PARAGLIDING ASSOCIATION OF INDIA

Tandem Pilot's HANDBOOK

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Illustrations by Karthika Aiyer

PAI Tandem Workshop Course Material

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CHAPTER 1

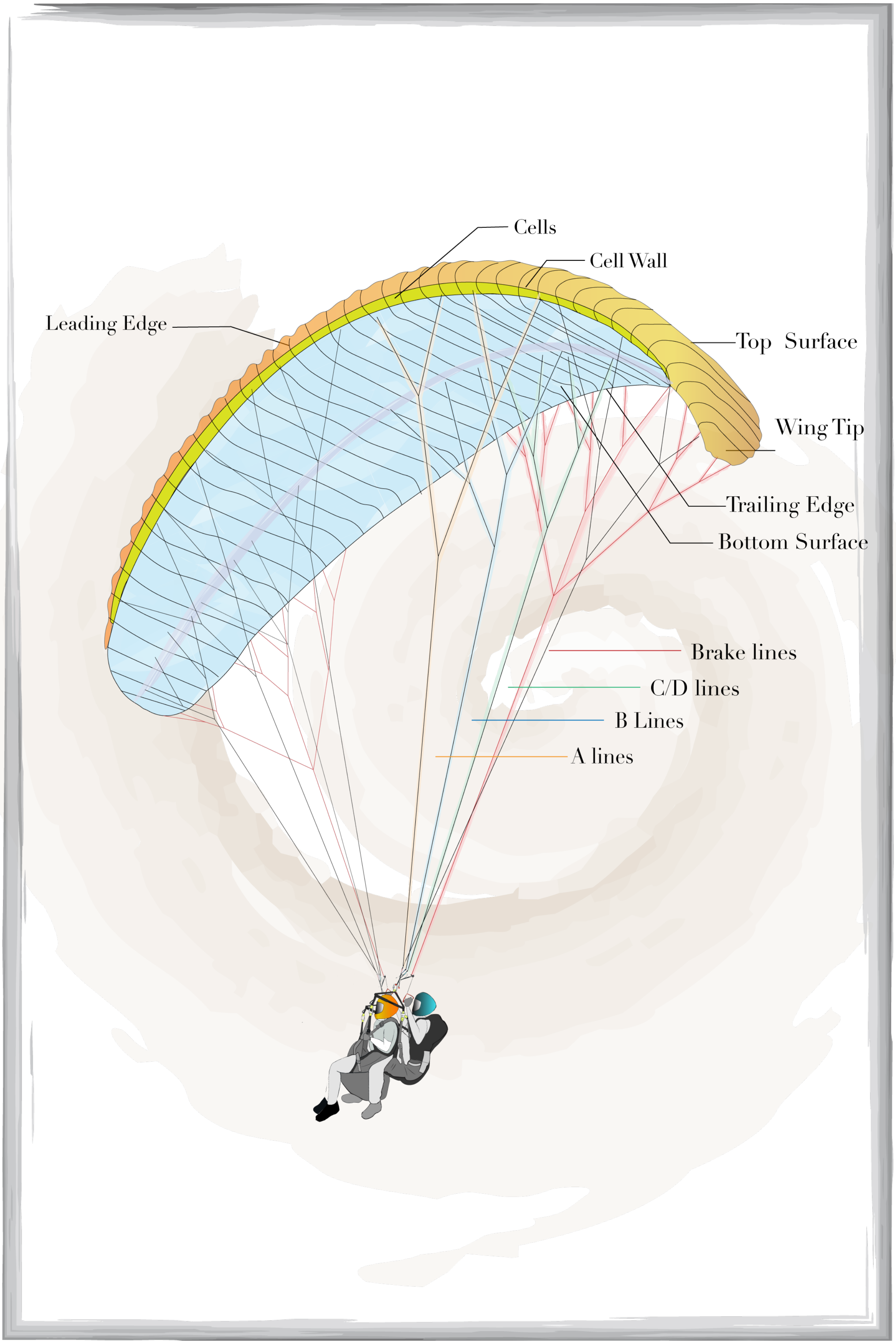
Nomenclature & Terminology in Tandem Paragliding

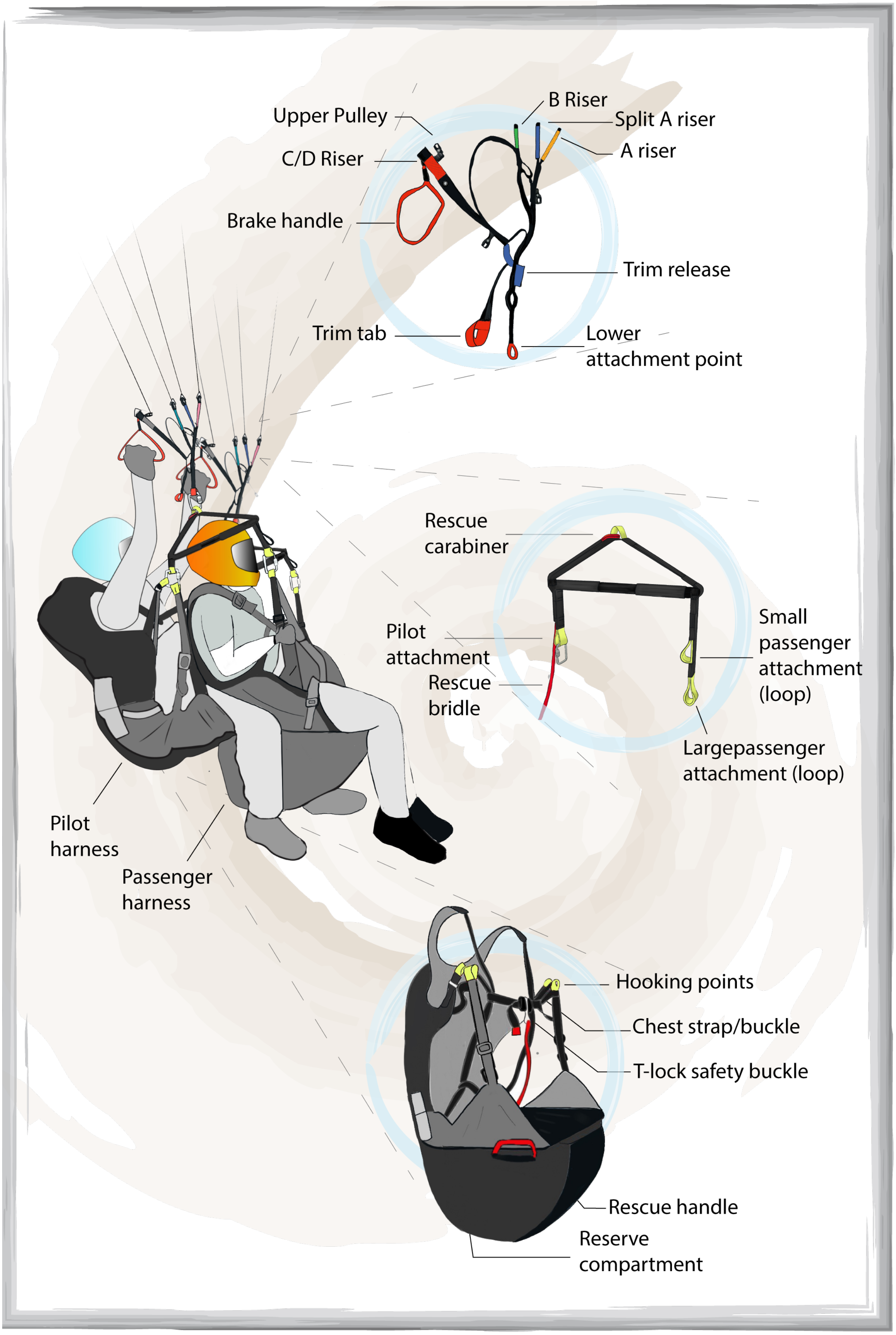
1.1 The Importance of The Use Of Precise Terminology

In the world of tandem paragliding, precise communication is key. This chapter focuses on the correct nomenclature and terminology essential for both professionals and enthusiasts. Using the right terms for various parts of the gliding equipment and accurately describing flying steps and manoeuvres is crucial for effective communication and to prevent a breakdown in communication with its detrimental effects on safety

1.2 Understanding The Different Parts of a Glider

Before we delve into terminology, let's familiarise ourselves with the key components of a tandem paraglider. Refer to the labelled images below, which illustrate the tandem wing and the harness setup, including T-bars. Knowing these parts and their functions is fundamental to safe and enjoyable tandem flights.


Cells
Cell Wall
Leading Edge
Top Surface
Wing Tip
Trailing Edge
Bottom Surface
Brake lines
C/D lines
B Lines
A lines


Upper Pulley
B Riser
Split A riser
A riser
C/D Riser
Brake handle
Trim release
Trim tab
Lower
attachment point
Rescue
carabiner
Pilot
attachment
Rescue
bridle
Small
passenger
attachment
(loop)
Largepassenger
attachment (loop)
Pilot
harness
Passenger
harness
Hooking points
Chest strap/buckle
T-lock safety buckle
Rescue handle
Reserve
compartment

1.3.1 Bringing the Glider Up: Inflation

When preparing for takeoff, it's essential to use the correct term for bringing the glider up. In this context, we refer to it as "inflation." This emphasises the controlled filling of the wing with air, ensuring a smooth and controlled ascent.

1.3.2 Taking Off: Take Off, Not Jump

The act of ascending into the skies should be referred to as "take off." Avoid using the term "jump," as it may convey an incorrect and potentially unsafe image. In Hindi, you can use the phrase "Udaan bharenge" to express the experience of taking flight

1.3.3 In-Flight Terminology

- Lift: The force that enables the glider to ascend.
- Sink: The descent caused by a lack of upward air currents.
- 360 Turn: Executing a complete turn in the air.
- Thermaling: Utilising thermal updrafts for sustained lift.
- Hold above carabiner
- Hands clear (if passenger is trying to hold launch assistant or any wrong part of glider)

1.3.4 Landing and Flare

When it comes time to descend, use the term "landing." The controlled descent should be accompanied by a controlled flare, emphasising a smooth and safe touch down. Use clear terms like Feet up, Feet down and run etc

1.3.5 Aerobatic Manoeuvres

While aerobatic manoeuvres may not be allowed at all commercial tandem flight sites, if permitted, it's crucial to use the correct names for each manoeuvre. Examples include spirals, wing overs, SATs, helico, etc. Safety should always be the priority when considering any aerobatic manoeuvres.

1.4 Conclusion

By adopting and understanding the precise nomenclature and terminology associated with tandem paragliding, both pilots and passengers contribute to a safer and more enjoyable experience. Clear communication ensures that everyone involved in the flight is on the same page, promoting a culture of safety and professionalism in the world of tandem paragliding.

CHAPTER 2

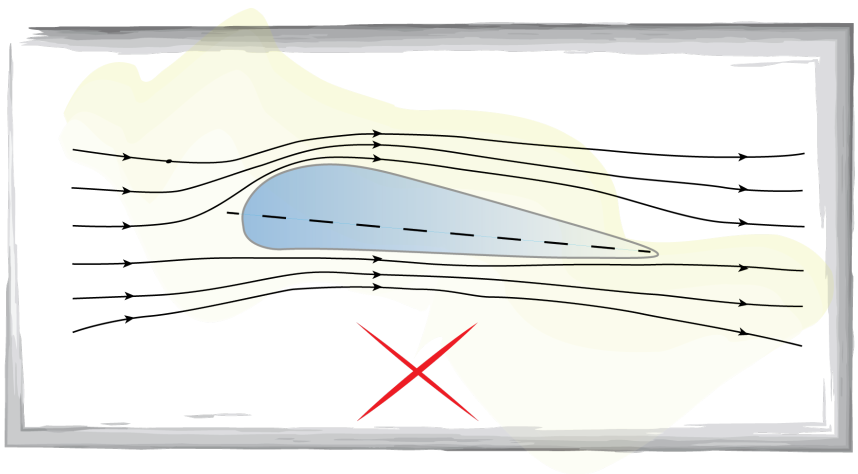
Theories of Lift

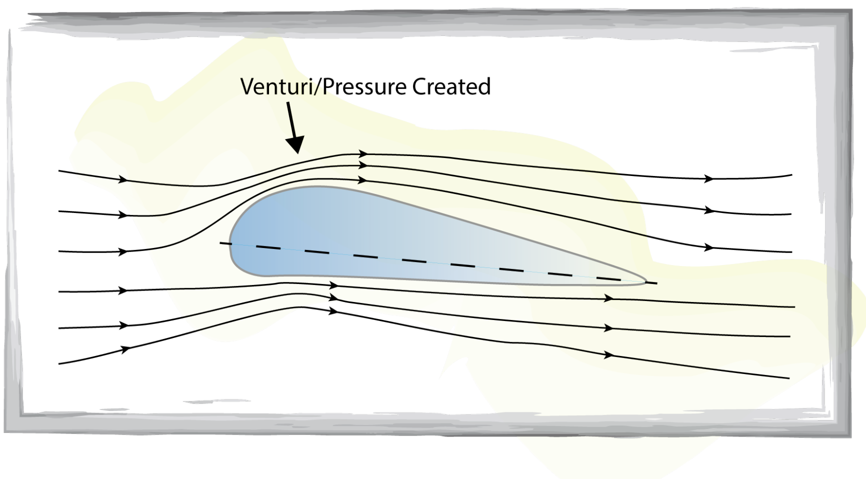
2.1 Revisiting Traditional Concepts

In the realm of paragliding, understanding the theories of lift is fundamental to mastering the art of flight. Traditionally, many of us have been taught the "equal transit time" or "longer path" theory during ground school. According to this theory, the low-pressure area on top of the wing is created because air particles passing over it must accelerate to match the air below, arriving at the trailing edge simultaneously.

2.2 Challenging the Conventional Wisdom

Recent insights from NASA's Glenn Research Center challenge the traditional view. The actual velocity over the top of an airfoil is found to be much faster than predicted by the "longer path" theory. Contrary to the belief that particles must arrive simultaneously, those moving over the top actually reach the trailing edge before those below the airfoil. But equal transit velocity is not the correct theory."



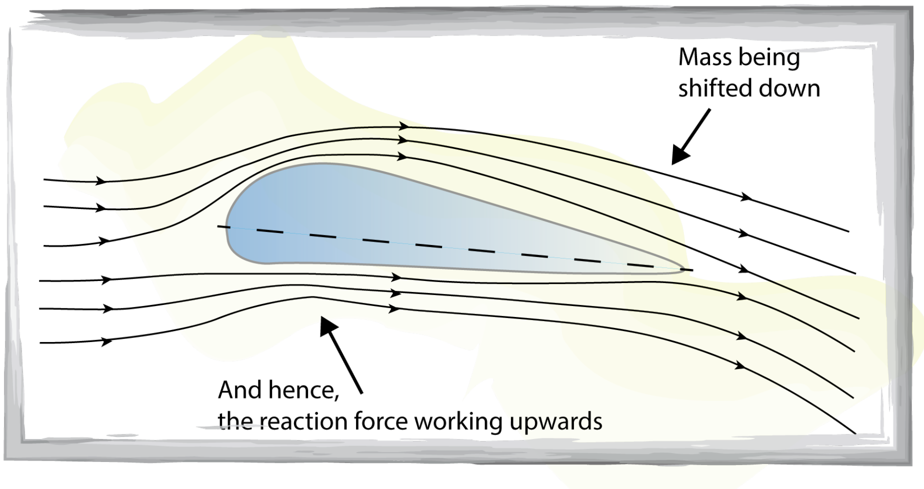


2.3 Beyond Bernoulli and Turning effect

While the traditional explanation relies heavily on Bernoulli's principle, it falls short in explaining certain phenomena. Bernoulli doesn't provide a comprehensive understanding of lift, especially in cases involving non-cambered wing designs or symmetrical airfoils.

NASA highlights that using Bernoulli's equation for pressure and performing pressure-area calculations often fails to align with the lift measured for a given airfoil. This discrepancy prompts a reevaluation of the traditional theories.

In the momentum-based explanation, it is argued that an airfoil acts like a turning vane deflecting the incoming flow downward, and thus lift is generated due to the deflection of the flow momentum flux according to Newton's second and third laws. However, a question is what the physical mechanism is for the deflection of the fluid stream. On the lower surface at the positive angle of attack (AoA), the fluid flow could be pushed down by the inclined surface. To explain the flow turning on the upper surface, the Coanda effect was proposed as a physical mechanism, originally describing the tendency of a powered jet flow to attach to the adjacent solid surface



2.4 A Unified Theory of Lift

Modern aerodynamicists, such as Doug McLean, former Boeing engineer and author of "Understanding Aerodynamics: Arguing from the Real Physics," propose a more comprehensive theory. McLean identifies four essential components for lift: a downward turning of the airflow, an increase in the airflow's speed, an area of low pressure, and an area of high pressure.

These components form a reciprocal cause-and-effect relationship, where each element supports the others. McLean's theory emphasises that pressure differences exert the lift force on the airfoil, while the downward turning of the flow and changes in flow speed sustain these pressure differences.

2.5 Embracing a New Understanding

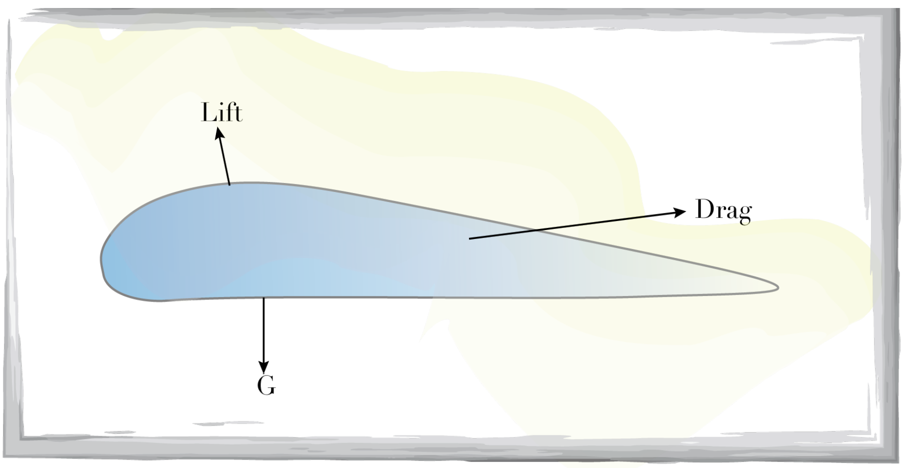
As we explore these emerging theories, it's crucial for tandem paragliders to go beyond traditional concepts and embrace a more nuanced understanding of lift. This knowledge lays the foundation for safer flights and a deeper appreciation of the complex aerodynamics at play during tandem paragliding

CHAPTER 3

Forces Acting on the Glider, Forward Motion, & Balance of Forces

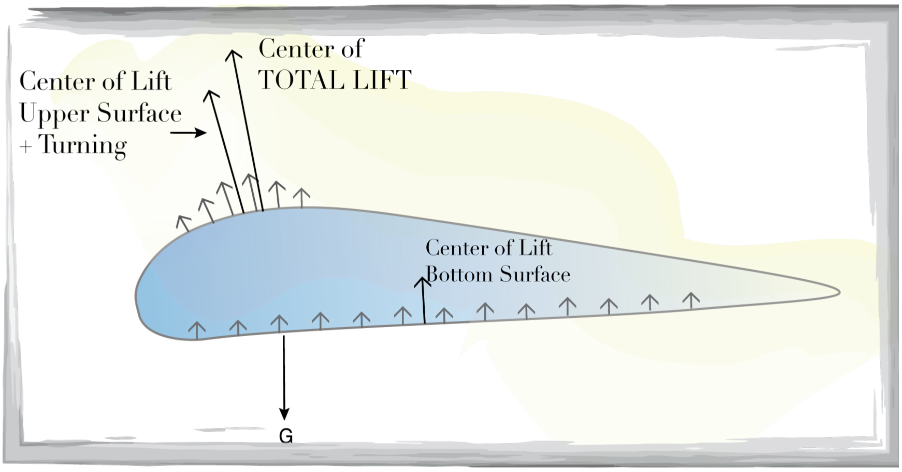
3.1 Forces at Play

Understanding the forces acting on a paraglider is essential for safe and controlled flight. Three primary forces come into play: Lift, Gravity, and Drag. In this chapter, we'll explore how these forces interact to create forward motion and maintain balance.



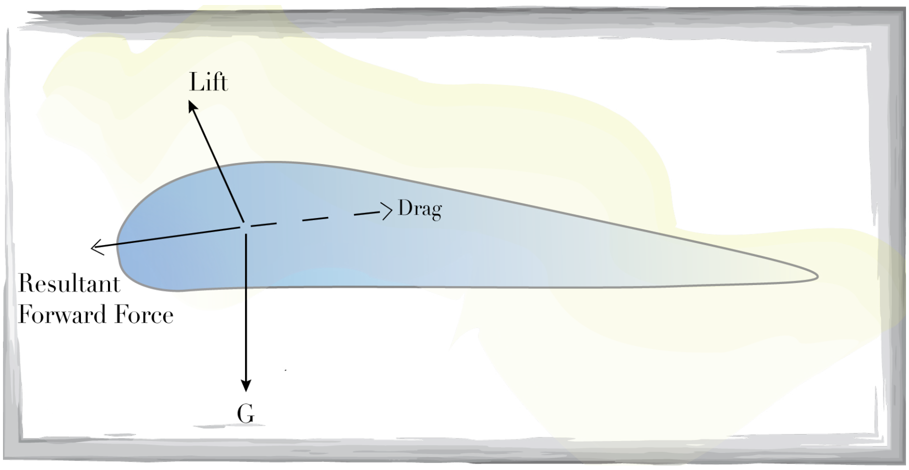
3.2 Center of Lift

Lift is generated by both the upper and lower surfaces of the glider. Notably, the Center of Lift is positioned at different points on these surfaces. While this distinction becomes crucial in stall recoveries, for the majority of lift generated from the top surface, the Center of Lift is visualised just behind the leading edge. Understanding this positioning becomes vital in managing the aerodynamics during flight.



3.3 Resultant Forces and Forward Motion

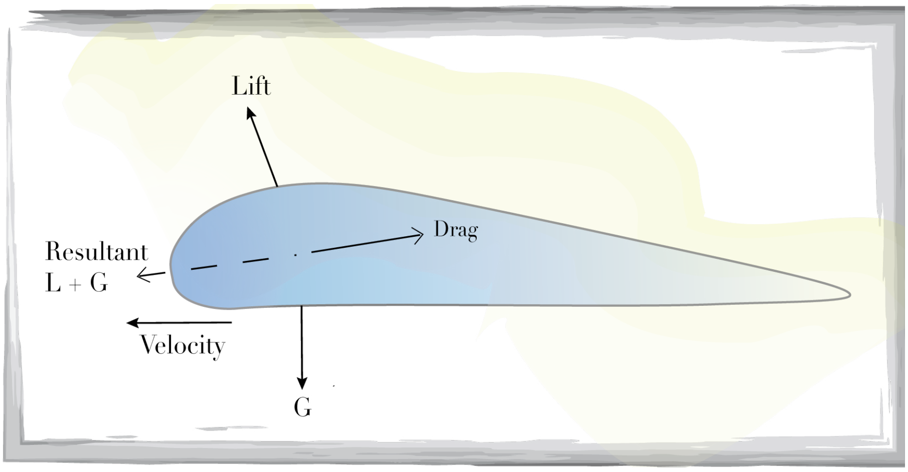
The gravitational pull on the wing's weight and the upward and forward-pointing lift create a resultant force that acts in the forward direction. This forward force is what propels the glider through the air. It's important to note that the direction of lift and gravity isn't precisely opposite. Lift is both upward and forward, while gravity acts vertically downward. This slight misalignment results in a forward component that contributes to the glider's motion.



3.4 Acceleration and Steady Flight

As the glider initiates its motion, lift and gravity work together to produce forward acceleration. (more accurately its the component of Weight vector in direction of motion that produces forward motion after the component directly opposite to lift has been neutralised by lift)

However, as the wing gains speed, drag comes into play. Drag increases exponentially with speed until it equals the forward force, leading to a state of equilibrium. This marks the point where acceleration ceases, and the glider maintains a steady speed, often referred to as Trim Speed.



