Pilot Manual

5- Technique part I

Association of Paragliding Pilots and Instructors

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5.1 - Preparing for flight

Important factors to consider for a typical flying day are:
• Physical health and mental state of mind.
• Currency.
• Meteorology - Forecast, wind Strength and direction.
• Choice of flying site. Contact local club, school or local pilots.
Also some knowledge and inspections are needed:
• Check your equipment is airworthy, batteries in instruments, gloves, boots jacket. (see chap. Material).
• The regulations and restrictions of airspace.
• Rules of conduct.

5.1.1 Physical health and Mental state of mind.

You must asses yourself every time before you go to fly. Are you physically fit enough and mentally stable enough to make the necessary correct decisions that paragliding requires. Even a cold can have a bad effect on your decision making process and your ears can be damaged if you are flying at high altitude.

5.1.2 State of mind.

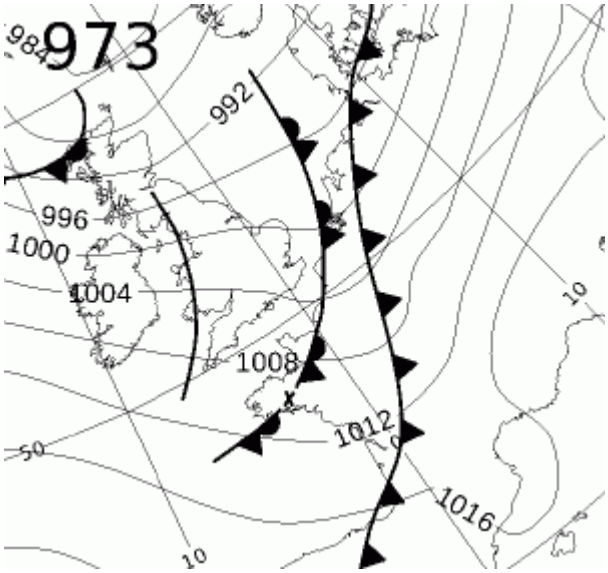
If you have had an emotional upset your judgement can also be impaired. You have to monitor yourself and trust that you can make sound judgements otherwise you are taking unnecessary risks.

5.1.3 Currency

Currency makes a big difference in paragliding. Keep a log book and check the last time you were flying. Think about the type of flying you are planning to do. If it has been a long time since you last flew then go ground handling or onto the training hill to brush up on your skills and feel confident before going to the take off.
If you learnt in a different country or really don't feel confident in your skills APPI recommends going to a school for some refresher training. Also if you are planning to fly a thermic site then fly in the morning or late afternoon when conditions are calm. There may be a local club you can join that can help you.
You have to judge your skill level honestly. Accidents can be avoided by following the correct procedure and having good technique.

5.1.4 Meteorology

The analysis and evolution of the general weather situation is the center of a conscientious preparation of flight. The decisive criteria are the wind strength, direction and cloud cover. One source of information for weather forecasts is the internet. There are many different sources it is best to use a few and cross reference them.
http://www.meteoblue.com
http://www.metoffice.gov.uk
You must make an individual weather analysis and prediction then monitor the development on a daily basis from when you first begin to learn to paraglide.



• Wind: Paragliding is very dependant on wind strength. It depends on the flying site what max wind strength is safe to fly in. It also depends how gusty the wind is. Coastal sites can be flown in a stronger wind as the airflow is laminar from the sea. High in the mountains the same strength wind would be very turbulent and too dangerous to fly in.If the wind strength doubles the turbulence is four times as much.During a stable high pressure situation or a uniform distribution of pressure, true winds are generally low. The enabling conditions for launching are in this case related to the development of thermal activity.

The exposure of the launching slope is decisive for the starting time of thermal activity: on the eastern slopes thermals start already early in the morning; on the southern slopes during the morning and on western and northern slopes around noon. For evening flights, on the contrary, the western and northern slopes are the most favorable due to their longer exposure to sunlight.
When the weather forecast announces winds of 10 to 15 km / h, this has consequences on the choice of the launching area: the higher the takeoff place the more important it is to match its orientation with the general direction of the wind. Accurate wind forecasts can be obtained on the day of flight through weather forecasts and the current wind information through Volmet.

• Cloud coverage:
The unstable layer of the atmosphere and the high humidity in days of sunshine, help the cloud formation. If cloud base is low the take off may be covered may be before noon and the clouds may only dissolve in the evening with the weakening of the thermal activity. For this reason, the much coveted high bases are an important aspect when choosing the launching place. Over development of cumulus can lead to storms these can form very quickly in mountain areas and arrive without warning. As well as knowing the forecast it is important to constantly monitor the weather on take off and whilst flying for yourself.

• Precipitation: Flying in the rain or snow is not advised. The wing can fill up with water and the wing will react differently. Also gust fronts can appear with showers.Paragliding material deteriorates quickly if it gets wet.In a warm front the rain appears with the wind strength steadily increasing.

5.1.5 Terrain

The ideal preparation of a flight in a new region involves:

- Contacting the local club school or local pilots for advice.

- A flying plan adapted to the conditions.
- Recognition of the landing site.
- Information on potential hazards.

• The landing zone:
There is a lot of information available online. Before you arrive in the area it is best to contact the local school, club or local pilots to find out about local conditons and flying sites, rules and regulations.If you do this research in advance it will save you a lot of time and effort on a flyable day. In the alps Tourist boards have a lot of paragliding information.

The difficulty level of a flying site depends on the conditions and the pilot's experience. When examining the landing site one must imagine the wind direction on the ground and what obstacles should be taken into account, according to the flight directions, allowing for wind hazards.

In addition, make sure it is allowed to land on the concerned place (ask local pilots or the owner). Find out if there is a set approach. As far as possible it is recommended to always use the official site.

• The flight plan:
This **includes information on power lines and cables** that are difficult to detect in flight (especially important for slope soaring), and contains the possible logical itinerary of flight.
Whatever the circumstances, reaching the landing site by flying into a strong head wind should be avoided.
By strong wind (frequent valley wind increasing with the loss of altitude) it may be impossible to reach an upwind landing area even with a fast wing.

• The launching place:
The difficulties of a launching place will be described later. At the preparation time at home, it is recommended to observe the following:
- Snow and humidity can change the soil conditions.
- Many takeoff places in the mountains are rocky and usable only covered with snow.
- On a steep and snowy launching place there may be a great danger of slipping, even avalanche.
- The wet grass can also be very slippery.

5.1.6 Airspace restrictions and requirements

• Temporary and local restrictions of airspace and danger areas.
• Contact the National Paragliding Association for requirements and where to get information on airspace restrictions.
• Division of airspace; mandatory radio.
• The hours of military flying.
• The rules of air navigation.
• Traffic lights.
• Obligations.

5.1.7 Paragliding and the environment

Wildlife protection:

Paragliding meets all the requirements of a friendly environment air sport. The move towards a sport for the masses undoubtedly increases the conflict with conservationists and landowners. To avoid site restrictions, the elaboration of a few rules of conduct is essential.

It should be noted that a comprehensive study on the influence of free flight on the wildlife behavior was conducted by the Federal Office of Environment and Forests in Switzerland. A practical guide was created to advice paragliding pilots in the hope that they freely adapt their flying habits to the mandatory protection of wildlife.

• Chamois and ibex:
It has been clearly demonstrated that glider pilots, by bad conduct, can strongly disturb the chamois and ibex above forest boundaries and the golden eagles near their nests.
During the day, chamois and ibex occupy quiet areas above the tree line where they graze and rest. In winter they concentrate preferably on the south-facing slopes. During this season, chamois and ibex live on their fat reserves, the snow covering the pastures, and many individuals do not survive. It is in late spring (Mai or June) that bearing goats will give birth.

