, which is where you deploy your parachute. Because you have drifted downwind in free fall, this point is not the same as your exit spot.

**Holding area**, which is the area where you can do canopy piloting exercises, fly around and enjoy the view, while you're certain that you can also make it home and have a good landing. The "halfway down, halfway home" point is in this area.

### Draw your flight plan

The easiest way to make a flight plan is to draw it on an aerial photo of the dropzone. Start from the back, by drawing the final approach, then the landing pattern and finally the rest of your flight plan back to the deployment point.

The final approach is the last part of the flight, from an altitude of 100 meters (300 ft), where you fly upwind. How long the final approach is, depends among other things on how fast the parachute flies and how much wind there is. On a windless day, the rule of thumb is that you'll fly forward about 200-250 m (600-800 ft) from an altitude of 100 meters (300 ft). If there's wind, your final approach will be shorter. If there's so much wind that you can't fly forward upwind, it's very simple to draw your flight plan: Don't! Stay on the ground!

When you have drawn up your final approach, you move on to the base leg. In windless weather, the base leg will be of the same length as the final approach. If there is some wind, the base leg will typically be a little bit longer than the final approach because you'll be flying across the wind instead of upwind.

Finally, draw up the downwind leg in the same way. If there is no wind, the downwind leg will be the same length as the final approach and the base leg. If there is wind, the downwind leg will be longer.

The following figures show landing patterns with no wind, some wind and strong wind, respectively. Notice that the base leg is also shorter when there is wind. This is because you have to turn your parachute upwind a little bit in order to fly across the wind (incidentally, this is called "crabbing"). If you were to just turn your side to the wind, you'd be pushed further away from your landing point.





Figure 4: No wind

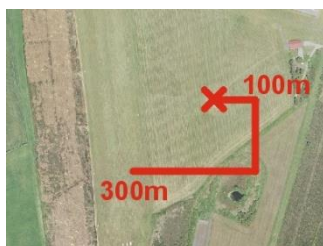


Figure 5: Some wind

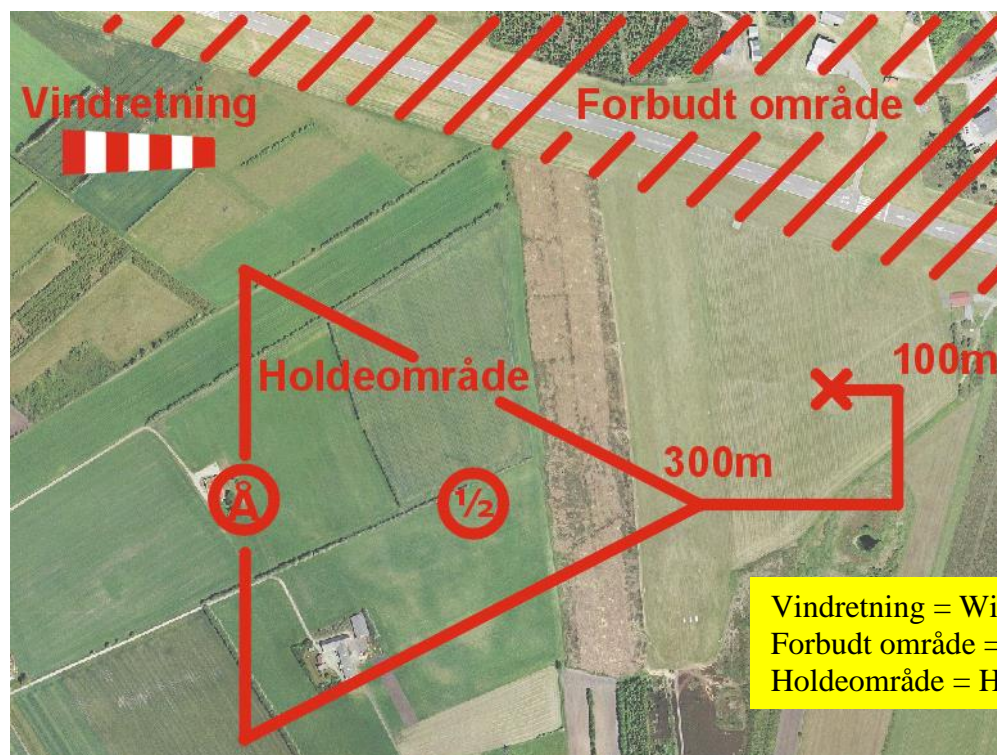


Figure 6: Strong wind

When you've drawn up your landing pattern, you draw up the holding area. As mentioned, the holding area is where you fly from deployment of the parachute until the beginning of your landing pattern. It's also where you would do any canopy piloting exercises.

The holding area is wide at first, right after you've deployed the parachute. It gets narrower the farther down and the closer to the landing are you get, much like a funnel. The more experienced you become, the more flexibility you have with regards to the holding area's size. The important thing is that you know what area you should fly in, so you can hit your 300 m point as accurately as possible.

There may be local rules or conditions that limit the holding area or define it in advance. Therefore, do remember to talk with your instructor about whether there are any off-limits areas.