CHAPTER 4

Stall & Spin

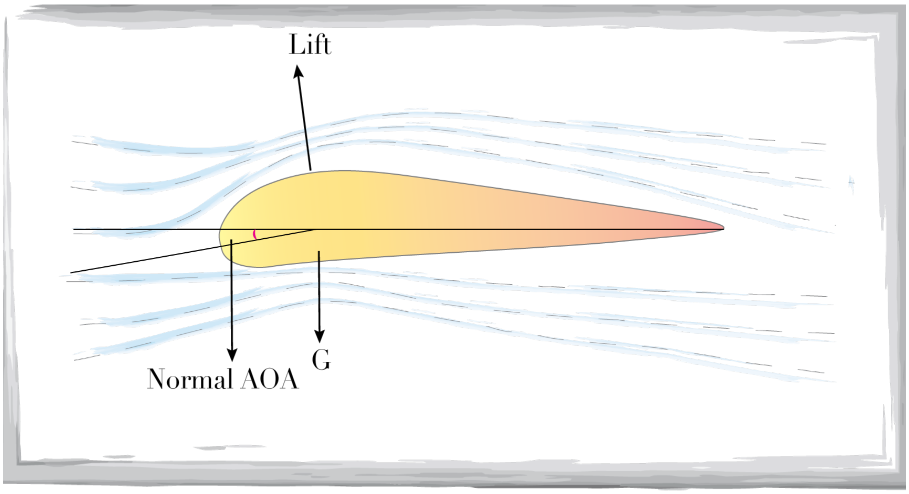
4.1 The Unified Theory of Lift and Airflow

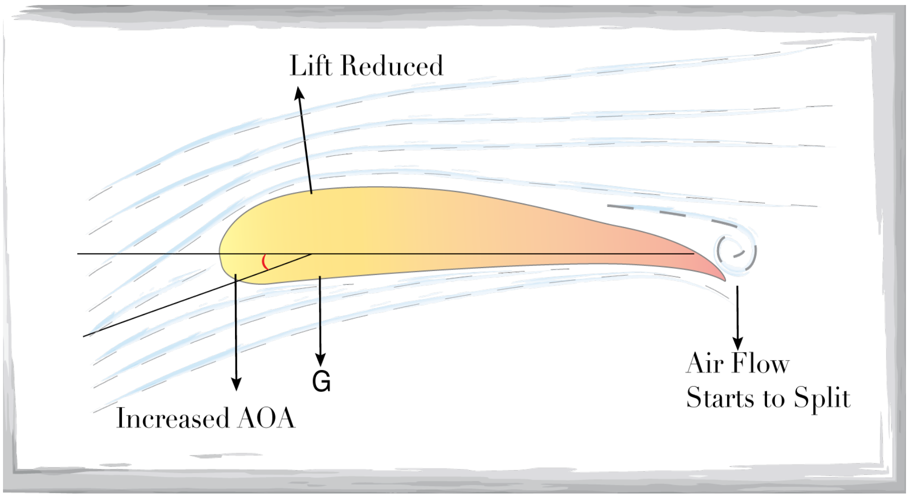
As we embrace the unified theory of lift, understanding the significance of smooth airflow over the wing becomes paramount. Both Bernoulli's lift and the momentum/ turning effect rely on undisturbed airflow over the wing to generate lift and forward motion, making it a critical factor. Any disruption to this airflow can result in a significant loss of lift and lead to a stall.

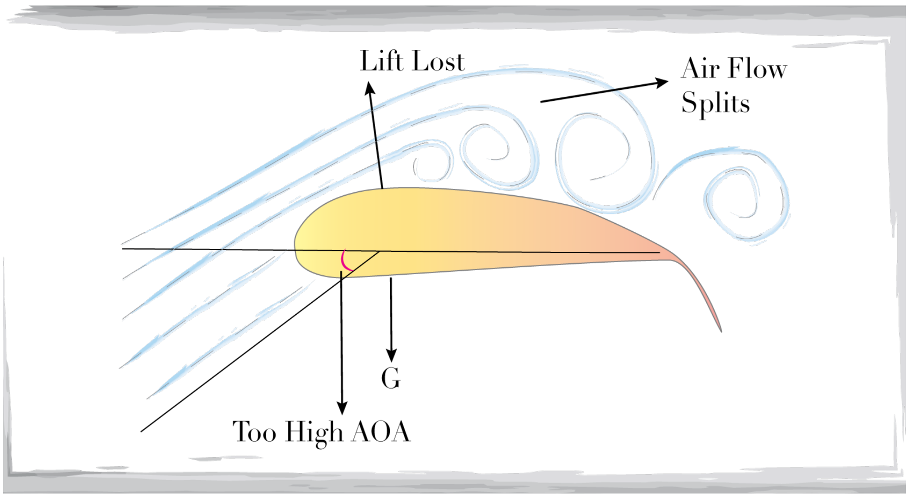
4.2 Stall:

4.2.1 Dynamic Stall, Too High Angle of Attack

As the pilot flies with more and more brake creating increasing drag and loss of speed, the wing loses lift gradually and hence descends at a steeper path . This leads to Relative Airflow to come towards the wing at a steeper angle. Thus increasing Angle of attack. At a certain angle of attack the airflow splits from top Surface causing sudden loss of major lift and forward motion. Wing will initially descend vertically and then whip back in a horse shoe shape. Pilot will swing back underneath it and if he doesn't release breaks this oscillation of the wing and pilot will continue. This kind of stall is called a Dynamic stall and is pilot induced only.

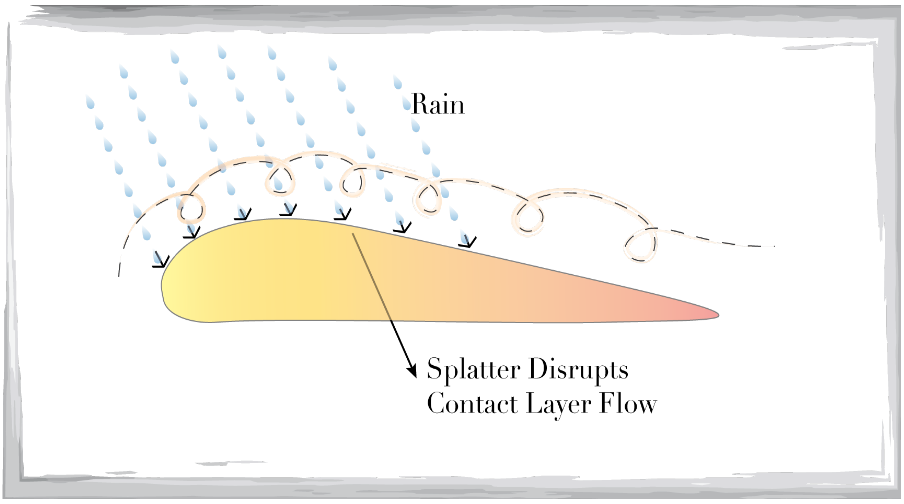


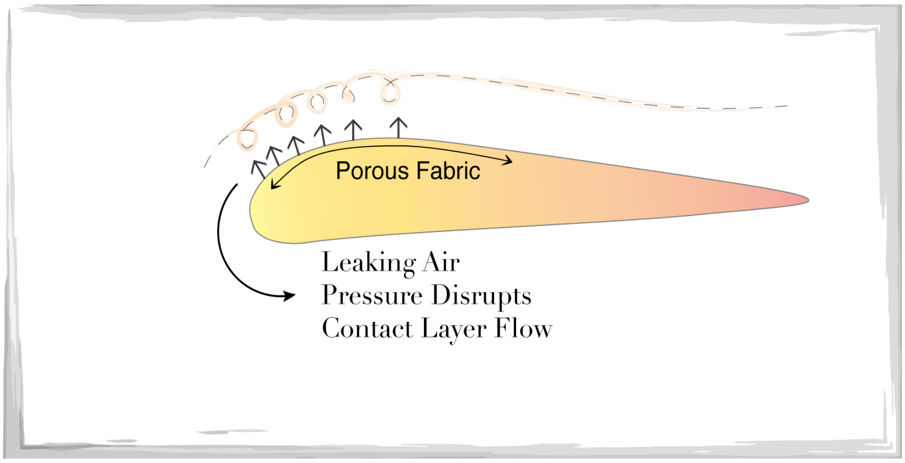


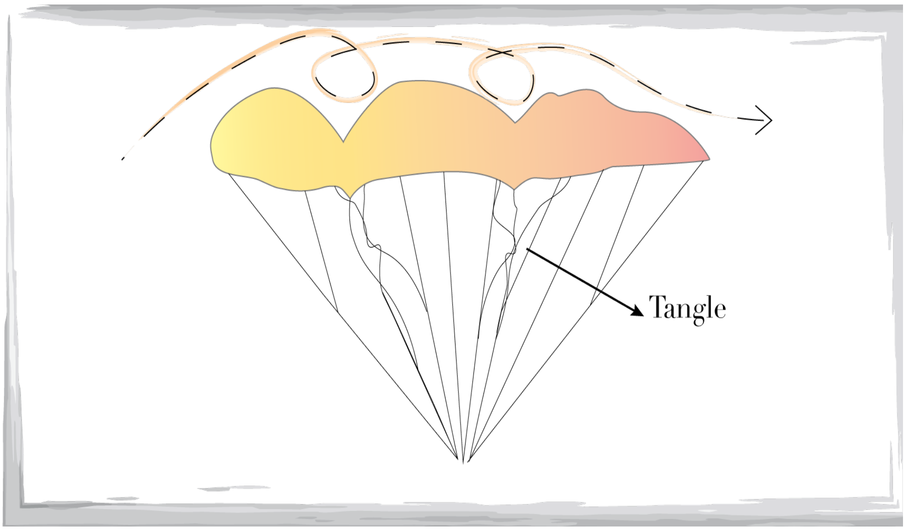


4.2.2 Deep Stall: Physical Disruption of Airflow

A deep stall occurs when the airflow over the wing is physically disrupted, even if the wing appears fully open. Factors such as a b-line pull, air leakage from porous fabric, or rain can lead to a deep stall. This disrupts the wing's ability to move forward, resulting in a more vertical descent.







4.3 Spin

Spin is an occurrence where one side of the wing stalls, and it can happen during dynamic or deep stalls on one side of the wing. Recovery from a spin requires specialised training and is typically covered in SIV (Simulation d'Incident en Vol) courses.

4.4 Instabilities and Recoveries

Recovery procedures for various instabilities are crucial skills covered in specific training courses, such as SIV. For the purposes of this workshop, we assume that participants have either completed or will undergo SIV training to address recoveries.

4.4.1 Paragliding Deflations

Deflations occur when the airflow pushes the wing from above, causing a negative angle of attack. Unlike stalls, where the wing's angle of attack is too high, collapses involve a quick folding of the paraglider's leading edge, either downward and backward for frontal collapses or asymmetrically for partial collapses. Collapses can result from sudden changes in air conditions or aggressive self-acceleration of the wing due to external disturbances or poor piloting.

These collapses pose several dangers:

- Sudden and unexpected occurrence.
- Loss of lift, causing the wing to fall rapidly.
- Potential for developing into an aggressive swing or spiral dive.
- Risk of complications such as riser twists or line entanglements.

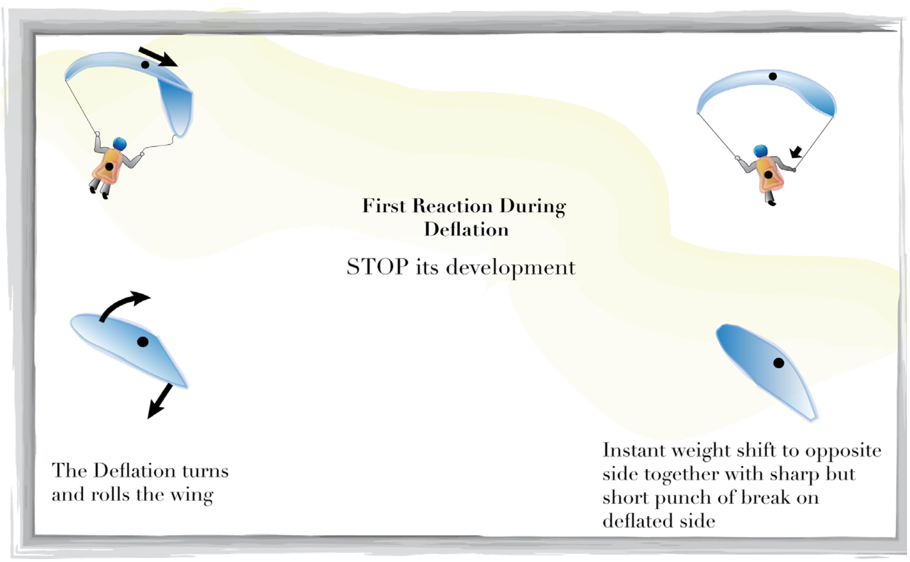
Collapses close to the ground are particularly dangerous, as they can lead to violent swings or spiral dives that may result in impact with the ground at high speeds. Even vertical falls from collapses pose a significant risk due to the high descent rate, especially considering the limited control the pilot has in emergency situations.

Most paragliding accidents occur shortly after takeoff, as it can be challenging to anticipate air conditions accurately. In contrast, pilots typically have a better understanding of air conditions during landing, allowing them to make safer decisions.

4.4.2 Asymmetric Deflation

Asymmetric deflation in paragliding occurs when a part of the leading edge of the wing collapses and folds downward due to airflow pushing it from above. Speaking very technically when part of the wing gets a negative angle of attack. This creates drag on the collapsed side, causing a turn towards that side. Asymmetric collapses can result in a loss of lift and a sudden drop in altitude. The severity of the collapse depends on various factors such as the type of air conditions and the size of the collapse.

Often, the reason for a collapse to stay is a cravat – the canopy is being tangled with the lines. In such a case, the pilot should locate the stabilo line – a line which usually starts from "B" or "C" risers, has a distinct colour and ends at the wing tip. It should not be mistaken with the "Big Ears" line, which starts from "A" risers and ends with outermost "A" lines. When an asymmetric collapse happens, the wing tip folds first and goes in between the lines. So, pulling the stabilo line is an efficient way to clear cravats.



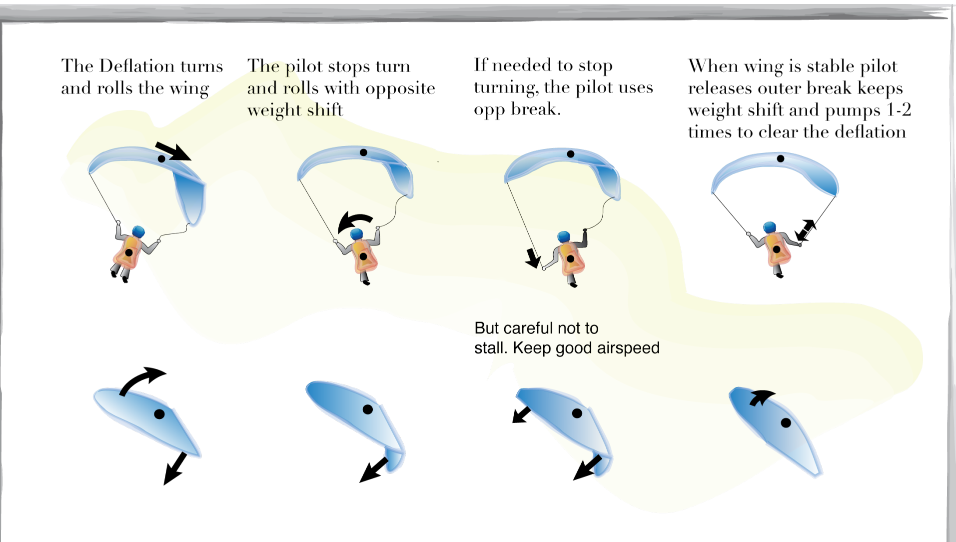
Asymmetric collapses pose several dangers:

- The potential for aggressive swings or spiral dives, reaching speeds of up to 100 km/h.
- Risks of complications such as line tangles or cravats, which can delay recovery.
- The possibility of worsening the situation by overreacting with brake inputs, leading to stalls or spins.

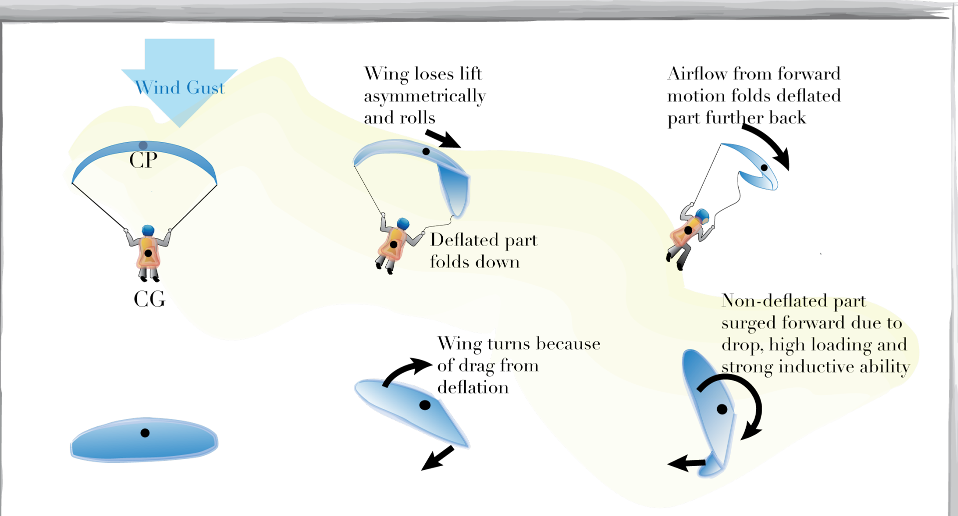
Asymmetric Deflations can be prevented and managed through various techniques:

- Quick weight shifts and brake inputs to counteract turning tendencies.

- Recognizing the severity of collapses and adjusting response accordingly.
- Clearing collapses through brake inputs and body positioning, ensuring sufficient airspeed before any manoeuvres.
- Identifying and clearing cravats promptly, using specific techniques such as pulling stabilo lines or stalling the wing if necessary.
- Knowing when to use a rescue parachute in case of unstable situations or when other recovery attempts fail.



Stopping and clearing an asymetric deflation



Big Asymmetric Deflation goes into spiral dive if not stopped by the pilot

4.4.3 Symmetric Deflation aka frontal tuck

Frontal Tuck, also known as symmetric deflation, is a symmetric folding of the entire leading edge of the paraglider wing. Unlike asymmetric collapses, which can result in violent swings or spirals, frontal collapses are generally safer because they typically recover by themselves without pilot intervention. Frontal collapses can occur when the wing enters sinking air suddenly or when it aggressively surges forward due to external factors or poor piloting.

The process of a frontal collapse involves several interconnected steps:

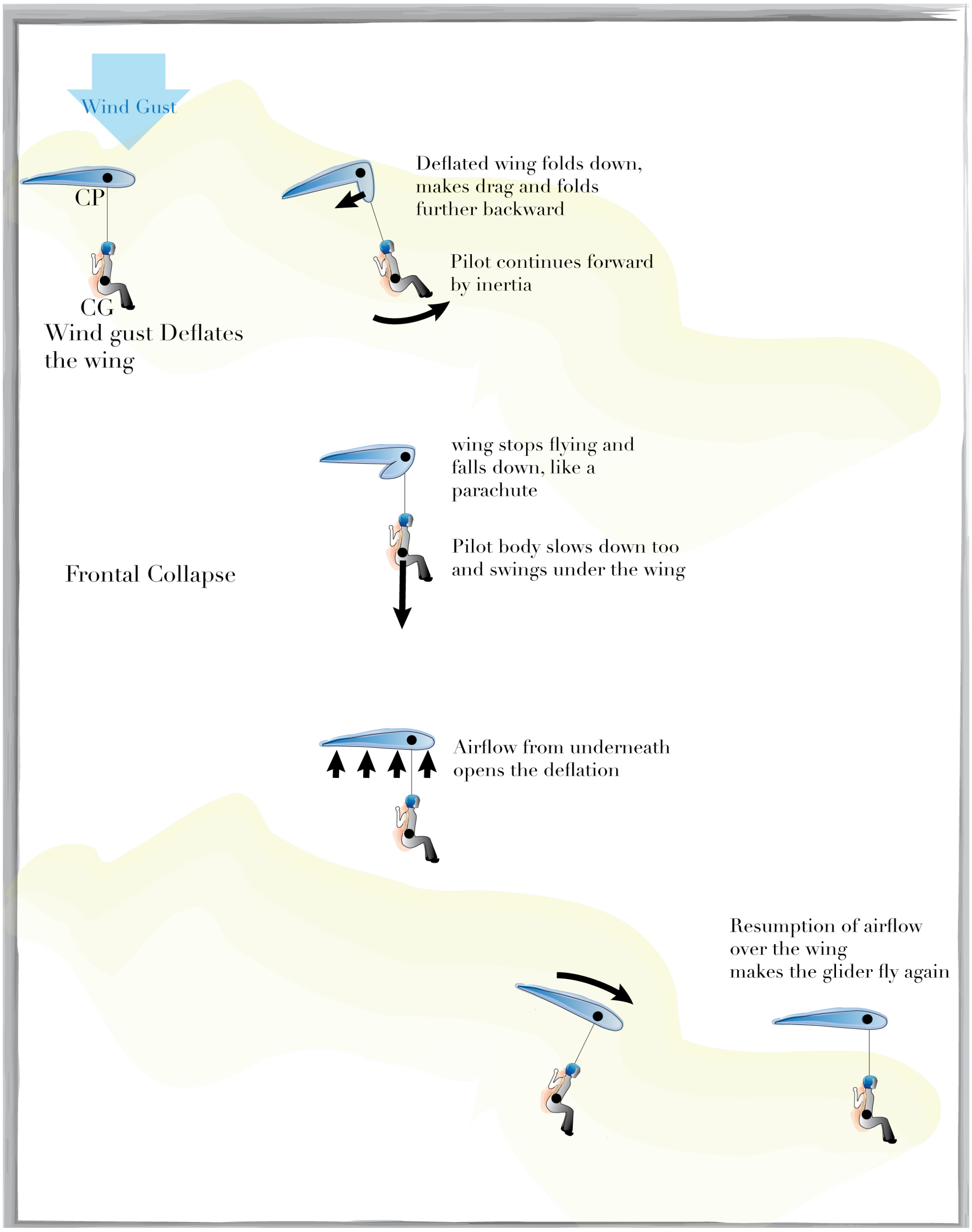
- The leading edge folds down due to air pressure from above or the pull of the "A" risers from below, by the pilot.
- As the paraglider continues to fly forward, the deflated leading edge is hit by airflow, causing it to fold backward.
- The deflation creates drag, causing the entire wing to move backward while the pilot's body continues forward.
- The lower pendulum motion brings the pilot back under the wing.
- The deformed wing profile ceases lift production, and the paraglider starts to fall.
- The wing acts like a drag parachute, slowing down the fall.
- Airflow from underneath helps to unfold the collapsed leading edge, and the wing starts to surge forward.
- After some oscillations, the wing recovers normal flight.

Complications of frontal collapses may include:

- Horseshoe frontal collapse: where the central part of the wing tucks down while the wingtips remain intact, potentially leading to cravats.
- Rolling of the leading edge backward: a prompt pull of brakes can prevent this.
- Staying of the leading edge pressed backward: disrupting the equilibrium with a sharp brake pull allows airflow to separate the folded leading edge.

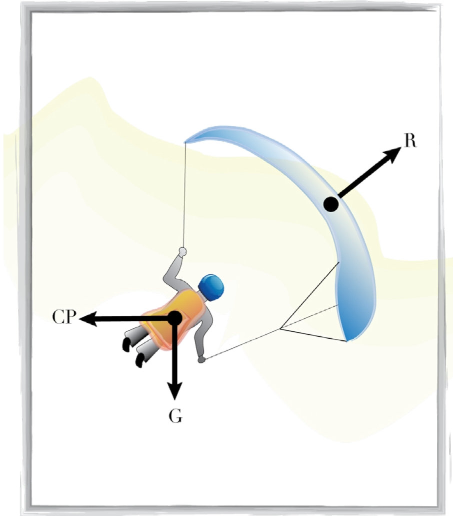
A frontal deflation may involve a temporary stall like situation, which can sometimes turn into a stable parachute stall, especially with modern wings with sharp leading edges. Recovery techniques include using the speed system or "A" risers to help the wing bite the airflow, pulling both brakes sharply to rock the wing and create a secondary swing forward, and then releasing the brakes to allow the wing to regain flight.

Aggressive frontal collapse recoveries may require asymmetrical brake inputs to regain symmetry of motion. Practice of pitch control exercises can help pilots become proficient in handling such scenarios. Overall, understanding frontal collapses and practising recovery techniques are essential for safe paragliding.