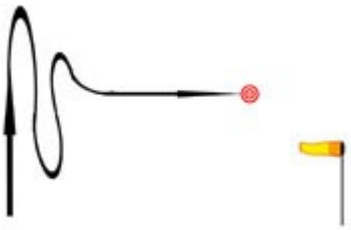
• Golden eagles:
The main species of birds to be disturbed by free-flight pilots are the golden eagles. This species usually hunts above the tree line but builds its nest in rocky areas below the tree line. The golden eagle lays its eggs between March and April and flights near the nest during this period may cause problematic reactions. The eagles are mature at 5 years and live as a couple on a territory they will defend all their lives. Young non-breeding eagles occupy the free spaces between nesting territories.

Recommendations to pilots:

Livestock Avoid landing in fields with livestock. Especially when they have young. Avoid flying sites with sheep during lambing time.

- Use the launching places, the flight routes and landing places recommended by clubs and free flight schools.
- Choose a trajectory that allows flying in open space at the right altitude.
- Do not fly over territories where the human being is absent above the upper limit of forests.
- Keep away from eagle nests in the spring.
- Respect the reserve areas and fly over them with only sufficient altitude. Game are first disturbed by a low flight above ridges and peaks, as well as by sudden appearances in the immediate vicinity of their settlements.
- Especially in winter game should not be disturbed. Therefore, forest areas bordering winter sports areas as well as

steep sunny slopes and cliffs, should be avoided since that is where game grazing places are most often located.



• The landing place:
- Whenever possible, always use the official landing place.
- If there is no official place available, ask permission from the landowner.
- When landing on tall grass, one must pick up the glider and immediately leave the field by the shortest way. Never fold the glider in tall grass. Contact the owner to inform him about damages (trampling the fields, damage to fruit crops, fences, etc.) and, if necessary, to pay the appropriate compensation.

5.2 - Launching

5.2.1 Daily Inspection

This inspection should be done every day before flying. An annual airworthiness inspection should be done by a proffesional. More thorough periodic inspections should be done on all equipment and should be performed if any thing has occured.

Canopy: As you spread out your paraglider inspect the material for rips and tears. Inspect inside the cells looking for internal damage. Check the placard to make sure the paraglider is suitable. It must be of the right type and you must be within the weight range. (remember it is all up flying weight - the weight of you plus all the equipment)

Lines: Run your hands up the lines to check for damage. If the line is damaged the inner core of the line will show through as a white fluffy material. Check the maillons that attach the lines to the risers. Check the brake line runs through the pulley cleanly and the knot is secure. Untangle any lines.

Harness: Check the harness is in an airworthy condition, that the straps do not have any excessive wear and tear. Periodically check the webbing under the seat board to ensure it is not worn. Check the buckles and Karabiners. (They should be replaced every 3 years)

Reserve: Check the reserve pin is in place and the handle is secure.
Caution: If the reserve pin is not checked it may deploy accidently and cause an accident. The reserve should be repacked every 6 months and should be less than 10 years old.

5.2.2 Preparing for takeoff

Untangling of lines and control of risers, start from the harness. Tending the lines facilitates control.

- Spread the canopy in an arc. With the leading edge open its entire length. Position the cell openings in the direction of flight.
- Separate left and right risers. Step back to put tension in the lines and disentangle them.
- Take one set of risers. Check the A risers are on the front.
- Separate the brake lines from the other suspension lines. Pull the brake lines down and to either side to put tension on them check for knots and position the canopy.
- Tension and check the other lines starting with the D's and finishing with the A's.
  Caution: There should be no suspension lines under the canopy. Check the lines lay on top of the wing tips. If the lines are very tangled go to the canopy and take the outermost A line beside the cell openings. Trace it back towards the risers and pull everything through. If this has not fully untangled them then go to the next A line and do the same.
- You can prepare the canopy with the harness attached or you can wear it and attach it after the wing is laid out. (This option is preferable on a busy site)
- If the harness is attached pick it up by one shoulder strap and see the risers are running straight, turn the harness into position. Check the reserve pin is in place and the handle secure.
- If unattached lift the harness by the shoulder. Look at the paraglider leading edge, ensure the lines are clear all the way to the front risers. Attach the risers to the Karabiners. Check they have closed properly. The front A risers are in front, the rear risers behind.

It is important that the central cells inflate first. Otherwise the wingtips may launch first and it becomes very difficult to correct it.
• Put the harness near the trailing edge to avoid disturbing the canopy shape, carefully prepared, by involuntarily pulling any stretched line.
• Check the reserve pin is securely in place and the handle velcro is secure. Pick the harness up by the shoulder straps and put it on.

- Always fasten the leg straps first. Check they are secure.

Warning: Taking off with the leg straps open represents a danger of life due to the possibility of slipping through the harness. To avoid this, it is recommended never to fully open the leg straps but just to loosen them when you get rid of

the harness. With the leg straps not tightened enough one may need one hand to help sitting comfortably.

- Fasten the chest strap and check the setting. (The chest strap is generally 42 cm, The setting the glider was tested at should be written on the placard on the canopy).
- Put the risers on the forearms, towards the rear, grab the control line and check both sides if the brake line:
  - is not twisted and goes from the rear riser through the eyelet and behind the elbow,
  - goes from there till the trailing edge without being tangled. Disentangling the control lines and checking the risers start from the harness. Spreading the lines makes the control easier.

Carry out the 5 point check (always do it in the same order so as not to forget anything)

1. **Equipment** laid out into wind in an arc, lines untangled, reserve pin in place, brakes and front risers in hands
2. **All buckles fastened** – harness, helmet, carabiners
3. **Wind strength**, direction, thermic cycle, weather
4. **Take off** stop line decision point. Turn direction
5. **Airspace** all clear above behind and around (Must be done just before launching).

5.2.3 Take off in 4 phases

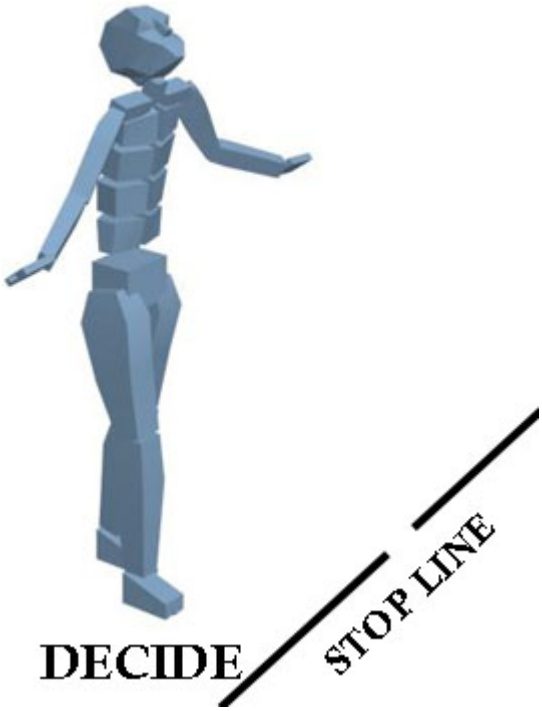
1. Inflation good timing/ right speed/ look ahead
2. Control with the break/ efficient visual check
3. Decision to take off or stop by safety stop line
4. Acceleration leaning on chest strap, keep running, contact point good trajectory

Inflate: Hold the front risers, arms relaxed. Step forward until the lines become just tense without moving the canopy. Make sure both arms feel the same even tension by stepping to either side. This ensures you are in the center of the canopy and facing into the wind.
Look ahead fix a point in the distance directly into the wind keep looking at this as you inflate the wing.
Step smoothly forward, the amount of energy you give the glider will change depending on the wind strength and the steepness of the terrain. Smoothly inflate the canopy with the minimum energy required this will prevent the glider overshooting. The pull must come from the carabiners on the harness not from your arms.

Control: Once overhead the risers will tug upwards this is the point to let go of the front risers and pull on the necessary amount of brake to control the glider and prevent it overflying. Until the glider is above and t risers released the pilot can not perform any correction with brake controls. For this reason it is mandatory to follow the glider, even if the flight direction should not be completely respected. If this is not feasible because the launching site is too small, the flight must be suspended. If the glider pulls to one side then side step diagonally forward to center yourself under the canopy. Look ahead to a fixed point will help you to do this. Do not look over your shoulder as you pull the glider up as it will pull unevenly to one side.
Check the canopy: Hold the glider with the brakes and maintain pressure on the waist strap by leaning forward as you check the wing is fully inflated and the lines are untangled.