Vindretning = Wind direction  
 Forbudt område = Off limits  
 Holdeområde = Holding area

Figure 7: Flight plan with deployment spot (A), holding area, "halfway down, halfway home" (1/2), landing pattern, landing point (X) and off-limits area

**Evaluate your flight plan**

You may not be able to follow your flight plan exactly. The ground wind and/or upper winds may change after you have entered the airplane, the exit spot is not as expected or the deployment point is not as planned. Therefore, you must be ready to change your flight plan en route and evaluate it on an on-going basis while you're under canopy.

Right after deployment you check your parachute, you check whether you're over the planned deployment point and whether the wind is as expected. If you're not at the planned deployment point or the wind has changed, you must adapt your flight plan.

**Change of wind direction**

In case the wind changes direction, you'll need to select a new holding area and a new landing pattern that fits with the new wind direction.

An example: The wind changes direction from west to southwest. If the wind was coming from the west when you made your flight plan, the holding area would be to the west of the landing point and the final approach from the east, as in Figure 7. Now, if the wind changes its direction to southwest, the holding area will move to the southwest and the final approach from the northeast, as shown in Figure 8.

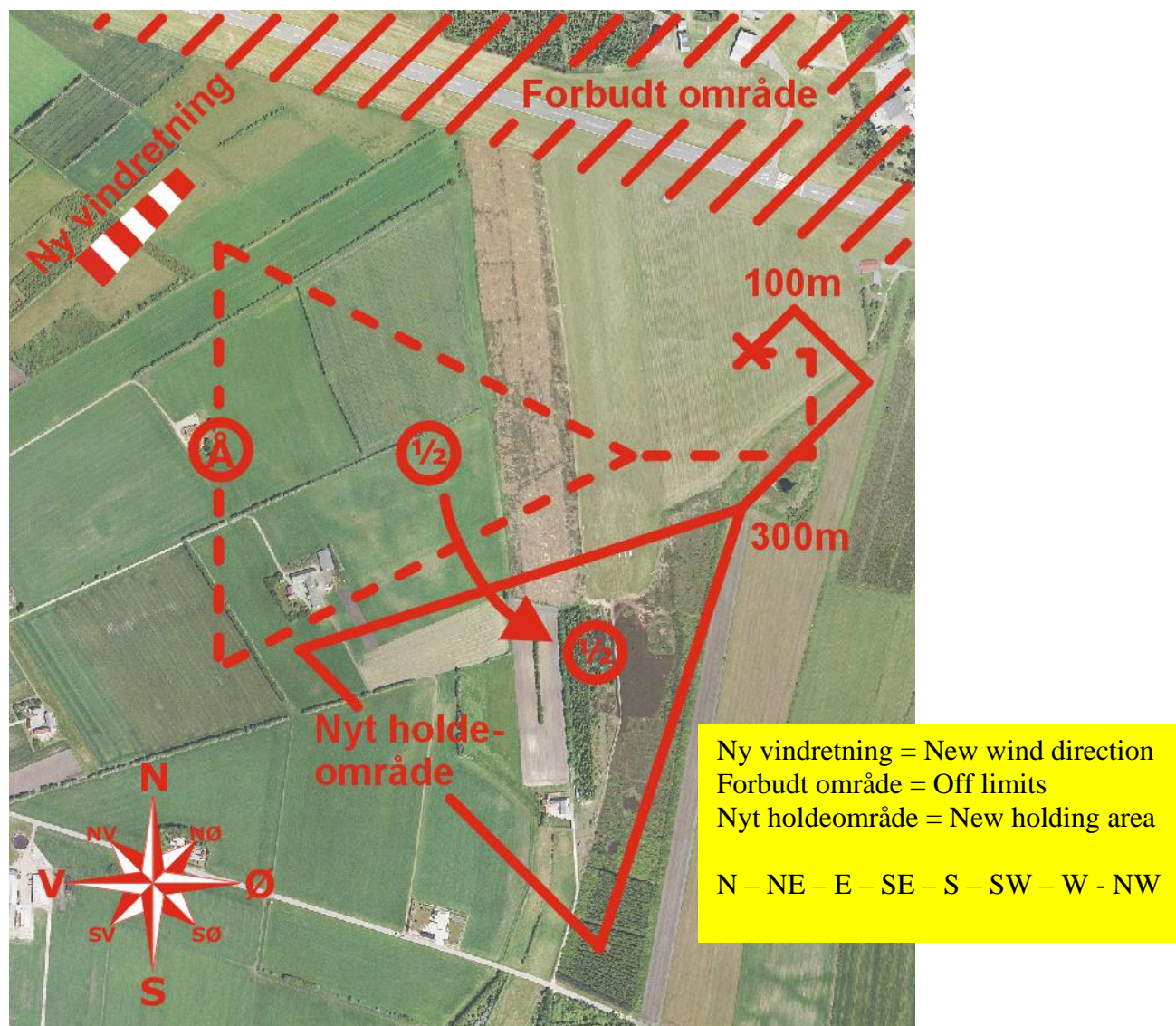


Figure 8: New flight plan that fits with the new wind direction

When you arrive at your new holding area, re-evaluate the flight plan.

### Change of wind direction and wind speed

A change of wind speed, especially when the wind direction also changes, often surprises skydivers and leads to landing out. Always start by adjusting your flight plan to the wind direction before assessing the wind speed.