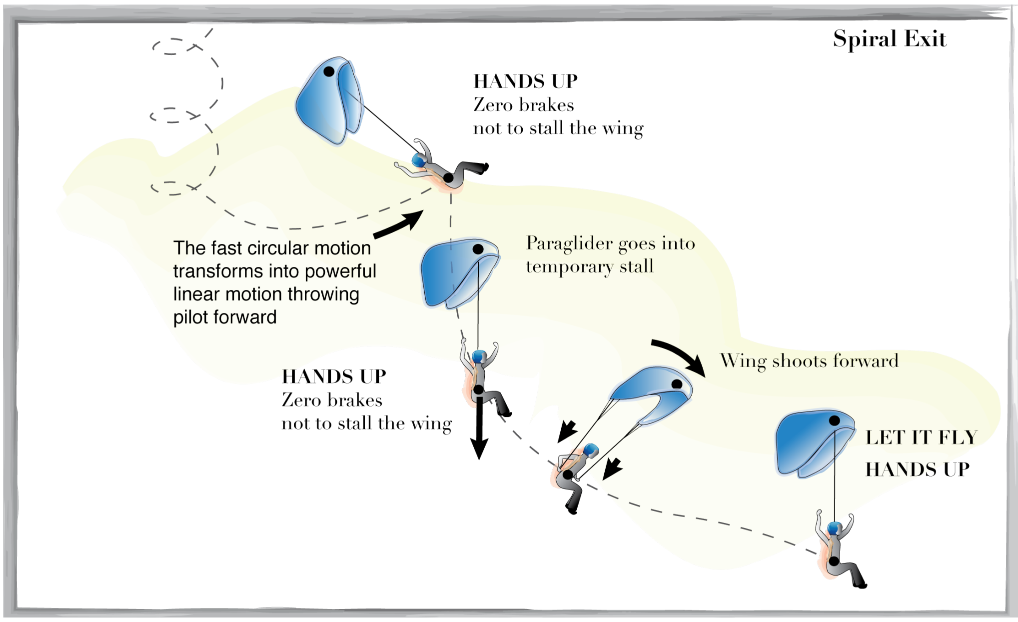
4.4.4 Spiral Dive

A spiral dive is a fast circling and descent with high g-force loading. It's essential to understand and practice spirals as they can be both a challenge and a useful escape manoeuvre. Here's a breakdown of the key points discussed in the text:



- Description and Physics: Spiral dives involve high-speed, high-g force rotations driven by the paraglider's inductive ability. The wing's lift force changes direction rapidly due to the turn and centripetal force increases towards outside of the turning, resulting in increased g-forces and wing loading. The higher the speed and g-force, the stronger the airflow .
- Stages : Spiral dive exercises typically involve three stages: entry, spiral, and exit. The entry phase requires progressive tightening of a turn until the paraglider enters a self-perpetual rotation. Smooth entry is crucial to avoid stalling or spinning the wing.
- Entry Techniques: Techniques for entering a spiral include progressive brake application, starting with weight shift followed by gradual brake input. It's essential to avoid abrupt brake pulls, which can lead to cascading collapses. Spirals can also be entered from mild wingovers which depend less on braking and less chance of accidentally entering a spin.
- Control and Exit: Pilots can control a spiral with minimalistic weight shifts and brake inputs, most wings naturally exit the spirals. Exiting a spiral involves releasing the inner brake and turning the body to a neutral position, allowing the wing to slow down and exit the rotation gradually. If the glider is in a locked spiral both brakes can be applied to reduce speed and hence the centripetal force allowing pendulum effect to recover the wing into straight flight. Glider will surge up and then dive due to any excess speed left in the exit. Pilot should be ready to control the aggressive pitch after the surge.
- Safety Considerations: The biggest dangers of spiral dives include locking into a spiral due to collapses, cravats, loose harnesses, unintentional weight shifts, or wing design. Pilots should remain calm and apply corrective actions to stop the spiral.
- Emergency Procedures: If unable to exit a spiral, pilots may need to deploy a rescue

parachute. Throwing the parachute requires careful consideration of g-forces and body movements to ensure a safe deployment.

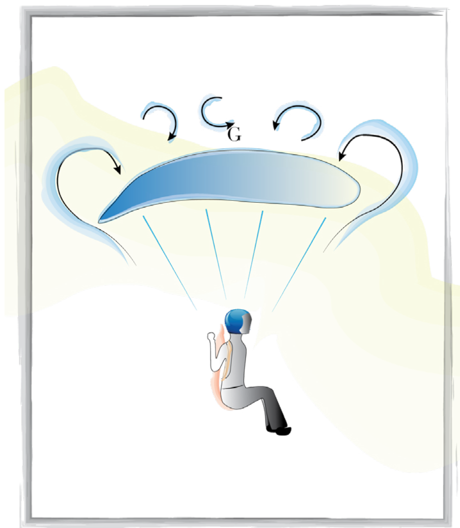


4.4.5 Stall and Spin

Stall and spin need detailed explanation and practice and it's totally recommended that you take the SIV course to master these recoveries. In Brief

Parachutal Stall:

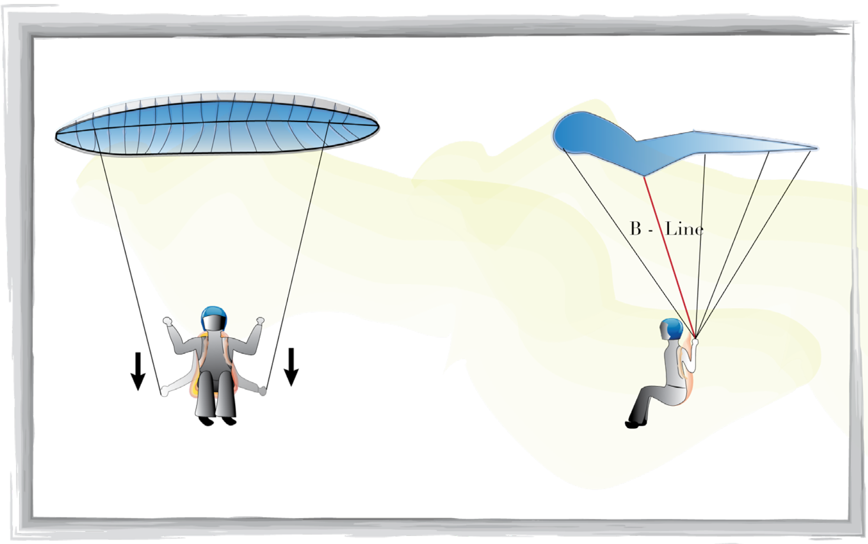
- Cause: Typically occurs when flying slowly in thermic conditions, entering a thermal, exiting a B-line stall, trying to slow down in a wind-shadow, landing on big-ears, or executing a butterfly landing.
- Description: The glider stalls due to high angle of attack, resulting in a loss of lift generation
- Recovery: Release the brakes to allow the glider to dive forward and regain vital airspeed. Some gliders may need encouragement with the speedbar or pulling down the A risers. Avoid asymmetric brake input to prevent a spin.



Stall & Spin

B-Line Stall:

- Cause : Used to escape strong cloud-suck or descend quickly while drifting back with the wind.
- Description : The glider stalls with a high sink rate but remains reasonably stable.
- Recovery : Release the B-lines, allowing them to shoot out of your hands and pop open the canopy. The glider should then surge forward to regain airspeed. Avoid gentle and slow release of the B-lines to prevent remaining in a parachutal stall. If that happens push on speed bar or push A risers.



Negative Spin:

- Cause : Attempting to core a small, strong thermal by slowing down the glider, leading to a loss of airspeed and spinning as the inside wing stalls during a turn.
- Description : The glider spins on the yaw axis with one wing flying forwards and the other backwards.
- Recovery : If you have altitude it might be a good idea to immediately stall the wing and then recover from stall. Otherwise

release the brakes as soon as the wing starts slipping instead of turning. The glider should pitch forward and recover. Avoid releasing the spin off to one side, which could lead to asymmetric collapse or a spiral dive.

Asymmetric Stall:

- Cause : Applying full brake on one side only during normal flying speed.
- Description : The glider spins on the yaw axis with one wing flying forwards and the other stalled and flying backwards.
- Recovery : Again if you have height stall the wing and then resolver from stall, otherwise immediately release the brakes (hands up). If possible, release the brake when the glider has dived in front of you to facilitate recovery. If the glider swings behind you, hold on until it comes back into view.

CHAPTER 5

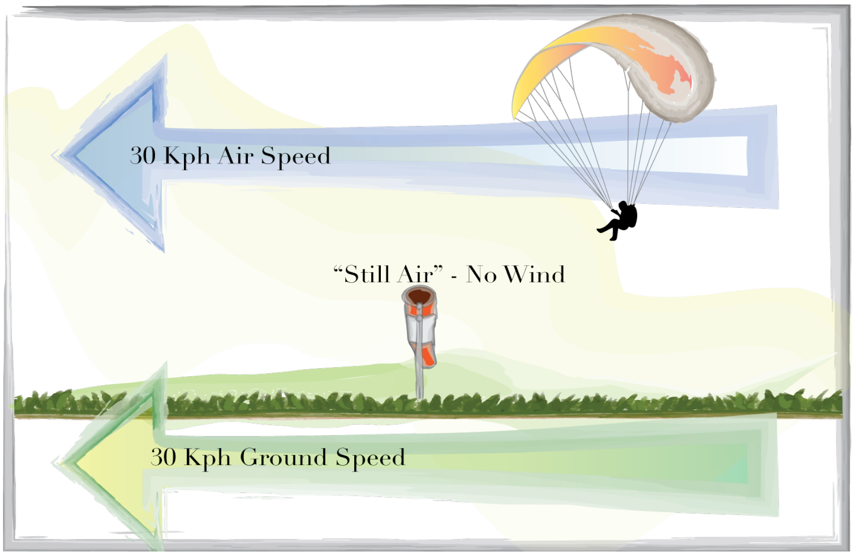
Airflow Over Ground & Flying Through Moving Air

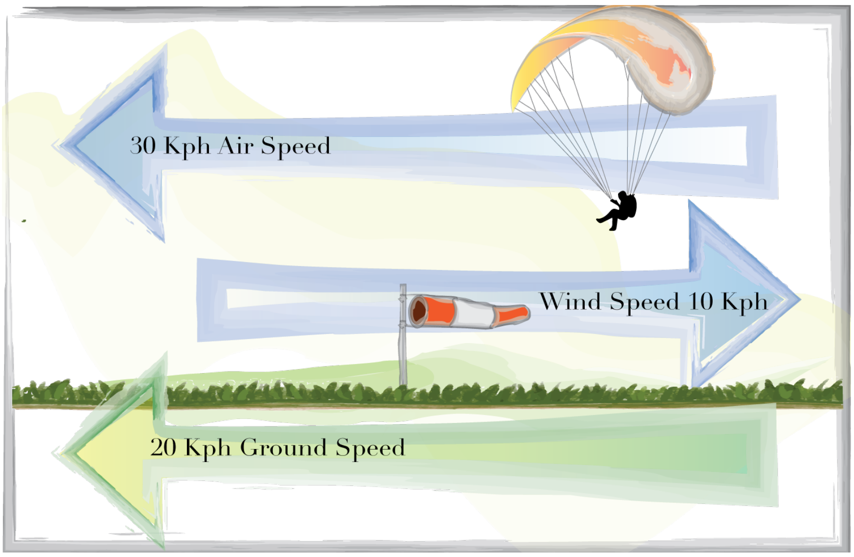
5.1 Airspeed and Groundspeed

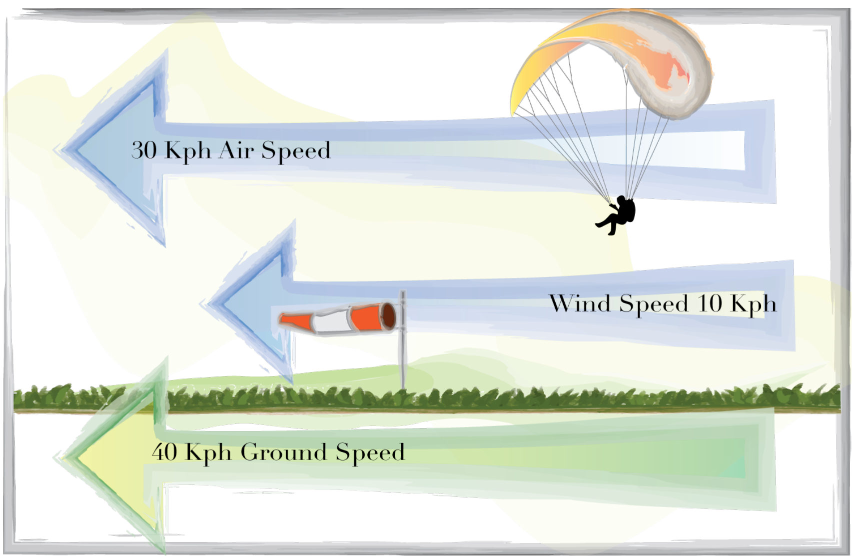
Understanding the relationship between airspeed and groundspeed is crucial for pilots to navigate effectively. Airspeed is the speed of the glider through the air, a parameter directly controlled by the pilot. Groundspeed, on the other hand, is the speed of the glider over the ground and can be affected by wind.

5.1.1 Impact of Wind on Groundspeed

Imagine flying at an airspeed of 30 kph in calm conditions. However, if there is a headwind of 10 kph, your groundspeed will be reduced to 20 kph. Conversely, flying with a tailwind of 10 kph will increase your ground speed to 40 kph. Understanding this dynamic is essential for effective navigation


30 Kph Air Speed
"Still Air" - No Wind
30 Kph Ground Speed

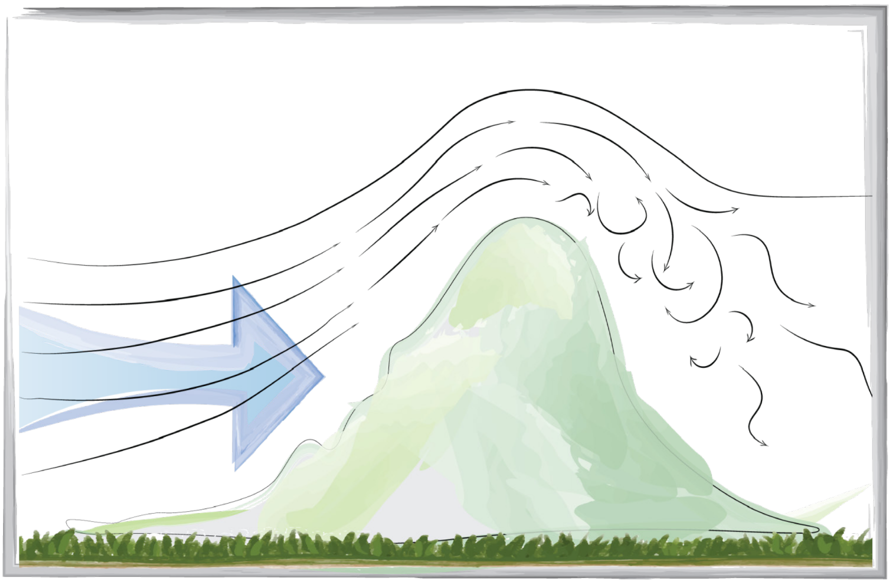

30 Kph Air Speed
Wind Speed 10 Kph
20 Kph Ground Speed


30 Kph Air Speed
Wind Speed 10 Kph
40 Kph Ground Speed

5.2 Turbulence

5.2.1 Causes of Turbulence

Turbulence, disturbances in the smooth flow of air, can be caused by various factors. It is crucial for pilots to avoid flying in turbulent areas whenever possible. Some common causes include thermal activity, wind shear, and obstacles on the ground.



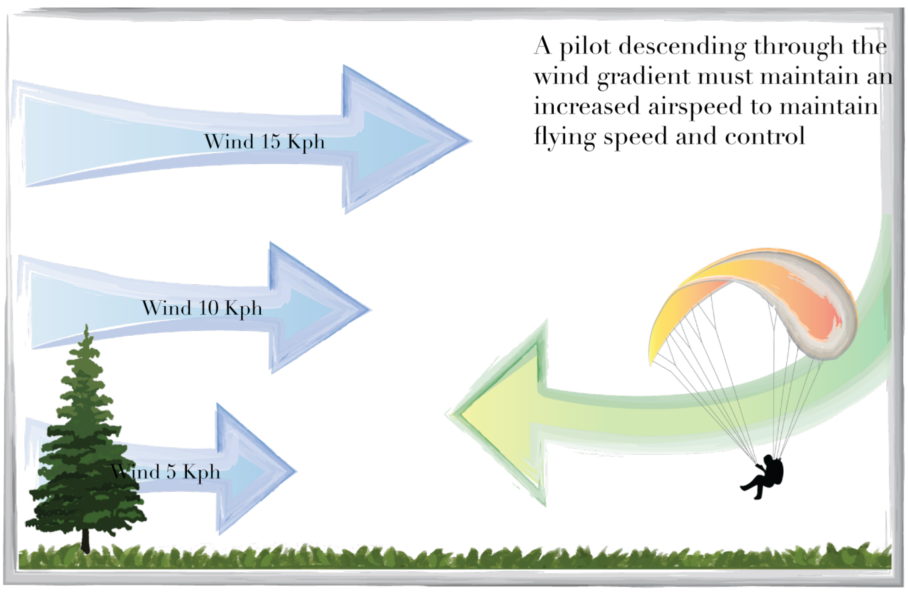
Turbulance behind hills and mountains

Turbulance behind man-made structures

Turbulence behind natural ground features

5.3 Wind Gradient

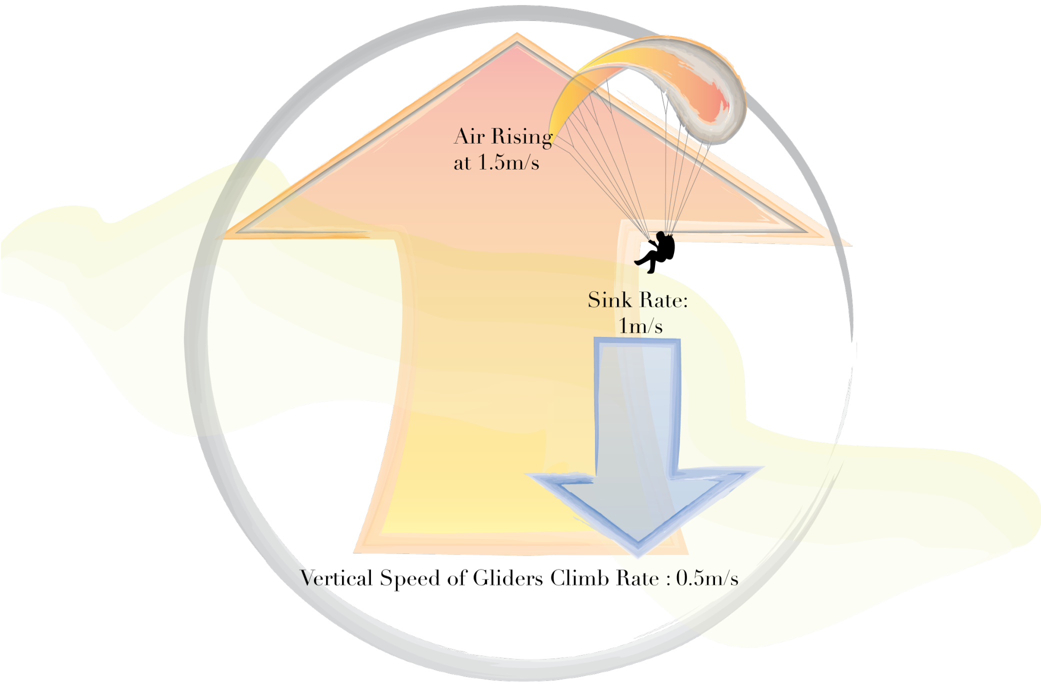
The wind gradient refers to the gradual decrease in wind speed closer to the Earth's surface due to friction. Pilots need to respect and account for the wind gradient, especially when descending for landing. Increasing airspeed during descent through the wind gradient helps maintain control and a safe approach.



5.4 Rising Air and Soaring

A glider gains height or soars when it is flying in air that is rising faster than the glider is descending through it.

One common scenario is ridge soaring, where wind blowing onto a ridge causes rising air that a glider can exploit. Additionally, thermals created by the sun's warmth in summer can carry a glider to great heights if skillfully navigated by circling within their confines.

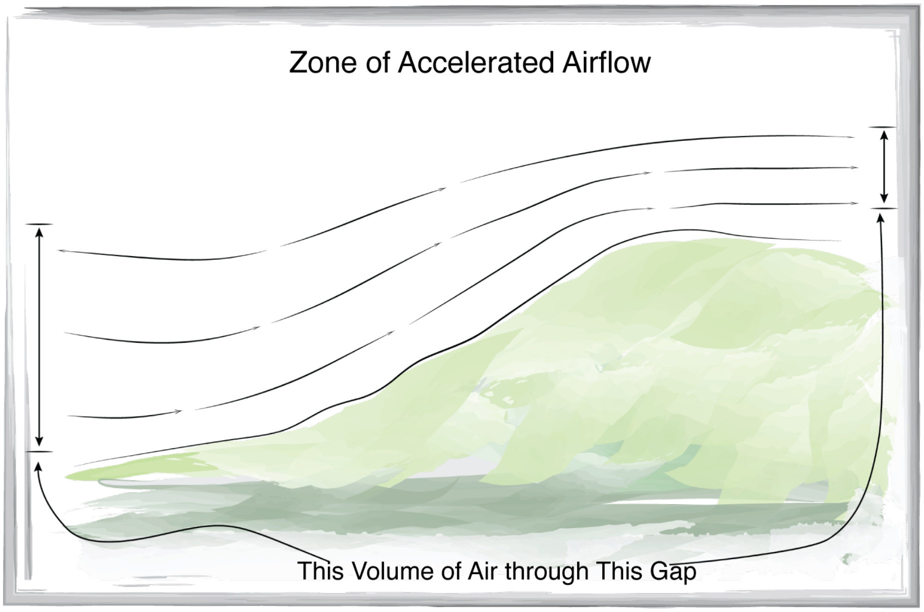


Developing a keen awareness of the interplay between airspeed, groundspeed, and the surrounding airflow is vital for safe and enjoyable tandem paragliding.

5.5 Venturi Effect

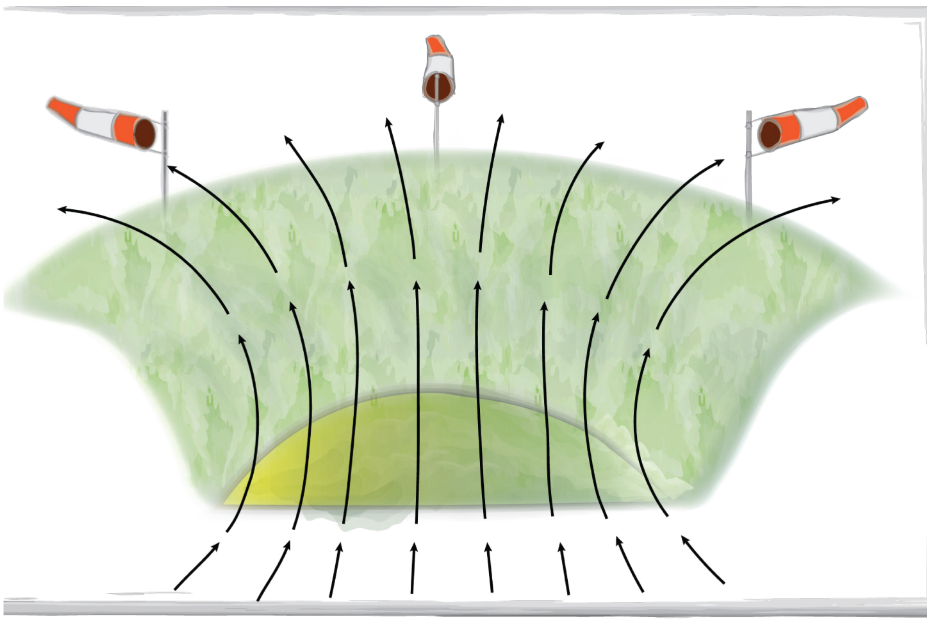
The Venturi effect is created by the presence of hills, leading to the acceleration of airflow as it passes over the terrain. Similar to the effect it has on generating lift over a wing, the Venturi effect can alter the windspeed at ground level compared to realistic flying heights.

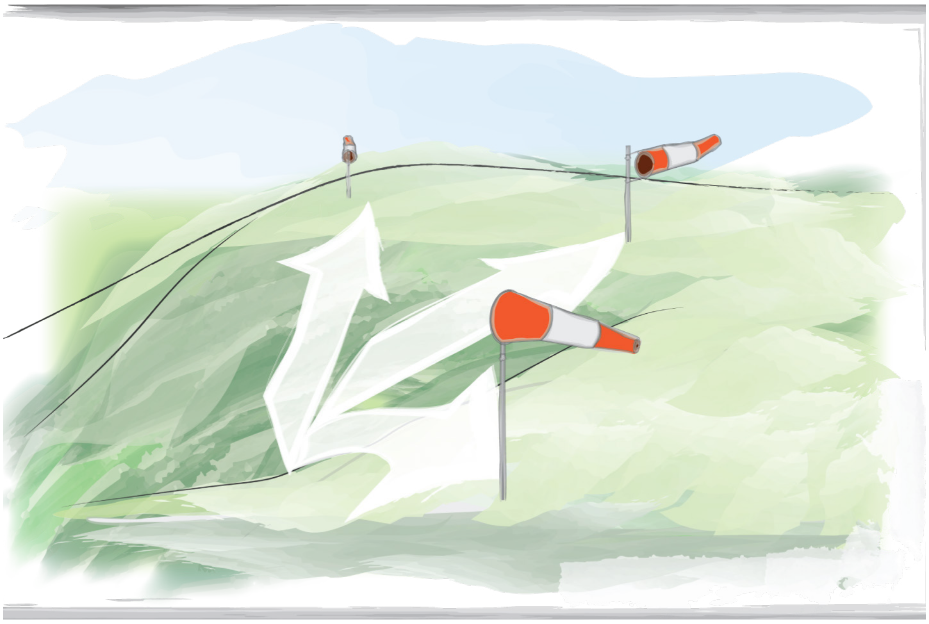
It's essential to recognize that a single windsock may not capture the full complexity of wind patterns, especially in areas with varied terrain.



5.6 Terrain Shape Considerations

The shape of the site plays a significant role in influencing wind patterns. Pilots relying on a single windsock without considering the terrain's shape may encounter confusion. The illustration below depicts a scenario where a pilot, without accounting for the site's features, might misinterpret wind conditions





Recognizing the impact of terrain on airflow is vital for making informed decisions during tandem paragliding adventures.

CHAPTER 6

Clouds & Atmospheric Phenomena

6.1 Cloud Formation

Clouds are formed when invisible water vapour in the air condenses into visible water droplets or ice crystals. Saturation of air, where it can no longer hold all its water in vapour form, leads to condensation. This can occur through

a. increasing water content in the air, e.g., through evaporation, or
b. cooling the air to its dew point, initiating condensation. Cloud formation is commonly associated with rising air in the lower atmosphere.