CONTROL

Decide: You must have a prearranged decision line on the take off - this is the point to abort if you are in any doubt that the launch will be successful.
STOP if you need to abort then stop running, fully brake one or both sides depending on the steepness of the slope. A wrap may be required depending on the length of the brakes. Step backwards to take the tension off the lines.



Accelerate: Lengthen your stride and accelerate progressively. Maintain the contact with the glider whilst allowing it to gain its speed. Keep running into the Sky.
Maintain contact with the brakes as you glide clear away from the hill with your legs down prepared to run, keep one leg stretched forward and one leg tucked underneath. Once well clear of the terrain keep your head forward and lift your knees and smoothly sit in your harness whilst keeping contact with the glider.

ACCELERATE

Make the 3 point in flight check look from one carabiner up the lines on one side along the length of the Glider down the lines to the other carabiner then go for your predecided flight plan :

Blocked brakes cause, most of the time, the abortion of an uncontrolled take-off and dangerous flight situations. That's why, when checking the 5 points, one must absolutely control whether the brake lines are free from the rear risers handle and pass through the eyelets and from there till the trailing edge without being blocked.

The wing rises more or less rapidly depending on the type of wing and wind conditions. Slow wings (only hold the front risers both sides) usually require a stronger impetus than fast wings (hold on both sides the front risers of the first and second row).

Errors and corrections

- The canopy closes in the middle:
  - Cause: The canopy is spread in a poorly laid out or the central cells did not open. Next time pull the brake controls down more to either side when laying out the glider to create a nice arc into wind.
  - Correction: Pull the brake control briefly and vigorously and release them immediately, then hold again the front risers and continue inflating.
- The canopy does not rise in the right direction
  - Cause: Not facing into wind, uneven tension on the hands.
  - Correction: Look into wind and step forward keeping even tension side step forward to move under glider.
- The paraglider closes along the leading edge
  - Cause: Pulling your hands forward on the risers or launching too vigorously.
  - Correction: Pull with the harness no tension in your arms.

Visual inspection and brakes control.

Acceleration until the feet no longer touch the ground

Repositioning under a wing that goes awry and only after the climb phase, move in the direction of desired takeoff

- **Control corrections:**

  Before takeoff, check if:

  - All cells are open and filled (visual inspection of the canopy). If it is not the case, pump with both brakes until the

entire leading edge is open (Pumping: by successive fits and starts, pull simultaneously the brake cords until the hips height, then release them).

- The glider is moving in the intended direction. If it is not the case, correction is done by quiet but decisive maneuvers.

Errors

- **Non-existent or too fast control of the wing:** On steep ground and according to the circumstances, even a partially open canopy or one with tangled suspension lines, rises up quickly. For this reason, do not pull the wing violently, in order to have time for the canopy control. Step forwards gently and be ready to brake a lot to prevent the wing overflying.
- **Ineffective correction maneuvers:** Many incidents during takeoff are due to insufficient steering corrections on the ground. Mainly on small launching places, the risk of collisions with obstacles just after the wing rises and the danger to touch the ground at low altitude, due to abrupt maneuvers, can have unfortunate consequences. The way to fix this is to stop on time or to do a lot of slalom exercises on the ground (at the training school).

Acceleration:

- Smoothly accelerate keeping in contact with the wing and loading the chest harness keep the wing pitch stable as you run. Depending on the type of paraglider and on the slope gradient, slow down the wing (less on flat ground than on sloping terrain) and speed up until the feet are off the ground.
- After a few meters away from the ground, slowly release the brake controls so that the glider picks up speed (if they are released too quickly, the glider clearly picks up speed and pitches forward, losing height in a very short period of time = imminent danger of touching the ground and especially in flat terrain).

Caution: Under no circumstances should you jump or sit in the harness before actually flying = great danger of injury (mainly on the back). It can also cause an assymetric collapse that pendulums you into the hill.

Errors

- **The glider leading edge closes:**
  Cause ⇒ The glider has accelerated forward. The action on the brakes was too weak and / or the pilot does not run with enough energy (make large strides).
- **The canopy falls behind the pilot:**
  Cause ⇒ Too much brake applied:
- **The pilot takes off but touches the ground just afterwards:**
  ⇒ Cause: Too strong action on the brakes and / or too sudden release of controls just after takeoff.

Caution: Releasing the brake controls immediately after take-off in order to sit comfortably in the harness, is frequently linked to risk of accident in case of assymetric collapse. For this reason wait until there is a sufficient distance from the slope. Never let go the two brakes, you should be able to sit comfortably by lifting your kness and sitting back, if necessary keep both brakes in one hand above the head and keep looking ahead to stay on a good trajectory, use the free hand to sit comfortably.

Acceleration: *Smooth acceleration with a long stride is the best way to takeoff quick and safely, especially on less sloping ground, one must takeoff with high speed and slightly drawn brakes. A body position leaning forward, loading the chest strap with the hands back is a great help in order to accelerate.* ***Caution:*** *If you brake too abruptly, you will inevitably retouch the ground despite a possible short flight phase.*

5.2.4 Launching interruption

In the paragliding field, the launching interruption is a daily practice. Experienced pilots are not immune to it either. It is more reasonable and safer to stop launching on time than trying to do it at any price. A successful launching interruption occurs without the pilot's fall and especially without risk of injury. The interruption may occur, depending on the circumstances, already in the inflation phase or later in the control and correction phase, but in any case before the acceleration. Interrupted takeoffs in the acceleration phase are not considered as takeoff interruptions but failed takeoffs. According to the quality and size of the land they are linked to a substantial risk of injury.

The point of no return for an aborted take-off is set accordingly to the land, the experience and the situation. On a vast meadow without any obstacle, one can try longer to correct a wing in a bad situation during the run. On the other hand, such attempts on uneven rocky terrain involve a significant risk of injury that can easily be avoided by a controlled launching interruption. In all cases it is recommended to consider, right before launching, which part of the launching field is to be used for maneuver corrections and at which limit the launching will be aborted ⇒ **Stop line**.

The Stop line*: It must only be crossed if the phase of correction is over and we are about to take off.*

Technique

- On a gently sloping ground, both brake controls are simultaneously drawn just like during landing.
- On sloping ground, only one brake control is drawn and launching is aborted by a rotation movement of the wing toward the slope. By the simultaneous action of the brakes there is the danger of being lifted. It is strongly recommended before takeoff to identify which side will be used for the launching interruption (⇒ obstacles, stones, etc. By crosswind, perform the maneuver upwind).

5.2.5 Launching conditions --- launching decision

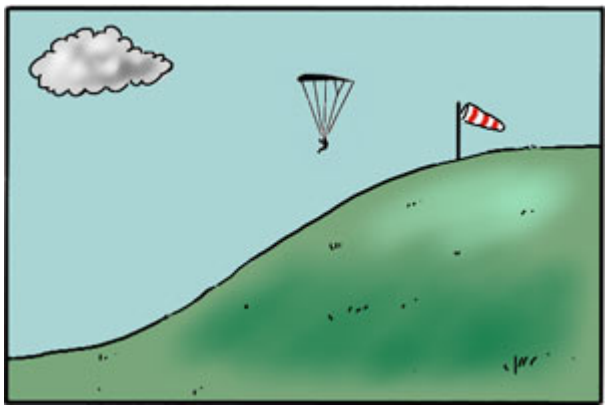
Two factors determine the launching conditions:

- **The terrain:**

An ideal launching site has the following characteristics:

- A flat space to unfold the wing,
- a slope whit gradual gradient,
- and with a flat end,
- 10° - 20° of gradient,
- good terrain quality,
- no barriers on the sides and especially not on the slope line.