If the wind turns out to milder than you expected, you'll not have as strong "tailwind on your way home". This means that you might struggle to make it all the way home to your landing point. In such a situation, it's important to use your "halfway down, halfway home" point to evaluate whether you can make it to your 300 m point to begin your landing pattern as planned. If not, you must choose a

different place to land. The sooner you make the decision to land somewhere safe rather than try to make it home, the greater your chances of a good landing. So make sure to select an area that you're certain you can reach, no later than at an altitude of 500 meters (1600 ft).

In addition to making it harder to get home, if the wind is not as strong as you planned for, you must also remember to adjust your landing pattern. The final approach will be longer and the downwind leg will be shorter. Altogether, this means that you have to shift your landing pattern farther behind the landing point than what you drew up on your flight plan.

If, on the other hand, the wind is stronger than you planned for, the opposite will be true, of course. Then you must avoid flying home too fast – use the “halfway down, halfway home” rule to guide you. You must also remember to adjust your landing pattern so your downwind leg is longer and your final approach is shorter.

### **Changes of landing pattern**

Between “halfway down, halfway home” and the beginning of your landing pattern you should evaluate whether you can follow your landing pattern without the risk of colliding with other parachutes. If not, select a different place to land in by shifting the landing pattern over.

As mentioned, the rule of thumb is that you land upwind. If the wind is weak, however, the windsock may move substantially from side to side and make it difficult to use it to find out the wind direction. If this is the case, you look and follow the landing pattern of other skydivers. If you're the first to land, use the “average direction” rather than adjusting your landing pattern all the way down.

If your club uses an arrow or a “landing T” to indicate the landing direction, you follow it. An arrow is used to indicate what direction to land in and a T is placed so you read it right side up when you land.

**Assignments:**

*Draw up the following on an aerial photo of the dropzone so it fits with current wind conditions:*

- *Landing point*
- *Wind direction*
- *Landing direction*
- *Landing pattern*
- *"Halfway down, halfway home"*
- *Deployment point*
- *Holding area*

*Explain how you will handle the following changes:*

- *The wind has changed direction or speed*
- *The deployment point is different than expected*
- *You have flown in the wrong direction*

## Steering

You can obtain full control over your parachute if you're capable of flying it in its full range between full speed and full brakes. The steering range is split into 3 zones to make it easier to understand and work with. The 3 zones are called green, yellow and red.

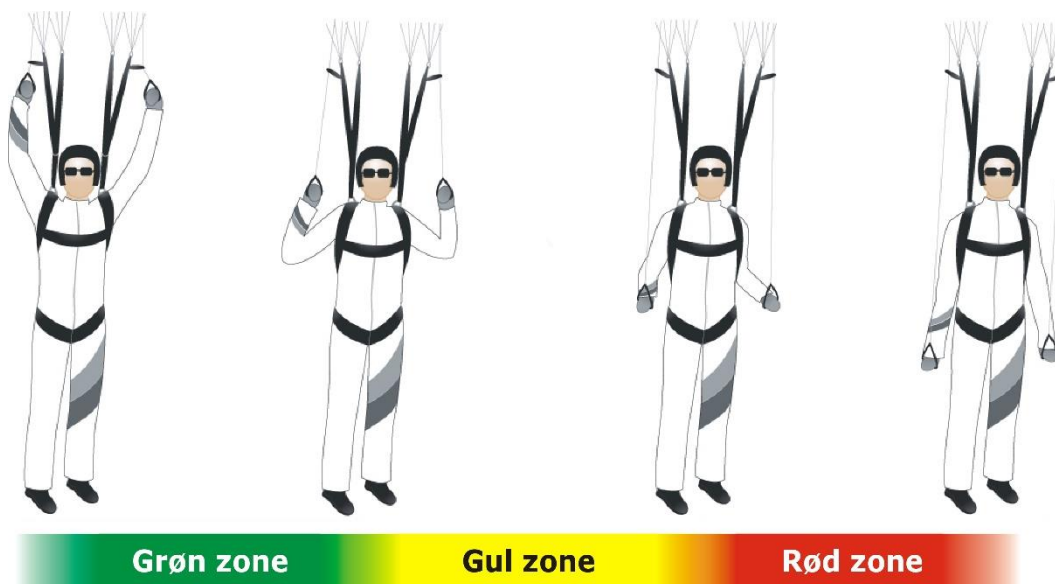


Figure 9: Green, yellow and red zones

### Green zone

This is the range from full speed to slightly braked. The top of the green zone is where you start to steer the canopy with the toggles. This point is important because it's also where you start your flare. At the bottom of the green zone, the toggles are at shoulder height.

When you hold the toggles all the way up, the steering lines will hang in a loose arc. This means that there is some clearance before the top of the green zone where the steering lines become taught and the tail of the canopy starts to move.

When you fly straight ahead in the green zone, both your hands are in the green zone and thereby you have braked the canopy slightly. If you pull the toggles quickly down into the green zone, you will swing a little bit forward under the canopy.

If you hold one toggle all the way up and the other one in the green zone, you will brake the canopy slightly on one side and make it turn slowly to that side.

The small adjustments you make during your final approach are all in the green zone, so the toggles remain above your shoulders.