6.1.1 Factors Leading to Air Rising and Cooling

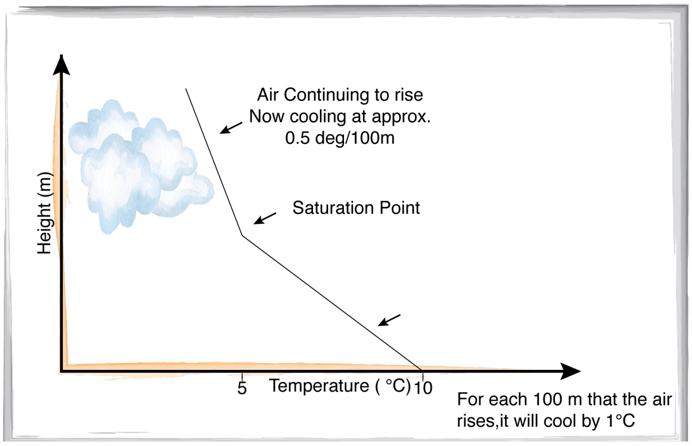
Several factors contribute to air rising and cooling, reaching the dew point and forming clouds:

- Surface Heating: The sun heats the ground, causing the air in contact with it to warm up and rise. Rising columns of air, known as thermals, are often generated.
- Topography: Air forced to rise over mountains or hills experiences orographic uplift.
- Frontal: Warm air rising over cold, dense air creates a front. Or Cold air undercutting the warm air mass, causing it to rise.

- Convergence: Streams of air flowing from different directions are forced to rise where they meet.
- Turbulence: Sudden changes in wind speed with height create turbulent eddies in the air.

6.1.2 Condensation Level

The vertical ascent of air causes fall in temperature and reduces its ability to hold water vapour, leading to condensation. The height at which the dew point is reached and clouds form is termed the condensation level. When water evaporates from water to water vapour it absorbs energy and the same energy is released when water vapour condenses into droplets in clouds to make air around warmer. This leads to the cottony shape of Cumulus clouds and also causes cloud suck.



6.1.3 Over development and Cloud Suck

When Humid air rises and cools down to dev point it forms condensation and water droplets in cloud form. This releases energy (latent heat) and leads to Warming up of surrounding air.. Which rises up to produce the cotton like shape and a partial vacuum at the bottom of the cloud. This gets filled by air from the area around the cloudbase creating a beginning of suck. Now two things can happen:

1. Pulled air is also humid: then more condensation is produced and hence more energy released and clouds suck sustains. Clouds like these are more vertical in shape and quite likely to overdevelop if sucked air keeps bringing humidity. So an important factor for overdevelopment of cu clouds is availability of humid air at the altitude near the cloudbase.

2. Pulled air is dry: this leads to evaporation of droplets already formed. Evaporation causes cooling. Hence the cloud dissipates and we get cold sinking air in the area.

6.2 Types of Clouds

Clouds are categorised based on their height in the atmosphere. There are three main types: low clouds, medium clouds, and high clouds.

6.2.1 Low Clouds

Cumulus (Cu)

1. 1,200-6,000 ft
2. White with darker undersides
3. Detached heaps, often with a cauliflower shape
4. May produce showers when well-developed

Cumulonimbus (Cb)

1. 1,000-5,000 ft
2. White upper parts with dark undersides
3. Considerable vertical extent, often with an anvil shape
4. Accompanied by heavy showers, hail, and thunder

Stratus (St)

1. Surface-1,500 ft
2. Usually grey
3. Appears as a layer or in ragged patches, may produce drizzle or snow grains

Stratocumulus (Sc)

1. 1,200-7,000 ft
2. Grey or white, with shading
3. Patches or a sheet of rounded elements, may produce light rain or snow

6.2.2 Medium Clouds

Altocumulus (Ac)

1. 7,000-17,000 ft
2. Grey or white, with shading
3. Patches or a sheet of rounded elements, may produce slight rain or snow

Altostratus (As)

1. 8,000-17,000 ft
2. Greyish or bluish
3. A sheet of uniform appearance, may produce light rain or snow

Nimbostratus (Ns)

1. 1,500-10,000 ft
2. Dark grey
3. A thick, diffuse layer covering the sky, accompanied by moderate or heavy rain or snow

6.2.3 High Clouds

Cirrus (Ci)

1. 17,000-35,000 ft
2. Composed of ice crystals, white
3. Delicate hair-like filaments, sometimes in patches or bands

Cirrocumulus (Cc)

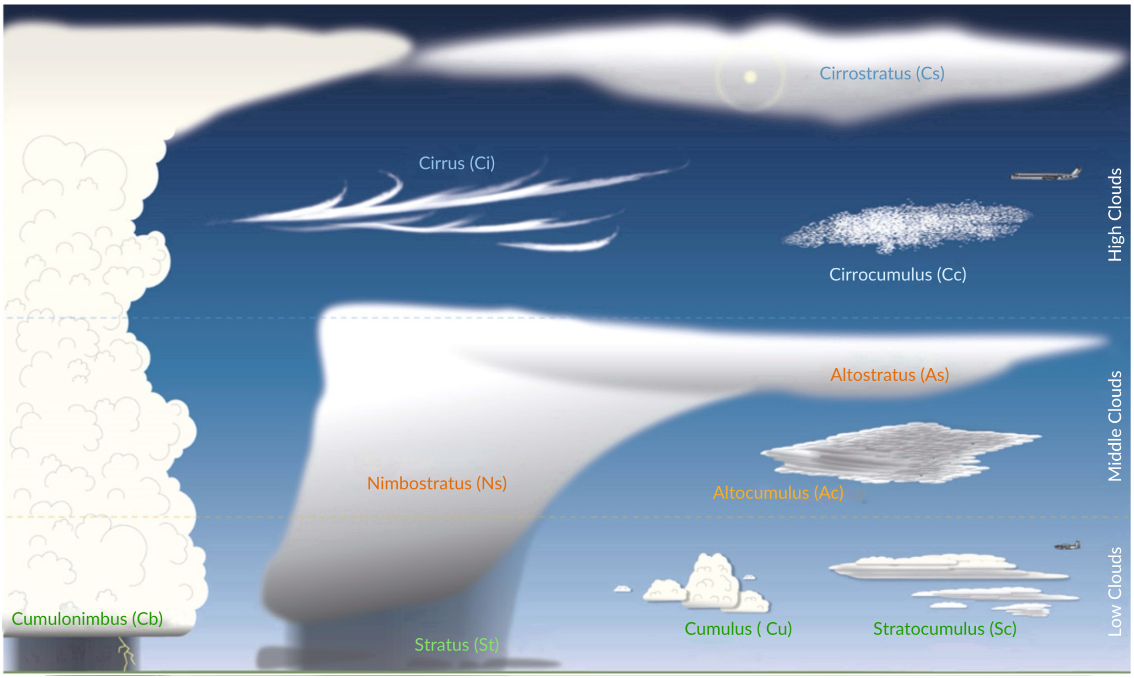
1. 17,000-35,000 ft
2. Composed of ice crystals, white
3. Patches or a sheet of very small elements, may resemble fish scales

Cirrostratus (Cs)

1. 17,000-35,000 ft

2. Composed of ice crystals, white
3. A transparent veil covering the sky, produces halo phenomenaSource images NOAA

CLASSIFICATION	CLOUD NAME	AVERAGE COMPOSITION	HEIGHT OF BASES
High	Cirrus Cirrocumulus Cirrostratus	Frozen Water Droplets or Ice Crystals	20,000 ft
Middle	Altostratus Altocumulus	Ice Crystals and/or Water Droplets	6,500 - 20,000 ft
Low	Nimbostratus Stratus Stratocumulus Factostratus Fractocumulus	Water Droplets (Ice Crystals in Winters)	50 - 6500 ft
Vertical Developmement	Cumulus Cumulonimbus	Water Droplets in Lower Levels and Ice Crystals in Upper Levels	In Low Cloud Range



6.3 Decaying Clouds, Precipitation, and Gust Fronts

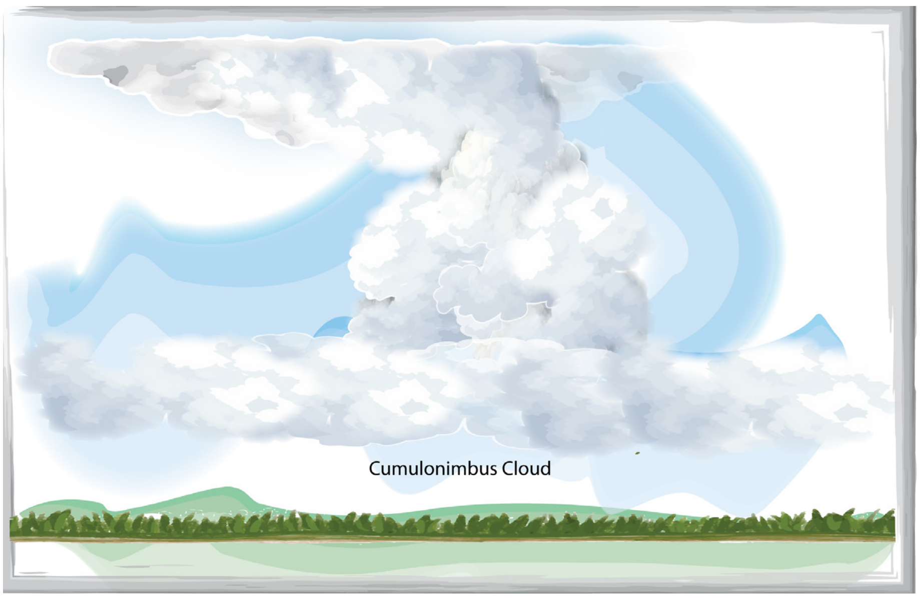
Forming clouds release latent heat, but decaying clouds and precipitation cause cooling, resulting in a dense, heavy, and cold wind that descends rapidly. This can produce gusts along the surface.

6.3.1 Gust Fronts

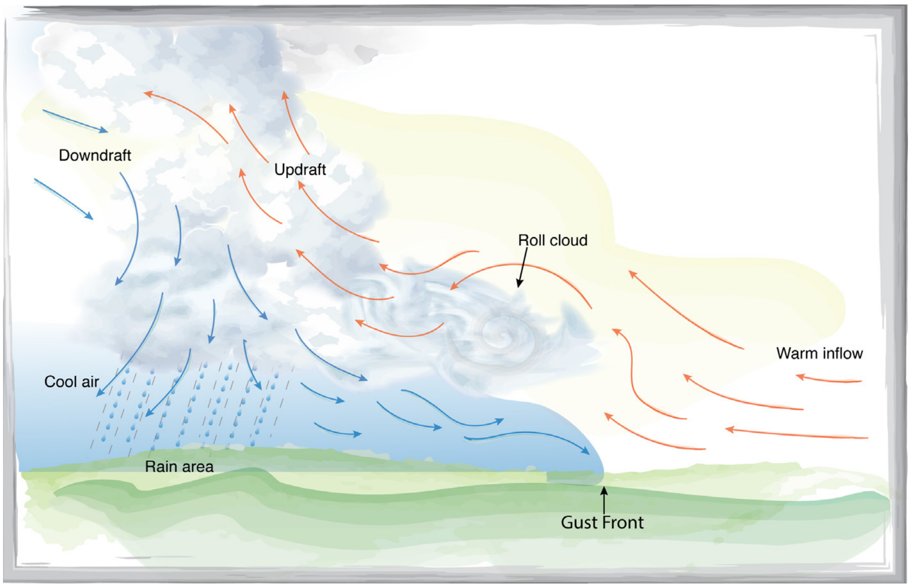
Gust fronts are lines of dangerously gusty winds formed by localised strong wind events, often associated with thunderstorms. They can create dust storms, particularly in arid regions.

When moisture, unstable air and warm air mix together, you could have a big thunderstorm on your hands. That warmer air rises, and it rises quickly if it bumps into cold, sinking air, or against a hillside or mountain. As that warm air goes higher in the atmosphere, it brings any water vapour it's holding along with it. It cools as it gets higher, and that water vapour condenses into liquid. A cloud begins to form. And it can grow upward into colder levels of the atmosphere, where the temperature is below freezing.

If the cloud continues to be fed by warm air below rising into it, it can develop into a cumulonimbus cloud—a good old thunderstorm. That gust front can also come in contact with the warm air that is "feeding" the thunderstorm. As the cold gust front goes down and out, the warm air is going over and up. This can create a swirling effect that can produce an ominous-looking shelf cloud. Some people call them roll clouds.

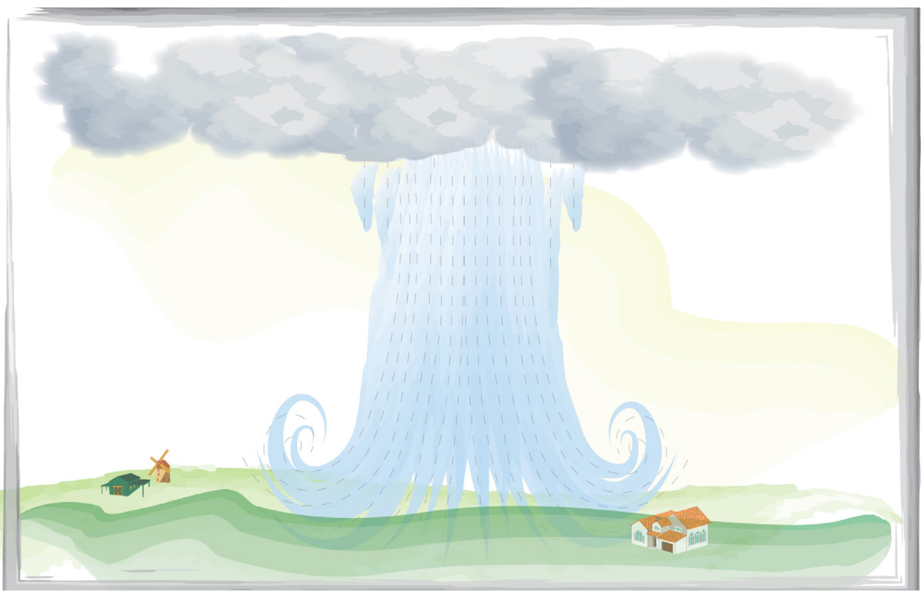


When that cloud begins to rain, cooler air descends to the surface. That cool air and rain create something called a downdraft. When that cool air descends and hits the ground, it spreads out in all directions, like when you pour a column of water on the floor. This air can be moving fast, so this spreading out can create a gust front. This is a line of sometimes dangerously gusty winds. It's also called an outflow boundary. A gust front is different from a simple downburst. Downbursts from convective storms are more localised, and are not considered gust fronts.



6.3.2 A downburst

is the general term used to broadly describe macro and microbursts. Downburst is the general term for all localised strong wind events that are caused by a strong downdraft within a thunderstorm, while microburst simply refers to an especially small downburst that is less than 4 km across.



Gust fronts are particularly dangerous for aircraft, as navigating through them can lead to sudden changes in wind direction. A downburst is the general term used to broadly describe macro and microbursts. Downburst is the general term for all localised strong wind events that are caused by a strong downdraft within a thunderstorm, while microburst simply refers to an especially small downburst that is less than 4 km across.

CHAPTER 7

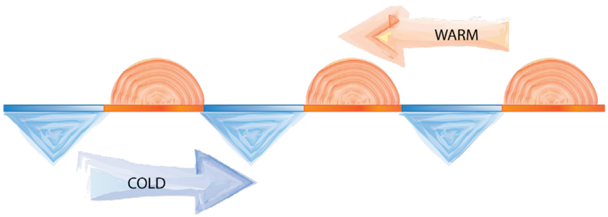
Fronts & Atmospheric Dynamics

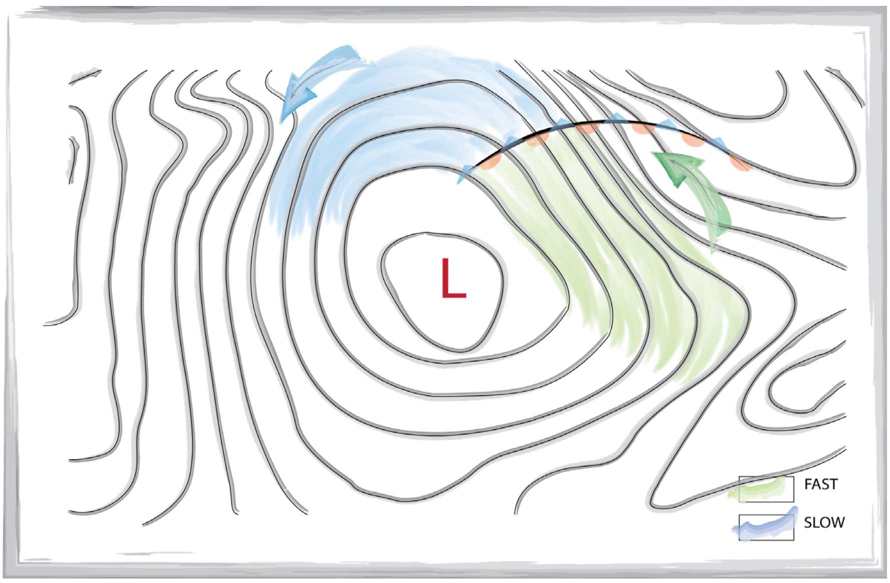
7.1 Understanding Fronts

A low pressure over an area pulls winds from relative high pressures around. Winds from different areas coming towards such a low pressure might have different temperatures. Fluids have a property that they don't mix very easily if there is a temperature difference. Thus these air masses travelling towards the same low pressure at different speeds will meet and form boundaries that will push the slower air mass. Such boundaries are called fronts. They can have different natures based on the temperature of pushing air mass.

7.1.1 Stationary Fronts

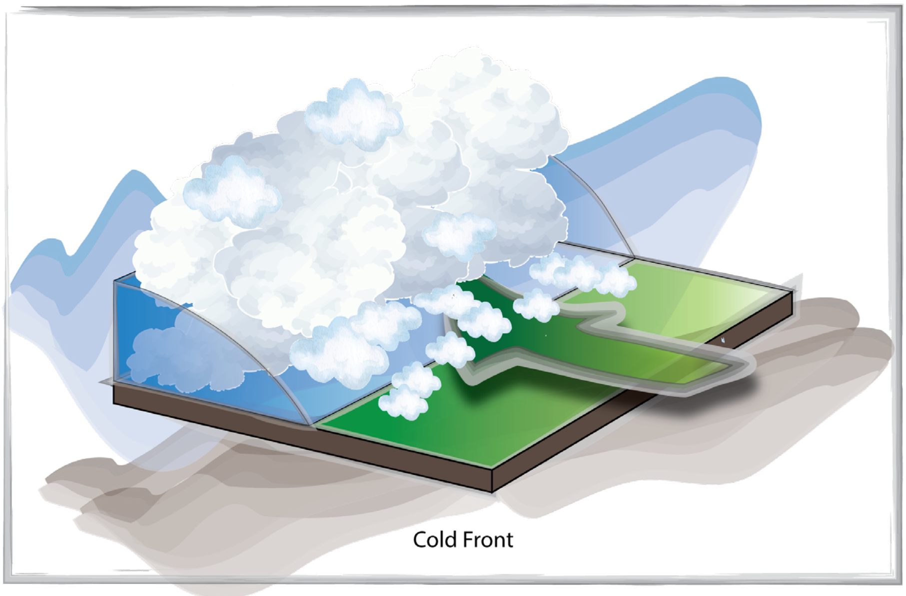
When air masses moving towards a low-pressure area have different temperatures and speeds, they create boundaries known as stationary fronts. These fronts may persist if an air mass is obstructed by geographical features like mountains. Stationary fronts can bring extended periods of rain, drizzle, and fog. Winds along these fronts usually blow parallel but in opposite directions. Over time, stationary fronts may break apart.





7.1.2 Cold Fronts

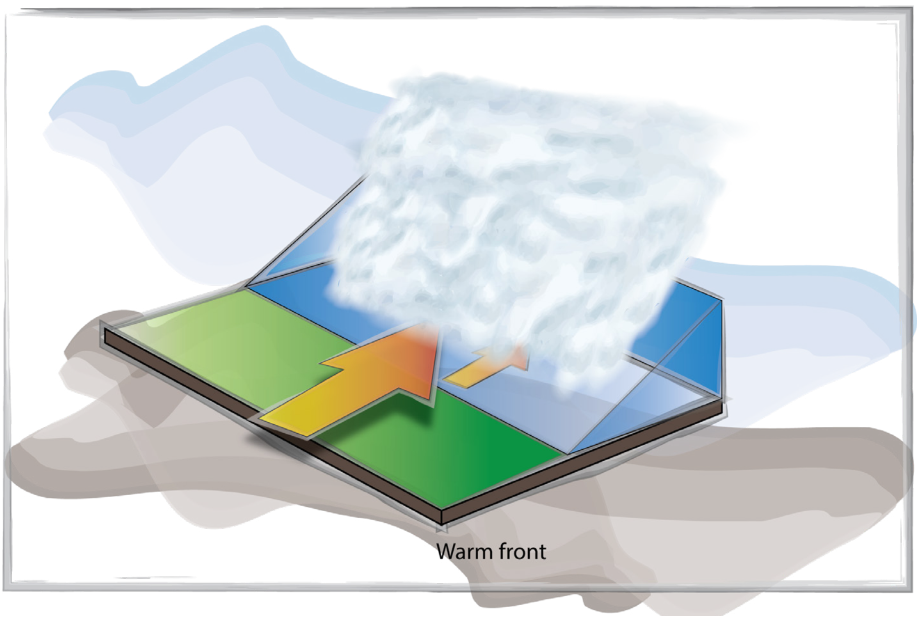
A cold front occurs when a dense, cold air mass advances and displaces a warmer air mass. As the cold air forces the warm air to rise, cumulus clouds form, leading to rain showers, snow showers, or thunderstorms along the front. Behind the cold front, a drier and colder air mass prevails, resulting in clear or partly cloudy conditions. The weather at a cold front varies with the season, ranging from thunderstorms in spring and summer to frigid temperatures and heavy snowfall in winter.



A squall line is a line of severe thunderstorms that forms along a cold front. Behind the front is the cold air mass. This mass is drier so precipitation stops. The weather may be cold and clear or only partly cloudy. Winds may continue to blow into the low pressure zone at the front. spring: If the temperature gradient is high, strong winds blow.

7.1.3 Warm Fronts

Warm fronts develop when a warm air mass glides over a cold air mass. This transition results in stable atmospheric conditions.



As a warm front approaches, cirrus clouds signal the impending change. Over time, the sky turns grey with the appearance of altostratus and nimbostratus clouds.

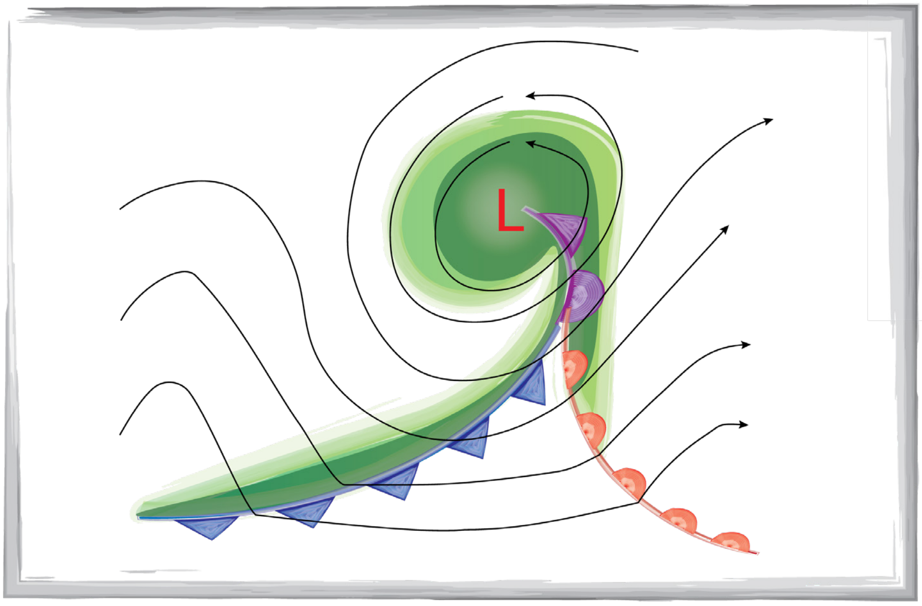
The transition from cold air to warm air takes place over a long distance so the first signs of changing weather appear long before the front is actually over you.

Initially, the air is cold: the cold air mass is above you and the warm air mass is above it. High cirrus clouds mark the transition from one air mass to the other.Over time, cirrus clouds become thicker and cirrostratus clouds form. As the front approaches, altocumulus and altostratus clouds appear and the sky turns grey.

Since it is winter, snowflakes fall. The clouds thicken and nimbostratus clouds form. Precipitation increases. Winds grow stronger as the low pressure approaches. As the front gets closer, the cold air mass is just above you but the warm air mass is not too far above that. The weather worsens. As the warm air mass approaches, temperatures rise. Warm and cold air mix at the front, leading to the formation of stratus clouds and fog.