The ideal takeoff terrain. *In these circumstances, we can try to take off without risk of injury, even with a slight tailwind.*

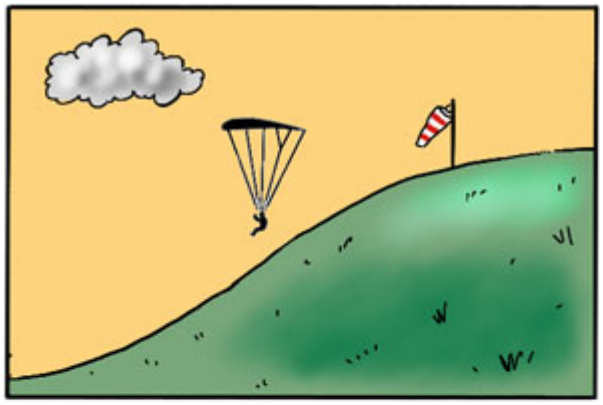


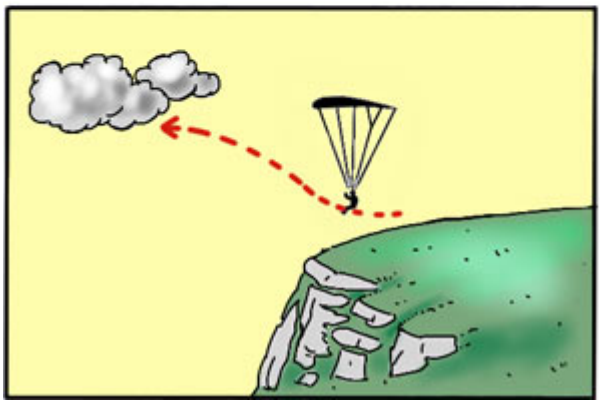
- **The wind:**

  The ideal wind blows:

  - Exactly on the slope line,
  - laminar and steady,
  - at 10-20 km / h.

It is only on the site and launching location that one can decide if it is feasible or not. Only there terrain and wind are estimated. The most important criterion of the decision is to establish whether the take-off may be interrupted without danger or not.





At particularly favorable wind conditions and an ideal ground, takeoff breaks on cliff, under certain conditions are possible without danger, as takeoffs with a light tailwind.

Warning: An attempt to takeoff with bad wind conditions and an unfavorable land can be very dangerous!

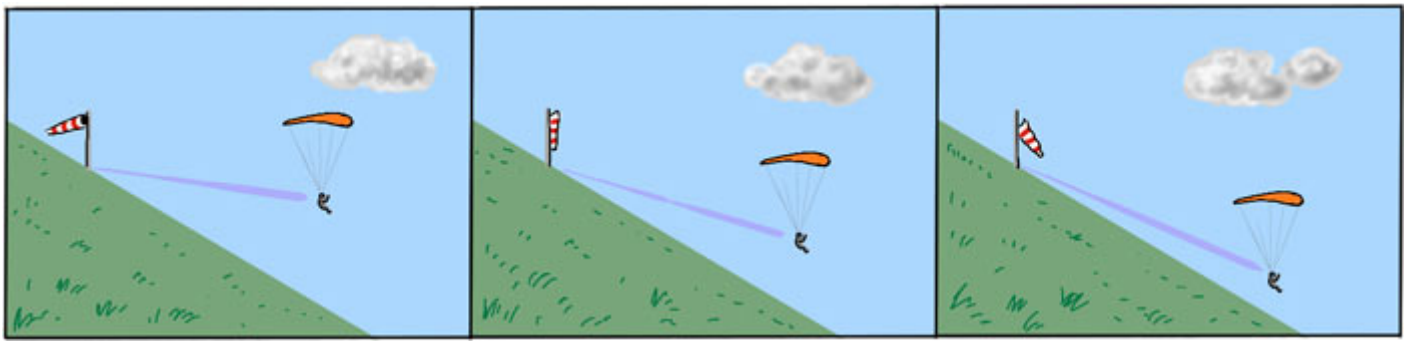
5.2.6 Special launching situations

- **Tailwind:**
  The take-off in a slight tailwind is also possible under certain conditions. Due to the downwind component the glide angle increases. Tailwind should be therefore compensated by a higher launching speed. The result is a risk of launching failure. That is why the field should be flat, wide and unobstructed. The wing will try to overfly you need to hold enough brake to prevent it whilst accelerating.

Warning: A launching attempt with tailwind on unfavorable ground must be avoided!

Summary	flat takeoff	Sloping takeoff
Headwind of 25 km/h	⇒ Slow takeoff run ⇒ Eventually difficulties in accelerate Beware: danger of being dragged back! The land ahead of the wing must be free of any obstacles.	⇒ low speed takeoff ⇒ Short takeoff distance Beware: involuntary and uncontrolled inflation possible!
Headwind of 14 km/h	⇒ Average speed of takeoff ⇒ Average distance of takeoff ⇒ Ideal	⇒ Average speed of takeoff ⇒ Short distance of takeoff ⇒ Ideal
No wind or light tailwind	⇒ Fast takeoff run ⇒ Long distance takeoff Beware: to undertake only on regular ground and without obstacle. Spread the canopy so that it is inflated as fast as possible	⇒ Fast takeoff run ⇒ Average distance of takeoff

The glide angle varies depending on wind conditions: headwind improves it, tailwind makes it worse.



- **Crosswind:**
  With crosswind of 10 km/h or more, the wing is inflated into wind (and not in the slope line as usual). Only after the visual inspection the wing is deflected for the forward run, in the chosen takeoff direction.

Assisted takeoff.
Inflating a wet glider is difficult. Assistance may in this case be necessary. An inexperienced external assistance must be informed to release the wing at the right time. With a wet canopy or by downwind, if you want to succeed to take off, it is strongly recommended to have a run fastest as possible and to climb the wing abruptly.

- **Strong wind launch and reverse launch:**
  In windy conditions, from 15 km / h or more, there is the risk, during the inflation phase, of being dragged backwards. One can significantly reduce this risk by turning the back to the wind and facing the glider in relation to the canopy. The land ahead of the spread out paraglider should be regular and free of obstacles.

Lifting one set of lines over his head the pilot turns 180° toward the glider from which the two risers come and cross in front of the body.

- **Reverse launch:**The following basic exercises of a reverse launch develop the interaction ability between the wing and the use of brake controls. For safety reasons, they should only be undertaken in an open and unobstructed ground, until they are completely dominated.

Tips: In strong winds, the wing which is kept folded is spread very little. This reduces the surface area exposed to the wind and the danger of falling back upon an unexpected inflation where the risk of a sudden gust ccarry the wing and the pilot.

Inflation front wing with the method of crossing the arms.

- **Brakes:**Take the brakes first. To take the correct brake start by the carabiner and follow the rear riser to take the brake line. Turn round to forward launch position to check you are doing it right. Make sure the risers cross at the body and not at the lines as this can cause line damage. Whichever way you are planning to turn then put that foot back on that side that way if you launch accidently you will turn the correct way.

- **Controlling and stabilizing the inflated wing:**
  The purpose of this exercise is to maintain for a few minutes, over oneself and under control, the inflated canopy and perform a few steps in every direction. A wing oscillation is corrected by an action on the brakes, the rear drop of the wing is caught up by releasing the brakes and by an eventual traction on the front risers. The parallel position of the arms allows, during this phase, more efficient corrections and is also simpler because it does not cause reversal movements. The hands control opposite sides. Brake the high side and side step to the high side whilst keeping tension and loading in the harness. Try inflating the canopy with the harness alone. Step back quickly and bend your knees to load the harness.

- **Turning around:**
  Check your turn direction. When the glider is stable take a step back into wind and turn round control th ewing again. Warning: Turning on the wrong direction represents, on a reverse launch, a very great danger = brake controls may block! It is highly recommended to always rotate in the same direction (e.g., left) and then turn on the opposite direction (right).

• **Towed launch:**
As far as we have personal experience and adequate equipment, the winch offers the paraglider pilot the possibility to fly safely even in a flat region. There are two different operating systems:
- Pay-in towing: the cable is unwound from a stowed winch before launching and wound during the winching by pulling a drive motor.
- Pay out-towing: is fixed on a vehicle; the cable is unwound from a drum during the winching and the traction force is adjusted by means of a brake.