### **Yellow zone**

The top of the yellow zone is at the bottom of the green zone, so the toggles are at your shoulders. At the bottom of the yellow zone, the toggles are level with your belly button.

With both toggles in the yellow zone, the canopy will be at about half of its full speed, both forward and downward.

Flying the parachute in the yellow zone provides certain advantages. When you want to survey your situation after deploying the parachute, you can fly in the yellow zone. This will give you about twice as much time to assess whether your flight plan will work or needs to be revised.

Turning with both toggles in the yellow zone makes for a flatter turn, meaning that you will not lose as much altitude. This can be a big advantage if you have an urgent need to change direction, but don't have much altitude left to work with.

### **Red zone**

The top of this zone is at the bottom of the yellow zone, which is level with your belly button. The bottom of the red zone is where the canopy flies so slowly that there's no more lift. We call that "stalling". A student parachute is designed to hardly be able to stall. This means that the bottom of the red zone in a student parachute is when the toggles are all the way down.

During flight and turns with deep brakes, at the bottom of the red zone, it doesn't take very much for the parachute to stall on one side and twist the lines of an otherwise perfectly good parachute. So be very careful when you fly in the red zone.

### **Powerful turns**

Up until now, we've only talked about turns where the toggles were in the same zone. By using the toggles in different zones, you can create more powerful turns.

If you keep one of the toggles in the clearance area above the green zone, and the other one at the bottom of the red zone, the parachute will turn as fast as it possibly can with input from the toggles. It's important to be aware that you can easily become disoriented and you lose a lot of altitude during such powerful turns. Therefore, you should always look out for other parachutes in the air and only make these turns in your holding area where you have enough altitude for it. Powerful turns are not to be used when there are a lot of parachutes in the air around you.

**Assignments:**

*Where is the top and bottom of the green, yellow and red zones (show and explain)?*

*How will the parachute fly and turn in the green, yellow and red zones, respectively?*

*When will you fly and turn in the green, yellow and red zones?*



# Landing

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## Landing priorities

Many accidents happen during landing because of wrong last-minute decisions. By knowing what's most important during landing, you can make the right decisions in due time and land as safely as possible under the circumstances.

The landing priorities are:

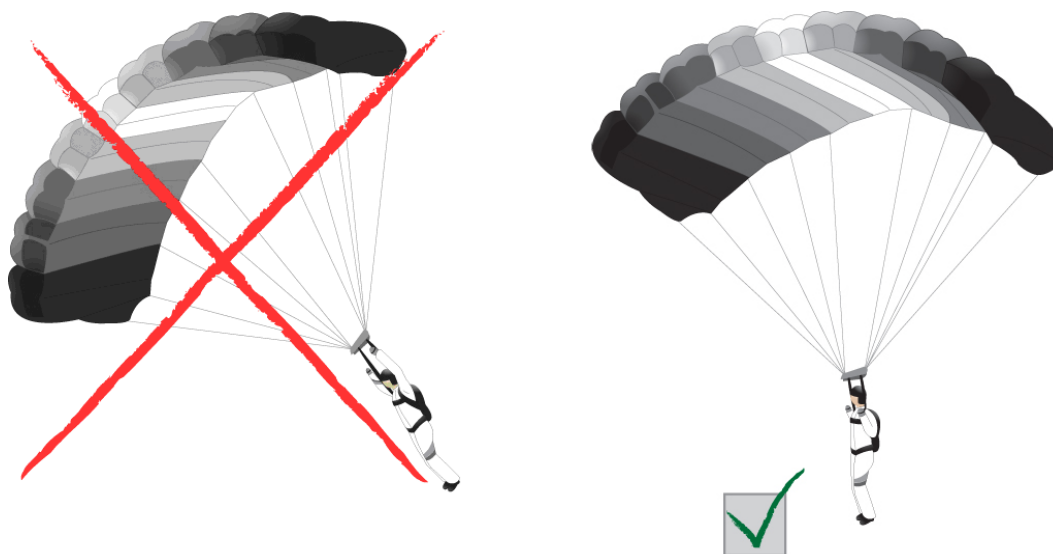
- 1. Land with your canopy above your head**
- 2. Land in an open area**
- 3. Land upwind**

### Land with your canopy above your head

When you land, the most important thing is that your downward speed is as low as possible. As mentioned earlier, your downward speed increases during turning. So, make sure to keep the parachute horizontal throughout your flare, until your feet are on the ground. You ensure this, by constantly flying straight ahead and keeping the canopy above your head.

If you can't turn the parachute upwind, remain calm and keep the canopy above your head. A well performed flare and a Parachute Landing Fall are much safer than a low turn.

In short: Never start a turn that you can't complete before you touch the ground.



*Figure 10: Land with your canopy above your head*

### **Land in an open area**

Landing on or in an obstacle can lead to injuries. So, land in an open area. Think ahead and make sure your planned landing area is free of obstacles.

Be sure to make a flight plan in advance and decide on your final landing area no later than your “halfway down, halfway home” altitude. This will reduce the risk of landing in an area with obstacles.

In case you need to change your landing area while you’re in the air, select the largest possible area that has the fewest obstacles. This will allow you enough space to land in, if you don’t hit your landing point accurately.