7.1.4 Occluded Fronts

Occluded fronts typically form around low-pressure systems. They occur when a cold front catches up to a warm front. The air masses involved, in sequence, are cold, warm, and cold again. The Coriolis Effect causes the boundary where the two fronts meet to curve towards the pole. An occluded front can be cold or warm, depending on the temperature of the arriving air mass. Fierce weather, including precipitation and shifting winds, is common at the occlusion point.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CHAPTER 8

Lapse Rate, Instability, & Rotor Turbulence

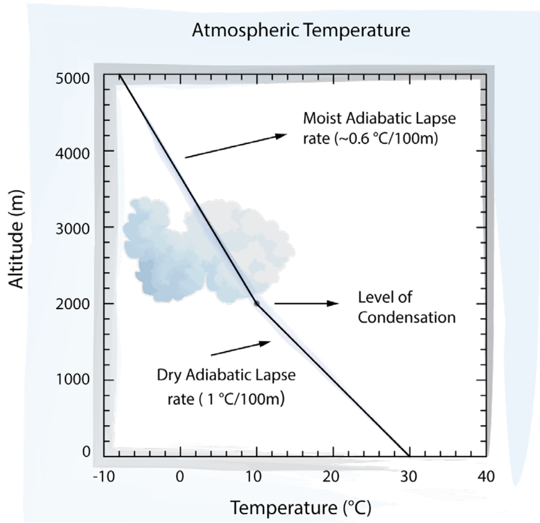
8.1 Understanding Lapse Rate

The Lapse Rate, or the rate at which temperature changes with height in the atmosphere, plays a crucial role in determining atmospheric stability. Boyle's Law states that for a given volume of gas, the pressure divided by the temperature remains constant. As air rises, the pressure decreases, leading to a decrease in temperature. If this process occurs without heat exchange with the surrounding air, it is known as adiabatic cooling.

If no heat is exchanged with the surrounding air during this process, which is called "adiabatic cooling", the rate at which the air cools, the Adiabatic Lapse Rate (ALR) is a constant.

For unsaturated air, the Dry Adiabatic Lapse Rate (DALR) is approximately 1 degree Celsius per 100 metres of ascent. However, when air reaches the Dew Point and becomes saturated, condensation of water vapour releases latent heat, warming the air. This results in the Saturated Adiabatic Lapse Rate (SALR), which is around 0.6°C per 100m at low levels and latitudes.

The Environmental Lapse Rate (ELR) represents the actual rate at which the ambient temperature changes with height.

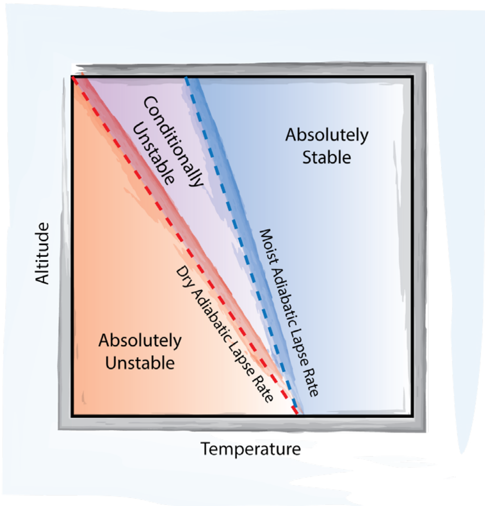


8.2 Stability

Stability in the atmosphere is determined by comparing the ELR with the DALR and SALR for a parcel of air. The relationships between these rates provide insights into the behaviour of rising or sinking air:

- Unstable Atmosphere:
  If ELR > DALR, rising air remains warmer than the surrounding air, leading to continued ascent. The atmosphere is absolutely unstable, indicating that both saturated and unsaturated air will always have a higher temperature than the surroundings.
- Conditionally Unstable Atmosphere:
  When ELR is less than DALR but greater than SALR, the atmosphere is conditionally unstable. The stability depends on whether the air is saturated or unsaturated.
- Stable Atmosphere:
  If ELR < DALR, rising air becomes cooler than the surrounding air, causing it to sink. the air is absolutely stable, and whether saturated or unsaturated, it will always be cooler than the surrounding air.

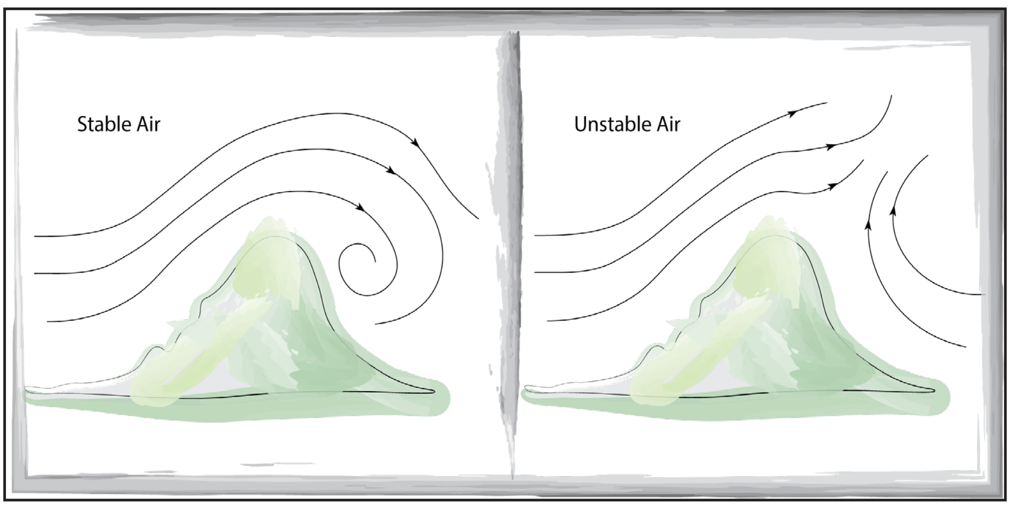
Understanding stability is crucial for activities like paragliding, as it influences the behaviour of air masses and the potential for vertical motion.



8.3 Stability and lee side rotor

A fair summary is that a rotor exists when stable air passing over an obstacle descends to form a rotor.

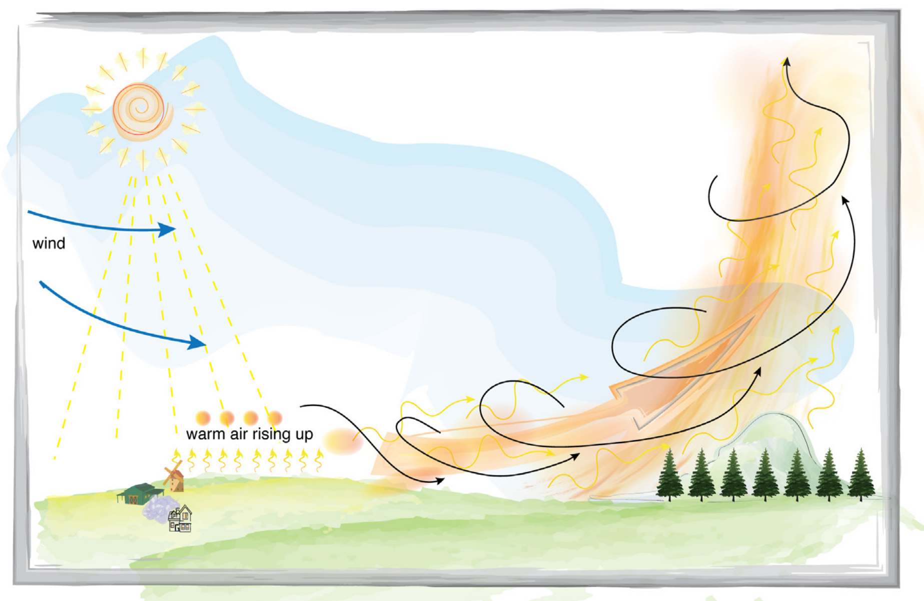
If the air is buoyant it will break from the ridge and continue to rise. There may even be more thermal rising on the other side to join ascent in the form of convergence.

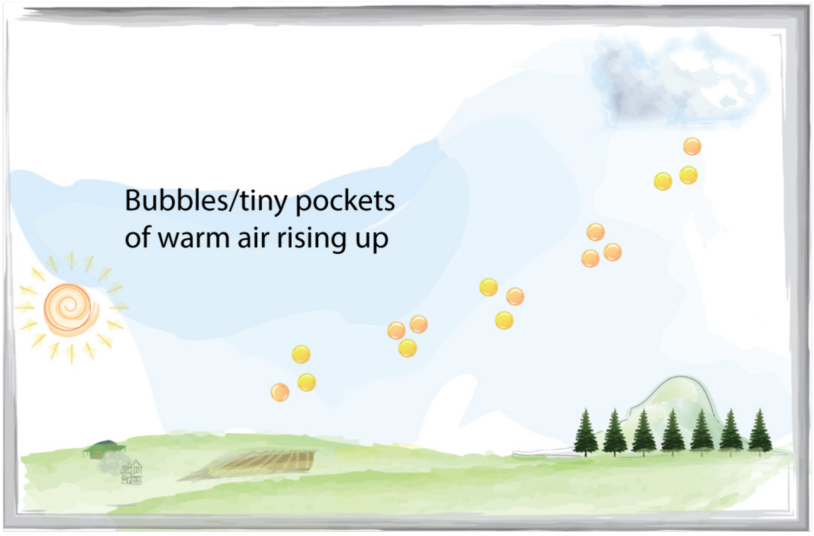


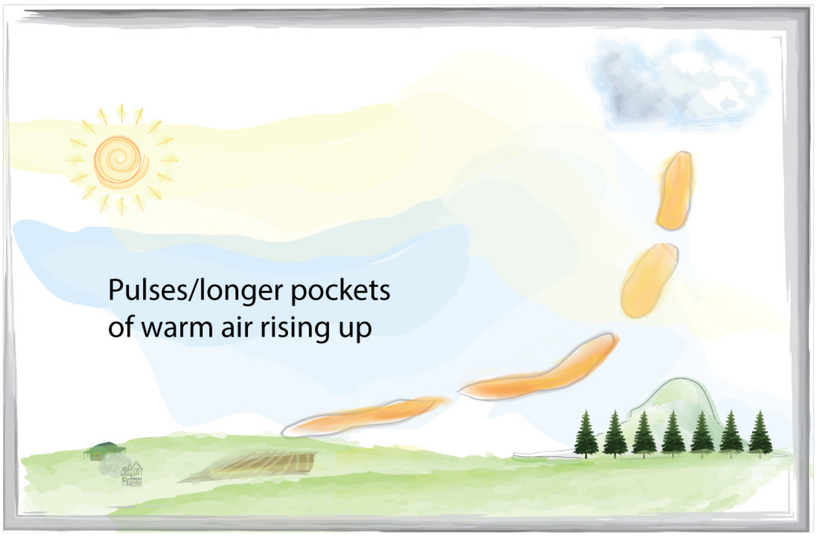
CHAPTER 9

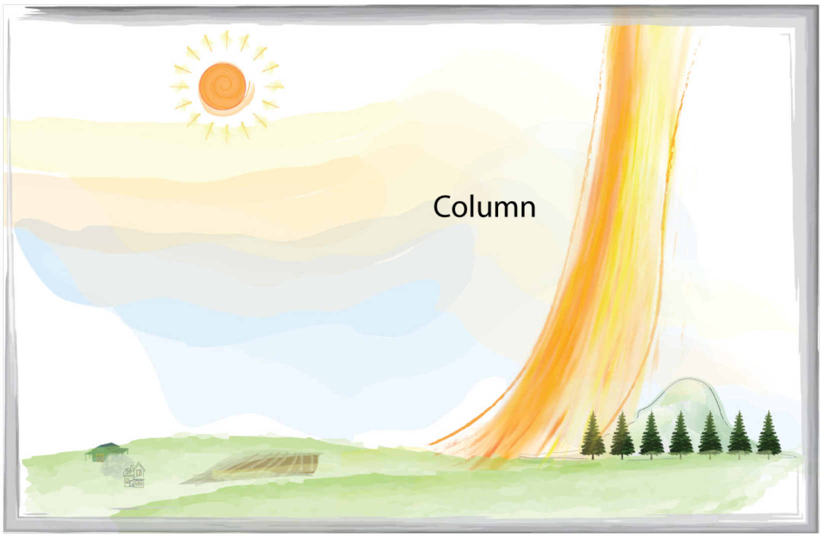
Thermals & Turbulence

Thermals are vertical columns of warm air that rise due to the heating of the Earth's surface. They form when certain areas of the ground, such as asphalt roads or sunlit fields, absorb heat more readily than others, creating "pockets" of warmer air. As this warmer air rises, it creates an updraft that can be utilised by paragliders to gain altitude.



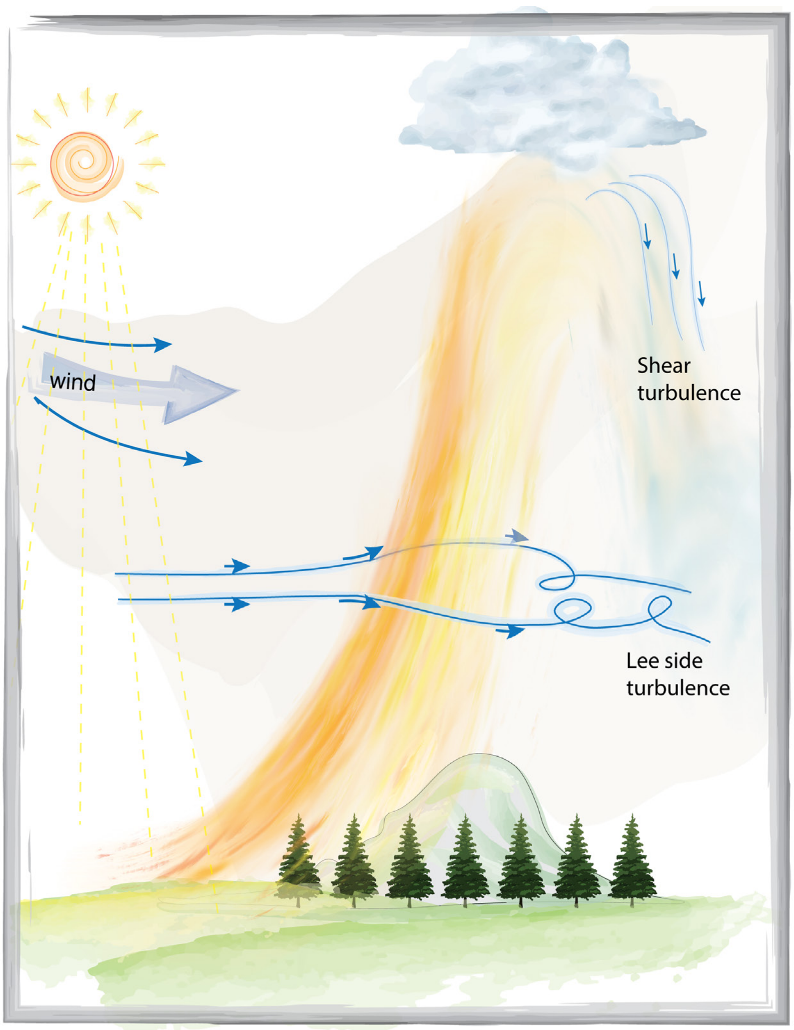

Bubbles/tiny pockets
of warm air rising up


Pulses/longer pockets
of warm air rising up


Column

9.1 Formation and Characteristics of Thermals

Thermals can take various shapes, including bubbles, pulses, or columns of warm air rising upward. They are essential for paragliding, providing pilots with opportunities to gain altitude and extend their flights. Understanding the formation and behaviour of thermals is crucial for pilots to effectively utilise them during flight.



Due to this push of prevailing wind and the lean, better lift is usually in the windward side of the thermal and leeward side will have broken lift and turbulence.

As they are vertical air currents in otherwise horizontal airflow or still air they also cause turbulence by wind shear or lee side. As tandem pilot we need be well aware of such turbulence

9.2 Relationship Between Thermals and Turbulence

Windward and Leeward Side Effects:

Due to this push of prevailing wind and the lean, better lift is usually in the windward side of the thermal and leeward side will have broken lift and turbulence due to weak lift bubbles getting washed towards leeside.

Turbulence from Vertical Air Currents:

Thermals disrupt the otherwise horizontal airflow, creating vertical air currents. This can lead to turbulence, particularly in areas where there is wind shear between rising and sinking air or on the lee side of thermal due to its obstruction effect. Pilots need to be vigilant and anticipate turbulence caused by thermals during their flights.

9.3 Awareness and Management as Tandem Pilots

As tandem pilots, it's essential to have a thorough understanding of thermals and their associated turbulence. Here are some key points to consider:

1. Awareness : Stay vigilant and constantly assess the surrounding conditions for signs of thermal activity and associated turbulence.
2. Management : Develop strategies for navigating through thermals and turbulent areas safely, such as adjusting flight path or altitude to avoid areas of intense turbulence.
3. Communication : Maintain clear communication with your passenger to ensure their comfort and safety, especially during turbulent conditions.
4. Training : Continuously improve your skills and knowledge through training and practice to effectively manage thermal-related turbulence during tandem flights.

By understanding the dynamics of thermals and being prepared to handle associated turbulence, tandem pilots can provide their passengers with a safe and enjoyable paragliding experience.

CHAPTER 10

Air Law

10.1 General collision avoidance

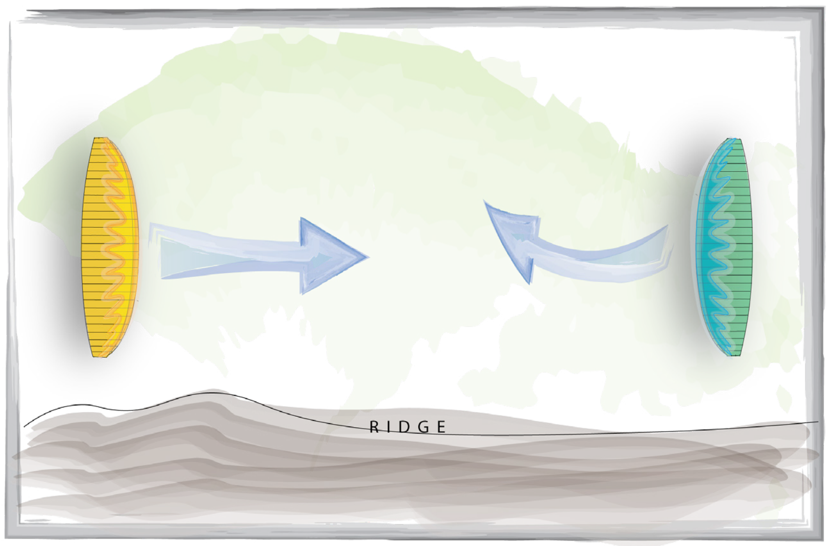
The prime rule is that it is every pilot's ultimate responsibility to avoid a collision with any other aircraft.

- An aircraft shall not be flown so close to another aircraft as to create a danger of collision.
- No formation flying unless all the pilots have agreed.
- When required by these Rules to give way, an aircraft shall avoid passing over, under or ahead of another unless well clear.
- An aircraft that has 'right of way' under these Rules shall maintain its course and speed.
- A powered aircraft shall give way to airships, gliders and balloons.
- An airship shall give way to gliders and balloons.
- A glider shall give way to balloons.

When approaching head-on:

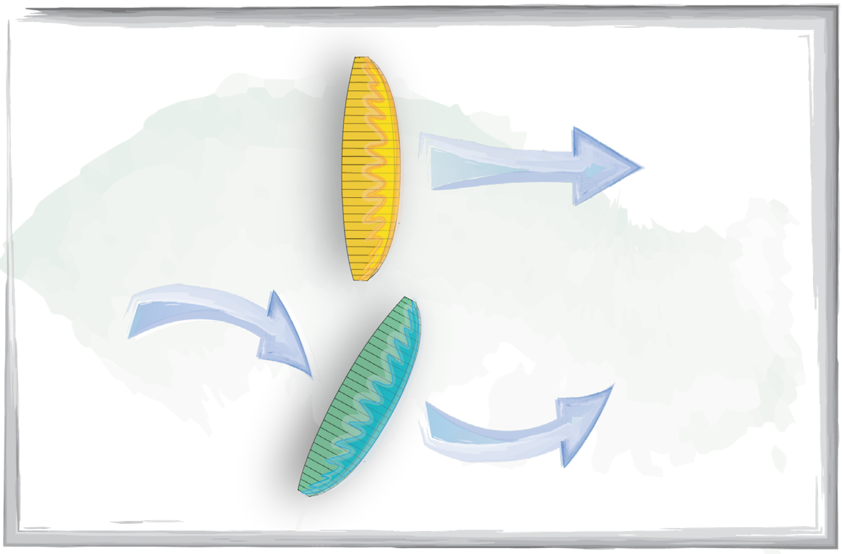
When approaching head-on with a risk of collision both aircraft shall alter course to the right.

When two gliders are approaching each other in opposite directions on a ridge, the glider with the hill on his or her left should give way. The pilot with the hill on their right will be unable to make a right turn to avoid a conflict (this is not in fact a legal Rule but common sense!)



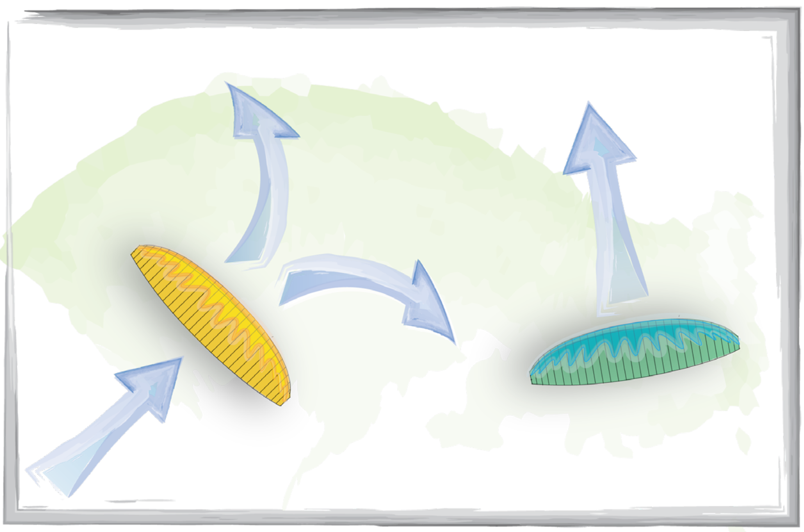
Overtaking :

When overtaking another aircraft you must give it a wide berth and take care not to impede it. In the UK a glider may overtake another glider to either the left or right (hang gliders and paragliders are both considered to be gliders). When hill soaring the safest course of action is often to turn back rather than to overtake. If you do need to overtake, make sure that you pass well clear of the other glider.t.



Converging

(The overtaking and head-on rules take precedence over this one.) When converging: When two aircraft of the same classification converge at approximately the same altitude, the one with the other on its right shall give way.



Landings

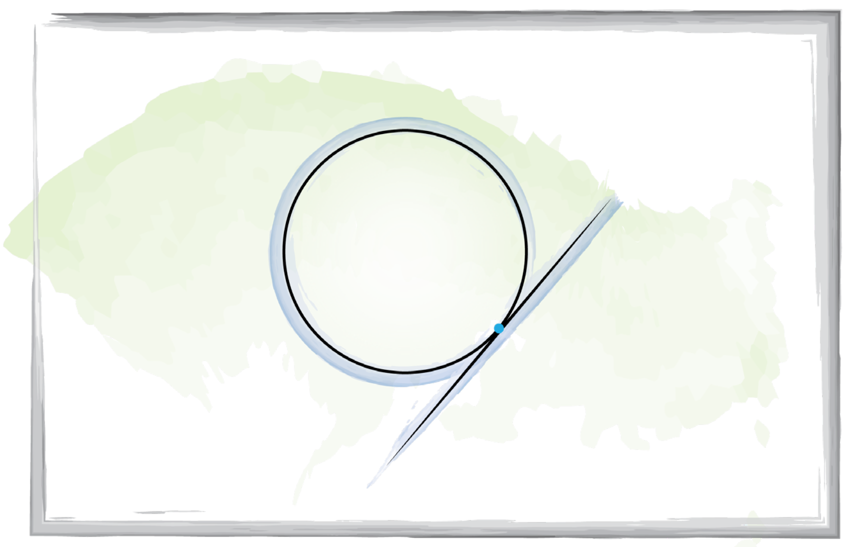
An aircraft landing or on final approach has right of way over all other aircraft in the air or on the ground. The lowest aircraft of any on an approach to land has right of way, provided it does not cut in front of or overtake any aircraft on final approach.