The release handle device should be attached to the pilot's harness at breast height, as close as possible to the body. Generally, all the gliders that do not tend to deep stall are suitable for towed flight. Warning: To winch with a fixed rope without any pulling fuse, by fixing a rope to a tree or winching by strong wind, carries a high risk of accident.

Boat towed launch: Here winching is done by boat.

• **Ski launch:**
From a technical point of view ski launch does not differ fundamentally from the feet launch. Ski take-offs are more difficult on a slightly sloping terrain or by low headwind because one can not make good traction or rather a good acceleration. Similarly, the lateral displacement under a wing that leans on the side during the inflation is made more difficult.
- The preparation before takeoff is the same as for running takeoff. For the wing not to slip on a slope, one can cover with snow a few places along the leading edge.
- Whenever possible, put the sticks in the backpack so that during the inflation no suspension lines hang on to it (expandable batons are great).
- In order to take a little momentum, stand near the trailing edge, across the slope. To launch put quickly the skis into the slope line. On a slightly sloping terrain the inflation can be difficult because it is not possible to gain momentum.

Ski flying: It's in winter, with stable high pressures, that it is possible to perform the quietest flights. Above the common stratus layer (inversion, see chap. 3 Weather) good visibility and ideal temperatures can be expected most of the time.

5.3 - Gliding flight

5.3.1 Straight flight

When gliding, and according to the polar curve, the different doses of action on the brakes have different corresponding sink rates and horizontal speeds. Each glider has its own polar curve. It changes with the load. The polar diagram shown here is from a modern intermediate class paraglider.

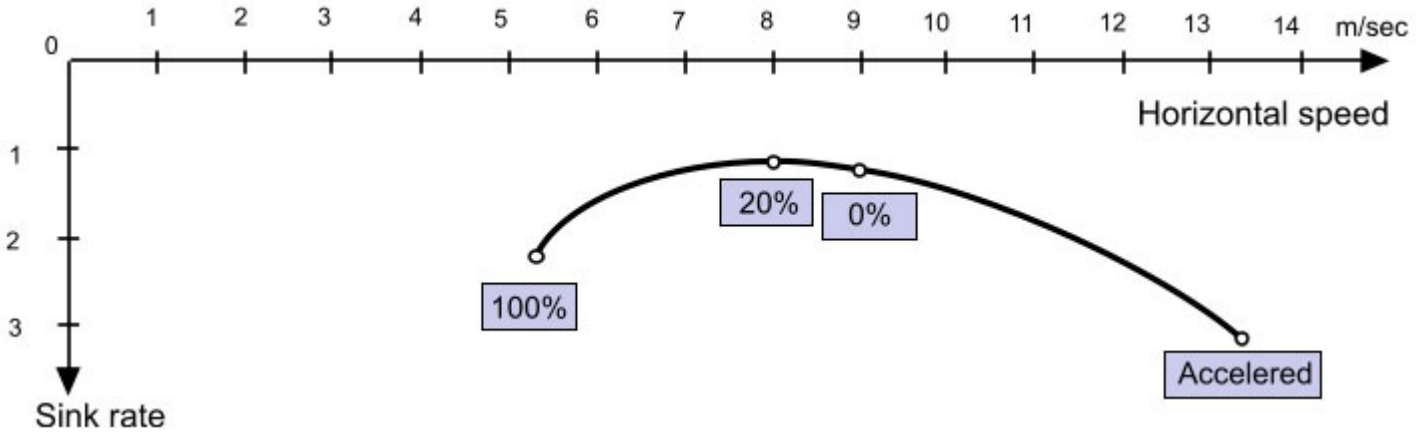


Figure 4-7: *Polar diagram speed of a medium class glider*

Brakes	Hands position	Horizontal speed	Sink rate	Drag ratio
Accelered	High	13.3 m/s	3.1 m/s	4.3
0 %	High	9 m/s	1.2 m/s	7.5
20 %	Shoulder	8 m/s	1.1 m/s	7.2
50 %	Chess	7.2 m/s	1.2 m/s	6
100 %	Hip	5.3 m/s	2.2 m/s	2.4

Table 4-1: Some values of polar speeds with the hands (brakes) position

- **Flight with brakes released:** With brake controls released, a horizontal speed of 9 m / s (32.4 km / h) is reached. The sink rate is around 1.2m / s. The drag ratio calculated from these two values 7.5 (9 / 1.2) corresponds to the optimal gliding flight in still air.
- **Minimum sink rate:** By slowing slightly (about 20%) the sink rate can still be slightly reduced. Simultaneously, the horizontal speed decreases slightly because the lift is also deteriorating.
- **Maximum flight speed:** Using a foot accelerator and / or releasing the trims, the horizontal speed can be increased, depending on the model, of 5 -10 km / h. Despite a significantly increased sink rate and a decreased lift one can fly a greater distance with headwind (see next chapter).
- **Minimum flight speed:** With a strong action on the brake controls - almost 100% - one flies on stall limit (see chap. 2 aerodynamics). While the sink rate slightly increases, the horizontal speed decreases about half. Flying with a strong action on the brake controls, the flight trajectory straightens and for this reason experienced pilots use the brakes in the final, aiming a precision landing (see 4.9.4 landing at the target). Warning: if you exceed the minimum flight speed (over 100% action on the brakes) stall or deep stall occurs (see 4.6.3 or 4.5.5 later in this chapter).

5.3.2 Braking technique

- Lower the arms along the body, do not hold them out aside.
  - Leverage effect decreased ⇒ less strength is required and provides better coordination.
  - Specific pinpoint of positions on the body to memorize the specific positions of the brakes (e.g., 100\% brake controls position).
  - Body position more calm and stable.
  - Less risk of injury if sinking.

- Sudden movements with brake controls cause a pendulum motion due to the inertia difference between the canopy and

the pilot.

Figure 4-8: *Forward pendulum movement of the pilot when using the brakes after a quick or accelerated flight.* ***Caution****: In an extreme case, the angle of attack can increase so much that the air flow picks up dynamic stall. Canopy swing during a sudden stop on brake action (e.g., after stall). Caution: In an extreme case, the glider is powered on the upper surface for a moment and closes along the leading edge.*

Braking at full speed → the pilot leans forward

In slow flight, during a sudden stop of the action on the brakes → the glider stalls and take speed

Caution: Near the ground, operate brake controls in a smooth and thoughtful way.

5.4 - Tactical flight in the wind

5.4.1 Wind influence on the trajectory

Airspeed is significant for the pilot when he is advancing in an unmoving air mass. From the moment the wind has an influence on the flight it is the speed according to the ground which becomes interesting. It is called ground speed. A tail, cross or head wind has an effect on the lift but not on the sink rate. Ascents or descents alter both the lift and the sink rate.

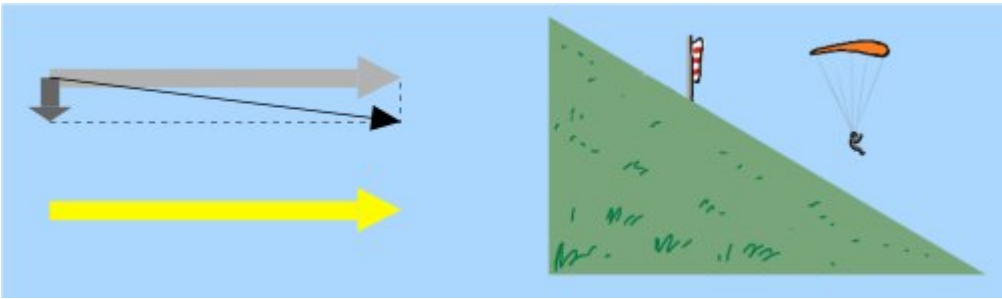


Figure 4-9: Calm wind
Horizontal speed: 30 km/h
Sink rate: 5 km/h (1.38 m/s)
Ground speed (yellow): 30 km/h
Lift: 30/5 = 6
Flight duration for 1000 m high: 12 min (1000/1.38/60)