If it turns out that there is an obstacle in your landing area after all, and you’re heading that way, look toward the open area and steer your parachute in that direction.

### **Land upwind**

Obviously, it’s preferable to land upwind, because it reduces your ground speed. In addition, the risk of collision with others is reduced if everyone lands in the same direction. Instead of thinking of it as an area you want to land in, think of it as a runway. If everyone has runways that go in the same direction, it’s much easier to avoid collisions during landing.

Don’t attempt to land upwind at the cost of the other landing priorities. Many skydivers have been injured due to a wrong judgement call and a low turn.

To summarize: Land upwind, when it’s safe to do so and the two first landing priorities are fulfilled.

**Assignments:**

*What are the 3 landing priorities?*

*Explain each of them.*

*Explain the order of the priorities.*

## **Common landing problems**

Landings are rarely perfect. You can become better at landing by knowing the typical things that cause problems when landing and knowing how to handle them or avoid them all together.

It's very common to experience one of the following problems at landing, but they can easily be mitigated. If your problem persists, ask someone to film some of your landings. That's an excellent tool for seeing what really happens which may be different from how you perceive it yourself.

### **High or low flare**

It's very common to accidentally flare either too high or too low, especially on your first jumps. One way to overcome this is to look ahead toward the horizon. By looking straight ahead rather than down, it's easier to judge your distance to the ground.

When you flare, you brake the parachute's forward and downward speed at the same time, so you'll swing forward under the canopy and for a brief moment you'll come to an almost complete stop in the air. A good flare makes this happen exactly when your feet hit the ground.

Work with the timing of your flare by doing flare exercises in the holding area (Exercise II-a). Practice will help you learn how much or how little it takes for you to swing forward and nearly stop in the air.

It is possible to adjust your flare after you've initiated it. If you're moving fast on the final meters of your landing, the last part of your flare should also be a little bit faster. If your approach is slow, then wait a little before you flare the last part. If you start your flare too high, you can also wait to complete the last part of it. Once you have flared all the way, you must keep your hands down and, if necessary, make a Parachute Landing Fall.

### **Asymmetrical flare**

Another typical landing problem is to flare asymmetrically by pulling one of the toggles down further than the other one. This makes the parachute turn, and there is a natural tendency to put your hand out to the side or forward to avoid falling. This will pull that toggle down even further and increase the turning.

If you feel like you're starting to turn to one side during your flare, straighten up the canopy by flaring more on the other side.

### **Partial flare**

It's essential for any good landing that the canopy is flared fully. If you don't complete your flare, you'll continue to fly down toward the ground.

If you find it hard to pull the toggles all the way down, try keeping your hands closer to your body.

***Assignments:***

*What can you do if you flare too high?*

*What can you do if you flare too low?*

*What can you do if you flare asymmetrically?*

## Safety

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### Turbulence

When the air around the canopy is calm, the parachute will fly steadily. On the other hand, unsteady air will impact the way the parachute flies, and in worst cases it can make the canopy collapse or lose altitude very suddenly.

Unsteady air is also called turbulence and it can have two different causes – thermal and mechanical.

**Thermal turbulence** arises when the air near the ground is heated up, for example when the sun heats up the asphalt of the runway. This makes the warm air rise and usually that air stream will be somewhat unstable. Thermal turbulence is often found above dark areas that get heated up more easily by the sun, for example roads, runways, woods etc.

**Mechanical turbulence** is the kind of unsteady air that arises when the wind hits an obstacle, for example a house or some trees. Behind the obstacle, “the wind rolls”. It blows in other directions than the one it’s coming from, and “air pockets” may arise. The stronger the wind is, the farther behind the obstacle there will be turbulence. On a day with some wind, the turbulence may cover a distance that’s 10-20 times the height of the obstacle in the direction of the wind.

If you fly through turbulence you’ll feel the parachute flying unsteadily – it might ‘jump’ a little and if you look at the canopy, you can often see that the shape of it changes. The best way to fly in turbulence is to maintain your heading or only turn a little bit. It’s also best to let the parachute fly as fast as possible. In short; only fly in the green zone through turbulence.

Since turbulence can make your parachute lose altitude very suddenly, it’s important to avoid turbulence close to the ground. So, make sure you land at a good distance from buildings and trees and never behind them, relative to the wind direction. If you still happen to enter turbulence during landing, prepare to make a Parachute Landing Fall.

**Assignments:**

*What is thermal turbulence and where is it usually found?*

*What is mechanical turbulence and where is it usually found?*

*How do you best fly through turbulence?*

*What are some places you should never land due to the risk of turbulence?*

## Landing pattern

When several skydivers are going to land in the same area, the safest way is for all of them to follow the same pattern. This way it's easier to predict where the others will fly and the risk of collisions is reduced.

Each dropzone may have local rules, so always ask the responsible person about this when you arrive at a new place. Such rules, for example, could be that there are certain areas that you're not allowed to fly over below a certain altitude, or that you're not allowed to get too close to buildings or trees during landing.

As a main rule, landing patterns should be conducted with left turns. This is called 'a left-hand pattern'. It means that you make left turns, both when you turn from your downwind to base legs, and from your base leg to the final approach.