After landing you must clear the landing area as soon as possible. If somebody lands on your parked glider, don't expect an insurance claim to work to your advantage if you have simply left it in the way

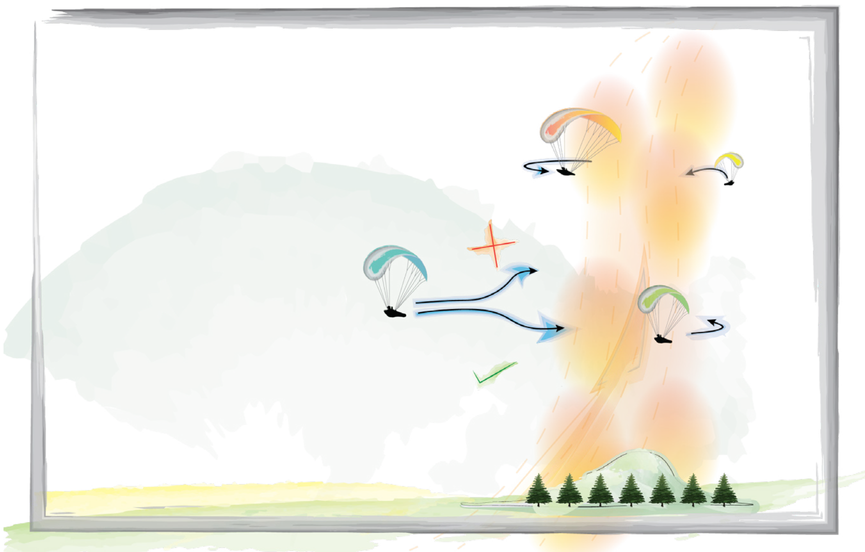
10.2 Thermalling traffic rules and manners:

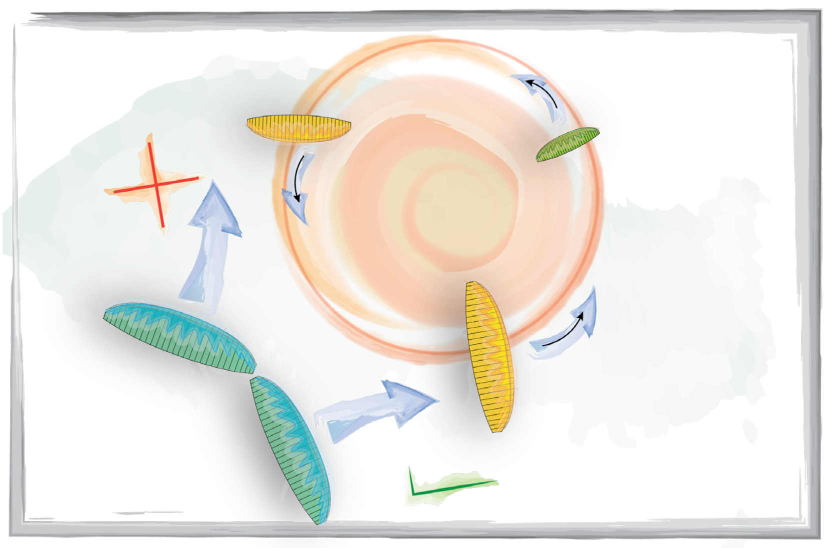
- The glider already circling in the thermal has the right to continue circling.
- Turn in the same direction as the other glider.
- If there is only one other glider present you may offset your circle, but you must turn "in phase" with the other glider.
- When there is more than one other wing, you MUST be concentric with the other wings.
- Time the entry so as not to interfere with the other wing(s).

Entering a Thermal



1. Always approach the thermal on a tangent.
2. Signal your intention. There's often uncertainty whether a merging pilot will join before or after a pilot who is already going around the thermal. When in doubt fly parallel to pilot thermalling, let him go ahead as his circle will be smaller and then merge behind him.
3. Make additional lanes: When there is no break in traffic for us to merge in, we can't just hit the brakes and come to a stop like we would in a car. So what do we do? We add lanes to the roundabout. Sometimes the outside lanes are still in lift, but other times it is necessary to fly around the outside of the lift, waiting for the opportunity to merge into the rising air





CHAPTER 11

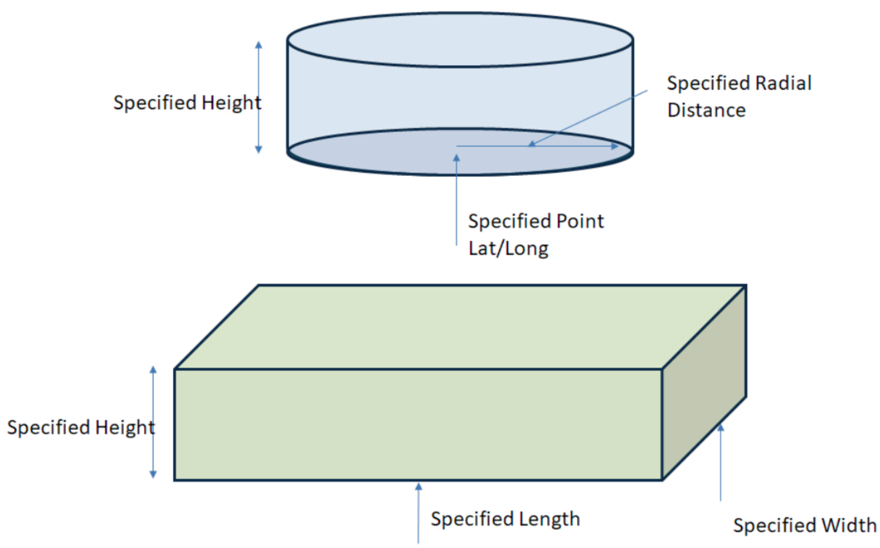
Understanding Airspaces

11.1 Airspace Construction,

"Airspaces" are three dimensional areas of specified dimensions, extending laterally between points defined with coordinates and/or radial distances from specified points and extending from a specified height/altitude to another level also defined as a specified height/altitude.

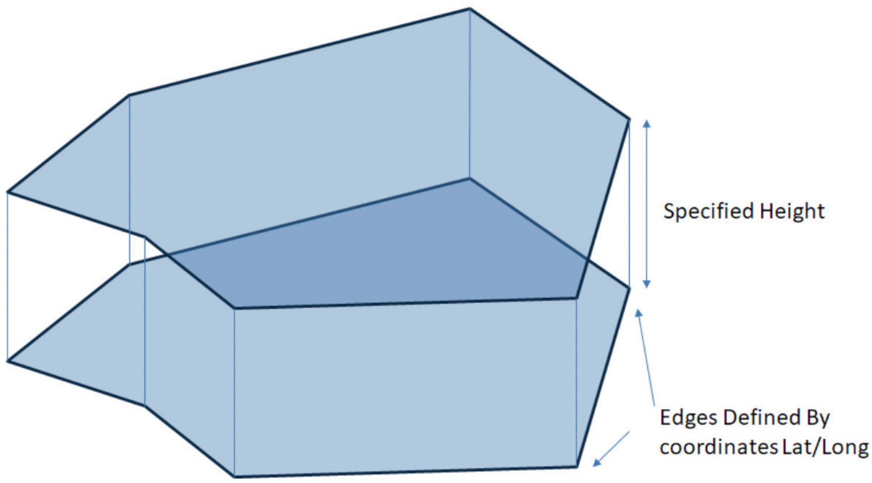
A large number of airspaces may be regular geometric shapes like cylinders or regular blocks, but also be irregularly shaped.

Examples of Defined Airspaces

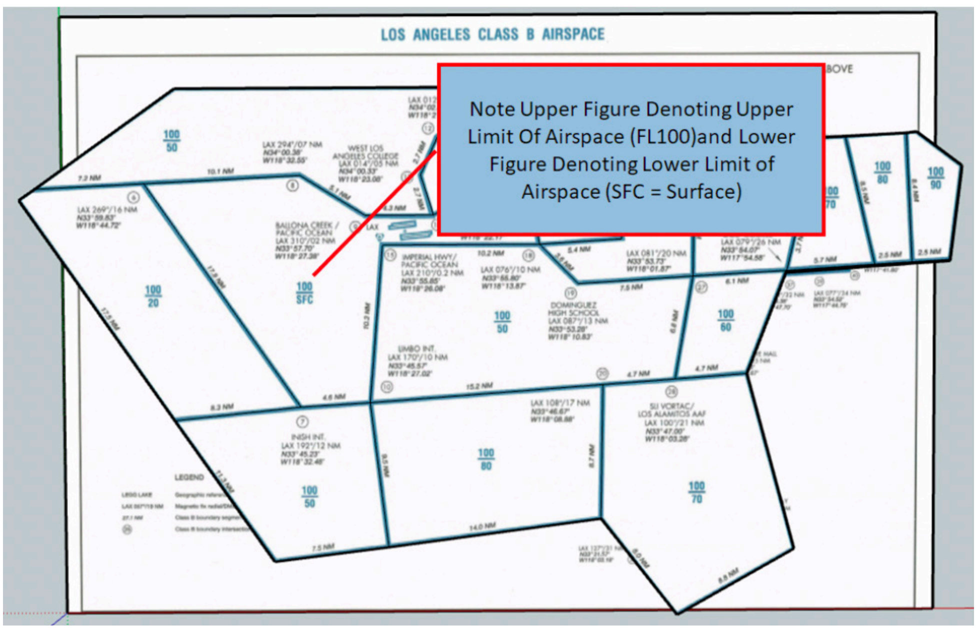


The Rectangular Airsspace above may also be defined by Lat/Long

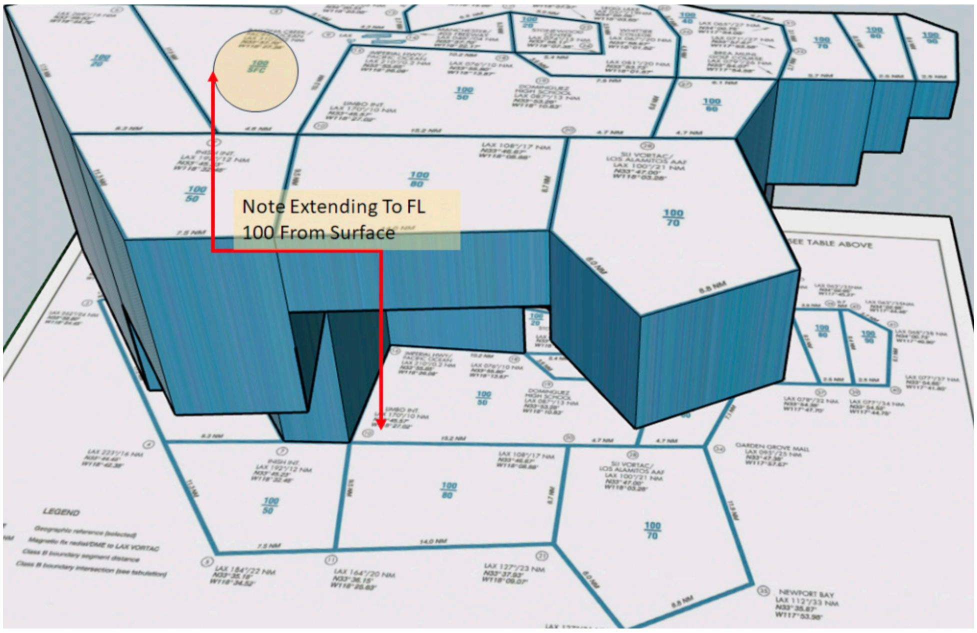
Irregular Shaped Airspace

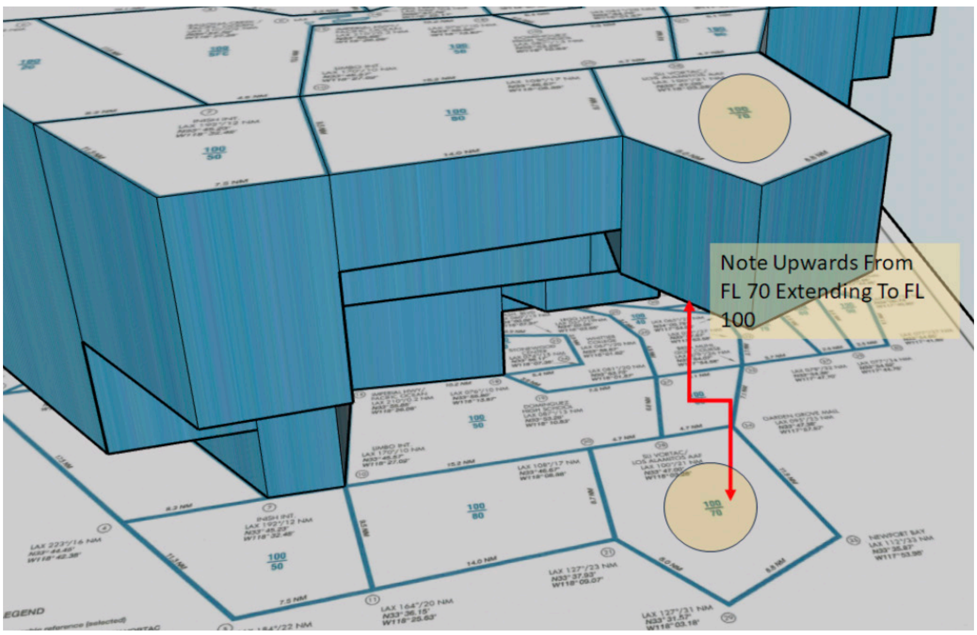


Top Down view of different airspaces stacked laterally and vertically. Note Lateral dimensions and the specified upper and lower levels.

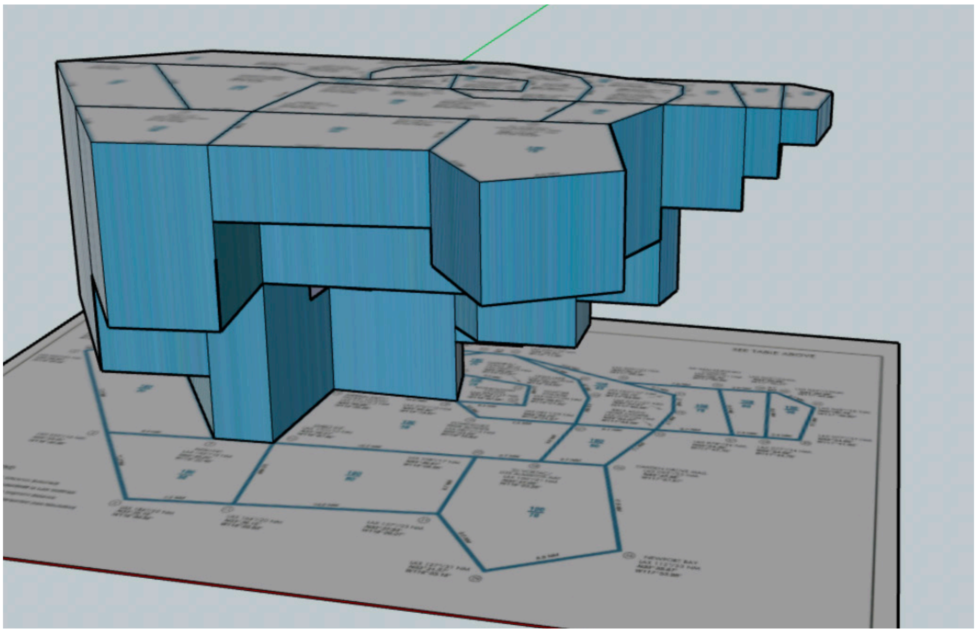


3D views of different airspaces stacked laterally and vertically. Note Lateral dimensions and the specified upper and lower levels.





In the image below, co-relate the lateral (top down) view as seen in the first image and the 3D depictions shown above.



To understand these better, study this 3d airspace model online Here

- https://app.sketchup.com/share/tc/northAmerica/h9

You can rotate the 3D model to study its extents and to visualise its structure.

Airspaces are generically of two types; controlled and uncontrolled. By definition controlled airspaces are 3D areas in which 'control' is exercised by an air traffic control agency, while uncontrolled airspaces have no control exercised within them, but any aerial activity within them, may need to be communicated to the agency providing overall control within the whole area within which a specified un-controlled airspace may exist.

Airspaces are specified for the purposes of defining the controlling agency, the type of control exercised, the need for radio communication, the type of flight rules to be adhered to and also other factors like speed restrictions etc.

Airspaces may be 'stacked', laterally, i.e side-by-side or stacked vertically above each other.

11.2 Airspace Classification,

Airspaces are classified as Class 'A' to Class 'G'. Each Class of airspace has a specified purpose and demands adherence to certain conditions as can be seen from the table below:

Class	Type of flight	Separation Provided	Service Provided	Speed limitation*	Radio communication requirement	Subject to an ATC clearance
A	IFR only	All aircraft	Air traffic control service	Not applicable	Continuous two-way	Yes
B	IFR	All aircraft	Air traffic control service	Not applicable	Continuous two-way	Yes
	VFR	All aircraft	Air traffic control service	Not applicable	Continuous two-way	Yes
C	IFR	IFR from IFR IFR from VFR	Air traffic control service	Not applicable	Continuous two-way	Yes
	VFR	VFR from IFR	1) Air traffic control service for separation from IFR 2) VFR/VFR traffic information service (and traffic avoidance advice on request)	250 kts IAS below 10000 ft amsl	Continuous two-way	Yes
D (1)	IFR	IFR from IFR	Air traffic control service, traffic information about VFR flights (and traffic avoidance advice on request)	250 kts IAS below 10000 ft amsl	Continuous two-way	Yes
	VFR	Nil	IFR/VFR and VFR/VFR traffic information (and traffic avoidance advice on request)	250 kts IAS below 10000 ft amsl	Continuous two-way	Yes
E (2)	IFR	IFR from IFR	Air traffic control service and, as far as practical traffic information about VFR flights	250 kts IAS below 10000 ft amsl	Continuous two-way	Yes
	VFR	Nil	Traffic information as far as practical	250 kts IAS below 10000 ft amsl	No	No
		IFR from IFR	Air traffic advisory	250 kts IAS		

Class	Type of flight	Separation Provided	Service Provided	Speed limitation*	Radio communication requirement	Subject to an ATC clearance
F	IFR	IFR from IFR as far as practical	Air traffic advisory service; flight information service	250 kts IAS below 10000 ft amsl	Continuous two-way	No
	VFR	Nil	Flight information service	250 kts IAS below 10000 ft amsl	No	No
G	IFR	Nil	Flight information service	250 kts IAS below 10000 ft amsl	Continuous two-way	No
	VFR	Nil	Flight information service	250 kts IAS below 10000 ft amsl	No	No
* When the height of the transition altitude is lower than 10,000 ft amsl, FL100 should be used in lieu of 10000 ft						

Class A airspace,

the zenith of the hierarchy, spans from 18,000 feet to the flight level 600. Reserved for high-speed, long-distance flights, it operates under stringent instrument flight rules (IFR) due to the potential for extensive interaction with commercial air traffic.

Class B airspace,

Typically surrounding busy airports, is tailored to facilitate the orderly flow of traffic during take-offs and landings. This classification demands heightened air traffic control (ATC) involvement, with specific entry and exit procedures to manage the often complex traffic patterns in these congested areas.

Class C airspace,

Encircling airports with moderate traffic, integrates controlled airspace from the surface to specified altitudes. This class necessitates communication with ATC and transponder-equipped aircraft.

Class D airspace,

Envelops airports with controlled towers, maintains a controlled environment up to certain altitudes. Pilots must establish communication with ATC and obtain clearance before entering.

Class E airspace

Extends beyond controlled airports and accommodates IFR and VFR (visual flight rules) operations. It includes diverse altitudes, providing flexibility for different flight profiles while ensuring separation and coordination through appropriate communication with ATC when required.

Class F airspace,

Primarily applicable in countries outside the United States, represents a flexible airspace classification that may be temporarily activated for specific purposes. It is typically used to accommodate special activities, such as skydiving or glider operations.

Class G airspace,

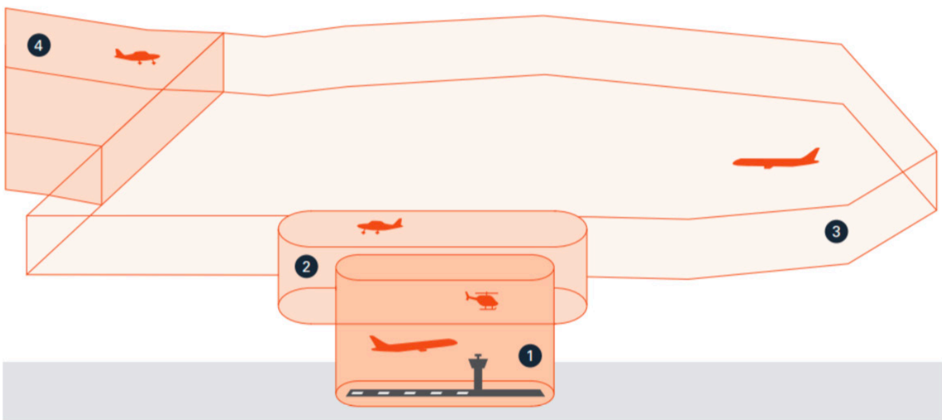
The least restrictive, spans from the surface to the base of controlled airspace. It is uncontrolled and primarily serves as the domain for VFR operations. Pilots in Class G airspace are responsible for their own separation and must exercise caution to avoid potential conflicts.

Note: Nearly all airports in India are CLass-'D' airspaces. India does not have a higher class of airspaces defined.

11.3 Types of Controlled Airspace,

Controlled Airspaces are of 4 types. Control 'Zones', 'Control Areas', Terminal Manoeuvering Areas (TMA), and Airways.

The diagram below shows the 3d structure of these controlled airspaces:



The controlled airspaces, like all airspaces, extend from a specified level to another and are constructed laterally as mentioned above. Each controlled airspace may be of a specified 'Class'. From Example a Control Zone will normally be a cylinder centred around an airport, extending outwards up to a certain radial distance, starting from ground level (GND 'ground' or SFC 'surface')to a specified height. These are normally Class-'D' airspaces. See the description below of each type and their depiction on charts.

1 Control zone (CTR)

CTRs are established around aerodromes, with the shape normally orientated around the length of the main runway.

CTRs are normally class D airspace and extend from the surface to around 2,500 ft AMSL or higher.

2 Control area (CTA)

CTAs overlay CTRs and extend further beyond the aerodrome. The base is normally around 1,500 ft AMSL. They are normally class D, however some higher or larger CTAs are class A.

3 Terminal manoeuvring area (TMA)

TMAs cover areas where there may be several busy aerodromes close together.

4 Airways

Airways link different parts of the airspace structure together. Airways have designations consisting of letters and numbers. They are normally class A.

Airspaces have lateral boundaries and vertical limits. Lateral boundaries can be seen on any chart and shows the geographical extent of the airspace. The vertical limits are specified with two numbers one above the other. The upper figure denotes the upper limit of the airspace and the lower number denotes the lower limit of the airspace. See an example in the image below.

11.4 Airspaces And 'Flight Rules',

A Flight may be conducted in accordance with visual / instrument flight rules (VFR/IFR). A flight under VFR can only be conducted under Visual Meteorological Conditions (VMC). the extract below from ICAO Annex-2 Rules of The Air, explains VMC.

VMC Visibility and distance from cloud minimia are contained in the table below

Table 3-1*
(see 4.1)

Altitude band	Airspace class	Flight visibility	Distance from cloud
At and above 3 050 m (10 000 ft) AMSL	A*** B C D E F G	8 km	1 500 m horizontally 300 m (1 000 ft) vertically
Below 3 050 m (10 000 ft) AMSL and above 900 m (3 000 ft) AMSL, or above 300 m (1 000 ft) above terrain, whichever is the higher	A***B C D E F G	5 km	1 500 m horizontally 300 m (1 000 ft) vertically
At and below 900 m (3 000 ft) AMSL, or 300 m (1 000 ft) above terrain, whichever is the higher	A***B C D E	5 km	1 500 m horizontally 300 m (1 000 ft) vertically
	F G	5 km**	Clear of cloud and with the surface in sight

* When the height of the transition altitude is lower than 3 050 m (10 000 ft) AMSL, FL 100 should be used in lieu of 10 000 ft.

** When so prescribed by the appropriate ATS authority:

a) flight visibilities reduced to not less than 1 500 m may be permitted for flights operating:

1) at speeds that, in the prevailing visibility, will give adequate opportunity to observe other traffic or any obstacles in time to avoid collision; or

2) in circumstances in which the probability of encounters with other traffic would normally be low, e.g. in areas of low volume traffic and for aerial work at low levels.

b) HELICOPTERS may be permitted to operate *in less than 1 500 m* flight visibility, if manoeuvred at a speed that will give adequate opportunity to observe other traffic or any obstacles in time to avoid collision.

*** The VMC minima in Class A airspace are included for guidance to pilots and do not imply acceptance of VFR flights in Class A airspace.

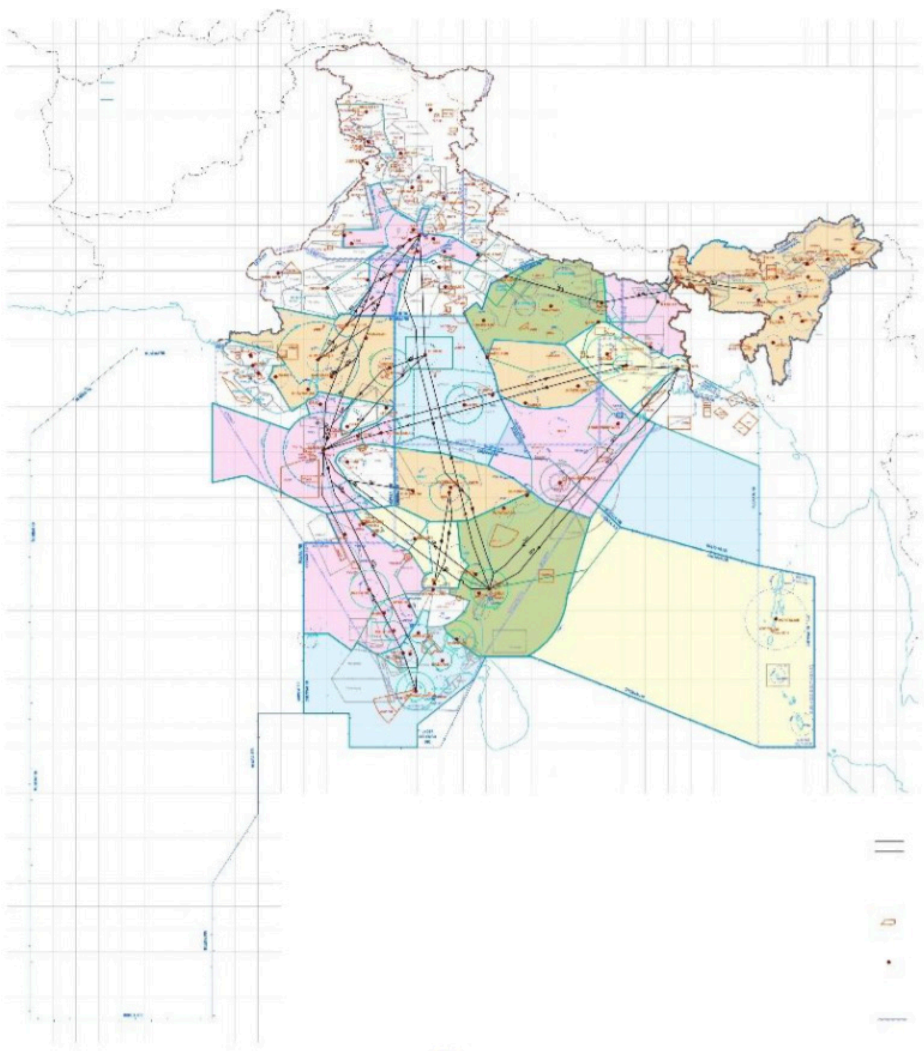
What is important to note here is that the type of aircraft operating within an airspace may be operating under IFR or VFR rules. Depending upon the rules they are following these aircraft may not be looking out for other aircraft as they expect the air traffic control to de-conflict them with other aircraft in the air.