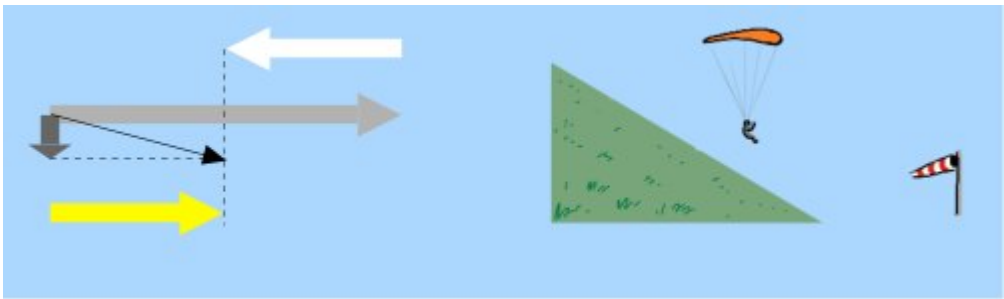


Figure 4-10: Headwind 15 km/h
Horizontal speed: 30 km/h
Sink rate: 5 km/h (1.38 m/s)
Ground speed (yellow): 15 km/h
Lift: 15/5 = 3
Flight duration for 1000 m high: 12 min (1000/1.38/60)

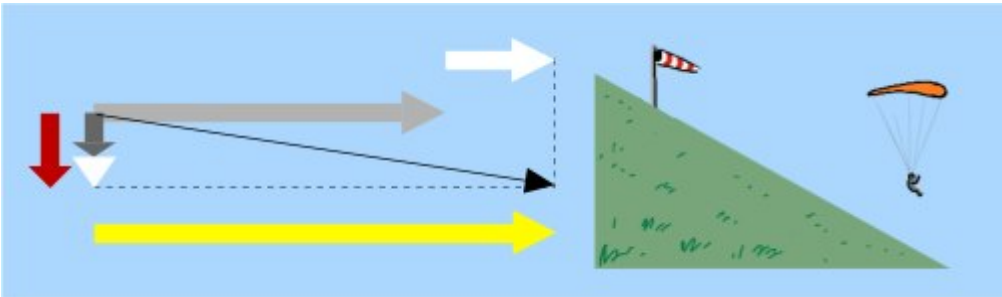


Figure 4-11: Tailwind 10 km/h and downward 3 km/h
Horizontal speed: 30 km/h
Sink rate: 8 km/h (2.22 m/s)
Ground speed (yellow): 40 km/h
Lift: 40/8 = 5
Flight duration for 1000 m high: 7 min 30 sec (1000/2.22/60)

5.4.2 Optimizing the drag ratio in the wind

According to the polar speed diagram the maximum lift is achieved by flying without action on brake controls (the polar tangent coming from the origin, see 2.6.3). This is valid only in calm conditions. Just as ground speed is subject to the wind influence, max.\ lift is dependent on brake doses.

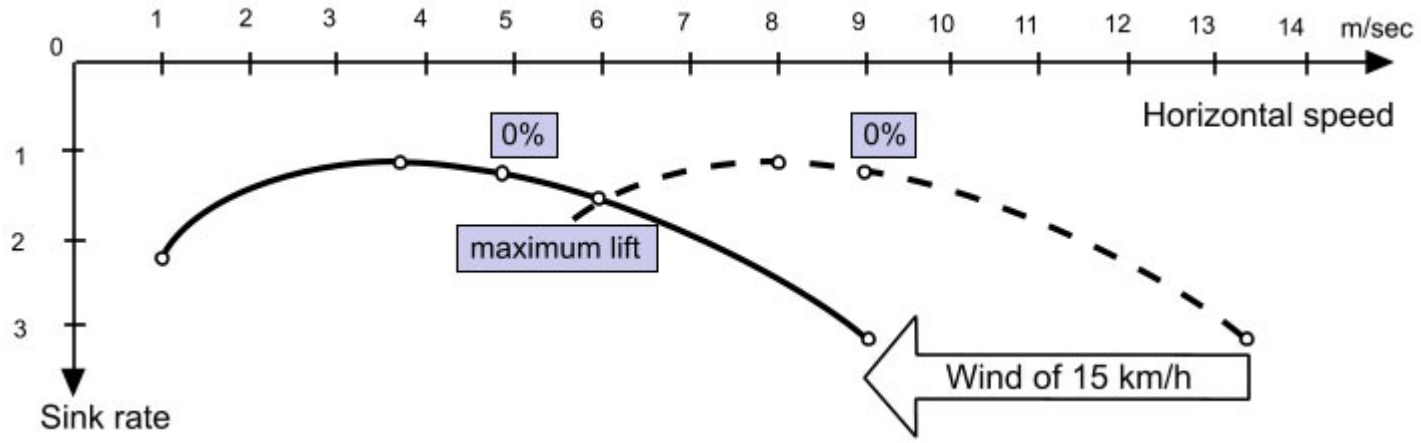


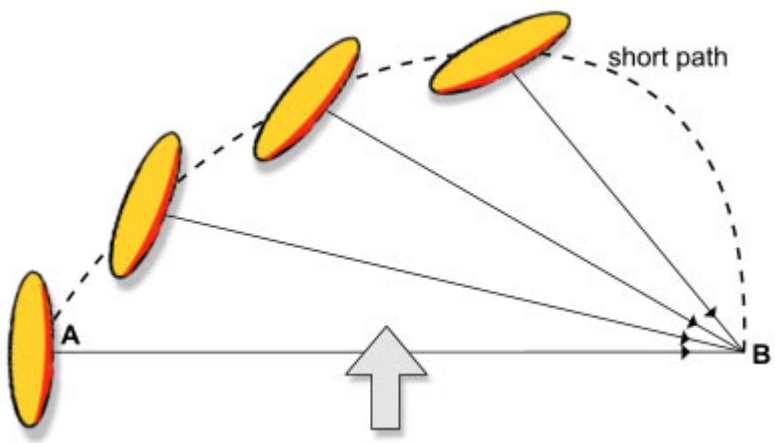
Figure 4-12: *Under the influence of wind, the unchanged polar curve with its respective brake positions moves according to the wind speed and in its direction. The tangent touches now the polar on the right 0% brake position. This means lift can be improved by speeding up (by releasing the trims or using the acceleration system). But it is only 4.2 while it is 7.5 in nil wind.*

With ascending or tailwind, is possible to fly with the best lift by slowing slightly to achieve the speed close to the sink rate. On the contrary, with descending or head wind, acceleration optimizes the flight distance.

5.4.3 Tactical flight with crosswind

With crosswind it is also possible to optimize the lift by flying faster. Simultaneously, one must determine the (actual) direction to follow, or rather the course, in order to win, as quickly as possible, the target point.

Figure 4-13: *If with crosswind the point of landing is always targeted, the flight trajectory has a curve shape because of the drift.*



The drift correction angle is determined by the strength and direction of the crosswind. The larger are the crosswind components and the larger is the drift and the correction angle as well. The opposite occurs with the flight speed: the faster the flight and the smaller are the drift and the drift correction angle.