However, the left-turn rule doesn't always apply. Different conditions at the dropzone, or different wind conditions, can make it necessary to make right-hand patterns. Always remember to ask.

The rule about one common landing pattern has been introduced to improve safety. However, in some very particular situations it may be safer not to comply with it. The three landing priorities are always more important than the direction you turn in your landing pattern.

**Assignment:**

*Describe the difference between a left-hand and a right-hand pattern?*

*Why do we use them?*

*When can you deviate from the agreed landing pattern?*

*Which landing pattern is used most often?*





# Stage III

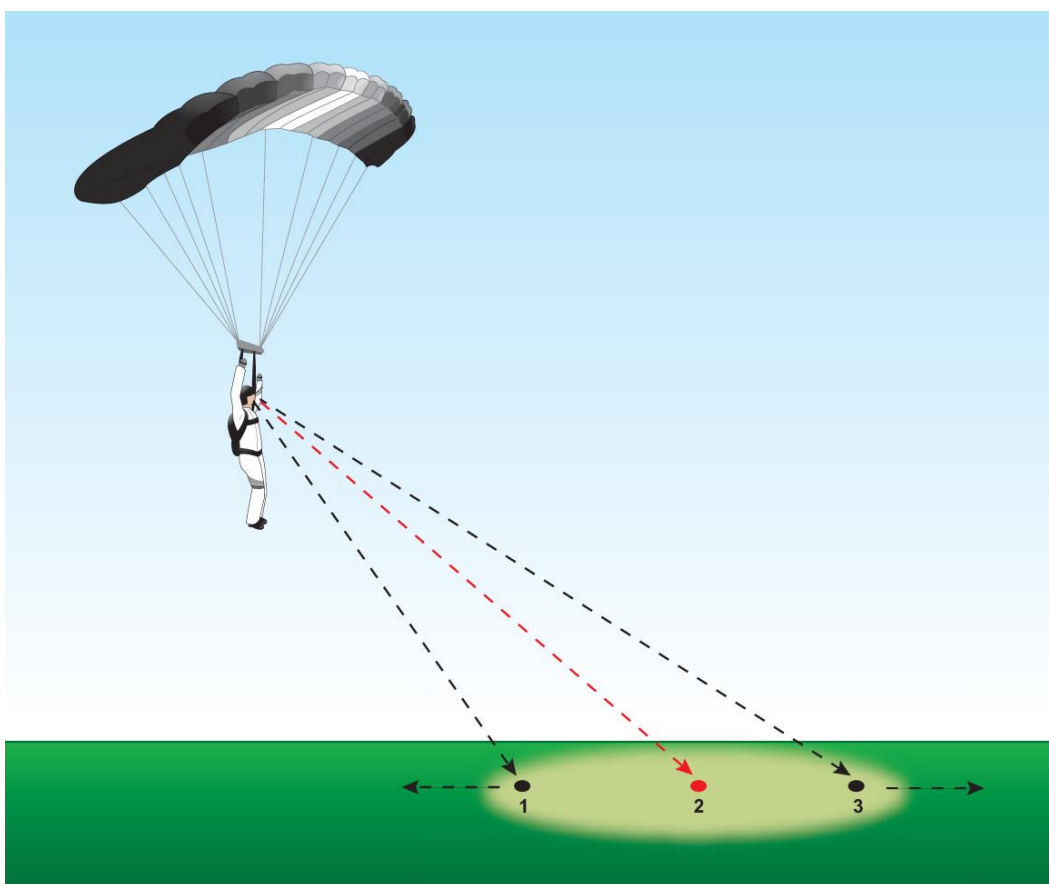
## Canopy piloting

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### Flight plan

#### The Accuracy Trick

Landing at a particular point is something you should practice on every jump, regardless of whether you deploy your parachute where you planned or not. The more you practice, the better you'll become at determining where you will actually land. If you find that it will be safer to land off the dropzone, it's better to make this decision early, so you have more time to plan a new landing point and pattern. The technique you need is known as "the Accuracy Trick" and is illustrated in the Figure below.



*Figure 11: The Accuracy Trick*

Look at the point where you want to land:

1. If the point moves under you, it means that you will fly past it.
2. If the point seems to come up right at you, it means that that's where you will land.

3. If the point moves away from you, you can't reach it.

If the Accuracy Trick has made you realize that you can't reach the landing point you want, you can try to fly farther or find an alternative landing area that's free of obstacles. If you choose to "land out", you can use the Accuracy Trick to determine, in due time, whether you'll be able to reach your new landing area. If you encounter obstacles on your way, you can also use the Accuracy Trick to make sure you can get past them.

### **Longer glide**

When you brake the canopy with the toggles, you also reduce the downward speed and you can stay in the air longer. If you do this downwind, the wind will push you farther.

If you can't reach your desired landing point, brake the canopy with your toggles between green and the yellow zone; with your hands at shoulder height. If your point is still moving away from you, pull the toggles down between the yellow and red zones, to the height of your belly button. If the point is still moving away from you, you will not be able to reach it. Find another place to land.

Keep in mind that you must have enough altitude for your landing pattern. So, you should use the Accuracy Trick to find a point that's farther away than your landing point.