So an 'un-controlled' aircraft (a glider) which inadvertently enters an airspace when radio contact is necessary with air traffic control and must follow their instructions for maintenance of separation form other aircraft, may create a hazardous condition if they are not in radio contact with the air traffic control in whose jurisdiction that airspace lies.

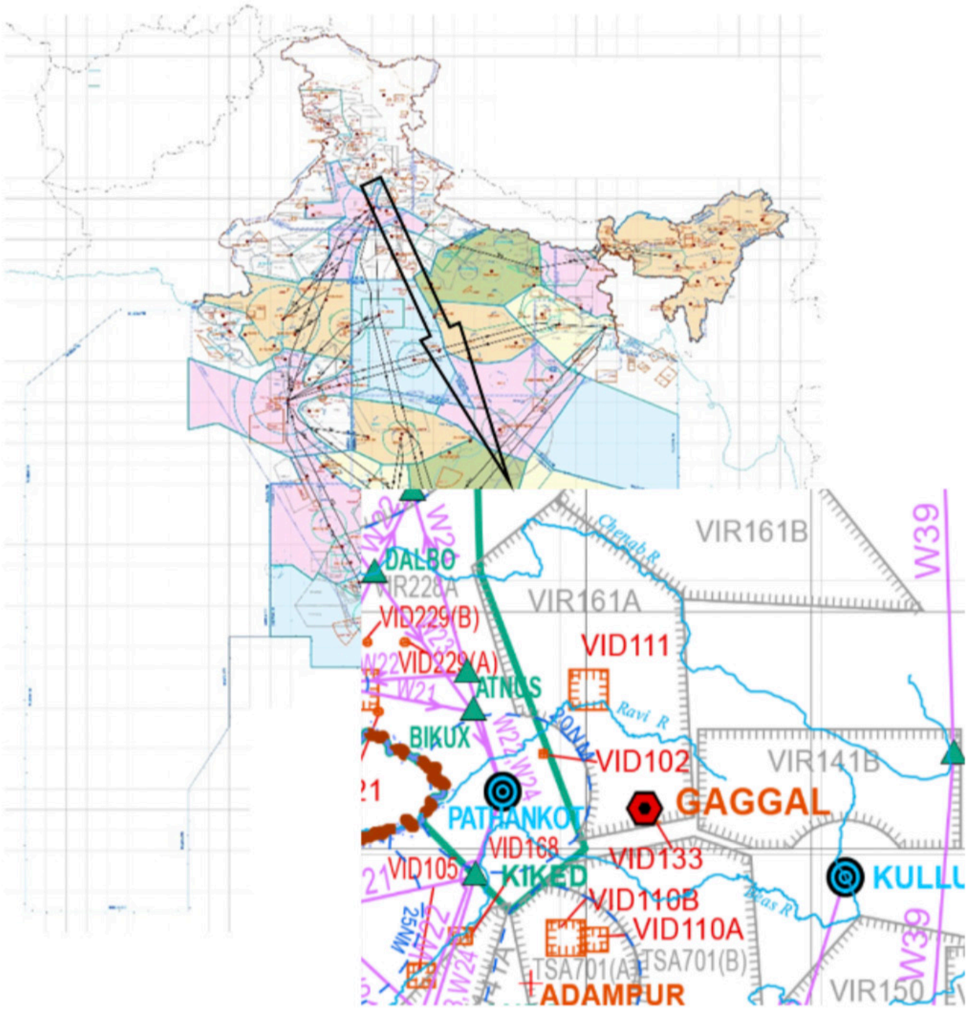
The picture below shows Indian Airspace Flight information Regions (FIRs), Air Defence identification Zones (ADIZs), TMAs, CTAs. Try and Locate these FIR / TMA / CTA on the Map.

When Transiting these airspaces, you will need to contact the air traffic control agency controlling that area. FIR agencies will always be contacted when transiting their airspace. TMAs / CTAs will also need to be contacted depending on your altitude. (See More Below The Image That Follows)

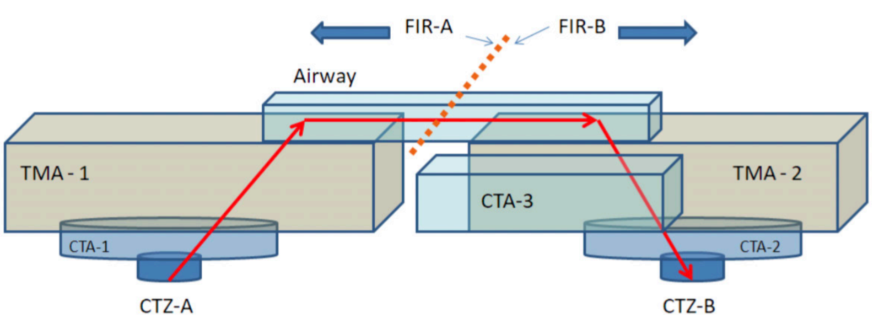
Note the Shaded Portions in the Map Below, with irregular polygons depicting TMAs, within their respective FIR boundaries.



The image below, shows the same chart as above, with an area around BIR, in Himachal Pradesh expanded to show the airspaces in that area.



See the 3D diagram to see an example of these stacked areas :



11.5 Airspaces In and Around Bir, Himachal Pradesh

In the area around Bir, You are affected by the presence of Kangra /Gaggal/ Dharamsala Airport. Specifications about this airport are shown below.

AD 2. AERODROMES

VIGG AD 2.1 AERODROME LOCATION INDICATOR AND NAME

VIGG - KANGRA AIRPORT

VIGG AD 2.2 AERODROME GEOGRAPHICAL AND ADMINISTRATIVE DATA

1	Aerodrome reference point coordinates and its site	320953N 0761544E M. Brg. 153.37DEG /664 M from Physical Beginning of RWY 15	
2	Direction and distance of aerodrome reference point from the centre of the city or town which the aerodrome serves	14 Kms SW of Dharamshala Town.	
3	Aerodrome elevation and reference temperature	2527 FT / 35.9 DEG C	
4	Magnetic variation, date of information and annual change	1.50 DEG E (2010) /0.016 DEG E	
5	Name of aerodrome operator, address, telephone, telefax, e-mail address, AFS address, website (if available)	Airports Authority of India, Kangra Airport, Gaggal (Kangra) - 176209	
		Telephone:	+91-1892-232374 +91-7650002233
		Fax:	+91-1892-233430 +91-1892-232374
		AFS:	
		Email:	apd_kangra@aai.aero
6	Types of traffic permitted (IFR/VFR)	VFR	
7	Remarks	1. Mobile no: +91-9418933303 2. Elevation in EGM 08	

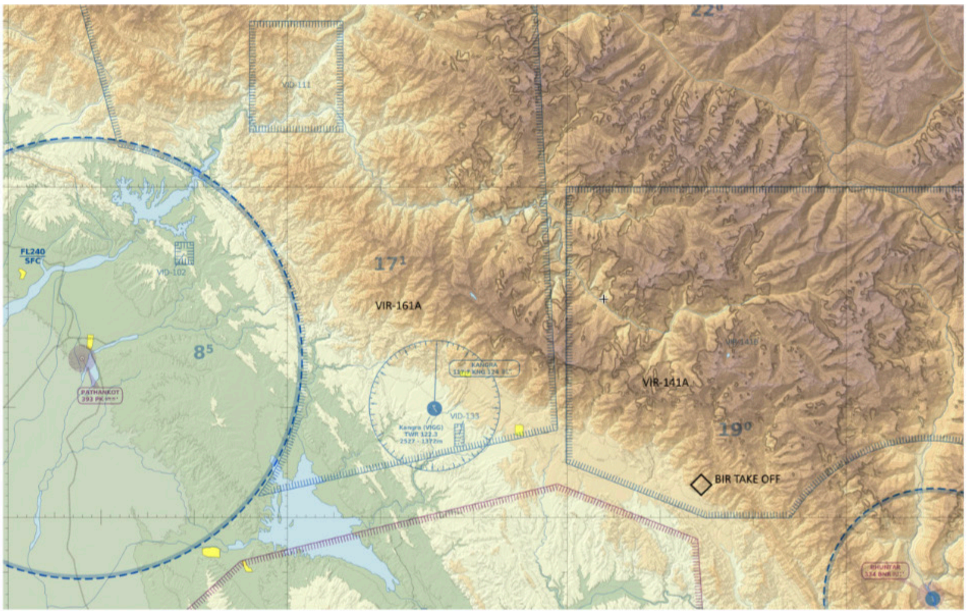
VIGG AD 2.17 AIR TRAFFIC SERVICE AIRSPACE

1	Airspace designation, geographical coordinates and lateral limits	Not established
2	Vertical limits	Not established
3	Airspace classification	G
4	Call sign and language(s) of the air traffic services unit providing service;	KANGRA Tower, English
5	Transition altitude	
6	Hours of applicability	
7	Remarks	NIL

Note:

- BIR PARAGLIDING AREA FALLS WITHIN RESTRICTED AIRSPACES VIR-141A AND VIR-161A, OTHER CRITICAL AREAS ARE THE DANGER AREAS VID-111 AND VID 133.
- ALSO NOTE THE AERODROME CONTROL ZONE MARKED BY THE CIRCLE AROUND KANGRA AIRPORT
- ALSO NOTE VERTICAL LIMITS ALSO. ALL FROM GROUND LEVEL UPWARDS.
- In the image here VIR-161A and VIR-141A are marked, note the position of Bir take off

point.



- It is important to note the implications of flying within these airspaces and the agencies that control them and also the restrictions imposed in their usage. The table below shows this:

VID 111 Ismailpur	Area bounded by 323459N to 324459N and 0755556E to 0760556E	37000 FT/ GND	1. Field firing range. 2. Activities permanent.
VID 133 Tanda	Area bounded by 320629N to 320829N and 0761756E to 0761856E	19000 FT/GND	1. Field firing range. 2. Activities permanent.
VIR 141-A Adampur-I	Area bounded by lines joining points 311059N 0750156E; 314459N 0753456E; 314559N 0753956E; 311259N 0752856E then along the counter clockwise arc of a circle of 5NM radius centred on 311659N 0753456E to 310959N 0753056E; 305859N 0752756E to point of origin.	3000 FT/ GND	No aircraft shall fly except under and in accordance with the terms and conditions of special permit issued by the Ministry of Defence, Government of India.
VIR 161-A Pathankot-I	Area bounded by 323329N 0754156E; 331059N 0752956E;332758N 0755156E; 330259N 0762556E; 320759N 0762856E; 320159N 0755656E; - then along the circular boundary of 20NM radius centred at 321359N 0753756E; 323329N 0754156E	UNL / GND	1. Local flying area. 2. Controlling authority ATC Pathankot.

11.6 Paragliding and Airspaces,

With a good understanding of the need for airspaces, their construction and depiction, how they are controlled the need for communication within them, the air traffic agencies exercising control, the restrictions imposed on their usage and the need to obtain clearances to operate within them, you as a paragliding pilot should be aware of your responsibilities and accountability when manoeuvering around them and within them.

In India, where there are vast airspace where no control is directly exercised or areas which are not clearly defined, it is crucial that some form of 'understanding' exists between its potential users and the air traffic controlling agencies. Communication is key to safety here and no assumptions should be made on the usage of any airspace where grey areas exist.

CHAPTER 12

Regulatory bodies, Licences, Certificates & Rating cards

International Bodies

These bodies do not have any legal jurisdiction in the country and regulate via agreement or member national bodies.
FAI : is international body regulating international aviation sports competitions. They also issue international pilot proficiency cards which are equivalency cards to relate various national levels to each other via Para pro ratings, Aero club of India, ACI, is their member national Body
PWCA: its independent body regulating Paragliding world cup events and its nationality independent participation.
APPI : Is international body issuing rating cards which can be licence n if recognized by national Civil aviation Association (DGCA in india) or by a body authorised by it. Currently not recognised by DGCA though they have tie up with ACI to get there rating card converted to FAI IPPI

National Bodies
As of Jan 2024

Aerosports Federation of India

SFI : Aero Sports Federation of India was proposed in 2022 and was supposed to be formed afresh ut currently ACI is being handed over the responsibilities of ASFI, to best of my knowledge legalities are n progress. This was to govern all aviation sports in India.
CI :Aero Club of India is member body of FAI in india and also in process of getting powers and esponsibilities of National Aero sports Federation.
AI: Paragliding Association of India, though yet to be recognised by ASFI or MoCA is most likely andidate to become National Paragliding body under ASFI /ACI.

12.1 Licence :

Licence to Pilot an Aircraft (Paraglider) can only be issued by MoCA, DGCA or a body duly authorised by them (likely that they will empower ASFI). As of now India doesn't have a Paragliding License (jan 2024)

12.2 Certification :

A certificate can be issued by anyone who trained or evaluated a pilot and value/recognition of said certificate depends on issuer's credentials and recognition.

12.3 Rating Card :

Can be issued by a body that has a rating and evaluation system in place and recognition of such a rating card depends on recognition of the issuing body. If recognised by DGCA/MoCA or their authorised bodies a rating card becomes a licence.

Currently PAI, IPPI and APPI issued cards fall in this category. Unless an IPPI card is issued on bases of a National Licence by a recognised association of that country. In such a case it's a valid licence till, Indian paragliding licence comes in place and then you will need to convert in 6 months (based on current DGCA rules).

Licence Issued by State Govt: So far DGCA has left regulation of paragliding to local govt and local ATC. It's not fully clear if this covered delegation of issuing licence. It seems to be a stop gap arrangement till a national licensing system comes in place. Only a duly formed ASFI can bring clarity to this issue.

12.4 FAI IPPI card and Sporting licence :

FAI member National aero club (ACI in india) issue two kind of FAI cards , Sporting licence and IPPI card (international pilot proficiency Instrument)

12.4.1 Sporting Licence :

It's just an instrument that you have been allowed to compete for the nation, India, by the National Aero Club , ACI. That you have paid the membership and sporting licence fee and fulfilled paperwork requirements. It's not a skill level Certification nor a national paragliding licence .

12.4.2 IPPI cards:

These are FAI equivalence rating cards and are a skill level certification going from P1 to P5. These are solo pilot certifications and FAI IPPI does not cover commercial licences like tandem or instructor. Commercial licences are usually a national issue though rules may vary with country and in India with state..

CHAPTER 13

Tandem Equipment

1. Only certified dual gliders may be used.
2. The recommended weight range for the glider must be adhered to.
3. Dual Pilots must thoroughly familiarise themselves with any new dual glider before carrying inexperienced passengers.
4. Both pilots must have a properly fitted harness.
5. Personal flight logs must be raised and maintained by all Dual Pilots.
6. A suitable emergency parachute must be carried.

13.1 Equipment Familiarisation

Before taking your passenger on a paragliding flight, it's essential to ensure they are familiar with the equipment and understand its function. Here's a guide to help you through the process:

13.2 Daily Inspection and Pre-flight Checks

- Walkthrough: Take your passenger through the daily inspection and pre-flight checks. Explain each step and what you are looking for during the inspection.
- Equipment Explanation: Explain the purpose of each piece of equipment, including harnesses, helmets, wings, emergency parachutes, and quick-release connectors.
- Harness and Helmet Fitting: Ensure your passenger's harness and helmet fit properly and are secured correctly. Pay attention to details such as leg loops and chin straps.
- Ground Preparation: Spend time on the ground sorting out the flying positions you'll adopt once in the air. Ensure both you and your passenger are comfortable with the positions.
- Practice: If using new equipment, familiarise yourself with it before taking a paying passenger. Gain experience with the equipment in easy conditions.

13.3 Equipment Considerations

- Paragliding Harness: Pilot harness should have a wide seat or split leg design. Passenger harnesses should not have an emergency parachute fitted to avoid accidental deployment.
- Helmets: Ensure both helmets are suitably certified and fit correctly. Consider full-face helmets for added protection.
- Wing: Use only gliders certified for dual flight within weight range recommendations. Ensure proper maintenance and check for adequate rating of maillons/carabiners.
- Spreader Systems: Choose between rigid and soft spreader systems based on passenger weight and comfort. Understand the implications of each type.
- Emergency Parachutes: Use dual emergency parachutes and ensure proper attachment according to manufacturer requirements. Avoid solo emergency parachutes.
- Ballast: If needed, use water or fine dry sand in ballast bags. Avoid solid objects in harnesses as they can be hazardous.
- Quick Release Connectors: Understand the function and drawbacks of quick release connectors. Practise their use and be aware of compatibility with other equipment.

When you are familiar with these devices, they can be a very useful tool in certain situations, however they do have some cons too. They can be hard to operate with gloved or cold hands, and because the block connected to the risers is released either forwards or backwards from its seat, there can be a delay between pressing the release buttons and disconnection. If the trimmer is closed (pulled down) the trimmer buckle can foul the Quickout block, making release difficult, delayed or impossible.

Conclusion

By familiarising your passenger with the equipment and ensuring its proper use and maintenance, you can enhance safety and enjoyment during paragliding flights. Always prioritise thorough preparation and safety measures before taking to the air.

CHAPTER 14

Pilot & Passenger Consideration

14.1 Yourself

Before taking a passenger on a dual flight, it's crucial to assess your own readiness and suitability for the task. Here are some considerations:

- Reasons for Flying: Reflect on your motivations for taking a passenger. Avoid feeling pressured into flying due to external expectations. Prioritise safety over pleasing others.
- Equipment Familiarity: Ensure you are well-versed with all the equipment you will be using during the flight. Familiarise yourself with the site and prevailing conditions before taking a passenger.
- Health and Fitness: Prioritise your health and well-being. Assess yourself using the "IM SAFE" checklist ie illness, medication, stress, alcohol, fatigue, and emotion. which includes factors like illness, medication, stress, alcohol, fatigue, and emotion. If you are not feeling your best, refrain from flying.
- Qualifications: To fly with a passenger, you must have passed the Dual pilot examination and be in current practice. If flying for monetary consideration, you must be an commercial tandem pilot rated,

14.2 The Passenger

As the pilot, you are responsible for assessing the suitability of your passenger for the flight. Here are some considerations:

- Weight and Payload: Ensure your passenger's weight is within the certified weight range of the glider and emergency parachute system. Be aware of any limitations on payload capacity. Be aware of variation in glider performance and behaviour with change in passenger weight.
- Fitness and Health: Assess your passenger's fitness level and inquire about any medical conditions or disabilities. Determine if they are prone to fits, dizziness, or heart conditions, and if they are taking any medication.
- Risk Awareness: Explain the sensations of flight and the potential effects of turbulence to your passenger. Emphasise the inherent risks involved in paragliding and ensure they understand and acknowledge these risks.
- Age and Maturity: There are no national legal age restrictions for passengers, but some states have made rules. Make sure you are aware and comply with local rules. Where there is no age restriction ensure they have the maturity to understand the risks involved. For minors, parental consent or presence may be required.
- Attitude Towards Flying: Assess your passenger's attitude and motivation for flying. Ensure they are personally committed to the experience and not just succumbing to peer pressure.
- Preparation: Ensure your passenger is dressed appropriately, with suitable clothing and footwear. Remove any sharp objects from their pockets and advise them on securing long hair to avoid obstructing vision.
- Avoidance of Intoxication: Do not allow passengers who are under the influence of drugs or alcohol to fly.
- Pilot Responsibility: Even if your passenger is an experienced pilot, remember that you are the pilot in command and ultimately responsible for their safety. Conduct thorough checks and do not assume anything, even with experienced pilots.
- Do not attempt any manoeuvres prohibited by PAI or local rules .

CHAPTER 15

Briefing for Tandem Paragliding Flight

By carefully considering these factors, you can ensure a safe and enjoyable dual flight experience for both yourself and your passenger.

When briefing your passenger for a dual paragliding flight, simplicity and clarity are key to ensuring safety and understanding. Here's a structured approach to conducting an effective briefing:

15.1. Keep it Simple

- Focus on Key Points: Emphasise essential information necessary for a safe takeoff, flight, and landing.
- Avoid Overloading: Too much information can be overwhelming and easily forgotten. Stick to the most important points.

15.2. Roles and Expectations

- Passenger's Role: Explain what the passenger's role will be during the flight, including what they can and can't hold onto, and how to respond to instructions.
- Tandem pilot's Role: Assure the passenger that you will communicate throughout the flight and guide them at each stage.

15.3. Addressing Nervousness

- Individual Attention: If a passenger seems nervous, offer individual attention and reassurance. Consider delaying their flight until they feel more comfortable.
- Honest Communication: Encourage open communication about any concerns or apprehensions the passenger may have.

15.4. Launch Procedure

- Clear Explanation: Clearly explain the procedure for takeoff, including what to expect from the glider and how the passenger should respond.
- Question and Answer: Use the instructor's "Question and Answer" technique to ensure the passenger understands the instructions.

15.5. Anchor Persons Briefing

- Duties Clarification: Thoroughly brief any assistants helping with launch (anchor persons) on their duties.
- Accountability: Remind them that training launch assistants is the responsibility of the pilot in command, and any mistakes could have consequences for the pilot.

15.6. Flight Duration

- Estimated Time: Provide an estimate of how long the flight will last before takeoff. Assure the passenger that the duration can be adjusted if conditions permit and both parties are comfortable.

Conclusion

By following these briefing guidelines, you can effectively prepare your passenger for a safe and enjoyable dual paragliding flight. Remember to prioritise safety, clear communication, and individual comfort throughout the experience.

CHAPTER 16

Practical Tips

16.1. Site and Conditions

When planning a paragliding flight with a passenger, it's crucial to consider the site and weather conditions. Here are some factors to keep in mind:

<u>Site Selection</u>

- Spacious Site: Choose a large, uncrowded site for dual flights. Dual paragliders are less manoeuvrable than solo wings and require more space for takeoffs and landings.
- Rotor-Free Areas: Opt for sites with rotor-free takeoff and landing areas to minimise complications during flight.
- Conservative Landing Approach: Ensure there is enough room for a sensible and conservative landing approach. Avoid sites with obstacles or restricted landing areas.

16.2. Weather Conditions

- <u>Wind Strength:</u> Check the forecast to ensure there won't be a significant increase in wind strength during the flight. Landing a tandem paraglider in breezy conditions is more challenging than a solo flight.
- <u>Test Flight:</u> Consider taking a test flight on a solo glider or waiting for another solo pilot to fly the area and watching to assess the conditions and determine if they are suitable for dual flight. This allows you to gauge the wind conditions and assess their compatibility with tandem flying.

By carefully selecting the site and monitoring weather conditions, you can enhance safety and ensure a smooth paragliding experience for you and your passenger. Always prioritise safety and conservative decision-making when planning a flight.

16.3. Camera Guideline

When passengers want to bring cameras on dual paragliding flights, it's important to prioritise safety. Here are some guidelines to ensure the safe use of cameras during the flight:

16.3.1 Safety Line Attachment

- Attach a Safety Line: Ensure that passengers have their cameras secured with a safety line to prevent them from dropping during flight.
- Retractable Selfie Sticks: If passengers wish to use extendible selfie sticks, they must retract and stow them safely before takeoff and landing to avoid hazards.

16.3.2 Camera Mounting

Centre of the Wing: Lightweight cameras may be fixed in the centre of the wing using magnetic mounts. However, avoid mounting them near the wing tips to prevent entanglements and cravats during takeoff and flight.

Harness Attachment: Opposite Side of Parachute Handle: Any cameras or selfie sticks secured to the harness should be positioned on the opposite side of the emergency parachute deployment handle. This reduces the risk of inadvertent deployment or entanglement during a real emergency.

16.4 Hazard Awareness

- Avoid Heavy Objects: Carrying long poles or heavy objects is not recommended as they can pose hazards during flight and landing.
- Entanglement Risks: Be aware of the risk of entanglement with cameras or selfie sticks, especially during launch and landing procedures.

Conclusion

By following these camera safety guidelines, you can ensure that passengers can capture memorable moments while prioritising the safety of the flight. Remember to communicate these guidelines clearly to passengers before takeoff to minimise risks during the flight.