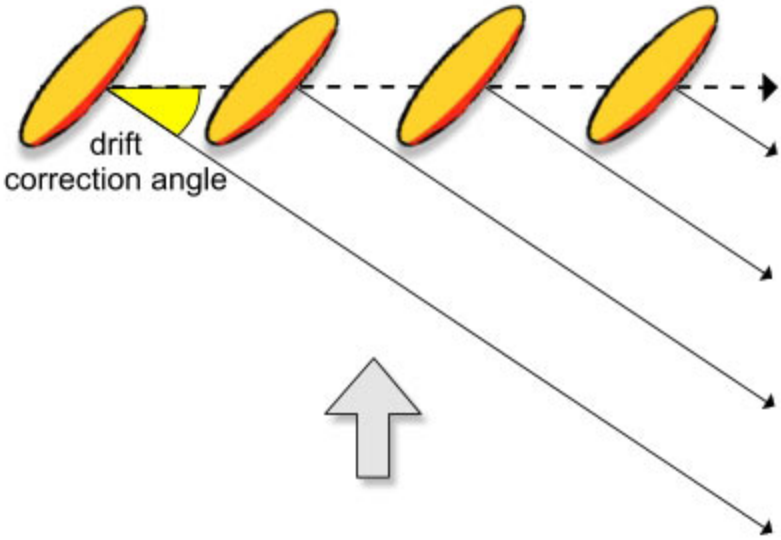
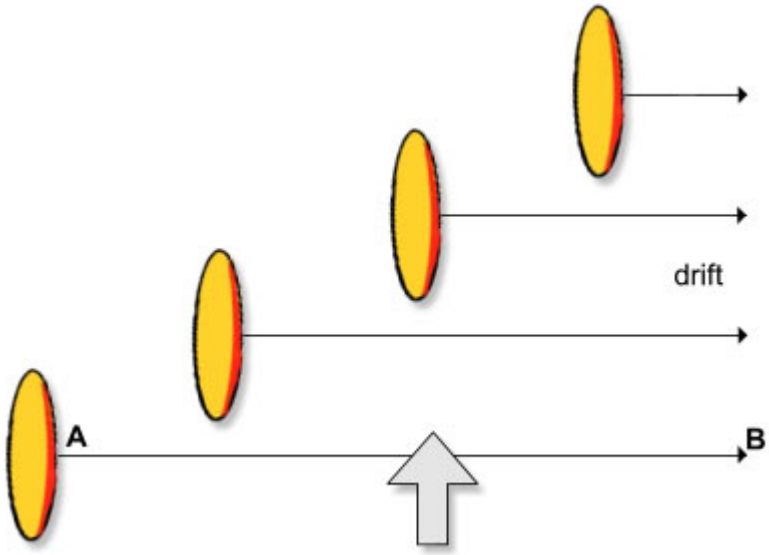


Figure 4-14: *If one wants to fly from A to B via the shortest way, an imaginary flight direction must be followed, oblique to the wind ⇒* ***crab flying****. The drift is compensated with the* ***drift correction angle****. This angle is the angle between the longitudinal axis of the glider and the ground trajectory.*

Figure 4-15: *With crosswind, if always flying straight ahead in the same direction, one is derived from the previously planed flight direction (⇒* ***drift****) and will pass lee side of the fixed point.*



5.4.4 Flying over an obstacle

To realize, during the flight, if the glide angle is enough to fly over a given obstacle, one should observe the field on the background above the highest point of the obstacle.

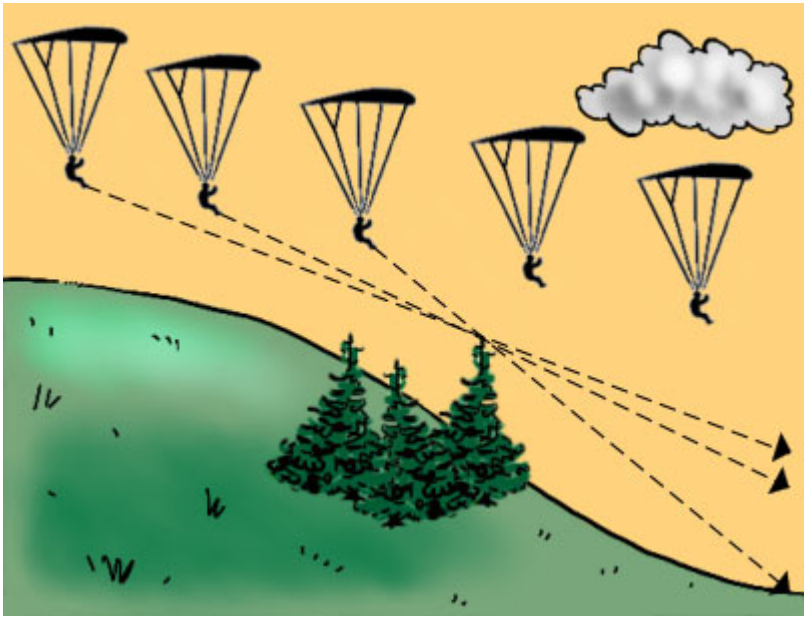
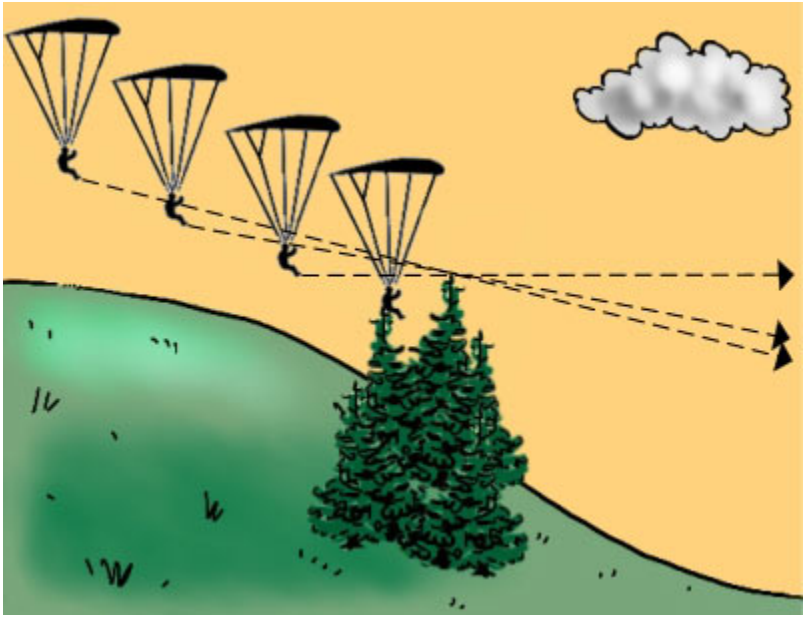


Figure 4-16: Determining the glide angle during flight: *the lift is enough to fly over the obstacle.*

If it is always possible to see more ground over the obstacle, it can be flown over.

Figure 4-17: Determining the glide angle during flight: *lift is insufficient for flying over the obstacle.*



If more and more ground is disappearing behind the obstacle, then lift is not enough to fly over the obstacle. A way to avoid it or an emergency landing must be considered.