Note: This technique only works when you're flying downwind back to the landing area. If you have to fly upwind, you can glide farther if you don't brake. Use the Accuracy Trick here to find out if you can make it home. If not: Choose a safe alternative landing area in due time.

As always, it's very important to keep an eye on your altitude and other parachutes, while you use the Accuracy Trick. Be sure you have plenty of altitude and space to make a safe landing, regardless of whether you're at the dropzone or making an out landing.

### **The Accuracy Trick on final approach**

The Accuracy Trick can also be used when you're on your final approach, to determine precisely where you will land. This way you can check whether your landing area is free of obstacles. If not, fly around them.

Remember: It's more important to land safely – than to land accurately!

***Assignments:***

*Explain how the Accuracy Trick works.*

*What can you do to fly farther downwind?*

# Landing

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## Other landing directions

In order to always fulfill landing priority no. 1: Land with your canopy above your head, it may be necessary to land crosswind or downwind.

### Crosswind landing

When you're landing crosswind, it may feel as if the canopy is turning (it's actually just being pushed sideways over the ground by the wind, while it's flying forward). In order to land safely you must remember to keep flying your parachute until you're safely on the ground after landing. Select a landing direction and keep flying that way until the parachute is no longer flying. Remember to still make your flare calmly and controlled throughout your landing.

### Downwind landing

If you end up landing downwind, remember that your downward speed is the same as when you land upwind. The only thing that's changed is your speed over the ground (which can be quite high, though).

Your high speed across the ground means that you'll put quite a long distance behind you during the landing. Therefore, you have to look ahead to see any possible obstacles. If you have to steer around an obstacle, then look around it and steer only as little as you need, to get around it. Stay calm and concentrate on making a calm and symmetrical flare. Then make a Parachute Landing Fall.

**Assignments:**

*How do you flare in a crosswind landing?*

*How do you flare in a downwind landing?*

## Safety

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### Multiple parachutes in the air

When there are multiple parachutes in the air at the same time, there's a risk of canopy collisions. Therefore, we have a set of "traffic rules" for parachutes.

**Surveying the situation after deployment:** The first thing to do after deploying and checking your parachute, is to look for other parachutes around you. Only then do you conduct the steering test. By keeping an eye on where other parachutes are, you can start early if you need to move away from someone who hasn't seen you. If you know how many skydivers were on the airplane, which number you exited as, and which direction the plane was flying on the final approach, it'll be much easier for you to figure out where the others are.

**Collision avoidance:** In case you're heading directly toward another skydiver, either during parachute deployment or flight, the rule for avoiding a collision is that both skydivers stay to the right (like in traffic on the ground). This is called the right-hand rule. Just after deployment it's quicker to do this by pulling on the back risers, because they're faster to grab hold of than the toggles.

**Direction of flight after deployment:** After deployment, turn the parachute so you fly perpendicular to the jump run (the airplane's direction during exits). That will keep you from flying directly toward those who exited before and after you. Fly perpendicular to the jump run until you've seen where the other skydivers are.

**Right-of-way:** The lowest parachute always has the right-of-way, because the skydivers above can see the ones below and therefore, have the best chance of avoiding a collision.

**Surveying the situation during flight:** Before you make a maneuver in your parachute, always look to make sure there is free airspace around you.

**Order of skydivers:** Each skydiver is responsible for keeping the order they had on the airplane. The one who exits first, lands first etc. It's easier if those who jump first, make some turns to lose altitude, and those who jump last fly braked, in order to stay up. This will create a greater vertical separation between the skydivers.

**Surveying the situation after landing:** As soon as you have landed and let your canopy collapse, look for where the other skydivers are in the air, and where they will land. You can do this while you pick up the parachute and move away from the landing area as quickly as possible.

**Assignments:**

*What should you do right after each deployment?*

*What direction should you fly after deployment?*

*How can you find the other skydivers under canopy in the air?*

*What should you do if you and another skydiver are heading straight toward each other?*

# Exercises

## Introduction to exercises

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It's only when you practice, that you'll really learn how to fly the parachute. This is where you build up routine, so you can react correctly on instinct when one day you need to fly your parachute to the limit.

You *can* do more than one exercise on each jump.

Learn this checklist by heart and go over it before each exercise:

**Free airspace** – make sure there's plenty of distance to other parachutes

**Good altitude** – all exercises are done above 600 m

**Stick to your flight plan** – be sure that you can make it home after the exercise

Before any turns – also when you're not doing exercises – look in the direction you want to turn, both before and while you're turning.



## II-a Flare exercises

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Canopies react differently depending on their type and how you flare them. By practicing your flare high up in the air you increase the likelihood of a safe and standing landing.

Flare the canopy in the air the same way you've done during landings. Make sure the horizon is horizontal during your entire flare, so you know the canopy is above your head.

After you've flared the canopy, bring your hands calmly back up to make the canopy fly again.

Do your flare exercises at different speeds and notice how much you swing forward under the canopy and how much the harness pulls on your leg straps.

***Assignments:***

*Minimum 2 jumps, where you flare your parachute 3 times at a safe altitude.*

*What difference does it make whether you flare quickly or slowly?*

## **II-b Flight plan**

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You'll use the theory about flight plans in practice, in order to become good at landing where you want to or making a decision about an alternative landing area while you're still at a good altitude.