16.5 Pre-Flight Checklist

Before every dual paragliding flight, it's crucial to conduct a thorough pre-flight check to ensure the safety of both the pilot and the passenger. Here's a comprehensive pre-flight checklist using the mnemonic "Will Geordie Have His Cat Aboard (Today)" (W.G.H.H.C.A.(T.)) (source :BHPA)

<u>W - Wind and weather</u>

- Check the wind direction - is it shifting?
- Wind strength - is it varying much? Is it OK for your level of experience?
- Visibility - is it satisfactory?
- Weather. Is any rain approaching? Are there any signs indicating likely turbulence?

<u>G - Glider</u>

Give your glider a quick 'once-over' to confirm that nothing has altered since your DI. Check:

- Laid out properly?
- Cells clear?
- Lines untangled?

<u>H - Helmet</u>

- Check that you and passenger are wearing one
- That it fits snugly and will not drop over your eyes
- That it is fastened and won't fall off

H - Harness Check the five main points both pilot and passenger:

- Left leg-strap fastened
- Right leg-strap fastened
- Chest strap fastened and adjusted correctly
- Left maillon/carabiner locked
- Right maillon carabiner locked
- Check that any cross-bracing straps are secure and adjusted to give the correct distance between the carabiners, and that your emergency parachute is stowed correctly, the release pins are in place and that the handle is within reach
- T-bar or spreader are attached correctly and reserve yoke attached properly

C - Controls

- Check control handles in the correct hands
- Correct risers held appropriately
- Control lines free-running?

A - All clear Check:

- Check that your take-off path is clear - nothing to trip you or wrench your ankles
- That you are well clear (in every direction) from bushes, posts or other fixed obstructions and from roving people or livestock (a mishandled launch can use up a lot of space in any direction)
- That the airspace above, in front and below you is clear from other air users and will remain so during your take-off sequence
- That no-one is about to overshoot their top landing and need the airspace you are about to occupy

(T - Turn direction) If you are using the reverse launch, check which riser is on top: that shoulder must go back when you turn to face into wind

You are now ready to launch.

Conclusion

By following this pre-flight checklist, you can systematically ensure that all aspects of the dual paragliding flight are in order before takeoff. Remember that safety is paramount, and thorough checks help mitigate risks and ensure a safe and enjoyable flight experience for both the pilot and the passenger.

16.6 Periodic Inspection

A periodic inspection is a crucial maintenance task recommended by paraglider manufacturers to ensure the safety and integrity of the equipment. Here's an overview of the periodic inspection process:

16.6..1. Frequency

- Timing: The periodic inspection should be conducted according to the manufacturer's recommendations, typically annually or after a specified number of flying hours.
- Importance: This inspection is essential for detecting any degradation in the fabric, lines, webbing, and metallic components of the paraglider.

16.6.2. Inspection Scope

- Fabric Degradation: Check for any signs of wear, tear, or damage on the canopy, lines, and webbing.
- Metallic Components: Inspect the integrity of all metallic components, such as carabiners, buckles, and connectors.
- Line Replacement: Lines may need to be replaced if they show signs of excessive wear or damage.
- Minor Repairs: Address any minor repairs needed to ensure the safety and airworthiness of the paraglider.

16.6.3. Additional Checks

- Porosity and Line Trimming: Conduct additional checks, such as measuring the porosity of the fabric and ensuring proper line trimming, as recommended by the manufacturer.

Conclusion

A periodic inspection is a comprehensive assessment of the paraglider's condition, focusing on fabric degradation, line integrity, and overall safety. By adhering to the manufacturer's recommendations and seeking professional assistance, pilots can maintain the airworthiness of their equipment and prioritise safety during flights.

16.7 During the flight

It's essential to prioritise the comfort and safety of your passenger. Here are some guidelines for managing the flight experience:

16.7.1. Gentle Manoeuvres

- Initial Turns: Be gentle with your manoeuvres, especially during the first turns after take-off. Your passenger needs time to acclimate to the sensations of flight.
- Communication: Explain to your passenger the manoeuvres you plan to execute and why you're doing them. This helps alleviate any anxiety and provides reassurance.

16.7.2. Airsickness Management

- Awareness: Be attentive to signs of airsickness from your passenger. If they complain of feeling airsick, try to maintain level flight and encourage them to focus on something else.
- Gentle Controls: Keep control inputs gentle to avoid aggravating airsickness. Consider heading out of lift areas to land promptly if airsickness persists.

16.7.3. Flight Awareness

- Visibility: Acknowledge that your visibility may be restricted due to the passenger's presence. Compensate for this limitation by executing manoeuvres cautiously and maintaining heightened situational awareness.
- Control Exchange: If necessary, you may pass over control to your passenger if conditions permit. However, be prepared to resume control quickly and ensure your passenger understands this.

- Safety Considerations: Avoid flying close to other aircraft or the ground when your passenger has control. Exercise caution and maintain adequate height, especially in congested or challenging conditions.

16.7.4. Communication

- Two-Way Conversation: Maintain open communication with your passenger throughout the flight. Engaging in conversation can help calm nerves and provide insights into their comfort level.
- Explanation of Manoeuvres: Always inform your passenger before executing any manoeuvres. This helps them anticipate changes and feel more secure during the flight.

Conclusion

By prioritising gentle manoeuvres, managing airsickness effectively, maintaining flight awareness, and fostering open communication, you can ensure a safe and enjoyable experience for your passenger during the flight. Remember to adapt your approach based on your passenger's comfort level and the prevailing conditions.

16.8 Flying with others

Especially solo pilots, requires careful consideration and communication to ensure safety and comfort for everyone involved. Here are some key points to keep in mind:

16.8.1. Wake Turbulence Awareness

- Increased Wake Turbulence: Understand that the wake turbulence generated by a loaded Tandem glider is greater than that of a solo glider, especially during turns or slow flight.
- Discussion with Other Pilots: Prior to flying, have a discussion with other pilots who may be sharing the airspace with you. Make them aware of the potential wake turbulence from your dual glider to avoid any surprises.

16.8.2. Maintain Safe Separation

- Give Wide Berth: Always provide ample separation from other aircraft, whether solo or dual, to avoid encountering wake turbulence or causing disruptions in flight.
- No Right of Way: Remember that having a passenger onboard doesn't grant you priority or right of way over other pilots. Respect the airspace and adhere to standard aviation rules and procedures.

16.8.3. Communication

- Clear Communication: Maintain clear and effective communication with other pilots, especially if you need to manoeuvre or adjust your flight path.
- Alerting Others: If you anticipate potential wake turbulence or any other factors that may affect nearby pilots, communicate this information to them in advance.

16.8.4. Flight Planning

- Route Selection: Choose flight routes that minimise the likelihood of encountering other aircraft or congested airspace.
- Anticipate Traffic: Stay vigilant and anticipate the movements of other aircraft, especially when flying in areas with high traffic volume.

16.8.5. Collaborative Approach

- Mutual Respect: Foster a culture of mutual respect and cooperation among pilots sharing the airspace. Prioritise safety and professionalism in all interactions.
- Assist Others: If you observe any unsafe situations or challenges faced by other pilots, offer assistance or support as needed.

Conclusion

By remaining aware of the increased wake turbulence from a loaded dual glider, maintaining safe separation from other aircraft, practising clear communication, careful flight planning, and fostering a collaborative approach with fellow pilots, you can ensure a safe and harmonious flying experience for everyone involved. Remember that safety is paramount, and cooperation among pilots is key to enjoying the skies together responsibly.

16.9. Landing

- Stable flight before landing: Keep at least 4 sec of straight flight between last turn and landing
- Smooth Flare: Execute a smooth and well-timed flare for a one-step landing. Avoid fast running landings with two pairs of legs, as this can lead to falls or loss of control.
- Avoid Side-slope Landings: Side-slope landings should be avoided unless conditions are ideal and there are no other safe options. Attempting side-slope landings with a passenger onboard is poor practice and increases the risk of accidents.

16.10 Post-Landing:

- Unclip Passenger First: Upon landing, prioritise unclipping the passenger from the glider first. Never leave the passenger clipped into the glider alone.
- Avoid Extended Ground Handling: Refrain from attempting extended ground handling or “kiting” back up a slope with the passenger attached or running to the end or side of the field. Unclip the passenger, properly secure the canopy, and then proceed to walk back up if necessary.
- Safety First: Ensure safety at all times during post-landing procedures. Coordinating movements with four legs can be challenging and may pose risks to both the pilot and passenger if not handled carefully.

CHAPTER 17

Tandem Techniques

17.1 Takeoff :

Get into your harness and attach the spreader bars and canopy to you first, check the canopy over and get ready to take-off. lastly attach the passenger.

17.1.1 Light winds :

In general use Alpine launch (forward Launch) in light winds. Passengers should have been briefed on the need for running. Be ready to push passenger harness from above passenger carabiner if passenger sits little too early (if there is enough lift by then to support passenger weight)

17.1.2 Moderate to strong winds :

You can reverse launch in moderate to strong winds but it is important to brief passengers that he has to face forward while you face the glider. Passenger should know he might be pulled back towards the glider a few steps but he has to run into the wind. Some manufacturers recommend reverse launching in moderate and strong breezes with the trimmers set to fly faster than the trimmer off position – it is

Important to practise by yourself in this setting to be familiar with the wings behaviour in conditions strong enough to reverse launch, it is important to brief the passenger that they may need to take several steps backwards as the wing comes up.

A good 'crossed-brake' technique is important in order to keep the wing under control at all times. Due to the position of the passenger, one riser is

much further away from you than the other, creating a turning effect. You must compensate for this as you pull up.

- On steep slope you might need to stand side by side along the slope to take-off. If your passenger stands in front of you down the slope you may not be able to stand up straight if using spreader bars.
- Inflating a Tandem wing has to be more precise than on a solo wing - if the wing does not come up straight you cannot easily side step to make a correction.

- Anticipate being pulled back a fair way before getting the wing flying and make sure you have a large 'drag back' area.
- A heavier or taller passenger may still be running long after you are airborne.
- The canopy attachment points are ahead of the pilot, in the correct flying position the leading edge of the canopy will seem to be a lot further forwards than when flying solo. Leading to the common mistake of letting go of the risers too soon on the pull up.

17.1.3 Moderate Wind Inflation Techniques

Method 1: Pilot-Facing, Passenger-Downhill

Procedure: The pilot faces the canopy while the passenger faces downhill. The pilot initiates a reverse take-off procedure and turns to face forwards as the canopy comes up.

◊ Advantages:

- Passenger faces the direction of travel and simply needs to stay standing and run forwards.
- Passenger (and anchor if used) can assist in bracing against drag loads during canopy inflation.

◊ Disadvantages:

- Passenger must remain standing while possibly being pulled backwards.
- Unequal riser lengths may make pulling the canopy up more challenging.
- Passenger is not in a position to assist in controlling the canopy.

Method 2: Pilot and Passenger Facing the Canopy

Procedure: Both the pilot and passenger face the canopy side by side. The passenger ducks under one set of lines, and both quickly turn as the canopy comes up.

◊ Advantages:

- Riser lengths are equal for the pilot, making coordination easier.
- Passenger have a clear view of the canopy and can react accordingly.
- Passenger can assist in pinning the canopy with 'C lines' before take-off.

◊ Disadvantages:

- Requires a relatively experienced passenger who can turn quickly and in the right direction.

<u>Method 3: Pilot-Facing, Passenger-Sitting, Often used for flying dunes in good winds</u>

Procedure: Similar to Method 1, but the passenger sits. Only possible with soft spreaders or significantly extended passenger connection points. The wing lifts the passenger off the ground as it comes up, and the pilot then turns and runs the passenger/wing combination forward.

◊ Advantages:

- Passenger cannot fall over and injure themselves.
- Ideal position for the passenger if dragged backwards..

◊ Disadvantages:

- Requires precise ground handling, as the passenger anchor can lock the canopy out if it comes up crooked.
- Not possible in light winds due to lack of lift to lift the passenger off the ground.

17.2 Forward Launch aka Alpine Launch

17.2.1 Light Wind Forward Take-off

- Requires a very good canopy layout with an exaggerated arc to prevent the tips from inflating before the centre.
- Pilot briefs the passenger to run forward toward a pre-selected target point.
- Practice runs are essential to ensure the pilot maintains speed and does not sit down during the launch.
- Pre-selecting an “abort” point helps prevent overrunning the launch area.

◊ Advantages:

- No need to turn around, simplifying the process.

◊ Disadvantages:

- Requires good forward take-off technique.
- Cannot visually check the wing as it comes up.
- The wing is flying properly only when it appears to be far in front of the pilot.
- May require running side by side with the passenger to reduce the risk of tripping.
- Requires an anchor-person in all but the lightest breezes due to the power of dual gliders.

17.2.2 Moderate Wind Forward Take-off

- Requires a very capable launch assistant or anchor person.
- On the pilot's command, the launch assistant pulls the passenger forward as the pilot and passenger move forward together.
- The pilot controls the wing at the appropriate moment.
- Going backward a few steps during launch is almost inevitable.
- The assistant's role is to prevent the passenger from falling backward.
- Once the glider is properly in the air, the assistant may be required to pull the whole setup forward, but this indicates potentially unsafe wind conditions.
- Neither the passenger nor the assistant should hold onto each other in a way that could lead to trapping.

◊ Advantages:

- Pilot is in full control of the glider at all times.
- Requires little space.
- Useful on steeper slopes where immediate airborne status is necessary.

◊ Disadvantages:

- Requires a high degree of skill from the launch assistant.
- Risk of the assistant being lifted.

These take-off techniques offer different approaches suitable for varying wind conditions and launch area characteristics. Pilots should choose the appropriate method based on experience, skill level, and prevailing wind conditions for a safe and successful take-off.

17.3 In-Flight Communication and Passenger Control

Two-Way Conversation:

- Engage in a continuous dialogue with the passenger, explaining actions and reasons behind manoeuvres.
- Encourage questions and feedback from the passenger to enhance their understanding and comfort.

Passenger Control:

- Avoid relinquishing control to a non-pilot passenger, especially if they are not undergoing training.
- Ensure the absence of other aircraft or obstacles before considering passing control.
- Instruct students undergoing training using standard aviation phrases like “I have control” and “you have control.”
- Brief students to visually check before executing turns and prohibit them from attempting radical manoeuvres.

Understanding Control Positions:

- Explain any differences in control positions between dual and solo gliders to students transitioning between the two.

Passenger Awareness:

- Keep the passenger informed about environmental changes or significant events during flight, such as finding a thermal.
- Obtain the passenger’s agreement before executing any acro (aerobatic) manoeuvres or low passes.
- Exercise caution when using big ears on a dual glider, adjusting trimmers if necessary to prevent deep stalls.

- Acknowledge that passengers may experience nervousness, and avoid manoeuvres that could heighten anxiety, such as spiral dives, without their agreement.

Maintaining effective communication and ensuring passenger comfort and safety are paramount during dual flights, especially when considering passenger control and manoeuvre execution.

17.4 Landing Procedures

Pilot Responsibility:

- Only pilots with dual licensing should perform dual landings.
- Take control well in advance to ensure a safe landing.
- Brief the passenger about landing procedures in advance.

Passenger Positioning:

- Ensure the passenger transitions from sitting to standing position early for a smooth landing.
- Account for the height difference between the pilot's and passenger's feet due to stepped hang-points on the spreader bars.

Brake Pressure and Canopy Peculiarities:

- Be prepared for varying brake pressure on different dual gliders and on different passenger weights, which may make flaring challenging.
- Understand the canopy's behaviour and peculiarities before takeoff.
- Using wraps to increase flare authority during final approach may help but must be within certification specifications.

Final Approach:

- Opt for a conservative into-wind final approach for all dual paragliding flights, avoiding crosswind or slope landings.
- Plan the landing circuit carefully, considering the reduced manoeuvrability of dual canopies.
- Preferably keep 4 sec straight flight between last turn and landing

Field Selection and Last-Minute Changes:

- Follow normal field selection procedures, accounting for the longer landing run.
- Avoid last-minute changes in landing approach to prevent fast and heavy landings.

Post-Landing Procedures:

- Instruct the passenger to immediately turn around to face the canopy upon landing.
- Collapse the canopy safely while running side by side with the passenger.
- Unclip the passenger from the glider promptly after canopy collapse to ensure safety.

Light Wind Landings:

- Prepare the passenger to run in light wind landings.
- Sweep the passenger to one side

Strong Wind Landings:

- Ensure efficient canopy collapse in strong winds, as controlling the canopy without assistance is challenging.
- Avoid a landing situation where collapsing the canopy without assistance is almost impossible due to strong winds.

Top-Landing in Soarable Conditions:

- Coordinate with a helper for top-landing, ensuring a safe and controlled collapse of the wing after touchdown.
- Helpers taking over controls must be briefed

Special Circumstances:

- In situations requiring fast landings or when flying passengers with limited mobility, brief the passenger to remain seated and lift their legs for touchdown if necessary.
- This technique requires a suitable protection system in the passenger harness and a fitted seat plate for safety.

Ensuring effective communication, pre-planning, and adherence to safety protocols are essential for successful dual paragliding landings.

CHAPTER 18

Tandem-Pilot Responsibilities & Duties

- To be a Tandem pilot, it is necessary to have a Tandem sports or commercial rating certificate.
- Sports Tandem Paragliding can fly another paragliding pilot with at least a student pilot licence as a passenger (non-commercial).
- All tandem pilots working must fulfil the Law, Regulation of the State as no National rules exist currently
- The pilot makes sure that the paraglider used has been checked for maintenance and airworthiness. Paragliders lacking maintenance and airworthiness control cannot be used.
- The pilot takes all kinds of precautions for the safety of the passengers in flights.
- Acrobatics or dangerous movements are prohibited, except if specially authorised. Obligatory manoeuvres made to reduce altitude due to meteorological reasons or in cases requiring emergency landing are recorded in writing by the pilot after the flight in his log

book

- The pilot is responsible for protecting and maintaining flight gear and equipment under his/her own care.
- The pilot evaluates the health status and physical fitness of the person who wants to fly as a passenger.
- The pilot ensures that the total weight is within the limits of the Tandem PG.
- The pilot uses safe harness equipment with a lock system in international standards, suitable for both him/herself and the passenger.
- The pilot prepares flight clothes suitable for him/her and his/her passenger. He/she prepares the passenger for the flight. He/she clad the harness gear him/herself, makes the connections.
- The pilot says reassuring and comforting words, taking into account the psychological state of the passenger. He/she makes pre-flight checks of TPG.
- The pilot makes the passenger wear helmets and shoes suitable for flight. It is unprofessional to fly wearing slippers/sandals.
- The pilot carries a radio during flights.
- The pilot signs the Undertaking agreeing to be tested for Alcohol and Psychoactive Substance at any time during work.
- The pilot must create an entry in his tandem logbook for each passenger before the flight.
- The pilot evaluates the meteorological conditions in terms of flight limits.
- The pilot must provide all information and documents requested by the authorities
- Before the flight, the pilot gives the passenger an informative briefing about the flight plan, the steps to be made during the flight, and the landing.

CHAPTER 19

Professional Behaviour

Professional behaviour by a tandem paraglider pilot encompasses a range of attributes and actions that prioritise safety, professionalism, and the overall well-being of passengers. Here's a comprehensive definition:

19.1 Safety Focused:

- Prioritises safety above all else, adhering to established safety protocols and industry standards.
- Conducts thorough pre-flight inspections of equipment and ensures all safety measures are in place before every flight.
- Maintains situational awareness during flight, continuously assessing risks and taking proactive measures to mitigate them.
- Demonstrates proficiency in handling emergency situations and exercises sound judgement to ensure passenger safety.
- Does not put monetary or other rewards above safety

19.2 Effective Communication:

- Communicates clearly and effectively with passengers, providing comprehensive pre-flight briefings and explaining manoeuvres during flight.
- Listens attentively to passengers' concerns and addresses them with empathy and professionalism.
- Encourages open dialogue, answering questions and providing reassurance to alleviate any apprehensions passengers may have.

19.3 Professionalism and Conduct:

- Upholds high standards of professionalism in all interactions with passengers, colleagues, and other aviation professionals.
- Presents a professional appearance and demeanour, instilling confidence and trust in passengers.
- Demonstrates respect for passengers' individual needs, preferences, and comfort levels throughout the flight experience.
- Maintains composure and remains calm under pressure, setting a positive example for passengers and other observers

19.4 Skill and Competence:

- Possesses the necessary skills and qualifications to operate a tandem paraglider safely and competently.
- Pursues ongoing training and professional development to enhance skills and stay updated on industry best practices.
- Demonstrates proficiency in manoeuvring the paraglider, executing smooth take-offs, landings, and manoeuvres with precision and control.

19.5 Ethical Conduct:

- Adheres to ethical principles and codes of conduct governing the aviation profession, including honesty, integrity, and accountability.
- Respects the rights and privacy of passengers, maintaining confidentiality and discretion regarding personal information.
- Avoids engaging in behaviour that could compromise safety, reputation, or the integrity of the profession.

19.6 Continuous Improvement:

- Strives for continuous improvement and excellence in all aspects of tandem paragliding operations.
- Seeks feedback from passengers and peers to identify areas for improvement and implement constructive changes.
- Remains committed to learning and growing as a professional tandem paraglider pilot, adapting to new technologies, regulations, and industry trends.

In summary, professional behaviour by a tandem paraglider pilot entails a commitment to safety, effective communication, professionalism, skill development, ethical conduct, and continuous improvement to ensure a safe and enjoyable experience for passengers.

References :

BHPA Tandem course material generously shared by Mr Ian Currer.

https://www.paraglidingassociationofindia.org/wp-content/uploads/2021/08/PAI-guidelines-for-tandem-operators.pdf

http://skynomad.com/articles/

https://skytribe.ro/wp-content/uploads/2012/06/The-SIV-Maneouvres-Explained.pdf

https://flybubble.com/blog/paraglider-control-stall-spin-collapse.

https://scholar.google.co.in/scholar?q=paraglider+instabilities+and+recoveries&hl=en&as_sdt=0&as_vis=1&oi=scholart

https://shmfethiye.kapadokya.edu.tr/Fethiye-Babadag-Yeni-Yonerge-en.pdf

https://www.bhpa.co.uk/pdf/BHPA_EP_Training_Guide.pdf

https://www.flytandem.com/etiquet.htm

https://www.ushpa.org/page/cooperative-to-the-core.aspx

https://mavicpilots.com/threads/total-newbie-interpreting-airmap.54280/

https://www.faa.gov/air_traffic/publications/atpubs/aip_html/images/fig-ENR-1dot4-1.png

https://atcguild.in/docs/ATS%20ROUTE%20CHART.pdf

https://insidefpv.com/blogs/news/what-is-the-air-space-map-of-india

https://www.flyers-lodge.com/beginners.html

https://www.lenzstaehelin.com/fileadmin/user_upload/IRASL_-_Final__Vol_1___005_.pdf

https://www.scribd.com/document/385476366/Aviation-Law-in-India

https://www.dgca.gov.in/digigov-portal/?dynamicPage=aircraftRulesContent2Req/1/3037/viewDynamicRuleContLvl2&mainaircraftRules1937/1/0/viewDynamicRulesReq

https://www.noaa.gov/weather

https://www.anac.gov.br/en/safety/aeronautical-meteorology/conditions/turbulence

https://pilotworkshop.com/tips/aviation_weather_bumps/

https://gpres.weebly.com/uploads/2/2/7/3/22733438/ch5-dry-moist-adiabatic-rate-graph-created_orig.jpg

https://www.sciencedirect.com/topics/earth-and-planetary-sciences/lapse-rate

https://skybrary.aero/articles/lapse-rate https://courses.lumenlearning.com/suny-geophysical/chapter/thunderstorms/

https://scied.ucar.edu/learning-zone/how-weather-works/weather-fronts

https://education.nationalgeographic.org/resource/front/#:~:text=Article%20Vocabulary-,A%20front%20is%20a%20weather%20system%20that%20is%20the%20boundary,hot%20days%2C%20and%20windy%20days.

https://www.nssl.noaa.gov/education/svrwx101/wind/types/#:~:text=Downburst%20is%20the%20general%20term%20for%20all%20localized%20strong%20wind,clashes%20with%20warmer%20thunderstorm%20inflow.

https://www.sciencedirect.com/topics/earth-and-planetary-sciences/cumulonimbus-clouds

https://www.weather.gov/source/zhu/ZHU_Training_Page/clouds/cloud_development/clouds.htm#:~:text=Clouds%20form%20when%20the%20invisible,a%20liquid%20or%20solid%20form.

https://learn.fly8ma.com/wp-content/uploads/2017/11/cloud-types.jpg

https://www.freedom-parapente.fr/en/blog/clouds-and-their-paragliding-classification#:~:text=Cumulus%20clouds%20are%20ultimately%20the,and%20how%20to%20avoid%20them.

https://www.skynomad.com/articles/thermal_clouds.htm

https://www.paraglidingspain.eu/beginners-paragliding-courses/clouds-and-paragliding/

https://www.grc.nasa.gov/www/k-12/VirtualAero/BottleRocket/airplane/glider.html

https://www.paraglidingspain.eu/beginners-paragliding-courses/understand-aerodynamic-of-paragliding/

https://www.avweb.com/features/theories-of-lift/

https://youcanfly.aopa.org/-/media/Files/You-Can-Fly/High-School-Curriculum/Sample-Materials/Theories-of-Lift-Lesson-Plan_watermark.pdf

https://www.paragliding-lessons.com/airfoil-theory-for-paragliding-wings/

https://www.grc.nasa.gov/www/k-12/VirtualAero/BottleRocket/airplane/wrong1.html