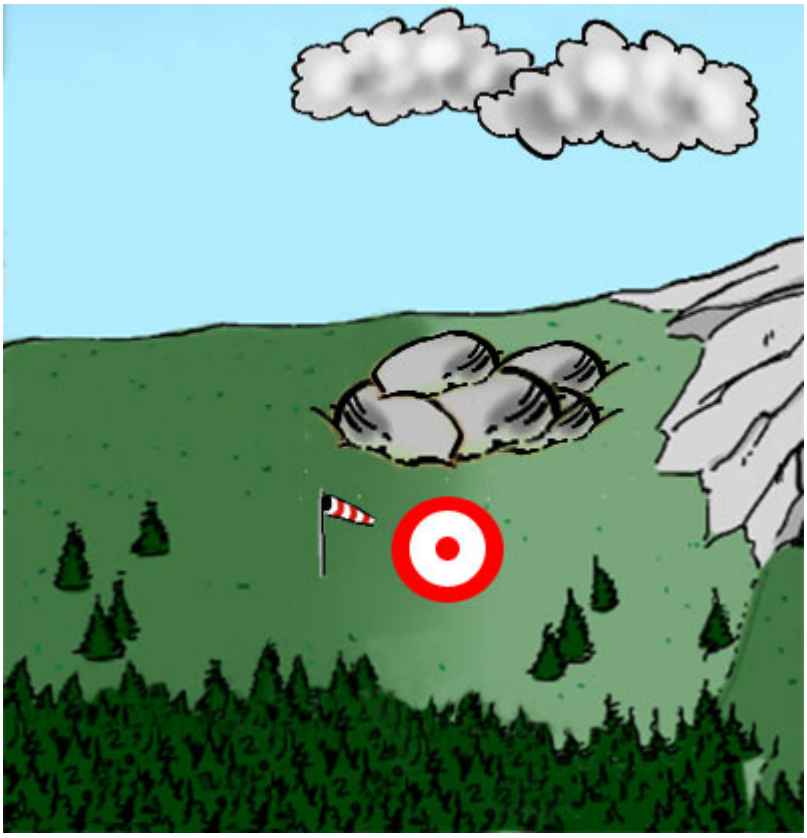
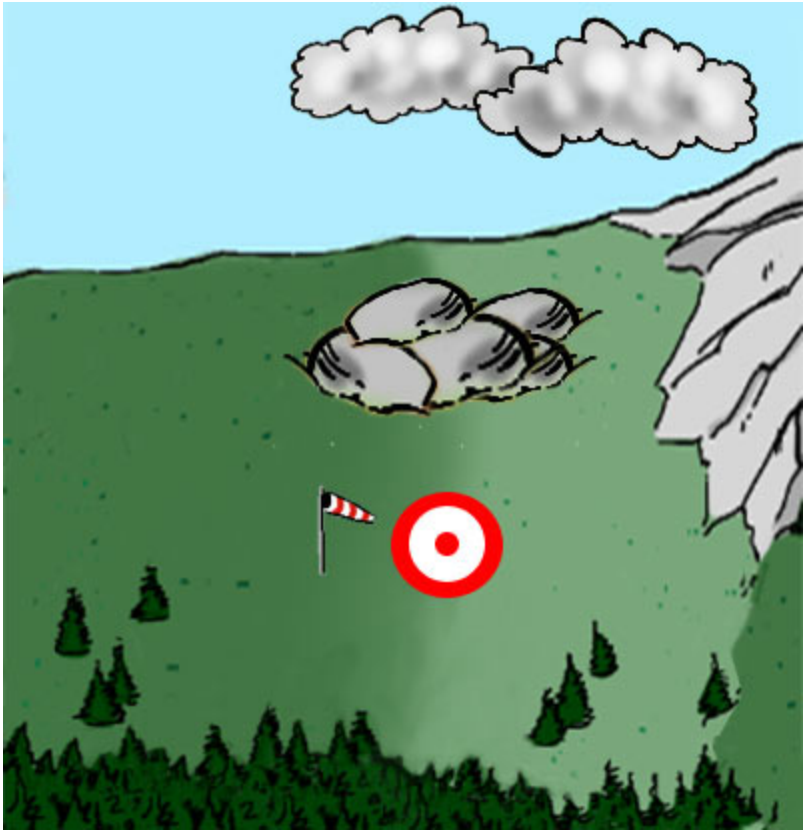


Figure 4-18: Starting position. *Just above the forest, there is a pile of rocks.*

Figure 4-19: *Between the pile of rocks and the forest, more land is still appearing ⇒ the forest may be flown over.*



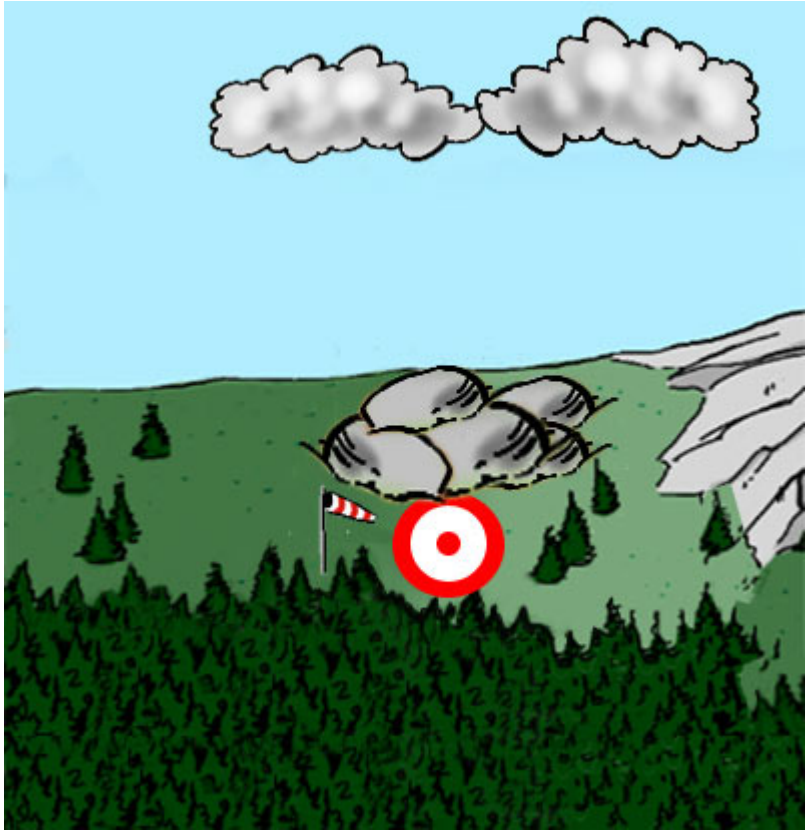


Figure 4-20: *The pile of rocks approaches the forest ⇒ the glide angle is not enough to fly over it.*

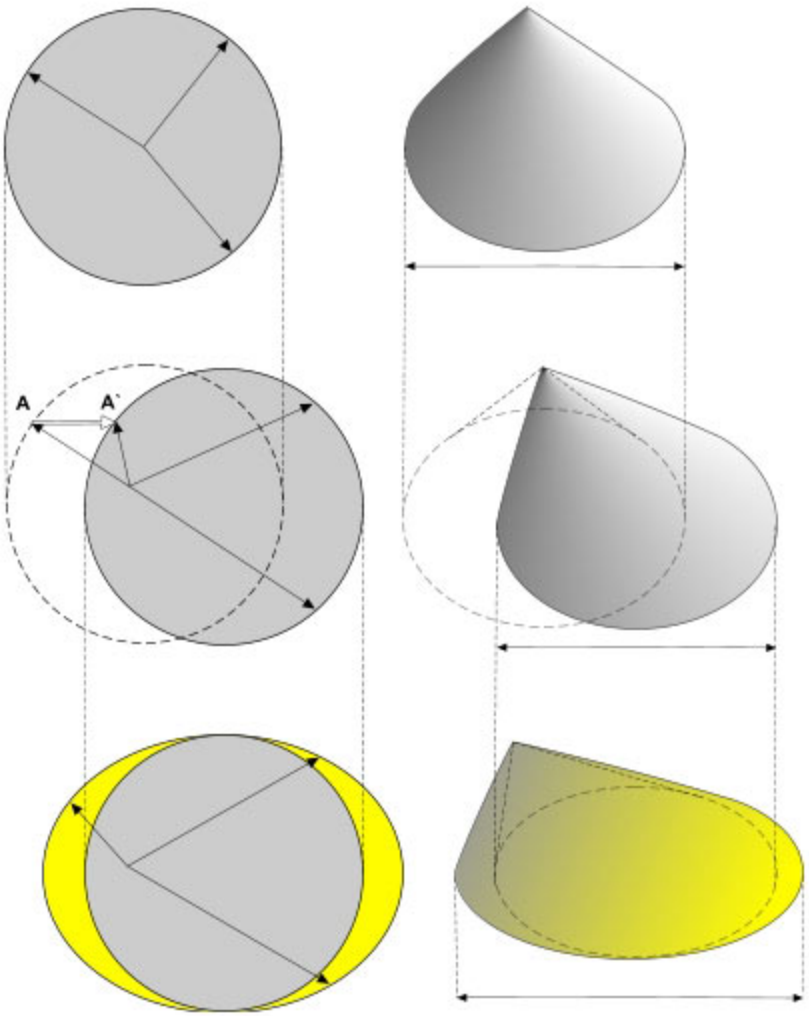



Figure 4-21: *In nil wind and with a height of 1000 m ground, one can, with a lift 7 paraglider, fly in all directions at 7 km away.*
Under the wind influence, the circle of attainable points (the lift cone) moves in the wind direction. It must be taken into account that to reach the point A, the point A' must be aimed (because of the drift).
By optimizing the lift, it is then possible to increase the radius of action by flying faster upwind and slowing down with the wind at the back. Thus the area of attainable points has an elliptic shape.