Before you do this exercise, you have to draw up a flight plan based on the current wind and dropzone conditions.

Observe, where you are, before you exit the airplane. After you've deployed your parachute: Check to make sure you're at your planned deployment point.

Evaluate your flight plan and if it's correct, stick to the points; the "halfway down/halfway home" point, 300-meter point (1000 ft) and 100-meter (300 ft) point.

***Assignment***

*Minimum 2 jumps where you fly according to your flight plan.*

## **II-c Green and yellow zones**

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This exercise will help you learn more about how your parachute flies and how it can be steered throughout its full range. You'll get to know your parachute in the green and yellow zones.

Find the top of the green zone by pulling down on the toggles until you see the rear edge of the canopy move. Hold your hands close to your body and notice how far down they are at the top of the green zone.

Fly straight forward for at least 10 seconds where the toggles are all the way up. Then for at least 10 seconds with the toggles in the green zone. Finally fly for at least 10 seconds with the toggles in the yellow zone.

Make turns where both toggles are in the green zone. Notice what happens to the horizon line and the canopy while you do it. Try the same thing with both toggles in the yellow zone.

Make a turn with one toggle in the green zone and the other one in the yellow zone. Check your altitude before and after each turn and stick to your flight plan.

***For approval***

*Minimum 2 jumps with forward flight and turns in the green and yellow zones.*

## III-a Stall

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For a good landing, it's important to be able to control the parachute when it's braked. It's also very useful to know how the parachute reacts if it's brought back from full brakes to full speed.

In order to stall the parachute, first bring your hands down to the top of the red zone. Then bring them slowly all the way down to the bottom of the red zone and notice what happens to our speed and the wind noise around you. Keep your hands all the way down while you look up at the canopy to see how it reacts.

When the parachute stalls, you bring your hands back up calmly. It's important to do this in a calm and steady movement in order to allow the parachute to return to flying.

If the parachute didn't stall: Wrap the steering lines around your hands and try again in the same way. Once you have stalled the parachute: Unwrap the steering lines so you have full steering range again.

Remember to notice if there are any other parachutes in your vicinity.

***For approval***

*Minimum 2 jumps where the parachute stalled and was brought back to normal flying.*

*How did the parachute feel just before and during the stall?*

*How many times did you have to wrap the steering lines around your hands to make the canopy stall?*

## **III-b Flare from the yellow zone**

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You might encounter a situation where it's safer for your parachute to be partially braked during landing and flare from there. This could be in an emergency where you have landed in a flat turn close to the ground.

Fly in the middle of the yellow zone and flare from there. Notice how it's different from a flare at full speed (no brakes). Try both a fast and a slow flare from the yellow zone and notice the difference.

***For approval***

*Minimum 2 jumps where you flare your parachute 3 times from the yellow zone at a safe altitude (above 600 m).*

## III-c Red zone

---

Flying the parachute slowly will help you keep an overview in an otherwise stressful situation. Landings are another type of situation where we fly slowly, so exercises in the red zone will also help you make better landings.

Fly with both hands at the top of the red zone. Notice the speed and the wind noise. Now try and turn slowly by braking one side more than the other. Be careful and be aware that the parachute is more likely to stall when it's turning. After flying in the red zone, bring your hands calmly back up to full speed.

***For approval***

*Minimum 2 jumps where you fly straight ahead and make small (about 45 degrees) turns in the red zone.*

## III-d Emergency flare

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An “emergency flare” is an option if you have to save yourself from a too low turn. If you’re in a turn too close to the ground, the most important thing is to slow your downward speed. You can do this by flaring forcefully, even if you’re at an angle in the air because of your turn. Then you straighten up so your canopy is above your head.

Start the exercise by turning 90 degrees to the left (by pulling the left toggle down to the bottom of the yellow zone). While you’re still turning to the left, flare by forcefully pulling both toggles equally far down into the red zone. Notice how fast you’re slowed down. Now bring the canopy back above your head by using the toggles in the red zone; that is, make the parachute fly straight ahead again. Try the same thing with a right turn.

Note that the term “emergency flare” is to be taken very literally. It’s absolutely only to be used to save yourself from the worst imaginable emergencies and hopefully, it’s something you’ll never need.

***For approval***

*Minimum 2 jumps with each 3 emergency flares at a safe altitude (above 600 m).*

*What happened to the canopy when you pulled the opposite toggle down into the red zone?*

## III-e Crosswind landing

---

In case it'll be necessary for you one day to land crosswind in order to fulfill landing priorities no. 1 and 2, it'll be a great advantage to have tried it before. That's why this exercise is about making a landing at 45 degrees to the direct headwind.

In principal, it's no different from landing upwind, except that your ground speed will be a little higher. Keep flying the parachute in the planned direction until your feet are on the ground.

Before you enter the plane, you must make sure that your instructor and the other skydivers on this load know that you intend to land in another direction than upwind. Make sure to adjust your flight plan and landing pattern accordingly.

The exercise must be conducted at a wind speeds of at least 2 m/s (4 knots) and no more than 6 m/s (11 knots).

***For approval***

*Minimum 2 jumps where you land at 45 degrees to the wind direction.*

*What was different about landing at an angle to the wind, compared to landing straight upwind?*